Project Manual for

University of South Carolina
School of Journalism Broadcast Studio

Columbia, South Carolina

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State Permanent Improvement Project No. H27-6099-MJ

Architect's Project No. U-646-12-3

Construction Documents

Volume II of II

October 1, 2014

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PROJECT NAME: University of South Carolina School of Journalism Broadcast Studio

SECTION

TECHNICAL SPECIFICATIONS

(List the technical specifications using the same Divisions numbers and titles as shown on the individual technical specification sections. Provide the issue date and revision number for each section.)

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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 and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.
2. Division 07 Section "Thermal Insulation" for insulation installed with Z-shaped furring members.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. 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. Recycled Content of Steel Products: Provide products with average recycled content of steel products such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 75 percent.

B. 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, G40 (Z120) 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: As indicated on Drawings.

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: 0.0179 inch (0.45 mm
b. Depth: As indicated on Drawings

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

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

F. 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 mm), minimum uncoated-metal thickness of 0.018 inch (0.45 mm).

1. Depth indicated on drawings.

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

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Armstrong World Industries, Inc.; Drywall Grid Systems.
b. Chicago Metallic Corporation; 640-C or 660-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)
2. Depth: As indicated on Drawings

B. 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)

C. 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: As indicated on Drawings
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.

D. 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

E. 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: As indicated on Drawings
2. 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.

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.

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.

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 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.

a. Space studs as indicated on drawings

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. 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.

B. Related Sections include the following:

1. Division 05 Section "Cold-Formed Metal Framing" for load-bearing steel framing that supports gypsum board.
2. Division 06 Section "Miscellaneous Rough Carpentry" for wood framing and furring that supports gypsum board.
3. Division 07 Section "Thermal Insulation" for insulation and vapor retarders installed in 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.

1.4 QUALITY ASSURANCE

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

1.5 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. Recycled Content: Provide gypsum panel products with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 50 percent by weight.

B. 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, but not limited to, one of the following:

a. American Gypsum Co.
b. BPB America Inc.
c. G-P Gypsum.
d. Lafarge North America Inc.
e. National Gypsum Company.
f. PABCO Gypsum.
g. Temple.
h. USG Corporation.

B. Regular Type:

1. Thickness: 5/8 inch

2. Long Edges: Tapered.

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

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

2.3 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:

a. Cornerbead.
b. Bullnose bead.
c. LC-Bead: J-shaped; exposed long flange receives joint compound.
d. L-Bead: L-shaped; exposed long flange receives joint compound.
e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
f. Expansion (control) joint.

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

2.5 AUXILIARY MATERIALS

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

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

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

C. 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).

D. Thermal & Sound Attenuation 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.

J. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Regular: Unless otherwise indicated.
2. Moisture-and Mold-Resistant Type: Restroom walls (without tile) and ceilings. Returns at jambs and heads of exterior windows and doors.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

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. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.4 INSTALLING TRIM ACCESSORIES

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

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

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners, unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.
3. U-Bead: Use at exposed panel edges and where indicated.

3.5 FINISHING GYPSUM BOARD

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

B. Prefill open joints 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, completely concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile and concealed at fire ratings.
3. 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.

4. Level 5: At Chroma Green wall as indicated on drawings.

3.6 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 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes acoustical panels and exposed suspension systems for ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

1.3 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

1.4 SUBMITTALS

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

B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: Set of 6-inch- (150-mm-) square. Samples of each type, color, pattern, and texture.
2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- (300-mm-) long Samples of each type, finish, and color.

D. Statement of Compliance with Seismic Design Category Requirements: Statement indicating system minimum compliance for category specified for all system components and list products and systems being provide that demonstrates compliance with requirements.

1.5 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:

D. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:

1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
2. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."
3. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."
4. ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

E. Seismic Requirements: Provide complete suspended acoustical panel ceilings system designed and installed to withstand the effects of earthquake motions according to the standards above and the following requirements:

1. Meet Requirements of Seismic Design Category C.

a. Section 1613.1 of the International Building Code 2009 Edition requires compliance with ASCE 7. In the event of conflicts with requirements with standards referenced above and ASCE 7, comply with ASCE 7.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.8 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 0.5 percent of quantity installed.
2. Suspension System Components: Quantity of each exposed component equal to 0.5 percent of quantity installed.
3. Hold-Down Clips: Equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

A. Recycled Content: Provide acoustical panels with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of DDD percent by weight.

B. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.

C. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

D. Antimicrobial Fungicide Treatment: Provide acoustical panels with face and back surfaces coated with antimicrobial treatment consisting of manufacturer's standard formulation with fungicide added to inhibit growth of mold and mildew and showing no mold or mildew growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING: APC1

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on the Drawings, **USG Mars Clima Plus 86185,** or a comparable product by one of the following, but not limited to the following:

1. CertainTeed Corp.
2. Chicago Metallic Corporation.
3. Tectum Inc.
4. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Classification: Provide fire-resistance-rated panels complying with ASTM E 1264 for type, form, and pattern as follows:

1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
2. Pattern: CE (perforated, small holes and lightly textured)

C. Color: White.

D. LR: Not less than 0.83.

E. NRC: Not less than 0.70

F. CAC: Not less than 35.

G. Edge/Joint Detail: Standard 15/16 IN

H. Thickness: 5/8 inch (16 mm).

I. Modular Size: 24 by 24 inches (610 by 610 mm).

J. Antimicrobial Treatment: Antimicrobial Fungicide Treatment BioBlock Plus.

K. Humidity Resistance: HumiGuard Plus

L. VOC Formaldehyde: Low

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

C. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

D. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

E. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

F. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch- (3.5-mm-) diameter wire.

2.4 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING : APC1

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings (15/16” Prelude Grid), or a comparable product by, but not limited to, one of the following, but not limited to the following:

1. CertainTeed Corp.
2. Chicago Metallic Corporation.
3. Tectum Inc.
4. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Wide-Face, Capped, Double-Web, Hot-Dip Galvanized, G60 (Z180), Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, hot-dip galvanized according to ASTM A 653/A 653M, G60 (Z180) coating designation, with prefinished, cold-rolled, 15/16-inch- (24-mm-) wide, aluminum caps on flanges.

1. Structural Classification: Heavy duty system.
2. Face Design: Flat, flush.
3. Face Finish: Painted white.

2.5 ACOUSTICAL SEALANT

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

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

1. Acoustical Sealant for Exposed and Concealed Joints:

a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
b. USG Corporation; SHEETROCK Acoustical Sealant.

C. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

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

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with **ASTM C 636** and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
7. Do not attach hangers to steel deck tabs.
8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
9. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:

    a. As indicated on reflected ceiling plans.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
6. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513 - RESILIENT BASE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Resilient base.

1.3 SUBMITTALS

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

B. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and pattern required.

1.4 QUALITY ASSURANCE

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

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

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.6 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C) in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.

2. During installation.
3. 48 hours after installation.

B. Install resilient products 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. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

A. Resilient Base:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Allstate Rubber Corp.; Stoler Industries.
b. Armstrong World Industries, Inc.
c. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
d. Endura Rubber Flooring; Division of Burke Industries, Inc.
e. Estrie Products International; American Biltrite (Canada) Ltd.
f. Flexco, Inc.
g. Johnsonite.
h. Mondo Rubber International, Inc.
i. Roppe Corporation, USA.
j. VPI, LLC; Floor Products Division.

B. Resilient Base Standard: ASTM F 1861.

1. Material Requirement: Type TP (rubber, thermoplastic).
2. Manufacturing Method: Group I (solid, homogeneous)
3. Style: Cove (base with toe

C. Minimum Thickness: 0.125 inch (3.2 mm).

D. Height: 6 inches (102 mm)]

E. Outside Corners: Job formed.

F. Inside Corners: Job formed.

G. Finish: Matte.

H. Colors and Patterns: As indicated on interiors finish material schedule.

2.2 INSTALLATION MATERIALS

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

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Cove Base Adhesives: Not more than 50 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

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

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Accessories: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
4. Moisture Testing: Perform tests recommended by manufacturer**.** Proceed with installation only after substrates pass testing.

a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.

b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

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

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
2. Inside Corners: Use straight pieces of maximum lengths possible.

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 resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products until Substantial Completion.

END OF SECTION 096513

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes modular carpet tile.

B. Related Requirements:
   1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

   1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:

      a. Review delivery, storage, and handling procedures.
      b. Review ambient conditions and ventilation procedures.
      c. Review subfloor preparation procedures.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
   2. Include installation recommendations for each type of substrate.

B. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

   1. Carpet Tile: Full-size Sample.
   2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- (300-mm-) long Samples.

C. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.10 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.11 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
3. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE (CPT-1)

A. Refer to Finish Schedule in Drawings for Basis-of-Design products. In all cases, the products listed in the Finish Schedule represent the minimum standard of quality, construction, and performance that shall be used in the project. The values listed below are in some cases a range based on the multiple types of carpet specified. In all cases, comparison with the Basis-of-Design products shall be the final indicator as to whether or not a product is equal.

B. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated on Drawings or comparable product by one of the following:

1. Shaw Contract Group
2. Tandus Flooring
3. Approved Equal

C. Color and Pattern: Color and Patterns to match or be equivalent to the products indicated in the drawings under schedule of finishes. The Architect shall make the final determination as to whether colors and patterns are equivalent.

D. Fiber Content: Refer to Finish Schedule in Drawings for Basis of Design products. Fiber content varies per carpet type.

E. Pile Characteristic: Patterned Loop.

F. Pile Thickness: 0.118 to 0.187 inches (mm) for finished carpet tile.

G. Stitches: 9.4 - 11 stitches per inch (mm).

H. Gage: 1/12 or 5/64 ends per inch (mm).

I. Surface Pile Weight: Varies per carpet. Refer to Basis-of Design selections.

J. Primary Backing/Backcoating: Synthetic, Non-woven

K. Secondary Backing/Backcoating: ecoworx by Shaw Contract Group or equal.

L. Size: Refer to Finish Schedule in Drawings for tile sizes.

M. Applied Soil-Resistance Treatment: Manufacturer's standard material

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or as recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

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

C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Install products per manufacturer’s recommendations and only under conditions and onto substrates recommended by the manufacturer. Examine carpet tile for type, color, pattern, and potential defects.

B. In all cases, install products per manufacturer’s recommendations in a manner which will not void any material or labor warranties.

C. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness

characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.

2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

D. For raised access flooring systems, verify the following:

1. Access floor substrate is compatible with carpet tile and adhesive if any.
2. Underlayment surface is flat, smooth, evenly planed, tightly jointed, and free of irregularities, gaps greater than 1/8 inch (3 mm), protrusions more than 1/32 inch (0.8 mm), and substances that may interfere with adhesive bond or show through surface.

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

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders.

H. Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1. Steel.
2. Galvanized metal.
3. Bituminous-coated surfaces.

B. Related Sections include the following:

1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
2. Division 09 Section "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.3 SUBMITTALS

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

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

1. Submit Samples on rigid backing, 8 inches (200 mm) square.
2. Step coats on Samples to show each coat required for system.

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. Final approval of color selections will be based on benchmark samples.

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

1.5 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 (7 deg C).

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 (10 and 35 deg C).

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) 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 gal. (3.8 L) of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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

1. Benjamin Moore & Co.
2. Duron, Inc.

3. ICI Paints.
4. Miller Paint.
5. Porter Paints.
6. PPG Architectural Finishes, Inc.
7. Rose Talbert
8. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

A. 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.

B. Colors: Match exterior prefinished material as identified on Exterior Finish Notes on A4.1 and as approved by architect.

2.3 PRIMERS/SEALERS

A. Bonding Primer (Water Based): MPI #17.

1. VOC Content: E Range of E3.

B. Bonding Primer (Solvent Based): MPI #69.

1. VOC Content: E Range of E2.

2.4 METAL PRIMERS

A. Alkyd Anticorrosive Metal Primer: MPI #79.

1. VOC Content: E Range of E1.

B. Quick-Drying Alkyd Metal Primer: MPI #76.

1. VOC Content: E Range of E3.

C. Cementitious Galvanized-Metal Primer: MPI #26.

1. VOC Content: E Range of E1.

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

1. VOC Content: E Range of E2.

2. Environmental Performance Rating: EPR 2.

E. Quick-Drying Primer for Aluminum: MPI #95.

1. VOC Content: E Range of E3.

2.5 EXTERIOR LATEX PAINTS

A. Exterior Latex (Flat): MPI #10 (Gloss Level 1).

1. VOC Content: E Range of E3.

B. Exterior Latex (Semigloss): MPI #11 (Gloss Level 5).

1. VOC Content: E Range of E1.

C. Exterior Latex (Gloss): MPI #119 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).

1. VOC Content: E Range of E2.

2.6 EXTERIOR ALKYD PAINTS

A. Exterior Alkyd Enamel (Flat): MPI #8 (Gloss Level 1).

1. VOC Content: E Range of E1.

B. Exterior Alkyd Enamel (Semigloss): MPI #94 (Gloss Level 5).

1. VOC Content: E Range of E1.

C. Exterior Alkyd Enamel (Gloss): MPI #9 (Gloss Level 6).

1. VOC Content: E Range of E1.

2.7 Exterior Bituminous-Coated Substrates:

A. Latex System: MPI Ext 10.2A
1. Prime Coat: Primer, rust inhibitive, water based**, MPI #107**.
   a. VOC Content: E Range of E1
2. Intermediate Coat: Latex, exterior, matching topcoat
3. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.
   a. VOC Content: E Range of E1.

B. Alkyd System MPI EXT 10.2C:
1. Prime Coat: Primer, rust inhibitive, water base**, MPI #107**.
   a. VOC Content: E Range of E1
2. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
3. Topcoat: Alkyd, exterior, semi-gloss (MPI Gloss Level 5), MPI #94.

a. VOC Content: E Range of E1

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

C. 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 and paint systems 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. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

E. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

F. Aluminum Substrates: Remove surface oxidation.

3.3 APPLICATION

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

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.

B. 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. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance of paint materials with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.5 CLEANING AND PROTECTION

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

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

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

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

3.6 EXTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. Quick-Drying Enamel System: MPI EXT 5.1A.

   a. Prime Coat: Quick-drying alkyd metal primer.
   b. Intermediate Coat: Quick-drying enamel matching topcoat.
   c. Topcoat: Quick-drying enamel semigloss.

2. Alkyd System: MPI EXT 5.1D.

   a. Prime Coat: Alkyd anticorrosive metal primer.
   b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
   c. Topcoat: Exterior alkyd enamel semigloss.

B. Galvanized-Metal Substrates:

1. Latex System: MPI EXT 5.3A.

   a. Prime Coat: Cementitious galvanized-metal primer.
   b. Intermediate Coat: Exterior latex matching topcoat.
   c. Topcoat: Exterior latex semigloss.

2. Latex Over Water-Based Primer System: MPI EXT 5.3H.

   a. Prime Coat: Waterborne galvanized-metal primer.
   b. Intermediate Coat: Exterior latex matching topcoat.
   c. Topcoat: Exterior latex semigloss.

3. Alkyd System: MPI EXT 5.3B.

   a. Prime Coat: Cementitious galvanized-metal primer.
   b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
   c. Topcoat: Exterior alkyd enamel semigloss.

C. Bituminous Coated Surfaces:

1. Latex System: MPI EXT 10.2A.

   a. Prime Coat: Rust inhibitive water based primer.
   b. Intermediate Coat: Exterior latex matching topcoat.

c. Topcoat: Exterior latex semigloss.

2. Alkyd System: MPI EXT 10.2C.

a. Prime Coat: Rust inhibitive water based primer.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
c. Topcoat: Exterior alkyd enamel semigloss.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1. Steel.
2. Aluminum
3. Wood.
4. Gypsum board.

B. Related Sections include the following:

1. Refer to Specification Section 051200 Structural Steel Framing for shop primers to be applied to structural steel in the shop.
2. Refer to Specification Section 053100 Steel Decking for shop primers to be applied to decking in the shop.
3. Refer to Specification Section 055000 Metal Fabrications for shop primers to be applied to miscellaneous metals in the shop.
4. Refer to Specification Section 051213 Pipe and Tube Railings for shop primers to be applied to structural steel in the shop.
5. Refer to Specification Section 074113 Metal Panels for roof panels receiving shop primers and finish paints in the shop.
6. Refer to Specification Section 074213.53 Metal Soffit Panels for metal soffits receiving shop primers and finish paints in the shop.
7. Refer to Specification Section 076200 Sheet Metal Flashings and Trim for flashing receiving shop primers and finish paints in the shop.
8. Division 08 Section “Aluminum Storefront” for windows to receive shop primers and finish paint to be applied in the shop
9. Division 09 Section "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.
10. Refer to Division 09 Section “Gypsum Board” for level of finishes.

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, 8 inches (200 mm) square.
2. Step coats on Samples to show each coat required for system.

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.

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 (7 deg C).

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 (10 and 35 deg C).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) 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 gal. (3.8 L) of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Benjamin Moore & Co.
2. Duron, Inc.
3. ICI Paints.
4. Miller Paint.
5. Porter Paints.
6. PPG Architectural Finishes, Inc.
7. Rose Tablert
8. Sherwin-Williams Company (The).
9. Rosco Chroma Key Paints

2.2 PAINT, GENERAL

A. 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.

B. 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. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
2. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
3. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
4. Flat Topcoat Paints: VOC content of not more than 50 g/L.
5. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
6. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
7. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.Verify that three subparagraphs below are acceptable for LEED-CI before retaining.
8. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.

C. 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.

D. Colors: As indicated on Drawings and Finish Materials Legend.

2.3 BLOCK FILLERS

A. Block Filler, Latex, Interior/Exterior: **MPI #4.**

1. VOC Content: E Range of E3

2.4 PRIMERS/SEALERS

A. Interior Latex Primer/Sealer: MPI #50.

1. VOC Content: E Range of E3
2. Environmental Performance Rating: EPR 3.

B. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

2.5 METAL PRIMERS

A. For steel that arrives to the site without shop primers, for primer touch up in the field and where shop primer is not specified to be provided in other specification sections and references this specification section, provide one of the following:

B. Alkyd Anticorrosive Metal Primer: MPI #79.

1. VOC Content: E Range of E1.

C. Quick-Drying Alkyd Metal Primer: MPI #76.

1. VOC Content: E Range of E3.

D. Rust-Inhibitive Primer (Water Based): MPI #107.

1. VOC Content: E Range of E3.
2. Environmental Performance Rating: EPR 3.

2.6 WOOD PRIMERS

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

1. VOC Content: E Range of E3.
2. Environmental Performance Rating: EPR 3.

2.7 LATEX PAINTS

A. Interior Latex (Flat): MPI #53 (Gloss Level 1).

1. VOC Content: E Range of E3
2. Environmental Performance Rating: EPR 2.5.

B. Interior Latex (Eggshell): MPI #52 (Gloss Level 3).

1. VOC Content: E Range of E3
2. Environmental Performance Rating: EPR 3.

C. Interior Latex (Semigloss): MPI #54 (Gloss Level 5).

1. VOC Content: E Range of E3
2. Environmental Performance Rating: EPR 4.

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.
   2. Gypsum Board: 12 percent.

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

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

   1. 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. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

E. 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.

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

3.3 APPLICATION

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

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

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

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

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

E. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:

1. Mechanical Work Outside Mechanical Rooms:

a. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.

2. Mechanical Work Inside Mechanical Rooms:

a. Uninsulated metal piping.
b. Uninsulated plastic piping.
c. Pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
d. Pipe hangers and supports.
e. Tanks that do not have factory-applied final finishes.
f. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

3. Electrical Work Inside Electrical and Communication Rooms:
   a. Plywood Backing Boards
   b. Electrical equipment that is indicated to have a factory-primed finish for field painting.

3.4 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.

3.5 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. Quick-Drying Enamel System: MPI INT 5.1A.

   a. Prime Coat: Quick-drying alkyd metal primer.
   b. Intermediate Coat: Quick-drying enamel matching topcoat.
   c. Topcoat: Quick-drying enamel (semigloss).

2. Water-Based Dry-Fall System: MPI INT 5.1C.

   a. Prime Coat: Quick-drying alkyd metal primer.
   b. Topcoat: Waterborne dry fall.

3. Latex Over Alkyd Primer System: MPI INT 5.1Q.

   a. Prime Coat: Quick-drying alkyd metal primer.
   b. Intermediate Coat: Interior latex matching topcoat.
   c. Topcoat: Interior latex (semigloss).

B. Dressed Lumber Substrates: Including architectural woodwork.

1. Latex System: MPI INT 6.3T.

   a. Prime Coat: Interior latex-based wood primer.
   b. Intermediate Coat: Interior latex matching topcoat.
   c. Topcoat: Interior latex (semigloss).

2. Latex Over Alkyd Primer System: MPI INT 6.3U.

    a. Prime Coat: Interior alkyd primer/sealer.
    b. Intermediate Coat: Interior latex matching topcoat.
    c. Topcoat: Interior latex (semigloss).

C. Wood Panel Substrates: Including painted plywood.

1. Latex System: MPI INT 6.4R.

    a. Prime Coat: Interior latex-based wood primer.
    b. Intermediate Coat: Interior latex matching topcoat.
    c. Topcoat: Interior latex (semigloss).

D. Wood Substrates, Traffic Surfaces:

1. Latex Floor Paint System: MPI INT 6.5G.

    a. Prime Coat: Interior alkyd primer/sealer.
    b. Intermediate Coat: Interior/exterior latex floor and porch paint (low gloss).
    c. Topcoat: Interior/exterior latex floor and porch paint (low gloss).

E. Gypsum Board Substrates:

1. Latex System: MPI INT 9.2A.

    a. Prime Coat: Interior latex primer/sealer.
    b. Intermediate Coat: Interior latex matching topcoat.
    c. Topcoat: Interior latex (eggshell).

END OF SECTION 099123

SECTION 101400 - SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Panel signs as required by code for Certificate of Occupancy.
2. Building Identification Sign

B. Related Sections include the following:
1. Division 1 Section "Temporary Facilities and Controls" for temporary project identification signs.
2. Division 15 Section "Mechanical Identification" for labels, tags, and nameplates for mechanical equipment.
3. Division 16 Section "Electrical Identification" for labels, tags, and nameplates for electrical equipment.
4. Division 16 Section "Interior Lighting" for illuminated exit signs.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

B. Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.

1. Provide message list for each sign, including large-scale details of wording, lettering and Braille layout.

C. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of signage manufacturer for installation and maintenance of units required for this Project.

B. Source Limitations: Obtain each sign type through one source from a single manufacturer.

C. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

1. Interior Code Signage: Provide signage as required by accessibility regulations and requirements of authorities having jurisdiction. These include, but are not limited to, the following:
   a. Restrooms Signs

1.5 PROJECT CONDITIONS

A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

1. For signs supported by or anchored to permanent construction, furnish templates for installation of anchorage devices.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

B. Available Manufacturers:

1. Allenite Signs; Allen Marking Products, Inc.
2. American Graphics Inc.
3. Andco Industries Corp.
4. APCO Graphics, Inc.
5. ASI Sign Systems, Inc.
6. Best Manufacturing Co.
7. Grimco, Inc.
8. Innerface Sign Systems, Inc.
9. Kaltech Industries Group, Inc.
10. Mills Manufacturing, Inc.
11. Mohawk Sign Systems.
12. Seton Identification Products.

13. Signature Signs, Inc.
14. Supersine Company (The).
15. BFG Industries.

C. Framed Panel Signs: Fabricate signs with edges mechanically and smoothly finished to comply with the following requirements:

1. Edge Condition: Square cut.
2. Corner Condition: Square rounded to ½ inch radius.
3. Color: Background to be Candlewick, text and graphics to be black

D. Graphic Content and Style: Provide sign copy that complies with requirements indicated in the Sign Schedule for size, style, spacing, content, mounting height and location, material, finishes, and colors of signage.

E. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square cut edges free from burrs and cut marks.

1. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).

2.2 PANEL SIGN TYPES

A. See attached graphic depictions of Sign Types.

B. Restroom Sign:

1. Material: Plastic laminate.
2. Perimeter: Framed.
3. Copy: Subsurface.
4. Character Style: Ariel.
5. Graphics/Text: See Signage Schedule.
6. Message: Fixed.
7. Sizes:
   a. Sign: see attachments for sizes.
   b. Character: Minimum 1-inch- (25-mm-) high major characters.

2.3 DIMENSIONAL CHARACTERS (CODE REQUIRED BUILDING IDENTIFICATION)

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

1. ACE Sign Systems, Inc.
2. Advance Corporation; Braille-Tac Division.
3. A. R. K. Ramos.
4. ASI-Modulex, Inc.
5. Bunting Graphics, Inc.

6. Charleston Industries, Inc.
7. Gemini Incorporated.
8. Grimco, Inc.
9. Innerface Sign Systems, Inc.
10. Metal Arts; Div. of L&H Mfg. Co.
11. Mills Manufacturing Company.
12. Mohawk Sign Systems.
13. Nelson-Harkins Industries.
14. Signature Signs, Incorporated.
15. Southwell Company (The).

B. Cast Characters: Cast Aluminum:
1. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color bone white as selected by architect from manufacturer's standard colors.
2. Overcoat: **Manufacturer's standard baked-on clear coating**
3. Character Size: 6"
4. Text/Message: 820
5. Location: As indicated on exterior elevation drawing.
6. Font: as selected by architect from manufacturer's standard colors.
7. Mounting: as recommended by manufacturer for masonry.

2.4 ACCESSORIES

A. Mounting Methods for interior signage: Use double-sided vinyl tape fabricated from materials that are not corrosive to sign material and mounting surface.

B. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.5 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.

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

3.2 INSTALLATION

A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.
2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using methods indicated below:

1. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

3.4. PANEL SIGN SCHEDULE

PANEL SIGN SCHEDULE

Plan No.	Sign Number	Sign Type	Copy	Room or Door Location #
FIRST FLOOR				
AX1.1		A	TOILET	102
		B	BUILDING IDENTIFICATION SIGN	(EXTERIOR)

3.5 SIGN TYPES

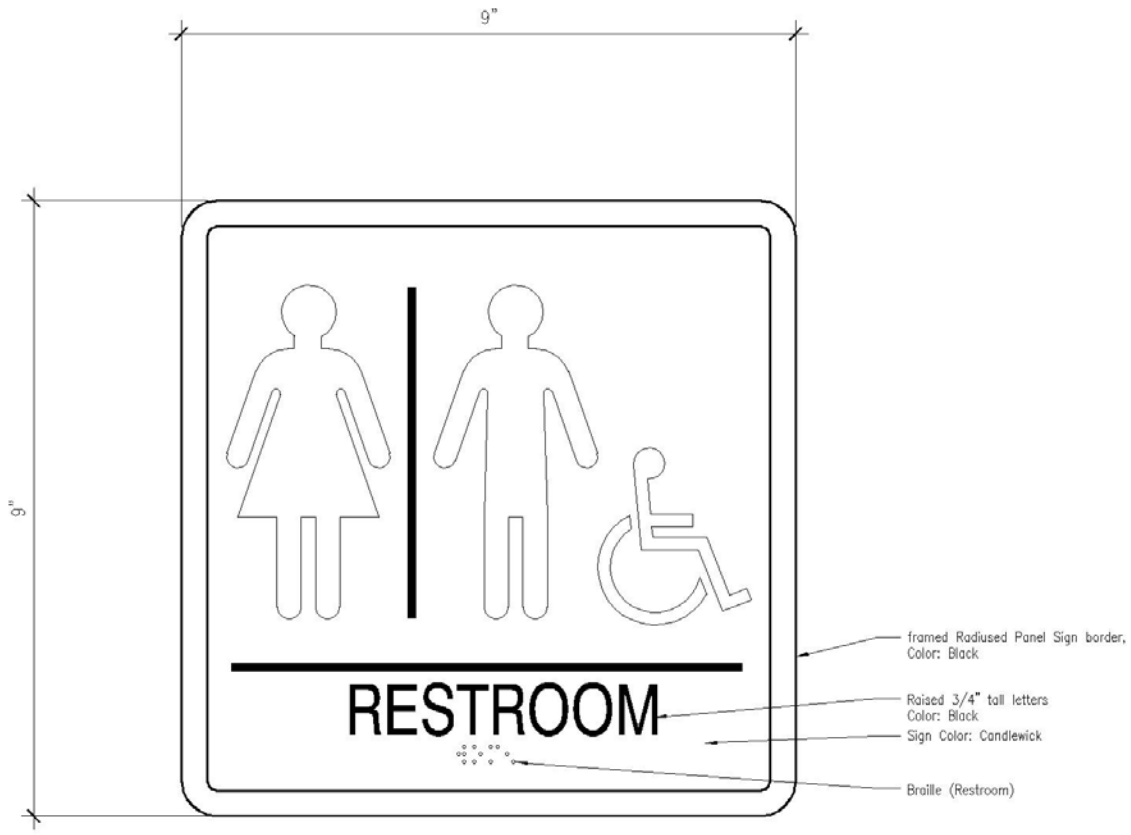
Sign Type Description

A **Accessible Restroom name and graphic symbol (glyph)**
Plastic laminate; raised copy and glyph, raised Braille room name.

B **Building Identification Sign - at Exterior**
9' high white powder coated aluminum letters with building address

END OF SECTION 101400

(Attachments)



Sign Type A: Accessible Restroom

Size: 9” h x 9” w
Face/Frame Material: See Specification
Copy/Glyph: Font - TBD
Braille: To match background finished, raised 1/32”
Mounting: See Installation Drawing for mounting instructions

A1

SECTION 102800 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Public-use washroom accessories.
2. Custodial accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated on Drawings.
2. Identify products using designations indicated on Drawings.

C. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

A. General Warranty: Special Warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.

B. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

C. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

D. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

E. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following, but not limited to the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. General Accessory Manufacturing Co. (GAMCO).

B. Multi-Roll Toilet Tissue Dispenser TTD:

1. Basis-of-Design Product: Model No. B-2888 manufactured by Bobrick.
2. Mounting: Surface mounted with concealed anchorage.

3. Capacity: Two 5-1/4-inch- diameter rolls.
4. Material and Finish: Stainless steel, No. 4 finish (satin) with chrome-plated plastic spindles with heavy-duty internal spring.
5. Lockset: Tumbler type.

C. Grab Bar GB-1:

1. Basis-of-Design Product: Model No. B-6806 x 36 manufactured by Bobrick
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.

    a. Finish: Smooth, No. 4, satin finish.

4. Outside Diameter: 1-1/4 inches (32 mm)
5. Configuration and Length: As indicated on Drawings

D. Grab Bar GB-2:

1. Basis-of-Design Product: Model No. B-6806 x 42 manufactured by Bobrick
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.

    a. Finish: Smooth, No. 4, satin finish.

4. Outside Diameter: 1-1/4 inches (32 mm)
5. Configuration and Length: As indicated on Drawings

E. Grab Bar GB-3:

1. Basis-of-Design Product: Model No. B-6806 x 18 manufactured by Bobrick
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.

    a. Finish: Smooth, No. 4, satin finish.

4. Outside Diameter: 1-1/4 inches (32 mm)
5. Configuration and Length: As indicated on Drawings

F. Mirror Unit MI-1:

1. Basis-of-Design Product: Model No. B-165 2436 manufactured by Bobrick.
2. Frame: Type 304 stainless steel.
3. Corners: Mitered.
4. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
    a. Galvanized steel back shall have integral horizontal hanging brackets located at top for mounting on concealed rectangular wall hanger and near bottom near bottom with concealed locking devices.
5. Size: 36” height by 24” width.

G. Mirror Unit MI-2:

1. Basis-of-Design Product: Model No. B-165 2460 manufactured by Bobrick.
2. Frame: Type 304 stainless steel.
3. Corners: Mitered.
4. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
   a. Galvanized steel back shall have integral horizontal hanging brackets located at top for mounting on concealed rectangular wall hanger and near bottom near bottom with concealed locking devices.
5. Size: 60” height by 24” width.

H. Liquid Soap Dispenser LSD:
1. Basis-of-Design Product: Model No. B-4112 manufactured by Bobrick.
2. Materials: one piece seamless construction with satin finished stainless steel and soap refill window
3. Locked, hinged top with special key to open and vandal resistant design
4. corrosion resistant valve to comply with ADA requirements for pressure to be used to dispense product
5. Mounting: Wall mounted per manufacturer’s instructions.

I. Paper Towel (Folded) Dispenser PTD:

1. Basis-of-Design Product: Model No. B-262 manufactured by Bobrick.
2. Mounting: Surface mounted.
3. Minimum Capacity: 400 C-fold or 525 multifold towels.
4. Material and Finish: Stainless steel, No. 4 finish (satin.)
5. Lockset: Tumbler type.
6. Refill Indicators: Pierced slots at sides or front.

2.3 CUSTODIAL ACCESSORIES

A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. General Accessory Manufacturing Co. (GAMCO).
6. Knape & Vogt Manufacturing Company.

B. Mop and Broom Holder MB:

1. Basis-of-Design Product: Model No. B-224 manufactured by Bobrick.
2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
3. Length: 36 inches .
4. Hooks: Three.
5. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.

6. Material and Finish: Stainless steel, No. 4 finish (satin).

    a. Shelf: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel.
    b. Rod: Approximately 1/4-inch- (6-mm-) diameter stainless steel.

2.4 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fire protection cabinets for the following:
   a. Portable fire extinguishers.

B. Related Sections:

1. Division 10 Section "Fire Extinguishers."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.

1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers and hose valves indicated are accommodated.

B. Coordinate sizes and locations of fire protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 3mm thick, with Finish 1 (smooth or polished).

2.2 FIRE PROTECTION CABINET FOR PORTABLE EXTINGUISHERS

A. Basis of Design Product: Subject to compliance with requirements provide, Alta Series Model No. 7023-DV-6-VB by Potter Roemer, or an equal product by one of the following manufacturers, but not limited to the one of the following:

1. JL Industries, Inc.
2. Larsen's Manufacturing Company.
3. Modern Metal Products; Div. of Technico.
4. Potter Roemer; Div. of Smith Industries, Inc.
5. Sampson Products, Inc.

B. Cabinet Type: Suitable for fire extinguisher.

C. Cabinet Construction: Non-rated and 1-hour fire-rated. See Drawings for locations.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch- (1.09-mm-) thick cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick fire-barrier material. Provide factory-drilled mounting holes.

D. Cabinet Material: Painted steel sheet.

E. Semi-recessed Cabinet: Cabinet box partially recessed in walls of shallow depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1. Rolled-Edge Trim: 2-1/2-inch (64-mm) backbend depth.

F. Cabinet Trim Material: Painted steel sheet.

G. Door Material: Painted steel sheet.

H. Door Style: Narrow vertical glazed lite in steel door panel with frame.

I. Door Glazing: 1/8” clear acrylic.

J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting door pull and friction latch.
2. Provide manufacturer's standard hinge permitting door to open 180 degrees.

K. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Door Lock: Cam lock/keyed cylinder that allows door to be opened during emergency by pulling sharply on door handle.
3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet glazing.
2) Application Process: Silk-screened.
3) Lettering Color: Black.
4) Orientation: Vertical.

L. Finishes:

1. Polyester Painted: Color to be selected by Architect from manufacturer’s standard colors.

2.3 FABRICATION

A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.
3. Prepare doors and frames to receive locks.
4. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
2. Fabricate door frames of one-piece construction with edges flanged.
3. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 STEEL FINISHES

A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with **SSPC-SP 5/**NACE No. 1, "White Metal Blast Cleaning" After cleaning, apply a conversion coating suited to the organic coating to be applied over it.

B. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

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

3.2 PREPARATION

A. Prepare recesses for semirecessed fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire protection cabinets in locations and at mounting heights indicated.

B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide recessed fire protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire protection cabinets.
2. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.

E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

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 portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

B. Related Sections:

1. Division 10 Section "Fire Extinguisher Cabinets."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

B. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by, but not limited to, one of the following.

a. Amerex Corporation.
b. Ansul Incorporated; Tyco International Ltd.
c. Badger Fire Protection; a Kidde company.
d. Buckeye Fire Equipment Company.
e. Fire End & Croker Corporation.
f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
g. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
h. Larsen's Manufacturing Company.
i. Moon-American.
j. Pem All Fire Extinguisher Corp.; a division of PEM Systems, Inc.
k. Potter Roemer LLC.
l. Pyro-Chem; Tyco Safety Products.
m. Or Equal.

2. Valves: Manufacturer's standard
3. Handles and Levers: Manufacturer's standard
4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

B. Regular Dry-Chemical Type in Steel Container: UL-rated 60-B:C, 10-lb (4.5-kg) nominal capacity, with sodium bicarbonate-based dry chemical in enameled-steel container.

1. Provide at all bracket locations.

C. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 2-A:10-B:C, 5-lb (2.3-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

1. Provide at all cabinet locations.

2.2 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.

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

a. Amerex Corporation.
b. Ansul Incorporated; Tyco International Ltd.
c. Badger Fire Protection; a Kidde company.
d. Buckeye Fire Equipment Company.
e. Fire End & Croker Corporation.
f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
g. Larsen's Manufacturing Company.
h. Potter Roemer LLC.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

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

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: 48 inches (1372 mm) above finished floor to top of fire extinguisher.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 122200 - CURTAINS AND DRAPES

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. Drapes.
2. Drapery tracks.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Drapery Tracks: Include maximum weights of drapes that can be supported.
2. Fabrics.
3. Textile treatments.

B. Shop Drawings:

1. Drapery Tracks: Show installation and anchorage details and location of blocking for anchors.

2. Drapes: Show sizes, locations, and details of installation, including heading pattern.

C. Samples: As follows:

1. Drapery Tracks: 18 inches (450 mm) long, with carriers, controls, and accessories.
2. Drapery Fabrics: For each color and pattern indicated, full width by 36 inches (1000 mm) long, from dye lot to be used for the Work and with specified textile treatments applied. Show complete pattern repeat if any. Mark top and face of fabric.
3. Textile Trims: For each color and pattern indicated, 18 inches (450 mm) long.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For drapery track installation; reflected ceiling plans drawn to scale and coordinating track installation with openings and ceiling-mounted items, on which the following items are shown:

1. Suspended ceiling components.
2. Structural members to which motors are attached.

B. Product Certificates: For each drapery fabric treated with flame retardant, signed by fabric supplier and indicating treatment durability and cleaning procedures required to maintain treatment effectiveness.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For products installed to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Drapery Track Carriers: For each size indicated, provide 10 of each size.
2. Drapery Fabrics: For each fabric, color, and pattern indicated, from the same product run, full-width lengths equal to 1 panel width (9 feet wide) of each fabric, color, and pattern.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before drape fabrication, and indicate measurements on Shop Drawings.

B. Scheduling: Do not deliver or install drapes until after other finish work, including painting, is complete and spaces are otherwise ready for occupancy.

PART 2 - PRODUCTS

2.1 DRAPERY TRACKS

A. Manually Operated Track:

1. Provide a product of the following manufacturers, or equal as approved by the architect:
   a. Kirsch, Sturgis, MI – Product Series 94001
   b. Graber, Springs Window Fashions Divisions, Inc., Montgomery, PA
   c. Rose Brand
2. Construction: Extruded aluminum, slotted for mounting at interval of not more than 24 inches (610 mm) o.c, and bendable to radii indicated.

   a. Lengths and Configurations: As indicated on Drawings.
   b. Support Capability: Weight of drape indicated mounted on track length indicated.
   c. Finish: White baked enamel.

3. Mounting Brackets: Aluminum, of type suitable for fastening track to surface indicated and designed to support weight of track assembly and drape plus force applied to operate track.

    a. Mounting Surface:Ceiling.
    b. Size: Adjustable.

4. Installation Fasteners: Sized to support track assembly and drape, and fabricated from metal compatible with track, brackets, and supporting construction. Provide two fasteners to fasten each bracket to supporting construction.
5. Operation: Baton.
    a. Draw: Two way, stacking as indicated on drawings.
    b. Operating Hardware Location: Right.

6. Carriers: Rollers to coordinate with drapery headings indicated.

    a. Master Carriers: Overlap, heavy duty.

7. End Stops: Manufacturer's standard with track end cap.
8. Accessories: As required for hanging draperies.

2.2 DRAPES

A. Source Limitations: Obtain each color and pattern of drapery fabric and trim from one dye lot.

B. Fire-Test-Response Characteristics: For fabrics treated with fire retardants, provide products that pass NFPA 701 as determined by testing of fabrics that were treated using treatment-application method intended for use for this Project by a testing and inspecting agency acceptable to authorities having jurisdiction.

C. Basis of Design Product: Provide the following product, or approved equal by the architect:
    1. RoseBrand Theatrical Memorable Velour Curtains, 25 oz., Pewter. Provide 50% fullness for acoustical performance in space. Contractor to verify quantities indicated on drawings with drapery supplier.

        a. Width: 54” bolt
        b. Orientation: with velour pile direction facing up
        c. Lining Fabric: opaque natural cotton denim
        d. Textile Treatments: Stain repellent; and flame retardant, polymer type.
        e. Heading Accessories:
            1) Woven snap tape, 7/8 inch (22 mm) wide, with nickel-plated snaps at 4 inches (102 mm) o.c.. – double riveted through webbing and additional backing material if required so that the snap will not separate from the webbing under a load of 35 pounds.
        f. Pleats: for 50% fullness.
        g. Sew vertical velour strips with rolled seams, 1” wide at bottom of curtain alternating 2 feet and 3 feet long at 12” o.c.
        h. Hem: Bottom hem 9”. Top hem 4”.

2.3 DRAPE FABRICATION

A. Fabricate drapes in heading styles and fullnesses indicated. Fabricate headings to stand erect. If less than a full width of fabric is required to produce panel of specified fullness, use equal widths of not less than one-half width of fabric located at ends of panel.
   1. Center-Opening Drapes: Add 10 inches (254 mm) to overall width for overlap. Verify quantities indicated on drawings.

