SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes joint sealants for the 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. Construction joints in cast-in-place concrete.
b. Control and expansion joints in unit masonry.
c. Joints between architectural pre-cast concrete units.
d. Joints between metal panels.
e. Joints between different materials listed above.
f. Perimeter joints between materials listed above and frames of doors, windows and louvers.
g. Control and expansion joints in ceilings and other overhead surfaces.
h. Other joints as indicated.

2. Exterior joints in the following horizontal traffic surfaces:

a. Control and expansion joints in brick pavers.
b. Isolation and contraction joints in cast-in-place concrete slabs.
c. Joints between different materials listed above.
d. Other joints as indicated.

3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:

a. Control and expansion joints on exposed interior surfaces of exterior walls.
b. Perimeter joints of exterior openings where indicated.
c. Tile control and expansion joints.
d. Vertical joints on exposed surfaces of interior unit masonry and concrete walls.
e. Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.
f. Joints between plumbing fixtures and adjoining walls, floors, and counters.
g. Other joints as indicated.

4. Interior joints in the following horizontal traffic surfaces:

a. Isolation joints in cast-in-place concrete slabs.
b. Control and expansion joints in stone flooring.

c. Control and expansion joints in brick flooring.
d. Control and expansion joints in tile flooring.
e. Other joints as indicated.

B. Section includes acoustical joint sealants.

C. Related Sections include the following:
1. Division 04 Section "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
2. Division 07 Section "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
3. Division 09 Section "Gypsum Board" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
4. Division 09 Section "Tiling" for sealing tile joints.
5. Division 09 Section "Acoustical Panel Ceilings" for sealing edge moldings at perimeters of acoustical ceilings.

1.3 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.

1.4 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. 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.

D. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

E. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.

F. Qualification Data: For Installer.

G. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.

H. 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.

I. Field Test Report Log: For each elastomeric sealant application.

J. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

K. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding the Notice to Proceed with the Work.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

E. 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.

F. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:

1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section. Refer to Division 1 section “Special Conditions” for composite mock-up panel.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 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 (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.

1.7 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which 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: 2 years from date of Substantial Completion.

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

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Nonmembrane Roof Sealants: 300 g/L.
3. Single-Ply Roof Membrane Sealants: 450 g/L.
4. Sealant Primers for Nonporous Substrates: 250 g/L.
5. Sealant Primers for Porous Substrates: 775 g/L.
6. Modified Bituminous Sealant Primers: 500 g/L.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 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 nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

D. Multicomponent Nonsag Neutral-Curing Silicone Sealant :

1. Subject to compliance with requirements, provide one of the products listed below:

    a. Dow Corning Corporation; 756 H.P.
    b. Approved equivalent.

2. Type and Grade: M (multicomponent) and P (pourable).
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.

    a. Use O Joint Substrates: Coated glass, aluminum coated with a high-performance coating (use with Dow Corning #84 primer applied to aluminum substrate), galvanized steel, brick and ceramic tile.

E. Single-Component Neutral-Curing Silicone Sealant:

1. Subject to compliance with requirements, provide one of the products listed below:

    a. Dow Corning Corporation; 790.
    b. GE Silicones; SilPruf LM SCS2700.
    c. Tremco; Spectrem 1 (Basic).
    d. GE Silicones; SilPruf SCS2000.
    e. Pecora Corporation; 864.
    f. Pecora Corporation; 890.
    g. Polymeric Systems Inc.; PSI-641.
    h. Sonneborn, Division of ChemRex Inc.; Omniseal.
    i. Tremco; Spectrem 3.
    j. Dow Corning Corporation; 791.
    k. Dow Corning Corporation; 795
    l. GE Silicones; SilPruf NB SCS9000.
    m. GE Silicones; UltraPruf II SCS2900.
    n. Pecora Corporation; 865.
    o. Pecora Corporation; 895.

p. Pecora Corporation; 898.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 100/50.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

a. Use O Joint Substrates: Coated glass, aluminum coated with a high-performance coating (use with Dow Corning 1200 OS primer applied to aluminum substrate) and brick.

6. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.

F. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant:

1. Subject to compliance with requirements, provide one of the products listed below:

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.

a. Use O Joint Substrates: Coated glass, aluminum coated with a high-performance coating, galvanized steel and ceramic tile.

2.4 SOLVENT-RELEASE JOINT SEALANTS

A. Butyl-Rubber-Based Solvent-Release Joint Sealant: Comply with ASTM C 1085.

1. Subject to compliance with requirements, provide one of the products listed below:

a. Bostik Findley; Bostik 300.
b. Fuller, H. B. Company; SC-0296.
c. Fuller, H. B. Company; SC-0288.
d. Pecora Corporation; BC-158.
e. Polymeric Systems Inc.; PSI-301
f. Sonneborn, Division of ChemRex Inc.; Sonneborn Multi-Purpose Sealant.
g. Tremco; Tremco Butyl Sealant.

2.5 LATEX JOINT SEALANTS

A. Latex Sealant: Comply with ASTM C 834, Type P, Grade NF.

B. Subject to compliance with requirements, provide one of the products listed

1. Bostik Findley; Chem-Calk 600.
2. Pecora Corporation; AC-20+.

3. Schnee-Morehead, Inc.; SM 8200.
4. Sonneborn, Division of ChemRex Inc.; Sonolac.
5. Tremco; Tremflex 834.

2.6 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.

2.7 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), O (open-cell material), B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

D. 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.

2.8 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants 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. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic 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.

3.3 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. 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.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. 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.

F. 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.

3.4 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply; Install acoustical joint sealants at joints as indicated on Drawings.

B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C 919, ASTM C 1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.

C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.5 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.

3.6 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.

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior vertical control and expansion joints in unit masonry and joints between architectural pre-cast concrete units.

1. Joint Sealant: Single-component neutral- and basic-curing silicone sealant, Single-component neutral-curing silicone sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

B. Joint-Sealant Application: Exterior perimeter joints between masonry and frames of doors, windows and louvers.

1. Joint Sealant: Single-component neutral- and basic-curing silicone sealant, Single-component neutral-curing silicone sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

C. Joint-Sealant Application: Interior perimeter joints of exterior openings.

1. Joint Sealant: Acrylic, Latex sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

D. Joint-Sealant Application: 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: Vertical joints on exposed surfaces of interior unit masonry and concrete walls and partitions.

1. Joint Sealant: Acrylic, Latex sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

F. Joint-Sealant Application: Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.

1. Joint Sealant: Acrylic, Latex sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

G. Acoustical Joint-Sealant Application: Interior joints in vertical surfaces and horizontal surfaces.

1. Joint Locations:

a. Vertical joints on exposed and unexposed surfaces of unit masonry and concrete walls and steel stud/gypsum board partitions.
b. Horizontal joints on exposed and unexposed surfaces of unit masony and concrete walls and steel stud/gypsum board partitions.
c. Other joints as indicated on Drawings and calling for acoustical sealant.

END OF SECTION 079200

SECTION 092116 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

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 gypsum board shaft-wall assemblies for the following:

1. Shaft-wall enclosures.

B. Related Sections include the following:

1. Division 07 Section "Fire-Resistive Joint Systems" for head-of-wall assemblies that incorporate gypsum board shaft-wall assemblies.

1.3 SUBMITTALS

A. Product Data: For each gypsum board shaft-wall assembly indicated.

1.4 QUALITY ASSURANCE

A. Fire-Resistance Ratings: Provide materials and construction identical to those of assemblies with fire-resistance ratings determined according to ASTM E 119 by a testing and inspecting 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.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures for installing gypsum board shaft-wall assemblies including, but not limited to, the following:

1. Fasteners proposed for anchoring nonstructural steel framing to building structure.
2. Wiring devices in shaft-wall assemblies.
3. Doors and other items penetrating shaft-wall assemblies.
4. Items supported by shaft-wall-assembly framing.
5. Mechanical work enclosed within shaft-wall assemblies.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

C. Stack panels flat on leveled supports off floor or slab to prevent sagging.

1.6 PROJECT 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 install interior products until installation areas are enclosed and conditioned.

C. 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

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Gypsum Company.
2. Certainteed Corporation.
3. Georgia-Pacific Gypsum LLC.
4. National Gypsum Company.
5. USG Corporation.(Basis-of-Design)

2.2 GYPSUM BOARD SHAFT-WALL ASSEMBLIES, GENERAL

A. Provide materials and components complying with requirements of fire-resistance-rated assemblies indicated.

B. Fire-Resistance Rating: 2 hours.

1. Provide panels in maximum lengths available to eliminate or minimize end-to-end butt joints.
2. Provide auxiliary materials complying with gypsum board shaft-wall assembly manufacturer's written recommendations.

3. STC Rating: 51, minimum.

2.3 PANEL PRODUCTS

A. Gypsum Shaftliner Board: Comply with ASTM C1396/C1396M.

1. Moisture-and Mold-Resistant Type X: Manufacturer's proprietary fire-resistive liner panels with ASTM D3273 mold-resistance score of 10 as rated according to ASTM D3274, 1-inch thick, with double beveled long edges.

a. Basis-of-Design: USG Sheetrock Brand Gypsum Liner Panels.

B. Gypsum Board: 3/4-inch USG Sheetrock Brand Ultracode Core Panels, joints finished.

2.4 NON-LOAD-BEARING STEEL FRAMING

A. General: Complying with ASTM C645 requirements for metal unless otherwise indicated and complying with requirements for fire-resistance-rated assembly indicated..

B. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
1. Protective Coating: ASTM A 653/A 653M, G40 (Z120**)** hot-dip galvanized, unless otherwise indicated.

C. C-H Studs: Manufacturer's standard profile for repetitive, corner, and end members as follows:

1. Depth: 6-inches.
2. Minimum Base-Metal Thickness: Minimum 0.030-inch thickness.

D. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2-inches long and matching studs in depth and thickness.

E. 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 leas than indicated for studs and in with to accommodate depth of studs.

F. Elevator-Hoistway-Entrance Struts: Manufacturer's standard J-profile jamb strut with long-leg length of 3-inches, matching studs in depth, and not less than 0.030-inch thick.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced product standards and manufacturer's written recommendations.

B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes specified in Division 09 Section "Gypsum Board" that comply with gypsum board shaft-wall assembly manufacturer's written recommendations for application indicated.

C. Gypsum Base Joint-Reinforcing Materials: As specified in Division 09 Section "Gypsum Veneer Plastering."

D. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

E. 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 per 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 per ASTM E 1190 conducted by a qualified testing agency.

F. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.

1. Basis-of-Design Product: Thermafiber SAFB Mineral Wool Insulation by Owens Corning or approved equivalent. Thickness: 5-1/2 inches.

2. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

G. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."

1. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 GYPSUM BOARD SHAFT-WALL ASSEMBLIES

A. Basis-of-Design Product: As indicated on Drawings by design designation of a qualified testing agency.

B. Fire-Resistance Rating**:** 2 hours.

C. STC Rating: 51, minimum.

D. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.

1. Depth: As indicated on Drawings.
2. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).

E. Runner Tracks: Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches (51 mm) long and in depth matching studs.

1. Minimum Base-Metal Thickness: Matching steel studs.

F. Room-Side Finish: As indicated.

G. Shaft-Side Finish: As indicated.

H. Insulation: Sound attenuation blankets.

PART 3 - EXECUTION

3.1 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.

3.2 PREPARATION

3.3 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 the following:

1. ASTM C 754 for installing steel framing except comply with framing spacing indicated.
2. Division 09 Section "Gypsum Board" for applying and finishing panels.
3. Division 09 Section "Tiling" for cementitious backer units.

B. Do not bridge architectural or 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, and similar items that cannot be supported directly by shaft-wall assembly framing.

D. 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. Control Joints: Install control joints at locations indicated on Drawings, while maintaining fire-resistance rating of gypsum board shaft-wall assemblies.

G. 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. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain an airtight and smoke-tight seal; and comply with ASTM C 919 requirements or with manufacturer's written instructions, whichever are more stringent.

H. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3mm) from the plane formed by faces of adjacent framing.

3.4 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 092116

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes non-load-bearing steel framing members for the following applications:

1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

B. Related Sections include the following:

1. Division 05 Section "Cold-Formed Metal Framing" for exterior interior load-bearing and exterior non-load-bearing wall studs.
2. Division 07 Section "Thermal Insulation" for insulation installed with Z-shaped furring members.
3. Division 07 Section "Fire-Resistive Joint Systems" for head-of-wall joint systems installed with non-load-bearing steel framing.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
2. Protective Coating: ASTM A 653/A 653M, G60 (Z180) hot-dip galvanized, unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.

B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.

C. Flat Hangers: Steel sheet, 1 by 3/16 inch (25.4 by 4.76 mm) by length indicated.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.37 mm) and minimum 1/2-inch- (12.7-mm-) wide flanges.

1. Depth: 1-1/2 inches (38 mm).

E. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges, 3/4 inch (19.1 mm) deep.
2. Steel Studs: ASTM C 645.

a. Minimum Base-Metal Thickness: 0.0312 inch (0.79 mm).
b. Depth: 1-5/8 inches (41.3 mm).

3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22.2 mm) deep.

a. Minimum Base Metal Thickness: 0.0312 inch (0.79 mm).

4. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep members designed to reduce sound transmission.

a. Configuration: Asymmetrical.

F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Armstrong World Industries, Inc.; Drywall Grid Systems.
   b. Chicago Metallic Corporation; 640-C Fire Front 650-C Drywall Furring System.
   c. USG Corporation; Drywall Suspension System.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.0179 inch (0.45 mm) except use 0.0312 inch as follows:

   a. For head runner, sill runner, jamb, and crippled studs at door and other openings.
   b. In locations to relieve ceramic tile backing panels.

2. Depth: As indicated on Drawings.

B. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- (50.8-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- (50.8-mm) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
      2) Superior Metal Trim; Superior Flex Track System (SFT).

C. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Fire Trak Corp.; Fire Trak.
   b. Metal-Lite, Inc.; The System.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.0179 inch (0.45 mm).

E. Cold-Rolled Channel Bridging: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.

1. Depth: 1-1/2 inches (38.1 mm).
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38.1 by 38.1 mm), 0.068-inch- (1.73-mm-) thick, galvanized steel.

F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).
2. Depth: As indicated on Drawings.

G. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical.

H. Cold-Rolled Furring Channels: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.

1. Depth: 3/4 inch (19.1 mm) unless noted otherwise.
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch (0.79 mm).
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.

I. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (31.8 mm), wall attachment flange of 7/8 inch (22.2 mm), minimum bare-metal thickness of 0.0179 inch (0.45 mm), and depth of 1-1/2 inches.

2.4 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.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with sprayed Fire-resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling 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 o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-loading-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.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, 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.

3.4 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. 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 permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

G. 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.

3.5 INSTALLING FRAMED ASSEMBLIES

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install studs so flanges within framing system point in same direction.

1. Space studs as follows:

a. Single-Layer Application: 16 inches (406 mm) o.c., unless otherwise indicated.
b. Multilayer Application: 16 inches (406 mm) o.c., unless otherwise indicated.
c. Tile backing panels: 16 inches (406 mm) o.c., unless otherwise indicated.

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 (12.7-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 not less than 2 studs at ends of arcs, place studs 6 inches (150 mm) o.c.

D. Direct Furring:

1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

E. Z-Furring Members:

1. Erect insulation (specified in Division 07 Section "Thermal Insulation") vertically and hold in place with Z-furring members spaced 24 inches (610 mm)o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (600 mm) o.c.
3. 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 (300 mm) from corner and cut insulation to fit.

F. 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.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Interior gypsum board.

2. Tile backing panels.

3. Trim accessories.

B. Related Sections include the following:
1. Division 06 Section "Rough Carpentry" for wood framing and furring that supports gypsum board.
2. Division 07 Section "Thermal Insulation" for insulation installed in assemblies that incorporate gypsum board.
3. Division 07 Section “Fire-Resistive Joint Systems” for head-of-wall assemblies that incorporate gypsum board.
4. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board.
5. Division 09 painting Sections for primers applied to gypsum board surfaces.

1.3 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.

1.4 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.

C. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockups for the following:

a. Each level of gypsum board finish indicated for use in exposed locations.

2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 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.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 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.

2.2 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Gypsum.
b. CertainTeed Gypsum, Inc.
c. National Gypsum Company.
d. USG Corporation.

B. Type X:

1. Thickness: 5/8 inch (15.9 mm).
2. Long Edges: Tapered.

C. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.

1. Thickness: 5/8 inch (15.9 mm).
2. Long Edges: Tapered.

D. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.

1. Core: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.

2.3 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Gypsum.
b. CertainTeed Corporation.
c. Georgia-Pacific Building Products.
d. National Gypsum Company.

2. Core: 5/8 inch (15.9 mm), Type X.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

B. Water-Resistant Gypsum Backing Board: ASTM C 1396/C 1396M, with manufacturer's standard edges.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Gypsum.
b. CertainTeed Corporation.
c. Georgia-Pacific Building Products.

2. Core**:** 5/8 inch (15.9 mm), Type X.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Paper-faced galvanized steel sheet.
2. Shapes:

a. Cornerbead; use outside corners, unless otherwise indicated.
b. LC-Bead: J-shaped; exposed long flange receives joint compound; use for edge trim, unless noted otherwise.
c. Expansion (control) joint.
d. Curved-Edge Cornerbead: With notched or flexible flanges.

B. 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. (Basis-of-Design manufacturer; or provide similar trim by other mfrs.listed below)
1) GBR-1: "U" reveal moulding: 1 inch – DRM-625-100. See drawings.
2) GBR-2: "W" reveal moulding: ¾ inch – DRWT-75-75
3) "V" reveal molding DRMV-25 (at GWB soffit and wall control joints)
4) "Z" reveal molding DRMZ-625-75 (as indicated in Drawings)
b. Gordon, Inc.
c. Pittcon Industries.
d. MM Systems, Inc.

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: Chemical Conversion Finish to prepare for Field Painting. Prime and Paint to match surrounding walls.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.

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 drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
2. Cementitious Backer Units: As recommended by backer unit manufacturer.
3. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."

1. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: As indicated on Drawings.
2. Ceiling Type: As indicated on Drawings.
3. Moisture- and Mold-Resistant Type: As indicated on Drawings.

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 horizontally (perpendicular 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 stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.4 APPLYING TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at showers and where indicated on Drawings. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

B. Water-Resistant Backing Board: Install where indicated with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners, unless otherwise indicated.
2. LC-Bead: Use for edge trim.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 3: Fire-resistance rated assemblies and sound rates assemblies.
4. 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.

3.7 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 096519- RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Vinyl Composition Tile. (VCT)

B. Related Sections:

1. Division 09 Section "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

C. Samples for Verification: Full-size units of each color and pattern of floor tile required.

D. Qualification Data: For qualified Installer.

E. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.4 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 manufacturer for installation techniques required.

B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store 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 55 deg F or more than 85 deg F). Store floor tiles on flat surfaces.

1.6 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 85 deg F, 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. Until Substantial Completion, maintain ambient relative humidity between 40% and 60% during installation.

C. Install floor tile after other finishing operations, including painting, have been completed.

1.7 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. Floor Tile and Planks: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.1 VINYL COMPOSITION TILE (**VCT-1**)

A. Basis of Design Color and Pattern: See Finish Schedule for product details.

B. Tile Standard: ASTM F1066, specify Class I.

C. Thickness: 1/8 Inch.

D. Size: 12" X 12".

E. Warranty: 5 year limited warranty.

F. Installation Pattern: See Finish Schedule.

G. Performance Requirements:
1. Slip Resistance: (ASTM D2047) >.5 wet/dry ADA Compliant
2. Radiant Flux: (ASTM E648) Class I
3. Impact Resistance: (ASTM F1265) Pass
4. Static Load Limit: (ASTM F970) 150 PSI
5. Chemical Resistance: (ASTM F925) Pass
6. Smoke Density: (ASTM E662) ≤450

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: As recommended by manufacturer to meet site conditions

1. Resilient Vinyl Floor Tile
   a. Tarkett 100 Clear Thin Spread Adhesive
   b. Tarkett 975 Two-Part Urethane Adhesive
   c. Tarkett 901 SpraySmart Adhesive

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to Tarkett written instructions to ensure proper adhesion of Resilient Flooring.
1. Prepare concrete substrates in accordance with ASTM F 710.

a. Concrete floors must be free of dust, solvent, paint, wax, oil, grease, residual adhesive, adhesive removers, film-forming curing compounds, silicate penetrating curing compounds, sealing, hardening or parting compounds, alkaline salts, excessive carbonation or laitence, mold, mildew, and other foreign materials that may affect dissipation rate of moisture from the concrete, discoloration or adhesive bonding.
b. Mechanically remove contamination on the substrate that may cause damage to the resilient flooring material. Permanent and non-permanent markers, pens, crayons, paint, etc., must not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and stain the flooring material.
c. Perform moisture testing as recommended by manufacturer. Proceed with installation only after substrates have been tested and meet the minimum requirements from the manufacturer in accordance with ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride or ASTM F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
d. A pH test for alkalinity must be conducted on the concrete floor prior to installation with results conforming to manufacturer requirements. If the test results are not within the acceptable range, then installation must not proceed until the problem has been corrected.

2. Wood subfloors must have a minimum 18" (45.7 cm) of cross-ventilated space beneath the bottom of the joist.
a. The floor must be rigid, free of movement.
b. Single wood and tongue and groove subfloors should be covered with ¼" (6.4 mm) or ½" (12.7 mm) APA approved underlayment plywood.
1) Use ¼" (6.4 mm) thick underlayment panels for boards with a face width of 3" (76 mm) or less.
2) Use ½" (12.7 mm) thick underlayment panels for boards with a face width wider than 3" (76 mm).
c. Do not install over OSB (Oriented Strand Board), particle board, chipboard, lauan or composite type underlayments.

B. Fill cracks, holes, depressions and irregularities in the substrate with good quality Portland cement based underlayment leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

C. Floor covering shall not be installed over expansion joints.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.
1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Vinyl Composition Flooring:

1. Install with Tarkett adhesive specified for the site conditions and follow adhesive label for proper use.
2. Follow Tarkett's recommendation for tile orientation.
3. Open enough cartons of floor tiles to cover each area, and mix tile to ensure shade variations do not occur within any one area.
4. Roll the flooring in both directions using a 100 pound three-section roller.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing 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 resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
1. No traffic for 24 hours after installation.
2. No heavy traffic, rolling loads, or furniture placement for 48 hours after installation.