B. Seams: Sew vertical seams with twin-needle sewing machine with selvage trimmed and overlocked. Join widths so that patterns match and vertical seams lay flat and straight without puckering. Horizontal seams are unacceptable.

C. Side Hems: Double-turned, 1 inch wide rolled hems consisting of three layers of fabric, and blindstitched so that stitches are invisible on face of drape.

D. Bottom Hems: Double-turned, 9-inch- (102-mm-) wide hems consisting of three layers of fabric, and weighted and blindstitched so that weights and stitches are invisible on face of drape.

   1. Sew in square lead weights at each seam and at panel corners.

E. Interlinings: Extend from top of drape to within 1/2 inch (13 mm) of lining's bottom hem and to leading edge of side hems to produce full-shadowed appearance.

F. Linings: Equal to widths of drapery fabric and joined to drapery fabric at top by inside invisible seam, and hand stitched at side hems and shadowed with 1-1/2-inch (38-mm) return of face fabric.

   1. Bottom Hem: Blind stitch to drapery fabric.

PART 3 - EXECUTION

3.1 DRAPERY TRACK INSTALLATION

A. Install track systems according to manufacturer's written instructions, level and plumb, and at height and location in relation to adjoining openings as indicated on Drawings.

B. Isolate metal parts of tracks and brackets from concrete, masonry, and mortar to prevent galvanic action. Use tape or another method recommended in writing by track manufacturer.

3.2 DRAPE INSTALLATION

A. Where drapes abut overhead construction, hang drapes so that clearance between headings and overhead construction is 1/4 inch (6.4 mm).

B. Where drapes extend to floor, install so that bottom hems clear finished floor by not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm).

3.3 ADJUSTING

A. After hanging drapes, test and adjust each drapery track to produce unencumbered, smooth operation.

B. Steam and dress down drapes as required to produce crease- and wrinkle-free installation.

C. Remove and replace drapes that are stained or soiled.

END OF SECTION 122200

SECTION 129300 - SITE FURNISHINGS

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. Trellis

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing post sleeve in concrete footings.
2. Section 312000 "Earth Moving" for excavation for installing concrete footings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For units with factory-applied finishes.

C. Samples for Verification: For each type of exposed finish, not less than 6-inch- (152-mm-) long linear components and 4-inch- (102-mm-) square sheet components.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For site furnishings to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 DECORATIVE TRELLIS

A. Basis of Design: Provide the following product or equal as approved by the architect:
1. 8’ x 14’ western red cedar 2 beam freestanding pergola with solid stain color by Gazebo Creations (www.gazebocreations.com)
a. Stain Color: as selected by architect
b. Top runner spacing: 16” o.c.
c. Posts: Straight with standard base

B. Wood Finish: Factory-applied solid stain and transparent finish

2.2 MATERIALS

A. Wood: Surfaced smooth on four sides with eased edges; kiln dried, free of knots, solid stock of species indicated.

1. Wood Species: Western Red Cedar, Select Grade or better.
2. Finish: Manufacturer's standard [stain] [and] [transparent sealer] [transparent wood preservative treatment and sealer] <Insert treatment or finish>.

B. Anchors, Fasteners, Fittings, and Hardware: Galvanized steel; commercial quality, tamperproof, vandal and theft resistant, concealed, recessed, and capped or plugged.

C. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M; recommended in writing by manufacturer, for exterior applications.

D. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound; resistant to erosion from water exposure without needing protection by a sealer or waterproof coating; recommended in writing by manufacturer, for exterior applications.

2.3 FABRICATION

A. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.

B. Factory Assembly: Assemble components in the factory to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

2.4 GENERAL FINISH REQUIREMENTS

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

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

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.

D. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

E. Pipe Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

END OF SECTION 129300

SECTION 220010 - GENERAL PROVISIONS - PLUMBING

PART 1 - GENERAL

1.1 SCOPE:

A. Bids of work covered by each section of these specifications shall be based on the layout and equipment as shown and specified with only such approved substitutions as are allowed. Drawings show general arrangement of piping. Because of small scale of drawings, it is not possible to indicate all offsets, fittings, and accessories, which may be required. Contractor shall carefully investigate structural and finish conditions affecting his work and shall arrange such work accordingly, furnishing such fittings, traps, valves, and accessories as may be required to meet such conditions. Where locations make it necessary or desirable from Contractor's standpoint to make changes in arrangements or details shown on drawings, he may present suggestions for such changes and obtain Engineer's approval prior to making such changes.

1.2 CODES:

A. All work under this division shall be in strict compliance with "International Codes" and all applicable Codes and Regulations of the City of Columbia, South Carolina.

1.3 MATERIAL AND SHOP DRAWINGS:

A. Use only new materials and the standard product of a single manufacturer for each article of its type unless specifically mentioned otherwise. Materials and workmanship in the case of assembled items shall conform to the latest applicable requirements of NFPA, ASME, NEC, ASTM, AWWA, NEMA, and ANSI.

B. Schedule submittals to expedite work. Unless otherwise indicated in this Section, submittals shall be submitted within 30 days of date of Notice to Proceed. Provide six (6) copies of submittals for review and approval. Provide folders or binders for each submittal. All submittals shall be bound in a single volume. Partial lists will not be considered and will be returned to the Contractor. Controls may be submitted separately and shall be submitted no later than 60 days of notice to proceed. Identify Project, Contractor, subcontractor, supplier, manufacturer, pertinent drawing sheet and detail numbers, and associated specification section numbers. A table of contents shall be included in the front of the submittal with tabs indicating each section. Identify variations from requirements of Contract Documents.

C. Contractor responsibilities:

1. Review submittals prior to transmittal. Verify compatibility with field conditions and dimensions, product selections and designations, quantities, and conformance of submittal with requirements of Contract Documents. Return non-conforming submittals to preparer for revision rather than submitting to Engineer. Coordinate submittals to avoid conflicts between various items of work. Failure of Contractor to review submittals prior to transmittal to Engineer

shall be cause for rejection. Incomplete, improperly packaged, and submittals from sources other than Contractor will not be accepted. Submittals not stamped APPROVED and signed by the Contractor will be returned to the Contractor.

2. Where required by specifications or otherwise needed, prepare drawings illustrating portion of work for use in fabricating, interfacing with other work, and installing products. Prepare ¼" per foot scale drawings of all mechanical rooms when substituting items of equipment that are not the basis for design. All equipment submitted shall be of adequate size and physical arrangement to allow unobstructed access when installed, for routine maintenance, coil removal, shaft removal, motor removal and other similar operations. Contract Drawings shall not be reproduced and submitted as shop drawings. Drawings shall be 8-1/2 by 11 inches minimum and 24 by 36 inches maximum. Title each drawing with Project name and reference the sheet the drawing corresponds to.

3. Provide product data such as manufacturer's brochures, catalog pages, illustrations, diagrams, tables, performance charts, and other material which describe appearance, size, attributes, code and standard compliance, ratings, and other product characteristics. Provide all critical information such as reference standards, performance characteristics, capacities, power requirements, wiring and piping diagrams, controls, component parts, finishes, dimensions, and required clearances. Submit only data which are pertinent. Mark each copy of manufacturer's standard printed data to identify products, models, options, and other data pertinent to project.

4. Engineer will review and return submittals with comments. Do not fabricate products or begin work which requires submittals until return of submittal with Engineer acceptance. Promptly report any inability to comply with provisions. Revise and resubmit submittals as required within 15 days of return from Engineer. Make re-submittals under procedures specified for initial submittals. Identify all changes made since previous submittal.

D. Engineer Review:

1. Engineer will review submittals for sole purpose of verifying general conformance with design concept and general compliance with Contract Documents. Approval of submittal by Engineer does not relieve Contractor of responsibility for correcting errors which may exist in submittal or from meeting requirements of Contract Documents. After review, Engineer will return submittals marked as follows to indicate action taken:

2. No Exception: Part of work covered by submittal may proceed provided it complies with requirements of Contract Documents. Final acceptance will depend upon that compliance. The term "approved" shall only indicate that there is no exception taken to the submittal.

3. No Exception As Corrected: Part of work covered by submittal may proceed provided it complies with notations and corrections on submittal and

requirements of Contract documents. Final acceptance will depend upon that compliance.

4. Revise And Resubmit: Do not proceed with part of work covered by submittal including purchasing, fabricating, and delivering. Revise or prepare new submittal in accordance with notations and resubmit.

E. Samples:

1. Submit samples to illustrate functional and aesthetic characteristics of products with all integral parts and attachment devices. Include full range of manufacturer's standard finishes, indicating colors, textures, and patterns for A/E selection. Submit the number of samples specified in individual specification sections. One sample will be retained by A/E.

F. Items Requiring Submittal are as Follows:

1. Insulation
2. Vent Piping
3. Victaulic Mechanical Pipe
4. All items listed in MANUFACTURERS: Section of 220010

1.4 ASBESTOS:

A. At any time the Contractor encounters asbestos, he shall immediately stop work in the immediate area and suspend any further work until asbestos is removed. Contractor shall, upon discovery of asbestos, notify owner, or owner's representative, who shall be responsible for the removal of the asbestos, all in accordance with NESHAP (National Emission Standard for Hazardous Air Pollutants). Any form of asbestos removal or demolition shall be by owner. Engineer is not an "Owner or Operator" as defined under NESHAP.

B. Contractor is responsible for, and shall be aware of all state and federal laws pertaining to asbestos as well as NESHAP requirements.

1.5 LEAD FREE:

A. All solder, flux and pipe used in water system must be lead free. Lead free is defined as less than 0.2 percent lead in solder and flux and less than 8.0 percent lead in pipes and fittings.

1.6 AMERICANS WITH DISABILITIES ACT:

A. All items or work under this division of the specifications shall comply with guidelines as set forth in the Americans with Disabilities Act.

1.7 PERMITS AND FEES:

A. Obtain permits, licenses, pay fees, etc. as required for performance of Contract. Arrange for necessary inspections required by governing authority and deliver certificates of approval to Architects or their representatives. File plans required by governing body.

1.8 DEFINITIONS:

A. In this division of the specifications and accompanying drawings, the following definitions apply:

B. Provide: To purchase, pay for, transport to the job site, unpack, install, and connect complete and ready for operation; to include all permits, inspections, equipment, material, labor, hardware, and operations required for completion and operation.

C. Install (Installed): To furnish and install complete and ready for operation.

D. Furnish: To purchase, pay for, and deliver to the job site for installation by others.

E. The Plumbing Contractor is cautioned that "furnish" requires coordination with others. Such coordination costs shall be included as part of Plumbing Contractor's bid.

1.9 CUTTING AND PATCHING:

A. Cutting of walls, floors, roofs, partitions, and ceiling, required for proper installation of the systems shall be performed under this contract.

B. Cutting shall be done in a neat, workmanlike manner. No joist, beams, girders, columns, or other structural members may be cut without written permission from the Engineer. When possible, holes shall be saw-cut or core drilled neat to minimize patching.

C. Re-routing of existing pipes, insulation, etc. as required for installation of new system is included in this work. All work shall be done in accordance with specifications for new work of the particular type involved.

D. Patching shall be performed to match existing structures, exterior walls and roofs, and shall form watertight installation.

1.10 VERIFICATION OF DIMENSIONS, ETC.:

A. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work, working conditions, verify all dimensions in the field, advise the Engineer of any discrepancy, and submit shop drawings of any changes he proposes to make in quadruplicate for approval before starting the work. Contractor shall install all equipment in a manner to avoid building interference.

1.11 COORDINATION WITH OTHER TRADES:

A. Coordinate all work of each section with work of other sections to avoid interference. Bidders are cautioned to check their equipment against space available as indicated on drawings, and shall make sure that proposed equipment can be accommodated. Before

beginning work under each section, inspect installed work of other trades and verify that such work is complete to the point where the installation may properly begin.

1.12 PROTECTION OF ADJACENT WORK:

A. Protect work and adjacent work at all times with suitable covering. All damage to work in place caused by Contractor shall be repaired and restored to original good and acceptable condition using same quality and kinds of materials as required matching and finishing with adjacent work.

1.13 EXISTING EQUIPMENT AND MATERIALS:

A. All items of equipment removed under this section of the specifications shall become the property of this Contractor shall be promptly removed from this site.

1.14 FIRESTOPPING:

A. Provide firestopping for all mechanical penetrations through fire resistant walls and shaft enclosures, and floor, ceiling, and roof elements of fire resistant assemblies. Firestopping shall provide rating comparable to rating of structure it protects.

B. Firestopping materials currently classified with UL as "Through Penetration Firestop Systems".

C. Firestopping materials shall have been tested in accordance with UL 1479 "Fire Tests of Through Penetration Firestops".

1.15 CLEAN-UP:

A. At the completion of the contract work, all areas where work has been performed shall be left clean. All trash shall be removed from the site by the Contractor.

1.16 APPROVALS AND SUBSTITUTIONS:

A. Notwithstanding any reference in the specifications to any article, device, product, material, fixture, form, or type of construction by name, make or catalog number, such references shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixture, or type of construction which, in the judgment of the Engineer, expressed in writing, is equal to that specified.

B. Requests for written approval to substitute materials or equipment considered by the Contractor as equal to those specified, shall be submitted for approval to the Engineer ten (10) days prior to bid date. Requests shall be accompanied by samples, descriptive literature and engineering information as necessary to fully identify and evaluate the product. No increase in the contract sum will be considered when requests are not approved.

1.17 AS-BUILT DRAWINGS:

A. The Contractor shall keep a record set of drawings on the job; and as construction progresses shall show the actual installed location of all items, material, and equipment on these job drawings. Indicate approved changes in red ink.

B. At the time of final completion, a corrected set of As-Built drawings shall be delivered to the Engineer. A final set of reproducible drawings with job information that reflects the actual installation shall be prepared by the Engineer and given to the Owner.

1.18 WARRANTY:

A. The Contractor for each section of the work under this division will furnish to the Owner a written warranty for the installation as installed, including controls and all other equipment covered under each section of the specifications, to perform in a quiet, efficient, and satisfactory manner with no more than normal service.

B. Each warranty shall extend for a period of one year following substantial completion and acceptance of construction. They shall be endorsed by the Contractor. Refrigeration compressors shall have a five (5) year warranty.

1.19 MANUFACTURERS:

A. In order to define requirements for quality and function of manufactured products, and requirements such as size, gauges, grade selection, color selections and like specifications requirements, the specifications as written hereinafter are based upon products of those manufacturers who are named hereinafter under various specifications for materials.

B. In addition to products of manufacturers named hereinafter in the specifications, equivalent products of the following named manufacturers will be acceptable under the base bid:

1. Temperature and Air Pressure Gages:

a) Dwyer Instruments, Weiss Instruments, H.O. Trerice Company, Ellison Draft Gauge Company, Inc., Weksler Instrument

2. Insulation:

a) Owens Corning, Johns Manville, CertainTeed Corporation, Knauf Insulation

3. Safety Valves:

a) Watts Regulator Company, McDonnell and Miller, Inc., H.A. Thrush & Company.

4. Control Valves:

a) Spence Engineering Company, Inc., Leslie Company, Fisher Governor Company, Watson McDaniel.

5. Valves:

a) Crane Company, Grinnell Company, O.I.C. Valve Co., Chase Brass & Copper Company, Rockwell Manufacturing Company, Consolidated Brass Company, Hammond, Nibco.

6. Pipe Hangers:

a) Cooper B-Line, Fee and Mason Manufacturing Company, Anvil International, Erico Caddy, Tolco a Division of Nibco

7. Plumbing Fixtures:

a) Kohler Company, American-Standard Plumbing & Heating Division Company, Eljer, Just Manufacturing Company, Elkay Manufacturing Company, Crane Company, Stern Williams, Fiat, Zurn Industries

8. Electric Drinking Fountains:

a) The Halsey W. Taylor Manufacturing Company, Ebco Manufacturing Company, Haws Drinking Faucet Company, Oasis Mfg. Co.

9. Flush Valves:

a) Sloan Valve Company, Coyne & Delany Company, Zurn Industries (PL Model only)

10. Water Closet Seats:

a) Church Seat Company, Beneke, Olsonite Corp., Bemis Mfg. Co., Centoco

11. Floor Drains, Cleanouts and Interceptors:

a) Wade, Inc., Zurn Industries, Inc., Josam Manufacturing Company, Jay R. Smith

12. Emergency Safety Equipment:

a) Encon Safety Products, Haws Drinking Faucet Company, Guardian Equipment, Western Emergency Equipment

13. Dielectric Fittings:

a) Capitol Manufacturing Company, Dresser Manufacturing Company, Epco Sales, Inc.

14. Acid Resisting Pipe:

    a) Owens-Illinois, Orion Fittings, Inc., Zurn Industries

15. Hydrants:

    a) Eddy Valve Company, Murdock Manufacturing & Supply Company

16. Water Heating Equipment:

    a) Patterson Kelley, Ace Tank and Heater Company, Pressure Vessels, Inc., Rheem Manufacturing Company, Rudd, State Industries, Lochinvar, A.O. Smith

17. Water Temperature Control Valves:

    a) Symmons Engineering Company, Lawler Automatic Control, Inc., Powers, Leonard Valve Company

18. Plumbing Trim:

    a) Delta Faucet Company, Chicago Faucets, Speakman, T & S Brass and Bronze Works, Inc., Moen, American Standard, Zurn Industries, Symmons Engineering Company

19. Air Compressors:

    a) Jensen-Thorsen Corporation, Ingersoll-Rand Company, Worthington Corporation, Joy Manufacturing Company, Kellogg-American, Inc., Champion Pneumatic Machinery Company, Nash Engineering Company, Aurora, Atlas Copco

20. Pumps:

    a) Bell & Gossett Company, Taco, Inc.

21. Sump Pumps:

    a) Bell & Gossett Company, Weil, Weinman, Barnes

22. Medical Gas Equipment:

    a) National Cylinder Gas, Puritan Gas Company, Handley Industries, Inc., Ohmeda

23. Supplies, Traps, Etc.:

a) McGuire Manufacturing Company, Engineered Brass Company, Zurn Industries

24. Identification Items:

a) Seton Name Plate Company, W.H. Brady Company, Handley Industries, Inc.

PART 2 - PRODUCTS

2.1 PAINTING:

A. Furnish touch up paint supplied by equipment manufacturer.

B. Coat ferrous metal surfaces that do not have factory painting or galvanizing with one coat of Sherwin Williams high heat aluminum paint.

2.2 CONCRETE EQUIPMENT FOUNDATIONS:

A. Use 3000-psi "batch plant" concrete or approved "precast" reinforced concrete foundations.

2.3 NAME PLATES:

A. All equipment provided under this division shall be labeled with a Bakelite nameplate 1" x 3" minimum with 3/8" minimum height lettering as manufactured by Seton Name Plate Company.

2.4 VALVES:

A. All valves provided under each section shall be of a single manufacturer unless otherwise specified. Leave packing for all valves in good condition, replacing as necessary for completion of work. Packing is to be of an approved material suitable for required service. Valve manufacturer and pressure rating shall be cast on side of valve body. Each threaded valve shall have a union installed adjacent to it. All valves shall be of listed manufacturer as scheduled hereinafter in other sections of Division 22.

2.5 EQUIPMENT ACCESSORIES:

A. Where flexible couplings are required, they shall be similar to Faulk Corporation, Type F Steelflex. All couplings shall be provided with guards.

B. Lubrication: Provide oil level gauges, grease cups, and grease gun fittings for all equipment bearings as recommended by equipment manufacturer. All grease gun fittings shall be of a uniform type.

2.6 VALVE TAGS AND SCHEDULE:

A. Provide separate typewritten list of all valves, giving number and use and control of each, on a small scale drawing outlining the general run of pipe lines and showing the location of valves for each section of work. Pipe lines in diagram shall be color coded to match piping. Drawings to be framed under glass and located in the equipment room. Provide a 1-1/2" diameter round brass numbered tag secured to each valve with "S" hook, Style P-250 BL as manufactured by Seton Name Plate Company, Brady Worldwide, Brimar Industries, or equal.

2.7 THERMOMETERS FOR PIPING:

A. Thermometers, except where otherwise specifically noted on drawing, shall be of the red reading mercury column type, or magnified mercury column type with wide angle vision and high magnification of mercury column.

B. All thermometers shall be heavy one-piece cast aluminum construction with 9" scale and glass front. Thermometers shall be accurate within plus or minus one of the smallest scale divisions through the entire range.

C. Thermometer shall be provided where indicated on the drawings and shall be easily read. Thermometers shall be so selected that normal operating temperature will be in the mid-range of the thermometer. Thermometers shall have a maximum of two degrees between graduations and shall have a maximum of ten degrees between figures.

D. Thermometer Wells:

1. Thermometer wells shall be provided at all points indicated on the drawing. Thermometer wells shall be designed to hold an engraved stem thermometer. The wells shall be made of heavy brass and shall be approximately six inches long, shall project two inches into the pipe and shall have dust protecting caps and chains. Pipes smaller than 2-1/2 inches in size shall be enlarged at the points where the wells are installed. Wells shall be set vertical or at an angle so as to retain oil.

2.8 PRESSURE GAUGES:

A. Pressure gauges shall be installed as indicated on the drawing. Pressure gauges shall be single spring bourdon tube type with wear resisting moving parts and adjustable linkage. Gauge movement shall be suitable mounted in a cast aluminum case with glass front and plain removable ring.

B. Each gauge shall be equipped with a brass needle valve.

C. Each steam gauge shall be equipped with syphon.

D. Gauges shall be installed in such a manner so as to be accessible and easily read. Range of gauge for each particular point of application shall be selected so that pointer is approximately in midpoint of scale under normal operating conditions.

2.9 FIRESTOPPING MATERIALS:

A. The material used to fill the annular space shall prevent the passage of flame and hot gases sufficient to ignite cotton waste when subjected to ASTM E 119 time-temperature fire conditions under a minimum positive pressure differential of 0.01 inches of water at the location of the test specimen for the time period equivalent to the fire resistance rating of the construction penetrated. Material shall be capable of curing in the presence of atmospheric moisture to produce durable and flexible seal, and will form airtight and watertight bonds with most common building materials in any combination including cement, masonry, steel, and aluminum.

2.10 SLEEVES AND OPENINGS:

A. Provide UL certified fire stop sleeving system for all pipe penetrations through fire rated walls, floors, partitions, ceilings, floor-ceiling assemblies and roofs as tested under ASTM E814-02 "Standard Method of Fire Tests of Through Penetration Fire Stops".

2.11 SEISMIC RESTRAINTS:

A. Seismic restraints shall be provided per International Building Code Chapter 16 for Category D Buildings (See Code Compliance on Drawing Cover Sheet), specification section 15241 and the drawings.

PART 3 - EXECUTION

3.1 CONCRETE EQUIPMENT FOUNDATIONS:

A. Consult ASHRAE: A Practical Guide to Seismic Restraint, Chapter 6 for specific reinforcement and anchoring details, with respect to pad size and seismic forces. Unless otherwise noted, set all floor mounted and "on-grade" mounted equipment on 6" high concrete foundation pads. Concrete foundations shall be reinforced with #4 bars - 12" o.c. both ways, or as directed by A Practical Guide to Seismic Restraint. Pads shall be approximately 6" larger than equipment base, and have 1" x 1" chamfer on all edges. Pads shall have carborundum brick rubbed finish. Surface finish shall be uniformly smooth. Concrete floor shall be rough and foundation doweled to floor per A Practical Guide to Seismic Restraint.

3.2 EXCAVATION, TRENCHING AND BACKFILLING:

A. To accommodate mechanical work execute all excavation, trenching, shoring and backfilling in excess of that required for structures. Coordinate this work with that required for structures, and schedule such work to be consistent with other construction work. All work shall be in compliance with OSHA safety standards.

B. Perform all excavations of every description and whatever substances encountered, to depths indicated, or as otherwise specified. During excavation, material suitable for backfilling shall be piled a sufficient distance from banks of trench in an orderly manner. Avoid overloading to prevent slides or cave-ins. All excavated materials not required or suitable for backfill shall be removed and wasted as indicated on drawings or as directed.

Execute such grading as may be necessary to prevent surface water from flowing into trenches or other excavations. Any water accumulating therein by surface flow, seepage or otherwise, shall be removed by pumping or by other approved method. Such sheeting, bracing and shoring shall be done as may be necessary for protection of work and for safety of personnel. Unless otherwise indicated, excavation shall be by open cut. Short section of a trench may be tunneled if, in the opinion of the Engineer, the pipe can be safely and properly installed and backfill can be properly tamped in such tunnel sections. Excavation shall be considered as unclassified and shall be executed complete.

C. Width of trenches at any point below top of pipe shall not be greater than outside diameter of pipe plus 16" for pipes measuring up to thirty inches, and 24" for pipe measuring greater than thirty inches, to permit satisfactory jointing and thorough tamping of bedding material under and around pipe. Care shall be taken not to over-excavate. Correct over-excavation by means of backfilling with concrete, or tamped and compacted suitable backfill material as approved for other backfilling work.

D. Remove rock in either ledge or boulder formation and replace with selected materials in such manner as to provide a compacted earth cushion having a thickness between unremoved rock and pipe of at least eight inches, or 1/2 inch for each foot of fill over top of pipe, whichever is greater, but not more than three-fourths nominal diameter of pipe. Where bell-and-spigot pipe is used, maintain cushion under bell as well as under straight portion of pipe.

E. Whenever wet or otherwise unstable soil that is incapable of adequately supporting pipe is encountered in trench bottoms, remove such material to depth required and replace to the proper grade with selected material compacted as hereinafter specified for backfilling of pipe.

F. Bedding surface for pipe shall provide a firm foundation of uniform density throughout entire length of pipe. Carefully bed pipe in a soil foundation that has been accurately shaped and rounded to conform to lowest one-fourth of outside portion of circular piped, or lower curved position of pipe arch for entire length of pipe or arch. When necessary, tamp bedding firmly. Bell holes and depressions for joints shall be only of such length, depth, and width as required for properly making particular type joint.

G. Existing utility lines that are shown on drawings, or locations of which are made known to Contractor prior to excavation, and that are to be retained, as well as utility lines constructed during excavation operation shall be protected from damage during excavation and backfilling and, if damaged, shall be repaired by Contractor at his expense. In event that Contractor damages any existing utility lines that are not shown on drawings or locations of which are not know to Contractor, report thereof shall be made immediately. If it is determined that repairs shall be made by Contractor, such repairs will be ordered under terms of "Changes in the Work" as set forth in the General Conditions.

H. After bedding has been prepared and pipe installed, selected material from excavation or burrow, at a moisture content that will facilitate compaction shall be placed along both sides of pipe in layers not exceeding six inches in compacted depth. Bring backfill up evenly on both sides of pipe for its full length. Care shall be taken to ensure thorough compaction of fill under tampers and rammers. Continue this method of filling and

compacting until fill has reached an elevation of at least 12 inches above top of pipe. Backfill and compact remainder of trench by spreading and rolling, or compact by mechanical rammers or tampers in layers not exceeding eight inches.

I. In compacting by rolling or operating heavy equipment parallel with pipe, displacement of or injury to pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage on construction shall be at Contractor's risk. Any pipe damaged thereby shall be repaired or replaced at option of Engineer and expense of Contractor.

J. Wet down all fill and backfill work, and each layer thereof to obtain optimum moisture content. Compaction shall then be executed to density of 95 percent of that obtainable in laboratory by Procter Method, or by AASHO Method T99.

K. When fill or backfill is required to be compacted to any specified density factor, tests shall be executed by an approved laboratory to ascertain compliance with requirements. One test shall be made for each 50 linear feet of open trench. Repeat tests for any specific area which fails to meet requirements until conformance is obtained. Cost of laboratory services shall be borne by Contractor as part of costs for this section of work.

L. Remove from site all excess earth, rock and other debris resultant from excavation and backfilling work.

3.3 PIPE FITTINGS:

A. General: Provide complete systems of piping and fittings for all services as indicated. All pipe, valves, and fittings shall comply with American National Standards Institute, Inc. Code and/or local codes and ordinances. All fittings shall be domestically produced from domestic forgings. Cut pipe accurately to measurements established at building or site, and work into place without springing or forcing, properly clearing all windows, doors, and other openings or obstructions.

B. Excessive cutting or other weakening of building to facilitate piping installation will not be permitted. Piping shall line up flanges and fittings freely and shall have adequate unions and flanges so that all equipment can be disassembled for repairs. Test all piping prior to insulation or concealing.

C. All welded pipe and fittings shall be delivered to job with machine beveled ends. Where necessary, beveling may be done in field by gas torch. In which case, surfaces shall be thoroughly cleaned of scale and oxidation after beveling.

D. Screwed piping shall have tapered threads cut clean and true; and shall be reamed out clean before erection. Each length of pipe, as erected, shall be upended and rapped to free it of any foreign matter.

3.4 WELDING:

A. All welding shall be done by certified welders. Welded pipe shall have flanges at valves and elsewhere as required to permit disassembly for maintenance. Tests and reports shall be as follows:

B. Qualification test of each welder prior to beginning of construction.

C. One sample of weld of each welder's work selected at random by Engineer during construction period.

D. Procedure for making tests of welds shall be as outlined in Section 9 of ASME Boiler Construction Code. These tests shall be made by an approved testing laboratory, and a report furnished to Engineer. Report on qualification tests shall be made for gas welding and electric arc welding on steel in horizontal fixed position. A testing laboratory representative shall witness making of welds made for qualification tests. All costs of testing of welds shall be paid by Contractor.

3.5 PIPE:

A. All piping material shall be as specified in other sections of this division.

B. Fittings and Connections: All turns and connections shall be made with long radius fittings as scheduled hereinafter. No miter connections will be permitted in welded work.

C. Pipe joints shall be made in accordance with the following applicable specifications:

D. Make up flanged joints with ring-type gaskets, 1/16 inch thick.

E. Weld-O-Lets, or similar approved fittings, may be used if branch pipe is less than one-half the size of the main. In all other cases, welding fittings shall be used. All welded piping shall be as specified hereinbefore.

F. Make all solder joints with non-corrosive type flux 95 Percent tin and 5 percent antimony alloy solder.

G. Mechanical Formed Tee Connections: In lieu of providing tee fittings in copper tubing, mechanically formed tee connections may be used providing they are in accordance with the following:

1. Size and wall thickness of both run tube and branch tube are listed by manufacturer of forming equipment as "Acceptable Application".

2. Height of drawn collar is not less than three times wall thickness of run tubing.

3. End of branch tube is notched to conform to inner curve of run tube, and dimpled to set exact penetration depth into collar.

4. Resulting joint is minimum of three times as long as thickness of thinner joint member, and brazed using B-cup series filler metal.

H. Cast Iron Pipe: Joints in bell-and-spigot, cast iron soil, waste and vent pipes, or between cast iron soil waste and vent pipes and threaded pipe or calking ferrules, shall be firmly packed with oakum or hemp, and calked with lead. Use at least 1 pound of lead for each inch of pipe diameter. Threaded pipe shall have a ring or half-coupling screwed onto form a spigot end. Joints in cast iron soil pipe and fittings without hubs shall be made using cast iron No-Hub joint with "Clamp-All Corporation" clamp, or approved equal by Husky or Mission.

I. Make joints in vitrified clay pipe and between such pipe and metal pipe, with approved hot-poured jointing compound. Calk hot-poured joints with oakum and ram. Material for hot-pouring joints shall not soften sufficiently to destroy effectiveness of joint at 160° F, nor be soluble in any of the wastes carried in drainage system.

J. Threaded Pipe: Threaded joints shall have American Nation taper screw threads with graphite and oil compound applied to male thread.

K. Plastic Pipe: Joints for polyethylene and polypropylene pipe and fittings shall be made by heat fusion. Approved mechanical compression type joints may be provided in lieu of joints made by heat fusion for polypropylene pipe. Installation and testing of mechanical compression joints shall be in accordance with the manufacturer's recommendations. Joints for acrylonitrile-butadiene-styrene and polyvinyl chloride pipe and fittings shall be made using solvent cement. Threaded joints shall be used only where required for disconnection and inspection.

L. Acid waste of polypropylene shall be mechanically jointed or heat fused system of welding. Entire installation shall be in full accordance with manufacturer's published recommendations and shall be similar to that as manufactured by Orion Fittings, Inc.

M. Acid waste of borosilicate glass to glass connections shall be made with Kimax Compression type stainless steel couplings, Articles No. 6650 or 6661 with a tetra-fluro-ethylene inner seal ring.

N. Lead "burned" joints shall be lapped and fused together, forming a weld a least 1-1/2 times as thick as the lead.

O. Make joints between earthenware fixtures and soil pipe by means of brass floor connections wiped to lead pipe. Joint shall be gas-tight and water-tight. Set all floor type water closets with a "no-seep" sleeve gasket. Caulk around perimeter of all floor mounted plumbing fixtures for leveling and prevention of water seepage.

3.6 SLEEVES:

A. Provide all sleeves in floors, beams, wall, roof, etc. as required for installing work of this division unless otherwise specified hereinafter. Size sleeves for insulated pipe to accommodate both pipe and insulation. Construct vertical sleeves in connection with concealed piping of 22 gauge galvanized iron. Sleeves thru fire-rated assemblies shall be firestopped as specified herein and insulation shall not pass thru sleeve unless material complies with firestopping specified.

3.7 PIPE HANGERS, SUPPORTS AND INSERTS:

A. Pipe hangers, supports and inserts shall comply with Table 308.5 of the 2012 International Plumbing Code and be provided as follows:

B. All piping shall be supported by forged steel hangers or brackets suitably fastened to structural portion. Wall brackets shall be Fee & Mason Fig. No. 151. Provide lock nuts on all adjustable hanger assemblies.

PIPE SIZE - INCHES

	1/2 – 2	2-1/2 – 4	6 – Up	Wall Plate Hanger
Grinnel	104	260	171	139
Fee & Mason	199	239	170	302
Elcen	92	12	15	---

C. Hanger or Support Spacing (unless specified different hereinafter):

1. Copper Pipe:

Nominal Pipe Size – Inches	Maximum Span - Feet
1-1/4" and under	6'
1-1/2" and above	10'

2. Cast Iron Pipe:

Length of Pipe – Feet	Maximum Span - Feet
5'- 0"	5'
10'- 0"	10'

3. Steel Pipe:

12'- 0" intervals

4. Threaded Pipe:

12'- 0" intervals

5. Plastic Pipe:

4'- 0" intervals

D. Size hangers on insulated piping to permit insulation and saddles to pass full size through hanger.

E. On Cast Iron Soil Pipe (horizontal):

1. At least one hanger on each full length of pipe, close to hub where possible and at least one within 24 inches of each fitting, and wherever else required to prevent tendency toward deflection due to load. Hanger at upper angle of each drop. Where multiple fittings are used, hangers shall be located not more than 4 feet on centers and adjacent to hubs on fittings.

F. On Chromium-plated Pipe:

1. Provide chromium-plated supports on chromium-plated pipe and fittings.

G. Bases of Stacks:

1. If not buried in earth, to be supported on concrete, brick in cement mortar, metal brackets permanently attached to the building structure, or by other approved methods.

H. Trapeze Hangers:

1. May be used for groups of pipes close together and parallel. Trapeze hangers may be constructed from structural channel or angle irons or from pre-formed channel shapes. All pipe lines must be held on specific centers by U bolts, clips or clamps.

I. Inserts:

1. For each hanger on horizontal pipes, installed before concrete is poured. Inserts shall permit horizontal adjustment of the nut.

J. Special and Additional Supports:

1. Special supports will be required where hangers cannot be used. Horizontal pipes shall be secured to prevent vibration or excessive sway. Where pipes must be laid on fill, they shall be supported at each joint by brick or concrete supports carried down into solid, natural earth. Where required, provide additional hangers to secure required level, slope or drainage, and also to prevent sagging. Provide a hanger within one foot of each elbow. Provide all miscellaneous steel required for pipe supports, anchors, etc.

3.8 INSULATION SHIELDS:

A. Provide all insulated piping with 10-inch long (16 gauge) protective galvanized sheet metal shields extending 120 degrees around bottom of insulated pipe.

3.9 FLOOR, WALL AND CEILING PLATES:

A. Where pipes pass through floors, finished walls, or ceilings, fit with chromium plate cast brass plates or chromium plated steel plates as specified hereinafter. Plates shall be large enough to completely close hole around pipes, and shall be square, octagonal, or round,

with least dimension not less than 1-1/2 times larger than diameter of pipe. Secure plates in an approved manner. Plates shall be Beaton-Caldwell No. 3A for floors and No. 40 for walls and ceilings.

3.10 SWING CONNECTIONS:

A. Swing connections shall be provided at all points of expansion. Install all connections to equipment, etc. in a manner to allow for normal pipe movement due to thermal expansion without causing undue stresses to be exerted on said equipment.

3.11 REDUCING FITTINGS:

A. Where pipe lines reduce in size, provide reducing fittings wherever possible. Provide eccentric fittings or reducers where horizontal runs of supply lines reduce in size, and install so that there will be no air trapped in hot or cold water systems. In screwed work, no bushings shall be used unless there is a difference of two standard pipe sizes between inner and outer threads.

3.12 DIELECTRIC CONNECTIONS:

A. Wherever any connection is made between dissimilar metals, provide dielectric pipe couplings or unions.

3.13 UNDERGROUND BARE STEEL PIPE AND FITTINGS COVERING:

A. All underground bare steel pipe and fittings shall be wrapped mechanically with asphalt primer, and asphalt-saturated felt or asphalt-saturated glass wrapper bonded to the enamel all in accordance with Asphalt Institute Specification M1. Joints that cannot be factory coated shall be field coated by hand as above.

3.14 ELECTRIC WORK:

A. All motors, and motor starters shall be furnished for items installed under this division of the specifications. All starters shall be magnetic type. All electrically operated equipment shall have readily accessible nameplates summarizing electrical information (i.e., voltage, phase, horsepower, watts, or amperes). Starters shall be as manufactured by General Electric Company, Westinghouse Electric Company, Cutler-Hammer Inc., or Square D Company. A.C. magnetic starters shall be across-the-line type. Starters shall provide overload protection in each phase and shall otherwise conform to all applicable requirements of these specifications. All magnetic starters shall be combination type, Motor Circuit Protector (MCP) type having interrupting rating equal to or greater than the available short circuit current, with "HAND-OFF-AUTO" selector switch, auxiliary contact, and pilot light in cover. Provide laminated plastic nameplates with white center core for each starter.

B. All control conduit and wires and control devices shall be furnished and installed under this division. All contactors shall be of the mechanically held type. All control wiring within starters shall be installed in a workmanlike manner and neatly laced. All control wiring shall be color coded.

C. All work shall conform with the applicable requirements of the National Electrical Codes. All electrical power characteristics shall be as indicated. All devices, which make and/or break electrical circuits, shall be rated for at least 125 percent of the load.

D. Relays, contactors, and control devices shall open all ungrounded conductors. All fuses shall be current limiting time delay type equal to Bussman "LPN", 250 volt or "LPS", 600 volt.

E. Control voltage shall not exceed 120 volts. Control power shall be taken from line terminals of controllers. Where necessary, control transformers shall be provided and shall conform to NEMA Standards, properly sized, and shall be properly fused. Where control voltage is 120 volts, control conductors shall be color-coded.

F. Electrical power service and connections to all equipment in this division will be made under electrical division of the work.

G. Manual motor starters with overload protection shall be flush mounted type with pilot light. Square D Catalog No. 2510-FS-1P or General Electric, or Westinghouse equivalent.

3.15 ITEMS OF MECHANICAL EQUIPMENT:

A. All items of mechanical equipment electrically operated shall be in complete accordance with paragraph in this division entitled "Electrical Work". Mechanical equipment, other than individually mounted motors, shall be factory pre-wired to a single-set of line terminals and to a single load terminal strip to match load terminals on equipment. Each step shall have properly sized contactor and overcurrent protection.

B. Mechanical equipment electrical components shall all be bonded together and connected to electrical system ground.

3.16 CLEANING:

A. All surfaces on metal, pipe, insulation covered surfaces, and other equipment furnished and installed under this division of the specifications shall be thoroughly cleaned of grease, scale, dirt and other foreign material.

3.17 TESTING (PIPING):

A. Upon completion of each system of work under this division, and at a designated time, all piping shall be pressure tested for leaks in the presence of the owner. Owner shall be notified five days before testing is to be conducted and all tests shall be conducted in the presence of the owner. All equipment required for test shall be furnished by contractor at his expense. All tests shall be performed as specified hereinafter. If inspection or tests show defects, such defective work or material shall be replaced and inspection and tests repeated at no additional cost to owner. Make tight any leaks. Repeat tests until system is proven tight. Caulking of leaks will not be permitted. All equipment not capable of withstanding the test pressure shall be valved off during the test.

B. Drainage System: Drainage and venting system shall be tested in such a manner that cast iron soil pipe will not be subjected to excessive pressure. Testing of any portion of this system shall be executed by plugging all necessary openings of that portion of system being tested and filling with water to a height of not less than ten feet above highest floor, or a pump may be used to maintain an equivalent pressure. Test pressure shall be maintained to thirty minutes when using pump method. When using water column method, test period shall also be thirty minutes, and water level shall not drop. Hot poured joints shall not be tested with more than eighty feet head of water. No tests shall be made during freezing weather.

C. Hot and Cold Water Piping: Upon completion of rough-in and before setting fixtures, entire hot and cold water systems shall be tested at a hydrostatic pressure of 1-1/2 times operating pressure, but not less than 150 psig, and be proved tight at this pressure. Where a portion of water system is to be concealed before completion, this portion shall be tested separately in a manner described for the entire system. Water used for testing shall be from a potable source of supply.

D. Gas Piping: Gas piping shall be tested at not less than 1-1/2 times working pressure, and be proved tight at this pressure. (Minimum test pressure 100 psig.)

E. Compressed air piping shall be tested at a pressure of 150 psig for a period of 24 hours. No pressure drop will be permitted except that due to temperature change.

F. Storm drainage piping shall be tested in a manner as specified hereinbefore for drainage system.

G. Vacuum Piping: Upon completion, the entire system with outlets in place, shall be subjected to a test pressure of 150 psig for a period of 24 hours. No pressure drop will be permitted except that due to temperature change. If system leaks, check each joint with solution of soap suds. Properly repair leaks and retest system.

3.18 IDENTIFICATION OF PIPING:

A. All piping, bare and insulated, installed under this division shall be given two coats of finish painting by this contractor as listed hereinafter. Paint shall be Glidden Industrial Enamel, or equal by Sherwin-Williams or Devoe Paints. Samples of colors and type paint shall be submitted for approval prior to application.

3.19 PIPE CODING:

A. After all piping has been painted with color-coding, all piping installed under this division shall be coded and marked with "Perma-Code" pipe markers as manufactured by W.H. Brady Company, 712 Glendale Avenue, Milwaukee, Wisconsin. Markers shall be applied to properly identify piping, but in no case shall they be applied more than 20 feet apart. Markers shall be 1-1/8 inch by 7 inches and shall be secured by spiral wrapping with 3/4 inch wide vinyl banding tape, color matching service, at each end of marker.

3.20 IDENTIFICATION OF EQUIPMENT IN MECHANICAL AREAS:

A. All items of mechanical equipment shall be identified with a black bakelite label with engraved white lettering 1/2" tall. Labels shall be mechanically attached to the equipment with rivets or stainless steel screws. Thermostats and control devices shall be identified with a black bakelite label with engraved white lettering 1/4" tall. Lettering shall correspond with the tags shown in the drawings.

3.21 OPERATION AND MAINTENANCE INSTRUCTIONS, AND MAINTENANCE MANUAL:

A. Upon completion of work, and at a time designated by the engineer, a competent employee of the contractor shall be provided to instruct a representative of the owner in the operation and maintenance of the system.

1. Minimum instruction period shall be:

a) Plumbing System - 1/2 day

B. Maintenance Manuals: The contractor shall compile and bind five (5) sets of all manufacturer's instructions and descriptive literature on all items of equipment furnished under this work. These instructions shall be delivered through the general contractor to the engineer for approval prior to final inspection.

1. Instructions shall include:

a) Warranty letter signed by the Mechanical Contractor.
b) Index for each section with each section properly identified.
c) Copy of sterilization report.
d) Copy of backflow preventer test.
e) Complete equipment list with model and serial numbers.
f) Copy of one complete, approved submittal for each equipment section.
g) Description of each system, including manufacturer's literature for all items.
h) Start-up and shut-down description for each system.
i) Suggested operating and maintenance instructions with frequency of maintenance indicated.
j) Parts list for all items of equipment.
k) Name, address, and telephone number of nearest sales and service organization for all items of equipment.

C. Manuals shall be 8-1/2 x 11 inch text pages bound in three ring expansion binders with a hard durable cover with clear plastic pocket on front for title page. Prepare binder covers with printed subject title of manual, title of project, date, and volume number when multiple binders are required. Printing shall be on face and spine. Provide a table of contents for each volume. Internally subdivide the binder contents with divider sheets with typed tab titles under reinforced plastic tabs. Provide directory listing as appropriate with names addresses, and telephone numbers of design consultant, Contractor, subcontractors, equipment suppliers, and nearest service representatives.

End of Section 220010

SECTION 220500 - PLUMBING

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. General Requirements: This Section of the Specifications and related drawings describe requirements pertaining to plumbing work including applicable insulation in separate Section 220700. All work shall conform to Section 220010, General Provisions - Plumbing. Work includes, but is not necessarily limited to:

1. All fixtures noted or specified.
2. Cold water and hot water systems.
3. Gas piping system.
4. Storm drainage system.
5. Soil, waste and vent piping system.
6. Compressed air and vacuum systems.
7. Acid waste systems.
8. Other plumbing indicated on drawings, specified herein, or required for complete and proper installation in accordance with applicable codes and regulations.
9. Insulation.

B. Upon completion of work, all fixtures, devices, etc. for use by persons with disabilities shall meet all requirements as set forth by the Americans with Disabilities Act (ADA).

PART 2 - PRODUCTS

2.1 SOIL, WASTE, DRAIN AND VENT PIPING AND FITTINGS:

A. Materials shall conform to the following specifications requirements:

B. Construct all building sewers and building drain lines underground and/or under floor slabs to a point 5'-0" outside of building walls, unless indicated otherwise on the drawings, with (standard)(extra heavy) weight, asphaltum-coated, cast iron, bell-and-spigot type, soil pipe and fittings with joints made using neoprene gaskets by Charlotte, or approved equal. Pipe and fittings shall be labeled with the Cast Iron Soil Pipe Institute’s Collective Trademark of quality and permanence as illustrated in ASTM Standard A-74, which indicates that it complies with this standard. No import pipe will be allowed.

C. Construct all soil, drain and waste piping, 2 inches and larger in diameter that is installed above floor slabs with (standard)(extra heavy) weight, asphaltum-coated, cast iron, bell-and-spigot type, soil pipe and fittings. Pipe and fittings shall be labeled with the Cast Iron Soil Pipe Institute's Collective Trademark of quality and permanence as illustrated in ASTM Standard A-74, which indicates that it complies with this standard. No import pipe will be allowed.

D. (All soil and vent piping throughout the building shall be Schedule 40 PVC plastic pipe and fittings conforming to ASTM D-2241 or ASTM D-1785.) Plumbing Contractor will connect up soil pipe at a point five feet outside the building.

E. Construct all soil, drain and waste piping less than 2 inches in diameter with Schedule 40, ASTM A-120, galvanized steel pipe with galvanized, cast iron recessed, threaded, drainage-type fittings.

F. Construct vent piping with Schedule 40, ASTM A-120, galvanized steel with galvanized malleable iron screwed 150-pound fittings up to 1-1/2 inches, and (standard)(extra heavy) weight asphaltum-coated, cast iron, bell-and-spigot for sizes 2 inches and larger.

G. (OPTION) In lieu of steel or bell and spigot pipe, contractor may use the cast iron No-Hub joint with "Clamp-All Corp." clamp, or approved equal by Husky or Mission, for aboveground piping.

H. Construct building sewer lines from a point 5 feet outside building walls to sewer connections with bell-and-spigot type vitrified clay pipe or concrete pipe, unless indicated otherwise. Contractor at his option may use PVC pipe - ASTM D 3033 or D 3034, SDR 35. Fittings: PVC. Joints: ASTM F 477, elastomeric gaskets.

I. Acid waste shall be Schedule 40 polypropylene supplied in straight lengths. Fittings shall be of same material and weight as pipe and shall be similar to that as manufactured by Orion Fittings, Inc.

J. Acid waste shall be Kimax borosilicate glass conforming to Federal Specification DD-G-541-B and as manufactured by O-I/SCHOTT. Glass to glass connections shall be made with Kimax Compression type stainless steel couplings, Articles No. 6650 or 6661 with a tetra-fluro-ethylene inner seal ring.

2.2 SUPPLY PIPING AND FITTINGS:

A. Materials for supply piping and fittings shall conform to the following specification requirements:

B. All water main 3 inches and smaller buried in earth and/or below slabs shall be seamless hard drawn type K copper tubing, ASTM B 88, with wrought copper ASA B16.22 fittings, Class 150. All water mains larger than 3 inches buried in earth shall be Class 150 bituminous coated, enamelined cast iron pipe and fittings with mechanical joints installed in full accordance with applicable requirements of local codes.

C. All water piping aboveground shall be seamless hard drawn type L copper tubing, ASTM B 88, with wrought copper ASA B16.22, fittings, Class No. 150.

D. All exposed water piping to plumbing fixtures (except piping noted to be run exposed in kitchen, shops, and utility areas) shall be IPS chrome-plated yellow brass pipe with polished chrome plated 125 pound screwed brass fittings.

E. Gas piping within structures shall be Schedule 40 black steel pipe with black malleable iron fittings.

F. Standpipe system shall be standard weight black steel with grooved ends.

G. (Compressed air) (and Vacuum) piping shall be (Schedule 40, black steel pipe with black malleable iron fittings) (Type L hard copper with wrought sweat type fittings.).

H. Valves: Materials for valves shall conform to the following specification requirements:

1. Gate:

a) Valves 2 inches and smaller shall be of solid disc, rising stem, solder end type suitable for a minimum working pressure of 300 psig.

b) Valves 2-1/2 inches and larger shall be flanged of non-rising stem iron body, bronze trim, solid wedge type for a minimum working pressure of 200 psig.

2. Ball:

a) Ball valves 3” and smaller shall be two-piece bronze body, full port, chrome ball, RTFE seats, with adjustable packing, rated for 600 psig minimum working pressure, meeting WWV-35 and MSS-SP110.

3. Globe:

a) Valves 2 inches and smaller shall be globe, solder end type suitable for a minimum working pressure of 300 psig.

4. Check:

a) Valves 2 inches and smaller shall be of swing check, solder end type suitable for a minimum working pressure of 300 psig.

b) Valves 2-1/2 inches and larger shall be swing check iron body, bronze trim, renewable seat and disc for a minimum working pressure of 200 psig.

5. Gas Valves:

a) Valves shall be semi-steel body, bolted cover type, screwed or flanged ends suitable for 175 pound, WOG.

I. Hose Bibb: Interior hose bibbs shall be on angle pattern for 3/4- inch hose connection with rough nickel plate finish. Loose key type shall be provided where indicated.

J. Wall hydrants shall be Woodford Manufacturing Co., Jay R. Smith, Zurn Industries, or equal, Style 67.

K. Temperature and pressure relief valves shall be type N 40 XL as manufactured by Watts Regulator Company, Cash Acme, Conbraco, or equal.

2.3 CLEANOUTS:

A. Provide cleanouts as follows:

1. Unfinished areas and chases - Z-1450-7 C.I. cleanout ferrule with counter-sunk lead seal plug.

2. Finished walls - ZN-1440-4 C.I. wall cleanout ferrule with raised head lead seal plug and Nikaloy square scoriated frame and cover.

3. Finished linoleum, asphalt, or vinyl tile floor - ZN-1400-6 C.I. floor cleanout with seriated cut-off ferrule lead seal plug adjustable Nikaloy round scoriated frame and cover recessed for tile.

4. General use in Finished Floor - ZN-1400-3 C.I. floor cleanout with seriated cut-off ferrule lead seal plug adjustable Nikaloy square scoriated frame and cover.

5. All cleanouts shall be as manufactured by Zurn Industries, Inc., Jay R. Smith, Josam, or equal.

2.4 DRAINS:

A. Provide floor drains of manufacturer's standard size at locations indicated on drawings. Construct drains of cast iron with polished brass strainer. Floor drains shall be as indicated on drawings. Drains shall be as manufactured by Zurn Industries, Inc., Jay R. Smith, Josam, or equal.

2.5 VENT PIPING FOR GAS-FIRED APPLIANCES (Max. Operating Temp. 550^{o} F):

A. Provide double wall galvanized steel outer wall, aluminum inner wall, metalbestos type piping with roof flashing, collars and Belmont caps, all as manufactured by Selkirk Metalbestos.

2.6 WATER HEATER:

A. Provide water heater complete, including all piping, specialties and connections as indicated on the drawings. All water heaters shall meet the minimum energy factor required by the U.S. Federal "National Appliance Energy Conservation Act of 2004".

2.7 FIXTURES AND FIXTURE TRIM:

A. Fixtures and fixture trim shall be as called for on fixture schedule shown on drawings. All enamel on cast iron fixtures shall be acid resisting. Color of fixtures shall be white.

2.8 BACKFLOW PREVENTERS:

A. Provide all backflow preventer in accordance with the requirements of the South Carolina State Board of Health. Backflow preventer for domestic water service shall be a Watts Model 007M1-QT-S double check backflow preventer assembly with quarter turn ball valves and strainer as sized and shown on plans. Backflow preventers shall be suitable for supply pressures up to 175 psi and water temperatures to 110°F. Backflow preventers shall be as manufactured by Watts Industries, Zurn Wilkins, FEBCO, or equal.

B. Upon completion of installation, contractor shall test all backflow preventers in accordance with the requirements of SCDHEC Regulations, and send a copy of this test report to the engineer and include a copy in the closeout documents.

2.9 STORM DRAINAGE:

A. All pipes shall conform to sizes shown on drawings. All drain piping shall be standard weight, galvanized steel with galvanized cast iron drainage fittings aboveground, and extra-heavy weight, coated, cast iron, bell-and-spigot soil pipe underground. All piping and fittings underground shall be extra heavy weight, coated, cast iron, bell-and-spigot soil pipe up to 15 inches and Class 50 cast iron water main enameline piping and fittings above 15 inches mechanical joint.

B. (OPTION) Aboveground, Contractor may use the Cast Iron Non-Hub Joint. Each joint shall consist of (1) two pipe or fitting spigot ends; (2) a sealing sleeve; and (3) a shield and clamp assembly as specified for sanitary waste.

C. (OPTION) All pipe and fittings shall conform to sizes shown on drawings. All drain piping shall be Schedule 40 PVC.

2.10 RECIRCULATING PUMPS:

A. Recirculating pumps shall be Bell & Gossett, or approved equal, of high efficiency models indicated on drawings. Pumps shall be of a horizontal, permanently lubricated type for quiet operation. The motor shall be non-overloading at any point of the pump performance curve.

2.11 SUMP PUMPS:

A. Sump pumps shall be Bell & Gossett, or approved equal, of high efficiency models indicated on drawings. Package shall consist of a wastewater pump, fiberglass sump pit,

completely assembled with valves, piping, guide rails, and lifting cable. Pump shall be for continuous operation when fully submerged and shall be capable of handling solids up to ½" sphere, and include a float switch. See schedule for operating conditions. Fiberglass wet well shall be 24" in diameter by 48" deep and shall be manufactured by spiral wound manufacturing. Well shall be complete with an anti-flotation flange. Provide inlet and electrical couplings as required. Slide rail assembly shall include a quick disconnect discharge elbow, sealing flange with rail guide, upper guiderail bracket and lifting cable.

B. The level controls shall be a sensing device to accurately monitor the liquid levels. The float cable shall be in a water resistant jacket. Control panel shall be standard series with a Nema 4x enclosure with 115 volt control circuit. Panel shall be complete with Hand-Off-Auto switch, high level alarm, solid state printed circuit board with float indicator lights and shall be UL listed.

PART 3 - EXECUTION

3.1 EXISTING CONDITIONS:

A. Verify locations and inverts of existing and proposed pipes. Location of structural elements, locations and sizes of chases, type and method of construction of floors, walls, partitions, etc.

B. Drawings do not indicate all offsets, fittings, and specialties. Examine other drawings, investigate conditions to be encountered and arrange work accordingly, furnishing required fittings, valves, specialties, etc. without extra charge. Where conditions necessitate rearrangement, submit for approval sketches showing proposed arrangement.

3.2 INSTALLATION:

A. GENERAL:

1. Protect pipe openings and drains by plugs or caps. Duct tape will not be acceptable. Clean all stoppages.

2. Unless otherwise shown, install piping concealed, straight, without sags or pockets and graded for drainage. Cut pipe ends square and ream. Before assembly, clean dirt, scale and chips.

3. Provide clearance between pipe and building structure so pipes can expand without damage to building structure.

4. Schedule meetings with other trades before and during installation to avoid conflicts and ensure that pipes and equipment are installed in best manner, taking into consideration headroom, maintenance, appearance and replacement.

3.3 PAINTING:

A. Clean damaged factory finishes and coat with matching touch-up paint. Paint all supports and hangers with two coats of high heat aluminum paint.

3.4 SOIL, WASTE, SEWER AND VENT PIPING:

A. Install sewer and water pipes in separate trenches with grades uniform to provide solid bearing. Dig bell holes at hubs. Piping through or under footings shall be provided with a pipe sleeve or relieving arch.

B. Run horizontal pipe, graded uniformly, not less than 1/4" per foot for pipes 2-1/2" and smaller; and 1/8" per foot for larger pipes. Offset as required to pass obstacles.

C. Change size by reducing fittings. Change directions by 45-degree wyes and long-sweep bends. Use short-sweep bends only with written approval. No pipe shall be drilled, tapped, or welded. Saddle hubs and bands, tapped tees, and crosses will not be approved.

D. Upon completion of tests and inspections, backfill with approved material, placed and tamped to prevent settlement.

3.5 HOT AND COLD WATER PIPING:

A. Unless otherwise indicated, run hot and cold water piping concealed, and uniformly pitched to ensure venting and drainage. Install drain valves at low points.

B. Unless otherwise required, branches to small fixtures shall be 1/2" ID for single fixture and 3/4" ID for two fixtures. Pipe size indications are "nominal" sizes.

3.6 STANDPIPE SYSTEM:

A. System shall be installed to comply with all applicable requirements of NFPA Pamphlet No. 14. Installation of grooved end piping and fittings shall conform to manufacturer's published recommendations.

3.7 GAS PIPING:

A. Gas piping shall be installed and connected to all gas-fired appliances with an individual regulating and shut-off valve at each appliance. Piping shall be installed in accordance with more stringent rules and recommendations of the following:

1. Local Gas Company

2. American Gas Association Recommendations

3. National Fire Protection Association Recommendations outlined in Bulletin No. 54.

3.8 STORM DRAINAGE:

A. This work in general consists of drainage lines, connections to downspouts, including cast iron boots, and other structures and connections into storm system at locations as indicated on drawings.

B. (OPTION) Complete installation of Cast Iron Non-Hub shall be in accordance with Cast Iron Soil Pipe Institute Specification Data Standard 301-75.

3.9 AIR CHAMBERS:

A. At each flush valve and other quick closing valves not protected by a shock arrestor, and at top of each hot and cold-water riser, provide a 12-inch long air chamber.

3.10 SHOCK ABSORBERS:

A. Provide sealed air chambers of PDI size models as indicated and as manufactured by Josam Manufacturing Company Series 7500 or Zurn series Z-1700. All shock absorbers shall bear PDI seal of approval. Locate shock absorbers so that they are accessible above lay-in ceiling or from all access panels installed by others.

3.11 TRAPS:

A. Provide each fixture with a trap when connection to drainage system is required. Place each trap as near to fixture as possible. No fixture shall be double trapped. Traps installed on bell-and-spigot pipe shall be cast iron. Traps installed on threaded pipe shall be recess drainage pattern.

3.12 FLASHING:

A. Vent pipes and stack vents shall be flashed and made watertight at roof with 16 ounce, soft, sheet copper or 4-pound sheet lead. Flashings shall extend not less than 8 inches from pipe in all directions. Flashing for pipe shall be extended up the pipe a minimum of 6 inches, at which point threaded standard cast iron or malleable iron recess roof coupling shall be installed to form counterflashing or rain guard. (Terminate each vent pipe with a vandal proof cap.)

3.13 CLEANOUTS:

A. Provide an easily accessible cleanout at foot of each vertical soil or waste stack and where indicated on drawings. Cleanouts shall be of the same nominal size as pipe in which they are installed, up to 4 inches; and not less than 4 inches for larger sizes. A cleanout shall consist of a long sweep 1/4 bend or one or two 1/8 bends. Maximum spacing of cleanouts shall be one hundred feet.

3.14 DRAINS:

A. Provide floor drains of manufacturer's standard size at locations indicated on drawings. Carefully set drains to grade to provide drainage of surrounding area, and trap.

3.15 FIXTURES AND FIXTURE TRIM:

A. Provide lavatories with angle stops. Provide all other plumbing fixtures with either angle or straight stops, integral with faucets, or with concealed type lock shield or loose-key pattern.

B. All fixtures and trimmings shall be designed to prevent backflow of polluted water or waste into water supply system.

C. Except where noted otherwise, exposed piping fittings and trimmings shall be chromium plated over nickel-plated brass with polished, bright surfaces.

D. Securely support fixtures with approved brackets, chairs, bolts, and metal expansion inserts. Where chases are provided or adjacent space in an undeveloped area, use through-bolts and heavy steel load distributing plate in addition to other means specified.

3.16 CONNECTIONS TO EQUIPMENT:

A. Kitchen equipment will be provided as part of work of another section of specifications. All materials and labor to make final connections to kitchen equipment shall be provided as part of work of this plumbing contract.

3.17 SANITARY SEWER SYSTEM:

A. Work includes providing of all materials and equipment, and performing all labor necessary to construct sewers and connections, including all pipe, wye branches, joint material, and appurtenances which may be reasonably implied as necessary to complete work shown on drawings or specified herein.

3.18 STERILIZATION:

A. All water piping installed under this section shall be thoroughly sterilized. The entire sterilization procedure shall be in strict accordance with the requirements of the State Board of Health and, upon completion of the sterilization; the potability of the water in the system shall be checked and approved by the Engineer. All costs for testing shall be paid for by this Contractor.

End of Section 220500

SECTION 220700 – PLUMBING INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. General Requirements: This section shall include all insulation as required for installation on all items as specified hereinafter and/or as indicated. All insulations shall be installed in a workmanlike manner by qualified workers in the employment of an independent insulation contractor. Costs of insulation shall be included as part of work by contractor as applicable to his section of work. No separate bid is to be included for insulation work.

B. Fire hazard classification for all material shall not exceed flame spread of 25 and smoke development of 50 as classified by Underwriters Laboratories under Test Method ASTM E-84 and acceptable under NFPA Standards. This is to apply to the complete system and be a composite rating of insulation material with jacket or facings, vapor barrier, joint sealing tapes, mastic and fittings.

C. Prior to commencing any work, submit data sheets for engineer's approval of all material proposed to be used on this project.

PART 2 - PRODUCTS

2.1 ABOVE GROUND INDOOR PIPING:

A. Pipe Insulation:

1. All water piping shall be insulated with heavy density fiberglass with all-service jacket Owens-Corning Double Self-Sealing Lap, ASJ/SSL-II, one piece, to be used on all lines above and below ambient temperature from 0ºF to 850ºF.

2. In block walls as construction progresses upwards, use Armacell Tubolit, or equal, in a thickness adequate to maintain an insulation surface temperature of 84ºF. Miter elbows and seal with adhesive. Coat all joints with Childers CP-30 LO or CP-35 WB Vapor Barrier Coatings or equal per Section 220010.

2.2 JACKET FOR EQUIPMENT ROOM PIPING:

A. All insulated piping in equipment rooms shall be covered with eight (8) ounce cotton canvas manufactured in the United States. All hot water piping shall be lagged with Childers CP-9, CP-10 or CP-11 Weather Barrier Coating, or equal per Section 220010. All chilled water piping shall be lagged with Childers CP-30 LO Solvent thinned Vapor Barrier Coating or CP-35 Water Based Vapor Barrier Coating, or equal per Section 220010.

2.3 JACKET FOR OUTDOOR PIPING:

A. All insulation outside (including insulation options) shall be protected with aluminum jacketing with factory applied moisture barrier. The aluminum jacketing shall be 0.016 thickness and be of 3003 alloy and H-14 temper. Jacketing shall be applied with 2-inch circumferential and 1-1/2 inch longitudinal lap and secured with 3/8 inch wide aluminum bands, 8 inches on center.

B. All elbows shall be covered with 2 piece aluminum insulation covers, manufactured from 110 aluminum alloy in .024" thickness, Childers Aluminum E11-Jacs or approved equal.

C. On hot service, aluminum elbows may be attached using self-tapping screws. On chilled water service, aluminum elbows shall be glued on pipe insulation.

2.4 PIPE INSULATION THICKNESS:

A. Piping for the following systems shall be insulated to the thickness listed:

Item	Insulation Thickness (Inches)
Fiberglass K = .24	
Cold Pipes:	
Cold Water (Domestic)	1"
Storm Drainage	1"
Hot Pipes:	
Hot Water (Domestic - Supply & Recirculating -	1"

2.5 EQUIPMENT INSULATION:

A. Hot Vessels (to 400°F)

1. Hot tanks and vessels operating at temperatures not over 400°F shall be insulated with the thickness of insulation board as outlined below. Insulation board shall be pre-formed, flat rectangular rigid material. Maximum K value shall be .24 at 75°F mean temperature.

2. All vessels storing fluids, or connected to systems containing fluids, at temperatures between 150°F to 400°F shall be insulated.

Equipment	Insulation Thickness

Expansion Tank and Air Release Tank	1"
Heat Exchanger	2"
Hot Water Storage Tank	2"
Hot Water Pumps	1-1/2"

B. Boiler Breeching:

1. Insulate boiler breeching with 2" thickness of 8 pound density, Delta 8 Mineral Wool Board as manufactured by Rockwool Manufacturing Company or approved equal.

PART 3 - EXECUTION

3.1 PIPE INSULATION:

A. All insulation shall be applied to clean, dry surfaces butting all sections firmly together and finishing as specified hereinafter.

B. All vapor barriers shall be sealed, and shall be continuous throughout. No staples shall be used on any vapor barrier jacket unless sealed with vapor barrier coating or vapor barrier tape.

C. Insulation of all insulated lines shall be interpreted as including all pipe, valves, fittings and specialties comprising the lines, except flanged unions and screwed unions on hot piping.

D. Where sectional insulation is not practical, the proper insulation cement or block insulation shall be utilized by forming it to the applied surface.

E. Insulation over fittings and soil pipe hubs shall be of equal thickness as the adjoining pipe insulation. Insulate p-trap’s serving ice machines where located above slab similar to that specified before for domestic cold water piping.

F. Pipe Insulation Protection: Direct contact between pipe and hangers shall be avoided. Hanger shall pass outside of a sheet metal protection saddle which shall cover a section of high density insulation (cellular glass or calcium silicate), of sufficient length to support the weight of the pipe without crushing the insulation. The vapor barrier shall be continuous behind the saddle or shall be lapped over the saddle and securely cemented thereto.

G. Flow measurement: Provide a removable section of insulation for each pump at location designated by the engineer. Removable section shall be approximately 18 inches long and shall consist of two (2) 1/2" layers of Armaflex, or approved equal, with staggered joints. Insulation shall be held in place by three (3) Velco straps and be fully removable and

replaceable without disturbing adjacent pipe insulation. All joints shall retain vapor seal integrity.

H. All pipe covering shall be furnished with self-seal lap and 3" wide butt joint strips. The release paper is pulled from adhesive edge, pipe covering closed tightly around pipe and self-seal lap rubbed hard in place with the blunt edge of an insulation knife. This procedure applied to longitudinal as well as circumferential joints. Staple all longitudinal and circumferential joints with 9/16" staples 6" on center and seal over all staples with Childers CP-30 vapor barrier coating. Care shall be taken to keep jacket clean as it is the finish on all exposed work. All adjoining insulation sections shall be firmly butted together before butt joint strip is applied, and all chilled water and cold water service lines shall have vapor barrier coating thoroughly coated to pipe at butt joints and at all fittings. All fittings, valve bodies, unions, and flanges shall be finished as follows:

I. To the hot insulated fittings, apply a tack coat of Childers CP-10 or CP-11 (use CP-35 on cold piping) at the rate of 2 gallons per 100 S.F. While the tack coat is still wet, a layer of 10 x 10 fiberglass reinforcing mesh shall be embedded with all fabric seams overlapped a minimum of 2". A finish coat, at a coverage rate of 4 gallons per 100 S.F. shall be applied, fully covering the reinforcing mesh.

J. Apply fiberglass inserts to all other hot fittings and cold water fittings in conjunction with Proto PVC Fitting Covers. Seal cold applications as recommended by the manufacturer.

3.2 APPLICATION VERTICAL VESSELS AND PIPE GREATER THAN 35" O.D.:

A. Insulation shall be furnished with a factory applied ASJ facing.

B. For application to piping and vessels operating between 0^{o}F. and 55^{o}F., apply a minimum 3" wide ASJ matching tape over the joints for proper vapor seal.

C. For application to piping and vessels operating between -50^{o}F. and 0^{o}F., apply a bead a CP-76 joint sealant before applying a minimum 3" wide ASJ matching tape over the joint for proper vapor seal.

3.3 ALUMINUM JACKET:

A. Jacketing shall be applied with 2-inch circumferential and 1-1/2 inch longitudinal lap and secured with 3/8 inch wide aluminum bands, 8 inches on center and at joints.

3.4 EQUIPMENT INSULATIONS:

A. Equipment Insulation for Hot Vessels (to 400^{o}F)

B. Insulation shall be cut and mitered where necessary to fit the contour of the vessel. For round vessels, insulation shall be banded in place with 1/2 inch x .020 stainless steel bands 18" on center. For flat or irregular vessels, insulation shall be impaled over weld pins and secured with speed washers. Apply a smoothing coat of One Shot Cement.

C. Apply metal lathe over the insulation, lacing edges on round vessels and securing to the weld pins with speed washers on flat and irregular vessels. Apply 1/2 inch coat of One Shot Cement and let thoroughly dry before applying finishing mastic.

D. Apply a tack coat of Childers CP-10/11 Vinyl Acrylic Mastic on hot vessels by brush. Embed a layer of Childers CHIL-GLAS 5 (5 x 5 weave) reinforcing mesh into wet coating, smoothing to avoid wrinkles. A finish coat at a coverage of 4 gallons per 100 S.F. shall be applied fully covering the reinforcing mesh so that the minimum dry film thickness is 1/16 inch.

E. Kitchen Range and Boiler Breeching:

1. Insulation block shall be secured to channel with 16 gauge stainless steel wire attached to anchors. Insulation shall be given two 1/4 inch coats of One Shot Finishing Cement with the first coat applied over galvanized hexagonal wire. The second coat shall be mixed 2 to 1 with Portland Cement. Doors shall be insulated as above with framing angles around doors.

F. Equipment Insulation for Cold Vessels:

1. Application:

a) Insulation shall be cut and mitered where necessary to fit the contour of the vessel. Cover the area of the size of one foamed plastic sheet with Rubatex Adhesive No. 373. Cover the back of the flexible sheet with the same, leaving 1/2 inch wide uncoated border around the outside edge. Let the adhesive dry to the touch before applying. Align sheet to overlap edges of the sheets in place by 1/8". Then press center of the sheet to adhere. Pressure butt edges into place for a tight joint. Roll the rest of the sheet for firm adhesion to surface. Spread the butt joints with a small brush, coat the edges and align for good appearance. Stagger all joints as applicable to horizontal or vertical installation. Do not fill the butt joints with adhesive. If painting is required, use two (2) even coats of Rubatex Mastic No. 374 (white), or equal, colored for desired purposes. Wipe the sheet with a cloth dampened with a non-oily solvent to remove powder before painting.

b) Apply a tack coat of Childers CP-30 LO or CP-35 on cold vessels by brush. Embed a layer of Childers CHIL-GLAS 5 (5 x 5 weave) reinforcing mesh into wet coating, smoothing to avoid wrinkles. A finish coat at a coverage of 4 gallons per 100 S.F. shall be applied fully covering the reinforcing mesh so that the minimum dry film thickness is 1/16 inch.

2. Pumps:

a) Insulation shall be fitted (boxed) around the water pumps so as to include the pump volute, the bearings and the portion of the base under the volute and bearings.

b) The upper portions of the insulating box, above the centerline of the pump shaft, shall be made up as a separate and easily removable box to permit access to the pump and bearings. The box shall be made up of #22 gauge galvanized sheet steel.

End of Section 220700

SECTION 221113 - FACILITY WATER DISTRIBUTION 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 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

1.3 SUBMITTALS

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

B. Field quality-control test reports.

C. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

D. Record Drawings:

1. The Contractor shall furnish to the Architect/Engineer CAD drawings of approved Record Drawings of the water system. Marked-up construction documents are not acceptable. Record Drawings shall include, but are not limited to the following:
    a. Sufficient data to determine and reproduce at the site, locations of all mains, service lines, valves, fire hydrants and other appurtenances. Location data shall be referenced from two stable physical features or monuments. Provide pipe sizes, materials and lengths between fittings.
    b. Record Drawings shall contain all necessary certifications and shall be prepared for the seal and signature of the Registered Professional Engineer of record for the project.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.

3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
4. All materials and installation shall be in accordance with the latest City of Columbia specifications and regulations. The City of Columbia specifications and regulations shall govern over specification section 221113 Facility Water Distribution Piping.

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

C. All material/products that contact potable water must be third party certified as meeting the specifications of ANSI/NSF Standard 61. The certifying party shall be accredited by ANSI.

D. Lubricants which will support microbiological growth shall not be used for slip-on joints. Vegetable shortening shall not be used to lubricate joints.

E. Natural rubber or other material which will support microbiological growth may not be used for any gaskets, O-rings, and other products used for jointing pipes, valves, or other appurtenances which will expose the material to the water.

F. All pipe material, solder and flux shall be lead free (less than .2% lead in solder and flux and less than 8.0% lead in pipes and fittings.)

1.5 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution 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 water-distribution service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of service.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. PVC, Schedule 40 Pipe: ASTM D 1785.

1. PVC, Schedule 40 Socket Fittings: ASTM D 2466.

B. PVC, Schedule 80 Pipe: ASTM D 1785.

1. PVC, Schedule 80 Socket Fittings: ASTM D 2467.
2. PVC, Schedule 80 Threaded Fittings: ASTM D 2464.

C. PVC, AWWA Pipe: AWWA C900, Class 200, with bell end with gasket, and with spigot end.
1. PVC Fabricated Fittings: AWWA C900, Class 200, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
2. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
3. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Gaskets: AWWA C111, rubber.

2.2 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:
1. Manufacturers: Subject to compliance with requirements and approval by City of Columbia, provide products are manufactured in the United States by one of the following:

a. American AVK Co.; Valves & Fittings Div.
b. American Cast Iron Pipe Co.; American Flow Control Div.
c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
d. Crane Co.; Crane Valve Group; Stockham Div.
e. East Jordan Iron Works, Inc.
f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
g. McWane, Inc.; Kennedy Valve Div.
h. McWane, Inc.; M & H Valve Company Div.
i. McWane, Inc.; Tyler Pipe Div.; Utilities Div.

j. Mueller Co.; Water Products Div.
k. NIBCO INC.
l. U.S. Pipe and Foundry Company.
m. “Or Equal”

2. Nonrising-Stem, Metal-Seated Gate Valves:

a. Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.

1) Standard: AWWA C500.
2) Minimum Pressure Rating: 200 psig (1380 kPa).
3) End Connections: Mechanical joint.
4) Interior Coating: Complying with AWWA C550.

B. Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements and approval by City of Columbia, provide products manufactured in the United States by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Div.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Red-White Valve Corporation.
h. “Or Equal”

2. Nonrising-Stem Gate Valves:

a. Description: Class 125, Type 1, bronze with solid wedge, threaded ends, and malleable-iron handwheel.

1) Standard: MSS SP-80.

2.3 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches (125 mm) in diameter.

2.4 BACKFLOW PREVENTERS

A. Double Check, Backflow-Prevention Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products manufactured in US as approved by the South Carolina Department of Health and Environmental Control. Install in Meter Box

2.5 EARTHWORK

A. Bedding:
   a. Continuous and uniform bedding shall be provided in the trench for all buried pipes.
   b. Back-fill material shall be tamped in layers around the pipe and to a sufficient height above the pipe to adequately support and protect the pipe.
   c. Stones, other than crushed bedding, shall not come into contact with the pipe and shall not be within six (6) inches of the pipe.

B. All pipes must have a minimum cover of 30”, unless the pipe material is concrete, DIP, or other approved material, and insulated to prevent freezing.

2.6 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground water-service piping NPS 3/4 to NPS 3 (DN 20 to DN 80) shall be the following:
1. PVC, Schedule 40 pipe; PVC, Schedule 40 socket fittings; and solvent-cemented joints.

F. Water Meter Box Water-Service Piping NPS 3/4 to NPS 2 (DN 20 to DN 50) shall be same as underground water-service piping.

2.7 VALVE APPLICATIONS

2.8 PIPING SYSTEMS - COMMON REQUIREMENTS

A. See Division 22 Section "Common Work Results for Plumbing" for piping-system common requirements.

2.9 PIPING INSTALLATION

A. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

B. Bury piping with depth of cover over top at least 36 inches, with top at least 12 inches below level of maximum frost penetration, and according to the following:
   a. Under Driveways: With at least 36 inches cover over top.

C. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.

D. Sleeves are specified in Division 22 Section "Common Work Results for Plumbing."

E. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

F. See Division 22 Section "Domestic Water Piping" for potable-water piping inside the building.

2.10 JOINT CONSTRUCTION

A. See Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.

B. Make pipe joints according to the following:

1. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure. Refer to Division 22 Section "Common Work Results for Plumbing" for joining piping of dissimilar metals.

2.11 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. Locking mechanical joints.
3. Set-screw mechanical retainer glands.
4. Bolted flanged joints.
5. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.

2.12 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

2.13 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. See Division 22 Section "Common Work Results for Plumbing" for piping connections to valves and equipment.

C. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve.

2.14 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Hydrostatic tests on pipe shall be made by the Contractor with equipment approved by the Engineer, system owner, and in accordance with AWWA Standards C600. The Contractor shall test sections of mains between valves, at intervals not exceeding 2,000 feet, at a pressure of not less than 1.5 times the maximum working pressure of the system. Test pressure shall be maintained for not less than two hours and as long as the Engineer may require in order to detect any leakage or defective material. Any makeup water required shall be carefully measured and the leakage shall not exceed the requirements listed below. Any leakage or sweating joints shall be corrected. All visible leaks, regardless of the amount of leakage, shall be repaired. Allowable leakage per hour shall be calculated as follows:

$L = (S \times D \times (P)^{0.5})/133{,}200$ **Ductile Iron**
$L = (N \times D \times (P)^{0.5})/7{,}400$ **PVC**
L = Allowable Leakage (gallon/hour)
S = Length of the pipeline tested (feet)
N= Number of joints being tested
D = Pipe diameter nominal (inches)
P = Average Test Pressure (psig)

C. Prepare reports of testing activities.

2.15 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 31 Section "Earth Moving."

2.16 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until clean at a rate of 880 gpm (3,331 L/min) in order to achieve a flushing velocity of 10 ft/sec (3.1 m/sec) as per NFPA 24. A *Contractor's Material and Test Certificate Underground Piping* form shall be submitted for the work.

3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
    b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
    c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
    e. The contractor shall collect a minimum of two (2) samples from each sampling site for total Coliform analysis. The number of sites depends on the amount of new construction but must include all dead-end lines, be representative of the water in the newly constructed mains, and shall be collected a minimum of every 1200 linear feet.
    f. Prior to sampling, the chlorine residual must be reduced to normal system residual levels or be non-detectable in those systems not chlorinating.
    g. The samples must be collected twenty-four (24) hours apart and must show the water line to be absent of total Coliform bacteria.
    h. The chlorine residual must also be measured and reported.
    i. If the membrane filter method of analysis is used for Coliform analysis, non-Coliform growth must also be reported.
    j. If non-Coliform growth is greater than eighty (80) colonies per one hundred (100) milliliters, the sample result is invalid and must be repeated.
    k. All samples must be analyzed by a State certified laboratory.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 221113

SECTION 230010 - GENERAL PROVISIONS - HVAC

PART 1 – GENERAL

1.1 SCOPE:

A. Bids of work covered by each section of these specifications shall be based on the layout and equipment as shown and specified with only such approved substitutions as are allowed. Drawings show general arrangement of ductwork and piping. Because of small scale of drawings, it is not possible to indicate all offsets, fittings, and accessories, which may be required. Contractor shall carefully investigate structural and finish conditions affecting his work and shall arrange such work accordingly, furnishing such fittings, traps, valves, and accessories as may be required to meet such conditions. Where locations make it necessary or desirable from Contractor's standpoint to make changes in arrangements or details shown on drawings, he may present suggestions for such changes and obtain Engineer's approval prior to making such changes.

1.2 CODES:

A. All work under this division shall be in strict compliance with "International Codes" and all applicable Codes and Regulations of the State of South Carolina.

1.3 MATERIAL AND SHOP DRAWINGS:

A. Use only new materials and the standard product of a single manufacturer for each article of its type unless specifically mentioned otherwise. Materials and workmanship in the case of assembled items shall conform to the latest applicable requirements of NFPA, ASME, NEC, ASTM, AWWA, NEMA, and ANSI.

B. Schedule submittals to expedite work. Unless otherwise indicated in this Section, submittals shall be submitted within 30 days of date of Notice to Proceed. Provide six (6) copies of submittals for review and approval. Provide folders or binders for each submittal. All submittals shall be bound in a single volume. Partial lists will not be considered and will be returned to the Contractor. Controls may be submitted separately and shall be submitted no later than 60 days of notice to proceed. Identify Project, Contractor, subcontractor, supplier, manufacturer, pertinent drawing sheet and detail numbers, and associated specification section numbers. A table of contents shall be included in the front of the submittal with tabs indicating each section. Identify variations from requirements of Contract Documents.

C. Contractor responsibilities:

1. Review submittals prior to transmittal. Verify compatibility with field conditions and dimensions, product selections and designations, quantities, and conformance of submittal with requirements of Contract Documents. Return non-conforming submittals to preparer for revision rather than submitting to Engineer. Coordinate submittals to avoid conflicts between various items of work. Failure of Contractor to review submittals prior to transmittal to Engineer

shall be cause for rejection. Incomplete, improperly packaged, and submittals from sources other than Contractor will not be accepted. Submittals not stamped APPROVED and signed by the Contractor will be returned to the Contractor.

2. Where required by specifications or otherwise needed, prepare drawings illustrating portion of work for use in fabricating, interfacing with other work, and installing products. Prepare ¼" per foot scale drawings of all mechanical rooms when substituting items of equipment that are not the basis for design. All equipment submitted shall be of adequate size and physical arrangement to allow unobstructed access when installed, for routine maintenance, coil removal, shaft removal, motor removal and other similar operations. Contract Drawings shall not be reproduced and submitted as shop drawings. Drawings shall be 8-1/2 by 11 inches minimum and 24 by 36 inches maximum. Title each drawing with Project name and reference the sheet the drawing corresponds to.