D. Wait 48 hours after installation before performing initial cleaning.

E. A regular maintenance program must be started after the initial cleaning.

END OF SECTION 096519

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Wood.
2. Gypsum board.

B. Related Sections include the following:
1. Division 06 Sections for shop priming carpentry with primers specified in this Section.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8x10 inches.
2. Label each Sample by Drawing designation.

C. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

1.4 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

    a. Wall and Ceiling Surfaces: Provide samples of at least 50 sq. ft.
    b. Other Items: Architect will designate items or areas required.

2. Apply benchmark samples for each color indicated in Finish Schedule after permanent lighting and other environmental services have been activated.
3. Final approval of color selections will be based on benchmark samples.

    a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

4. Accepted and undisturbed Mock-Ups may become part of the Work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gallon of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Sherwin-Williams Company.(Basis of Design)
2. Benjamin Moore & Co.

3. PPG Architectural Finishes, Inc.

2.2 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Non-flat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
2. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
3. Non-flat Topcoat Paints: VOC content of not more than 150 g/L.
4. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
5. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.

6. Dry-Fog Coatings: VOC content of not more than 400 g/L.
7. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
8. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.
9. Flat Paints and Coatings: VOC content of not more than 50 g/L.
10. Stains: VOC not more than 730 g/L.

D. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
2. Restricted Components: Paints and coatings shall not contain any of the following:

a. Acrolein.
b. Acrylonitrile.
c. Antimony.
d. Benzene.
e. Butyl benzyl phthalate.
f. Cadmium.
g. Di (2-ethylhexyl) phthalate.
h. Di-n-butyl phthalate.
i. Di-n-octyl phthalate.

j. 1,2-dichlorobenzene.
k. Diethyl phthalate.
l. Dimethyl phthalate.
m. Ethylbenzene.
n. Formaldehyde.
o. Hexavalent chromium.
p. Isophorone.
q. Lead.
r. Mercury.
s. Methyl ethyl ketone.
t. Methyl isobutyl ketone.
u. Methylene chloride.
v. Naphthalene.
w. Toluene (methylbenzene).
x. 1,1,1-trichloroethane.
y. Vinyl chloride.

E. Colors: Match Architect's samples, as indicated in Finish Schedule.

F. Stain Colors: Match Architect's samples, as indicated in Finish Schedule.

2.3 WOOD FILLERS

A. Wood Filler Paste: MPI #91.

2.4 PRIMERS/SEALERS

A. Primer, Alkali Resistant, Water Based: MPI #3

B. Primer Sealer, Latex, Interior: MPI #50.

C. Primer Sealer, Interior, Institutional Low Odor/VOC: MPI #149.

D. Interior Latex-Based Wood Primer: MPI #39.

2.5 METAL PRIMERS

A. Alkyd Anticorrosive Metal Primer: MPI #79.

B. Waterborne Galvanized-Metal Primer: MPI #134.

2.6 WATER-BASED PAINTS

A. Latex, Interior, High Performance Architectural, Satin (Gloss Level 4): MPI #140.

B. Latex, Interior, High-Performance Architectural, Semi-Gloss (Gloss Level 5): MPI #141.

C. Latex, Interior, High-Performance Architectural, Flat (Gloss Level 1) @ ceilings, typical.

D. Latex, Interior, Dry Fog, flat (Gloss Level 1).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Wood: 15 percent.
      a. Maximum Moisture Content of Interior Wood Substrates: 15 percent, when measured with an electronic moisture meter.
   2. Gypsum Board: 12 percent.

C. Gypsum board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

   1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
   2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

   1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Interior Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

E. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall apply touch up and restore painted surfaces damaged by testing.

2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer’s written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer’s written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Gypsum Board:

1. High-Performance Architectural Latex System: MPI INT 9.2B.

a. Prime Coat: Interior latex primer/sealer, MPI #50.
b. Intermediate Coat: High-performance architectural latex matching topcoat.
c. Topcoat: High-performance architectural latex flat (MPI #138), eggshell (MPI #139) and semigloss (MPI#141) as indicated in Finish Schedule.

3.7 INTERIOR WOOD-FINISH-SYSTEM SCHEDULE

A. Wood Substrates: Including wood trim..

1. High-Performance Architectural Latex System:

a. Prime Coat: Primer, latex, for interior wood, MPI #39.
b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
c. Topcoat: Latex, interior, high performance architectural, (Gloss: Level 5 Semi-Gloss.)

END OF SECTION 099123

SECTION 142100 – ELECTRIC TRACTION ELEVATORS

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 electric traction passenger elevators.

B. Related Sections include the following:

1. Division 01 Section "Temporary Facilities and Controls" for protection of floor openings and personnel barriers; temporary power and lighting.
2. Division 03 Section "Cast-in-Place Concrete" for elevator pit and elevator machine foundation.
3. Division 04 Section "Unit Masonry" for masonry hoistway enclosure, building-in and grouting hoistway door frames and grouting of sills, setting sleeves, inserts, and anchoring devices in concrete masonry units.
4. Division 05 Section "Metal Fabrications" for the following:
   a. Attachment plates, angle brackets, auxiliary support steel and divider beams for supporting guide-rail brackets.
   b. Structural-steel shapes for subsills and entrance frames.
   c. Pit ladders.
   d. Hoist beams.
5. Division 09 Section “Resilient Sheet Flooring” for finish flooring in elevator cars.
6. Division 26 Sections for electrical service for elevators to and including fused disconnect switches at machine room door, transfer switches with shunt trip circuit breakers, connection from auxiliary contacts in transfer switch to controller, and Emergency (Standby) Power Supply Systems.
7. Division 26 Section “Voice and Data Communication Cabling” for telephone service for elevators.
8. Division 26 Section "Digital, Addressable Fire-Alarm System" for smoke detectors in elevator lobbies to initiate emergency recall operation.

1.3 DEFINITIONS

A. Definitions in ASME A17.1 apply to work of this Section.

B. Defective Elevator Work: Operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

1.4 SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for the following:

1. Signal and operating fixtures, operating panels and indicators.
2. Cab design, dimensions and layout.
3. Hoistway-door and frame details
4. Electrical characteristics and connection requirements
5. Expected heat dissipation of elevator equipment in hoistway (BTU).
6. Color selection chart for Cab and Entrances.

B. Shop Drawings: Show plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure, relationships with other construction, and locations of equipment and signals. Include the following:

1. Large-scale layout of car control station and standby power operation control panel. Indicate variations from specified requirements, maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.
2. Car, guide rails, buffers, and other components in hoistway.
3. Maximum rail bracket spacing.
4. Maximum loads imposed on guide rails requiring load transfer to building structure.
5. Clearances and travel of car.
6. Clear inside hoistway and pit dimensions.
7. Location and sizes of access doors, hoistway entrances and frames.

C. Samples: For exposed finishes of cars, hoistway doors and frames, and signal equipment; 3-inch- (75-mm-) square Samples of sheet materials; and 4-inch (100-mm) lengths of running trim members. When requested, submit color charts of exposed finishes for color selection.

D. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service including standby-power generator, as shown and specified, are adequate for elevator system being provided.

E. Qualification Data: Manufacturer.

F. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals. Provide Owner's Manual and Wiring Diagrams. Provide three (3) hardcopies and one (1) laminated hardcopy.

G. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

H. Permits, Inspections and Certificates: Elevator contractor shall obtain and pay for all necessary Municipal and/or State inspections and permits as required by the elevator inspection authority, and make such tests as are called for by the regulations of such authorities. These tests shall be made in the presence of such authorities or their authorized representatives.

1. Arrange for inspections and make required tests. Coordinate inspections and tests with C ontractor.
2. Deliver to Owner upon completion and acceptance of elevator work.

I. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Elevators shall be installed by the manufacturer.

B. Manufacturer's Qualifications: Regularly engages in manufacturing, installing, and servicing elevators of the type specified.

C. Source Limitations: Obtain elevators through one source from a single manufacturer.

1. Provide major elevator components, including pump-and-tank units, hydraulic cylinder assemblies, controllers, signal fixtures, door operators, car frames, cabs, and entrances, manufactured by a single manufacturer.

D. Regulatory Requirements: Comply with applicable provisions in ASME A17.1/CSA B44, "Safety Code for Elevators and Escalators", ICC/ANSI A117.1, and IBC 2012.

1. Provide earthquake equipment required by ASME A17.1/CSA B44.

2. Project's seismic design category is C.

3. See Structural Drawings for seismic and structural loads.

E. Accessibility Requirements: Comply with ICC/ANSI A117.1.

F. Fire-Rated Hoistway Entrance Assemblies: Door and frame 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 at as close to neutral pressure as possible according to NFPA 252 or UL 10B.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging.

B. Store materials, components, and equipment off of ground, under cover, and in a dry location. Handle according to manufacturer's written recommendations to prevent damage, deterioration, or soiling.

1.7 COORDINATION

A. Coordinate installation of sleeves, block outs, and items that are embedded in concrete for elevator equipment. Furnish templates and installation instructions and deliver to Project site in time for installation.

B. Coordinate sequence of elevator installation with other work to avoid delaying the Work.

C. Coordinate locations and dimensions of other work relating to hydraulic elevators including pit ladders, sumps, and floor drains in pits; entrance subsills; and electrical service, electrical outlets, lights, and switches in hoistways and pits.

1.8 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace defective elevator work within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: The design for electric traction elevators No. EV1 and EV2 is based on Otis Elevator's Gen3 machine-room less elevator system.

1. Provide machine-room less Gen3 traction passenger elevators from Otis Elevator Company. The control system and card design based on materials and systems manufactured by Otis Elevator Company. The system shall consist of the following components:
   a. Controller located entirely inside the hoistway.
   b. An AC gearless machine using embedded permanent magnets mounted at the top of the hoistway.
   c. Polyurethane Coated-Steel Belts for elevator hoisting purposes.
   d. LED lighting standard in ceiling lights and elevator fixtures.
   e. Sleep mode operation for LED ceiling lights and car fan.

2.2 SYSTEMS AND COMPONENTS

A. General: Provide manufacturer's standard elevator systems. Where components are not otherwise indicated, provide standard components published by manufacturer as included in standard pre-engineered elevator systems and as required for complete system.

B. Equipment Description: Gen3 Edge gearless machine-room less elevator by Otis Elevator where all components fit inside the hoistway with the controller in the top landing entrance frame.

C. Equipment Control: Elevonic Control System.

D. Drive: Regenerative.

E. Quantity of Elevators: Two.

F. Stops: Three.

G. Openings: Front only.

H. Travel: 29'-0".

I. Rated Capacity: 3500 lbs.

J. Rated Speed: 150 fpm.

K. Clear Hoistway Dimensions: 17'-8" x 6'-11".

L. Clear Car Inside Dimensions: 6'-5 9/16" x 5'5 9/16".

M. Cab Height: 9'-7".

N. Clear Cab Height: 7'-4 5/16".

O. Entrance Type and Width: Single Slide – 36".

P. Entrance Height: 7'-0"

Q. Main Power Supply: 480 volts, 3-Phase, with a separate equipment grounding conductor.

R. Car Lighting Power Supply: 120 V., single-phase, 15 amps, 60 Hz.

S. Machine Location: Inside the hoistway at the top of the hoistway.

T. Signal Fixtures: Manufacturer's standard with metal button targets.

U. Controller Location: In the top landing entrance frame.

2.3 OPERATION SYSTEMS

A. General: Provide manufacturer's standard microprocessor operation system for each elevator as required to provide type of operation system indicated.

B. Operation: Simplex Collective Operation: Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered the car shall park at the last landing served.

Operation Features – Standard:

1. Full Collective Operation.
2. Anti-nuisance.
3. Fan and Light protection.
4. Load Weighing Bypass.
5. Independent Service.
6. Firefighters' Service Phase 1 and Phase II.
7. Top of Car inspection.

C. Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated:

1. Automatic Dispatching of Loaded Car: When car load exceeds 80 percent of rated capacity, doors will begin closing.

2. Nuisance Call Cancel: When car calls exceed a preset number while car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight can be adjusted.

3. Automatic Standby Power Operation with Manual Override.

D. Security Features: Provide the following security features, where indicated. Security features shall not affect emergency firefighters' service.

1. Car-to-Lobby Feature: Feature, activated by keyswitch at main lobby, that causes car to return immediately to lobby and open doors for inspection. On deactivation by keyswitch, calls registered before keyswitch activation are completed and normal operation is resumed.

E. Controller: The elevator control system shall be microprocessor based and software oriented and be linked together for purposes of communication by a serial communications link. Controller shall be protected from environmental extremes and excessive vibrations in a NEMA 1 enclosure. Controller shall be integrated in a hoistway entrance jamb. 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.

1. Monetary pressing of one or more buttons shall dispatch the car to the designated landings in the order in which the landings are reached by the car, irrespective of the sequence in which the buttons are pressed. Each landing call shall be canceled when answered.

2. When the car is traveling in the up direction, it shall stop at all floors for which car buttons or "up" hall buttons have been pressed. The car shall not stop at floors where "down" buttons have been pressed, unless the stop for that floor has been registered by a car button or unless the down call is at the highest floor for which any buttons have been pressed. Pressing the "up" button when the car is traveling in the down direction shall not intercept the travel unless the stop for that floor has been registered by a car button or unless the up call is the lowest for which any button has been pressed.

3. When the car has responded to its highest or lowest stop, and stops are registered for the opposite direction, its direction of travel shall reverse automatically and it shall then answer the calls registered for that direction. If both up and down calls are registered at an intermediate floor, only the call corresponding to the direction of car travel shall be canceled upon the stopping of the car at the landing.

F. Service Panel: Shall 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.
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 electrical assisted manual lowering.
9. Run/stop button.

G. 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.

H. Single-Car Standby-Power Operation: On activation of standby power, car is returned to a designated floor and parked with doors open. Car can be manually put in service on standby power, either for return operation or for regular operation, by switches in control panel located at main lobby. Manual operation causes automatic operation to cease.

2.4 FIRE ALARM CONTROL PANEL INTERFACE

A. General: If a smoke detector in an elevator lobby senses smoke, the fire alarm control panel (FACP) will send a signal to the elevator controller to move the car to a designated egress floor, usually first or main level. If smoke is detected in the designated egress floor lobby, then the controller sends the car to an alternate floor (next best egress floor, i.e. second floor). If smoke is detected in the elevator shaft (detectors located in pit and at top) or in elevator equipment room and the room temperature remains under sprinkler head rating (165 degrees), the FACP will tell the car to go to the designated floor. Heat detectors are provided in the equipment room and top of elevator shaft and set at 135 degrees. If heat is detected in these locations, the FACP sends a signal to shunt trip (shut down) electrical power to the elevator before the sprinkler system is turned on at 165 degrees. The elevator car will be lowered to lowest floor and doors opened and remain open.

2.5 EQUIPMENT: HOISTWAY COMPONENTS

A. Machine: AC gearless machine, with a synchronous permanent-magnet motor, dual solenoid service and emergency disc brakes, mounted at the top of the hoistway.

B. Governor: The governor shall be a tension type car-mounted governor.

C. Buffers, Car, and Counterweight: Polyurethane type buffers shall be used for speeds of 150 feet per minute.

D. Hoistway Operating Devices: Emergency stop switch in the pit. Terminal stopping switches.

E. Positioning System: Consists of an encoder, reader box, and door zone vanes.

F. Guide Rails and Attachments: Guide rails shall be Tee-section steel rails with brackets and fasteners. Side counterweight arrangements shall have a dual-purpose bracket that combines both counterweight guide rails and one of the car guide rails to building fastening.

G. Coated-Steel Belts: Polyurethane coated belts with high-tensile-grade, zinc-plated steel cords and a flat profile on the running surface and the backside of the belt. The belts shall have an FT-1 rating as referenced by NFPA 13. All driving sheaves and deflector sheaves should have a crowned profile to ensure center tracking of the belts. A continuous 24/7 monitoring system using resistance-based technology shall be installed to continuously monitor the integrity of the coated steel belts and provide advanced notice of belt wear.

H. Governor Rope: Shall be steel and shall consist of at least eight strands wound about a sisal core center.

2.6 DOOR OPERATION

A. Door Operation: Provide a direct current motor driven heavy duty operator designed to operate the car and hoistway doors simultaneously. Door movements shall be electrically cushioned at both limits of travel and the 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. Closed-loop, microprocessor controlled motor-driven linear door operator, with adjustable torque limits, also 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 with 6 inches of fully closed, the travel will reverse and the door will 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 will sound. When the obstruction is removed, the door will begin to close at reduced speed. If the infra-red door protection system detects a person or object while closing on nudging, the doors will stop and resume closing only after the obstruction has been removed.
5. Limited Door Reversal: If the doors are closing and the infra-red beam(s) is interrupted, the doors will reverse and reopen partially. After the obstruction is cleared, the doors will begin to close.
6. Door Open Watchdog: If the doors are opening, but do not fully open after a field adjustable time, the doors will 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 will 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 Devices: Provide a door protection system using 150 or more 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.

2.7 FINISH MATERIALS

A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated:

B. Enameled-Steel Sheet: Cold-rolled steel sheet complying with ASTM A 366/A 366M, matte finish, stretcher-leveled standard of flatness; hot-rolled steel sheet complying with ASTM A 569/A 569M may be used for door frames. Provide with factory-applied enamel finish; colors as selected by Architect.

C. Prime-Painted Steel Sheet: Cold-rolled steel sheet, ASTM A 366/A 366M, or hot-rolled steel sheet, ASTM A 569/A 569M, with factory-applied rust-inhibitive primer.

D. Polished Stainless-Steel: ASTM A666, Type 304, with No. 8 mirror polished finish

E. Satin Stainless-Steel: ASTM A 666, Type 304, with No. 4, directional satin finish.

F. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.

G. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063.

H. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type GP-50 General Purpose Grade, nominal 0.050" thickness; color, texture, and pattern as selected by Architect from elevator manufacturer's standard range of products. See Finish Schedule on Drawings for Basis-of-Design finish selection.

2.8 CAR ENCLOSURES

A. General: Provide steel-framed car enclosures with nonremovable wall panels, suspended ceiling, trim, accessories, access doors, doors, power door operators,sills (thresholds), lighting, and ventilation.

1. Provide standard railings complying with ASME A17.1 on car tops where required by ASME A17.1.

2. Provide finished car including materials and finishes specified below.

B. Materials and Finishes: Provide manufacturer's standards, but not less than the following:

1. Subfloor: Underlayment grade, exterior plywood, 5/8-inch (16-mm) nominal thickness.

2. Floor Finish: Specified in Division 09 Section "Resilient Sheet Flooring".

3. Stainless-Steel Wall Panels: Flush, hollow-metal construction; fabricated from stainless-steel sheet.

4. Plastic-Laminate Wall Panels: Plastic laminate adhesively applied to 1/2-inch (13-mm) fire-retardant-treated particleboard with manufacturer's standard protective edge trim. Panels have a flame-spread index of 75 or less, when tested according to ASTM E 84. Plastic-laminate color, texture, and pattern as selected by Architect from elevator manufacturer's standard range.

5. Fabricate car door frame integrally with front wall of car.

6. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet or by laminating stainless-steel sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.

7. Sills: Extruded metal, with grooved surface, 1/4 inch (6.4 mm) thick.

8. Satin Stainless Steel Ceiling: Flush panels with low-voltage halogen downlights in the center of each panel, concealed access door.

9. Sight Guards: Provide sight guards on doors matching door edges.

10. Handrails: Manufacturer's standard handrails, of shape, metal, and finish indicated.

C. Car Top Inspection: Provide a car top inspection station with an "Auto-Inspection switch, and "emergency stop" switch, and constant pressure "up and down" direction and safety buttons to make the normal operation devices inoperative. The station will give the inspector complete control of the elevator. The car top inspection station shall be mounted in the door operator assembly.

2.9 HOISTWAY ENTRANCES

A. General: Provide manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Provide frame size and profile to coordinate with hoistway wall construction.

1. Where gypsum board wall construction is indicated, provide self-supporting frames with reinforced head sections.

B. Materials and Fabrication: Provide manufacturer's standards, but not less than the following:

1. Typical door & frame finish: ASTM A366 steel panels, factory applied powder coat enamel finish.

2. Sight Guards: Provide sight guards on doors matching door edges.

3. Sills: Extruded metal, with grooved surface, 1/4 inch (6.4 mm) thick.

4. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

2.10 SIGNAL EQUIPMENT

A. General: Provide signal equipment for each elevator with hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with LEDs.

B. Car Control Stations: Provide manufacturer's standard semirecessed car control stations. Mount in return panel adjacent to car door, unless otherwise indicated.

1. Include call buttons for each landing served and other buttons, switches, and controls required for specified car operation.

2. Mark buttons and switches with standard identification for required use or function that complies with ASME A17.1. Use both tactile symbols and Braille.

3. Mount controls at heights complying with ICC/ANSI A117.1.

4. Provide "No Smoking" sign matching car control station, either integral with car control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.

C. Emergency Communication System: Provide system that complies with ASME A17.1 and ICC/ANSI A117.1. On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station. System provides two-way voice communication without using a handset and provides visible signals that indicate when system has been activated and when monitoring station has responded. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply. Provide required conductors in traveling cable for emergency communications system.

D. Car Position Indicator: For elevator cars, provide illuminated digital-display type (LED) car position indicator, integrated to and located above car control station. Also provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served.

1. Include travel direction arrows if not provided in car control station.

E. Hall Push-Button Stations: Provide one tamper-proof hall push-button station at each landing for each elevator.

1. Provide units with flat faceplate for mounting with body of unit recessed in wall.

2. Equip units with metallic, impact-resistant buttons and halos for calling elevator and for indicating desired direction of travel. Center jewel illuminates red.

F. Floor Identification Pads: Provide pry-resistant, flush mounted door jamb pads at each floor. Jamb pads shall comply with ICC/ANSI A117.1 requirements.

G. Standby-Power Elevator Selector Switches: Provide switches, as required by ASME A17.1/CSA B44, where indicated. Adjacent to switches, provide illuminated signal that indicates when normal power supply has failed. For each elevator, provide illuminated signals that indicate when they are operational and when they are at the designated emergency return level with doors open.

H. Corridor Call Station Pictograph Signs: Provide engraved signs matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station, unless otherwise indicated. Provide sign proof for Owner approval prior to fabrication.