3. Provide product data such as manufacturer's brochures, catalog pages, illustrations, diagrams, tables, performance charts, and other material which describe appearance, size, attributes, code and standard compliance, ratings, and other product characteristics. Provide all critical information such as reference standards, performance characteristics, capacities, power requirements, wiring and piping diagrams, controls, component parts, finishes, dimensions, and required clearances. Submit only data which are pertinent. Mark each copy of manufacturer's standard printed data to identify products, models, options, and other data pertinent to project.

4. Control diagrams: Show relative positions of each component as a system diagram. Provide points list, wiring diagram and schedule of all products and components used in system.

5. Engineer will review and return submittals with comments. Do not fabricate products or begin work which requires submittals until return of submittal with Engineer acceptance. Promptly report any inability to comply with provisions. Revise and resubmit submittals as required within 15 days of return from Engineer. Make re-submittals under procedures specified for initial submittals. Identify all changes made since previous submittal.

D. Engineer Review:

1. Engineer will review submittals for sole purpose of verifying general conformance with design concept and general compliance with Contract Documents. Approval of submittal by Engineer does not relieve Contractor of responsibility for correcting errors which may exist in submittal or from meeting requirements of Contract Documents. After review, Engineer will return submittals marked as follows to indicate action taken:

2. No Exception: Part of work covered by submittal may proceed provided it complies with requirements of Contract Documents. Final acceptance will depend upon that compliance. The term "approved" shall only indicate that there is no exception taken to the submittal.

3. No Exception As Corrected: Part of work covered by submittal may proceed provided it complies with notations and corrections on submittal and requirements of Contract documents. Final acceptance will depend upon that compliance.

4. Revise And Resubmit: Do not proceed with part of work covered by submittal including purchasing, fabricating, and delivering. Revise or prepare new submittal in accordance with notations and resubmit.

E. Samples:

1. Submit samples to illustrate functional and aesthetic characteristics of products with all integral parts and attachment devices. Include full range of manufacturer's standard finishes, indicating colors, textures, and patterns for A/E selection. Submit the number of samples specified in individual specification sections. One sample will be retained by A/E.

F. Items Requiring Submittal are as Follows:

1. Test and Balance
2. Insulation
3. All items listed in MANUFACTURERS: Section of 230010

1.4 ASBESTOS:

A. At any time the Contractor encounters asbestos, he shall immediately stop work in the immediate area and suspend any further work until asbestos is removed. Contractor shall, upon discovery of asbestos, notify owner, or owner's representative, who shall be responsible for the removal of the asbestos, all in accordance with NESHAP (National Emission Standard for Hazardous Air Pollutants). Any form of asbestos removal or demolition shall be by owner. Engineer is not an "Owner or Operator" as defined under NESHAP.

B. Contractor is responsible for, and shall be aware of all state and federal laws pertaining to asbestos as well as NESHAP requirements.

1.5 LEAD FREE:

A. All solder, flux and pipe used in water system must be lead free. Lead free is defined as less than 0.2 percent lead in solder and flux and less than 8.0 percent lead in pipes and fittings.

1.6 AMERICANS WITH DISABILITIES ACT:

A. All items or work under this division of the specifications shall comply with guidelines as set forth in the Americans With Disabilities Act.

1.7 PERMITS AND FEES:

A. Obtain permits, licenses, pay fees, etc. as required for performance of Contract. Arrange for necessary inspections required by governing authority and deliver certificates of approval to Architects or their representatives. File plans required by governing body.

1.8 DEFINITIONS:

A. In this division of the specifications and accompanying drawings, the following definitions apply:

B. Provide: To purchase, pay for, transport to the job site, unpack, install, and connect complete and ready for operation; to include all permits, inspections, equipment, material, labor, hardware, and operations required for completion and operation.

C. Install (Installed): To furnish and install complete and ready for operation.

D. Furnish: To purchase, pay for, and deliver to the job site for installation by others.

E. The Mechanical Contractor is cautioned that "furnish" requires coordination with others. Such coordination costs shall be included as part of Mechanical Contractor's bid.

1.9 CUTTING AND PATCHING:

A. Cutting of walls, floors, roofs, partitions, and ceiling, required for proper installation of the systems shall be performed under this contract.

B. Cutting shall be done in a neat, workmanlike manner. No joist, beams, girders, columns, or other structural members may be cut without written permission from the Engineer. When possible, holes shall be saw-cut or core drilled neat to minimize patching.

C. Re-routing of existing pipes, insulation, etc. as required for installation of new system is included in this work. All work shall be done in accordance with specifications for new work of the particular type involved.

D. Patching shall be performed to match existing structures, exterior walls and roofs, and shall form watertight installation.

1.10 VERIFICATION OF DIMENSIONS, ETC.:

A. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work, working conditions, verify all dimensions in the field, advise the Engineer of any discrepancy, and submit shop drawings of any changes he proposes to make in quadruplicate for approval before starting the work. Contractor shall install all equipment in a manner to avoid building interference.

1.11 COORDINATION WITH OTHER TRADES:

A. Coordinate all work of each section with work of other sections to avoid interference. Bidders are cautioned to check their equipment against space available as indicated on drawings, and shall make sure that proposed equipment can be accommodated. Before beginning work under each section, inspect installed work of other trades and verify that such work is complete to the point where the installation may properly begin.

B. Where equipment supplied by an approved manufacturer is substituted for the specified equipment, the Contractor will be responsible for coordinating any changes required in his work or other trades work, including but not limited to electrical requirements, structural steel requirements and space requirements. Any additional costs required to make changes to other trades work shall be borne by this contractor.

1.12 PROTECTION OF ADJACENT WORK:

A. Protect work and adjacent work at all times with suitable covering. All damage to work in place caused by Contractor shall be repaired and restored to original good and acceptable condition using same quality and kinds of materials as required to match and finish with adjacent work.

1.13 EXISTING EQUIPMENT AND MATERIALS:

A. All items of equipment removed under this section of the specifications shall become the property of this Contractor shall be promptly removed from this site.

1.14 CLEAN-UP:

A. At the completion of the contract work, all areas where work has been performed shall be left clean. All trash shall be removed from the site by the Contractor.

1.15 APPROVALS AND SUBSTITUTIONS:

A. Notwithstanding any reference in the specifications to any article, device, product, material, fixture, form, or type of construction by name, make or catalog number, such references shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixture, or type of construction which, in the judgment of the Engineer, expressed in writing, is equal to that specified.

B. Requests for written approval to substitute materials or equipment considered by the Contractor as equal to those specified, shall be submitted for approval to the Engineer ten (10) days prior to bid date. Requests shall be accompanied by samples, descriptive literature and engineering information as necessary to fully identify and evaluate the product. No increase in the contract sum will be considered when requests are not approved.

C. The Contractor shall bear the burden and cost of coordinating with all trades any changes in work required by substitutions, including but not limited to electrical connections, additional components required, service clearance, etc.

1.16 AS-BUILT DRAWINGS:

A. The Contractor shall keep a record set of drawings on the job; and as construction progresses shall show the actual installed location of all items, material, and equipment on these job drawings. Indicate approved changes in red ink.

B. At the time of final completion, a corrected set of As-Built drawings shall be delivered to the Engineer. A final set of reproducible drawings with job information that reflects the actual installation shall be prepared by the Engineer and given to the Owner.

1.17 WARRANTY:

A. The Contractor for each section of the work under this division will furnish to the Owner a written warranty for the installation as installed, including controls and all other equipment covered under each section of the specifications, to perform in a quiet, efficient, and satisfactory manner with no more than normal service.

B. Each warranty shall extend for a period of one year following substantial completion and acceptance of construction. They shall be endorsed by the Contractor. Refrigeration compressors shall have a five (5) year warranty.

1.18 MANUFACTURERS:

A. In order to define requirements for quality and function of manufactured products, and requirements such as size, gauges, grade selection, color selections and like specifications requirements, the specifications as written hereinafter are based upon products of those manufacturers who are named hereinafter under various specifications for materials.

B. In addition to products of manufacturers named hereinafter in the specifications, equivalent products of the following named manufacturers will be acceptable under the base bid:

1. Unitary Heat Pump Units:

a) Carrier Air Conditioning Company, The Trane Company

2. Variable Air Volume Boxes:

a) The Trane Company, Environmental Technologies, Price Company, Titus Manufacturing Company, Nailor Industries, Carnes Company, Krueger, York International Corporation, Carrier Air Conditioning Company, Tuttle and Bailey, MetalAire

3. Air Distribution:

   a) Metal Industries, Price Company, Titus Manufacturing Company, Nailor Industries, Anemostat Products Division, Krueger, J & J Register Co., Carnes Company, Tuttle and Bailey, AirGuide Manufacturing

4. Fans:

   a) Greenheck Fan Corporation, Loren Cook Company, Breidert/Jenn Fans, Carnes Company, ACME, PennBarry, Twin City Blower, American Coolair/ILG

5. Dampers:

   a) Ruskin Manufacturing Company, NCA Manufacturing, Safe Air/Dowco, Inc., Cesco Products, Inc., Leader Industries, Pottorff, Arrow United, Young Regulator, Nailor Industries

6. Insulation:

   a) Owens Corning, Johns Manville, CertainTeed Corporation, Knauf Insulation

7. Temperature Controls:

   a) Johnson Controls

8. Identification Items:

   a) Seton Name Plate Company, W.H. Brady Company, Handley Industries, Inc.

PART 2 - PRODUCTS

2.1 PAINTING:

A. Furnish touch up paint supplied by equipment manufacturer.

B. Coat ferrous metal surfaces that do not have factory painting or galvanizing with one coat of Sherwin Williams high heat aluminum paint.

2.2 CONCRETE EQUIPMENT FOUNDATIONS:

A. Use 3000-psi "batch plant" concrete or approved "precast" reinforced concrete foundations.

2.3 NAME PLATES:

A. All equipment provided under this division shall be labeled with a Bakelite nameplate 1" x 3" minimum with 3/8" minimum height lettering as manufactured by Seton Name Plate Company. See filter nameplate requirement below.

2.4 FILTERS:

A. Provide one new set of MERV 13 pleated filters in each unit at final completion. Provide the Owner one replacement set of filters with a complete filter list indicating unit tag and size and quantity of filters needed. At each filter door provide a Bakelite nameplate 1" x 3" minimum with 1/8" minimum height lettering as manufactured by Seton Name Plate Company, that indicates the size and quantity of each filter required in that particular unit.

2.5 SLEEVES AND OPENINGS:

A. Provide UL certified fire stop sleeving system for all pipe penetrations through fire rated walls, floors, partitions, ceilings, floor-ceiling assemblies and roofs as tested under ASTM E814-02 "Standard Method of Fire Tests of Through Penetration Fire Stops".

PART 3 - EXECUTION

3.1 CONCRETE EQUIPMENT FOUNDATIONS:

A. Consult ASHRAE: A Practical Guide to Seismic Restraint, Chapter 6 for specific reinforcement and anchoring details, with respect to pad size and seismic forces. Unless otherwise noted, set all floor mounted and "on-grade" mounted equipment on 6" high concrete foundation pads. Concrete foundations shall be reinforced with #4 bars - 12" o.c. both ways, or as directed by A Practical Guide to Seismic Restraint. Pads shall be approximately 6" larger than equipment base, and have 1" x 1" chamfer on all edges. Pads shall have carborundum brick rubbed finish. Surface finish shall be uniformly smooth. Concrete floor shall be rough and foundation doweled to floor per A Practical Guide to Seismic Restraint.

3.2 EXCAVATION, TRENCHING AND BACKFILLING:

A. To accommodate mechanical work execute all excavation, trenching, shoring and backfilling in excess of that required for structures. Coordinate this work with that required for structures, and schedule such work to be consistent with other construction work. All work shall be in compliance with OSHA safety standards.

B. Perform all excavations of every description and whatever substances encountered, to depths indicated, or as otherwise specified. During excavation, material suitable for backfilling shall be piled a sufficient distance from banks of trench in an orderly manner. Avoid overloading to prevent slides or cave-ins. All excavated materials not required or suitable for backfill shall be removed and wasted as indicated on drawings or as directed. Execute such grading as may be necessary to prevent surface water from flowing into

trenches or other excavations. Any water accumulating therein by surface flow, seepage or otherwise, shall be removed by pumping or by other approved method. Such sheeting, bracing and shoring shall be done as may be necessary for protection of work and for safety of personnel. Unless otherwise indicated, excavation shall be by open cut. Short section of a trench may be tunneled if, in the opinion of the Engineer, the pipe can be safely and properly installed and backfill can be properly tamped in such tunnel sections. Excavation shall be considered as unclassified and shall be executed complete.

C. Width of trenches at any point below top of pipe shall not be greater than outside diameter of pipe plus 16" for pipes measuring up to thirty inches, and 24" for pipe measuring greater than thirty inches, to permit satisfactory jointing and thorough tamping of bedding material under and around pipe. Care shall be taken not to over-excavate. Correct over-excavation by means of backfilling with concrete, or tamped and compacted suitable backfill material as approved for other backfilling work.

D. Remove rock in either ledge or boulder formation and replace with selected materials in such manner as to provide a compacted earth cushion having a thickness between unremoved rock and pipe of at least eight inches, or 1/2 inch for each foot of fill over top of pipe, whichever is greater, but not more than three-fourths nominal diameter of pipe. Where bell-and-spigot pipe is used, maintain cushion under bell as well as under straight portion of pipe.

E. Whenever wet or otherwise unstable soil that is incapable of adequately supporting pipe is encountered in trench bottoms, remove such material to depth required and replace to the proper grade with selected material compacted as hereinafter specified for backfilling of pipe.

F. Bedding surface for pipe shall provide a firm foundation of uniform density throughout entire length of pipe. Carefully bed pipe in a soil foundation that has been accurately shaped and rounded to conform to lowest one-fourth of outside portion of circular piped, or lower curved position of pipe arch for entire length of pipe or arch. When necessary, tamp bedding firmly. Bell holes and depressions for joints shall be only of such length, depth, and width as required for properly making particular type joint.

G. Existing utility lines that are shown on drawings, or locations of which are made known to Contractor prior to excavation, and that are to be retained, as well as utility lines constructed during excavation operation shall be protected from damage during excavation and backfilling and, if damaged, shall be repaired by Contractor at his expense. In event that Contractor damages any existing utility lines that are not shown on drawings or locations of which are not know to Contractor, report thereof shall be made immediately. If it is determined that repairs shall be made by Contractor, such repairs will be ordered under terms of "Changes in the Work" as set forth in the General Conditions.

H. After bedding has been prepared and pipe installed, selected material from excavation or burrow, at a moisture content that will facilitate compaction shall be placed along both sides of pipe in layers not exceeding six inches in compacted depth. Bring backfill up evenly on both sides of pipe for its full length. Care shall be taken to ensure thorough compaction of fill under tampers and rammers. Continue this method of filling and compacting until fill has reached an elevation of at least 12 inches above top of pipe.

Backfill and compact remainder of trench by spreading and rolling, or compact by mechanical rammers or tampers in layers not exceeding eight inches.

I. In compacting by rolling or operating heavy equipment parallel with pipe, displacement of or injury to pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage on construction shall be at Contractor's risk. Any pipe damaged thereby shall be repaired or replaced at option of Engineer and expense of Contractor.

J. Wet down all fill and backfill work, and each layer thereof to obtain optimum moisture content. Compaction shall then be executed to density of 95 percent of that obtainable in laboratory by Procter Method, or by AASHO Method T99.

K. When fill or backfill is required to be compacted to any specified density factor, tests shall be executed by an approved laboratory to ascertain compliance with requirements. One test shall be made for each 50 linear feet of open trench. Repeat tests for any specific area which fails to meet requirements until conformance is obtained. Cost of laboratory services shall be borne by Contractor as part of costs for this section of work.

L. Remove from site all excess earth, rock and other debris resultant from excavation and backfilling work.

3.3 PIPE FITTINGS:

A. General: Provide complete systems of piping and fittings for all services as indicated. All pipe, valves, and fittings shall comply with American National Standards Institute, Inc. Code and/or local codes and ordinances. All fittings shall be domestically produced from domestic forgings. Cut pipe accurately to measurements established at building or site, and work into place without springing or forcing, properly clearing all windows, doors, and other openings or obstructions.

B. Excessive cutting or other weakening of building to facilitate piping installation will not be permitted. Piping shall line up flanges and fittings freely and shall have adequate unions and flanges so that all equipment can be disassembled for repairs. Test all piping prior to insulation or concealing.

C. All welded pipe and fittings shall be delivered to job with machine beveled ends. Where necessary, beveling may be done in field by gas torch. In which case, surfaces shall be thoroughly cleaned of scale and oxidation after beveling.

D. Screwed piping shall have tapered threads cut clean and true; and shall be reamed out clean before erection. Each length of pipe, as erected, shall be upended and rapped to free it of any foreign matter.

3.4 WELDING:

A. All welding shall be done by certified welders. Welded pipe shall have flanges at valves and elsewhere as required to permit disassembly for maintenance. Tests and reports shall be as follows:

B. Qualification test of each welder prior to beginning of construction.

C. One sample of weld of each welder's work selected at random by Engineer during construction period.

D. Procedure for making tests of welds shall be as outlined in Section 9 of ASME Boiler Construction Code. These tests shall be made by an approved testing laboratory, and a report furnished to Engineer. Report on qualification tests shall be made for gas welding and electric arc welding on steel in horizontal fixed position. A testing laboratory representative shall witness making of welds made for qualification tests. All costs of testing of welds shall be paid by Contractor.

3.5 PIPE:

A. All piping material shall be as specified in other sections of this division.

B. Fittings and Connections: All turns and connections shall be made with long radius fittings as scheduled hereinafter. No miter connections will be permitted in welded work.

C. Pipe joints shall be made in accordance with the following applicable specifications:

D. Make all solder joints with non-corrosive type flux 95 Percent tin and 5 percent antimony alloy solder.

3.6 SLEEVES:

A. Provide all sleeves in floors, beams, wall, roof, etc. as required for installing work of this division unless otherwise specified hereinafter. Size sleeves for insulated pipe to accommodate both pipe and insulation. Construct vertical sleeves in connection with concealed piping of 22 gauge galvanized iron. Sleeves thru fire-rated assemblies shall be firestopped as specified herein and insulation shall not pass thru sleeve unless material complies with firestopping specified.

3.7 PIPE HANGERS, SUPPORTS AND INSERTS:

A. Pipe hangers, supports and inserts shall comply with Table 305.4 of the 2006 International Mechanical Code and be provided as follows:

B. All piping shall be supported by forged steel hangers or brackets suitably fastened to structural portion. Wall brackets shall be Fee & Mason Fig. No. 151. Provide lock nuts on all adjustable hanger assemblies.

PIPE SIZE - INCHES

	1/2 – 2	2-1/2 – 4	6 – Up	Wall Plate Hanger
Grinnel	104	260	171	139
Fee & Mason	199	239	170	302

Elcen	92	12	15	---

C. Hanger or Support Spacing (unless specified different hereinafter):

1. Copper Pipe:

Nominal Pipe Size – Inches	Maximum Span - Feet
1-1/4" and under	6'
1-1/2" and above	10'

2. Steel Pipe:

12'- 0" intervals

3. Threaded Pipe:

12'- 0" intervals

4. Plastic Pipe:

4'- 0" intervals

D. Size hangers on insulated piping to permit insulation and saddles to pass full size through hanger.

E. Trapeze Hangers:

1. May be used for groups of pipes close together and parallel. Trapeze hangers may be constructed from structural channel or angle irons or from pre-formed channel shapes. All pipe lines must be held on specific centers by U bolts, clips or clamps.

2. When supported with uni-strut an insulation sleeve under the clamp equal to Armacell Armafix is required.

F. Inserts:

1. For each hanger on horizontal pipes, installed before concrete is poured. Inserts shall permit horizontal adjustment of the nut.

G. Special and Additional Supports:

1. Special supports will be required where hangers cannot be used. Horizontal pipes shall be secured to prevent vibration or excessive sway. Where pipes must be laid on fill, they shall be supported at each joint by brick or concrete supports carried down into solid, natural earth. Where required, provide additional hangers to secure required level, slope or drainage, and also to prevent sagging. Provide a

hanger within one foot of each elbow. Provide all miscellaneous steel required for pipe supports, anchors, etc.

3.8 INSULATION SHIELDS:

A. Provide all insulated piping with 10-inch long (16 gauge) protective galvanized sheet metal shields extending 120 degrees around bottom of insulated pipe.

3.9 DIELECTRIC CONNECTIONS:

A. Wherever any connection is made between dissimilar metals, provide dielectric pipe couplings or unions.

3.10 ELECTRIC WORK:

A. All motors, and motor starters shall be furnished for items installed under this division of the specifications. All starters shall be magnetic type. All electrically operated equipment shall have readily accessible nameplates summarizing electrical information (i.e., voltage, phase, horsepower, watts, or amperes). Starters shall be as manufactured by General Electric Company, Westinghouse Electric Company, Cutler-Hammer Inc., or Square D Company. A.C. magnetic starters shall be across-the-line type. Starters shall provide overload protection in each phase and shall otherwise conform to all applicable requirements of these specifications. All magnetic starters shall be combination type, Motor Circuit Protector (MCP) type having interrupting rating equal to or greater than the available short circuit current, with "HAND-OFF-AUTO" selector switch, auxiliary contact, and pilot light in cover. Provide laminated plastic nameplates with white center core for each starter.

B. For motors controlled by variable frequency drives, provide shaft grounding on the motor equal to Aegis bearing protection ring.

C. All control conduit and wires and control devices shall be furnished and installed under this division. All contactors shall be of the mechanically held type. All control wiring within starters shall be installed in a workmanlike manner and neatly laced. All control wiring shall be color coded.

D. All work shall conform with the applicable requirements of the National Electrical Codes. All electrical power characteristics shall be as indicated. All devices, which make and/or break electrical circuits, shall be rated for at least 125 percent of the load.

E. Relays, contactors, and control devices shall open all ungrounded conductors. All fuses shall be current limiting time delay type equal to Bussman "LPN", 250 volt or "LPS", 600 volt.

F. Control voltage shall not exceed 120 volts. Control power shall be taken from line terminals of controllers. Where necessary, control transformers shall be provided and shall conform to NEMA Standards, properly sized, and shall be properly fused. Where control voltage is 120 volts, control conductors shall be color-coded.

G. Electrical power service and connections to all equipment in this division will be made under electrical division of the work.

H. Manual motor starters with overload protection shall be flush mounted type with pilot light. Square D Catalog No. 2510-FS-1P or General Electric, or Westinghouse equivalent.

I. Duct smoke detectors shall be provided under electrical division and installed under this division. This division shall provide interlock wiring required for fan shutdown and smoke damper control. Power wiring and fire alarm communication wiring shall be provided under the electrical division.

3.11 ITEMS OF MECHANICAL EQUIPMENT:

A. All items of mechanical equipment electrically operated shall be in complete accordance with paragraph in this division entitled "Electrical Work". Mechanical equipment, other than individually mounted motors, shall be factory pre-wired to a single-set of line terminals and to a single load terminal strip to match load terminals on equipment. Each step shall have properly sized contactor and overcurrent protection.

B. Mechanical equipment electrical components shall all be bonded together and connected to electrical system ground.

3.12 CLEANING:

A. All surfaces on metal, pipe, insulation covered surfaces, and other equipment furnished and installed under this division of the specifications shall be thoroughly cleaned of grease, scale, dirt and other foreign material.

B. Upon complete installation of ducts, clean entire system of rubbish, plaster, dirt, etc., before installing any outlets. After installation of outlets and connections to fans are made, blow out entire system with all control devices wide open.

3.13 SYSTEM BALANCING:

A. The HVAC Contractor is responsible for the entire Test & Balance process. The contractor shall employ an independent balancing firm specializing in total system air balancing as approved by the engineer and certified by the AABC or NEBB. The balancing firm shall be employed prior to installation of any ductwork. Provide all labor, engineering and test equipment required to test, adjust, and balance all heating, ventilating, air conditioning, exhaust systems.

B. The Contractor is responsible to have a functioning system prior to Testing and Balancing, to provide a joint and cooperative effort to coordinate the test and balance, and to solve any problems in balancing and controls in order to establish proper system performance before leaving the job. The Contractor is responsible for providing the Test and Balance Agency (TAB) with a complete set of project drawings, specifications, and submittals, and for providing and installing new sheave or sheaves, new belts, as required, if a change in fan speed is necessary which cannot be made by adjusting the

sheave originally installed. When requested by the Engineer, the TAB Agency will review plans and specifications of the systems prior to installation and submit a report of any deficiencies, which could preclude proper adjusting, balancing and testing of the system. The TAB agency shall submit copies of deficiency reports along with a preliminary report to the Engineer for review prior to final submittal.

C. Instruments used will be those that meet the instrument requirements for Agency Qualifications of the AABC as published in the NEBB "Procedural Standards for Testing Adjusting and Balancing of Environmental Systems" or the AABC "National Standards for Total System Balance".

D. Fan air volume shall be adjusted to within 5% of design, and diffuser air volumes to within 10% of design.

E. Reporting (Submit five copies of final Test Report)

1. Complete nameplate data and equipment schedule number for all rotating equipment.
2. Design and actual operating data for all rotating equipment including inlet and outlet data, flow rates, amps, voltage and rpm.
3. Design and actual duct and diffuser volumes. Prepare a diagram showing flow measurement points.
4. Record coil air pressure drop, filter pressure drop, external static pressure, and fan static pressure.
5. Record flow rates, temperatures and pressures across each water coil, condenser and other heat exchangers.
6. Heating equipment nameplate data, equipment schedule number design data, and operating data at maximum achievable load conditions.

3.14 TESTING (PIPING):

A. Upon completion of each system of work under this division, and at a designated time, all piping shall be pressure tested for leaks in the presence of the owner. Owner shall be notified five days before testing is to be conducted and all tests shall be conducted in the presence of the owner. All equipment required for test shall be furnished by contractor at his expense. All tests shall be performed as specified hereinafter. If inspection or tests show defects, such defective work or material shall be replaced and inspection and tests repeated at no additional cost to owner. Make tight any leaks. Repeat tests until system is proven tight. Caulking of leaks will not be permitted. All equipment not capable of withstanding the test pressure shall be valved off during the test.

B. Steam and Condensate Systems: Upon completion of the installation, but before covering, all steam and condensate piping, and all heating equipment shall be given a hydrostatic test of 1-1/2 times the working pressure, but not less than 100 psig, and proven tight. Equipment not designed for this pressure shall be blanked off.

C. All refrigerant piping and apparatus shall be tested with dry carbon dioxide or nitrogen plus a small amount of refrigerant. All refrigerating equipment shall be tested under vacuum and shall show no evidence of leakage with an absolute pressure of .20 inch

mercury gauge, sustained for a period of one hour without pumping. Leaks shall be corrected by remaking the joint. Test pressures shall be as follows:

High Side	Low Side
Refrigerant 410A - 400 psi	Refrigerant 410A - 350 psi

3.15 IDENTIFICATION OF PIPING:

A. All piping, bare and insulated, installed under this division shall be given two coats of finish painting by this contractor as listed hereinafter. Paint shall be Glidden Industrial Enamel, or equal by Sherwin-Williams or Devoe Paints. Samples of colors and type paint shall be submitted for approval prior to application.

3.16 PIPE CODING:

A. After all piping has been painted with color-coding, all piping installed under this division shall be coded and marked with "Perma-Code" pipe markers as manufactured by W.H. Brady Company, 712 Glendale Avenue, Milwaukee, Wisconsin. Markers shall be applied to properly identify piping, but in no case shall they be applied more than 20 feet apart. Markers shall be 1-1/8 inch by 7 inches and shall be secured by spiral wrapping with 3/4 inch wide vinyl banding tape, color matching service, at each end of marker.

3.17 IDENTIFICATION OF EQUIPMENT IN MECHANICAL AREAS:

A. All items of mechanical equipment shall be identified with a black bakelite label with engraved white lettering 1/2” tall. Labels shall be mechanically attached to the equipment with rivets or stainless steel screws. Thermostats and control devices shall be identified with a black bakelite label with engraved white lettering 1/4” tall. Lettering shall correspond with the tags shown in the drawings.

3.18 ADJUSTMENT AND TRIAL RUNS:

A. Upon completion of all work, the contractor shall operate the system in the presence of the owner for the purpose of demonstrating quiet and satisfactory operation, the proper setting of controls, safety and relief valves, and cleanliness of system. Heating and cooling shall be tested separately during periods approaching design conditions and shall fully demonstrate fulfillment of capacity requirements. Test procedures shall be in accordance with applicable portions of ASME, ASHRAE, and other generally recognized test codes as far as field conditions will permit. Any changes or adjustment required shall be made by the contractor without additional expense to owner.

B. Document and submit all operating conditions (startup report) of equipment during trial runs and after test and balance is complete. Include in the report:

1. Ambient air temperature
2. Design operating temperatures and flow rates
3. Entering and leaving air temperatures across each coil or heating device
4. Entering and leaving water temperatures at each coil

5. Entering and leaving water temperatures at each chiller, boiler or heat exchanger
6. Amp draw of all motors and nameplate amps
7. Voltage at each piece of equipment
8. Refrigerant pressures and temperatures

3.19 OPERATION AND MAINTENANCE INSTRUCTIONS, AND MAINTENANCE MANUAL:

A. Upon completion of work, and at a time designated by the engineer, a competent employee of the contractor shall be provided to instruct a representative of the owner in the operation and maintenance of the system.

B. Minimum instruction period shall be:

1. Air Conditioning System - 1 day

C. Maintenance Manuals: The contractor shall compile and bind five (5) sets of all manufacturer's instructions and descriptive literature on all items of equipment furnished under this work. These instructions shall be delivered through the general contractor to the engineer for approval prior to final inspection.

D. Instructions shall include:

1. Warranty letter signed by the Mechanical Contractor.
2. Index for each section with each section properly identified.
3. Complete equipment list with model and serial numbers.
4. Complete equipment list with filter sizes and quantities.
5. Copy of one complete, approved submittal for each equipment section.
6. Description of each system, including manufacturer's literature for all items.
7. Start-up and shut-down description for each system.
8. Suggested operating and maintenance instructions with frequency of maintenance indicated.
9. Parts list for all items of equipment.
10. Name, address, and telephone number of nearest sales and service organization for all items of equipment.
11. Startup reports.
12. Test and Balance Reports

E. Manuals shall be 8-1/2 x 11 inch text pages bound in three ring expansion binders with a hard durable cover with clear plastic pocket on front for title page. Prepare binder covers with printed subject title of manual, title of project, date, and volume number when multiple binders are required. Printing shall be on face and spine. Provide a table of contents for each volume. Internally subdivide the binder contents with divider sheets with typed tab titles under reinforced plastic tabs. Provide directory listing as appropriate with names addresses, and telephone numbers of design consultant, Contractor, subcontractors, equipment suppliers, and nearest service representatives.

End of Section 230010

SECTION 230500 – HEATING, VENTILATION and AIR CONDITIONING

PART 1 - GENERAL

1.1 General Requirements:

A. This Section of the Specifications and related drawings describe requirements pertaining to Air Conditioning, Heating and Ventilation work, including applicable HVAC Insulation in separate Section 230700 and Vibration Isolation and Seismic Restraint in separate Section 230548. All work shall comply with Section 230010 - General Provisions - HVAC.

B. Construct rectangular ductwork to meet all functional criteria defined in Section VII, of the SMACNA "HVAC Duct Construction Standards Metal and Flexible" 2005 Edition. All ductwork must comply with all local, state and federal code requirements.

PART 2 - PRODUCTS

2.1 SUBMITTALS:

A. Ductwork shop drawings must be submitted for approval by Engineer. Any ductwork installed without prior approval by the Engineer shall be replaced at the expense of the contractor.

2.2 QUALITY ASSURANCE:

A. The contractor must comply with this specification in its entirety. At the discretion of the Engineer, sheet metal gauges, and reinforcing may be checked at various times to verify all duct construction is in compliance.

2.3 DUCTS, PLENUM, ETC.:

A. As indicated on drawings, provide a system of metal ducts for supply, return and exhaust air.

B. All sheet metal, ducts, casing, plenums, etc., of sizes indicated, shall be constructed from prime galvanized sheet steel.

2.4 DUCTS THRU WALLS:

A. Where ducts pass through masonry walls, protect duct from contact with wall by 1/2 inch thick filler of fire rated felt or sponge rubber.

B. Provide sheet metal flashing around all duct penetrations.

C. Ducts shall be properly sealed per the fire rating and UL assembly.

2.5 INSTRUMENT TEST HOLES:

A. Install for air handling units instrument test holes in supply, return and outside air duct. Instrument test connections shall be Ventlock Model 699-2, or equal, and shall be located in accessible locations.

2.6 AIR DISTRIBUTION:

A. Devices shall quietly and draftlessly deliver and/or remove air quantities required to attain conditions indicated. Devices shall have sponge rubber gaskets for sealing devices to walls and ceilings. Exposed surfaces shall have baked enamel finish of manufacturer's standard colors noted.

B. All air distribution equipment and accessories shall be as scheduled on drawings.

2.7 METAL DUCTWALL:

A. All interior ducts shall be constructed of G-60 or better galvanized steel (ASTM A653) LFQ, chem treat. Exterior ductwork or duct exposed to high humidity conditions shall be constructed of G-90 or better galvanized steel LFQ, chem treat. Galvanized metal ducts shall be a minimum thickness of 24 gage.

B. Low Pressure Supply, Return, and Exhaust Duct:

1. Ductwork downstream from the VAV box, ductwork on low pressure supply and return systems and restroom exhaust duct shall be fabricated to meet minimum 2" w.g. pressure class in accordance with SMACNA Duct Construction Standard.

2.8 LONGITUDINAL SEAMS:

A. Pittsburgh lock shall be used on all longitudinal seams. All longitudinal seams will be sealed with mastic sealant. Snaplock is not acceptable.

2.9 DUCT JOINTS:

A. Ductmate or W.D.C.I. proprietary duct connection systems will be accepted as an alternative to SMACNA duct construction standards. Duct constructed using these systems will refer to the manufacturers guidelines for sheet gauge, intermediate reinforcement size and spacing, and joint reinforcements.

B. Ductmate 440 or a Butyl Rubber Gasket which meets Mil-C 18969B, Type II Class B, TT-C-1796A, Type II Class B, and TTS-S-001657 must also pass UL-723. This material, in addition to the above, shall not contain vegetable oils, fish oils, or any other type vehicle that will support fungal and/or bacterial growth associated with dark, damp areas of ductwork. The recommended test procedure for bacterial and fungal growth is found in 21CFR 177, 1210 closures with sealing gaskets for food containers.

2.10 FLEXIBLE DUCT:

A. Flexible duct to meet criteria as defined in SMACNA's 2005 Manual, HVAC Duct Construction Standards, Metal and Flexible, or as defined within. Flexible air ducts and flexible air connectors shall be tested in accordance with UL 181, and listed and labeled as Class 0 or Class 1.

B. Flexible duct shall be constructed with a polyethylene core with foil faced insulation.

C. Flexible duct is not allowed in lengths greater than 8', unless otherwise noted. Bends, turns, or sagging, is not accepted.

D. Flexible duct shall be acoustic rated for sound attenuation.

2.11 SEALERS:

A. Duct sealer shall be flexible, water-based, adhesive sealant designed for use in all pressure duct systems. After curing, it shall be resistant to ultraviolet light and shall seal out water, air, and moisture. Sealer shall be UL listed and conform to NFPA 90A & 90B. Sealer shall be Childers CP-145A, or equal.

2.12 DUCTWORK HANGER/SUPPORT:

A. Hang and support ductwork as defined by SMACNA, Chapter 5 2005 Manual, First Edition, or as defined within. Hanger spacing not to exceed 8'.

2.13 TURNING VANES:

A. Turning vanes shall be double wall turning vanes fabricated from the same material as the duct. Tab spacing shall be SMACNA Standard. Rail systems with non-standard tab spacings shall not be accepted. All tabs shall be used, do not skip tabs. Mounting rails shall have friction insert tabs which align the vanes automatically. Vanes shall be subjected to tensile loading and be capable of supporting 250 lbs. when fastened per the manufacturers instructions.

2.14 APPARATUS CONNECTIONS:

A. Flexible connections: For low velocity ductwork (less than 2,400 FPM), provide flexible connections at inlet and outlet of each fan connected to ductwork and elsewhere as indicated. Flexible connections shall be 6 inches wide, waterproof and fireproof, and shall be equal to “Hardcast Connector Plus Neoprene” flexible connectors. Provide at least one inch slack.

2.15 MANUAL OPPOSED BLADE DAMPERS:

A. Provide at locations shown on plans, or in accordance with details, schedules or specifications Ruskin Model CD35 manual opposed blade balancing dampers, or approved equal. Frame shall be 16 gage galvanized structural steel hat channel with tabbed corners for reinforcement. The blades shall be single skin, 16 gage galvanized

steel with three longitudinal grooves for reinforcement. Bearings shall be corrosion resistant, molded synthetic sleeve type turning in an extruded hole in the damper frame. Axles shall be square or hexagonal positively locked into the damper blade. Linkage shall be concealed out of the airstream, within the damper frame to reduce pressure drop and noise. Submittal must include leakage, pressure drop, maximum velocity and maximum pressure data based on AMCA Publication 500.

2.16 PIPE AND FITTINGS:

A. Schedule of pipe and fittings: Piping and fittings shall conform to requirements as indicated herein.

B. All pipe shall be domestically produced from domestic forgings.

2.17 SCHEDULE OF PIPING

SERVICE	ITEM	PIPING	FITTINGS	FLANGES OR UNIONS
Steam and Condensate	Steam mains 2-1/2" and larger	Black seamless steel ASTM A-106 or electric weld ASTM A-53 Sch. 40	Buttweld black steel Sch. 40	150 lb. forged black steel welding neck or slip-on flat face
	Condensate 2-1/2" & larger	Black seamless steel ASTM A-106 or electric weld ASTM A53 Sch. 80	Buttweld black steel Sch. 80	150 lb. forged black steel slip-on
Unitary Condensate Drain	2" and smaller	Type L, Hard drawn copper	Solder type wrought copper	Wrought solder copper to copper

2.18 REFRIGERANT PIPING:

A. General: Execute all refrigerant piping with stamped type "ACR" hard copper and long radius, wrought copper, sweat fittings with tolerance not to exceed 3/1000 of an inch. All joints shall be made with silver solder. Submit equipment manufacturer's suggested piping diagram for approval.

B. After refrigerant piping has been installed and tested, each system shall be evacuated and charged with proper refrigerant of quantity as recommended by manufacturer.

2.19 VENTILATING FANS:

A. See Schedule for characteristics and accessories. Units shall be AMCA or PFMA certified. Use shaded pole, single phase motors under 1/4 HP and split capacitor or polyphase motors 1/4 HP and larger.

B. Fans shall be complete with all accessories required for installation including integral overload protection or motor starter.

2.20 AIR HANDLING UNITS:

A. Provide Trane split system air handling unit(s) or approved equal (see Section 230010) of the type, arrangement, size, and indicated capacities and characteristics. Air handler shall be completely factory assembled including coil, condensate drain pan, fan motor(s), filters and controls in an insulated casing that can be applied in a vertical or horizontal configuration. Units shall be UL listed and tested in accordance with ARI standard 210/240 or 340/360. Units shall be UL listed and labeled in accordance with UL 1995 for indoor blower coil units.

B. Unit casing shall be constructed of zinc coated, heavy gauge, galvanized steel. Exterior surfaces shall be cleaned, phosphatized and finished with a weather resistant baked enamel finish. Casing shall be completely insulated with cleanable, foil faced, fire retardant permanent, odorless glass fiber material. All insulation edges shall either be captured or sealed. Knockouts shall be provided for unit electrical and refrigerant piping connections. Captive screws shall be standard on all access panels.

C. Each refrigerant circuit shall be controlled by a factory installed thermal expansion valve. Coil shall be arranged for a draw through airflow and shall provide a double sloped drain pan constructed of PVC plastic. The drain pan shall be removable for cleaning. The condensate pan can be installed in any of four positions allowing for horizontal or vertical application and providing external connections on either side of the unit.

D. Double inlet, double width, forward curved centrifugal-type fan(s), with adjustable belt drive shall be standard for AHU's 7-1/2 tons and larger, and with 3-speed direct drive shall be standard for AHU's 5 tons and smaller. Thermal overload protection shall be standard on motor. Fan and motor bearings shall be permanently lubricated.

E. Magnetic evaporator fan contactor, low voltage terminal strip, check valves and single point power entry shall be included. All necessary controls shall be factory wired.

F. Filter rack shall be accessible from the side access panel. Filters shall be one inch throwaway pleated style for AHU's 5 tons and smaller.

2.21 HEAT PUMP UNITS:

A. Provide Trane split system heat pump unit(s) or approved equal (see Section 230010) of the type, arrangement, size, and indicated capacities and characteristics. Unit shall be assembled on heavy gauge steel mounting rails and shall be weatherproofed. Unit shall include a hermetic scroll or reciprocating compressor(s), plate fin condenser coil, fans

and motors, controls and holding charge of nitrogen. Units 6 tons and less shall have a factory charge of Freon for up to 15' length of tubing. Operating range shall be 115°F to 50°F in cooling as standard. Units shall be UL 1995 listed and tested in accordance with ARI standard 210/240 or 340/360.

B. Unit casing shall be constructed of zinc coated, heavy gauge, galvanized steel. Exterior surfaces shall be cleaned, phosphatized and finished with a weather resistant baked enamel finish. Units shall be tested 500 hours in salt spray.

C. Each refrigeration circuit shall have an integral subcooling circuit. A refrigeration filter drier, expansion valve and check valves shall be provided as standard. Units shall have both a liquid line and a suction line service valve with gauge port. The direct drive hermetic scroll compressor shall have a centrifugal oil pump providing positive lubrication to moving parts. Motor shall be suction gas cooled and shall have a voltage utilization range of +/- 10% of name plate voltage. Crankcase heater, discharge line thermostat, internal temperature and current sensitive motor overloads shall be included for maximum protection. External high and low pressure cutout devices shall be provided. Evaporator defrost control provided in indoor blower coil unit shall prevent compressor slugging by temporarily interrupting compressor operation when low evaporator coil temperatures are encountered.

D. Coils shall be internally finned or smooth bore 3/8" copper tubes mechanically bonded to configured aluminum plate fin as standard. Coil shall be factory leak tested to 420 psig air pressure.

E. Permanently lubricated totally enclosed or open drip proof type motors shall be provided and shall have built in current and thermal overload protection.

F. Unit shall be completely factory wired with necessary controls and contactor pressure lugs or terminal block for power wiring. Control wiring shall be 24-volt control circuit which includes fusing and control transformer. Electronic timed initiated, temperature terminated defrost system with choice of 50, 70, or 90 minute cycle. Timed override limits defrost cycle to 10 minutes.

G. Provide complete system of air conditioning units and accessories as scheduled on the drawings. All units shall carry a five (5) year compressor warranty.

2.22 FILTER RESISTANCE INDICATORS:

A. Provide filter resistance indicators for each air handling unit on external of filter section and in an accessible location. Filter Resistance Indicator shall be as manufactured by F.W. Dwyer Manufacturing Company, Series 2000 or Marshalltown, Weiss or equal.

PART 3 - EXECUTION

3.1 DUCTWORK, GENERAL:

A. Drawings show general arrangement of duct. Provide all ductwork required to complete installation and avoid interferences. Installation shall conform with applicable portions of Section 230010, General Provisions, HVAC. Fabricate ducts as job progresses, using actual job measurements and referring to architectural, structural, electrical, plumbing and equipment drawings in order to avoid conflicts. Where space limitations preclude use of ducts and fittings as shown, consult Engineer for instructions. All ductwork, offsets, fittings, etc. required to make a complete and efficiently operating installation are included in this contract and shall be fabricated and installed in accordance with SMACNA Standards for the application unless noted otherwise herein.

B. All duct dimensions shown on drawings are "inside clear". The sizes of acoustically lined ducts and dampers in ducts shall be increased accordingly. Ducts shall be smooth on inside.

C. Provide flexible duct connectors at all ductwork connections to equipment with fans, motors or rotating components.

D. Install double thickness turning vanes in duct fittings having centerline radius less than 1-1/2 times width of duct.

E. Support ducts from building structure with 1 inch wide galvanized steel bands per SMACNA recommendations. Wire hangers and nylon straps will not be acceptable.

F. Do not install runout drops to ceiling diffusers until ceiling grids have been installed. Center ceiling diffusers between grids.

G. Seal all joints in supply, return and exhaust ducts with Childers CP-145 Veloseal, or McGill Airseal, DuroDyne or equal water based synthetic duct sealant, or equal.

H. Upon complete installation of ducts, clean entire system of rubbish, plaster, dirt, etc. before installing any outlets. After installation of outlets and connections to fans are made, blow out entire system with all control devices wide open.

3.2 PIPING, GENERAL:

A. All piping shall conform with Section 230010 - General Provisions - HVAC.

B. Run pipes parallel to walls and ceilings. Wherever pipes change size, use eccentric fittings. Run piping so as not to obstruct walking or service areas.

C. Pipe and equipment locations shown are approximate. Exact location of equipment, pipes, and chases to be as approved and determined in field to avoid other pipes and maintain structural clearances. Use actual job dimensions and equipment shop drawings for roughing.

D. Piping to comply with best trade practice. Provide clearance between pipe and building structure so pipes can expand without damage to building structure.

E. Pipe drains to, but not into, the most convenient floor drain or where otherwise directed.

F. When soldering refrigerant pipe joints, a dry nitrogen purge shall be required through the inside of the pipe to prevent oxidation.

3.3 AUTOMATIC TEMPERATURE CONTROL:

A. Controls shall be provided by Johnson Controls and shall be connected to the central MetaSys campus energy management system.

B. General: Provide a complete system of temperature controls as described herein. The system shall be installed complete by competent mechanics in the employment of the control manufacturer. All control wiring shall be installed in EMT conduit with control and power wiring in separate conduits.

C. Wiring for low voltage circuits (24 volts or less) may be No. 16 up to 50 feet, and above 50 feet shall be of size to limit voltage drop to 5 percent. Interlock wiring shall be as recommended by equipment manufacturer.

D. Motorized outdoor air dampers shall open to the ventilation position when in the occupied condition and close when system is in the unoccupied condition.

3.4 SUBMITTALS:

A. Provide submittals as required in Section 230010. At completion of work, submit check-out report of automatic control system. Submit start up reports per Section 230010. Submit test and balance report per 230010. Submit manufacturer's installation, operation, and maintenance instructions.

End of Section 230500

SECTION 230700 – HVAC INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. General Requirements: This section shall include all insulation as required for installation on all items as specified hereinafter and/or as indicated. All insulations shall be installed in a workmanlike manner by qualified workers in the employment of an independent insulation contractor. Costs of insulation shall be included as part of work by contractor as applicable to his section of work. No separate bid is to be included for insulation work.

B. Fire hazard classification for all material shall not exceed flame spread of 25 and smoke development of 50 as classified by Underwriters Laboratories under Test Method ASTM E-84 and acceptable under NFPA Standards. This is to apply to the complete system and be a composite rating of insulation material with jacket or facings, vapor barrier, joint sealing tapes, mastic and fittings.

C. Prior to commencing any work, submit data sheets for engineer's approval of all material proposed to be used on this project.

PART 2 - PRODUCTS

2.1 ABOVE GROUND INDOOR PIPING:

A. Refrigerant Pipe Insulation:

1. Insulation material shall be a flexible, closed-cell elastomeric insulation in tubular form equal to AP Armaflex, or Aerocell, or FlexTherm. This product meets the requirements as defined in ASTM C 534, “Specification for preformed elastomeric cellular thermal insulation in tubular form.” Insulation materials shall have a closed-cell structure to prevent moisture from wicking which makes it an efficient insulation. Insulation material shall be manufactured without the use of CFC’s, HFC’s or HCFC’s. It is also formaldehyde free, low VOC’s, fiber free, dust free and resists mold and mildew.

2. Materials shall have a flame spread index of less than 25 and a smoke-developed index of less than 50 when tested in accordance with ASTM E 84, latest revision. In addition, the product, when tested, shall not melt or drip flaming particles, the flame shall not be progressive and all materials shall pass simulated end-use fire tests.

3. Materials shall have a maximum thermal conductivity of 0.27 Btu-in./h-ft2- °F at a 75°F mean temperature when tested in accordance with ASTM C 177 or ASTM C 518, latest revisions. Materials shall have a maximum water vapor transmission of 0.08 perm-inches when tested in accordance with ASTM E 96, Procedure A, latest revision.

4. When supported with uni-strut an insulation sleeve under the clamp is required equal to Armacell Armafix, Aerocell Aerofix, or Cooper B-Line.

2.2 JACKET FOR OUTDOOR PIPING:

A. All insulation outside (including insulation options) shall be protected with aluminum jacketing with factory applied moisture barrier. The aluminum jacketing shall be 0.016 thickness and be of 3003 alloy and H-14 temper. Jacketing shall be applied with 2-inch circumferential and 1-1/2 inch longitudinal lap and secured with 3/8 inch wide aluminum bands, 8 inches on center.

B. All elbows shall be covered with 2 piece aluminum insulation covers, manufactured from 110 aluminum alloy in .024" thickness, Childers Aluminum E11-Jacs or equal.

C. On hot service, aluminum elbows may be attached using self-tapping screws. On chilled water service, aluminum elbows shall be glued on pipe insulation.

2.3 UNDERGROUND PIPING:

A. All piping insulation shall be Foamglas as manufactured by Pittsburg Corning, Dyplast, Dow or equal, jacketed with Pittwrap jacketing in accordance with procedures given on Pittsburgh Corning Product Data Sheet FI-112.

2.4 PIPE INSULATION THICKNESS:

A. Piping for the following systems shall be insulated to the thickness listed:

Item	Insulation Thickness (Inches)
Armaflex K = 0.25	
Cold Pipes:	
Condensate Drain Piping	1/2"
Refrigerant Suction	1”
Hot Pipes:	
Steam and Condensate	
Pipe 2”and above	3”

2.5 DUCTWORK INSULATION:

A. Rectangular Supply And Return Ducts:

1. Line all rectangular metal ducts with 1-1/2 pound density, 1 inch thick duct liner equal to Owens Corning Aeroflex PLUS. Liner shall meet requirements of ASTM C1338, G21 and G22 with respect to resistance to microbial growth.

B. Supply, Return, and Fresh Air Return Ducts in Unconditioned Plenums:

1. Insulate all, including lined and double wall spiral, metal ducts with 2" thick, 3/4 pound density duct wrap with FRK vapor barrier equal to Owens Corning Fiberglas All Service Duct Wrap.

PART 3 - EXECUTION

3.1 PIPE INSULATION:

A. All insulation shall be applied to clean, dry surfaces butting all sections firmly together and finishing as specified hereinafter.

B. All vapor barriers shall be sealed, and shall be continuous throughout. No staples shall be used on any vapor barrier jacket unless sealed with vapor barrier coating or vapor barrier tape.

C. Foamglas: All butt joints shall be staggered and longitudinal, and end joints and seams shall be thoroughly coated with asphalt base mastic before applying. Insulation shall be held in place with 18-gauge copper clad wire on 12-inch centers. Before applying jacket, all voids, cracks, and punctures shall be filled in with foamglass shaving and mastic. Insulation shall be jacketed with the manufacturer's recommended waterproofing membrane and installed as per the manufacturer's suggested application procedures.

D. Refrigerant Pipe Insulation: Armaflex insulation shall be slip fit over all tubing. Under no circumstances shall insulation be slit to fit over pipe already in place. Sufficient length shall be provided at all bends or turns to prevent the insulation from being pulled too tight and cracking. All seams and butt joints shall be adhered and sealed using Armaflex 520 or 520 BLVAdhesive or equal. Direct contact between pipe and hangers shall be avoided. Hanger shall pass outside of a sheet metal protection saddle which shall cover a section of high density insulation (cellular glass or calcium silicate), of sufficient length to support the weight of the pipe without crushing the insulation. The vapor barrier shall be continuous behind the saddle or shall be lapped over the saddle and securely cemented thereto.

3.2 ALUMINUM JACKET:

A. Jacketing shall be applied with 2-inch circumferential and 1-1/2 inch longitudinal lap and secured with 3/8 inch wide aluminum bands, 8 inches on center and at joints.

3.3 UNDERGROUND PIPING:

A. Insulation shall have all joints closely butted and be jacketed with the manufacturer's recommended waterproofing membrane and installed as per the manufacturer's suggested application procedures. (See Section 230700-2)

3.4 DUCTWORK INSULATION:

A. Flexible Insulation (External):

1. Application: Insulation shall be wrapped tightly on the ductwork with all circumferential joints butted and longitudinal joints overlapped to the bottom of the rectangular duct. On ductwork over 24 inches wide, secure insulation with suitable resistance welded mechanical fasteners at not more than 18 inches on center. The 2-inch flange on the facing shall be stapled with 9/16 inch flare door stainless steel staples on 6 inch centers. Apply a three inch wide bank of Childers CP-30 LO or CP-35 or equal Vapor Barrier Coating on all joints of insulation. While tack coat is still wet, embed 3-inch wide White 10 x 10 Fiberglass reinforcing mesh and recoat fully covering the mesh. Spot all pin penetrations or punctures in the insulation with a full coat of CP-30 LO or CP-35 or equal.

B. Flexible Insulation (Internal):

1. Applications: Duct Liner shall be applied to the interior of metal ducts using Childers CP-121 HV Duct Liner Adhesive or an equal product having a flame spread of less than 25 and a smoke development of less than 50 and classified such by Underwriters Laboratories. Exposed edges of insulation shall be coated with a heavy layer of Childers CP-135 CHIL-SPRED or equal to eliminate erosion of fibers.

2. When duct height or plenum walls exceed 24 inches and when duct widths exceed 12 inches, resistance welded mechanical fasteners will be used in addition to duct liner adhesive. Fasteners shall start within 3 inches of the upstream transverse edges of the liner and 3 inches from the longitudinal joints. Fasteners should be spaced a maximum of 6 inches on center around the perimeter of the duct, except that they may be a maximum of 6 inches from a corner break. Elsewhere they shall be a maximum of 18 inches on center.

3. Insulation shall extend the full length of each duct section to permit butting firmly at the duct joints. All joints shall be tightly sealed with CP-135 or equal.

End of Section 230700

SECTION 260500 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Common electrical installation requirements.
4. Electrical demolition.

1.3 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, and cable trays will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Provide access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Coordinate sleeve selection and application with selection and application of firestopping.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Coordinate sleeve selection and application with selection and application of firestopping

C. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

D. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches above finished floor level.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.

J. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

K. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 ELECTRICAL DEMOLITION

A. Remove all electrical materials indicated to be demolished from construction site and dispose of it per local ordinances and laws.

B. Turn over any material indicated to be maintain by the owner. Deliver the material to the owner's dedicated storage location.

C. Remove all associated conductors, conduits, and boxes of devices/fixtures indicated to be demolished. Maintain continuity of existing circuits. Existing conduits in slab may be abandoned in place.

D. Existing fire alarm system shall remain in operation. Provide protective material (i.e. bags, plastic covers, etc.) for existing devices or panels. Re-install devices in new ceiling indicated to remain. Provide retesting of fire alarm system and give a copy of the report to the Owner, Architect, and Engineer.

E. The Contractor shall replace any damaged devices, fixtures, or any electrical materials indicated to remain. Replacements shall be new and not previously used.

F. Replace any damaged wiring devices (receptacles and switches) and associated plates indicated to remain. Match desired color of Architect's selection.

3.4 FIELD QUALITY CONTROL

A. Inspect installed sleeve and sleeve-seal installations and associated firestopping for damage and faulty work.

END OF SECTION 260500

SECTION 260519 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70-2011, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70 - 2011.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Insulated Wire Corp.; a Leviton Company.
2. General Cable Corporation.
3. Senator Wire & Cable Company.
4. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hubbell Power Systems, Inc.
2. O-Z/Gedney; EGS Electrical Group LLC.
3. 3M; Electrical Products Division.
4. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Class 1 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

B. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

C. Support cables according to Division 26 Section "Electrical Supports and Seismic Restraints."

D. Identify and color-code conductors and cables according to Division 26 Section "Electrical Identification."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm).

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the following critical equipment and services for compliance with requirements.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70-2011, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by10 feet (19 mm by 3 m).

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger, unless otherwise indicated.

B. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide one 24”x 2”x 1/4” bare copper ground bus and No. 6 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
2. For grounding electrode system, install at least three rods spaced at least 20 feet from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

END OF SECTION 260526

SECTION 260529 - ELECTRICAL SUPPORTS AND SEISMIC RESTRAINTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Seismic restraints for electrical equipment and systems.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IBC: International Building Code.

C. IMC: Intermediate metal conduit.

D. RMC: Rigid metal conduit.

E. Seismic Restraint: A structural support element such as a metal framing member, a cable, an anchor bolt or stud, a fastening device, or an assembly of these items used to transmit seismic forces from an item of equipment or system to building structure and to limit movement of item during a seismic event.

1.4 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent. This site is a Seismic ‘C’ Classification.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Comply with NFPA 70 – 2011.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project, with a minimum structural safety factor of five times the applied force.

B. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly.

1. Channel Dimensions: Selected for structural loading.

C. Raceway and Cable Supports: As described in NECA 1.

D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

3. Concrete Inserts: Steel or malleable-iron slotted-support-system units similar to MSS Type 18; complying with MFMA-3 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 SEISMIC-RESTRAINT COMPONENTS

A. Angle and Channel-Type Brace Assemblies: Steel angles or steel slotted-support-system components; with accessories for attachment to braced component at one end and to building structure at the other end.

B. Cable Restraints: ASTM A 603, zinc-coated, steel wire rope attached to steel or stainless-steel thimbles, brackets, swivels, and bolts designed for restraining cable service.

1. Seismic Mountings, Anchors, and Attachments: Devices as specified in Part 2 "Support, Anchorage, and Attachment Components" Article, selected to resist seismic forces.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 for application of hangers and supports for electrical equipment and systems, except if requirements in this Section are stricter.

B. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
1. Secure raceways and cables to these supports with two-bolt conduit clamps using spring friction action for retention in support channel.

C. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT AND SEISMIC-RESTRAINT INSTALLATION

A. Comply with NECA 1 for installation requirements, except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, as permitted in NFPA 70.

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm)

thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.

5. To Light Steel: Sheet metal screws.
6. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 INSTALLATION OF SEISMIC-RESTRAINT COMPONENTS

A. Restraint Cables: Provide #12 slack steel cables on all recessed light fixtures. Provide two cables on all 2'x4' recessed fixtures attached from structure to diagonally opposite corners of fixtures. Provide one cable on each smaller fixture.

B. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. IMC: Intermediate metal conduit.

D. LFMC: Liquidtight flexible metal conduit.

E. RGS: Rigid galvanized steel conduit.

F. RNC: Rigid nonmetallic conduit.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70-2011, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70 - 2011.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1.

B. IMC: ANSI C80.6.

C. EMT: ANSI C80.3.

D. FMC: Zinc-coated steel.

E. LFMC: Flexible steel conduit with PVC jacket.

F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
1. Fittings for EMT: Steel , set-screw (indoors), weatherproof compression (outdoors).

2.2 NONMETALLIC CONDUIT AND TUBING

A. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

B. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material. Provide rigid steel conduit elbows.

2.3 BOXES, ENCLOSURES, AND CABINETS

A. Metal Floor Boxes: Cast metal semi-adjustable, rectangular.

B. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

C. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

2.4 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.

1. Color of Frame and Cover: Gray.
2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, “ELECTRICAL” or “COMMUNICATION.”
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit.
2. Concealed Conduit, Aboveground: EMT.
3. Underground Conduit: RNC, Type EPC-40 PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
6. Application of Handholes and Boxes for Underground Wiring:

    a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Severe Physical Damage: IMC.
3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: IMC.
6. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, nonmetallic in damp or wet locations.

C. Minimum Raceway Size: Indoors -3/4-inch (16-mm), outdoors- 3/4-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Electrical Supports and Seismic Restraints."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Change from RNC to rigid steel conduit, or IMC before rising above the floor, whether exposed or within a wall.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

L. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations.

M. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earthwork" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Division 31 Section "Earthwork."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earthwork."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
    a. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

D. Install handholes and boxes with bottom below the frost line.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

END OF SECTION 260533

SECTION 260534 - FLOOR BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Related Sections:
   1. Section 260533 - Raceway and Boxes for Electrical Systems.
   2. Section 262726 - Wiring Devices: Receptacles for installation in floor boxes.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures.

B. Product Data: Submit catalog data for floor boxes service fittings.

1.4 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements.

B. Project Record Documents: Record actual locations of each floor box and poke-through fitting.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

PART 2 PRODUCTS

2.1 FLOOR BOXES

A. Manufacturers:
   1. Hubbell Wiring Products, Inc.
   2. Wiremold, Inc.
   3. Steel City, Inc.
   4. FSR, Inc.

B. Floor Boxes: NEMA OS 1-1/2 inches deep.

C. Adjustability: Fully adjustable.

D. Material: Cast metal.

E. Shape: Rectangular.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify locations of floor boxes and outlets in finished spaces prior to rough-in.

3.2 INSTALLATION

A. Floor Box Requirements: Use cast floor boxes for all installations.

B. Set floor boxes level.

C. Install boxes and fittings to preserve fire resistance rating of slabs and other elements, using materials and methods specified in Section 078400.

D. Install protective rings on active flush cover service fittings.

3.3 ADJUSTING

A. Section 017000 - Execution and Closeout Requirements:Testing, adjusting, and balancing.

B. Adjust floor box flush with finish flooring material.

3.4 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Final cleaning.

B. Clean interior of boxes to remove dust, debris, and other material.

END OF SECTION 260534

SECTION 260553 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Identification for conductors and control cable.
   2. Underground-line warning tape.
   3. Equipment identification labels.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 70 - 2011.

1.4 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 CONDUCTOR AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.2 UNDERGROUND-LINE WARNING TAPE

A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.

1. Not less than 6 inches (150 mm) wide by 4 mils (0.102 mm) thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend shall indicate type of underground line.

2.3 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.

2.4 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with black letters on a white background. Minimum letter height shall be 3/8 inch (10 mm).

2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 APPLICATION

A. Power-Circuit Conductor Identification: For secondary conductors in pull and junction boxes use color-coded tape.

B. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape.

C. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

D. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where 2 lines of text are required, use labels 2 inches (50 mm) high.

2. Equipment to Be Labeled:

a. Panelboards, electrical cabinets, and enclosures.
b. Access doors and panels for concealed electrical items.
c. Disconnect switches.
d. Enclosed circuit breakers.
e. Fire-alarm control panel and annunciators.
f. Monitoring and control equipment.
g. Contactors.
h. Lighting control panels.

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for conductors.

1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.

2. Colors for 120/208-V Circuits:

a. Phase A: Black.

b. Phase B: Red.
c. Phase C: Blue.
d. Neutral: White
e. Ground: Green

3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches (400 mm) overall.

END OF SECTION 260553

SECTION 262200 - DRY-TYPE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following types of dry-type transformers rated 600 V and less:

1. Distribution transformers.

1.3 SUBMITTALS

A. Product Data Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C 57.12.91.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cutler-Hammer.
   2. GE Electrical Distribution & Control.
   3. Square D/Groupe Schneider NA.

2.2 MATERIALS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Coils: Continuous windings without splices, except for taps.

   1. Internal Coil Connections: Brazed or pressure type.
   2. Coil Material: Copper.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Provide transformers that are internally braced to withstand seismic forces specified in Division 16 Section "Electrical Supports and Seismic Restraints."

C. Cores: One leg per phase.

D. Enclosure: Ventilated, NEMA 250, Type 2.

E. Indoor Transformer Enclosure Finish: Comply with NEMA 250 for "Indoor Corrosion Protection."

   1. Finish Color: Gray.

F. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

H. K-Factor Rating: Transformers shall be K-factor rated (K-13) and comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.

1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
2. Indicate value of K-factor on transformer nameplate.

I. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls and floors for suitable mounting conditions where transformers will be installed. Provide reinforcement of walls as required for proper mounting.

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

3.2 INSTALLATION

A. Install floor-mounting transformers level on concrete pad.

1. Anchor transformers to concrete bases according to manufacturer's written instructions, seismic codes at Project, and requirements in Division 26 Section "Electrical Supports and Seismic Restraints."

2. Maintain clearances as listed on transformer per NEC.

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding."

B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B. Land each conductor under a separate lug barrel.

END OF SECTION 262200

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Snap switches.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70-2011, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70 - 2011.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).

2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5351 (single), 5352 (duplex).
b. Hubbell; HBL5351 (single), CR5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; GF20.
b. Hubbell; GF5262.
c. Leviton; 6899.
d. Pass & Seymour; 2084.

2.4 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

2.5 WALL PLATES

A. Single and combination types to match corresponding wiring devices. Provide jumbo size plates for devices installed in block walls; confirm with Architect.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material : Smooth, stainless steel, confirm with Architect..
3. Material for Damp Locations: Metallic with spring-loaded lift, “in use” type cover, and listed and labeled for use in wet locations. Cover shall be capable of being locked with padlock.

2.6 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70-2008 or device listing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70-2008, Article 300, without pigtails.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
7. All switches shall be ADA-compliant, not exceeding 48" aff mounting height to toggle.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on bottom. Group adjacent switches under single, multigang wall plates.

3.2 FIELD QUALITY CONTROL

A. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
3. Using the test plug, verify that the device and its outlet box are securely mounted.
4. The tests shall be diagnostic, indicating damaged conductors, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Fuses.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses from one source and by a single manufacturer.

B. Comply with NFPA 70 - 2011 for components and installation.

C. Listing and Labeling: Provide fuses specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

1.4 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Spare Fuses: Furnish quantity equal to 20 percent of each fuse type and size installed, but not less than 1 set of 3 of each type and size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Cooper Industries, Inc.; Bussmann Div.
2. General Electric Co.; Wiring Devices Div.
3. Gould Shawmut.
4. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class as specified or indicated; current rating as indicated; voltage rating consistent with circuit voltage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine utilization equipment nameplates and installation instructions to verify proper fuse locations, sizes, and characteristics.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Motor Branch Circuits: Class RK1, time delay.

B. Other Branch Circuits: Class RK5, non-time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices as indicated. Arrange fuses so fuse ratings are readable without removing fuse.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following individually mounted, enclosed switches and circuit breakers:

1. Fusible switches.
2. Non-fusible switches.
3. Enclosures.

1.3 DEFINITIONS

A. GD: General duty.

B. HD: Heavy duty.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70-2011, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70 - 2011.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).

1.6 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE AND NONFUSIBLE SWITCHES

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
3. Siemens Energy & Automation, Inc.
4. Square D/Groupe Schneider.

B. Fusible Switch, NEMA KS 1, Type GD (general duty), with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and door interlocked with cover in closed position.

C. Nonfusible Switch: NEMA KS 1, Type, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

2.2 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Outdoor Locations: NEMA 250, Type 3R.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

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

3.2 INSTALLATION

A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated.

C. Comply with mounting and anchoring requirements specified in Division 26 Section "Electrical Supports and Seismic Restraints."

D. Where disconnect switches are indicated to be provided with Division 23 equipment, Division 26 Contractor shall install (if not integral with equipment) and connect switches as required. Coordinate all connections to switches with Division 23.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Electrical Identification."

B. Enclosure Nameplates: Label each enclosure with engraved laminated-plastic nameplate as specified in Division 26 Section "Electrical Identification."

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance testing as follows:

1. Inspect mechanical and electrical connections.
2. Verify switch and labeling.
3. Verify rating of installed fuses.
4. Inspect proper installation of type, size, quantity, and arrangement of mounting or anchorage devices complying with manufacturer's certification.

3.5 CLEANING

A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 262816

SECTION 26 4313 - SURGE PROTECTIVE DEVICES

(formerly TRANSIENT VOLTAGE SUPPRESSION)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section describes the materials and installation requirements for Surge Protective Devices (SPDs), formerly TVSS, for the protection of AC electrical circuits.

1.3 STANDARDS

A. Underwriters Laboratories: UL 1449 and UL 1283.

B. ANSI/IEEE C62.41.1-2002, C62.41.2-2002, C62.45-2002.

C. National Electrical Code 2011: Article 285.

D. NEMA LS-1.

1.4 LISTING REQUIREMENTS

A. The SPD industry recently revised UL 1449 Third Edition, 2008 NEC Article 285, NEMA LS-1 and various other surge standards. UL 1449 Third Edition, effective 09/2009, includes extensive new indepednet performance testing. This specification centers on UL 1449 Third Edition certification to ensure comparable test evaluations and accessibility of UL's website to verify spec compliance.

B. SPD shall bear the UL Mark and shall be Listed to most recent editions of UL 1449 and UL 1283. "Manufactured in accordance with" is not equivalent to UL listing and does not meet the intent of this specification.

1.5 SUBMITTAL REQUIREMENTS

A. Submittals shall include UL 1449 Listing documentation verifying:

1. Short Circuit Current Rating (SCCR)

2. Voltage Protection Ratings (VPRs) for all modes
3. Maximum Continuous Operating Voltage rating (MCOV)
4. I-nominal rating (l-n)
5. Type 1 Device Listing

B. Submittals shall include shop drawings including manufacturer installation instruction manual and line drawings detailing dimensions and weight of enclosure, internal wiring diagram illustrating all modes of protection in each type of SPD required, wiring diagram showing all field connections and manufacturer's recommended wire and breaker sizes.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within 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. Current Technology, Inc.
2. LEA International.
3. Liebert Corporation; a division of Emerson.
4. APT (Advanced Protection Technology).

2.2 SURGE PROTECTIVE DEVICES (SPDs)

A. SPD shall be UL labeled with 200ka Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.

B. SPD shall be UL labeled as Type 1 (verifiable at UL.com), intended for use without need for external or supplemental overcurrent controls. Every compression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls.

C. SPD shall be UL labeled with 20kA nominal (L-N) (verifiable at UL.com) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.

D. Minimum surge current capability (single pulse rated) per phase shall be 100kA.

E. SPD shall provide surge current paths for all modes of protection: L-N, L-G, and N-G for Wye systems.

F. UL 1449 Listed Voltage Protection Ratings (VPRs) shall not exceed the following:

System Voltage	L-N	L-G	L-L	N-G
208Y/120	800V	800V	12000V	800V
480Y/277	1200V	1200V	18000V	1200V

G. UL 1449 Listed Maximum Continuous Operating Voltage (MCOV):

System Voltage	Allowable System Voltage Fluctuation(%)	MCOV
208Y/120	25%	150V
480Y/277	15%	320V

H. SPD shall include visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED. SPD shall include an audible alarm with on/off silence function and diagnostic test function (excluding branch).

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTION DEVICES

A. At Service Entrance or Transfer Switch, a UL approved disconnect switch shall be provided as a means of servicing disconnect if a 60 amp breaker is not available.

B. SPD shall be installed per manufacturer's installation instructions with lead lengths as short (less than 24" and straight as possible. Gently twist conductors together.

C. The contractor shall rearrange breaker locations to ensure shortest and straightest possible leads to SPDs.

D. Before energizing, the contractor shall verify service and separately derived system Neutral-to-Ground bonding jumpers per NEC.

3.2 FIELD QUALITY CONTROL

A. Testing: After installing surge protection devices, but electrical circuitry has been energized, test for compliance with requirements. Remove and replace malfunctioning units and retest.

END OF SECTION 264313

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Lighting fixtures, lamps, and ballasts (interior and exterior building mounted).
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CRI: Color-rendering index.

C. CU: Coefficient of utilization.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Luminaire: Complete lighting fixture, including ballast housing if provided.

G. RCR: Room cavity ratio.

1.4 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Ballast.
4. Energy-efficiency data.
5. Lighting Fixtures.

6. Suspended ceiling components.
7. Structural members to which suspension systems for lighting fixtures will be attached.

B. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

C. Shop Drawings: Custom fixtures shall require submittal of detailed, scaled shop drawings showing lamping, material, and UL certification.

D. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70-2011, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70 - 2011.

1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide products listed in Lighting Fixture Schedule on the drawings or prior approved equals.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Comply with UL 1598.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to

prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

F. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

G. Plastic Diffusers, Covers, and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless different thickness is indicated.
b. UV stabilized.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. Electronic Ballasts: Comply with ANSI C82.11; instant-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.

1. Sound Rating: A.
2. Total Harmonic Distortion Rating: Less than 20 percent.
3. BF: 0.85 or higher.
4. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C 82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic programmed rapid-start type, complying with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: A.
4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher, unless otherwise indicated.

9. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
10. Ballast Case Temperature: 75 deg C, maximum.

2.5 EMERGENCY FLUORESCENT POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.

1. Emergency Connection: Operate 2 fluorescent lamp(s) continuously at an output of 1400 lumens each (1000 lumens for compact fluorescent). Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
2. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

    a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

3. Battery: Sealed, maintenance-free, nickel-cadmium type.
4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.

2.6 EXIT SIGNS

A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

    a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.7 FLUORESCENT LAMPS

A. Low-Mercury Lamps: Comply with EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

B. T8 rapid-start low-mercury lamps, rated 32 W maximum, nominal length of 48 inches (1220 mm), 2800 initial lumens (minimum), CRI 75 (minimum), color temperature as indicated on drawings, and average rated life 20,000 hours, unless otherwise indicated.

C. Compact Fluorescent Lamps: 4-Pin, low mercury, CRI 80 (minimum), color temperature as indicated on drawings, average rated life of 10,000 hours at 3 hours operation per start, unless otherwise indicated. All compact fluorescent fixtures shall have lamps installed at factory before shipping.

2.8 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Electrical Supports and Seismic Restraints" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.
   1. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
   2. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.

3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Provide final aiming of all directional fixtures with Architect and Engineer present.

END OF SECTION 265100

SECTION 267210 - FIRE DETECTION AND ALARM

PART 1 GENERAL

1.1 SUMMARY

A. Section includes fire alarm systems. In includes requirements for system components including but not limited to:
   1. manual fire alarm stations
   2. automatic smoke and heat detectors
   3. duct detectors
   4. combination remote indicating and test stations
   5. fire alarm signaling appliances
   6. backboxes for system devices
   7. Addressable interface units (AIUs)
   8. Isolation relays
   9. Sprinkler system flow and tamper switches
   10. Surge protection devices (SPD)
   11. Emergency power supply
   12. Digital Alarm communicatior transmitter (DACT)
   13. RJ-31X communications jacks
   14. System instructions and tags
   15. auxiliary fire alarm equipment
   16. power and signal wire.

1.2 REFERENCES

A. National Fire Protection Association:
   1. NFPA 72 - National Fire Alarm Code.
   2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

1.3 DEFINITIONS

A. Active Multiplex System: A multiplexing system in which signaling devices are employed to transmit and receive status signals of each initiating device and/or initiating device circuit within a prescribed time interval so that lack of receipt of such signal may be interpreted as a trouble signal.

B. ADA: Americans with Disabilities Act Guidelines.

C. Alarm Notification Appliances: Devices such as audible-only alarm units (speakers), visible-only alarm units (strobes), and combination audible/visible alarm units.

D. Alarm Signal: Signifies a state of emergency requiring immediate action. Pertains to signals caused by the operation of alarm initiating devices.

E. Analog Smoke Detector: A smoke detector that transmits a signal indicating varying degrees of smoke density and includes a warning system to indicate when the detector is dirty and when the detector drifts outside of its listed sensitivity range. Detectors shall include an adjustable sensitivity feature capable of being manipulated at the fire alarm control panel.

F. Class B Wiring: Wiring method used to interface non-addressable detection devices to addressable interface units (AIU's)) and for notification appliance circuits. Class B circuits shall be electrically supervised such that a single break or a single ground fault condition will be indicated by a trouble signal at the FVCC and remote annunciator panels no matter where the break or ground fault condition occurs.

G. Notification Appliance Circuit (NAC): Circuit for connection of notification appliances. Circuits shall be electrically supervised such that a single break or a single ground fault condition will be indicated by a trouble signal at the FVCC and remote annunciator panels no matter where the break or ground fault condition occurs.

H. Signaling Line Circuit (SLC): Multiplex circuit for connection of alarm initiating devices. Circuits shall be electrically supervised such that a single break or a single ground fault condition will be indicated by a trouble signal at the FVCC and remote annunciator panels no matter where the break or ground fault condition occurs.

I. Supervisory Signal: Indicates a need for action regarding maintenance or the fire detection and alarm system.

J. Trouble Signal: Indicates that an open circuit or ground has occurred in the system.

K. Zone: designation for an initiating device having an unique identity on a signaling line circuit.

1.4 SYSTEM DESCRIPTION

A. Fire Alarm System: NFPA 72, manual and automatic local fire alarm system with connections to licensed central station. Active multiplex, addressable, microprocessor based type system with both manual and automatic alarm initiation, and both audible and visible evacuation alarms. All components shall be provided integral to the fire alarm control panel cabinets

B. Signal Transmission: Multiplex signal transmission dedicated to fire alarm service only.

C. System connections for alarm initiating devices: Devices shall be connected using signaling line circuits (multiplex addressable type).

D. System connections for alarm notification appliances: Devices shall be connected using Class B notification appliance circuits.

E. Priority of Signals: Automatic response functions shall be accomplished by the first zone/device initiated. Alarm functions resulting from initiation by the first zone/device shall not be altered by subsequent alarms. An alarm signal shall be the highest priority.

Supervisory or trouble signals shall have second- and third-level priority. Signals of a higher level priority shall take precedence over signals of lower priority even though the lower priority condition occurred first. Annunciate all alarm signals regardless of priority or order received.

F. Noninterfering: Provide zoned, powered, wired, and supervised system so that a signal from one zone/device does not prevent the receipt of signals from any other zone/device. All zones/devices shall be manually resettable from the FVCC after the initiating device or devices have been restored to normal. Systems that require the use of batteries or battery backup for the programming function are not acceptable and shall not be provided.

G. Transmission to Remote Central Station: Alarm signals shall be automatically routed to a UL Listed, FM Approved central monitoring station via a digital alarm communicator transmitter (DACT).

H. Function Switches at FVCC and Remote Annunciator Panels: Switches shall provide capability for Alarm Acknowledgement, Supervisory Acknowledgement, Trouble Acknowledgement, System Reset, Alarm Silence, AHU Shutdown, and Drill / Full Evacuation.
   1. Alarm Acknowledgement: Under normal conditions each panel shall display a "SYSTEM NORMAL" message. Should an abnormal condition be detected an appropriate LED (Alarm, Supervisory, or Trouble) shall flash and an audible signal shall be activated at each panel. Each panel shall display the following information relative to the abnormal condition of a point in the system:
      a. Custom alarm point label (40 characters minimum)
      b. Type of device.
      c. Point status
   2. Pressing the appropriate acknowledge button shall acknowledge the alarm, supervisory or trouble condition. After all the points have been acknowledged, the LEDs shall glow steady and each panel's audible signal shall be silenced.
   3. Alarm Silencing: Should the "Alarm Silence" button be pressed, all building and panel audible alarm signals shall cease operation. All building visible alarm signals shall continue operation.
   4. System Reset: The "System Reset" button shall return the system to its normal state after an alarm condition has been remedied. Should an alarm condition continue to exist, the system shall remain in an abnormal state. System control relays shall not reset. Each panel's audible signal and the Alarm LED shall be on. Each display shall indicate the total number of alarms and troubles present in the system along with a prompting to review the points. These points shall not require acknowledgement if they were previously acknowledged.
   5. AHU Shutdown: Should the "AHU Shutdown" button be pressed, all air handling units that include a duct smoke detector shall be shutdown automatically throughout the facility. Pressing the button a second time shall cause all air handling units to automatically restart (unless a unit's duct detector is in alarm).
   6. Drill / General Evacuation: Should the "Drill / General Evacuation" button be pressed, all building audible alarm signals and visible signals shall be activated throughout the facility.

I. General Alarm Sequence of Operation: Actuation of initiating device causes the following system operations:
   1. Local fire alarm signaling devices sound digital voice alarm messages and tone signals on loudspeakers throughout the facility. The audio alarm signal of the voice alarm system shall consist of an alarm tone for approximately 10 seconds followed by automatic pre-selected voice evacuation messages (see message requirements under PRODUCTS section). At the end of each voice evacuation message, the alarm tone shall resume. The alarm tone and messages shall sound alternately until the alarm silence switch at the FVCC has been operated.
   2. Visible Alarm Indication: By synchronized strobe light units that comply with NFPA 72 and A.D.A. guidelines.
   3. Zone-coded signal transmits to remote central station.
   4. Location of alarm zone indicates on fire alarm control panel and on remote annunciator.
   5. Automatic unlocking of all access controlled doors.

J. Drill Sequence of Operation: Manual drill function causes alarm mode sequence of operation.

K. Power Loss Indication: Sound trouble signal at the FVCC and remote annunciator panel upon loss of primary power at the FVCC. Provide an indication at the FVCC and remote annunciator panel when the system is operating on an alternate power supply.

L. Alarm initiation for fire detection devices shall be as follows:
   1. Manual Pull Station alarm operation initiates a general alarm.
   2. Smoke detector requiring maintenance/cleaning initiates a trouble alarm.

M. Trouble Sequence of Operation: System or circuit trouble causes the following system operations:
   1. Visual and audible trouble alarm indicates by zone at fire alarm control panel.
   2. Visual and audible trouble alarm indicates at remote annunciator panel.
   3. Trouble signal transmits to central station.

N. Remote Detector Status Indication:
   1. Tamper: Status annunciation of individual smoke and heat detectors at the FVCC to indicate when a detector has been removed from its base.
   2. Maintenance: Status annunciation of individual analog smoke detectors at the FVCC and the remote annunciator panel to indicate when a detector is dirty and requires cleaning or when it has drifted outside of its listed sensitivity range.

O. Remote Detector Sensitivity Adjustment: Manipulation of controls at the FVCC shall allow the selection of specific smoke and heat detectors for adjustment, display their current status and sensitivity settings, and control changes in those settings. Provide ability of using the same controls to program repetitive scheduled changes in sensitivity of specific detectors. These adjustments shall be capable of being made by the Owner's maintenance personnel and shall not require the use of additional and/or proprietary programming equipment.

P. Annunciation: Annunciate manual or automatic operation of any alarm or supervisory initiating device on the FVCC and the remote annunciator panel indicating the location and type device as indicated herein and as scheduled on the contract drawings.

Q. Annunciator Display: 80 character (minimum) alphanumeric, liquid-crystal-display (LCD) type.

R. Alarm Verification: Alarm verification shall be requested from the AHJ. If acceptable: Smoke detector alarm operation of spot type smoke detector shall activate a 60-second alarm delay. If after 60 seconds the alarm condition for the detector has cleared, the system shall be reset to normal. If after 60 seconds the alarm condition is still present, a general alarm shall be initiated.

S. Duct smoke detector alarm operation shall initiate a supervisory alarm and shuts down its associated air handling unit fan. Any associated electric duct heaters shall also be shut down.

T. Sprinkler system flow switch operation initiates a general alarm. Sprinkler system pressure switch operation initiates a general alarm. Sprinkler valve tamper switch operation initiates a trouble alarm.

U. Independent System Monitoring: Supervise each detection device and each alarm notification device for both normal operation and trouble.

V. Circuit Supervision: Indicate circuit faults with both a zone and a trouble signal at the FVCC and the remote annunciator panel. Provide a distinctive indicating audible tone and (LED) indicating light.

W. The maximum elapsed time between the occurrence of an alarm or a trouble condition and its indication at the FVCC shall be 10 seconds. The maximum elapsed time between the occurrence of an alarm condition and activation of all associated notification devices shall be 10 seconds.