2.11 ELEVATORS

A. Elevator Description:
1. Elevator Number: Elevators No. EV1 and EV2, (2-car hoistway).
2. Floors Served: First through Third.
3. Type: Electric traction elevator, Gen3 Edge gearless machine-room less elevator where all components fit inside the hoistway with the controller in the top landing entrance frame.
4. Equipment Control: Elevonic Control System.
5. Drive: Regenerative.
6. Elevator Stop Designations: 1,2,3.
7. Stops: 3
8. Openings: Front only.
9. Travel: 29'-0".
10. Rated Capacity: 3500 lbs.
11. Rated Speed: 150 fpm.
12. Car Inside Dimensions: 6'-5 9/16" W x 5'-5 9/16" D.
13. Clear Hoistway Dimensions: 17'-8" total width x 6'-11" depth.
14. Cab Height: 7'-9".
15. Clear Cab Height: 7'-4 5/16".
16. Entrance Type and Width: Single Slide – 3'-6".
17. Entrance Height: 7'-0".
18. Main Power Supply: 480 volts, 3 Phase, with a separate equipment grounding conductor.
19. Car lighting Power Supply: 120 volts, single-phase, 15 amps, 60 Hz.
20. Machine Location: Inside the hoistway at the top of the hoistway.
21. Signal Fixtures: Manufacturer's standard with metal button targets.
22. Seismic Requirements: Zone 2.
23. Auxiliary Operations:
    a. Automatic dispatching of loaded car.
    b. Nuisance call cancel.
    c. Standby power operation.

24. Car Enclosures:
    a. Front Walls (Return Panels) Satin stainless steel, No. 4 finish with integral car door frames.
    b. Car Fixtures: Satin stainless steel, No. 4 finish.
    c. Side and Rear Wall Panels: Plastic laminate.
    d. Door Faces (Interior): Satin stainless steel, No. 4 finish.
    e. Door Sills: Aluminum, mill finish.
    f. Ceiling: Satin stainless steel, flush panels with LED lights dropped perimeter lit (LED) ceiling.
    g. Handrails: 3/8" x 2" flat tubular bar, satin stainless steel, No. 4 finish at sides and rear of car.
    h. Floor prepared to receive ceramic tile (specified in Division 09 Section "Tiling" and Finish Schedule; allow for 5/8" thickness for tile and thin-set mortar).

25. Hoistway Entrances:
    a. Width: 3'-6".
    b. Height: 7'-0".
    c. Door Type: Single-speed, side opening.

d. Fire-Protection Rating: 1-1/2 hours.
e. Frames: Typical frame finish: ASTM A366 steel panels, factory applied powder coat enamel finish.
f. Provide 4-inch high head at door frames for 84-inch high doors.
g. Doors: Typical door finish: ASTM A366 steel panels, factory applied powder coat enamel finish.
h. Sills: Aluminum, mill finish.

26. Hall Fixtures: Satin stainless steel, No. 4 finish.
27. Additional Requirements:
a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
b. Provide blanket hooks and one complete set of full-height protective blankets for Elevator No. EV1 and EV2.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.

1. For the record, prepare a written report, endorsed by Installer, listing dimensional discrepancies and conditions detrimental to performance or indicating that dimensions and conditions were found to be satisfactory.

2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions.

B. Welded Construction: Provide welded connections for installing 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 qualifications of welding operators.

C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.

D. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.

E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.

F. Leveling Tolerance: 1/8 inch (3 mm), up or down, regardless of load and travel direction.

G. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting use (either temporary or permanent) of elevators, perform acceptance tests as required and recommended by ASME A17.1 and by governing regulations and agencies.

B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times tests are to be performed on elevators.

3.4 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service to include 12 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Parts and supplies to be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance during regular working hours of regular working days.

3.5 PROTECTION

A. Temporary Use: Comply with the following requirements for each elevator used for construction purposes:

1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
2. Provide strippable protective film on entrance and car doors and frames.
3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
5. Do not load elevators beyond their rated weight capacity.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate elevator(s). Refer to Division 01 Section "Demonstration and Training." 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.

B. Check operation of each elevator with Owner's personnel present and before date of Substantial Completion. Determine that operation systems and devices are functioning properly.

END OF SECTION 142100

SECTION 220000 - BASIC PLUMBING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 IMPOSED REGULATIONS:

A. Applicable provisions of the State and Local Codes and codes and standards in addition to those listed elsewhere in the contract documents are hereby imposed on a general basis for plumbing work.

1.2 SCOPE OF WORK:

A. Provide all labor, materials, equipment and supervision to construct complete and operable plumbing systems as indicated on the drawings and specified herein. All materials and equipment used shall be new, undamaged and free from any defects.

1.3 RELATED DOCUMENTS AND OTHER INFORMATION:

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the portions of work specified in each and every Section of this Division, individually and collectively.

1.4 EXISTING SERVICES AND FACILITIES:

A. Damage to Existing Services: Existing services and facilities damaged by the Contractor through negligence or through use of faulty materials or workmanship shall be promptly repaired, replaced, or otherwise restored to previous conditions by the Contractor without additional cost to the Owner.

B. Interruption of Services: Interruptions of services necessary for connection to or modification of existing systems or facilities shall occur only at prearranged times approved by the Owner. Contractor shall provide no less than 14 days notice to owner when scheduling outages. Interruptions shall only occur after the provision of all temporary work and the availability of adequate labor and materials will assure that the duration of the interruption will not exceed the time agreed upon.

1.5 PRODUCT WARRANTIES:

A. Provide manufacturer's standard printed commitment in reference to a specific product and normal application, stating that certain acts of restitution will be performed for the Purchaser or Owner by the manufacturer, when and if the product fails within certain operational conditions and time limits. Where the warranty requirements of a specific specification section exceeds the manufacturer's standard warranty, the more stringent requirements will apply and modified manufacturer's warranty shall be provided. In no case shall the manufacturer's warranty be less than one (1) year.

1.6 PRODUCT SUBSTITUTIONS:

A. General: Materials specified by manufacturer's name shall be used unless prior approval of an alternate is given by addenda. Requests for substitutions must be received in the office of the Architect at least 14 days prior to opening of bids. Refer to the general conditions for the substitution request form and required documentation.

PART 2 - NOT USED.

PART 3 - EXECUTION

3.1 PRODUCT INSTALLATION, GENERAL:

A. Except where more stringent requirements are indicated, comply with the product manufacturer's installation instructions and recommendations, including handling, anchorage, assembly, connections, cleaning and testing, charging, lubrication, startup, test operation and shut-down of operating equipment. Consult with manufacturer's technical experts, for specific instructions on unique product conditions and unforeseen problems.

B. Protection and Identification: Deliver products to project properly identified with names, models numbers, types, grades, compliance labels and similar information needed for distinct identifications; adequately packaged or protected to prevent deterioration during shipment, storage and handling. Store in a dry, well ventilated, indoor space, except where prepared and protected by the manufacturer specifically for exterior storage.

C. Permits and Tests: Provide labor, material and equipment to perform all tests required by the governing agencies and submit a record of all tests to the Owner or his representative. Notify the Architect five days in advance of any testing.

END OF SECTION 220000

SECTION 22 05 10 - PLUMBING COORDINATION

PART 1 - GENERAL

1.1 QUALITY ASSURANCE:

A. Retain or delete this article in all Sections of Project Manual.

B. Plumbing Coordination Drawings: Prepare a set of coordination drawings showing the coordination of the major elements, components, and systems of the Plumbing work, and showing the coordination of Plumbing work with other work. Prepare drawings at accurate scale and sufficiently large to show locations of every item, including clearances for installing, maintaining, insulating, breaking down equipment, replacing motors and similar requirements. Drawings shall indicate coordination with all other trades including, but not limited to, lighting, structural, plumbing, and architectural items. Prepare drawings to include plans, elevations, sections and details as needed to conclusively show successful coordination and integration of the work. Submit drawings for review by the Architect/Engineer and Owner.
1. Plans shall include dimensioned locations of all Floor Drains
2. Plans shall include locations of all ceiling and wall access panels required for equipment access (valves, for example).

C. Record Drawings: During construction operations, the Plumbing contractor shall faithfully make a record of all approved changes from the contract drawings, including accurate dimensions where applicable, and shall also record accurate dimensions locating all below-grade outside Plumbing utilities (whether changed or not) with reference to permanent above-grade objects. A minimum of two (2) dimensions from building reference points shall be provided and a bury depth indicated. At completion of the work, all such changes shall be recorded neatly with red ink by the Plumbing contractor on an unused set of the Plumbing contract drawings supplied by the architect.

D. Photographs: For all below-grade plumbing piping, photograph installation of trenches before backfilling. Submit to A/E for review and include in closeout documents to the Owner.

1.2 RELATED DOCUMENTS AND OTHER INFORMATION:

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the portions of work specified in each and every Section of this Division, individually and collectively.

PART 2 - PRODUCTS

1.1 PLUMBING PRODUCT COORDINATION:

A. Power Characteristics: Refer to the electrical sections of the specifications and the electrical drawings for the power characteristics available for the operation of each power driven item of Plumbing equipment. The electrical design was based on the power requirements of the Plumbing equipment

manufacturer scheduled or specified as "basis of design." Any modifications to the electrical system that are required due to the use of an approved equivalent manufacturer shall be made at no additional cost to the owner. All changes must be clearly documented and submitted for review by the Architect/Engineer prior to purchasing equipment. Coordinate purchases to ensure uniform interface with electrical work. Refer to Division 26 specifications for additional coordination requirements.

B. Coordination of Options and Substitutions: When the contract documents permit the selection from several product options and it becomes necessary to authorize a substitution, do not proceed with purchase until coordination of interface to equipment has been checked and satisfactorily established.

PART 3 - EXECUTION

1.1 INSPECTION AND PREPARATION:

A. Substrate Examination: The Installer of each element of the Plumbing work must examine the condition of the substrate to receive the work, the conditions under which the work will be performed, and must notify the Contractor in writing of conditions detrimental to the proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Do not proceed with the installation of sleeves, anchors, hangers, roof penetrations and similar work until Plumbing coordination drawings have been processed and released for construction. Where work must be installed prior to that time in order to avoid a project delay, review proposed installation in a project coordination meeting including all parties involved with the interfacing of the work.

1.2 CUTTING AND PATCHING:

A. Structural Limitations: Do not cut structural framing, walls, floors, decks and other members intended to withstand stress, except with the Architect's or Engineer's written authorization. Authorization will be granted only where there is no other reasonable method for completing the Plumbing work, and where the proposed cutting clearly does not materially weaken the structure.

B. Where authorized, cut opening through concrete (for pipe penetrations and similar services) by core drilling or sawing. Do not cut by hammer-driven chisel or drill.

C. Other work: Do not endanger or damage other work through the procedures and processes of cutting to accommodate Plumbing work. Review the proposed cutting with the Installer of the work to be cut, and comply with his recommendations to minimize damage. Where necessary, engage the original Installer or other specialists to execute the cutting in the recommended manner.

D. Where patching is required to restore other work, because of either cutting or other damage inflicted during the installation of Plumbing work, execute the patching in the manner recommended by the original Installer. Restore the other work in every respect, including the elimination of visual defects in exposed finishes, as judged by the Architect. Engage the original Installer to complete patching of the following categories of work:

1. Exposed concrete finishes.
2. Exposed masonry.
3. Waterproofing and vapor barriers.
4. Roofing, flashing and accessories.
5. Interior exposed finishes and casework, where judged by the Architect to be difficult to achieve an acceptable match by other means

1.3 COORDINATION OF PLUMBING INSTALLATION:

A. General: Sequence, coordinate and integrate the various elements of Plumbing work so that the Plumbing system will perform as indicated and be in harmony with the other work of the building. The Architect/Engineer will not supervise the coordination, which is the exclusive responsibility of the Contractor. Comply with the following requirements:
1. Install piping and similar services straight and true, aligned with other work and with overhead structures and allowing for insulation. Conceal where possible.
2. Arrange work to facilitate maintenance and repair or replacement of equipment. Locate services requiring maintenance on valves and similar units in front of services requiring less maintenance. Connect equipment for ease of disconnecting, with minimum of interference with other work.
3. Give the right-of way to piping systems required to slope for drainage (over other service lines). Piping shall be located to avoid interference with ductwork and light fixtures.

B. Drawings: Conform with the arrangement indicated by the contract documents to the greatest extent possible, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, comply with the Architect's decision on resolution of the conflict.

C. Electrical Work: Coordinate the Plumbing work with electrical work, and properly interface with the electrical service. In general, and except as otherwise indicated, install Plumbing equipment ready for electrical connection. Refer to the electrical sections of the specifications for electrical connection of Plumbing equipment.

D. Utility Connections: Coordinate the connection of Plumbing systems with exterior underground utilities and services. Comply with the requirements of governing regulations, franchised service companies and controlling agencies.
1. Provide a single connection for each service except where multiple connections are indicated. Water, tap, meter, and vault cost shall be incurred by the Contractor.

1.4 COORDINATION OF PLUMBING START-UP:

A. Seasonal Requirements: Adjust and coordinate the timing of Plumbing system start-ups with seasonal variations, so that demonstration and testing of specified performance can be observed and recorded. Exercise proper care in off-season start-ups to ensure that systems and equipment will not be damaged by the operation.

END OF SECTION 200510

SECTION 220517 - 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. Grout.

1.3 ACTION 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.

2.2 SLEEVE-SEAL SYSTEMS

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. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT (Link-Seal).
4. Metraflex Company (The).

5. Pipeline Seal and Insulator, Inc.
6. Proco Products, Inc.
7. Or approved equal.

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: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

C. Install sleeves in concrete floors, concrete roof slabs, concrete walls, and masonry walls as new slabs and walls are constructed.

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.

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

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 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 with sleeve-seal system.

2. Concrete Slabs-on-Grade:

a. Galvanized-steel-pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs above Grade:

a. Galvanized-steel sleeves with sleeve-seal system.

END OF SECTION 220517

SECTION 220523 - 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. Brass ball valves.
2. Bronze ball valves.
3. Bronze swing check valves.

B. Related Sections:

1. Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
2. Section 221116 "Domestic Water Piping" for valves applicable only to this 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: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

1.4 ACTION 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/ANSI Compliance: NSF 61 for valve materials for potable-water service.

D. NSF/ANSI Compliance: NSF 372 for low lead construction 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, and weld ends.
3. Set ball valves open to minimize exposure of functional surfaces.
4. 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.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Standards: NSF/ANSI 61 & 372.

C. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

D. Valve Sizes: Same as upstream piping unless otherwise indicated.

E. Valve Actuator Types:
1. Handlever: For quarter-turn valves NPS 6 and smaller.

F. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.
2. 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.

G. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRASS BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.3 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. 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: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.4 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

1. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 200 psig.

c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: PTFE.

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. Lift Check Valves: With stem upright and plumb.

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 valves.
2. Throttling Service: Ball valves.
3. Pump-Discharge Check Valves:

a. NPS 2 and Smaller: Bronze swing 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.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, full port, brass or bronze with stainless-steel trim.
3. Bronze Swing Check Valves: Class 150, nonmetallic disc.

END OF SECTION 220523

SECTION 220529 - 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. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. 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 7-16.

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 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: 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. Pipe stands.
4. Equipment supports.

C. Engineered Seismic Submittal: For pipe and equipment hangers and supports, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of seismic restraints.
2. Design Calculations: Calculate requirements for seismic restraints.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 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. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

B. 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 stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural stainless-steel shapes with MSS SP-58 stainless-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
2. Standard: MFMA-4.
3. Channels: Continuous slotted steel channel with inturned lips.
4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.4 THERMAL-HANGER SHIELD INSERTS

A. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

B. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

C. 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, stainless-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 piping.

B. High-Type, Single-Pipe Stand:
1. Base: Stainless steel.
2. Vertical Members: Two or more stainless-steel, continuous-thread rods.
3. Horizontal Member: stainless-steel rod with stainless-steel, roller-type pipe support.

C. High-Type, Multiple-Pipe Stand:
1. Bases: stainless steel.

2. Vertical Members: Two or more stainless-steel channels.
3. Horizontal Member: Stainless-steel channel.
4. Pipe Supports: Stainless-steel, clevis-type pipe hangers.

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 stainless-steel shapes.

2.9 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, stainless-steel plates, shapes, and bars.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 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, stainless-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 Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. 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.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. 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.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. 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.

N. Insulated Piping:

1. 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.

2. 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.

3. 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.

4. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
5. 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. 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. Use stainless-steel pipe hangers and stainless-steel attachments.

B. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

C. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

F. Use padded hangers for piping that is subject to scratching.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or 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 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. 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 220529

SECTION 220548 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUBMITTALS

A. Submit signed and sealed shop drawings from a professional engineer. Shop drawings to include project specific details, sketches, product data cut sheets.

B. See drawings for additional requirements.

PART 2 - NOT USED.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Refer to the details and notes on the construction documents.

3.2 FIELD QUALITY CONTROL

A. Inspect installation after installation and submit report.

END OF SECTION 220548

SECTION 220553 - 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. Pipe labels.
2. Valve tags.
3. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Valve numbering scheme.

C. 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 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.2 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: Stainless Steel, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass beaded chain.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 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 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 along each run. Reduce intervals to 15 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule:

1. Domestic Water Piping:

a. Background Color: Blue.
b. Letter Color: White.

2. Sanitary Waste and Storm Drainage Piping:

a. Background Color: Black or Green.
b. Letter Color: White.

3.3 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:

a. Cold Water: 2 inches, round.

END OF SECTION 220553

SECTION 220719 - 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. Piping insulation for domestic hot, tempered, and cold water piping.
2. Supplies and drains for handicap-accessible lavatories and sinks.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

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 Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

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" article for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA, Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
d. Or approved equal.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

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. Aeroflex USA, Inc.; Aeroseal.
b. Armacell LLC; Armaflex 520 BLV Adhesive.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
d. K-Flex USA; R-373 Contact Adhesive.

e. Or approved equal.

2. Adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 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. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

O. 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.

3.4 PENETRATIONS

A. Insulation Installation at Underground Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

B. Insulation Installation at Aboveground Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. 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. Finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 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.

3.8 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 PIPING INSULATION SCHEDULE

A. Domestic Water Piping:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 1 inch thick.

END OF SECTION 220719

SECTION 221316 - 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.

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.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE 7-16.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For coordination. Include plans, elevations, sections, and details.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For waste and vent piping, 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. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect/Owner no fewer than five days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Architect's/Owner's written permission.

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.

B. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ANACO-Husky.
b. Charlotte Pipe & Foundry.
c. MIFAB, Inc.
d. Mission Rubber Company; a division of MCP Industries, Inc.
e. Tyler Pipe.
f. Or approved equal.

2. Standards: ASTM C 1540.
3. Description: Stainless-steel shield, 0.015 inch minimum thickness, with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.3 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.

D. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

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. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.4 SPECIALTY PIPE FITTINGS

A. 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, Nonpressure Transition Couplings:

a. Standard: ASTM C 1460.
b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Capitol Manufacturing Company.
2) Central Plastics Company.
3) Hart Industries International, Inc.
4) Jomar International Ltd.
5) Matco-Norca, Inc.
6) McDonald, A. Y. Mfg. Co.
7) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
8) Wilkins; a Zurn company.
9) Or approved equal.

b. Description:

1) Standard: ASSE 1079.

2) Pressure Rating: 125 psig minimum at 180 deg F.
3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric-Flange Insulating Kits:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Advance Products & Systems, Inc.
2) Calpico, Inc.
3) Central Plastics Company.
4) Pipeline Seal and Insulator, Inc.
5) Or approved equal.

b. Description:

1) Nonconducting materials for field assembly of companion flanges.
2) Pressure Rating: 150 psig .
3) Gasket: Neoprene or phenolic.
4) Bolt Sleeves: Phenolic or polyethylene.
5) Washers: Phenolic with steel backing washers.

4. Dielectric Nipples:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Elster Perfection.
2) Grinnell Mechanical Products.
3) Matco-Norca, Inc.
4) Precision Plumbing Products, Inc.
5) Victaulic Company.
6) Or approved equal.

b. Description:

1) Standard: IAPMO PS 66
2) Electroplated steel nipple.
3) Pressure Rating: 300 psig at 225 deg F .
4) End Connections: Male threaded or grooved.
5) Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 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. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

K. 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.

L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Sanitary Drainage Piping: 1/4" per foot downward in direction of flow for piping NPS 2 and smaller; 1/8" per foot downward in direction of flow for piping NPS 3 and larger.
2. Vent Piping: 1/8" per foot down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

N. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

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.

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. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "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.

S. Install sleeve seals for piping penetrations of exterior concrete walls and slabs.

T. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.2 JOINT CONSTRUCTION

A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

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. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

3.3 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: Shielded, nonpressure 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 nipples or unions.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install stainless-steel pipe hangers for horizontal piping.
2. Install stainless-steel pipe support clamps for vertical piping.
3. Vertical Piping: MSS Type 8 or Type 42, clamps.
4. Install individual, straight, horizontal piping runs: MSS Type 1, adjustable, clevis hangers

C. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

F. 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.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod.

I. Install supports for vertical copper tubing every 10 feet.

J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 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 Section 221319 "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.

3.6 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.7 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.

3.8 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.

3.9 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil, waste, and vent piping shall be any of the following:

1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
2. For stubouts through walls to fixture trap arm: Copper DWV tube, copper drainage fittings, and soldered joints.

END OF SECTION 221316

SECTION 221319 - 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. Section Includes:

1. Cleanouts.
2. Floor drains.
3. Roof flashing assemblies.
4. Miscellaneous sanitary drainage piping specialties.
5. Flashing materials.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer Seismic Qualification Certification: Submit certification that accessories, and components will withstand seismic forces defined in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal Cleanouts, CO:

1. ASME A112.36.2M, Cast-Iron Cleanouts:

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) Josam Company.
2) MIFAB, Inc.
3) Smith, Jay R. Mfg. Co.
4) Tyler Pipe.
5) Watts Drainage Products.
6) Zurn Plumbing Products Group.
7) Or approved equal.

2. Standard: ASME A112.36.2M for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch or hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, brass 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, FCO:

1. ASME A112.36.2M, Cast-Iron Cleanouts:

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) Josam Company.
2) Smith, Jay R. Mfg. Co.
3) Watts Drainage Products.
4) Zurn Plumbing Products Group.
5) Or approved equal.

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: Not required.
7. Outlet Connection: Spigot.
8. Closure: Brass plug with tapered threads.
9. Adjustable Housing Material: Cast iron.