1.5 SUBMITTALS

A. General: Submit in accordance with Division 26 Section "Basic Electrical Requirements." The contractor shall not begin the installation of any raceways or boxes for the fire alarm system until shop drawings and product data have been reviewed by the Architect/Engineer.

B. Shop Drawings: Submit product data for all fire alarm system components including dimensioned plans, sections, and elevations showing minimum clearances, installed features and devices, and list of materials. Submit wiring diagrams from the manufacturer differentiating between manufacturer-installed and field-installed wiring. Include diagrams for equipment wiring and for system wiring with all terminals and interconnections identified. Include drawings indicating components for both field and factory panel wiring. Submit shop drawings from the manufacturer indicating all horizontal and vertical building wiring for detection, alarm, and communications circuits. Include equipment types and locations, raceway sizes, number and type of wires/cables,

and conductor color coding for each circuit type. Shop drawings shall be provided on 30" x 42" (E-size) prints. In addition to the requirements of Division 26 Section "Basic Electrical Requirements", final submittal shall include one set of shop drawings on a disc in PDF or DWG format

C. Product Data: Submit catalog data showing electrical characteristics and connection requirements. Submit product data for all fire alarm system components including dimensioned plans, sections, and elevations showing minimum clearances, installed features and devices, and list of materials.

D. Battery Calculations: Submit battery capacity calculations for both alarm and supervisory modes.

E. Voltage Drop Calculations: Submit calculations for voltage drop of each notification appliance circuit.

F. System Operation Description: Submit system operation description including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs. Description shall cover this specific project. Manufacturer's standard descriptions for generic systems shall not be acceptable.

G. Test Reports: Indicate procedures and results for specified field testing and inspection.

H. Manufacturer's Field Reports: Indicate activities on site, adverse findings, and recommendations.

I. Product Certification: Submit a product certification letter signed by the manufacturer of the fire alarm system components certifying that their products comply with the referenced standards.

J. Submit operation and maintenance data that will be included in the operating and maintenance manual specified in Division 26 Section "Basic Electrical Requirements." Operation and maintenance data shall cover each type of product, including all features and operating sequences, both automatic and manual. In addition, provide the following:
1. Spare parts data.
2. Names, addresses, and telephone numbers of service organizations that carry stock of repair parts for the systems to be furnished.
3. A listing of the manufacturer’s representatives responsible for installation coordination and service.
4. A list of CPU addresses for every device that is provided for purposes of alarm initiation, status monitoring, supervised notification appliance circuits, and auxiliary control.
5. A list of detector sensitivity setpoints for all installed smoke and heat detectors.

1.6 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

B. Maintain one copy of each document on site.

C. Installer Qualifications: Engage an experienced Installer who is a factory-authorized service representative and a licensed contractor in the State of South Carolina to perform the Work of this Section.

D. Compliance With Local Requirements: Comply with the International Building Code (IBC), local ordinances, local regulations, and requirements of the South Carolina Office of State Engineer (the authority having jurisdiction).

E. NFPA compliance: Comply with NFPA 70 - 2008 (National Electrical Code). Comply with NFPA 72, "National Fire Alarm Code".

F. UL Listing and Certification: Provide system and components that are listed and labeled by UL. Installer shall be UL licensed.

G. American National Standards Institute (ANSI): Installation of equipment, devices, and controls shall comply with:
1. CABO/ANSI A117.1, "Acessible and Usable Buildings and Facilities."

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of experience and with service facilities to provide a minimum of four (4) hours service response to the project site.

1.8 SPARE PARTS

A. Furnish two indoor type visual only alarm indicating units of each rating specified.

B. Furnish ten smoke detectors.

C. Furnish 5 heat detectors, 135 deg rated.

D. Furnish 2 heat detectors, 190 deg rated.

E. Furnish 10 standard detector bases.

1.9 SINGLE-SOURCE RESPONSIBILITY: Obtain fire alarm components from a single source who assumes responsibility for compatibility of system components furnished.

1.10 MAINTENANCE SERVICE

A. Furnish service and maintenance of fire alarm equipment for two years from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS: Subject to compliance with requirements, provide products by, but not limited to, one of the following:

A. Simplex/Grinell LP; Tyco Inc.

B. Notifier; Honeywell Inc.

C. Gamewell FCI (Fire Control Instruments); Honeywell, Inc.

2.2 BACKBOXES FOR FIRE ALARM SYSTEM DEVICES

A. Flush Type Backboxes for use in Indoor Conditioned Spaces:
1. Outlet and Device Backboxes: Conform to UL 514A, "Metallic Outlet Boxes, Electrical," and UL 514B, "Fittings for Conduit and Outlet Boxes." Boxes shall be of type, shape, size, and depth to suit each location and application. Provide “old-work” type boxes where required for proper mounting in existing walls and ceilings.

B. Surface Type Backboxes for use in Indoor Spaces:
1. Surface mounted devices and raceways shall only be used where the specific device/component/function has been prior approved in writing by the Engineer.
2. Surface Raceway Backboxes for Fire Alarm System Devices: Metallic boxes made by surface raceway manufacturer with knockouts and accessories suitable for each location. Boxes shall have an ivory finish to match surface raceway.
3. Surface raceway boxes for square devices requiring the mounting screw pattern of a 4" square backbox shall be Wiremold Type V5752 or V5753 boxes (or prior approved equal) except as required below for custom surface device boxes. Surface raceway boxes for round devices (detectors) shall be Wiremold Type V5737 or V5739 boxes (or prior approved equal).

C. Custom Surface Device Backboxes for Fire Alarm System Devices: Fire detection and alarm devices that do not properly mate with surface raceway boxes (e.g., manual pull stations) shall be mounted on custom made surface type backboxes specifically manufactured for the installed device. Device faceplates shall mate flush with outer edges of boxes. Custom boxes shall have not more than two stamped knockouts per box and shall be painted to match surface raceway or the installed device. Where applicable, proper surface raceway fittings shall be provided to interface conduit knockouts in custom boxes with surface raceway. Fittings shall be ivory in color to match surface raceway.

D. Surface Type Backboxes for use in Indoor and Outdoor Non-Conditioned Spaces: Weatherproof type backboxes shall be provided for all devices located in non-conditioned spaces. Provide backboxes as scheduled on the contract drawings. Where backboxes are not scheduled, provide cast-metal boxes with threaded conduit hubs and neoprene gaskets (Crouse-Hinds, Appleton, or equal). Drill two 1/8” weep holes in the bottom side of each box to allow water drainage. Provide weatherproof boxes that are

manufactured by the fire alarm device manufacturer where available. Provide plugs in all unused conduit hubs.

2.3 MANUAL PULL STATIONS

A. Indoor Types for Use in Conditioned Spaces: Single-action type, fabricated of metal or plastic, and finished in red with molded raised letter operating instructions of contrasting color. Stations requiring the breaking of a glass panel shall not be provided. Stations that require the breaking of a concealed glass rod may be provided. Provide custom surface backbox and mounting trims for surface mount installations. See requirements for custom surface device boxes.

B. Addressability: Provide manual pull stations with a communication transmitter and receiver having a unique identification and status reporting capability to the FVCC. The communication transmitter and receiver (AIU) shall be either integral to the station or remote mounted from the station, as indicated on the contract drawings.

C. Reset: Key-operated reset station switch, double pole, double throw, and rated for the voltage and current at which they operate. Provide stations with screw terminals for connections.

D. Cover: Provide an STI #6535 Mini Weather Stopper II (Safety Technology InterNational, phone number 1-800-888-4784) weatherproof cover/housing and an STI #6581 backplate for all manual pull stations. Sign/Message on front of housing shall read, “IN CASE OF FIRE - LIFT COVER AND PULL FIRE ALARM”. Provide additional STI #6531 spacers and #6501 gaskets as required to accommodate pull station and backbox depth.

2.4 SPOT AND DUCT SMOKE DETECTORS

A. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signalling Systems." Detectors shall be analog type and shall be provided with the following features:
1. Factory Nameplate: With serial number and type identification.
2. Operating Voltage: 24-V d.c., nominal.
3. Self-Restoring: Provide detectors that do not require resetting or readjustment after actuation to restore them to normal operation.
4. Plug-in Arrangement: Detector and associated encapsulated electronic components mounted in a module that connects to a fixed base with a twist-locking plug connection. The plug connection shall require no springs for secure mounting and contact maintenance. Provide terminals in the fixed base for building wiring.
5. Visible Indicator: LED type connected to indicate detector has operated.
6. Analog Function: Transmit signals to indicate when a detector is dirty and requires cleaning or when it has drifted outside of its listed sensitivity range.
7. Addressability: Provide detectors with a communication transmitter and receiver having a unique identification and status reporting capability to the FVCC.

B. Spot Type Smoke Detectors: Include the following features and characteristics:

1. Sensor: Photoelectric type with infrared detector light source and matching silicon cell receiver.
2. Detector Sensitivity: Adjustable between 0.6 and 3.7 percent per foot smoke obscuration when tested in accordance with UL 268. Programmed/Installed setpoint for each detector shall be 3.7% per foot.
3. Remote Controllability: Provide detectors individually monitorable at the FVCC for calibration, sensitivity, and alarm condition, and that have the capability of having their sensitivity individually adjusted from the FVCC.

C. Duct Smoke Detector: Include the following features and characteristics:
1. Smoke detector with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Complete with housing and programmable relay as required for fan shutdown. Housings shall be of types that are surface mounted to the exterior of ducts to allow immediate access to smoke detector; housings manufactured to be installed within ducts shall not be provided.
2. Sensor: Photoelectric type with infrared detector light source and matching silicon cell receiver.
3. Detector Sensitivity: Adjustable between 0.6 and 3.7 percent per foot smoke obscuration when tested in accordance with UL 268. Programmed/Installed setpoint for each detector shall be 3.7% per foot.
4. Remote Controllability: Provide detectors individually monitorable at the FVCC for calibration, sensitivity, and alarm condition, and have capability of individually adjusting sensitivity from the FVCC. Detector units shall also shutdown air handling units via manual operation of control switch at the FVCC.
5. Programmable Relay: Each detector shall be provided with an integral programmable control relay that shall be rated to properly interface with the HVAC control system for shutdown functions. Provide an isolation relay of proper ratings if the detector relay ratings do not meet HVAC system control voltage and amperage requirements.
6. Provide weatherproof type units for roof mounted detectors.

2.5 COMBINATION REMOTE INDICATING LIGHT AND TEST STATION

A. General: Provide stations including a location-indicating, system-voltage light and a keyed test switch for remote status and testing of smoke detectors. Station components shall be attached to a wallplate for mounting on a single-gang wall or ceiling box, as applicable. Provide two keys to the Owner for each unit provided.

B. Weatherproof Units: Provide a weatherproof cast metal backbox with gasket for units indicated to be weatherproof. Provide an STI #6535 Mini Weather Stopper II (Safety Technology InterNational, phone number 1-800-888-4784) weatherproof cover/housing and an STI #6581 backplate to cover unit. Sign/Message on front of housing shall read, “DUCT DETECTOR TEST STATION”. Provide additional STI #6531 spacers and #6501 gaskets as required to accommodate test station and backbox depth.

2.6 FIRE AND VOICE COMMAND CENTER

A. General: Comply with UL 864, "Control Units for Fire Protective Signaling Systems." Networked type systems including multiple control panels installed in different locations of the building shall not be provided unless otherwise indicated on the contract drawings. All components shall be provided integral to the fire alarm control panel cabinets.

B. Cabinets: Provide matching lockable steel enclosures. The cabinets shall have trims for surface mounting. Arrange panels so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. Provide cabinets large enough to accommodate all components and to allow ample gutter space for interconnection of panels as well as field wiring. Identify each enclosure and each component by an engraved red laminated phenolic resin nameplate. Lettering on the enclosure nameplate shall not be less than 1 inch high. Identify individual components and modules within the cabinets by engraved laminated phenolic resin nameplates.

C. Systems: Provide for separate and independent alarm and supervisory systems in the FVCC. The signaling line circuit loop boards in the FVCC shall consist of plug-in cards. Construction requiring removal of field wiring for module removal shall not be provided.

D. Control Modules: Types and capacities to perform all functions of the fire alarm system. Provide local, visible, and audible signals to notify of any alarm, supervisory, and trouble condition. Provide each type of audible alarm with a distinctly different sound.

E. Zones: Make provision in the FVCC for all detection, communications, and supervisory zones scheduled or otherwise required to provide the functions described herein and indicated on the contract drawings. Subpanels, transponder panels, and/or power supply units located remotely from the fire alarm control panels shall not be provided unless otherwise indicated on the contract drawings. All components shall be provided integral to the fire alarm control panel cabinets.

F. Notification Appliance Circuits: Separate notification appliance zones and associated circuits shall be provided for audible and visible notification appliances. They shall be arranged such that audible notification appliances can be silenced during a general alarm while the visible notification appliances remain flashing. Make provision in the FVCC for all notification appliance zones and circuits (audible and visible) scheduled or otherwise required to provide the functions described herein and indicated on the contract drawings. Power supply units located remotely from the fire alarm control panels shall not be provided unless otherwise indicated on the contract drawings. All components shall be provided integral to the fire alarm control panel cabinets.

G. Synchronized Flash: Visible notification appliance circuits (and their associated visible alarm notification appliances) shall be arranged to provide a synchronized flash sequence for all visible alarm notification appliances throughout the facility.

H. Alphanumeric Display and System Controls: Arrange to provide the basic interface between human operator at FVCC and addressable system components, including annunciation, supervision, and control. Provide a display with a minimum of 80 characters, arranged to display alarm, supervisory, and component status messages and

indicate control commands to be entered into the system for control of smoke detector sensitivity and other parameters.

I. Voice Alarm: A digital-voice, integrated, UL listed, life safety, and emergency communication system, complying with the requirements of NFPA 72. The FVCC shall include central voice alarm system components complete with all necessary microphones, pre-amplifiers, amplifiers, and tone generators. Features shall include:
   1. Amplifiers: Comply with UL 1711, "Amplifiers for Fire Protective Signaling Systems." Provide amplifier wattage capacity to accommodate all audible notification appliances where each appliance is tapped at 2 watts.
   2. Alarm Channels: Two channels to permit simultaneous transmission of different voice evacuation announcements to specific zones or floors as well as emergency public address announcements to specific areas via the central control microphone and remote microphone. All announcements shall be made over dedicated, supervised communication lines.
   3. Voice Alarm Messages:
      a. General Message:
         i. May I have your attention please.
         ii. May I have your attention please.
         iii. A fire has been reported in the building.
         iv. A fire has been reported in the building.
   4. Status Annunciator: Indicating the status of the various voice alarm speaker zones.
   5. Zoning: Provide individual voice alarm and communication zones as scheduled on the contract drawings to allow paging into specific areas.
   6. Switches: Provide programmable switches within the FVCC to perform paging to specific areas. Program a 5 minute time delay into the signal circuit supervisory alarm function as required to allow paging without initiating a supervisory (trouble) condition at the FVCC. The 5 minute delay shall be reset each time the microphone is keyed.
   7. Programmable Switches: Provide switches as specified herein and as scheduled on the contract drawings

J. Surge Protection Device (SPD)
   1. General: Provide a surge protection device to protect the primary power branch circuits to the FVCC. Devices shall be specifically designed and UL listed to protect the type of circuit connected thereto. Fuses are not acceptable and shall not be provided

K. Power supply: Adequate to serve control panel modules, remote detectors, remote annunciator, and alarm signaling devices.
   1. General: Provide an emergency power supply for the FVCC. Components shall include batteries, charger, an automatic transfer switch, and a mounting enclosure. The emergency power system may be provided integral with the FVCC cabinets in lieu of providing a separate enclosure.
   2. Battery: Sealed lead-acid type. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (nonalarm) mode for a period of 24 hours. Following this period of operation on battery power, the batteries shall

have sufficient capacity to operate all components of the system, including all alarm indicating devices in alarm or supervisory mode for a period of 5 minutes.

3. Automatic Transfer Switch: Transfer the load to the battery without loss of signals or status indications in the event of the failure of primary power.
4. Battery Charger: Solid-state, fully automatic, variable-charging-rate type. Provide for 150 percent of the connected system load while maintaining the batteries at full charge. In the event batteries are fully discharged, the charger shall recharge them fully within twelve hours. Charger output shall be supervised as part of system power supply supervision. Charger unit shall include the following features: Ammeter, Voltmeter, "Charger On" LED indicator, "Charger Trouble" LED indicator, and a "High Charge Rate" LED indicator.
5. Battery Enclosure (if required): Vented steel enclosure primed and finished in red paint

L. System Supervision: Component or power supply failure places system in trouble mode.

M. Initiating Device Circuits: Supervised zone module with alarm and trouble indication; occurrence of single ground or open condition places circuit in trouble mode but does not disable circuit from initiating alarm.

N. Auxiliary Relays: Sufficient SPDT auxiliary relay contacts for each detection zone to provide accessory functions specified.

2.7 SPOT HEAT DETECTOR

A. Product Description: Combination rate-of-rise and fixed temperature, spot heat detector.

B. General: Comply with UL 521. Provide the following features:
1. Factory Nameplate: With serial number and type identification.
2. Visual Indicator: To indicate detector has operated.

C. Spot Type Heat Detectors - 135 Degree Type: Combination fixed-temperature and rate-of-rise unit:
1. Fixed Temperature Setting: Adjustable between 117 and 135 degrees Fahrenheit. Programmed/Installed setpoint for each detector shall be 135 degrees.
2. Self-Restoring: Provide detectors that do not require resetting or readjustment after actuation to restore them to normal operation.
3. Plug-in Arrangement: Detector and associated encapsulated electronic components mounted in a module that connects to a fixed base with a twist-locking plug connection. The plug connection shall require no springs for secure mounting and contact maintenance. Provide terminals in the fixed base for building wiring.
4. Addressability: Provide detectors with a communication transmitter and receiver having a unique identification and status reporting capability to the FVCC.
5. Remote Controllability: Provide detectors individually monitorable at the FVCC for calibration, sensitivity, and alarm condition, and have capability of individually adjusting sensitivity from the FVCC.

D. Spot Type Heat Detectors - 190 Degree Type: Fixed-temperature only type unit. Fixed temperature setting shall be 190 degrees Fahrenheit. Remote mounted addressable interface units shall be provided.
   1. Self-Restoring: Provide detectors that do not require resetting or readjustment after actuation to restore them to normal operation.
   2. Plug-in Arrangement: Detector and associated encapsulated electronic components mounted in a module that connects to a fixed base with a twist-locking plug connection. The plug connection shall require no springs for secure mounting and contact maintenance. Provide terminals in the fixed base for building wiring.
   3. Addressability: Provide detectors with a communication transmitter and receiver having a unique identification and status reporting capability to the FVCC.
   4. Remote Controllability: Provide detectors individually monitorable at the FVCC for calibration, sensitivity, and alarm condition, and have capability of individually adjusting sensitivity from the FVCC

2.8 ADDRESSABLE INTERFACE UNITS (AIUs)

A. General: Addressable interface units designed to provide either the monitoring of system components not equipped for multiplex communication and/or the actuation of dry contacts based on the operation of other detection components in the fire detection system, as applicable. Provide units with a communication transmitter and receiver having a unique identification and status-reporting capability to the FVCC. Provide epoxy encapsulated units for mounting inside of a box; wallplate mounted units shall not be provided.
   1. Provide a weatherproof cast metal backbox with cover and gasket for units indicated to be weatherproof.
   2. Provide a NEMA 1 box with cover for units not indicated to be weatherproof

2.9 ISOLATION CONTROL RELAYS

A. General: Electrical relay units designed to provide isolation of operating power from switched power for other control systems. Provide units with contact ratings as required for connected loads. Operating voltage shall be 24-V d.c., nominal. Output contacts shall be Form C relay type. Provide a weatherproof cast metal backbox with cover and gasket for each relay.

2.10 SPRINKLER SYSTEM FLOW AND PRESSURE ALARM SWITCHES

A. Provide addressable interface units (AIU's) and associated wiring as required to individually interface the switches to the fire alarm system. AIU's shall be programmed to "latch" upon alarm detection.

2.11 SPRINKLER SYSTEM VALVE TAMPER SWITCHES

A. Provide addressable interface units (AIU's) and associated wiring as required to individually interface the switches to the fire alarm system. AIU's shall be programmed to "latch" upon alarm detection

2.12 MONITORING OF FIRE SUPPRESSION SYSTEMS

A. Provide addressable interface units (AIU's) and associated wiring as required to interface the alarm contacts of the fire suppression system to the fire alarm system. AIU's shall be programmed to "latch" upon alarm detection.

2.13 ALARM NOTIFICATION APPLIANCES

A. General: Equip alarm notification devices for mounting as indicated. Provide terminal blocks for incoming and outgoing system connections

B. Visual-only Alarm units:
1. Strobe lights utilizing high-intensity, clear, optic lens and xenon flash tube. Provide luminaires having their lenses mounted on an aluminum faceplate. Provide the word "FIRE" engraved in minimum 1-inch-high letters displayed on the unit. Orient lettering in accordance with mounting of unit (e.g., lettering for ceiling mounted units shall be horizontal across the lens, lettering for wall mounted units shall be vertical down the lens). Strobe leads shall be factory connected to screw terminals. Provide units with lamps having intensities as indicated on the contract drawings (minimum). Where a strobe unit manufacturer does not produce units with strobe intensities that match those indicated on the contract drawings, units with the next higher intensity above the intensity specified shall be provided. Intensity requirements indicated for each unit shall be met regardless of the viewing angle to the device (e.g., dual rated 15/75 candela strobes shall only be used for 15 candela applications).
2. Synchronized Flash: Units (and their associated notification appliance circuits) shall be arranged to provide a synchronized flash sequence for all visible alarm units throughout the facility.
3. Note that synch circuit modules specified below shall only be used on signal circuits that serve devices that they are approved and listed to serve. Provide additional notification appliance circuits/zones where required to ensure that devices and synch circuit modules produced by different manufacturers are segregated from one another.
4. Visible-Only Alarm Units, Indoor Rated, Wall Mounted: Provide the following, as applicable, or prior approved equal:
   a. Wheelock #RSS-2415W-FR (15cd)
   b. Wheelock #RSS-2430W-FR (30cd)
   c. Wheelock #RSS-2475W-FR (75cd)
   d. Wheelock #RSS-24110W-FR (110cd
5. Visible-Only Alarm Units, Indoor Rated, Ceiling Mounted: Provide the following, as applicable, or prior approved equal:
   a. Wheelock #RSS-2415C-FR (15cd)
   b. Wheelock #RSS-2430C-FR (30cd)
   c. Wheelock #RSS-2475C-FR (75cd)
   d. Wheelock #RSS-24110C-FR (110cd
6. Visible-Only Alarm Units, Outdoor Rated (Weatherproof), Wall Mounted: Provide the following, as applicable, or prior approved equal:
   a. System Sensor #S241575K (15cd) with #WBB-R-1/2T-1/2B backbox.
   b. System Sensor #S2475K (75cd) with #WBB-R-1/2T-1/2B backbox.

c. System Sensor #S24110K (110cd) with #WBB-R-1/2T-1/2B backbox

C. Product Description: NFPA 72, strobe lamp and flasher with red lettered "FIRE" on white lens.

D. Candela rating as indicated on drawings.

E. Synch Circuit Modules for Wheelock Notification Devices: Provide Wheelock #SM-12/24-R, #DSM-12/24-R, or prior approved equal.

F. Synch Circuit Modules for System Sensor Notification Devices: Provide System Sensor #MDL, or prior approved equal.

G. Combination Audible/Visible Alarm Units: Provide factory-combined audible and visible alarm units in a single mounting unit where indicated.
1. Combination Audible/Visible Alarm Units, Indoor Rated, Ceiling Mounted with a Square Red Baffle: Provide the following, as applicable, or prior approved equal
   a. Wheelock #ET70-2415W-FR (15cd) - Provide #SBB backbox for surface mount applications.
   b. Wheelock #ET70-2430W-FR (30cd) - Provide #SBB backbox for surface mount applications.
   c. Wheelock #ET70-2475W-FR (75cd) - Provide #SBB backbox for surface mount applications.
   d. Wheelock #ET70-24110W-FR(110cd)-Provide #SBB backbox for surface mount applications
2. Combination Audible/Visible Alarm Units, Indoor Rated, Ceiling Mounted with a Round White Baffle: Provide the following, as applicable, or prior approved equal:
   a. Wheelock #ET90-2415C-FW (15cd)
   b. Wheelock #ET90-2430C-FW (30cd)
   c. Wheelock #ET90-2475C-FW (75cd)
   d. Wheelock #ET90-24100C-FW (110cd)

H. Synch Circuit Modules: Provide Wheelock #SM-12/24-R, #DSM-12/24-R, or prior approved equal.

I. Audible-only alarm units: Comply with UL 1480, “Speakers for Fire Protective Signaling”.
1. Speakers: Compression-driver type having a frequency response of 400 to 4,000 Hz for fire alarm horn tone and 125 Hz to 12,000 Hz for voice messages. Speakers shall be equipped with an alnico V magnet and a multiple tap, varnish impregnated, sealed matching transformer. Speakers shall be connected for 2 watt tap setting. Minimum output at 2 watt setting shall be 90 dB per UL 1480. Speakers shall be voltage-matched to the signal control panel amplifier output voltage.
2. Audible-Only Alarm Units, Indoor Rated, Ceiling Mounted with a Square Red Baffle: Provide Wheelock #ET70-R or prior approved equal.

3. Audible-Only Alarm Units, Outdoor Rated (Weatherproof) with a Square Red Baffle: Provide Wheelock #ET-1010-R with a Wheelock #WBB-R-1/2T-1/2B backbox or prior approved equal

2.14 DIGITAL ALARM COMMUNICATOR TRANSMITTER (DACT)

A. Provide a digital alarm communicator transmitter that is UL listed for commercial fire reporting in accordance with NFPA 72. Unit shall include a two-line Digital Alarm Communication Transmitter (DACT) for communicating with a central monitoring station. The DACT shall be provided integral with the FVCC; a separate panel shall not be provided. The DACT shall be capable of transmitting all data as specified herein.
   1. Communicator Program: The system shall have a dual telephone line transmission feature. The first line shall be capable of dialing 2 telephone numbers, of 15 digits each using the switched telephone network such that if 2 unsuccessful attempts are made to the first number the system shall automatically switch to the second number and make 2 attempts. If these 2 attempts are unsuccessful the system shall switch between numbers after 2 attempts each, until a successful connection is made or a maximum of 10 tries are attempted. Once 10 unsuccessful attempts are made the system shall stop dialing. Should another event occur which requires a message to be transmitted the dialing process shall be repeated. This line shall be supervised. If the first line is tampered-with or cut-off, the second line shall transmit an alarm to the central station.
   2. Automatic Recall Time: The system shall transmit an Automatic Recall Message using the digital alarm communicating transmitter to test communications, each 24 hours.
   3. Communication Failure Alarm: Should the digital alarm communicating transmitter fail to communicate with the central monitoring station receiver on 3 successive attempts, a trouble condition shall be activated in the FVCC.
   4. Alarm Signals: The system shall be configured to a general alarm signal, and a trouble signal.
   5. Communication Reporting Format: The communicator shall be capable of communicating to a central monitoring station using the Silent Knight 4+2 Extended format and the Contact ID format (Contact ID format shall be utilized for this installation).
   6. Emergency Power Supply: Emergency power for the DACT unit shall be provided from the FVCC emergency power supply system specified above.
   7. Central Station Coordination: Provide system programming and coordination with the central monitoring station as required to establish proper communications and communicate alarm signals.

2.15 RJ-31X TELEPHONE JACKS

A. General: Provide two RJ-31X telephone jacks for connection of DACT unit to telephone lines. Jacks shall be ADI part #MO-RJ31X (ADI phone number 803/754-9289) or equal.

2.16 REMOTE ANNUNCIATOR

A. General: Provide an annunciator panel for the remote annunciation of alarm, supervisory, and trouble conditions. Panel shall be arranged for f;ush mounting. Color of panel and associated trim shall be red unless prior approved by the Architect/Engineer.

B. Alphanumeric Display and System Controls: Arrange to provide the basic interface between human operator and addressable system components, including annunciation, supervision, and control. Provide a display with a minimum of 80 characters, arranged to display alarm, supervisory, and component status messages.

C. Switches: Provide programmable type switches to perform system control functions as specified herein and scheduled on the contract drawings.

D. Keyed Lock-Out Switch: Provide a keyed switch that will lock-out (disable) local operation of accessible switches on the front of the remote annunciator panel. Provide two keys to the Owner.

E. Product Description: Supervised remote annunciator including audible and visual indication of fire alarm by zone, and audible and visual indication of system trouble.

F. Mounting: Factory mounted in flush wall-mounted enclosure.

2.17 SYSTEM INSTRUCTIONS

A. Instructions: Provide typeset, printed, or typewritten instruction cards mounted behind lexan plastic or glass covers in a stainless steel or aluminum frame. Frame shall be painted high-gloss beige. Describe steps to be taken by an operator when a signal is received as well as the functional operation of the system under all conditions: normal, alarm, and trouble. Provide one framed set of instructions adjacent to the FVCC and one adjacent to the remote annunciator panel. Obtain approval for instructions before mounting.

2.18 TAGS

A. Tags for identifying tested components – comply with NFPA 72.

2.19 WIRE

A. THHN in metal raceway.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify products and systems receiving devices are ready for installation.

3.2 INSTALLATION

A. Install system in compliance with codes and standards referenced in Part 1.

B. Backboxes for Fire Alarm System Devices: Install recessed boxes adjacent to structural members where possible and fasten boxes to structural members for added support.

C. Install manual station with operating handle 4 feet feet above floor.

D. Install audible and visual signal devices 80 inches above floor.

E. Install 14 AWG minimum size conductors for fire alarm detection and signal circuit conductors in metal conduit or EMT.

F. Mount end-of-line device in box with last device or separate box adjacent to last device in circuit.

G. Connect conduit and wire to sprinkler flow switches, sprinkler valve tamper switches, system control panels, duct smoke detectors and other system components as required. Obtain fire suppression system shop drawings for coordination with fire suppression system components.

H. Automatic Detector Installation: Conform to NFPA 72.
1. Spot Type Smoke Detectors: Install detectors indicated to be ceiling mounted not less than 4 inches from a side wall to the near edge. Detectors shall be semi-flush mounted on recessed backboxes unless noted or detailed otherwise. Backboxes shall be supported independent of acoustical drop ceilings. On smooth ceilings, install detectors not over 30 feet apart in any direction. Install detectors located on the wall at least 4 inches but not more than 12 inches below the ceiling. Install detectors no closer than 3 feet from air registers unless prior approved by the Architect/Engineer. Provide a cast metal backbox with gasket for detectors indicated to be weatherproof.
2. Duct Smoke Detectors: Mount units in duct work as recommended by the manufacturer and in accordance with NFPA 72 and 90A. Provide all electrical power and control circuits as required to shutdown air handlers and any associated duct heaters.
3. Spot Type Heat Detectors: Install detectors indicated to be ceiling mounted not less than 4 inches from a side wall to the near edge. Detectors shall be semi-flush mounted on recessed backboxes unless noted or detailed otherwise. Backboxes shall be supported independent of acoustical drop ceilings. Install detectors located on the wall at least 4 inches but not more than 12 inches below the ceiling. Install detectors no closer than 3 feet from air registers unless prior approved by the Architect/Engineer. Provide a cast metal backbox with gasket for detectors indicated to be weatherproof.

I. Addressable Interface Units: Provide a cast metal box with gasket and cover for units indicated to be weatherproof. Install units in a NEMA 1 enclosure at locations not indicated to be weatherproof.

J. Isolation Control Relays: Provide a cast metal box with gasket and cover for each unit. Sprinkler System Flow and Pressure Alarm Switches: Provide addressable interface units and associated raceway and wiring as required to monitor each switch. Raceway connections at switches shall be made with liquid-tight flexible metal conduit.

K. Sprinkler System Valve Tamper Switches: Provide addressable interface units and associated raceway and wiring as required to monitor each switch. Raceway connections at switches shall be made with liquid-tight flexible metal conduit.

L. Monitoring of Fire Suppression Systems: Provide addressable interface units and associated raceway and wiring as required to monitor general alarm and/or trouble alarm (as applicable) condition of fire suppression systems.

M. Fire and Voice Command Center Panels: Mount with tops of cabinets not more than 6 feet above the finished floor.

N. Alarm Notification Appliances: Mount as indicated on the contract drawings. Provide supervised wiring of units, zoned as scheduled on the contract drawings. Tap speakers at 2-watt setting. Mount Synch Circuit modules for visible notification appliance circuits in auxiliary FVCC cabinets unless prior approved by the Architect/Engineer

O. Surge Protection Device: Install device either integral with the FVCC cabinets or adjacent to the FVCC cabinets in Nema 1 enclosures. Leads shall be as short as possible.

P. Battery Enclosure: Wall or floor mount on unistrut framing members. Securely fasten enclosure to wall or floor to avoid accidental spillage.

Q. Digital Alarm Communicator Transmitter: Provide telephone line connections from the existing telephone backboard to the DACT as indicated on the contract drawings. Coordinate telephone line requirements with the Owner and telephone utility to ensure that proper telephone lines are used in accordance with NFPA 72 and the DACT manufacturer's requirements. Provide system programming and coordination with the central monitoring station as required to establish proper communications and communicate alarm signals.

R. RJ-31X Telephone Jacks: Mount jacks in one of the FVCC auxiliary cabinets. Provide one 4-pair, #24 AWG, Category 6 communications cable from the existing telephone backboard to each jack in EMT raceway.

S. Remote Annunciator Panel: Mount as indicated on the contract drawings with top of panel at 60" above finished floor.

T. STI Weatherproof Covers: Install covers in accordance with the manufacturer's written instructions. Provide additional gaskets and conduit spacers where required for a proper installation

U. System Instructions: Securely fasten framed system instructions to walls at 60" above finished floor

V. Combination Remote Indicating Light and Test Stations:
1. Ceiling Mounted: Mount stations in a single-gang, recessed, “old-work” type box for stations indicated to be ceiling mounted. Mount station in ceiling as close in proximity to the detector as practical.
2. Wall Mounted: Mount stations in a single-gang, surface raceway type wall box at 48 inches above finished floor. Provide a cast metal backbox with gasket and weatherproof cover for stations indicated to be weatherproof.

W. Ground and bond fire alarm equipment and circuits in accordance with Section 260526.

3.3 WIRING AND RACEWAY INSTALLATION

A. General: Provide raceway and wiring to all equipment and devices indicated on the contract drawings. The contract drawings indicate partial raceway and wiring requirements to help clarify design intent. Where raceway and wiring is not indicated on the drawings for devices or equipment, the arrangement, grouping, and routing of raceway and wiring shall be provided by the contractor in accordance with the National Electrical Code and in accordance with methods outlined in the contract specifications and drawings.

B. Wiring: Provide wiring in accordance with Division 26 specification section "Wires and Cables."

C. Raceways: Install all wiring in metal raceway in accordance with Division 26 specification section "Raceways."

D. Wiring Within Enclosures: Install conductors parallel with or at right angles to the sides and back of the enclosure. Bundle, lace, and train the conductors to terminal points with no excess. Connect conductors associated with the fire alarm system that are terminated, spliced, or interrupted to terminal blocks. Mark each terminal in accordance with the wiring diagrams of the system. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Cable Taps and Splices: Cable taps and splices shall be kept to a minimum and shall only be allowed in addressable signaling line circuits; cable taps and splices shall not be provided in notification appliance circuits (most alarm notification appliances have both incoming and outgoing connection terminals – with proper planning there should be no need to splice a notification appliance circuit). Provide numbered terminal strips in junction boxes, pull boxes, outlet boxes, cabinets, and equipment enclosures where any tap or splice is made. Solder and/or wire nuts shall not be used.

F. Color Coding: Color code all fire alarm conductors differently from the normal building power wiring. Provide one color code for audible notification appliance circuits and a different color code for visible notification appliance circuits. Provide a different color code for signaling line circuits. Paint concealed fire alarm system junction boxes and covers red

3.4 GROUNDING

A. Ground equipment and conductor and cable shields. For audio circuits, minimize to the greatest extent possible ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide ground from main service equipment to FVCC.

3.5 FIELD QUALITY CONTROL

A. Test in accordance with NFPA 72 and OSE requirements.

B. Pretesting: Upon completing installation of the system, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

C. Report of Pretesting: After pretesting is complete, provide a letter certifying the installation is complete and fully operable. The letter shall include the names and titles of the witnesses to the preliminary tests.

D. Final Test Notice: Provide 10 days' minimum notice in writing when the system is ready for final acceptance testing.

E. Minimum System Tests: Test the system in accordance with the procedures outlined in NFPA 72. Minimum required tests are as follows:
   1. Verify the absence of unwanted voltages between circuit conductors and ground.
   2. Verify the control unit is in the normal condition as detailed in the manufacturer's operating and maintenance manual.
   3. Test initiating and indicating circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than 10 percent of the initiating and indicating devices. Proper signal transmission in accordance with class of wiring used shall be observed.
   4. Test each initiating and indicating device for alarm operating and proper response at the control unit. Test smoke detectors with actual products of combustion.
   5. Test the system for all specified functions in accordance with the manufacturer's operating and maintenance manual. Systematically initiate specified functional performance items at each station including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications. Observe all voice audio for routing, clarity, quality, freedom from noise and distortion, and proper volume level.
   6. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the period and in the manner specified.
   7. Retesting: Rectify deficiencies indicated by tests and completely retest work affected by such deficiencies at Contractor's expense. Verify by the system test

that the total system meets the Specifications and complies with applicable standards.

8. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log upon the satisfactory completion of tests

3.6 MANUFACTURER'S FIELD SERVICES

A. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

3.7 WARRANTY SERVICE

A. Warranty Service: Provide maintenance of fire alarm systems and equipment for a period of 12 months commencing with Substantial Completion, using factory-authorized service representatives.

B. Basic Services: Systematic, routine maintenance visits on a monthly basis at times coordinated with the Owner. In addition, respond to service calls within 24 hours of notification of system trouble. Adjust and replace defective parts and components with original manufacturer's replacement parts, components, and supplies.

3.8 COMMISSIONING AND TRAINING

A. Provide the services of a factory-authorized service representative to demonstrate and train Owner's maintenance personnel as specified below.

B. Furnish 8 hours of instruction for four persons, to be conducted at project site with manufacturer's representative. Document date, time and attendees.

C. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system.

D. Schedule training with the Owner in writing at least seven days in advance.

E. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, detector sensitivity setpoints, and controls to suit actual occupied conditions. Provide three 8-hour visits to the site for this purpose.

END OF SECTION 267210

SECTION 311000 - SITE CLEARING

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. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and removing site utilities.
7. Retain subparagraph below if erosion- and sedimentation-control measures are not included in Division 01 Section "Temporary Facilities and Controls."
8. Temporary erosion- and sedimentation-control measures.

B. Related Sections:

1. Division 01 Section "Temporary Facilities and Controls" for temporary utility services, construction and support facilities, security and protection facilities.
2. Division 01 Section "Execution" for field engineering and surveying.

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.

D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably

free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings.

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or videotape.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

F. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

I. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31 Section "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. General: Protect trees and plants remaining on-site according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

C. Locate, identify, disconnect, and seal or cap utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

D. Locate, identify, and disconnect utilities indicated to be abandoned in place.

E. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

F. Excavate for and remove underground utilities indicated to be removed.

3.4 EXISTING UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

E. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches (450 mm) below exposed subgrade.
3. Use only hand methods for grubbing within protection zones.
4. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches (150 mm) in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000

SECTION 312000 - EARTH MOVING

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. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, and plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for concrete slabs-on-grade.
4. Subbase course and base course for asphalt paving.
5. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Sections:
1. Division 01 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities; also for temporary site fencing if not in another Section.
2. Divisions 21, 22, 23, and 26 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet (3 m) in width and more than 30 feet (9 m) in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. (0.76 cu. m) for bulk excavation or 3/4 cu. yd. (0.57 cu. m) for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- (1065-mm-) wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp (103-kW) flywheel power with bucket-curling force of not less than 28,700 lbf (128 kN) and stick-crowd force of not less than 18,400 lbf (82 kN) with extra-long reach boom; measured according to SAE J-1179.
2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp (172-kW) flywheel power and developing a minimum of 47,992-lbf (213.3-kN) breakout force with a general-purpose bare bucket; measured according to SAE J-732.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Geotextiles.
2. Controlled low-strength material, including design mixture.
3. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:

1. Geotextile: 12 by 12 inches (300 by 300 mm).
2. Warning Tape: 12 inches (300 mm) long; of each color.

C. Qualification Data: For qualified testing agency.

D. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 698.

E. Seismic survey report from seismic survey agency.

F. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

G. Co-Permittee Agreement for Storm Water Management: This submittal shall be submitted prior to beginning work.

H. Permits: Contractor shall review the DHEC Storm Water Management and Sediment Control Permit issued for the project and shall comply fully with all requirements.

1.5 QUALITY ASSURANCE

A. Blasting: Not allowed

B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:
1. Seismographic monitoring during blasting operations.

C. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

D. Preexcavation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.

D. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Division 31 Section "Site Clearing," are in place.

E. Do not commence earth moving operations until plant-protection measures specified in Division 01 Section "Temporary Tree and Plant Protection" are in place.

F. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SC, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

1. Liquid Limit: <35
2. Plasticity Index: <20

C. Unsatisfactory Soils: Soil Classification Groups GC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.

J. Sand: ASTM C 33; fine aggregate.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 157 lbf (700 N); ASTM D 4632.
3. Sewn Seam Strength: 142 lbf (630 N); ASTM D 4632.
4. Tear Strength: 56 lbf (250 N); ASTM D 4533.
5. Puncture Strength: 56 lbf (250 N); ASTM D 4833.
6. Apparent Opening Size: No. 40 (0.425-mm) sieve, maximum; ASTM D 4751.
7. Permittivity: 0.5 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf (1100 N); ASTM D 4632.
3. Sewn Seam Strength: 222 lbf (990 N); ASTM D 4632.
4. Tear Strength: 90 lbf (400 N); ASTM D 4533.
5. Puncture Strength: 90 lbf (400 N); ASTM D 4833.
6. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting flowable concrete material produced from the following:

1. Portland Cement: ASTM C 150, Type I.
2. Fly Ash: ASTM C 618, Class C or F.
3. Normal-Weight Aggregate: ASTM C 33, 3/4-inch (19-mm) nominal maximum aggregate size.
4. Foaming Agent: ASTM C 869.
5. Water: ASTM C 94/C 94M.
6. Air-Entraining Admixture: ASTM C 260.

B. Produce low-density, controlled low-strength material with the following physical properties:

1. As-Cast Unit Weight: 30 to 36 lb/cu. ft. (480 to 576 kg/cu. m) at point of placement, when tested according to ASTM C 138/C 138M.
2. Compressive Strength: 80 psi (550 kPa), when tested according to ASTM C 495.

C. Produce conventional-weight, controlled low-strength material with 80-psi (550-kPa) compressive strength when tested according to ASTM C 495.

2.4 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

a. 24 inches (600 mm) outside of concrete forms other than at footings.
b. 12 inches (300 mm) outside of concrete forms at footings.
c. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.

e. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
f. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches (300 mm) each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of

pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
4. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course if necessary. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

E. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

3.8 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes) to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."

D. Backfill voids with satisfactory soil while removing shoring and bracing.

E. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches (300 mm) over the pipe or conduit. Coordinate backfilling with utilities testing.

G. Place and compact final backfill of satisfactory soil to final subgrade elevation.

H. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

I. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.13 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use satisfactory soil material.
4. Under building slabs, use satisfactory soil material.
5. Under footings and foundations, satisfactory soil material.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Refer to geotechnical report included in the specifications. Recommendations in geotechnical report shall govern over section 312000.

B. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers

C. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

D. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 98 percent and the upper one (1) foot of floor slab and footing area compacted to 100 percent of its maximum dry density.
2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 95 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 90 percent in lawn areas and 95 percent under paved areas.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch (25 mm).
2. Walks: Plus or minus 1/2 inch (13 mm).
3. Pavements: Plus or minus 1/2 inch (13 mm).

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.17 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape subbase course and base course to required crown elevations and cross-slope grades.
4. Place subbase course and base course 6 inches (150 mm) or less in compacted thickness in a single layer.
5. Place subbase course and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches (300 mm) wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.18 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.19 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material and maximum lift thickness comply with requirements.
3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

E. Testing agency will test compaction of soils in place according to ASTM D 698, ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937 as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet (30 m) or less of wall length, but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet (46 m) or less of trench length, but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.20 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

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. Section Includes:

1. Soil treatment with termiticide.

1.3 SUBMITTALS

A. Product Data: For each type of termite control product.

1. Include the EPA-Registered Label for termiticide products.

B. Product Certificates: For termite control products, from manufacturer.

C. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:

1. Date and time of application.
2. Moisture content of soil before application.
3. Termiticide brand name and manufacturer.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes used, and rates of application.
6. Areas of application.
7. Water source for application.
8. Polymer Barrier Fittings with Termiticide Application Report: After installation of polymer

D. Warranties: Sample of special warranties.

1.4 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 and who is accredited by manufacturer.

B. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.

C. Source Limitations: Obtain termite control products from single source from single manufacturer.

1.5 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.

B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.6 WARRANTY

A. Soil Treatment 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: Three years from date of Substantial Completion.

1.7 MAINTENANCE SERVICE

A. Continuing Service: Beginning at Substantial Completion, provide 12 months continuing service including monitoring, inspection, and re-treatment for occurrences of termite activity. Provide a standard continuing service agreement. State services, obligations, conditions, terms for agreement period, and terms for future renewal options.

PART 2 - PRODUCTS

2.1 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.

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. BASF Corporation, Agricultural Products; Termidor.
    b. Bayer Environmental Science; Premise 75.
    c. FMC Corporation, Agricultural Products Group; Dragnet FT
    d. Syngenta; Demon TC

2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than three years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.

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

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for 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; around interior column footers, piers, and chimney bases; and 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 321313 - CONCRETE PAVING

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 exterior cement concrete pavement for the following:

1. Pads
2. Walkways.

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for general building applications of concrete.
2. Division 31 Section "Earth Moving" for subgrade preparation, grading, and subbase course.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Samples: 10-lb (4.5-kg) sample of exposed aggregate.

D. Qualification Data: For manufacturer.

E. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

F. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Bonding agent or epoxy adhesive.
5. Joint fillers.

G. Field quality-control test reports.

H. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.

C. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

E. Mockups: Cast mockups of full-size sections of concrete pavement and curb and gutter to demonstrate typical joints, surface finish, texture, color, and standard of workmanship.

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Obtain Architect's approval of mockups before starting construction.
4. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed pavement.
5. Demolish and remove approved mockups from the site when directed by Architect.
6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

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

1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete producer.
d. Concrete pavement subcontractor.

1.6 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

1. Use flexible or curved forms for curves with a radius 100 feet (30.5 m) or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use one of the following cementitious materials, of the same type, brand, and source throughout the Project:

1. Portland Cement: ASTM C 150, Type I/II

a. Fly Ash: ASTM C 618, Class F.
b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, Class 4M, 4S, 1N coarse aggregate, uniformly graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar pavement applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.4 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

1. Available products equal to but not limited to the following:

a. Axim Concrete Technologies; Cimfilm.
b. Burke by Edeco; BurkeFilm.
c. ChemMasters; Spray-Film.
d. Conspec Marketing & Manufacturing Co., Inc.; Aquafilm.
e. Dayton Superior Corporation; Sure Film.
f. Euclid Chemical Company (The); Eucobar.
g. Kaufman Products, Inc.; Vapor Aid.
h. Lambert Corporation; Lambco Skin.
i. L&M Construction Chemicals, Inc.; E-Con.
j. MBT Protection and Repair, ChemRex Inc.; Confilm.
k. Meadows, W. R., Inc.; Sealtight Evapre.
l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
n. Sika Corporation, Inc.; SikaFilm.
o. Symons Corporation; Finishing Aid.
p. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.

E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

1. Available products equal to but not limited to the following:

a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
b. Burke by Edoko; Aqua Resin Cure.
c. ChemMasters; Safe-Cure Clear.
d. Conspec Marketing & Manufacturing Co., Inc.; W.B. Resin Cure.
e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
f. Euclid Chemical Company (The); Kurez DR VOX.
g. Kaufman Products, Inc.; Thinfilm 420.
h. Lambert Corporation; Aqua Kure-Clear.
i. L&M Construction Chemicals, Inc.; L&M Cure R.
j. Meadows, W. R., Inc.; 1100 Clear.
k. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
l. Symons Corporation; Resi-Chem Clear.
m. Tamms Industries Inc.; Horncure WB 30.
n. Unitex; Hydro Cure 309.
o. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

2.5 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to requirements, and as follows:

1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

D. Chemical Surface Retarder: Water-soluble, liquid-set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch (3 to 6 mm).

1. Available products equal to but not limited to the following:

a. Burke by Edeco; True Etch Surface Retarder.
b. ChemMasters; Exposee.
c. Conspec Marketing & Manufacturing Co., Inc.; Delay S.
d. Euclid Chemical Company (The); Surface Retarder S.
e. Kaufman Products, Inc.; Expose.
f. Metalcrete Industries; Surftard.
g. Nox-Crete Products Group, Kinsman Corporation; Crete-Nox TA.
h. Scofield, L. M. Company; Lithotex.
i. Sika Corporation, Inc.; Rugasol-S.
j. Vexcon Chemicals, Inc.; Certi-Vex Envioset.

2.6 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.

B. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 6 percent plus or minus 1.5 percent for 1-inch (25-mm) nominal maximum aggregate size.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture, high-range, water-reducing admixture, high-range, water-reducing and retarding mixture, plasticizing and retarding mixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

E. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements as follows:

1. Fly Ash or Pozzolan: 25 percent.

2. Ground Granulated Blast-Furnace Slag: 50 percent.
3. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

2.7 CONCRETE MIXING

A. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete mixes of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete mixes larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph (5 km/h).
2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch (13 mm) require correction according to requirements in Division 31 Section "Earth Moving."

C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.

1. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
2. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 50 feet (15.25 m), unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch (6-mm) radius. Repeat grooving of

contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
3. Scored Joints: On sidewalk score joints at 10’ o/c unless otherwise indicated on drawings. On sidewalks wider than 10’provide a center line scoring. On curb and gutters and concrete flumes score joints shall be at 10’ o/c.

E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch (6-mm) radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.5 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site.

F. Do not add water to fresh concrete after testing.

G. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

H. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating joint devices.

I. Place concrete in one operation.

J. Screed pavement surfaces with a straightedge and strike off.

K. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

L. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.

M. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.6 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.

3.7 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.8 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:

1. Elevation: 1/4 inch (6 mm).
2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
3. Surface: Gap below 10-foot- (3-m-) long, unleveled straightedge not to exceed 1/4 inch (6 mm).
4. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
5. Joint Width: Plus 1/8 inch (3 mm), no minus.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least 1 composite sample for each 100 cu. yd. (76 cu. m) 5000 sq. ft. (465 sq. m) or fraction thereof of each concrete mix placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.

    a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321400 - UNIT PAVING

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. Pedestrian grade brick pavers set in mortar setting beds.
2. Vehicular grade brick pavers set in sand at alleyway.

B. Related Sections:
1. Section 321313 "Concrete Paving" for concrete base under unit pavers and for cast-in-place concrete curbs and gutters serving as edge restraints for unit pavers.

1.3 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Submit to latex-additive manufacturer, for testing as indicated below, samples of paving materials that will contact or affect mortar and grout that contain latex additives.

1. Use manufacturer's standard test methods to determine whether mortar and grout materials will obtain optimum adhesion with, and will be nonstaining to, installed pavers and other materials constituting paver installation.

1.4 ACTION SUBMITTALS

A. Product Data: For materials other than water and aggregates.

B. Product Data: For the following:

1. Pavers.
2. Mortar and grout materials.

C. Sieve Analyses: For aggregate setting-bed materials, according to ASTM C 136.

D. Samples for Initial Selection: For the following:

1. Each type of unit paver indicated.
2. Joint materials involving color selection.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of unit paver, joint material, and setting material from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

1.7 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Mortar and Grout:

1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F (38 deg C) and higher.

a. When ambient temperature exceeds 100 deg F (38 deg C), or when wind velocity exceeds 8 mph (13 km/h) and ambient temperature exceeds 90 deg F (32 deg C), set pavers within 1 minute of spreading setting-bed mortar.

PART 2 - PRODUCTS

2.1 BRICK PAVERS

A. Regional Materials: Provide brick pavers that have been manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

B. Brick Pavers: Light-traffic paving brick; ASTM C 902, Class SX, Type I Provide brick without frogs or cores in surfaces exposed to view in the completed Work.

1. Manufacturers: Subject to compliance with requirements, provide the Basis of Design product or another equal product by another manufacturer that is similar in appearance

a. Basis of Design: Pine Hall Brick, Pathway Red, Modular.

2. Thickness: 2-1/4 inches (57 mm)
3. Face Size: 3-5/8 by 7-5/8 inches (92 by 194 mm)
4. Color: Medium red

C. Brick Pavers: Heavy vehicular paving brick; ASTM C 1272, Type F, Application PX. Provide brick without frogs or cores in surfaces exposed to view in the completed Work.

1. Manufacturers: Subject to compliance with requirements, provide the Basis of Design product or another equal product by another manufacturer that is similar in appearance

a. Basis of Design: Pine Hall Brick, Pathway Red, Modular.

2. Thickness: 2-3/4 inches (77 mm)
3. Face Size: 4 by 8 inches (102 by 203 mm)
4. Color: Medium red.

D. Efflorescence: Brick shall be rated "not effloresced" when tested according to ASTM C 67.

E. Temporary Protective Coating: Precoat exposed surfaces of brick pavers with a continuous film of a temporary protective coating that is compatible with brick, mortar, and grout products and can be removed without damaging grout or brick. Do not coat unexposed brick surfaces; handle brick to prevent coated surfaces from contacting backs or edges of other units. If, despite these precautions, coating does contact bonding surfaces of brick, remove coating from bonding surfaces before setting brick.

2.2 ACCESSORIES

A. Compressible Foam Filler: Preformed strips complying with ASTM D 1056, Grade 2A1.

2.3 MORTAR SETTING-BED MATERIALS

A. Regional Materials: Provide aggregate, and cement, for mortar that has been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

B. Portland Cement: ASTM C 150, Type I or Type II.

C. Sand: ASTM C 144.

D. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed, and not containing a retarder.

E. Water: Potable.

2.4 GROUT MATERIALS

A. Regional Materials: Provide aggregate and cement for grout that has been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

B. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.

1. Colored Mortar Pigments for Grout: Natural and synthetic iron and chromium oxides, compounded for use in mortar and grout mixes. Use only pigments that have proved, through testing and experience, to be satisfactory for use in portland cement grout.

C. Standard Cement Grout: ANSI A118.6, sanded.

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. Boiardi Products; a QEP company.
b. Bostik, Inc.
c. C-Cure.
d. Custom Building Products.
e. Jamo Inc.
f. Laticrete International, Inc.
g. MAPEI Corporation.
h. Mer-Krete System, ParexLahabra, Inc.
i. ProSpec.
j. Southern Grouts & Mortars, Inc.
k. Summitville Tiles, Inc.
l. TEC, Specialty Construction Brands, Inc.

D. Polymer-Modified Tile Grout: ANSI A118.7, sanded.

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. Boiardi Products; a QEP company.
    b. Bostik, Inc.
    c. C-Cure.
    d. Custom Building Products.
    e. Jamo Inc.
    f. Laticrete International, Inc.
    g. MAPEI Corporation.
    h. ProSpec.
    i. Southern Grouts & Mortars, Inc.
    j. Summitville Tiles, Inc.
    k. TEC, Specialty Construction Brands, Inc.

E. Grout Colors: As selected by Architect from manufacturer's full range.

F. Water: Potable.

2.5 MORTAR AND GROUT MIXES

A. General: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing times, and other procedures needed to produce setting-bed and joint materials of uniform quality and with optimum performance characteristics. Discard mortars and grout if they have reached their initial set before being used.

B. Mortar-Bed Bond Coat: Mix neat cement and latex additive and water to a creamy consistency. Comply with manufacturers recommendations.

C. Portland Cement-Lime Setting-Bed Mortar: Type M complying with ASTM C 270, Proportion Specification.

D. Job-Mixed Portland Cement Grout: Proportion and mix job-mixed portland cement and aggregate grout to match setting-bed mortar except omit hydrated lime and use enough water to produce a pourable mixture. Provide one of the two options below.

1. Pigmented Grout: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1 to 10, by weight.
2. Colored-Aggregate Grout: Produce color required by combining colored aggregates with portland cement of selected color.

E. Packaged Grout Mix: Proportion and mix grout ingredients according to grout manufacturer's written instructions.

2.6 SAND AT VEHICULAR PAVER JOINTS

A. Polymeric Sand: Blend of water-stable polymers, graded aggregates that cures into durable resilient material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 PREPARATION

A. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.

B. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.

C. At vehicular pavers, proof-roll prepared subgrade according to requirements in Section 312000 "Earth Moving" to identify soft pockets and areas of excess yielding. Proceed with unit paver installation only after deficient subgrades have been corrected and are ready to receive subbase base, and base course for unit pavers.

3.3 INSTALLATION, GENERAL

A. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.

B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

D. Handle protective-coated brick pavers to prevent coated surfaces from contacting backs or edges of other units. If, despite these precautions, coating does contact bonding surfaces of brick, remove coating from bonding surfaces before setting brick.

E. Joint Pattern: Running bond with edge trim as indicated on drawings.

F. At Pedestrian Paths and Plazas: Tolerances: Do not exceed 1/32-inch (0.8-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 10 feet (3 mm in 3 m) from level, or indicated slope, for finished surface of paving.

G. At Vehicular Paths: Tolerances: Do not exceed 1/16-inch (1.6-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches (3 mm in 600 mm) and 1/4 inch in 10 feet (6 mm in 3 m) from level, or indicated slope, for finished surface of paving.

H. Expansion and Control Joints: Provide for sealant-filled joints at locations and of widths indicated. Provide compressible foam filler as backing for sealant-filled joints. Install joint filler before setting pavers. Sealant materials and installation are specified in Section 079200 "Joint Sealants."

3.4 MORTAR SETTING-BED APPLICATIONS

A. Saturate concrete subbase with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.

B. Apply mortar-bed bond coat over surface of concrete subbase about 15 minutes before placing mortar bed. Limit area of bond coat to avoid its drying out before placing setting bed. Do not exceed 1/16-inch (1.6-mm) thickness for bond coat.

C. Apply mortar bed over bond coat; spread and screed mortar bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated.

D. Mix and place only that amount of mortar bed that can be covered with pavers before initial set. Before placing pavers, cut back, bevel edge, and remove and discard setting-bed material that has reached initial set.

E. Wet brick pavers before laying if the initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

F. Place pavers before initial set of cement occurs. Immediately before placing pavers on mortar bed, apply uniform 1/16-inch- (1.5-mm-) thick bond coat to mortar bed or to back of each paver with a flat trowel.

G. Tamp or beat pavers with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each paver in a single operation before initial set of mortar; do not return to areas already set or disturb pavers for purposes of realigning finished surfaces or adjusting joints.

H. Spaced Joint Widths: Provide 3/8-inch (10-mm)

I. Grouted Joints: Grout paver joints complying with ANSI A108.10.

J. Grout joints as soon as possible after initial set of setting bed.

1. Force grout into joints, taking care not to smear grout on adjoining surfaces.
2. Clean pavers as grouting progresses by dry brushing or rubbing with dry burlap to remove smears before tooling joints.
3. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

4. If tooling squeezes grout from joints, remove excess grout and smears by dry brushing or rubbing with dry burlap and tool joints again to produce a uniform appearance.

K. Cure grout by maintaining in a damp condition for seven days unless otherwise recommended by grout or liquid-latex manufacturer.

3.5 VEHICULAR PAVER JOINTS

A. Paver joints shall be filled with commercial grade polymeric stabilizing sand. Final setting of brick shall be with a plate compactor taking care to have sufficient material so brick is not damaged. After compacting the masonry sand, the area shall be flushed with water to ensure joints have been filled. Any areas that show gaps in the joints shall be re-compacted and appropriately sweep, misted, or flushed.

3.6 REPAIRING, POINTING, AND CLEANING

A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

B. Pointing: During tooling of joints, enlarge voids or holes and completely fill with grout. Point joints at sealant joints to provide a neat, uniform appearance, properly prepared for sealant application.

C. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.

1. Remove temporary protective coating as recommended by coating manufacturer and as acceptable to paver and grout manufacturers.
2. Do not allow protective coating to enter floor drains. Trap, collect, and remove coating material.

END OF SECTION 321400

SECTION 323119 - DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Decorative steel fences.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For gates. Include plans, elevations, sections, details, and attachments to other work.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Product Test Reports: For decorative metallic-coated-steel tubular picket fences, including finish, indicating compliance with referenced standard.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

   1. Include 10-foot (3-m) length of fence complying with requirements.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 DECORATIVE STEEL FENCES

A. Decorative Steel Fences: Provide the product listed as basis of design product or equal as reviewed by the architect. Fences made from steel tubing, bars, and shapes, hot-dip galvanized.

1. Basis of Design: Style #6 Victorian Hoop Custom Commercial Grade iron fence in custom panel sizes from Iron Fence Shop (www.ironfenceshop.com)

B. Posts: Square steel tubing.

1. Line Posts: 2 by 2 inches (51 by 51 mm) with 1/8-inch (3.2-mm) wall thickness.

C. Post Caps: Formed from steel sheet and hot-dip galvanized after forming

D. Rails:
1. Steel Channel Rails: Steel channels 1-1/2 by 1/2 inch (38 by 13 mm).

E. Pickets: 3/4-inch- (19-mm-) square steel bars.

1. Extend pickets beyond top rail as indicated and cap with metal spear point finial.
2. Picket Spacing: 3.87” clear, maximum.
3. Treillage: Provide iron castings of pattern as specified.

F. Fasteners: Stainless-steel carriage bolts and tamperproof nuts.

G. Fabrication: Assemble fences into sections by welding pickets to rails.

1. Fabricate sections with clips welded to rails for field fastening to posts.
2. Drill posts and clips for fasteners before finishing to maximum extent possible.

H. Finish exposed welds to comply with NOMMA Guideline 1, Finish #4 - good-quality, uniform undressed weld with minimal splatter.

I. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.

1. Hot-dip galvanize posts and rails.
2. Hot-dip galvanize rail and picket assemblies after fabrication.
3. Hot-dip galvanize bar grating infill after fabrication.
4. Hot-dip galvanize custom-design rail and infill assemblies after fabrication.

J. Finish: Powder coating.

2.2 STEEL AND IRON

A. Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Bars (Pickets): Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.

C. Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

D. Bar Grating: NAAMM MBG 531.

1. Bars: Hot-rolled steel strip, ASTM A 1011/A 1011M, Commercial Steel, Type B.
2. Wire Rods: ASTM A 510 (ASTM A 510M).

E. Hot Dipped Galvanized-Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 50 (Grade 340), with G90 (Z275) coating.

F. Castings: Either gray or malleable iron unless otherwise indicated.

1. Gray Iron: ASTM A 48/A 48M, Class 30.
2. Malleable Iron: ASTM A 47/A 47M.

2.3 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.

B. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M and specifically recommended by manufacturer for exterior applications.

2.4 STEEL FINISHES

A. Surface Preparation: Clean surfaces according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

1. After cleaning, apply a conversion coating compatible with the organic coating to be applied over it.

B. Powder Coating: Immediately after cleaning, apply two-coat finish consisting of epoxy primer and TGIC polyester topcoat, with a minimum total dry film thickness of not less than 8 mils (0.20 mm). Comply with coating manufacturer's written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range to be black gloss.

C. Primer Application: Apply zinc-rich epoxy primer immediately after cleaning, to provide a minimum dry film thickness of 2 mils (0.05 mm) per applied coat, to surfaces that are exposed after assembly and installation, and to concealed surfaces.

D. Shop-Painted Finish: Comply with Section 099113 "Exterior Painting."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

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

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

1. Construction layout and field engineering are specified in Section 017300 "Execution."

3.3 DECORATIVE FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Install fences by setting posts as indicated and fastening.

C. Post Excavation: Drill or hand-excavate holes for posts as indicated in existing brick wall. Do not damage existing brick wall.

D. Post Setting: Set posts in existing wall as indicated.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

2. Posts Set into Voids in Brick: Form or core drill holes not less than 3/4 inch (20 mm) larger than outside diagonal dimension of post.

a. Extend posts 12” deep into existing wall as indicated on drawings.
b. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions. Finish and slope top surface of grout to drain water away from post.

END OF SECTION 323119

SECTION 328400 - UNDERGROUND IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. The work covered by this Section consists of furnishing all labor, equipment and materials and performing all operations necessary for installing an automatic irrigation system as shown on the Drawing and/or described by these Specifications. The work includes: preparation and excavation of trenches, installation of irrigation system (including: plastic pipe, fittings and connectors, sprinkler heads, automatic control valves and valve boxes, drip accessories, electric control cable, wiring to controller and required submittals).

1.2 QUALITY ASSURANCE:

A. Subcontract work to a single firm specializing in irrigation systems.

B. Manufacturer Qualifications. Provide underground sprinkler system as a complete unit produced by a single acceptable manufacturer including heads, valves, piping circuits, controls and accessories.

1.3 SUBMITTALS

A. Product Data: Submit three (3) copies (neatly stapled into sets) of manufacturer's catalog cuts, equipment data sheets, or shop drawings for the following products:

1. Sprinkler heads
2. Swing Joints
3. Valves: electric and manual
4. Controller and controller accessories
5. Valve boxes
6. Pipe and pipe fittings
7. Control wire and splice connectors
8. Drip components
9. Solvent, primer and Teflon tape

B. Submit a written proposal including a breakdown of components to be used in the system and a complete description of the scope of work. Include all information of plumbing and/or electrical permits and fees. Also include with the written proposal:

1. A letter(s) from the manufacturer(s) of all major components of the system (sprinklers, electric valves, controllers, and drip components) that a local authorized service center exists. The name and address of that service center shall be included in the letter. The

same letter(s) shall also include the name of the local authorized manufacturer's representative.

PART 2 - PRODUCTS

2.1 SPRINKLER SYSTEM:

A. Manufacturers offering products that may be included in the work include, but are not limited to, the following:

- Rainbird Sprinkler Mfg. Corp. 1-800-247-3782 www.rainbird.com
- Hunter Industries. 1-509-525-7907 www.mprotator.com
- The Toro Company 1-800-664-4740 www.toro.com

2.2 GRAVEL:

A. Material for gravel sump shall be pea gravel or approved equal.

2.3 PLASTIC PIPE AND FITTINGS:

A. The plastic pipe shall be rigid unplasticized PVC class 200 or class 160 (SDR 26), unless otherwise noted on drawings, extruded from virgin parent material. The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, deleterious wrinkles and dents. All plastic pipe shall be manufactured by CertainTeed, Johns-Mansville or approved equal.

B. All plastic pipe fittings shall be schedule 40 PVC and shall be manufactured by the same manufacturer as the plastic pipe.

2.4 SHRUB AND LAWN SPRINKLER HEADS:

A. All full and part circle sprinklers shall be of the fixed spray variety as is specified on the Drawing. These sprinklers shall be of the pop-up type with spring retraction. The body of the sprinkler shall be constructed of Cycolac Material and the sprinkler shall be easily serviced from the Manufacturer's specifications with regard to the diameter of throw and gallonage at a given pressure. Spacing of heads shall not exceed the manufacturer's maximum recommendation.

B. Matched precipitation will be required on all full and part circle sprinklers operation on the same zone.

2.5 PVC SLEEVING:

A. Schedule 40 PVC pipe shall be as noted on the drawings. These sleeves are to be used for proposed irrigation lines. Irrigation sub-contractor shall coordinate installation with General Contractor.

2.6 AUTOMATIC CONTROL VALVES:

A. The remote control valve shall be a normally closed 24 volt A.C. 50/60 cycle solenoid type. Valve pressure rating shall not be less than 150 PSI.

B. The valve body and bonnet shall be constructed of heavy duty glass-filled nylon, diaphragm shall be on nylon reinforced nitrile rubber. Solenoid coil shall be encapsulated in molded epoxy.

C. The valve body shall be activated by a low power, 2.0 watt 24 volt A.C. solenoid. The solenoid plunger shall have a filter to insure positive valve operation.

D. The valve shall have a flow control stem with wheel handle for regulation or shutting off the flow of water and a bleed screw for manual operation without electrically energizing the solenoid coil.

E. The valve construction shall be such as to provide for all internal parts to be removable from the top of the valve without disturbing the valve installation.

2.7 VALVE BOXES:

A. All control valves shall be installed in a valve box in accordance with manufacturer's specifications.

2.8 CONTROL VALVE CABLE:

A. All wiring to be used for connecting the automatic remote control valve to the automatic controllers shall be Type "UF", 14-1 stranded or solid copper, single conduction wire with PVC insulation and bear UL approval for direct underground burial feeder cable. Wire connections to remote control electric valves and splices of wire in the field shall use Pen-Tite wire connectors or approved equal and scaling cement.

2.9 BACKFLOW PREVENTER:

A. Install size as indicated on drawings and as per local codes.

2.10 DRIP IRRIGATION ACCESSORIES:

A. Filter. Provide filter at valve to each drip zone. Provide screen having equivalent of 140-mesh filtration capacity.

B. Pressure Regulator. Incorporate regulator into each drip system if supply pressure exceeds 40 PSI.

C. Closure Caps. Provide in accordance with manufacturer's recommendations.

2.11 AUTOMATIC RAIN SENSOR

A. The rain sensor shall be a micro electronic solid-state type, capable of interrupting the power from the irrigation controller to the valves when rainfall exceeds a preselected setting of 1/8" to 3/4". Device shall be made of corrosion resistant plastic casing.

2.12 AUTOMATIC CONTROLLER:

A. The controller shall be capable of operating 24 V.A.C. electric remote control valves. The controller shall have an active day light with timing accurate to 1 minute per month. (See plan for more specific information).

B. The wall mount type controller cabinet shall be of injection molded high impact plastic which shall resist corrosion and provide for an attractive appearance. The door shall be mated with the other cabinet parts and be made of the same material. The controller shall be wall mounted as shown on the irrigation plan. The controller shall have adequate lightning protection.

PART 3 - EXECUTION

3.1 LAYOUT OF LINES:

A. The water lines will be laid at the locations shown on the plans. The Landscape Contractor shall stake out the location of each run of pipe and all sprinkler heads or valve locations for approval by Landscape Architect prior to digging trench.

B. The lawn irrigation system shall be installed so that it will drain at all points.

C. Install PVC pipe in dry weather when temperature is above 40° F in strict accordance with manufacturer's instructions. Allow joints to cure at least 24 hours at temperature above 40° F (4° C) before testing unless otherwise recommended by manufacturer.

3.2 EXCAVATION AND BACKFILL:

A. Trenches for PVC pipe main lines shall be excavated to sufficient depth of 12" minimum and an unspecified width to permit proper handling and installation of pipe and fittings. Trenches for PVC pipe lateral sprinkler lines shall be excavated to sufficient depth of 12" minimum and an unspecified width to permit proper handling and installation of pipe and fittings.

B. On sodded areas the Landscape Contractor will remove and replace the sod where possible from the trench area to the necessary width and depth required to facilitate his installation.

C. The backfill shall be thoroughly compacted and brought to finish grade, with proper allowance for topsoil. Selected dirt or sand shall be used if soil conditions are rocky. In rocky areas the trenching depth shall be two inches (2'') below normal trench depth to allow for this bedding. The pea gravel fill shall be usedin filling the top 4" above the pipe. The remainder of the backfill shall contain no lumps or rocks larger than three inches (3"). The top six inches (6") of backfill shall be free of rocks over one inch (1") diameter, subsoil or trash.

3.3 PLASTIC PIPE AND FITTINGS:

A. All pipe fittings and valves, etc. shall be installed and joined in accordance with the manufacturer'srecommendations. Interior of pipes shall be kept free from dirt and debris and when pipe laying is not in progress, open ends of pipe shall be closed by approved means.

B. Pipe shall be firmly supported throughout its entire length. Extreme care shall be exercised to prevent low points except at drains so that every section of pipe is placed with positive gravity drainage flow towards a drain valve.

C. Sharp changes in alignment and grade shall be made with appropriate fittings. All elbows, tees and fittings shall be installed with a reaction block bearing against undisturbed soil to prevent breakage or separation of the joint.

3.4 AUTOMATIC CONTROL VALVES:

A. Automatic control valves shall be installed in accordance with the manufacturer's specifications.

3.5 VALVE BOXES:

A. Valve boxes shall be installed on a suitable base of gravel for proper foundation box and easy leveling of box to proper grade and also to provide proper drainage of the box. All valve boxes shall be provided with the proper size extensions, wherever required, to bring the valve boxes level with the finished grade.

3.6 ELECTRICAL INSTALLATION:

A. The Contractor will be required to make connections to the building electrical system as is required for the proper operation of the automatic control system. The entire installation shall fully comply with all local and state laws and ordinances and with all the established codes applicable thereto.

B. All control circuitry, whether electrical or hydraulic, passing through the wall of the building or beneath a sidewalk, road or drive shall be installed in a suitable sleeve; whereas in all other locations they shall be installed in the pipe trench and protected by the pipe whenever possible.

C. The joining of all underground wires shall be by the use of wire nuts covered with Scotch Lok per installation instructions provided by manufacturer.

3.7 CONTROL VALVE CABLE:

A. All control valve cables shall be installed by direct burial at a minimum depth of 12". Where practical the wire shall be installed in same trench as mainline pipe.

B. Extreme care shall be exercised during backfilling of trench to avoid damage and displacement of mainline pipe.

C. Control valve cable shall be fed through conduit from inside the building.

D. Each control valve shall be connected to one station of the controller by a control wire. All of the valves shall be connected to a common ground.

3.8 SPRINKLER HEADS:

A. Sprinkler heads shall be installed as shown on the drawings and in accordance with manufacturer's specifications. The height of each sprinkler head in relation to the finish grade shall be approved by the Landscape Architect.

3.9 INSTALLATION OF DRIP IRRIGATION SYSTEM:

A. Install main lines and valves. Before installing emitter laterals, perform pressure test then flush out sand, plastic shaving and other foreign matter.

B. Emitter Hose. Bury emitter laterals under 3 inches of mulch. Solvent weld each connection in accordance with manufacturer's recommendation to standard weight Schedule 40 PVC fittings and bushings. Install hose in a serpentine manner. When cutting hose, use a shearing tool such as a pipe cutter, knife or shears. Use only manufacturer's recommended tool and procedure when punching hose for emitters.

C. Emitter Heads. Connect emitter on a rigid PVC nipple to PVC drip lateral with a tee or elbow. Attach tubing to barbed fitting and daylight distribution tubing at rootball secured with stake. Add bug cap at end of secured distribution tubing. If necessary after installing emitters and before operating system, open end of drip lateral and flush lines clean. The number of emitters on a line shall not exceed manufacturer's recommendations for that hose or distribution tubing size and length.

3.10 BACKFLOW PREVENTERS: METERS

A. Install backflow preventer in new connection between connection and control valves, as per local codes.

B. Irrigation meter- Contractor shall pay for and install a separate irrigation meter to be utilized for this system. Location as shown on plan.

3.11 FLUSHING:

A. After all new sprinkler piping and risers are in place and connected for a given section, and all necessary work has been completed and prior to installation of sprinkler heads, all control valves shall be opened and a full head of water shall be flushed through the system to remove any foreign material.

3.12 TESTING:

A. Tests shall be made on portions of the line as completed. Final testing, however, shall be made on the entire system. Trenches shall be partially backfilled to prevent displacement of pipes.

B. Pressure test shall be performed to a maximum hydrostatic pressure of 200 PSI based on the elevation of the lowest point in the system and corrected to the elevation of the test gauge. Duration of the pressure test shall be at least one hour.

C. Leakage test shall be performed after satisfactory completion of the pressure test. The leakage test shall be conducted at a hydrostatic pressure of 130 PSI without showing a leakage in excess 7.5 gallons per hour. Extend the leakage test for a period of time necessary to allow inspection, but in no case shall the duration be less than two hours.

D. Remove and replace any defective materials of installations discovered in testing and repeat the test until satisfactory to the Landscape Architect. This work shall be performed at the Landscape Contractor's expense.

E. The tests shall be witnessed by the Landscape Architect.

3.13 AS-BUILT DRAWINGS:

A. After completion of the piping installation, the Landscape Contractor shall furnish a signed "as-built" drawing and a digital drawing in AutoCad 2007 or later showing exact dimensions, depths and locations of all pipe, drains, controls, heads, etc. of sprinkler system.

3.14 MAINTENANCE AND OPERATING INSTRUCTIONS:

A. Provide four (4) hours of instruction for Owner's Representative's personnel upon completion of check/test/start-up/adjust operations. Owner's Representative shall be notified at least one (1) week in advance of check/test/start-up/adjust operations.

B. Upon completion of the irrigation system and in conjunction with application for final payment, submit one Maintenance and Operation Manual. Each Manual shall be a 3-ring binder with:

1. One (1) hard copy and one digital drawing in AutoCad 2007 or later of the "RECORD" drawing of the irrigation system, and
2. One (1) complete set of the "APPROVED" Submittals required in paragraph 1.06 above.
3. One (1) copy of the suggested "SYSTEM OPERATING SCHEDULE" which shall call out the controller program required in order to provide 1.0" of water per week to each planted zone area and 1.5" of water per week to each turf zone area.
4. A typewritten description of the procedures to be followed for proper winterization of the entire system.

C. Contractor shall be responsible for the first year's winterization and subsequent spring start-up procedures and shall perform these operations in the presence of the Owner's Representative's personnel.

3.15 CLEAN-UP:

A. Upon completion of the work and before acceptance and final payment will be made, the Landscape Contractor shall make any necessary repairs, adjustments and corrections to the work as required by the Drawings and Specifications. The Landscape Contractor shall remove from the site all machinery, equipment, surplus and discarded materials, rubbish, temporary structures and all other items not incorporated into the work. The site shall be left in a neat and presentable condition. Any damage to roads buildings, walks, vegetation, utilities or any other item of personal property which is the responsibility of the Landscape Contractor, through accident, negligence or normal usage, shall be satisfactorily repaired or replaced as a requirement for completion of this contract.

3.16 GUARANTEE:

A. For a period of one year from date of final acceptance of the work performed under this Contract, the Landscape Contractor shall promptly furnish, without cost to the Owner, any and all parts and labor which prove defective in material, workmanship, or proper functioning of system.

END OF SECTION

SECTION 329300-LANDSCAPE WORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Work included: Work under this Section includes installation of all trees, shrubs, ground cover, annuals, sod and related work required for completion of the project as shown on the Drawings and specified herein.

1. Included hereunder are the furnishing of all equipment, materials and labor necessary to furnish and/or install soil treatment, sodding, planting and mulching of trees, shrubs and vines, protection, maintenance, guarantee and replacement of plants and all work related to the above as specified.

1.2 QUALITY ASSURANCE:

A. Contract landscape work to a single firm specializing in landscape work.

1.3 SOURCE QUALITY CONTROL:

A. General: Ship landscape materials with certificates of inspection required by governing authorities. Comply with regulations applicable to landscape materials.

B. Do not make substitutions. If specified landscape material is not obtainable, submit proof of non-availability to Landscape Architect, together with proposal for use of equivalent material.

C. Analysis and Standards: Package standard products with manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.

PART 2 - PRODUCTS

2.1 SOIL AMENDMENTS:

A. The Landscape Contractor shall furnish the Landscape Architect soil analysis and reports as performed by the Agricultural Extension Service or commercial testing laboratory for all area to receive planting. The Landscape Contractor shall incorporate necessary additives in proper quantities as recommended in the soil analysis, or as necessary to bring the soils up to acceptable standards. The Landscape Contractor shall include in his bid and shall pay for all tests required.

B. Commercial fertilizer shall be complete slow release fertilizer as specified by soil analysis and shall conform to the applicable state fertilizer laws. Fertilizer shall be uniform in composition,

dry and free-flowing and shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guaranteed analysis. Any fertilizer which becomes caked or otherwise damaged making it unsuitable for use will not be accepted.

C. Fertilizer Tablets or Packets. Fertilizer planting tablets or packets shall contain prolonged-release nitrogen, derived from Urea-formaldehyde. Tablets or packets shall be at least a strength of 16-8-5. The amount of available nitrogen, phosphorus or potash may be increased slightly to meet the standard manufactured products available. This fertilizer shall conform to the applicable state fertilizer laws and shall be delivered to the site in the original unopened containers, each bearing the manufacturer's guaranteed analysis.

D. Herbicide shall be an approved commercial grade pre-emergent herbicide used in soil preparation. The particular type of herbicide shall be certified safe for the plants specified in the Plant List or for the plants around which the herbicide shall be used.

E. Lime shall be ground limestone (Dolomite) containing not less than eighty-five (85) percent of total carbonates and shall be ground to a fineness that fifty (50) percent will pass through a 100-mesh sieve and ninety (90) percent will pass through a 20-mesh sieve. Courser material shall be acceptable provided that specified rates of application are increased proportionally on the basis of quantities passing the 100-mesh sieve.

F. Compost shall be a domestic product consisting of partially decomposed vegetable matter of natural occurrence. It shall be brown, clean, and low in content of mineral and woody materials, mildly acid and granulated or shredded.

G. Ammonium nitrate shall be a commercially available agricultural chemical and shall be furnished under the manufacturer's guaranteed statement of analysis giving percentage of active ingredients.

H. Water. The Owner shall supply, at no expense, an adequate supply of water to meet the needs of this Contract. The contractor shall furnish all necessary hose, equipment, attachments and accessories for the adequate irrigation of planted areas as may be required to complete the work as specified.

2.3 STAKING:

A. Material for Staking and Guying:

1. Material for staking and guying must be 2 1/2" x 2 1/2" x 8' long solid oak stake.

2. Wire for fastening trees to stakes shall be No. 10 gauge pliable, galvanized iron. All wires to be placed with brightly colored uniform flagging for easy sighting.

3. Hose to encase wire used for fastening trees to stakes shall be new or used two-ply reinforced rubber garden hose, black or green in color. Only one color shall be used throughout the project.

2.4 GRASSING

A. Sod shall be well-rooted, at least 98% Centipede completely free of noxious weeds and grasses. It shall be mowed to a height not to exceed 2" before lifting and shall be of uniform thickness, with not over 1-1/4" or less than 1" of soil and shall be approved by the Landscape Architect before planting.

B. Sprigs shall be healthy living stems (stolons or rhizomes) with attached roots, harvested without adhering soil and obtained from approved sources where sod is heavy and thickly matted. The presence of Johnson grass, Nutgrass or other objectionable grasses, weeds, or other detrimental materials will be cause for rejection. Not more than 24 hours shall elapse between harvesting and planting of sprigs, except that when weather or other uncontrollable conditions interrupt the work, a time extension may be granted, providing sprigs are still moist and viable. Sprigs that have heated in stockpiles, become frozen, allowed to become dry or otherwise seriously damaged will be rejected and shall be disposed of as directed by the Landscape Architect.

C. Grass seed shall be clean, new-crop seed complying with tolerance for purity and germination established by Official Seed Analysts of North America. Provide seed mixtures composed of grass species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed, as specified. Seed shall conform to all State laws and requirements and regulations of the SC Department of Agriculture. The Owner reserves the right to test, reject, or approve all seed.