10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Heavy Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts, WCO:

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. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products.
   f. Zurn Plumbing Products Group.
   g. Or approved equal.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, drilled-and-threaded brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, stainless-steel cover plate with screw.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains: See Plumbing Fixture Schedule.

2.3 FLOOR SINKS

A. Stainless-Steel Floor Drains: See Plumbing Fixture Schedule.

2.4 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch-thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

   a. Low-Silhouette Vent Cap: With vandal-proof vent cap.

2.5 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Floor-Drain, Trap-Seal Fittings:

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. MIFAB, Inc.
    b. Precision Plumbing Products, Inc.
    c. Smith, Jay R. Mfg. Co.
    d. RectorSeal
    e. Or approved equal.

2. Description: Barrier, type, HDPE (High Density Poly Ethylene) housing with heavy duty silicone diaphragm and soft EPDM sealing gasket, conforming to ASSE 1072.
3. Size: Same as floor drain outlet.

B. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

C. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

D. Expansion Joints:

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

2.6 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. Fasteners: Metal compatible with material and substrate being fastened.

C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

D. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet.
4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Install 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.
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.

E. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

G. Install deep-seal traps on floor drains and other waste outlets, if indicated.

H. Install floor-drain, trap-seal fittings on floor drains: barrier type conforming to ASSE 1072.

I. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

J. Install vent caps on each vent pipe passing through roof.

K. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

L. Install wood-blocking reinforcement for wall-mounting-type specialties.

M. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.3 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.

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Leak Test: After installation, charge system 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.

3.5 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 221319

SECTION 221429 - 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 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Wiring Diagrams: For power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pumps and controls, 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.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.6 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, 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 Domestic Pump; ITT Corporation.
c. Flo Fab inc.
d. Glentronics, Inc.
e. Goulds Pumps; ITT Corporation.
f. Grundfos Pumps Corp.
g. Liberty Pumps.
h. Little Giant Pump Co.
i. McDonald, A. Y. Mfg. Co.
j. Pentair Pump Group; Hydromatic Pumps.
k. Pentair Pump Group; Myers.
l. Stancor, Inc.
m. Sta-Rite Industries, Inc.
n. Weil Pump Company, Inc.
o. Weinman Division; Crane Pumps & Systems.
p. 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. Pump and Motor Shaft: Stainless steel, with factory-sealed, grease-lubricated ball bearings.
6. Seal: Mechanical.
7. 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.

8. Controls:

a. Enclosure: NEMA 250, Type 4X.
b. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
c. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches.
d. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

9. 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.

B. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with galvanized grooved couplings or galvanized threaded fittings.

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Motors for submersible pumps shall be hermetically sealed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for plumbing piping to verify actual locations of storm drainage piping connections before sump pump installation.

3.2 INSTALLATION

A. Pump Installation Standards: Comply with HI 1.4 for installation of sump pumps.

3.3 CONNECTIONS

A. Comply with requirements for piping specified in Section 221413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

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.

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.

3.5 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.

3.6 ADJUSTING

A. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust control set points.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.

3.8 COMMISSIONING

A. The manufacturer’s representatives and installing contractors shall participate and cooperate with the Commissioning Authority with the pre-functional testing, pre-installation meetings, witnessing start-up and functional testing of all equipment and systems.

END OF SECTION 221429

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUBMITTALS

A. Product Data: Provide catalog cut sheets of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

B. Closeout:

1. Manufacturer's Instructions: Indicate installation, maintenance, operation, cleaning methods, and replacement procedures.

2. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer. Warranty shall be minimum 1 year parts and labor.

1.2 QUALITY ASSURANCE

A. ANSI Standards: Comply with ANSI Standards pertaining to plumbing fixtures and systems.

B. ANSI Standards: Comply with ANSI A117.1 standard pertaining to plumbing fixtures for handicapped.

C. PDI Compliance: Comply with standards established by Plumbing and Drainage institute (PDI) pertaining to plumbing fixture supports.

D. Federal Standards: Comply with applicable Federal Standard FS WW-P-541/Series sections pertaining to plumbing fixtures.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

A. General: Provide factory-fabricated fixtures of the type, style and material indicated in the Plumbing Fixture Schedule. For each type of fixture, unless otherwise specified, provide fixture manufacturer's standard trim, carrier. Seats. and valves as indicated by their published product information, either as designed and constructed, or as recommended by the manufacturer, and as required for a complete installation.

2.2 MATERIALS

A. General: Unless otherwise specified, comply with applicable Federal Specification WW-P-541/series sections pertaining to plumbing fixtures, fittings, trim, metals and finishes. Comply with requirements of WW-P-541/specification relative to quality of ware, glazing, enamel, composition and finish of metals, air gaps and vacuum breakers, even though some plumbing fixtures specified in this section are not described in WW-P-541.

B. Provide materials that have been selected for their surface flatness and smoothness. Exposed surface

which exhibit pitting, seam marks, roller marks, foundry sand holes, stains, discoloration or other surface imperfections on finished units are not acceptable.

C. Where fittings, trim and accessories are exposed or semi-exposed, provide bright chrome-plated or polished stainless steel units.

D. Unless noted otherwise, provide solid chrome-plated heavy cast brass (17 gauge) P-Trap with 2" minimum water seal and cast brass slip nut. Exposed P-Traps shall be fitted with cleanout plug.

E. Vitreous China: High quality, free from fire cracks, spots, blisters, pinholes and speck; glaze exposed surfaces and test for crazing resistance in accordance with ASTM C 554.
Vitreous China Fixtures shall be white.

F. Comply with additional fixture requirements contained in the fixture schedule.

2.3 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Lavatory Supply Fittings:

1. Supply Piping Stub-out: Chrome-plated-brass pipe or chrome-plated-copper tube matching water-supply piping size. Include chrome-plated wall flange.

2. Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression stop with inlet connection matching water-supply piping type and size. Wheel handle operation.

D. Risers:

1. Size: NPS 3/8 for lavatories and kitchen sinks, NPS 1/2 for tank-type water closets.

2. Material: ASME A112.18.6, braided-stainless-steel flexible hose riser.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install plumbing fixtures of types indicated where shown and at indicated heights or where not shown in accordance with manufacturer's written instruction, roughing-in drawings and with recognized industry practices.

B. Fasten plumbing fixtures and water supplies securely to supports or building structure, and ensure that fixtures are level and plumb and tight against mounting surface.

C. Seal the outer perimeter of wall mounted lavatories and urinals and water closets to the wall and floor mounted water closets to the floor with a smooth bead of white silicone compound.

D. Provide supply fittings for lavatories, sinks, and water closets.

E. Install flush handle accessible water closets with handle mounted on wide side of compartment.

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories and sinks.

3.2 FIELD QUALITY CONTROL

A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test and adjust fixtures for proper operation.

3.3 ADJUSTING

A. Operate and adjust plumbing fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.4 CLEANING AND PROTECTION

A. After completing installation of plumbing fixtures, inspect and repair damaged finishes.

B. Clean plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed plumbing fixtures and fittings.

D. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 IMPOSED REGULATIONS

A. Applicable provisions of the State and Local Codes and of the following codes and standards in addition to those listed elsewhere in the specifications are hereby imposed on a general basis for electrical work: codes and standards listed on the electrical drawings.

1.2 SCOPE OF WORK

A. Provide all labor, materials, equipment and supervision to construct complete and operable electrical systems as indicated on the drawings and specified herein. All materials and equipment used shall be new, undamaged and free from any defects.

1.3 RELATED DOCUMENTS AND OTHER INFORMATION

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the portions of work specified in each and every Section of this Division, individually and collectively.

1.4 EXISTING SERVICES AND FACILITIES

A. Damage to Existing Services: Existing services and facilities damaged by the Contractor through negligence or through use of faulty materials or workmanship shall be promptly repaired, replaced, or otherwise restored to previous conditions by the Contractor without additional cost to the Owner.

B. Interruption of Services: Interruptions of services necessary for connection to or modification of existing systems or facilities shall occur only at prearranged times approved by the Owner. Interruptions shall only occur after the provision of all temporary work and the availability of adequate labor and materials will assure that the duration of the interruption will not exceed the time agreed upon.

C. Removed Materials: Existing materials made unnecessary by the new installation shall be stored on site. They shall remain the property of the Owner and shall be stored at a location and in a manner as directed by the Owner. If classified by the Owner's authorized representative as unsuitable for further use, the material shall become the property of the Contractor and shall be removed from the site at no additional cost to the owner.

1.5 PRODUCT WARRANTIES

A. Provide manufacturer's standard printed commitment in reference to a specific product and normal application, stating that certain acts of restitution will be performed for the Purchaser or Owner by the manufacturer, when and if the product fails within certain operational conditions and time limits. Where the warranty requirements of a specific specification section exceed the manufacturer's standard warranty, the more stringent requirements will apply and modified manufacturer's warranty shall be provided. In no case shall the manufacturer's warranty be less than one (1) year.

1.6 PRODUCT SUBSTITUTIONS

A. General: Materials specified by manufacturer's name shall be used unless prior approval of an alternate is given by addenda. Requests for substitutions must be received in the office of the Architect at least 10 days prior to opening of bids.

1.7 ELECTRICAL DRAWINGS

A. Electrical contract drawings are diagrammatic and indicate the general arrangement of electrical equipment. Do not scale electrical plans. Obtain all dimensions from the Architect's dimensioned drawings and field measurements. The Contractor shall review Architectural plans for door swings and built-in equipment; conditions indicated on those plans shall govern for this work.

B. Coordinate installation of electrical equipment with the structural and mechanical equipment and access thereto. Coordinate exterior electrical work with civil and landscaping work.

C. Discrepancies shown on different drawings, between drawings and specifications or between documents and field conditions shall be installed to provide the better quality or greater quantity of work; or, comply with the more stringent requirement; either or both in accordance with the A/E's interpretation.

1.8 SYSTEMS REQUIRING ROUGH-IN

A. Rough-in shall consist of all outlet boxes/raceway systems/supports and sleeves required for the installation of cables/devices by other Divisions and by the Owner. It shall be the responsibility of this Contractor to determine the requirements by reviewing the contract documents and meeting with the Superintendent of the trade involved and Owner's representative to review submittal data, shop drawings, etc.

B. Sealing of all sleeves, to meet the fire rating of the assembly, whether active or not, is work of this Division.

1.9 SUBMITTALS

A. Refer to section 260510

PART 2 - PRODUCTS

2.1 FIRESTOPPING

A. Refer to Division 07 sections for additional requirements.

B. A firestop system shall be used to seal penetrations of electrical conduits and cables through fire-rated partitions per the NEC. The firestop system shall be qualified by formal performance testing in accordance with ASTM E-814, or UL 1479.

C. The firestop system shall consist of a fire-rated caulk type substance and a high temperature fiber insulation. It shall be permanently flexible, waterproof, non-toxic, smoke and gas tight and have a high adhesion to all solids so damming is not required. Only metal conduit shall be used in conjunction with

this system to penetrate fire rated partitions. Install in strict compliance with manufacturer's recommendations. 3M, Hilti, STI or equal.

D. Comply with TIA/EIA-569-A, Annex A, "Firestopping."

E. Comply with BICSI TDMM, "Firestopping Systems" Article.

PART 3 - EXECUTION

3.1 PRODUCT INSTALLATION, GENERAL

A. Except where more stringent requirements are indicated, comply with the product manufacturer's installation instructions and recommendations, including handling, anchorage, assembly, connections, cleaning and testing, charging, lubrication, startup, test operation and shut-down of operating equipment. Consult with manufacturer's technical experts, for specific instructions on unique product conditions and unforeseen problems.

B. Protection and Identification: Deliver products to project properly identified with names, models numbers, types, grades, compliance labels and similar information needed for distinct identifications; adequately packaged or protected to prevent deterioration during shipment, storage and handling. Store in a dry, well ventilated, indoor space, except where prepared and protected by the manufacturer specifically for exterior storage.

C. Permits and Tests: Provide labor, material and equipment to perform all tests required by the governing agencies and submit a record of all tests to the Owner or his representative. Notify the Architect five days in advance of any testing.

D. Install temporary protective covers over equipment enclosures, outlet boxes and similar items after interiors, conductors, devices, etc. are installed, to prevent the entry of construction debris and to protect the installation during finish work performed by others. Do not install device plates, equipment covers or trims until finish work is complete.

E. Clean all equipment, inside and out, upon completion of the work. Scratched or marred surfaces shall be touched-up with touch-up paint furnished by the equipment manufacturer.

F. Replace all equipment and materials that become damaged.

G. No more than three phase conductors, each of opposite phases for a three phase WYE system, shall be combined in a single raceway unless written approval is granted by the engineer or noted otherwise on the construction documents. (For 120 volt and 277 volt receptacle and lighting circuits are no more than 3 circuits unless written approval is granted by the engineer or noted otherwise on the construction documents.)

3.2 LOW VOLTAGE CABLING SEPARATION FROM EMI SOURCES

A. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.

B. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
   1. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches
   2. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches
   3. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches

C. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
   1. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches
   2. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches
   3. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches

D. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   1. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   2. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches
   3. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches

E. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches

F. Separation between Cables and light fixtures: A minimum of 5 inches

3.3 EQUIPMENT PROTECTION

A. Equipment and materials shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.

B. Store equipment indoors in clean dry space with uniform temperature to prevent condensation. Equipment shall include but not be limited to switchgear, switchboards, panelboards, transformers, motor control centers, motor controllers, uninterruptible power systems, enclosures, controllers, circuit protective devices, cables, wire, light fixtures, electronic equipment, and accessories.

C. During installation, equipment shall be protected against entry of foreign matter; and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.

D. Damaged equipment shall be, as determined by the Engineer, placed in first class operating condition or be returned to the source of supply for repair or replacement.

E. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.

F. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

3.4 ELECTRICAL WORK

A. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished in this manner for the required work, the following requirements are mandatory:

1. Electricians must use full protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance with NFPA 70E.

2. Electricians must wear personal protective equipment while working on energized systems in accordance with NFPA 70E.

3. Before initiating any work, a job specific work plan must be developed by the contractor with a peer review conducted and documented by the Contractor. The work plan must include procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used and exit pathways. This plan is subject to review and comment by the owner.

B. Nothing in the above shall impose any duty on the Architects and Architect's consultants, nor relieve the General Contractor and its subcontractors of its obligations, duties and responsibilities including but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending and coordinating the Electrical Work in accordance with the Contract Documents and any health or safety precautions required by any regulatory agencies.

END OF SECTION 260500

SECTION 260501 - ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 Not Used

PART 2 - PRODUCTS

2.1 Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

A. Field verify measurements and circuiting arrangements are as shown on Drawings.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on casual field observation.

D. Report discrepancies to Engineer before disturbing existing installation.

E. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Provide temporary wiring and connections to maintain existing systems in service during construction.

C. When work must be performed on energized equipment or circuits, use personnel experienced in such operations, submit verification of compliance with the contractor's safety procedures to the Architect, and notify the Owner in writing a minimum of 24 hours prior to work.

D. Existing Fire Alarm System: Maintain existing system in service until new system is installed and tested. Disable system only to make switchovers and connections. Minimize outage duration. Notify owner and AHJ before partially or completely disabling system.

E. The existing television, telephone, computer data, intrusion detection and intercom system shall remain operable during construction. Plan and execute the work accordingly. Provide temporary wiring and facilities as may be required.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Maintain electrical service to areas outside of the construction area.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

F. Disconnect and remove abandoned panelboards and distribution equipment.

G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

H. Disconnect and remove abandoned luminaries. Remove brackets, stems, hangers, and other accessories.

I. Repair adjacent construction and finishes damaged during demolition and extension work.

J. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

L. All demolished ballasts and lamps shall be recycled.

M. Remove all abandoned conductors and cables within the construction area.

N. Support all existing communication cables within the construction area.

O. Provide fire stopping for all existing communication conduit fire rated wall penetrations within the construction area.

3.4 CONSTRUCTION PHASING

A. Plan and execute the work in accordance with the construction phasing indicated on the Architectural plans. Test and certify all systems, by phase of construction, so that "partial occupancy" can be obtained.

3.5 REUSE OF EXISTING MATERIALS

A. Where new devices are to replace existing, it shall be permissible to reuse existing outlet boxes and branch circuit conduits. It shall be the responsibility of the Contractor to ensure that existing outlet boxes and conduits that are reused comply with requirements for new.

B. The reuse of conduits (not remaining in place), conductors, and devices is not permitted.

3.6 CUTTING AND PATCHING

A. Structural Limitations: Do not cut structural framing, walls, floors, decks, and other members intended to withstand stress, except with the Engineer's written authorization. Authorization will be granted only when there is no other reasonable method for completing the electrical work, and where the proposed cutting clearly does not materially weaken the structure.

B. Cutting Concrete: Where authorized, cut openings through concrete (for conduit penetrations and similar services) by core drilling or sawing. Do not cut by hammer-driven chisel or drill. Prior to cutting of existing concrete walls, floors, or ceilings x-ray existing concrete to locate existing hidden utilities.

C. Other Work: Do not endanger or damage other work through the procedures and process of cutting to accommodate electrical work. Review the proposed cutting with the Installer of the work to be cut, and comply with his recommendations to minimize damage. Where necessary, engage the original Installer or other specialists to execute the cutting in the recommended manner.

D. Patching: Where patching is required to restore other work, because of cutting or other damage inflicted during the installation of electrical work, execute the patching in the manner recommended by the original Installer. Restore the other work in every respect, including the elimination of visual defects in exposed finished, as judged by the Engineer. Engage the original Installer to complete patching of various categories of work including: concrete and masonry finishing, waterproofing and roofing, exposed wall finishes, etc.

3.7 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or that are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions.

3.8 LABELING

A. Provide typed circuit directory showing revised circuiting arrangement.

B. Provide and install a new engraved nameplate for all electrical panels that have been modified during construction. Refer to the panelboard specification section for labeling requirements.

END OF SECTION 260501

SECTION 260510 – ELECTRICAL SUBMITTALS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Comply with the applicable requirements of the Division 1 specifications (013300) and the requirements of this Division of the specifications.

1.2 SUBMITTALS

A. Submit for review by the Engineer Architect a schedule with engineering data of materials and equipment to be incorporated in the work. Submittals shall be supported by descriptive materials, i.e., catalog sheets, product data sheets, diagrams, performance curves and charts published by the manufacturer, warranties, etc., to show conformance to Specifications and Plan requirements; model numbers alone shall not be acceptable. Data submitted for review shall contain all information to indicate compliance with Contract Documents. Complete electrical characteristics shall be provided for all equipment. Submittals for lighting fixtures shall include Photometric Data. The Engineer reserves the right to require samples of any equipment to be submitted for review.

B. The purpose of shop drawing review is to demonstrate to the Architect that the Contractor understands the design concept. The Architect's review of such drawings, schedules, or cuts shall not relieve the Contractor from responsibility for deviations from the drawings or specifications unless he has, in writing, called the Architect's attention to such deviation at the time of submission, and received written permission from the Architect for such deviations.

C. Where cut sheets include an entire product family, mark all specific items to be utilized for this project on equipment cut sheets. Generic cut sheets with no indication of which items on the cut sheet shall be used will be rejected.

D. Response to Submittals: Shop drawings shall be returned by the Electrical Engineer with the following classifications:

1. "No Exceptions Taken": No corrections, no marks. Contractor shall submit copies for distribution

2. "Make Corrections Noted": A few minor corrections. Items may be ordered as marked up without further resubmission. Submit copies for distribution.

3. "Amend and Resubmit": Minor corrections. Item may be ordered at the Contractor's risk. Contractor shall resubmit drawings with corrections noted.

4. "Rejected - Resubmit": Major corrections or not in accordance with the contract documents. No items shall be ordered. Contractor shall correct and resubmit drawings.

E. Prior Approvals and Shop Drawings must be hand delivered, received by mail, or email.

F. Equipment and materials requiring submittals:
1. Section 260500 – Common Work Results for Electrical

a. Product Warranties
b. Firestopping Materials
c. Firestopping Installation Drawings for each conduit penetration, cable in metal sleeve penetration and blank metal sleeve penetration for each type of wall/floor construction encountered

2. Section 260511 – Electrical Work Closeout
   a. Record Drawings
   b. Record Manuals
   c. Close out submittals
   d. Training verification

3. Section 260519 – Low-Voltage Electrical Conductors and Cables
   a. Splice Kits
   b. Waterproof Wire Connectors
   c. Wire
   d. Field Quality Control Test Reports

4. Section 260523 – Control Voltage Electrical Power Cables
   a. Cables and wire

5. Section 260526 – Grounding and Bonding for Electrical Systems
   a. Product Data

6. Section 260529 – Hangers and Supports for Electrical Systems
   a. Product Data

7. Section 260533 – Raceway and Boxes for Electrical Systems
   a. Product Data
   b. Enclosure ratings

8. Section 260548 – Vibration and Seismic Controls for Electrical Systems
   a. Submit seismic force level (Fp) calculations from applicable building code.
   b. Submit pre-approved restraint selections and installation details
   c. Restraint selection and installation details shall be sealed by a professionally licensed engineer experienced in seismic restraint design.
   d. Submit manufacturer's product data on strut channels including, but not limited to, types, materials, finishes, gauge thickness, and hole patterns. For each different strut cross-section, submit cross sectional properties including Section Modulus (Sx) and Moment of Inertia (Ix).
   e. Field reports

9. Section 260553 – Identification for Electrical Systems
   a. Product data for all labeling products
   b. Samples of device nameplates

10. Section 262400 – Panelboards
    a. Product data
    b. Enclosures
    c. Dimensional Data
    d. Layout Drawings and elevations
    e. Short Circuit Current Rating
    f. Device nameplate data.

11. Section 262726 – Wiring Devices
    a. Product data
    b. Device Plates

12. Section 262813 – Fuses
    a. Fuses

13. Section 262816 – Enclosed Switches and Circuit Breakers
    a. Product data
    b. Enclosures
    c. Dimensional Data
    d. Control Wiring Diagrams
    e. Accessories
    f. Short Circuit Current Rating
    g. Test reports
    h. Indicate on the submittal the name of the load served by each device submitted

14. Section 265100 – Lighting
    a. Lighting Fixtures
    b. Emergency Ballasts

15. Section 283100 – Fire Detection and Alarm
    a. Battery calculations.
    b. Voltage drop calculations
    c. Installer's qualifications.
    d. Conduit fill calculations.
    e. Manufacturer's detailed data sheet for each control unit, initiating device, and notification appliance.
    f. Device layout drawings with proposed conduit routing. Drawings must be prepared using AutoCAD Release 2017 or newer.
    g. System riser diagram.
    h. List of all devices on each signaling line circuit, with spare capacity indicated.
    i. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72
    j. Warranty
    k. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
    l. Verify that each duct detector is listed for complete range of air velocity, temperature,

and humidity possible when air-handling system is operating.

m. Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the authority having jurisdiction. Include copies of shop drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, make resubmissions if required to make clarifications or revisions to obtain approval.

n. Inspection and Test Reports:
   1) Submit inspection and test plan prior to closeout demonstration
   2) Submit documentation of satisfactory inspections and tests.
   3) Submit NFPA 72 "Inspection and Test Form," filled out.

16. Section 283200 – Two-Way Communication
   a. Product Data
   b. Wiring diagrams showing typical field wiring connections.
   c. System riser diagram

PART 2 - PRODUCTS

2.1 Not Used.

PART 3 - EXECUTION

3.1 MANUFACTURER'S DATA

A. Include the manufacturer's comprehensive product data sheet and installation instructions. Where operating ranges are shown, mark data to show portion of range required for project application. Where pre-printed data sheet covers more than one distinct product-size, type, material, trim, accessory group or other variations, delete or mark-out portions of the pre-printed data which are not applicable.

3.2 EQUIPMENT LIST

A. Where more than one type of a product is being used (i.e. starters, disconnects, breakers, etc.) provide a list with each submittal correlating the type and size of product to the load served.

3.3 TEST REPORTS

A. Submit test reports which have been signed and dated by the firm performing the tests, and prepare in the manner specified in the standard or regulation governing the tests procedure as indicated.

END OF SECTION 260510

SECTION 260511 - ELECTRICAL WORK CLOSEOUT

PART 1 - GENERAL

1.1 SUBMITTALS

A. Refer to section 260510.

1.2 RELATED SECTIONS

A. Refer to section 017839 for additional requirements.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Except where otherwise indicated, electrical drawings prepared by Engineer are diagrammatic in nature and may not show locations accurately for various components of electrical system. Shop drawings, including coordination drawings, prepared by the Contractor show portions of work more accurately to scale and location, and in greater detail. It is recognized that actual layout of installed work may vary substantially from both Contractor drawings and shop drawings.

B. The electrical superintendent shall maintain a white set of contract documents and shop drawings in clean, undamaged condition, for mark-up of actual installations which vary substantially from the work as shown. PDF or digital mark-ups is acceptable alternates Mark-up whatever drawings are most capable of showing installed conditions accurately. However, where shop drawings are marked, record a reference note on appropriate contract drawings. Mark with erasable pencil, and use multiple colors to aid in the distinction between work of separate electrical systems. <u>These documents shall be used for no other purpose</u>. In general, record every substantive installation of electrical work which previously is either not shown or shown inaccurately, but in any case record the following:

1. Post all addenda prior to beginning work.
2. Underground feeder conduits, both interior and exterior, drawn to scale and fully dimensioned.
3. Work concealed behind or within other work, in a non-accessible arrangement.
4. Mains and branches of wiring systems, with panelboards and control devices located and numbered, with concealed splices located, and with devices requiring maintenance located.
5. Scope of each change order (C.O.), noting C.O. number.

C. Upon each visit by the Architect/Engineer, the Contractor shall demonstrate that the record documents are being kept current, as specified hereinbefore.

2.2 RECORD MANUALS

A. Record manuals shall include the following:

1. Manufacturer's operation and maintenance manuals for:
   a. Light Fixtures
   b. Panelboards and Circuit Breakers
   c. Fire Alarm System

d. Two way communication systems

2. Shop drawings, revised to reflect all review comments, supplemented with the installation instructions shipped with equipment.
3. One copy of all panelboard directories.
4. All field test Reports
5. Electrical Contractor's Warranty
6. Fire alarm set of floor plans showing actual installed locations of components, conduit, and zones.
7. Fire Alarm "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

B. Submit record manuals in quantities and in the format prescribed in the Division 1 specifications.

C. Submit copies of all Maintenance contracts including:
1. Fire Alarm Systems.
2. Two way communication systems

2.3 CLOSEOUT SUBMITTALS

A. Software and Firmware Operational Documentation:
1. Software operating and upgrade manuals.
2. Program Software Backup: On USB drive, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

PART 3 - EXECUTION

3.1 SITE VISITS

A. At all construction observations by the Architect/Engineer, the Contractor shall demonstrate to the Architect/ Engineer that all work is complete in accordance with the contract documents and that all systems have been tested and are fully operational. The Contractor shall furnish the personnel, tools and equipment required to inspect and test all systems.

3.2 TRAINING

A. Train Owner's personnel on the operation and maintenance of the following systems:
1. Fire Alarm System - 1 hours
2. Lighting Control Systems – 1 hours
3. Two way communication system – 1 hours

B. Training shall not be conducted until system has been tested by the Contractor and is 100% operational. Refer to the individual specification sections for additional requirements.

END OF SECTION 260511

SECTION 260519 – LOW-VOLTAGE ELECTRICAL CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the requirements for the following:
   1. Wire and cable for 600 volts and less.
   2. Wiring connectors and connections.

1.2 SUBMITTALS

A. Refer to section 260510.

1.3 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.4 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; current edition.

B. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; current edition.

C. NFPA 70 - National Electrical Code; National Fire Protection Association, current edition.

PART 2 - PRODUCTS

2.1 WIRING REQUIREMENTS

A. Concealed Dry Interior Locations: Use only THHN-2, THWN-2 or XHHW-2 wire in raceway.

B. Exposed Dry Interior Locations: Use only THHN-2, THWN-2, or XHHW-2 in raceway.

C. Above Accessible Ceilings: Use only THHN-2, THWN-2, or XHHW-2 in raceway.

D. Wet or Damp Interior Locations: Use only THWN-2 or XHHW-2 in raceway.

E. Exterior locations (above or below grade) THWN-2, XHHW-2 or USE in raceway.

F. Use conductors not smaller than 12 AWG for power and lighting circuits.

G. Use conductors not smaller than 14 AWG for control circuits.

H. Metal Clad (MC) cable shall not be used unless prior approval has been granted by the architect and engineer.

2.2 BUILDING WIRE

A. Conductor: Copper.

B. Insulation Voltage Rating: 600 volts.

C. Temperature Rating: 90°C.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Pull all conductors into raceway at same time.

B. Use suitable wire pulling lubricant for building wire 4 AWG and larger. Do not exceed manufacturers 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. Neatly train and lace wiring inside boxes, equipment, and panelboards.

E. Clean conductor surfaces before installing lugs and connectors.

F. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

G. Use split bolt connectors or compression fittings for splices and taps on conductors 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.

H. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.

I. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

J. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values or UL 486A and UL 486B.

K. Identify and color code wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

L. For each electrical connection/termination, provide a complete assembly of materials, including but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other materials necessary to complete splices and

terminations. Torque all connections according to installation instructions.

M. Motor connections shall be made with compression connectors forming a bolted in-line or stub-type connection.

N. Splicing of feeder conductors shall not be acceptable, unless specifically indicated on the drawing. Where splicing of feeder conductors is indicated, splices shall be made using compression type butt splice.

O. All splices made underground or in the pipe basements shall be rated suitable for water immersion.

P. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for 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.

3.2 LABELING

A. Color Coding
1. Color shall be green for grounding conductors and green with yellow stripe for isolated grounding conductors.
2. The color of the circuit conductors shall be as follows:

120/208 volt, 3-phase	Phase A - Black
	Phase B - Red
	Phase C - Blue
	Neutral - White
277/480 volt, 3-phase:	Phase A - Brown
	Phase B - Orange
	Phase C - Yellow
	Neutral - Gray

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA STD ATS, except Section 4.

B. Perform inspections and tests listed in NETA STD ATS, Section 7.3.2.

END OF SECTION 260519

SECTION 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Grounding and bonding components.

B. Provide all components necessary to complete the grounding system(s) consisting of:
1. Existing and new metal underground water pipe.
2. Metal frame of the building.
3. Steel water storage tank and supports.
4. Concrete-encased electrode.

1.2 SUBMITTALS

A. Refer to section 260510.

1.3 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.4 REFERENCES

A. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; current edition.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; current edition.

C. NFPA 99 - Standard for Health Care Facilities; National Fire Protection Association; current edition.

D. IEEE Standard 142 “Green Book” – Recommended Practices for Grounding of industrial and Commercial Power Systems; current edition.

1.5 PERFORMANCE REQUIREMENTS

A. Maximum grounding system resistance: 15 ohms.

B. Services at power company interface points shall comply with the power company ground resistance requirements.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Bonding Jumper Braid: Copper braided tape, sized for application.

B. Electrical Grounding conductors: Unless otherwise indicated, provide bare or green insulated stranded copper electrical grounding conductors sized according to NEC or as shown or specified. Provide green

insulated for conductors sized No. 10 AWG and smaller.

2.2 GROUND CONNECTIONS

A. Below Grade: Exothermic-welded type connectors.

B. Above Grade:
1. Bonding Jumpers: compression type connectors, using zinc-plated fasteners and external tooth lock washers.
2. Ground Busbars: Two-hole compression type lugs using tin-plated copper or copper alloy bolts and nuts.
3. Rack and Cabinet Ground Bars: one-hole compression-type lugs using zinc-plated or copper alloy fasteners.

C. Install exothermic connectors and terminals as recommended by the connector and terminal manufacturer for intended applications.

D. Bolted clamp will not be accepted between grounding rods and ground conductors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions prior to beginning work.

B. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 SECONDARY EQUIPMENT AND CIRCUITS

A. Switchgear, Panelboards, Disconnects, Switchboards, Unit Substations, and Motor Control Centers; Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and grounding conductor to the equipment ground bus.

B. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders and power and lighting branch circuits, sized in accordance with Article 250 of NFPA 70.

C. Boxes, Cabinets, Enclosures, and Panelboards:
1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.

D. Motors and Starters: Provide lugs in motor terminal box and starter housing or motor control center compartment to terminate equipment grounding conductors.

E. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.

F. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

G. Metallic Conduit: Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a bare grounding conductor to the equipment ground bus.

3.3 INSTALLATION

A. Install ground electrodes at locations indicated. Provide additional electrodes as required to achieve specified resistance to ground.

B. Install nominal 10" diameter x 18" long fiberglass "water valve" type enclosure, with cover, over each ground rod. The top of ground rods shall be 12" below finished grade. The rod and exothermic connection to the grounding electrode conductor shall be accessible from within enclosure. Fill the lower 3" of enclosure with crushed rocks. Top of enclosure shall be flush with finished grade.

C. Make rebar in concrete footing around the perimeter of the building electrically continuous such that the resulting installation consists of a concrete encased electrode per Article 250 of the NEC. Extend No. 1/0 THWN grounding electrode conductors from convenient points along the “ground ring” to the equipment ground system.

D. If it is determined that the rebar cannot be made electrically continuous, install a No 1/0 bare copper conductor in the footing around the perimeter of the building.

E. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing.

F. Bond together metal siding not attached to grounded structure; bond to ground.

G. Bond together reinforcing steel and metal accessories in pool and fountain structures.

3.4 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA STD ATS except Section 4.

B. Perform inspections and tests listed in NETA STD ATS, Section 7.13.

C. Upon completion of installation of electrical grounding system, test resistance of each ground rod installation using the "Fall of Potential" method. Ground resistances shall be measured in normally dry conditions not less than 48 hours after rainfall and at low tide. Where tests show resistance to ground is over the specified value, take appropriate action to reduce resistance by driving additional sections of ground rods and then retest to demonstrate compliance. Tests shall be conducted in the presence of the Project Electrical Engineer. Provide forms to record the data as the tests are conducted. Forms shall be signed by the person conducting the test and included with project closeout documents.

D. Test the effectiveness of the grounding system in patient care areas as required by NFPA 99.

END OF SECTION 260526

SECTION 260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the requirements for the following:
   1. Conduit and equipment supports.
   2. Anchors and fasteners.

1.2 SUBMITTALS

A. Refer to section 260510.

1.3 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.4 REFERENCE STANDARDS

A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; current edition.

PART 2 - PRODUCTS.

2.1 MATERIALS

A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

B. Supports: Fabricated of structural steel or formed steel members; galvanized.

C. Anchors and Fasteners:
   1. Do not use powder-actuated anchors.
   2. Concrete Structural Elements: Use precast inserts, expansion anchors, or preset inserts.
   3. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
   4. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
   5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
   6. Solid Masonry Walls: Use expansion anchors or preset inserts.
   7. Sheet Metal: Use sheet metal screws.
   8. Wood Elements: Use wood screws.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
   1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

B. Cutting or Holes:
   1. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the Architect prior to drilling through structural sections.
   2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Architect as required by limited working space.

C. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

D. Install surface-mounted cabinets and panelboards with minimum of four anchors.

E. In wet and damp locations use steel channel supports to stand cabinets, disconnects and panelboards 1 inch (25 mm) off wall.

F. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

G. Use stamped steel bridges to fasten flush mounting outlet box between studs.

H. Use adjustable steel channel fasteners for hung ceiling outlet box.

I. Do not fasten boxes to ceiling support wires.

J. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.

K. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

L. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits

M. Do not support conduit with wire, wire ties, or perforated pipe straps. Remove wire used for temporary supports.

N. Do not attach conduit to ceiling support wires.

END OF SECTION 260529

SECTION 260533 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUBMITTALS

A. Refer to section 260510

1.2 QUALITY ASSURANCE

A. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.3 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); current edition

B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); current edition

C. ANSI C80.5 - American National Standard for Electrical Rigid Aluminum Conduit (ERAC); current edition

D. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; current edition

E. NECA 101 - Standard for Installing Steel Conduit (Rigid, IMC, EMT); National Electrical Contractors Association; current edition

F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; current edition

1.4 DELIVERY, STORAGE, AND HANDLING

A. Accept conduit on site. Inspect for damage

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

PART 2 - PRODUCTS

2.1 CONDUIT REQUIREMENTS

A. Conduit Size: Comply with NFPA 70.
   1. Minimum Size: 3/4 inch

B. Wet and Damp Locations:
   1. Exterior above ground and in pipe basements: RMC, IMC, or LFMC (LFMC shall be only used with restrictions, see conduit installation)
   2. Exterior below ground: RNC schedule 40

3. Interior: RMC, IMC, or LFMC (LFMC shall be only used with restrictions, see conduit installation)
4. Interior below grade: RNC schedule 40
5. Where RNC Schedule 40 is installed below grade or under floor slabs, the elbows required to turn the raceway up through the slab shall be RMC.

C. Dry Locations:
1. Concealed: Use EMT or FMC (FMC shall be only used with restrictions, see conduit installation)
2. Exposed: Use EMT or FMC (FMC shall be only used with restrictions, see conduit installation)
3. Interior below grade: RNC schedule 40

D. Area subject to physical damage: RMC, IMC, or LFMC (LFMC shall be only used with restrictions, see conduit installation)
1. "Areas subject to physical damage" shall be defined as the most stringent of the following:
a. Exposed conduit below eight feet above finished floor.
b. As interpreted by the authority having jurisdiction (AHJ).

2.2 METAL CONDUIT

A. Rigid Steel Galvanized Conduit (RMC): ANSI C80.1.

B. Intermediate Metal Conduit (IMC): ANSI C80.6.

C. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.
1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
2. Standard threaded couplings, locknuts, bushings, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
3. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
4. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
5. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
6. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.

2.3 FLEXIBLE METAL CONDUIT

A. FLEXIBLE METAL CONDUIT (FMC) Description: Interlocked steel construction. Flexible metal conduit shall conform to UL 1.

B. Fittings: NEMA FB 1.
1. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
2. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
3. Clamp type, with insulated throat.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC) Description: Interlocked steel construction with PVC jacket. Liquid-tight flexible metal conduit: Shall Conform to UL 360.

B. Fittings: UL 514B and ANSI/ NEMA FB1.
1. Only steel or malleable iron materials are acceptable.
2. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
3. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

2.5 ELECTRICAL METALLIC TUBING

A. ELECTRICAL METALLIC TUBING (EMT) Description: ANSI C80.3

B. Fittings and Conduit Bodies: NEMA FB 1; steel compression type.
1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
2. Only steel or malleable iron materials are acceptable.
3. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
4. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 50mm (2 inches) and smaller.
5. Indent type connectors or couplings are prohibited.

2.6 NONMETALLIC CONDUIT

A. RIGID NONMETALLIC CONDUIT (RNC): Direct burial plastic conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).

B. RNC: NEMA TC 2, schedule 40 PVC

C. Fittings shall meet the requirements of UL 514C and NEMA TC3

D. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

2.7 EXPANSION AND DEFLECTION COUPLINGS

A. Conform to UL 467 and UL 514B.

B. Accommodate, 0.75 inch deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.

C. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.

D. Jacket: Flexible, corrosion resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.

2.8 CORROSION PROTECTION

A. Corrosion protection for conduits passing through concrete slabs shall be by one of the following means: field-wrapped with 3M Scotchrap No. 50, 2-inch wide (minimum), with a 50 percent overlay, or shall have a factory-applied polyvinyl chloride, plastic resin, or epoxy coating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify routing and termination locations of conduit prior to rough-in.

B. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to provide a complete wiring system.

3.2 CONDUIT INSTALLATION

A. All fire alarm cable shall be installed in metallic conduit. Coordinate with fire alarm system manufacturer for cable routing and quantities.

B. Install conduit securely, in a neat and workmanlike manner, as specified in NECA 101.

C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight.

D. Arrange supports to prevent misalignment during wiring installation.

E. Arrange conduit to maintain headroom and present neat appearance.

F. Route exposed conduit parallel and perpendicular to walls.

G. Route conduit installed above accessible ceilings parallel and perpendicular to walls.

H. Route conduit in and under slab from point-to-point.

I. Maintain adequate clearance between conduit and piping.

J. Maintain 12 inch (300 mm) clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).

K. Cut conduit square using saw or pipecutter; de-burr cut ends.

L. Bring conduit to shoulder of fittings; fasten securely.

M. For power conduits install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate bends in metal conduit larger than 2 inch (50 mm) size.

N. For communication conduits install no more than the equivalent of two 90 degree bends between pull points. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate bends in metal conduit larger than 2 inch (50 mm) size.

O. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

P. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control, and expansion joints.

Q. Seal the inside of all conduits where conduit passes below floor or outside of the building.

R. Provide suitable pull string in each empty conduit except sleeves and nipples.

S. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

T. Do not install FMC or LFMC in lengths over 6'.

U. Use LFMC or FMC only to connect to equipment subject to vibration or to suspended light fixtures.

V. Wherever possible, install horizontal raceway runs above water and drain piping. Give the right-of-way in confined spaces to piping that must slope for drainage and to larger HVAC ductwork and similar services that are less conformable than electrical services.

W. Complete the installation of electrical raceways before starting installation of cables within raceways.

X. Raceways shall not be installed exposed in finished spaces. Install concealed in walls, ceilings, below slab-on-grade or embedded in slabs above grade.

3.3 BOX INSTALLATION

A. Boxes for Concealed Conduits:
   1. Flush mounted.
   2. Provide raised covers for boxes to suit the wall or ceiling, construction and finish.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.

C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

D. Outlet boxes in the same wall mounted back-to-back are prohibited. A minimum 24 inch, center-to-center lateral spacing shall be maintained between boxes.

E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 4 inches square by 2-1/8 inches deep, with device covers for the wall material and thickness involved.

F. Clean all debris out of floor boxes.

3.4 IDENTIFICATION

A. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1"

B. On all concealed junction box covers, identify the circuits with black marker. For exposed junction boxes use printed labels.

END OF SECTION 260533

SECTION 260543 – UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUBMITTALS:

A. Refer to section 260510.

PART 2 - PRODUCTS

2.1 WARNING TAPE

A. Provide a plastic warning tape in the backfill above all underground cables, conduits and duct banks. The tape shall be 3 inches wide, shall be bright, fade-resistant, red in color for power, yellow/orange in color for low voltage, and shall include an imprinted legend, ""WARNING - BURIED HIGH VOLTAGE LINE", "WARNING - BURIED FIBER OPTIC LINE" or "WARNING - BURIED TELEPHONE LINE", as applicable., repeated continuously throughout the entire length. Tape shall be buried 12 inches below top of trench.

PART 3 - EXECUTION

3.1 GENERAL

A. Layout of duct banks is the responsibility of the Contractor. Coordinate layout with existing site conditions, the elevation of manhole openings and work by other trades. Duct lines shall be sloped to drain towards manholes and pull boxes, with a pitch of not less than 3 inches in 100 feet. For lines run between adjacent manholes or pull boxes, high point may occur in the middle of run.

B. Excavation, Trenching and Backfilling: Provide as required to install duct banks in the manner indicated on the drawings and in accordance with the applicable sections of Division 31 through 33 of the specifications.

C. Provide barricades with warning lights, around all trenches. Barricades shall be orange mesh type supported by rods driven into the earth. Barricades shall remain in place at all times, not just at night. Maintain the integrity and appearance of the barricades until the trenches have been backfilled and compacted.

D. Clearance from Other Utilities: Do not install lines installed under this contract in the same trenches with other utilities. Maintain horizontal and vertical separation as required by ANSI C2.

3.2 INSTALLATION

A. During construction, partially completed duct lines shall be protected from the entrance of debris such as mud, sand and dirt, by means of suitable conduit plugs. As each section of a duct line is completed from manhole to manhole, a testing mandrel not less than 12 inches long with a diameter 1/4-inch less than the size of the conduit, shall be drawn through each conduit, after which a brush having the diameter of the conduit, and having stiff bristles, shall be drawn through until the conduit is clear of all particles of earth, sand, and/or gravel; conduit plugs shall then be immediately installed.

B. Install spacers every 5' along the duct run and at the midpoint and points of tangency of all bends. Anchor spacers to trench to ensure that the duct banks are held securely in place during concrete pours.

C. Ducts shall be encased in concrete as shown on the drawings. Care shall be taken that no voids are left between ducts.

D. Ducts crossing roadways and parking lots shall be reinforced as indicated on the drawings. Cutting and patching shall conform to the details shown on the Civil drawings. Engage the services of the paving and grading contractor to perform all cutting and patching.

E. Install warning tape 12" below grade along the entire length of, and centered on duct banks.

F. Bends: Except at conduit risers, changes in direction of runs exceeding a total of 10 degrees, either vertical or horizontal, shall be accomplished by long sweep bends having a minimum radius of curvature of 25 feet. Sweep bends may be made up of one or more curved or straight sections or combinations thereof. Manufactured bends shall have a minimum radius of 48".

G. Connections to Handholes: Connections shall be constructed to have a flared section adjacent to the manhole to provide shear strength. Underground structures shall be constructed to provide for keying the concrete envelope of the duct line into the wall of the structure. Vibrators shall be used when this portion of the envelope is poured to assure a seal between the envelope and the wall of the structure. Conduits shall terminate in end-bells where duct lines enter manholes.

H. Connections at Pad Mounted transformers: Terminate encasement at underside of concrete pad.

3.3 RECONDITIONING OF SURFACES

A. Ground covering and vegetation disturbed during installation, shall be restored to original elevation and condition.

B. Sod or topsoil shall be preserved carefully and replaced after the backfilling is completed. Sod that is damaged shall be replaced by sod of quality equal to that removed. When the surface is disturbed in a newly seeded area, the restored surface shall be re-seeded with the same quantity and formula of seed as that use in the original seeding.

3.4 CABLE PULLING

A. Pull cables down grade with the feed-in point at the handhole or buildings of the highest elevation. Use flexible cable feeds to convey cables through the handhole opening and into the conduit. Cable slack shall be accumulated at each handhole where space permits. Minimum allowable bending radii shall be maintained.

B. Lubricants: For assisting in the pulling of cables shall be those specifically recommended by the cable manufacturer. The lubricant shall not be deleterious to the cable sheath, jacket, or outer coverings.

C. Cable Pulling Tensions: Shall not exceed the maximum pulling tension recommended by the cable manufacturer.

D. Grounding Conductor: Secondary cable runs, 600 volts and less, in non-metallic conduit shall, although not indicated, include an insulated copper equipment grounding conductor sized as required by the rating of the overcurrent device supplying the phase conductors.

END OF SECTION 260543

SECTION 260548 – VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUBMITTALS

A. Refer to section 260510.

1.2 QUALITY ASSURANCE

A. Submittals must be signed and sealed shop drawings from a professional engineer licensed in the state that the project is located in. Shop drawings to include project specific details, sketches, product data cut sheets.

B. The contractor shall provide pre-engineered seismic restraint systems to meet total design lateral force requirements for support and restraint of piping, conduit, cable trays and other similar systems and equipment where required by the applicable building code.

C. System Supports/Restraints Manufacturers shall be firms regularly engaged in the manufacture of products of the types specified in this section, whose products have been in satisfactory use in similar service for not less than 5 years.

PART 2 - PRODUCT

2.1 SEISMIC BRACING

A. General:
1. Seismic restraint designer shall coordinate all attachments with the structural engineer of record.
2. Design analysis shall include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
3. Analysis shall detail anchoring methods, bolt diameter, and embedment depth.
4. All seismic restraint devices shall be designed to accept without failure the forces calculated per the details and notes on the construction documents

B. Friction from gravity loads shall not be considered resistance to seismic forces.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All seismic restraint systems shall be installed in strict accordance with the manufacturer's seismic restraint guidelines manual and all certified submittal data

B. Installation of seismic restraints shall not cause any change in position of equipment or piping, resulting in stresses or misalignment.

C. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.

D. Do not install any equipment, piping, duct, or conduit that makes rigid connections with the building.

E. Prior to installation, bring to the architect's/engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.

F. Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or wedge-type concrete anchors. Consult structural engineer of record.

G. Overstressing of the building structure shall not occur from overhead support of equipment. Bracing attached to structural members may present additional stresses. The contractor shall submit loads to the structural engineer of record for approval in this event.

H. Brace support rods when necessary to accept compressive loads. Welding of compressive braces to the vertical support rods is not acceptable.

I. Provide reinforced clevis bolts where required.

J. Seismic restraints shall be mechanically attached to the system. Looping restraints around the system is not acceptable.

K. Do not brace a system to two independent structures such as a ceiling and wall.

L. Provide appropriately sized openings in walls, floors, and ceilings for anticipated seismic movement.

3.2 FIELD QUALITY CONTROL

A. Inspect all seismic supports after installation and submit a report from a professional engineer licensed in the state that the project is located in.

END OF SECTION 260548

SECTION 262400 – SWITCHBOARDS AND PANELBOARDS

PART 1 - GENERAL

1.1 SUBMITTALS

A. See section 260510.

1.2 QUALITY ASSURANCE

A. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; current edition.

B. NEMA PB 1 - Panelboards; National Electrical Manufacturers Association; current edition.

C. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; National Electrical Manufacturers Association; current edition.

D. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; current edition.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Eaton Electrical/Cutler-Hammer

B. GE Industrial

C. Square D

D. Siemens

2.2 PANELBOARDS

A. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.

B. Panelboard Bus: Copper (98% conductivity).

C. Provide copper ground bus in each panelboard

D. Enclosure: Interior - NEMA 1, Exterior locations – gasketed NEMA 4X, Kitchen - Stainless NEMA 1

E. Cabinet Front: Flush cabinet front with concealed trim clamps, concealed hinge, metal directory

frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel. Paint all hallway panels to match wall finish.

F. All panelboards shall be hinged "door in door" type with:
   1. Interior hinged door with hand operated latch or latches as required to provide access to circuit breaker operating handles only, not to energized ports.
   2. Outer hinged door shall be securely mounted to the panelboard box with factory bolts, screws, clips or other fasteners requiring a tool for entry, hand operated latches are not acceptable.
   3. Push inner and outer doors shall open left to right.

G. All panelboard shall have bolt-on style breakers.

H. Provisions for future breakers shall be fully bussed complete with all necessary mounting hardware.

2.3 CIRCUIT BREAKERS

A. For circuit breakers 1200 amps and over (or capable of being adjusted to 1200 amps and over) – Provide a means of arc energy reduction per NEC 240.87.

B. For Circuit breakers 1000 Amps and over – Provide low voltage AC power circuit breaker, with fixed mounting, stored energy and solid state trip devices.
   1. Provide individual adjustable solid-state elements as an integral part of the solid-state trip devices for complete system selective coordination. All breakers shall have LSI settings. All breakers shall have LSIG settings for 277/480V distribution.
   2. Position indicator: Provide an indicator visible from the front of the unit to indicate whether the breaker is open or closed.
   3. Trip button: Provide a mechanical trip button accessible from the front of the door to trip the breaker.
   4. Padlocking: Include provisions for padlocking the breaker in the open position.
   5. Operation: Unless otherwise shown on the drawings, breakers 1600 ampere frame size and less may be manually operated. Breakers larger than 1600 amperes frame size shall be electrically operated.
   6. Trip devices shall have the following features:
      a. Trip device in each pole.
      b. Metering, voltage, current memory and LCD display
      c. Mechanically and electrically trip free.
      d. Long time element with adjustable pick-up and selective maximum, intermediate, and minimum time delay bands.
      e. Short time element with adjustable pick-up and selective maximum, intermediate, and minimum time delay bands.
      f. Ground fault element with adjustable pick-up and selective maximum, intermediate and minimum time delay bands.
      g. Maintenance setting option to reduce Arc Flash hazards.

C. For circuit breakers over 200 amps – Provide adjustable trip molded case, solid state adjustable trip type circuit breakers.
   1. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip). (where indicated)

2. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator. (where indicated)
3. Shunt Trip: [120] [24] <Insert voltage>-V trip coil energized from separate circuit, set to trip at [55] [75] percent of rated voltage. (where indicated)
4. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage [without intentional] [with field-adjustable 0.1- to 0.6-second] time delay. (where indicated)
5. Auxiliary Contacts: [One SPDT switch] [Two SPDT switches] with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts. (where indicated)
6. Trip units shall have field adjustable tripping characteristics as follows:
   a. Ampere setting (continuous).
   b. Long time band.
   c. Short time trip point.
   d. Short time delay.
   e. Instantaneous trip point.

D. For all circuit breakers 200 amps and smaller – Provide molded case circuit breakers: Thermal magnetic trip circuit breakers.
1. Type SWD for lighting circuits.
2. Type HACR for air conditioning equipment circuits.
3. Class A ground fault interrupter circuit breakers where scheduled.
4. Do not use tandem circuit breakers.
5. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration for all residential applications.
6. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip). (where indicated)

E. Circuit breakers serving elevators shall have adjustable long-time setting and shall be provided with a shunt trip coil rated for 120V operation. Breaker shall also have a set of Form C contacts. Connect shunt trip coil to operate as indicated on the drawings.

F. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

G. Circuit breakers serving fire alarm devices shall be provided with a red fire alarm circuit breaker lockout kit that permanently identifies circuit as “FIRE ALARM”.

H. Circuit breakers serving emergency communication devices (e.g. mass notification, area of refuge, two way communication) shall be provided with a circuit breaker locking device and be permanently identified as “EMERGENCY COMMUNICATIONS”.

2.4 CONTROL WIRING

A. Control wiring shall be 600 volt class B stranded SIS. Install all control wiring complete at the factory adequately bundled and protected. Wiring across hinges and between shipping units shall be Class C stranded. Size in accordance with NEC. Provide control circuit fuses. Provide integral power supply in switchgear for control power.

2.5 SHORT CIRCUIT CURRENT RATING:

A. Devices which achieve the level of fault protection indicated by means of "series" or "integrated" rating shall not be acceptable unless specifically indicated on the drawings. All panelboards shall be fully rated.

B. Minimum SSCR
   1. 208 Volt Panelboards: Minimum 10,000 amperes rms symmetrical unless noted otherwise on plans.
   2. 480 Volt Panelboards: Minimum 22,000 amperes rms symmetrical unless noted otherwise on plans.
   3. Match existing equipment short circuit current ratings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1 and NECA 1.

B. Install panelboards plumb. Install recessed panelboards flush with wall finishes.

C. Height: 6 feet (1800 mm) to top of panelboard; install panelboards taller than 6 feet (1800 mm) with bottom no more than 4 inches (100 mm) above floor.

D. Provide filler plates for unused spaces in panelboards.

E. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

F. Provide engraved plastic nameplates on all switchboard and panelboards.

G. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as SPARE.
   1. Minimum spare conduits: 6 empty 1 inch conduits.

H. Ground and bond panelboard and switchboard enclosure according to Section 260526.

I. Do not splice conductors in panelboard or switchboard enclosure.

J. Install switchboard on 4" high concrete pad with 6" minimum overlap on all sides. Bolt switchboard to pad in all four corners, minimum.

K. Each section of two section panels shall contain only those conductors which originate in that section. Do not use panel as a wireway.

L. Piggy-back or tandem type breakers shall not be used.

M. Multi-pole breakers shall be common trip, with a single handle.

3.2 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA STD ATS, except Section 4.

B. Perform inspections and tests listed in NETA STD ATS, Section 7.5 for switches, Section 7.6 for circuit breakers.

3.3 ADJUSTING

A. Adjust the breaker trip set points per the values provided by the engineer, per an Overcurrent protective device study provided by the contractor.

B. Touch-up scratched or marred surfaces to match original finish.

C. Clean all debris from panel interiors.

3.4 LABELING

A. Provide nameplates on all electrical panels that new circuits are modified or installed. Indicate the following information:
1. Panel name
2. Panel fed from
3. Normal (Black with white letters), Emergency Critical (Orange with black letters), Emergency Equipment (Green with black letters), or Emergency Life safety (Yellow with black letters)
4. Voltage, phase, wire
5. Available fault circuit (main only)
6. Date installed

B. Provide a typed legend for all modified or new electrical panels. Update the panel board schedules after load balancing.

C. Identify load served and location by room names assigned by user, not by room numbers on floor plans. Note spares and spaces as such.

D. For switchboards, provide laminated plastic nameplate for main and for each feeder circuit. Nameplates shall be secured to switchboard with two screws.

E. Provide a laminated 11x17 one line diagram in the main electrical room mounted to the wall or main electrical panel.

F. Provide ARC flash identification per NFPA 70E.

3.5 CLEARANCE AND WORKSPACE

A. Maintain workspace and clearances as required by the NEC for the voltage encountered. No pipes or ducts shall pass above the outline of the panelboard. It shall be the responsibility of this Contractor to make sure that other trades do not encroach on this space.

END OF SECTION 262400

SECTION 262726 – WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the requirements for the following:
1. Receptacles.
2. Device plates.
3. Wall switches.
4. Wall dimmers.
5. Occupancy Sensors
6. Motion Sensors

1.2 SUBMITTALS

A. Refer to section 260510.

1.3 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Products: Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.4 OCCUPANCY SENSOR DRAWING

A. Drawing Format: Drawings shall be prepared at a scale of no less than 1/16"=1'-0". Drawing shall be titled to define Project Name, Drawing subject and date prepared. Drawings are to be prepared in AutoCAD 2017 or compatible software.

1.5 REFERENCE STANDARDS

A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; current edition.

B. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; current edition).

C. NEMA WD 6 - Wiring Device -- Dimensional Requirements; National Electrical Manufacturers Association; current edition.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Acceptable manufacturers, contingent upon compliance with the contract documents, are as listed below. Bidders shall carefully review the requirements listed in the technical specifications and only submit products that are equal or better. Equal products by other manufacturers are acceptable providing substitutions are submitted in accordance with requirements listed in the front end specifications and approved by the A/E. Bidders shall carefully review the front end documents and submit all information required to allow the A/E the ability to make a fully informed decision.
   1. Cooper Wiring Devices
   2. GE Industrial
   3. Leviton Manufacturing, Inc
   4. Hubbell, Inc
   5. Lutron Electronics Inc
   6. Wattstopper Inc
   7. Schneider Electric
   8. Legrand – Pass & Seymour
   9. C.W. Cole & Company
   10. Acuity Brands Lighting, Inc

2.2 RECEPTACLES

A. Receptacles: Fed spec listed complying with NEMA WD 6 and WD 1.
   1. Device Body: color by architect plastic, or Red for emergency power devices.
   2. Configuration: NEMA WD 6, type as specified and indicated.
   3. Type 5-20.

B. Educational Receptacles: Tamper-resistant receptacle
   1. Device Body: color by architect.
   2. Type 5-20 or 5-15

C. GFCI Receptacles: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements. Feed through GFCI devices shall not be used. GFCI devices shall contain self-testing feature with power lockout if self-test fails.

D. Special Purpose Receptacles: Provide heavy-duty type as indicated on the drawings.

2.3 WALL PLATES

A. Cover Plates: Provide one piece wall plates for wiring devices, with ganging and cutouts as required. Provide blank wall plates for all un-used outlet boxes. Provide with metal screws for securing plates to devices, screw heads colored to match finish of plate. All plates shall be standard size, smooth stainless steel. Impact resistant Nylon

2.4 WALL SWITCHES

A. Wall Switches: Heavy Duty, AC only general-use snap switch, complying with NEMA WD 6 and WD
   1. Body and Handle: color by architect plastic with toggle handle, or red for emergency power devices.
   2. Locator Light: Lighted handle type switch; red color handle.
   3. Ratings: Match branch circuit and load characteristics.
   4. Switch shall be rated for the horse power of the motor served.

B. Switch Types: Single pole, double pole, 3-way, and 4-way.

2.5 WALL DIMMERS

A. Electronic Wall Dimmers: Coordinate with electronic dimming ballast requirements.
1. Body and Handle: plastic with slide adjuster.

B. Incandescent Wall Dimmers:
1. Body and Handle: plastic with slide adjuster.
2. Rating: Dimmer ratings shall be at least 125% of circuit load. De-rate ganged installations as recommended by the Manufacturer.

2.6 OCCUPANCY SENSORS

A. Wall switch sensors: Passive Infrared type.
1. Capable of detection of occupancy at desktop level up to 300 sqft, and gross motion up to 1000 sqft with 180 degree coverage capability.
2. Rating: Sensor rating shall be at least 125% of the connected load.
3. Sensor shall utilize Zero Crossing Circuitry.
4. Sensor shall have no leakage current to load, and voltage drop protection.
5. Sensor shall provide high immunity to false triggering from RFI and EMI.
6. Sensor shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.
7. Sensor shall utilize automatically adjustable time delay and sensitivity settings.
8. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
9. A bypass manual override shall be provided on each sensor.
10. An integral photo cell with adjustable light level shall be provided
11. All sensors shall have UL rated, 94V-0 plastic enclosures.

B. Ceiling Sensors: Dual Technology type.
1. Rating: Sensor rating shall be at least 125% of the connected load.
2. Sensor shall be ceiling mounted in such a way as to minimize coverage in unwanted areas.
3. Sensor shall consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.
4. Passive Infrared Sensor shall provide high immunity to false triggering from RFI and EMI.
5. Ultrasonic Sensor shall adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout the controlled space.
6. Sensor shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.
7. Sensor shall utilize automatically adjustable time delay and sensitivity settings.
8. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
9. A bypass manual override shall be provided on each sensor.
10. All sensors shall have UL rated, 94V-0 plastic enclosures.

C. Circuit Control Hardware – Where required.
1. Control Unit: Self-contained unit consisting internally of isolated load switching relay(s) and

transformer to provide low-voltage power.
2. Control Unit shall provide power to a minimum of two sensors.
3. Relay Contacts shall have ratings as required for connected load.

2.7 MOTION SENSORS

A. Exterior Motion Sensors shall have the following features:
1. Rated for covered exterior applications.
2. A 1 minute built-in time delay.
3. Sensor shall utilize a sensitivity adjustment for wind in trees.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that outlet boxes are installed at proper height.

B. Verify that wall openings are neatly cut and will be completely covered by wall plates.

C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean debris from outlet boxes.

3.3 INSTALLATION

A. Install securely, in a neat and workmanlike manner, as specified in NECA 1.

B. Install devices plumb and level.

C. Do NOT utilize back wiring on any wiring device.

D. Install receptacles with grounding pole on top.

E. Do not install receptacles within 6” of the edge of sinks.

F. Connect wiring device ground terminal to outlet box with bonding jumper.

G. All receptacles installed as listed below shall be GFCI type.
1. Receptacles installed outdoors.
2. Receptacles installed within six feet of sinks.
3. Receptacles designated for electric drinking fountains.
4. Receptacles designated for vending machines.
5. Any other receptacles specifically indicated on the drawings.
6. Receptacles installed in residential mechanical rooms.

H. Install decorative plates in finished areas.

I. Connect wiring devices by wrapping conductor around screw terminal.

J. Provide screenprinted nylon wall plates that indicate the branch circuit to which the associated device is connected. Use 1/8" high black letters.

K. Install switches with OFF position down.

L. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

M. Do not share neutral conductor on load side of dimmers.

3.4 FIELD QUALITY CONTROL

A. Perform all field inspection, testing, and adjusting specified in NETA STD ATS.

B. Inspect each wiring device for defects.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

F. Operate each wall switch with circuit energized and verify proper operation.

G. Test each occupancy sensor and verify settings are appropriate for associated space.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. It shall be the contractor's responsibility to locate and aim occupancy sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.

C. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall also provide, at the owner's facility, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

3.6 CLEANING

A. It is anticipated that painting and other finish work may occur after device installation. Device plates shall not be installed until these activities are completed. Protect device and conductors by installing molded plastic cover.

B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION 262726

SECTION 262813 – FUSES

PART 1 - GENERAL

1.1 SUBMITTALS

A. Refer to Section 260510.

1.2 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Cooper Bussmann

2.2 FUSES – GENERAL

A. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.

B. Voltage: Rating suitable for circuit phase-to-phase voltage.

C. Provide class R5 time delay fused for all motor applications.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fuses with label oriented such that manufacturer, type, and size are easily read.

B. Provide a spare fuse cabinet and stock with one fuse puller for each size fuse installed and provide 10% spare fuses or a minimum of 3 for each size installed. Install fuse cabinet in main electrical room.

END OF SECTION 262813

SECTION 262816 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUBMITTALS

A. Refer to section 260510.

1.2 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Products: Furnish products listed and classified by Underwriters Laboratories Inc.; or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and indicated.

1.3 REFERENCES

A. NEMA FU 1 - Low Voltage Cartridge Fuses; National Electrical Manufacturers Association; current edition.

B. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; current edition.

C. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; current edition.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers
1. Eaton Electrical/Cutler-Hammer
2. GE Industrial
3. Square D
4. Siemens

2.2 NON-FUSIBLE SWITCH

A. Non-fusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.
1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
2. Handle lockable in OFF position.

2.3 FUSIBLE SWITCH

A. Fusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.

1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
2. Handle lockable in OFF position.
3. Fuse clips: Designed to accommodate NEMA FU1, Class R or J fuse

B. Fusible switches serving elevators shall be provided with a set of Form C contacts.

2.4 MOLDED CASE CIRCUIT BREAKERS

A. Molded Case Circuit Breakers for circuit breakers smaller than 200 amps: UL listed for the following service conditions: Temperature: 40 degrees C. Provide HACR rated breakers where they serve HVAC equipment.

B. Field-Adjustable Trip Circuit Breakers: Provide circuit breakers with frame sizes 200 amperes and larger with mechanism for adjusting long time and short time current

C. Circuit breakers serving elevators shall have adjustable long-time setting. Breaker shall also have a set of Form C contacts.

2.5 ENCLOSURES

A. Enclosures: NEMA KS 1.
1. Interior Dry Locations: Type 1.
2. Exterior Locations: NEMA 4X stainless steel.
3. Kitchen and locations subjected to hose down: gasketed, stainless steel, NEMA 4X Rated.

2.6 ACCESSORIES

A. Shunt Trip Device: 120; volts, AC; provide where indicated.
24; volts, DC; provide where indicated.

B. Undervoltage Trip Device: 120; volts, AC; provide where indicated

C. Auxiliary NO and NC contact: 120; volts, AC; provide where indicated

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with Manufacturer's instructions.

B. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

C. All switches associated with outdoor equipment shall be located as close to the equipment as possible (when equipment is in a service yard, switches shall also be in the service yard) and mounted such that the top of the switch is no more than 6'-6" above grade. All switches associated with equipment mounted above a lay-in ceiling shall also be located above the lay-in ceiling.

D. Coordinate safety and disconnect switch installation with surrounding equipment to provide unobstructed access to the switch (4 foot clearance) and to insure that the switch is within sight of the controller or driven equipment.

3.2 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA STD ATS, except Section 4.

B. Perform inspections and tests listed in NETA STD ATS, Section 7.5.

C. Touch-up scratched or marred surfaces to match original finish.

D. Clean all debris from enclosure interiors.

E. Test all shunt trip and under voltage trip units.

3.3 LABELING

A. Provide nameplates on all switch enclosures wherein new circuits are modified or installed. Indicate the following information:
1. Equipment Switch Serves.
2. Branch Circuit.
3. Normal (Black with white letters), Emergency Critical (Orange with black letters), Emergency Equipment (Green with black letters), or Emergency Life safety (Yellow with black letters)
4. Voltage, phase, wire, short circuit current rating
5. Date installed

3.4 CLEARANCE AND WORKSPACE

A. Maintain workspace and clearances as required by the NEC for the voltage encountered. No pipes or ducts shall pass above the outline of the switch enclosure. It shall be the responsibility of this Contractor to make sure that other trades do not encroach on this space.

END OF SECTION 262816

SECTION 265100 – LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the requirements for the following:
   1. Interior luminaires and accessories.
   2. Emergency lighting units.
   3. Exit signs.
   4. Luminaire accessories.

1.2 SUBMITTALS

A. Refer to section 260510.

1.3 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70 and NFPA 101.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.4 REFERENCE STANDARDS

A. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns; current edition.

B. ANSI C78.377 – American National Standard for Electric Lamps – Specifications for the Chromaticity of Solid State Lighting Products.

C. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; current edition.

D. IESNA LM-79-08 – Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products.

E. IESNA LM-80-08 – Approved Method: Measuring Lumen Maintenance of LED Light Sources.

F. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association; current edition.

G. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association; current edition.

H. NFPA 70 - National Electrical Code; National Fire Protection Association, current edition.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of design is as scheduled on drawings. Acceptable manufacturers, contingent upon compliance with the contract documents, are as follows: _____. Equal products by other manufacturers are acceptable providing substitutions are submitted in accordance with requirements listed elsewhere in the Bid Documents and approved by the A/E.

B. Prior Approved Equal Manufacturer(s) are listed in lighting fixture schedule on drawings.

C. LM-79 reports must be submitted with all proposed LED substitutions from Basis of Design, regardless of whether manufacturer is listed as an approved equal.

2.2 LUMINAIRES

A. Furnish products as indicated in Schedule on plans.

2.3 EMERGENCY LED DRIVERS

A. Regardless of catalogue number shown in fixture schedule, all fixtures indicated to be emergency type shall be provided with emergency type driver battery packs conforming to the following:
   1. Fixture Using Integral Emergency Driver/Battery Pack: Provide emergency driver installed within the fixture. The charging light and test switch shall be accessible/visible from below. Driver/Battery must be capable of operating fixture at 75% of fixture lumens for a minimum of 90 minutes. Drivers/batteries shall have full 5-year warranty.
   2. Fixture Using Remote Emergency Driver/Battery Pack: Provide Iota or Bodine emergency driver/battery pack installed remotely above accessible ceiling. Driver/Battery must be capable of operating fixture at 75% of fixture lumens for a minimum of 90 minutes. Drivers/batteries shall have full 5-year warranty.

B. Integral emergency drivers/batteries shall be factory installed whenever possible.

C. Drivers/batteries installed in fixtures located outdoors or unheated spaces shall be suitable for the ambient temperatures encountered or remotely located in a nearby accessible space.

2.4 EMERGENCY LIGHTING INVERTERS

A. Emergency lighting inverter shall be provided by a Bodine ELI Series inverter or prior approved equal with the following characteristics:
   1. The device shall comply with the standards set forth in UL 924, "Emergency Lighting and Power Equipment", and UL Listed for installation for field installation. Emergency illumination shall exceed the NEC and Life Safety Code (NFPA-LSC) requirements.
   2. Upon failure of normal power, the device shall instantly begin providing emergency power to the connected lighting load for a minimum of 90 minutes. The device shall support lumen output at 91% of the lamp's rating throughout the 90-minute duration.

3. The device shall operate at 120 or 277 VAC, 60 Hz and an ambient temperature of 68 degrees F to 86 degrees F.
4. The device shall have self-diagnostics operation in addition to a momentary test switch.
5. The unit shall be provided with a 3-year full coverage warranty and the battery shall have a 3-year warranty.
6. The unit shall have a recharge time of 24 hours and display a charging indicator light.

2.5 EMERGENCY TRANSFER DEVICES

A. Generator (or central inverter) supplied egress lighting shall be provided by using a standard LED fixture equipped with a Bodine GTD generator transfer device or prior approved equal with the following characteristics:
1. The device shall be capable of bypassing the local wall switch when the auxiliary generator (or central inverter) powers lighting.
2. The device shall consist of relay switching circuitry and fusing contained in one galvanized steel case.
3. The device shall operate at 120 or 277 VAC, 60 Hz; shall have all inputs fused to 3 A maximum; shall draw 280 mA and 1.6 Watts during normal operation; and shall comply with the current NEC.
4. The device shall be UL Listed for installation inside, on top of or remote from the fixture and shall be warranted for a full five years from date of purchase.

B. All Emergency Transfer Devices shall be provided with five full years of warranty from the date of purchase.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting).

B. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.

C. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.

D. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

E. Install recessed luminaires to permit removal from below.

F. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

G. Install clips to secure recessed grid-supported luminaires in place.

H. Install wall mounted luminaires, emergency lighting units, and exit signs at height as indicated on Drawings.

I. Install accessories furnished with each luminaire.

J. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

K. Bond products and metal accessories to branch circuit equipment grounding conductor.

L. Install specified lamps in each emergency lighting unit, exit sign, and luminaire.

3.2 FIELD QUALITY CONTROL

A. Perform field inspection in accordance with Section 01 40 00.

B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.3 ADJUSTING

A. Aim and adjust luminaires as indicated.

B. Position exit sign directional arrows as indicated.

3.4 CLEANING

A. Clean electrical parts to remove conductive and deleterious materials.

B. Remove dirt and debris from enclosures.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

3.5 CLOSEOUT ACTIVITIES

A. Demonstrate luminaire operation for minimum of two hours.

3.6 PROTECTION

A. Replace/Repair luminaires that have failed at Substantial Completion.

END OF SECTION 265100

FOR REFERENCE ONLY – COMMUNICATION HORIZONTAL CABLING TO BE PROVIDED BY OTHERS.

SECTION 270500 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. All division 27 work shall, in addition to all division 1 specification sections, comply with all of the requirements in the following specification sections:

260500 Common Work Results for Electrical
260501 Electrical Demolition
260510 Electrical Submittals
260511 Electrical Work Closeout
260512 Electrical Coordination
260519 Low-Voltage Electrical Power Conductors and Cables
260526 Grounding and Bonding for Electrical Systems
260529 Hangers and Supports for Electrical Systems
260533 Raceway and Boxes for Electrical Systems
260548 Vibration and Seismic Controls for Electrical Systems
262726 Wiring Devices

1.2 COORDINATION

A. CCU ITs must approve any deviation from the specifications in this document. All communications, correspondence, and approvals must be conveyed through the official project contacts of record such as the Architect and Construction Manager.

B. All Division 27 Contractor Project Managers shall schedule and conduct a coordination meeting with CCU ITS to confirm and coordinate scope of work requirements prior to commencement of work whether project is new construction, renovation, or retrofit. Project meetings shall be scheduled through the General Contractor, Construction Manager, or CCU Facilities Services depending upon how the project management process is structured in each instance.

C. The Contractor shall submit a work schedule before any work begins. This schedule shall identify the major phases of the installation. The Architect or Construction Manager shall review the schedule with CCU ITS and CCU Facilities representatives, identify inspection requirements based on phasing and request any required modifications to the installation schedule. When the installation plan is finalized and approved, work may begin.

1.3 SUBMITTALS

A. Work shall not proceed without CCU approval of all submitted items.

1.4 QUALITY ASSURANCE

A. Cabling Contractor shall provide with bid an RCDD and Installer-level BICSI Certification. A minimum of one (1) permanent crew member shall be BICSI Installer Level II as well as manufacturer certified. Twenty-five percent (25%) of installation force shall be BICSI Installer Level I. Work crew, not involved in installing cable elements (e.g. laborers delivering/moving materials, installing grounding by an electrician, or workers installing pathway elements) do not require BICSI or manufacturer certification or registration.

B. Only installers trained and certified by the proposed manufacturer shall be allowed to terminate and test optical fiber. Others specified above may pull/place optical fiber cable under the supervision of an installer trained and certified by the manufacturer.

1.5 SYSTEM WARRANTY

A. The Contractor shall provide a single manufacturer 25-year system performance warranty covering the installed cabling system against defects in workmanship, components and performance, and follow-up support after project completion. Project must be registered with Commscope prior to start of work. All documentation of the 25-year system performance coverage and 25-year component coverage must be provided to CCU prior to completion of project. During the warranty period, and for non-conformities of which contractor has notice, contractor shall take all necessary and appropriate action; free of charge, to correct any non-conformity with the warranties contained in the manufacturer agreement. During the warranty period, contractor shall provide to CCU, free of costs and charges, all support necessary to ensure that the cabling system meets the requirements specified in this document and performance guarantees provided by the contractors. During the warranty period, contractors shall furnish, or cause to be furnished, all maintenance, service, parts and replacements necessary to maintain the cabling system in good working condition, at no cost to CCU.

B. All deficiencies shall be corrected within a period of forty-eight (48) hours.

END OF SECTION 270500

FOR REFERENCE ONLY – COMMUNICATION HORIZONTAL CABLING TO BE PROVIDED BY OTHERS.

SECTION 271500 – COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. UTP cabling.
2. Cable connecting hardware, patch panels.
3. Telecommunications outlet/connectors.
4. Cabling system identification products.

1.2 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.

C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

D. EMI: Electromagnetic interference.

E. IDC: Insulation displacement connector.

F. LAN: Local area network.

G. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.

H. UTP: Unshielded twisted pair.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.4 SUBMITTALS

A. Refer to section 260510.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
   1. Layout Responsibility: Preparation of Shop Drawings and Cabling Administration Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.
   2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
   3. Delete subparagraph below if Contractor performs field quality-control testing.
   4. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Testing Agency Qualifications:
   1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 814 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency. All cable must have the following characteristics.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 50 or less.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

F. Grounding: Comply with ANSI-J-STD-607-A.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.
   1. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLING DESCRIPTION

A. The maximum allowable horizontal cable length is 295 feet (90 m).

B. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications

equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.

1. Install per TIA/EIA-B.2-1 “Performance specifications for 4-pair 100 ohm Category 6 cabling.”
2. Bridged taps and splices shall not be installed in the horizontal cabling.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1 when tested according to test procedures of this standard.

B. Communication contractor shall be an Commscope Uniprise contractor.

C. The project must be registered with Commscope in order to provide a complete 25 year Extended Product and Application Warranty. Warranty documentation must be provided to owner.

D. Surface-Burning Characteristics: Comply with ASTM E 84; testing 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.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Grounding: Comply with J-STD-607-A.

2.3 UTP CABLE

A. Description: 100-ohm, four-pair UTP, covered with a blue thermoplastic jacket (Commscope).
   1. Comply with ICEA S-90-661 for mechanical properties.
   2. Comply with TIA/EIA-568-B.1 for performance specifications.
   3. Comply with TIA/EIA-568-B.2, Category 6.
   4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

   Communications, Non-Plenum Rated: Type CMP complying with NFPA 262.

2.4 UTP CABLE HARDWARE

A. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

B. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
   1. Provide 8-position, 8-conductor jacks Commscope part number 760237628 USL600-BLUE. Fill vacant positions with blank insert Commscope part number 1116412-3.
   2. Faceplates shall be white in color. Provide Commscope part number 2111012-3 4 port white faceplate.

C. Patch Cords: Factory-made, four-pair cables in 5', 7', and 10' lengths; terminated with eight-position modular plug at each end.
   1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
   2. Patch cords shall have color-coded boots for circuit identification.
   3. Provide one patch cord for each user end connection plus 10% spare. I.E. One patch cord for each connection in the data rack and one patch cord for each connection at the user end.
   4. Quantity of patch cords shall be divided between the multiple lengths as follows: 5' = 20 percent, 7' = 30 percent, and 10' = 50 percent.

2.5 GROUNDING

A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Comply with J-STD-607-A.

2.6 IDENTIFICATION PRODUCTS

A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Install cables in pathways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces. Conceal pathways and cables except in unfinished spaces.
   1. Install plenum cable in environmental air spaces, including plenum ceilings.
   2. Comply with requirements in Division 260533 Section "Raceway and Boxes for Electrical Systems."

B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures:
   1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
   2. Install lacing bars and distribution spools.
   3. Install conductors parallel with or at right angles to sides and back of enclosure.

3.2 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:
   1. Comply with TIA/EIA-568-B.1.
   2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
   3. Install 66-style IDC termination hardware unless otherwise indicated.
   4. MUTOA shall not be used as a cross-connect point.
   5. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
   6. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
   7. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
   8. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
   9. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
   10. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
   11. In the communications equipment room, install a 10-foot long service loop on each end of cable.
   12. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
   13. Cables shall be installed in continuous lengths from origin to destination (no splices) unless specifically addressed in this document.
   14. Where cable splices are allowed, they shall be in accessible locations and housed in an enclosure intended and suitable for the purpose.
   15. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of four-foot intervals - at no point shall cable(s) rest on acoustic ceiling grids or panels.
   16. Horizontal distribution cables shall be bundled in groups of not greater than 40 cables (cable bundle quantities in excess of 40 cables may cause deformation of the bottom cables within the bundle).

17. Panel terminations shall be fed by and individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
18. Cable shall be installed above fire-sprinkler and systems and shall not be attached to the system or any ancillary equipment or hardware.
19. The cabling system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
20. Cables shall not be attached to ceiling grid or lighting support wires.
21. Pulling tension on 4-pair UTP cables shall not exceed 25-pounds for a single cable or cable bundle.
22. Unshielded twisted pair cable shall be installed so that there are no bends less than four times the cables outside diameter (4 X cable O.D.) at any point in the run.
23. Cables shall be identified by a self-adhesive label in accordance the specifications.
24. The cable label shall be applied to the cable behind the faceplate on a sec-tion of cable that can be accessed by removing the cover plate. Cable labels shall not be obscured from view.

C. UTP Cable Installation:
1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

D. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
4. Cable shall not rest on or make contact with any other system.

E. Group connecting hardware for cables into separate logical fields.

3.3 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with J-STD-607-A.

C. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.4 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
   1. Administration Class: 4.
   2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.

B. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation. At completion, cable and asset management software shall reflect as-built conditions.

C. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 4 level of administration, including optional identification requirements of this standard.

D. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.

F. Cable and Wire Identification:
   1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
   2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
   3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet
   4. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
   5. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.

G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.
   1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections
   1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
   2. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.
   3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
   4. UTP Performance Tests:
      a. Test for each outlet. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:
         1) Wire map.
         2) Length (physical vs. electrical, and length requirements).
         3) Insertion loss.
         4) Near-end crosstalk (NEXT) loss.
         5) Power sum near-end crosstalk (PSNEXT) loss.
         6) Equal-level far-end crosstalk (ELFEXT).
         7) Power sum equal-level far-end crosstalk (PSELFEXT).
         8) Return loss.
         9) Propagation delay.
         10) Delay skew.
   5. Final Verification Tests: Perform verification tests for UTP after the complete communications cabling and workstation outlet/connectors are installed.
      a. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

B. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

C. End-to-end cabling will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 271500

SECTION 280500 – COMMON WORK RESULTS FOR SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. All division 28 work shall, in addition to all division 1 specification sections, comply with all of the requirements in the following specification sections:

260500 Common Work Results for Electrical
260501 Electrical Demolition
260510 Electrical Submittals
260511 Electrical Work Closeout
260512 Electrical Coordination
260519 Low-Voltage Electrical Conductors and Cables
260526 Grounding and Bonding for Electrical Systems
260529 Hangers and Supports for Electrical Systems
260533 Raceway and Boxes for Electrical Systems
260548 Vibration and Seismic Controls for Electrical Systems
260553 Identification for Electrical Systems
262726 Wiring Devices

END OF SECTION 280500

SECTION 283101 – FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 SUBMITTALS

A. Refer to section 260510

1.2 QUALITY ASSURANCE

A. Installer Qualifications: NICET Level III certified fire alarm technician.
   1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.

1.3 RELATED DOCUMENTS

A. The system and all associated operations shall be in accordance with the following:
   1. Guidelines of the following Building Code: IBC
   2. NFPA 72, National Fire Alarm Code
   3. NFPA 70, National Electrical Code
   4. NFPA 101, Life Safety Code
   5. NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems
   6. Other applicable NFPA standards
   7. Local Jurisdictional Adopted Codes and Standards
   8. ADA Accessibility Guidelines

1.4 WARRANTY

A. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers, contingent upon compliance with the contract documents, are as listed below. Bidders shall carefully review the requirements listed in the technical specifications and only submit products that are equal or better. Equal products by other manufacturers are acceptable providing substitutions are submitted in accordance with requirements listed in the “Instructions to Bidders” (AIA A701) and approved by the A/E. Bidders shall carefully review the front end documents (AIA A701) and submit all information required to allow the A/E the ability to make a fully informed decision.

1. Fire Alarm Control Units, Basis of Design: Edmonds.

2.2 FIRE ALARM SYSTEM

A. Fire Alarm System: Replace the fire alarm control panel, and expand the existing automatic fire detection and alarm system to include the elevator renovation:
   1. Provide all components necessary, regardless of whether shown in the contract documents or not.
   2. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
      a. The Americans With Disabilities Act (ADA).
      b. The requirements of the local authority having jurisdiction, (DHEC).
      c. The contract documents (drawings and specifications).
      d. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
   3. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
   4. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
   5. Program notification zones and voice messages as directed by Owner.

B. Circuits:
   1. Initiating Device Circuits (IDC): Class B
   2. Signaling Line Circuits (SLC) Within Single Building: Class B
   3. Notification Appliance Circuits (NAC): Class B

C. Power Sources:
   1. Primary: Dedicated branch circuits of the facility power distribution system.
   2. Secondary: Storage batteries.
   3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.

2.3 EXISTING COMPONENTS

A. Existing Fire Alarm System: Remove existing system and devices to be demoed completely after new system is fully operational and tested.

B. On-Premises Supervising Station: Include as part of this work all modifications necessary to existing supervising station to accommodate new fire alarm work.

C. Clearly label components that are "Not In Service."

D. Remove unused existing components and materials from site and dispose of properly.

E. Provide a fire watch for the building if the existing system is brought off line for any reason. Notify the AHJ of all fire watch plans.

F. Protect any fire alarm devices that are in service from dust during construction operations.

2.4 FIRE SAFETY SYSTEMS INTERFACES

A. Provide connection to all flow and tamper switches installed by the fire suppression contractor whether shown on the construction documents or not.

B. HVAC:
1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

2.5 COMPONENTS

A. General:
1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units, Initiating Devices, and Notification Appliances: Addressable type; listed by Underwriters Laboratories as suitable for the purpose intended.

C. Initiating Devices:
1. Smoke Detectors: photo electric type, match existing
2. Addressable Interface Devices: provide as required

D. Surge Protection: In accordance with IEEE C62.41 B3 combination waveform and NFPA 70; except for optical fiber conductors.

E. Locks and Keys: Deliver keys to owner.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and the contract documents.

B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

3.2 CIRCUIT BREAKERS

A. Circuit breakers serving fire alarm devices shall be provided with a red fire alarm circuit breaker lockout kit that permanently identifies circuit as “FIRE ALARM”.

3.3 INSPECTION AND TESTING FOR COMPLETION

A. Notify engineer 7 days prior to beginning completion inspections and tests.

B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

E. Provide all tools, software, and supplies required to accomplish inspection and testing.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

G. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.4 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to owner.
   1. Be prepared to conduct any of the required tests.
   2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
   3. Have authorized technical representative of control unit manufacturer present during demonstration.
   4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
   5. Repeat demonstration until successful.

B. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
   1. Approved operating and maintenance data has been delivered.
   2. All aspects of operation have been demonstrated to Engineer.

3. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
4. Specified pre-closeout instruction is complete.

C. Perform post-occupancy instruction within 3 months after Substantial Completion.

END OF SECTION 283101

SECTION 313116 - TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Soil treatment with termiticide.

B. Related Sections include the following:

1. Division 06 Section "Rough Carpentry" for wood preservative treatment by pressure process.

1.3 PERFORMANCE REQUIREMENTS

A. Service Life of Soil Treatment: Soil treatment by use of a termiticide that is effective for not less than five years against infestation of subterranean termites.

1.4 SUBMITTALS

A. Product Data: For termiticide.

1. Include the EPA-Registered Label for termiticide products.

B. Product Certificates: For termite control products, signed by product manufacturer.

C. Qualification Data: For Installer of termite control products.

D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following:

1. Date and time of application.
2. Moisture content of soil before application.
3. Brand name and manufacturer of termiticide.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes, and rates of application used.
6. Areas of application.
7. Water source for application.

E. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.

B. Regulatory Requirements: Formulate and apply termiticides according to the EPA-Registered Label.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

1.7 COORDINATION

A. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Termiticides:

a. Aventis Environmental Science USA LP; Termidor.
b. Bayer Corporation; Premise 75.
c. FMC Corporation, Agricultural Products Group; Prevail FT.
d. Syngenta; Demon TC.

2.2 SOIL TREATMENT

A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control.

1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
2. Foundations: Adjacent soil including soil along the entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating the slab, and around interior column footers, piers, and chimney bases; also along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
3. Masonry: Treat voids.
4. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 313116

SECTION 316613 - HELICAL PILES

PART 1 GENERAL

1.1 Description

This work pertains to furnishing and installing Helical Piles, Helical Anchors, and Bracket Assemblies shown in the Contract in accordance with the Drawings and this specification. Each Helical Pile and Helical Anchor shall be installed at the location and to the elevation, minimum length, installation torque, and allowable capacities shown on the Plans or as established. This work also pertains to load testing and pre-loading Helical Piles and Helical Anchors (if required on the Drawings).

1.2 Referenced Codes and Standards

This specification is based on nationally recognized codes and standards including the references listed below. In case of a conflict between the reference and this specification, this specification shall govern.

A. American Society for Testing and Materials (ASTM):

1. ASTM A36/A36M Structural Steel
2. ASTM A123-02 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
3. ASTM A153-05 Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware
4. ASTM A450/A450M-07 Standard Specification for General Requirements for Carbon and Low Alloy Steel Tubes
5. ASTM D1143/D1143M-07 Standard Test Method for Piles Under Static Axial Compressive Load
6. ASTM D3689 Standard Test Method for Individual Piles Under Static Axial Tensile Load

B. American Society of Mechanical Engineers (ASME):

1. ANSI/ASME Standard B18.2.1-1996, Square and Hex Bolts and Screws, Inch Series

C. Occupational Safety and Health Administration (OSHA):

1. Excavation Safety Guidelines

D. ICC-Evaluation Services, Inc.:

1. AC358 Acceptance Criteria for Helical Foundation Systems and Devices

E. American Welding Society

1. ANSI/AWS B2.1-00 Standard for Welding Procedure and Performance Qualification

1.3 Definitions

A. Helical Pile: Manufactured steel foundation with one or more helical bearing plates that is rotated into the ground to support structures.

B. Engineer: Individual or firm retained by Owner or General Contractor to verify Helical Pile and Helical Anchor quality assurance with the Contract, the Drawings, and this specification.

C. Allowable Bearing Capacity: Ultimate bearing capacity of the bearing stratum divided by a factor of safety.

D. Lead Section: The first section of a Helical Pile or Helical Anchor to enter the ground. Lead Sections consist of a central shaft with a tapered end and one or more helical bearing plates affixed to the shaft.

E. Extension Section: Helical Pile or Helical Anchor sections that follow the Lead Section into the ground and extend the Helical Lead to the appropriate depth. Extension Sections consist of a central shaft and may have helical bearing plates affixed to the shaft.

F. Brackets: Cap plate, angle, thread bar, or other termination device that is bolted or welded to the end of a Helical Pile or Helical Anchor after completion of installation to facilitate attachment to structures or embedment in cast-in-place concrete.

G. Augering: Rotation of the shaft with little or no advancement. It can occur when the helical bearing plates pass from a relatively soft material into a comparatively hard material. Augering can also result from insufficient crowd or downward pressure during installation. In some cases, augering may be (temporarily) necessary in order to grind through an obstruction.

H. Pile Design Professional: Individual or firm responsible for the design of Helical Piles, Helical Anchors, and Brackets.

1.4 Qualifications

A. Due to the special requirements for installation of Helical Piles, Helical Anchors, and Brackets, all Helical Piles, Helical Anchors, and Brackets shall be installed by an organization specializing in the installation of those products.

Any Contractor desiring to bid as the Helical Pile and Helical Anchor installer for this project shall submit a request to the Engineer for review not less than seven
(7) calendar days prior to the bid date. The request must include:

1. Evidence the Contractor has completed training in the proper methods of installation of Helical Piles and Helical Anchors and the mounting of Brackets.
2. A recent company brochure indicating experience in this type of work.
3. Evidence of having installed Helical Piles and Helical Anchors on at least ten (10) projects, including project name, number and type of Helical Piles or Helical Anchors, project location, and client contact information.
4. Resume of Contractor's foreman including experience in the oversight of Helical Pile and Helical Anchor installation on at least five (5) projects in the last five (5) years, including project name, number and type of Helical Piles or Helical Anchors installed, project location, and client contact information.
5. List of installation and testing equipment and detailed description of proposed method of

installation and load testing Helical Piles and Helical Anchors (if testing is required).

6. Current ANSI/AWS welding certificate and documentation of welder experience within the last 5 years (if welding is required).

B. Due to the special requirements for design of Helical Piles, Helical Anchors, and Brackets, all Helical Piles, Helical Anchors, and Brackets shall be designed by a licensed design professional specialized in the engineering and design of Helical Piles and Helical Anchors.

1.5 Submittals

A Contractor shall prepare and submit to the Engineer for review and approval, Shop Drawings and specifications for the Helical Piles and Helical Anchors intended for use on the project at least 14 calendar days prior to planned start of installation. The Shop Drawings shall include the following:

1. Helical Pile and Helical Anchor product identification number(s) and designation(s)
2. Maximum allowable mechanical compression and tensile strength of the Helical Piles and Helical Anchors
3. Number of Helical Piles and Helical Anchors and respective design allowable capacities from the Drawings
4. Planned installation depth and the number of lead and extension sections
5. Preliminary helical configuration (number and diameter of helical bearing plates)
6. Manufacturer's recommended capacity to installation torque ratio
7. Minimum final installation torque(s)
8. Product identification numbers and designations for all Bracket Assemblies and number and size of connection bolts or concrete reinforcing steel detail
9. Corrosion protection coating on Helical Piles, Helical Anchors, and Bracket Assemblies

B. Contractor shall submit to the Engineer calibration information certified by an independent testing agency for the torque measurement device and all load testing and monitoring equipment to be used on the project. Calibration information shall have been tested within the last year of the date submitted. Calibration information shall include, but is not limited to, the name of the testing agency, identification number or serial number of device calibrated, and the date of calibration.

C. If load tests or proof load tests are required on the Drawings, the Contractor shall submit for review and acceptance the proposed load testing procedure. The proposal shall provide the minimum following information:

1. Type and sensitivity of load equipment
2. Type and sensitivity of load measuring equipment
3. Type and sensitivity of pile-head deflection equipment
4. General description of load reaction system, including description of reaction anchors or bearing plate
5. Calibration reports for equipment, including hydraulic jack, pressure gauges, and deflection dial gauges

D. Manufacturer shall provide a one year warranty against manufacturing defects on Helical Pile, Helical Anchor, and Bracket products. Any additional warranty provided by the Contractor shall be issued as an addendum to this specification.

E. Work shall not begin until all the submittals have been received and approved by the Engineer. The Contractor shall allow the Engineer a reasonable number of days to review, comment, and return

the submittal package after a complete set has been received. All costs associated with incomplete or unacceptable submittals shall be the responsibility of the Contractor.

1.6 Shipping, Storage, and Handling

A. All Helical Pile, Helical Anchor, and Bracket Assemblies shall be free of structural defects and protected from damage. Store Helical Piles, Helical Anchors, and Bracket Assemblies on wood pallets or supports to keep from contacting the ground. Damage to materials shall be cause for rejection.

PART 2 PRODUCTS

2.1 Helical Piles, Helical Anchors, and Brackets

A. Unless noted otherwise, it is the Contractor's Pile Design Professional's responsibility to select the appropriate size and type of Helical Piles, Helical

Anchors, and Brackets to support the design loads shown on the Drawings. These specifications and the Drawings provide minimum requirements to aid the Contractor in making appropriate materials selections. The size and number of helical bearing plates must be such that the Helical Piles and Helical Anchors achieve the appropriate torque and capacity in the soils at the site within the minimum and maximum length requirements. Failure to achieve proper torque and capacity shall result in Contractor replacing Helical Piles and Helical Anchors as appropriate to support the required loads. All material replacements shall be acceptable to Engineer.

B. The design strength of the helical bearing plates, shaft connections, Brackets, and the pile shaft itself shall be sufficient to support the design loads specified on the Drawings times appropriate service load factors. In addition, all Helical Piles and Helical Anchors shall be manufactured to the following criteria.

1. Central Shaft: The central shaft shall consist of a high strength structural steel tube meeting the requirements of ASTM A513.
2. Helical Bearing Plates: One or more helical bearing plates shall be affixed to the central shaft. Helical bearing plates shall be attached to central shafts via fillet welds continuous on top and bottom and around the leading edges. Helical bearing plates shall be cold pressed into a near perfect helical shape that when affixed to the central shaft are perpendicular with the central shaft, of uniform pitch, and such that the leading and trailing edges are within 3/8 inch of parallel. Average helical pitch shall be within plus or minus 1/4 inch of the thickness of the helical bearing plate plus 3 inches.
3. Corrosion Protection: Depending on project requirements and soil corrosivity, Helical Piles, Helical Anchors, and Brackets shall be bare steel, powder coated, or hot-dip galvanized (per ASTM A123 or A153 as applicable).
4. Shaft Connections: The Helical Pile and Helical Anchor shaft connections shall consist of an external sleeve connection or a welded connection. External sleeve connections shall be in-line, straight and rigid and shall have a maximum tolerable slack of 1/16-inch. Welded connections shall consist of a full penetration groove weld all-around the central shaft. Shaft connections shall have a flexural strength at least as great as the shaft itself.
5. Bolts: Bolt holes through the external sleeve and central shaft shall have a diameter that is 1/16th inch greater than the bolt diameter. Bolts and nuts used to join Helical Pile and Helical Anchor sections at the shaft connections shall be bare steel, epoxy coated, or zinc coated to match the corrosion protection used for the central shaft. All Helical Pile and

Helical Anchor bolts shall be securely snug tightened.

6. Plug Welds: Alternatively, external sleeve connections may be made using plug welds matching the diameter and number of bolt holes.
7. External sleeve: External sleeve Helical Pile and Helical Anchor shaft connections shall consist of a high strength structural steel tube outer sleeve meeting the requirements of ASTM A513. The outer sleeve shall be welded to the central shaft via a continuous fillet weld all-around. The fillet weld shall have a throat thickness equal to the external sleeve tube thickness.

C. Helical Piles and Helical Anchors shall be fitted with a manufactured Bracket that facilitates connection to the structure. Brackets shall be rated for the design loads shown on the Drawings. Brackets shall be affixed to the end of Helical Piles and Helical Anchors via bolts, plug welds, or continuous penetration welds meeting the requirements for shaft connections given previously in these specifications.

PART 3 EXECUTION

3.1 Examination

A. Contractor shall take reasonable effort to locate all utilities and structures above and underground in the area of the Work. Contractor shall pot hole to determine the exact location of underground utilities and buried structures within a distance from a Helical Pile or Helical Anchor equal to three times the maximum helix diameter. Contractor is responsible for protection of utilities and structures shown on the Drawings. Costs of avoiding, relocating, or repair of utilities not shown on Drawings shall be paid by Owner as extra work.

B. Contractor shall review Drawings and soil borings in the Contract Documents to determine subsurface conditions for sizing and installation of Helical Piles and Helical Anchors. In addition, Contractor shall make a site visit to observe conditions prior to the start of Work.

C. Contractor shall notify Engineer of any condition that would affect proper installation of Helical Piles and Helical Anchors immediately after the condition is revealed. Contractor shall halt installation work until the matter can be resolved upon mutual satisfaction of Contractor, Owner, and Engineer. Costs associated with construction delays, product substitutions, pile or anchor relocations, or other related costs shall be the responsibility of the Owner if the result of an unforeseen condition that could not be inferred by a reasonable Contractor from the Drawings and Construction Documents.

D. If the number and size of helical bearing plates required for the project is not shown on the working drawings, the contractor shall have the option of performing subsurface tests using methods subject to the review and acceptance of the Owner. The data collected along with other information pertinent to the project site shall be used to determine the required helical bearing plate configuration.

E. If excavation is required for proper installation of Helical Piles and Helical Anchors, Contractor shall make safe excavations in accordance with OSHA standards. All excavations greater than 20 feet in depth or not in strict accordance with OSHA standard details shall be designed by a registered design professional specializing in the design of excavations and shoring. The costs of all excavations, shoring, and related design shall be born by the Contractor unless noted otherwise in the Contract.

F. Contractor shall notify Engineer at least 24 hours prior to installation of Helical Piles or Helical Anchors to schedule quality assurance observations required on the Drawings.

3.2 Installation Equipment

A. Torque Motor: Helical Piles and Helical Anchors should be installed with high torque, low RPM torque motors, which allow the helical plates to advance with minimal soil disturbance. The torque motor shall be hydraulic power driven with clockwise and counter-clockwise rotation capability. The torque motor shall be adjustable with respect to revolutions per minute during installation. Percussion drilling equipment shall not be permitted. The torque motor shall have torque capacity equal to or greater than the minimum final installation torque required for the project. The connection between the torque motor and the installation rig shall have no more than two pivot hinges oriented 90 degrees from each other. Additional hinges promote wobbling and affect lateral capacity.

B. Installation Equipment: The installation equipment shall be capable of applying adequate crowd and torque simultaneously to ensure normal advancement of the Helical Piles and Helical Anchors. The equipment shall be capable of maintaining proper alignment and position.

C. Drive Tool: The connection between the torque motor and Helical Pile and Helical Anchor shall be in-line, straight, and rigid, and shall consist of a hexagonal, square, or round kelly bar adapter and helical shaft socket. To ensure proper fit, the drive tool shall be manufactured by the Helical Pile manufacturer and used in accordance with the manufacturer's installation instructions.

D. Connection Pins: The central shaft of the Helical Pile or Helical Anchor shall be attached to the drive tool by ASME SAE Grade 8 smooth tapered pins matching the number and diameter of the specified shaft connection bolts. The connection pins should be maintained in good condition and safe to operate at all times. The pins should be regularly inspected for wear and deformation. Pins should be replaced with identical pins when worn or damaged.

E. Torque Indicator: A torque indicator shall be used to measure installation torque during installation. The torque indicator can be an integral part of the installation equipment or externally mounted in-line with the installation tooling. The torque indicator shall be capable of torque measurements with a sensitivity of 500 ft-lb or less. Torque indicators shall have been calibrated within 1-year prior to start of Work. Torque indicators that are an integral part of the installation equipment shall be calibrated on-site. Torque indicators that are mounted in-line with the installation tooling shall be calibrated either on-site or at an appropriately equipped test facility. Indicators that measure torque as a function of hydraulic pressure shall be re-calibrated following any maintenance performed on the torque motor. Torque indicators shall be re-calibrated if, in the opinion of the Engineer, reasonable doubt exists as to the accuracy of the torque measurements.

3.3 Installation Procedures

A. Unless shown on the Drawings, the number and size of helical blades shall be determined by the Contractor's Pile Design Professional in order to achieve the required torque and tensile/bearing capacity for the soil conditions at the site. The ratio of design load to the total area of the helical bearing plates shall not exceed the Allowable Bearing Capacity.

B. Connect the lead section to the Torque Motor using the Drive Tool and Connection Pins. Position and align the Lead Section at the location and to the inclination shown on the Drawings and crowd the pilot point into the soil. Advance the Lead Section and continue to add Extension Sections to

achieve the Termination Criteria. All sections shall be advanced into the soil in a smooth, continuous manner at a rate of rotation between 10 and 40 revolutions per minute. Snug tight all coupling bolts.

C. Constant axial force (crowd) shall be applied while rotating Helical Piles and Helical Anchors into the ground. The crowd applied shall be sufficient to ensure that the Helical Pile and Helical Anchor advances into the ground a distance equal to at least 80% of the blade pitch per revolution during normal advancement.

D. The manufacturer's torsional strength rating of the Helical Pile or Helical Anchor shall not be exceeded during installation.

E. Bolt hole elongation due to torsion of the shaft of a Helical Anchor at the drive tool shall be limited to ¼ inch. Helical Anchors with bolt hole damage exceeding this criterion shall be uninstalled, removed, and discarded.

F. When the Termination Criteria of a Helical Pile or Helical Anchor is obtained, the Contractor shall adjust the elevation of the top end of the shaft to the elevation shown on the Drawings or as required. This adjustment may consist of cutting off the top of the shaft and drilling new holes to facilitate installation of Brackets to the orientation shown on the Drawings. Alternatively, installation may continue until the final elevation and orientation of the pre-drilled bolt holes are in alignment. Contractor shall not reverse the direction of torque and back-out the Helical Pile or Helical Anchor to obtain the final elevation.

G. The Contractor shall install Brackets in accordance with Helical Pile manufacturer's details or as shown on the Drawings.

H. All Helical Pile and Helical Anchor components including the shaft and Bracket shall be isolated from making a direct electrical contact with any concrete reinforcing bars or other non-galvanized metal objects since these contacts may alter corrosion rates.

I. After installation, Helical Anchors shall be pre-tensioned if indicated on the Drawings.

3.4 Termination Criteria

A. Helical Piles and Helical Anchors shall be advanced until all of the following criteria are satisfied.

1. Axial capacity is verified by achieving the final installation torque as shown on the Drawings or as provided by the Pile Design Professional.

2. Minimum depth is obtained. The minimum depth shall be as shown on the Drawings, that which corresponds to the planned bearing stratum, or the depth at which the final installation torque is measured, whichever is greater. In addition, Helical Anchors shall be advanced until the average torque over the last three (3) feet equals or exceeds the required final installation torque.

B. If the torsional strength rating of the Helical Pile or Helical Anchor and/or the maximum torque of the installation equipment has been reached or Augering occurs prior to achieving the minimum depth required, the Contractor shall have the following options:

1. Terminate the installation at the depth obtained subject to the review and acceptance of the Engineer and Owner.

2. Remove the Helical Pile or Helical Anchor and install a new one with fewer and/or smaller diameter helical bearing plates or with dual cutting edge helical bearing plates. The new helical configuration shall be subject to review and acceptance of the Engineer and Owner.

3. Remove the Helical Pile or Helical Anchor and pre-drill a 4-inch diameter pilot hole in the same location and reinstall the anchor/pile.

4. If the obstruction is shallow, remove the Helical Pile or Helical Anchor and remove the obstruction by surface excavation. Backfill and compact the resulting excavation and reinstall the anchor/pile.

5. Remove the Helical Pile or Helical Anchor and relocate 1-foot to either side of the installation location subject to the review and acceptance of Engineer and Owner.

6. Reverse the direction of torque, back-out the Helical Pile or Helical Anchor a distance of 1 to 2 feet and attempt to reinstall by decreasing crowd and Augering through the obstruction.

7. Remove the Helical Pile or Helical Anchor and sever the uppermost helical bearing plate from the Lead Section if more than one helical bearing plate is in use, or reshape the helical bearing plates to create a special tapered edge by cutting with a band saw. Reinstall the anchor or pile with revised helical bearing plate configuration.

C. If the final installation torque is not achieved at the contract length, the Contractor shall have the following options:

1. Until the maximum depth is achieved (if any), install the Helical Pile or Helical Anchor deeper using additional Extension Sections.

2. Remove the Helical Pile or Helical Anchor and install a new one with additional and/or larger diameter helical bearing plates.

3. Decrease the rated load capacity of the Helical Pile or Helical Anchor and install additional Helical Piles or Helical Anchors. The rated capacity and additional unit location shall be subject to the review and acceptance of the Engineer and Owner.

3.5 Allowable Tolerances

A. Helical Piles and Helical Anchors shall be installed as close to the specified installation and orientation angles as possible. Tolerance for departure from installation and orientation angles shall be +/- 5 degrees.

B. Helical Piles, Helical Anchors, and Bracket Assemblies shall be installed at the locations and to the elevations shown on the Plans. Tolerances for Bracket Assembly placement shall be +/- 1 inch in both directions perpendicular to the shaft and +/- 1/4 inch in a direction parallel with the shaft unless otherwise specified.

3.6 Quality Assurance

A. The Contractor shall provide the Engineer and Owner copies of installation records within 48 hours after each installation is completed. These installation records shall include, but are not limited to, the following information:

1. Name of project and Contractor
2. Name of Contractor's supervisor during installation
3. Date and time of installation
4. Name and model of installation equipment
5. Type of torque indicator used
6. Location of Helical Pile or Helical Anchor by grid location, diagram, or assigned identification number
7. Type and configuration of Lead Section with length of shaft and number and size of helical bearing plates
8. Type and configuration of Extension Sections with length and number and size of helical bearing plates, if any
9. Installation duration and observations
10. Total length installed
11. Final elevation of top of shaft and cut-off length, if any
12. Final plumbness or inclination of shaft
13. Installation torque at minimum three-foot depth intervals
14. Final installation torque
15. Comments pertaining to interruptions, obstructions, or other relevant information
16. Verified axial load capacity

B. Unless specified otherwise on the Drawings or by local codes, the Engineer, the Pile Design Professional, or an inspection agency accepted by the Engineer shall observe and document at least 10 percent of Helical Pile and Helical Anchor installations.

3.7 Load Testing

A. Helical Pile Compression Tests

1. Contractor shall perform the number of compression tests shown on the Drawings, if any
2. Compression tests shall be performed following the "quick test" procedure described in

ASTM D1143 specifications

3. Load tests shall be observed and documented by the Engineer
4. Unless otherwise shown on the Drawings, the maximum test load shall be 200% of the allowable load shown on the Drawings
5. The locations of Helical Piles to be tested shall be determined by the Contractor, unless noted on the Drawings
6. Installation methods, procedures, equipment, products, and final installation torque shall be identical to the production Helical Piles to the extent practical except where otherwise approved by the Owner or Engineer
7. A load test shall be deemed acceptable provided the maximum test load is applied without Helical Pile failure and the deflection of the pile head at the design load is less than 1-inch unless noted otherwise on the Drawings. Failure is defined when continuous jacking is required to maintain the load.

B. If a load test fails the forgoing acceptance criteria, the Contractor shall modify the Helical Pile or Helical Anchor design and/or installation methods and retest the modified pile or anchor, as directed by the Owner or Engineer. These modifications include, but are not limited to, de-rating the load capacity, modifying the installation methods and equipment, increasing the minimum final installation torque, changing the helical configuration, or changing the product (i.e., duty). Modifications that require changes to the structure shall have prior review and acceptance of the Owner. Any modifications of design or construction procedures, and any retesting required shall be at the Contractor's expense.

C. The Contractor shall provide the Owner and Engineer copies of load test reports confirming configuration and construction details within 1 week after completion of the load tests. This written documentation will either confirm the load capacity as required on the working drawings or propose changes based upon the results of the tests. At a minimum, the documentation shall include:

1. Name of project and Contractor
2. Date, time, and duration of test
3. Location of test Helical Pile or Helical Anchor by grid location, diagram, or assigned identification number
4. Test procedure (ASTM D1143, D3689, or D3966)
5. List of any deviations from procedure
6. Description of calibrated testing equipment and test set-up
7. Type and configuration of Helical Pile or Helical Anchor including lead section, number and type of extension sections, and manufacturer's product identification numbers
8. Load steps and duration of each load increment
9. Cumulative pile-head movement at each load step
10. Comments pertaining to test procedure, equipment adjustments, or other relevant information

PART 4 MEASUREMENT AND PAYMENT

4.1 Helical Piles, Helical Anchors and Bracket Assemblies

A. Per Unit: Payment will be at a per unit price with one unit consisting of the labor, equipment, and materials required to furnish and install a Helical Pile or Helical Anchor and associated Bracket at the location and to the elevation, orientation, inclination, length, and capacity shown in the Drawings. Unless established in the Contract, there shall be no payment for additional Helical Pile or Helical Anchor length.

B. Per Load Test: Payment will be at a per unit price with one unit consisting of the labor, equipment, and materials required to perform each required load test.