2.5 MULCH:

A. Shredded and double hammered Hardwood Mulch shall be fresh, clean, and free from sticks and debris.

B. Samples of materials as listed below shall be submitted for inspection, on the site or as otherwise determined by the Landscape Architect. Upon approval of samples by the Landscape Architect, delivery of materials may begin.

MATERIALS	SAMPLE
Shredded and Double Hammered Hardwood Mulch	1 Gallon
Plants	1 of each
Sod	1 Roll

Typical samples shall be furnished from each separate source of supply. Approved samples shall be stored on the site and protected until furnishing of materials is complete. Plant samples may be planted in permanent positions, but labeled as samples.

2.6 PLANT MATERIALS (See Plant List):

A. Nomenclature. The names of plants required under this Contract conform to those given in Standardized Plant Names, 1942 Edition, prepared by the American Joint Committee on Horticultural Nomenclature. Names of varieties not included therein conform generally with names accepted in the nursery trade.

B. Quantities. Provide quantities necessary to complete the planting as shown on the drawings. Contractor must check quantities and differences shall be brought to the attention of the Landscape Architect.

C. Quality and Size. Plants shall have a habit of growth that is normal for the species and shall be sound, healthy, vigorous and free from insect pests, plant diseases and injuries. All plants shall equal or exceed the measurements specified in the Plant List which are minimum acceptable sizes. They shall be measured before pruning with branches in normal position. Any necessary pruning shall be done at the time of planting. Requirements for the measurement, branching, grading, quality, balling and burlapping of plants in the Plant List generally follow or exceed the Code of Standards currently recommended by the American Association of Nurserymen, Inc. in the American Standard for Nursery Stock.

D. Substitutions will be permitted after Award of Contract only upon submission of proof in writing that a plant is not obtainable and authorization by the Landscape Architect for use of the nearest equivalent obtainable size or variety of plant having the same essential characteristics. Should this substitution result in the use of a smaller or less valuable plant, a change order will be issued with an equitable adjustment in contract price.

E. Type of Protection to Roots:

1. Balled and Burlapped Plants. Plants shall be balled and burlapped unless otherwise noted on the Drawings. They shall be dug with firm, natural balls of earth of sufficient diameter and depth to encompass the fibrous and feeding root system necessary for full recovery of the plant and of minimum sizes shown on the Plant List. Balls shall be firmly wrapped with untreated burlap or similar material and bound with twine, cord or wire mesh. Where necessary to prevent breaking or cracking of the ball during the process of planting, the ball may be secured to a platform.

2. Container-grown plants designated in the Plant List shall have been grown in a container such as pots, cans, tubs or boxes and have sufficient roots to hold earth together intact after removal without being root bound. Container size shall be in proportion to plant size and in accordance with AAN Standards. The Landscape Architect shall have the option to

reject container-grown material if the growing media is too porous to hold adequate water for the plant's survival without watering more than once a week.

F. Protection after Delivery. The balls of plants which cannot be planted immediately upon delivery shall be covered with moist soil or mulch or provided with other protection from drying winds and sun. All plants shall be watered as necessary until planted.

PART 3 - EXECUTION

3.1 PLANTING METHODS:

A. Time of Planting. Planting operations shall be conducted under favorable weather conditions preferably during the period from October 1 to April 1. The Landscape Contractor has the option and assumes full responsibility for planting during unseasonable conditions. Trees should be dug and heeled in or in container and placed in a well watered holding area provided by the nursery or Landscape Contractor until the time of planting. Landscape Contractor to be responsible for the welfare of the tree until project is completed, when the owner will assume responsibility.

B. Plants to Remain. The Landscape Contractor shall take all necessary precautions to preserve and protect all existing plants that are to remain on the site. This shall include, but is not limited to, hand excavation of planting pits in close proximity to existing shrubs or within the spread of branches of larger trees, watering of existing materials adjacent to plant pits, trimming or pruning to permit installation of new plants or to repair damaged existing plants.

C. Obstructions Below Ground or Overhead:

1. It is not contemplated that planting shall be done where the depth of soil over underground construction, obstructions or rock, is insufficient to accommodate the roots or where pockets in rock or impervious soil will require drainage. Where such conditions are encountered in excavation of planting areas and where the stone, boulders or other obstructions cannot be broken and removed by hand methods in the course of digging plant pits of the usual size and where trees to be planted are found to be under overhead wires, other locations for the planting may be designated by the Landscape Architect.

2. Removal of rock or other underground obstruction, relocation of construction and provisions of drainage for planting areas shall be done only as directed by the Landscape Architect.

3. Should the Landscape Contractor encounter unsatisfactory surface or subsurface drainage conditions, soil depth, latent soils, hard pan, steam or other utility lines or any other conditions that will jeopardize the health and vigor of the plantings, he must advise the Landscape Architect in writing of the conditions prior to installing the plants. Otherwise, the

Landscape Contractor warrants that the planting areas are suitable for proper growth and development of the plants to be installed.

D. Lawns

1. See Planting Plans for location of areas to be sodded.

2. Fine Grading Areas to be sodded shall be brought to within the thickness of the sod of the finished grade. Allowance for settlement shall be made. Fine grading for all areas will be performed by the Landscape Contractor prior to any planting or sodding.

3. Soil Improvements:

   a. Ground limestone shall be applied at the rate recommended by the testing laboratory.

   b. Fertilizer shall be applied at the rate recommended by the testing laboratory.

   c. Application. Limestone shall be thoroughly mixed into the topsoil and as far ahead of sodding as possible, to prevent interfering with other grading operations.

E. Laying of Sod

1. Before any sod is laid, all soft spots and inequalities in grade shall be corrected. Fertilizer spread shall be raked in. Sod shall be laid so that no voids occur, tamped or rolled and then watered thoroughly. The completed sodded surface shall be true to finished grade, even and firm at all points.

2. Sod on slopes steeper than 2 1/2 to 1 shall be held in place by wooden pins about 1" square and about 6" long, driven through the sod into the soil until they are flush with the top of the sod or by other approved methods for holding the sod in place. Stakes shall be spaced along the center-line of a strip of sod at intervals of approximately 3'.

3. During dry periods, sod must be watered as it is laid.

F. Seeding

1. Areas to be seeded shall be uniform and shall conform to the finished grade as shown on the plans. The seedbed shall be loosened to a miniumum depth of 3 inches before agricultural lime, fertilizer or seed is applied. Areas to be seeded shall be cleared of stones larger than 2.5 inches in any dimension, roots and other debris. At areas to be grassed where the existing seed bed has little or no topsoil, the Contractor shall furnish and place topsoil in order to ensure a good stand of grass.

2. Lime and/or fertilizer shall be spread uniformly over the designated areas and shall be thoroughly mixed with the soil to a depth of 2 inches. Lime and fertilizer shall be applied at the rate specified by the soil test report. Lime and fertilizer may be applied by approved mechanical spreaders or by hydraulic methods as a mix of fertilizer and seed.

3. Within 24 hours following the covering of the seed, straw or hay mulch material shall be spread at the rate of 2 tons per acre. Mulch shall be held in place by an approved tacking agent applied at the manufacturer's recommended rate. Hydroseeding may be performed using 1500 pounds per acre wood, cellulose, or a wood/cellulose mix hydroseeding mulch with the manufacuturer's recommended rate of an approved tacking agent.

4. The Contractor shall obtain a satisfactory stand of perennial vegetation whose root system shall be developed sufficiently to survive dry periods and winter weather, and be capable of re-establishment in the spring. The perennial vegetative cover shall have a minimum coverage density of 70% for the seeded areas.

G. New Plantings:

1. Layout. New planting shall be located where shown on the Drawings except where obstructions below ground or overhead are encountered or where changes have been made in the construction. Necessary adjustments shall be made only after approval by the Landscape Architect. No planting, with the exception of ground cover, espalier plants and hedge, shall be placed closer than 2' to pavement or structures. The Landscape Contractor shall be responsible for staking and layout of plantings on this project. The Landscape Architect shall be advised when stakes are in place and ready for inspection on various planting areas. All layout work shall be inspected and approved by the Landscape Architect prior to opening any plant pits.

2. Planting Pits. Reasonable care shall be exercised to have pits dug and soil prepared prior to moving plants to their respective locations for planting to insure that they will not be unnecessarily exposed to drying elements or to physical damage. However, no open holes shall be left overnight or unmarked or unattended.

   a. Circular pits with vertical sides shall be excavated for all plants in beds or trenches. See Planting Plan for more detailed information regarding preparation of planting areas. Diameter of pits for trees and shrubs shall be at least 2'greater than the diameter of the ball or spread of roots. The depth of pits for trees, shrubs and vines shall be enough to accommodate the ball or roots when the plant is set to finished grade allowing for 6" of compacted topsoil or prepared soil in the bottom of the pit.

   b. Before planting any area, fill a representative sample of the excavated planting pits and beds with water to a depth 6" or more as required to verify if the subsoil is permeable enough to percolate satisfactorily and drain adequately after plants are in-

stalled. Advise the Landscape Architect in writing if any problems are anticipated regarding excessive ground water or unsuitable percolation.

H. Soil Preparation for Planting Trees and Shrubs:

1. Soil used in planting shall be existing soil and/or re-spread topsoil. The prepared soil mix in tree pits as herein before specified shall be thoroughly mixed with one part compost to three parts of existing soil.

2. Fertilizer tablets or packets shall be placed in each tree or shrub plant pit at a depth of 6" to 8" when the plant is set in place. The exact quantity and distribution of tablets or packets shall be in strict accordance with the manufacturer's recommendation for the sizes of material specified.

3. Excess excavated soil shall be disposed of off site by the Landscape Contractor unless specific permission is obtained from the owner to dispose of excess material on the site.

I. Soil Preparation for Planting Ground Cover and Annuals:

1. Loosen subgrade of lawn areas to a minimum depth of 6". Remove stones over 1 1/2" in any dimension, sticks, roots, rubbish, and other extraneous matter. Limit preparation to areas which will be planted promptly after preparation.

2. Soil used in planting shall be existing soil as herein before specified and shall be thoroughly mixed with one part compost to three parts of existing soil.

3. Add specified soil amendments as per soil analysis and mix thoroughly into upper 4" of topsoil.

4. Excess excavated soil shall be disposed of off site by the Landscape Contractor unless specific permission is obtained from the Owner to dispose of excess material on the site.

J. Setting Plants. Unless otherwise specified, all plants shall be planted in pits, centered and set on 6" of compacted soil or prepared soil to such a depth that the finished grade level at the plant after settlement will be the same as that at which the plant was grown. Prior to setting container-grown plants, make four to five cuts 1/2" - 1" deep, top to bottom on root-bound mass to loosen roots. Plants shall be planted upright and faced to give the best appearance or relationship to adjacent structures. No burlap shall be pulled out from under balls. Plant forms, wires and surplus binding from top and sides of the balls shall be removed. All broken or frayed roots shall be cut off cleanly. Prepared soil shall be placed and compacted carefully to avoid injury to roots and to fill all voids. When the hole is nearly filled, add water as necessary and allow it to soak away. Fill the holes to finished grade. After the ground settles, additional soil shall be filled in, to the level of the finished grade.

K. Guying and Staking. Trees shall be supported immediately after planting. All trees shall be staked as detailed and shown on the Plans. Wires shall be encased in hose to prevent direct contact with the bark of the tree and shall be placed around the trunk in a single loop. Wires shall be tightened and kept taut by the use of turnbuckles. Stakes shall be equally spaced about each tree and shall be driven vertically into the ground to a depth of about 2' in such a manner as not to injure the ball or roots. Trees shall be fastened to each stake at a height where substantial branching will hold encased wire in place. Wire shall be doubled and twisted taut. Stakes shall be uniform in length and placed according to the type, size and location of the tree.

L. Herbicide Treatment. All tree saucers, shrub and ground cover beds shall be treated after plants have been installed with an approved pre-emergent herbicide recommended by the manufacturer. Plants installed during the fall planting season shall be treated with the approved herbicide during the first week of April of the following year. Plants installed in the spring shall be treated with the approved herbicide immediately after installation. Herbicide shall be cleared by the manufacturer as safe for use around plants itemized in the Plant List.

M. Shredded Hardwood Mulching. Tree and shrub beds shall be mulched with 3" of shredded hardwood mulch. This mulch shall cover the entire bed area and shall have a neat and well-defined edge between lawn area and shrub bed. Trees in lawn areas with individual saucers shall be mulched with 3" of shredded hardwood mulch.

N. Pruning and Repair. All pruning and repair work must be completed within a ten day period after planting. The amount of pruning included under the work of this Section shall be limited to the minimum necessary to remove dead or injured twigs and branches and to compensate for the loss of roots as a result of transplanting operations.

1. Trees and some shrubs will be pruned back after planting to maintain a balance between the reduced root system and the branches. Care will be taken in this work to insure that the plants preserve their natural form.

2. The natural form of newly planted trees and shrubs will be preserved in pruning by the removal of branches and/or part of branches at different lengths in accord with standard horticulture practices and as directed by the Landscape Architect. Pruning will always be done with a clean cut in living wood without bruising or tearing of bark and without leaving any stubs which would prevent the wound from healing over. Horizontal cuts may cause rot and will be avoided.

3.2 CLEAN-UP:

A. Clean-up. Any soil, bark, peat or similar material which has been brought onto paved areas within or outside the construction area by hauling operations or otherwise shall be removed promptly, keeping these areas clean at all times. Upon completion of the planting, all excess soil, stones and debris which have not been cleaned up shall be removed from the site or disposed of as directed by the Landscape Architect. All planting areas shall be prepared for final inspection.

B. Other Work. The Landscape Contractor shall be responsible for the repair of any damage caused by his activities or those of his subcontractors within or outside the construction area such as the storage of topsoil or other materials, operation of equipment and other usage. Such repair operations shall include any regrading, sodding or other work necessary to restore damaged work or areas to an acceptable condition.

3.3 MAINTENANCE:

A. Maintenance shall begin immediately following the last operation of installation for each portion for each plant and shall continue until installation of planting is complete and the planting is formally accepted. Maintenance shall include mowing, watering, weeding, cultivating, mulching, tightening and repairing of guys, removal of dead material, resetting plants to proper grades or upright positions, restoration of the planting saucer and other necessary operations. Any damage resulting from planting operations shall be repaired promptly.

B. The Owner shall be responsible for all required maintenance after the planting is formally accepted (final acceptance).

C. Maintenance Instructions - Landscape Work. The Landscape Contractor shall submit to the Owner three (3) copies of typewritten instructions recommending the monthly procedures to be established by Owner for the maintenance of landscape work during the one-year guarantee period. Submit prior to the final inspection for acceptance.

3.4 INSPECTION FOR ACCEPTANCE:

A. Inspection of the work of this Section to determine completion of the Landscape Contractor's work, exclusive of the possible guarantee replacement of plants, shall be made by the Landscape Architect upon receipt of written notice requesting such inspection submitted by the Landscape Contractor at least ten (10) days prior to the anticipated date of inspection.

B. Acceptance. After inspection, the Landscape Contractor will be notified in writing by the Landscape Architect of acceptance of all work of this Section, exclusive of the possible replacement of plants subject to guarantee or the Landscape Contractor will be notified in writing if there are any deficiencies from the requirements for completion of the work. Replacements, maintenance and repair work remaining to be done shall be subject to re-inspection before acceptance.

3.5 PLANT GUARANTEE AND REPLACEMENT:

A. Guarantee. This guarantee shall be provided to the owner by the contractor responsible for planting and irrigation. Plants shall be guaranteed for the duration of one (1) full year after the formal acceptance of the planting by the Owner and shall be alive and in satisfactory growth at the end of the guarantee period. The Owner shall be responsible for all maintenance necessary to keep the plants alive and healthy between the time the plantings are accepted and the end of the

guarantee period. The basic needs of the plants during this period are for adequate water and protection from insects and other similar pests. Plants severely damaged by vandals are not subject to replacement by this Landscape Contractor.

B. Sodded lawn areas are not subject to a one year guarantee.

C. Should the Landscape Contractor find the plant material is not receiving the proper maintenance at any time prior to the end of the guarantee period, he should advise the Landscape Architect and the Owner immediately in writing so corrective measures may be initiated.

D. Replacement. At the end of the guarantee period, inspection will be made by the Owner and the Landscape Architect upon written notice requesting such inspection submitted by the Landscape Contractor at least ten (10) days prior to the anticipated date. Any plant installed under this Contract that is dead or not satisfactory in growth as determined by the Landscape Architect shall be removed from the site. These, and any plants missing due to the Landscape Contractor's negligence, shall be replaced as soon as conditions permit but during the normal planting season.

1. Any plant that has die-back or otherwise loses 30% or more of its branches, excluding branches removed by trimming and pruning, as existing and living prior to removal from the nursery field shall be rejected. In case of any question, the Landscape Contractor may elect to allow such plant to remain through another complete growing season at which time the rejected plant, if found to be dead or in an unhealthy or badly impaired condition, shall be replaced.

2. The Landscape Contractor shall be responsible for removing dead or diseased plants from the site during the guarantee period upon notification by the Owner or Landscape Architect. Dead plants may be removed by the Owner during the guarantee period provided they keep a photographic record of all plants removed. Photographs should show plant to such a degree that is clearly evident the plant is dead. Replacements shall be made only at the end of the guarantee period as described herein.

3. The Landscape Architect shall inspect replaced plants when all replacements have been made. Any plant that is not alive and in a healthy vigorous condition shall be replaced again by the Landscape Contractor.

E. Materials and Operations. All replacements shall be plants of the same kind and size as specified in the Plant List. They shall be furnished and planted as specified under "New Planting", the cost of which shall be borne by the Landscape Contractor.

F. Replaced plants are not subject to a full one (1) year guarantee, but replacements must be alive and vigorous when inspected after planting and must leaf out fully in spring, if replacements are made while the plant is dormant.

END OF SECTION

SECTION 334100 - STORM UTILITY DRAINAGE 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 and fittings.
2. Manholes.
3. Stormwater structures.
4. Pipe outlets.

1.3 SUBMITTALS

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

B. Shop Drawings:

1. Manholes: Include plans, elevations, sections, details, frames, and covers.
2. Stormwater Structures: Include plans, elevations, sections, details, frames, and grates.

C. Field quality-control reports.

D. Record Drawings: The Contractor shall furnish to the Architect/Engineer Record Drawings of the storm drainage system. This information shall be presented electronically using the electronic file of the Grading and Utilities Plan Sheets. Marked-up Construction Document drawings are not acceptable. Record Drawings shall include, but not limited to, the following:

1. All pipe invert elevations, all rims, throats and grate elevations of structures, lengths of pipe between storm drainage structures, pipe sizes and materials. Also so included shall be an as-built topo of the detention pond and outlet structure.
2. Record Drawings shall contain all necessary certifications and shall be prepared for the seal and signature of the Registered Professional Engineer of record for the project.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect pipe, pipe fittings, and seals from dirt and damage.

B. Handle stormwater structures according to manufacturer's written rigging instructions.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage 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 no fewer than two days in advance of proposed interruption of service.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Material as specified at Contractor option unless indicated otherwise.

2.2 PE PIPE AND FITTINGS

A. Corrugated PE Drainage Pipe and Fittings NPS 3 to NPS 10 (DN 80 to DN 250): AASHTO M 252M, Type S, with smooth waterway for coupling joints.

1. Silt tight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
2. Soil tight Couplings: AASHTO M 252M, corrugated, matching tube and fittings.

B. Corrugated PE Pipe and Fittings NPS 12 to NPS 60 (DN 300 to DN 1500): AASHTO M 294M, Type S, with smooth waterway for coupling joints.

1. Silt tight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.
2. Soil tight Couplings: AASHTO M 294M, corrugated, matching pipe and fittings.

2.3 PVC PIPE AND FITTINGS

A. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

2.4 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76 (ASTM C 76M).

1. Bell-and-spigot or tongue-and-groove ends and gasketed joints with ASTM C 443 (ASTM C 443M), rubber gaskets sealant joints with ASTM C 990 (ASTM C 990M), bitumen or butyl-rubber sealant.

2. Class III, Wall B

2.5 MANHOLES

A. Standard Precast Concrete Manholes:

1. Description: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches (1200 mm) minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 4-inch (102-mm) minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
9. Steps: ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches (1500 mm).
10. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (102-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: ASTM A 48/A 48M, Class 35 gray iron unless otherwise indicated.

2.6 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Downspout Boots:

1. Description: Manufactured, ASTM A 48/A 48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 outlet; and shop-applied bituminous coating.
2. Size: Inlet size to match downspout and NPS 4 outlet.

2.7 STORMWATER STRUCTURES

A. Standard Precast Concrete Stormwater Structures:

1. Description: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
3. Riser Sections: 4-inch (102-mm) minimum thickness, 48-inch (1200-mm) diameter, and lengths to provide depth indicated.
4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
5. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
6. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch (150- to 225-mm) total thickness, that match 24-inch- (610-mm-) diameter frame and grate.
8. Steps: ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 60 inches (1500 mm).

B. Frames and Grates: See Plans

C. Brick Structures:

1. Base, Channel and Bench: Concrete.
2. Wall: Clay or shale brick ASTM C 32, grade MS, or cement brick ASTM C 55, grade SII (2-3/4” x 3-3/4” x 7-3/4”+-) 8-inches minimum thickness. Thickness of section of wall deeper than 12-feet shall be 12-inches minimum.
3. Mortar and Parging: ASTM C 270, Type S, using ASTM C 150, Type II Portland cement, ½-inch minimum thickness on exterior surface.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING and BOOT INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install downspout boots at grade with top 6 inches above grade. Secure to building wall.

G. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install PE corrugated sewer piping according to ASTM D 2321.
3. Install PVC profile gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
4. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:
1. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
2. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
3. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints or with Plastic Joint Sealing Compound in accordance with FS SS-S-210. Installation of sealing compounds shall follow the recommendation of the particular manufacturer in regard to special installation requirements. Surfaces to

receive lubricants, primers, or adhesives shall be dry and clean. Sealing compounds shall be affixed to the pipe not more than three hours prior to installation of the pipe and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Sealing compounds shall be inspected before installation of the pipe and any loose or improperly affixed sealing compound shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pulled together. If, while making the joint with mastic-type sealant, a slight protrusion of the material is not visible along the entire inner and outer circumference of the joint when the joint is pulled-up, the pipe shall be removed and the joint remade. After the joint is made, all inner protrusions will be cut off flush with the inner surface of the pipe. In nonmastic-type sealant material is used, the “squeeze-out” requirement above shall be waived.

4. Join dissimilar pipe materials with nonpressure-type flexible couplings.
5. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."

3.4 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches (76 mm) above finished surface elsewhere unless otherwise indicated.

3.5 STORMWATER STRUCTURE INSTALLATION

A. Construct structure to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.6 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.7 IDENTIFICATION

A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.8 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

    a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
    b. Option: Test plastic piping according to ASTM F 1417.
    c. Option: Test concrete piping according to ASTM C 924 (ASTM C 924M).

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.9 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with water.

END OF SECTION 334100

USC's Asbestos and Lead Paint Abatement
Appendix A

University of South Carolina
School of Journalism Broadcast Studio

The Asbestos and Lead Paint Survey and Abatement Documents included in this Appendix A has been produced by:

F&ME Consultants
3112 Devine Street
Columbia, SC 29250
(803) 254-4540

F&ME has produced these documents directly for USC, hired by and as a consultant to USC.

F&ME is not a consultant to The Boudreaux Group nor has contractual relationship with The Boudreaux Group for the work described in this Appendix A. As such, The Boudreaux Group does not take responsibility for or liability for the work described in the scope of this Appendix A. **These documents are ONLY being bound with the Project Manual for the Bidders' convenience upon USC's request.**

State Permanent Improvement Project No. H27-6099-MJ

October 1, 2014

Contents of Appendix A:

1. Specification Section 02080 - Asbestos Abatement
2. Asbestos Containing Materials Investigation Report
3. Lead-Based Paint Investigation Report
4. USC Lead Management Plan

SECTION 02080 - ASBESTOS ABATEMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Documents affecting work of this Section include, but are not necessarily limited to, abatement design drawing AB-1 and the asbestos investigation report developed by F&ME Consultants (dated 9/25/14) located in the appendix of these specifications. Please note that the F&ME report contains analytical results provided by USC HAZMAT personnel (dated 7/29/14).

1.2 ASBESTOS ABATEMENT CONTRACTOR QUALIFICATIONS:

A. Asbestos Abatement Contractor's Qualifications:

1. A qualified firm that has not less than five (5) years' experience in the removal and proper disposal of asbestos-containing materials (ACM).

1.3 SCOPE OF WORK – SUMMARY

A. The scope of work for the asbestos abatement generally includes the removal and proper disposal of asbestos-containing materials (ACM) within the project limits as indicated on the provided drawings and referenced in these specifications.

B. Abatement Contractor (Contractor) will be required to coordinate with the General Contractor (GC) regarding all abatement activities associated with the project included herein.

C. Contractor and GC shall coordinate general demolition activities that will not impact ACM within the building with those that will either require or potentially impact ACM.

D. GC and Contractor are to be aware that components with lead-based paint (LBP) are associated with the subject building structure. See herein for additional information.

E. Prior to commencement of abatement activities, Contractor shall submit required documents as outlined herein.

F. Contractor shall remove ACM utilizing work practices outlined by the USEPA's and the SCDHEC's regulations.

G. The Contractor shall refer to abatement plans for locations and limits of abatement activities.

H. Contractor shall thoroughly clean areas where abatement activities are to occur prior to establishing containment or performing abatement work.

I. In the event of a fiber release (airborne or amended water), Contractor will follow procedures as outlined in Section 3.2, part A of these specifications.

J. The Contractor shall be responsible for verification of all ACM quantities.

K. Estimated quantities of ACM to be removed and/or impacted during the abatement operations shall include the following:

1. TSI elbows (Est. 21 L.F.)
2. Exterior caulking associated with exterior brick base of the greenhouse window system (Est. 120 L.F.)
3. Interior window caulking (Est. 120 L.F.)
4. Corrugated Transite heat shield panels (Est. 400 S.F.)
5. Transite boards (140 S.F.)
6. Gray exterior greenhouse window glazing (Est. 1,875 L.F.)
7. Mudding material associated with fiberglass expansion tank (Est. 12 S.F.)

1.4 ABATEMENT ACTIVITIES

The following is a summary of the scope of abatement activities required during the abatement operations. More detailed information regarding materials, execution, etc. are provided in other sections herein and abatement plan AB-1.

The Contractor shall remove the following materials from the greenhouse and associated brick structure:

A. *TSI elbows* – Contractor shall remove the ACM elbows utilizing either acceptable non-friable methods of wetting, wrapping, and cutting the pipe in place, or utilizing acceptable glove bag technique. Upon completion of the removal, Contractor shall dispose of all ACM TSI and associated contaminated materials as ACM.

B. *Exterior caulking* – Contractor shall remove the ACM exterior caulking associated with exterior brick greenhouse window system and the windows and doors associated with the brick structure utilizing proper exterior non-friable removal methods and dispose of as ACM.

C. *Interior white window glazing* – Contractor shall remove ACM interior white window glazing associated with the windows of the brick structure utilizing acceptable non-friable removal methods and dispose of as ACM.

D. *Corrugated Transite heat shield panels* – Contractor shall remove ACM corrugated Transite heat shield panels utilizing acceptable non-friable or friable removal and disposal methods. Contractor shall note that the panels are attached to support framing. If during the use of non-friable removal methods the panels are rendered friable, Contractor shall finish removal under full friable containment. Contractor shall dispose of all ACM corrugated Transite heat shield panels and associated contaminated materials (i.e. screws/ nails) as ACM.

E. *Transite board* – Contractor shall remove ACM Transite board utilizing acceptable non-friable removal and disposal method. Contractor shall note that the Transite boards are fastened to the non-suspect wood table tops with nails. If the integrity of the ACM Transite board cannot be maintained during the removal of the nails, then the Contractor shall use acceptable friable methods of removal under full friable containment. Contractor shall dispose of all ACM Transite board and associated contaminated materials (i.e. screws/ nails) as ACM.

F. *Gray exterior greenhouse window glazing* – The entire greenhouse window system contains ACM window glazing, to include the exterior and interior glass walls as well as the glass roof. Contractor shall remove ACM gray exterior greenhouse window glazing utilizing acceptable non-friable exterior removal and disposal methods.

G. *Mud associated with expansion tank fiber glass insulation* – An expansion tank insulated with fiberglass and an ACM mud material is located inside the brick structure. Contractor shall remove the ACM mud material and associated fiberglass insulation utilizing acceptable friable methods. This material is in significantly damaged, friable condition. Contractor shall wet wipe and HEPA vacuum all surfaces immediately adjacent to the expansion tank prior to the start of any abatement activities.

1.5 LEAD-BASED PAINTED MATERIALS SUMMARY

A. All ACM abatement activities that impact building components coated with LBP shall only be performed by personnel who are properly trained in lead awareness.

C. If ACM abatement activities will impact LBP, Contractor shall utilize means and methods that take in to account and meet all regulatory requirements for worker protection (OSHA) and proper disposal (SCDHEC) of LBP paint chips or dust that are generated. Precautions shall be employed to capture dust/ debris from all areas within and adjoining the work area should ACM abatement activities impact identified LBP.

D. Materials and building components coated with lead-based paint have been identified by USC HAZMAT personnel associated with both the interior and the exterior of the subject structure, to include the following:

1. Metal door casing(s)

2. Exterior wood fascia boards

1.6 CONTRACTOR'S DUTIES – SUMMARY

A. The Contractor is to provide and pay for the following, except as specifically noted:

1. Labor, material, tools, required equipment (i.e. scaffolding, *etc.*) and machinery.

2. Other facilities and services necessary for proper execution and completion of Work.

3. Pay legally required sales, consumer and use taxes.

B. Contractor will absorb costs for the following:

1. Permits

2. Government fees

3. Licenses

C. Contractor shall provide notifications to appropriate entities based on applicable regulations.

D. Contractor shall comply with codes, ordinances, rules, regulations, orders, and other legal requirements of public authorities which bear on performance of Work.

E. Contractor shall enforce strict discipline and good order among employees. Do not employ on Work, on Project or Work Site:

1. Unfit persons.

2. Persons not skilled in assigned task.

1.7 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS

Pub #4545	(1994) OSHA Analytical Methods Manual

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z9.2	(1979; R 1991) Fundamentals Governing the Design and Operation of Local Exhaust Systems
ANSI Z87.1	(1989; Errata; Z87.1a) Occupational and Educational Eye and Face Protection
ANSI Z88.2	(1992) Respiratory Protection

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 1368	(1990) Visual Inspection of Asbestos Abatement Projects

CODE OF FEDERAL REGULATIONS (CFR)

CFR 29 Part 1910	Occupational Safety and Health Standards
CFR 29 Part 1926	Safety and Health Regulations for Construction
CFR 40 Part 61	National Emission Standards for Hazardous Air Pollutants
CFR 40 Part 763	Asbestos

ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 340/1-90-018	(1990) Asbestos/NESHAP Regulated Asbestos Containing Materials Guidance
EPA 340/1-90-019	(1990) Asbestos/NESHAP Adequately Wet Guidance

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH Pub No. 84-100	(1984; Supple 1985, 1987, 1988 & 1990)
NIOSH	Manual of Analytical Methods

UNDERWRITERS LABORATORIES (UL)

UL 586	(1990) High-Efficiency, Particulate, Air Filter Units

1.8 DEFINITIONS

A. Adequately Wet

1. A term as defined in CFR 40 Part 61, Subpart M and EPA 340/1-90-019 that means to sufficiently mix or penetrate with liquid to prevent the release of particulates. If visible emissions are observed coming from asbestos-containing material (ACM), then that material has not been adequately wetted. However, the absence of visible emissions is not sufficient evidence of being adequately wetted.

B. Aggressive Method

1. Removal or disturbance of building material by sanding, abrading, grinding, or other method that breaks, crumbles, or disintegrates intact ACM.

C. Amended Water

1. Water containing a wetting agent or surfactant with a surface tension of at least 29 dynes per square centimeter when tested in accordance with ASTM D 1331.

D. Asbestos

1. Asbestos includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophylite asbestos, actinolite asbestos, and any of these minerals that have been chemically treated and/or altered.

E. Asbestos-Containing Construction Material (OSHA):

1. Any manufactured construction material that contains more than one tenth of one percent asbestos by weight.

F. Asbestos-Containing Material (ACM)

1. Any material containing more than one percent asbestos

G. Asbestos Regulated Work Area

1. An asbestos regulated work area is an area established by the Contractor to demarcate areas where Class I, II and III asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work accumulate; and a work area within which airborne concentrations of asbestos exceed or there is a reasonable possibility they may exceed the permissible exposure limit.

H. Authorized Person

1. Any person certified and authorized by the Contractor, Owners Representative and/or Owner and required by work duties to be present in regulated areas.

I. Category I Non-friable ACM

1. A term as defined in CFR 40 Part 61, Subpart M and EPA 340/1-90-018 that means asbestos-containing packing, gaskets, resilient floor covering, and asphalt roofing products containing more than 1 percent asbestos as determined using the method

specified in CFR 40 Part 763, Appendix A, Subpart F, Section 1, Polarized Light Microscopy.

J. Category II Non-friable ACM

1. A term as defined in CFR 40 Part 61, Subpart M and EPA 340/1-90-018 that means any material, excluding Category I Non-friable ACM, containing more than 1 percent asbestos as determined using the methods specified in Appendix A, Subpart F, CFR 40 Part 763, Section 1, Polarized Light Microscopy, that when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

K. Class I Asbestos Work

1. Activities that involve the removal of thermal system insulation (TSI) and surfacing ACM.

L. Class II Asbestos Work

1. Abatement activities involving the removal of ACM, which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastic.

M. Competent Person

1. In addition to the definition in CFR 29 1926.32 (f), one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, and who has the authority to take prompt corrective measures to eliminate them.

N. Critical Barrier

1. One or more layers of 6-mil plastic sealed over all openings into a work area or any other similarly placed physical barrier sufficient to prevent airborne asbestos in a work area from migrating to an adjacent area.

O. Disturbance

1. Contact, which releases fibers from ACM or debris containing ACM. This term includes activities that disrupt the matrix of ACM, render ACM friable, or generate visible debris. Disturbance includes cutting away small amounts of ACM no greater than the amount that can be contained in one standard sized glove bag or waste bag in order to access a building component. In no event shall the amount of ACM so disturbed exceed that which can be contained in one glove bag or waste bag which shall not exceed 60 inches in length and width.

P. Friable ACM

1. A term as defined in CFR 40 Part 61, Subpart M and EPA 340/1-90-018 that means any material containing more than 1 percent asbestos as determined using the method specified in CFR 40 Part 763, Appendix A, Subpart F, Section 1, Polarized Light Microscopy, that when dry, can be crumbled, pulverized, or reduced to powder by

hand pressure. If the asbestos content is less than 10 percent as determined by a method other than point counting by polarized light microscopy (PLM), verify the asbestos content by point counting using PLM.

Q. Glove Bag

1. A term as defined by CFR 29 Part 1926.1101 that means a sealed compartment with attached inner gloves used for the handling of asbestos containing materials.

R. Intact

1. ACM which has not crumbled, been pulverized, or otherwise deteriorated so that it is no longer likely to be bound with its matrix.

S. Negative Initial Exposure Assessment

1. A demonstration by the Contractor that employee exposure during an operation is expected to be consistently below the PELs (TWA and Excursion Limit).

T. Non-friable ACM

1. A term as defined in CFR 40 Part 61, Subpart M and EPA 340/1-90-018 that means any material containing more than 1 percent asbestos as determined using the method specified in CFR 40 Part 763, Appendix A, Subpart F, Section 1, Polarized Light Microscopy, that, when dry, cannot be crumbled, pulverized or reduced to powder by hand pressure.

U. Permanent Barrier, Vertical

1. A permanent leak-tight enclosure constructed of metal studs and sheetrock. The permanent barrier walls shall be constructed as detailed herein and shall be air tight and non-combustible.

V. Time-Weighted Average (TWA)

1. The TWA is an 8-hour time weighted average of airborne concentration of fibers (longer than 5 micrometers) per cubic centimeter of air which represents the employee's 8-hour workday as determined by Appendix A of CFR 29 Part 1926, Section 1926.58.

1.9 DESCRIPTION OF WORK

A. The work covered by this section includes the requirements for the removal, transportation, disposal, storage, containment of, and housekeeping activities involving asbestos-containing materials and asbestos-contaminated materials associated with the USC greenhouse and associated brick structure. CFR 40 Part 763 governs this abatement work.

1.10 SECURITY

A. Security shall be provided for each asbestos regulated work area. A logbook shall be kept documenting entry into and out of the asbestos regulated work area. Entry into asbestos regulated work areas shall only be by personnel authorized by the Abatement Contractor, Owners Representative and Owner. Personnel authorized to enter asbestos regulated work

areas shall be trained, medically evaluated and wear the personal protective equipment, as required by this specification, for the specific asbestos regulated work area to be entered.

1.11 MEDICAL REQUIREMENTS

A. Medical requirements shall conform to CFR 29 Part 1926, Section 1926.58.

1. Medical Examinations

a. The Contractor shall provide medical examinations for all workers who may encounter an airborne fiber level of 0.1 f/cc or greater for an 8 hour time weighted average. In the absence of specific airborne fiber data provide medical examination for all workers who will enter the work area for any reason. Examination shall as a minimum meet OSHA requirements as set forth in 29 CFR 1926.1101(m) and, in addition, provide an evaluation of the individuals' ability to work in environments capable of producing heat stress in the worker.

2. Medical and Exposure Records

a. The Contractor shall maintain complete and accurate records of employees' medical examinations for a period of 30 years after termination of employment as required by 29 CFR 1926.1101(n) and make records of the required medical examinations available for inspection and copying to: The Assistant Secretary for Occupational Safety and Health, The Director of The National Institute for Occupational Safety and Health (NIOSH), authorized representatives of either of them, and an employee's physician upon the request of the employee or former employee.

1.12 TRAINING

A. All Contractor personnel involved with asbestos work must be trained and tested prior to any work, and shall be thoroughly familiar with the Contractor's standard operating procedure for the abatement work. All personnel shall undergo the specific medical examinations required by OSHA. The superintendent and the foreman shall be thoroughly familiar with all applicable regulations and practices for asbestos work and shall have participated in at least two abatement projects of similar size and scope within the past two years. All personnel shall be in possession of valid respirator fit test Paperwork.

1.13 RESPIRATORY PROTECTION PROGRAM

A. The Contractor shall establish in writing, and implement a respiratory protection program in accordance with CFR 29 Part 1926, Section 1926.58, CFR 29 Part 1910, Section 1910.134, ANSI Z88.2, CGA G-7 and CGA G-7.1. The Contractor shall establish minimum respiratory protection requirements based on measured or anticipated levels of airborne asbestos fiber concentrations encountered during the performance of the asbestos abatement work. The Contractor’s respiratory protection program shall include, but not be limited to, the following elements:

1. The company policy, used for the assignment of individual responsibility, accountability, and implementation of the respiratory protection program.

2. The standard operating procedures covering the selection and use of respirators. Respiratory selection shall be determined by the hazard to which the worker is exposed.

3. Medical evaluation of each user to verify that the worker may be assigned to an activity where respiratory protection is required.

4. Training in the proper use and limitations of respirators.

5. Respirator fit testing (i.e., quantitative, qualitative and individual functional fit checks).

6. Regular cleaning and disinfection of respirators.

7. Routine inspection of respirators during cleaning and after each use when designated for emergency use.

8. Storage of respirators in convenient, clean, and sanitary locations.

9. Surveillance of work area conditions and degree of employee exposure (e.g., through air monitoring).

10. Regular evaluation of the continued effectiveness of the respiratory protection program.

11. Recognition and procedures for the resolution of special problems as they affect respirator use (e.g., no facial hair that comes between the respirator face piece and face or interferes with valve function; prescription eyewear usage; prohibition of wearing contact lenses; etc.).

12. Proper training in putting on and removing respirators.

1.14 HAZARD COMMUNICATION PROGRAM

A. A hazard communication program shall be established and implemented in accordance with CFR 29 Part 1926, Section 1926.59.

1.15 SAFETY AND HEALTH COMPLIANCE

A. In addition to detailed requirements of this specification, the work shall comply with applicable laws, ordinances, criteria, rules, and regulations of Federal, state, regional, and local authorities regarding handling, storing, transporting, and disposing of asbestos waste materials and with the applicable requirements of CFR 29 Part 1910, CFR 29 Part 1926, CFR 40 Part 61, Subpart A, and CFR 40 Part 61, Subpart M, NFPA 10, NFPA 70, NFPA 90A, NFPA 101. Matters of interpretation of standards shall be submitted to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, rules, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirement as defined by the Owner shall apply.

1.16 COMPETENT PERSON

A. When the contractor has employees engaged in Class I or II asbestos work, he shall have a Competent Person performing or supervising the following duties, as applicable:

1. Set up the regulated area, enclosure, or other containment;

2. Ensure (by on-site inspection) the integrity of the enclosure or containment;

3. Set up procedures to control entry to and exit from the enclosure and/or area;

4. Supervise all employee exposure monitoring and ensure that it is conducted as required;

5. Ensure that employees working within the enclosure and/or using glove bags wear protective clothing and respirators as required.

6. Ensure through on-site supervision that employees set up and remove engineering controls, use work practices and personal protective equipment in compliance within all requirements;

7. Ensure that employees use the hygiene facilities and observe the decontamination procedures specified;

8. Ensure through on-site inspections that engineering controls are functioning properly and employees are using proper work practices; and,

9. Ensure notification of other employees on site.

1.17 PERMITS, LICENSES AND NOTIFICATIONS

A. The Contractor shall obtain all necessary permits and licenses in conjunction with the project asbestos abatement, transportation and disposal actions and timely notification furnished of such actions required by Federal, state, regional, and local authorities and as otherwise specified herein. The Contractor shall notify the SCDHEC and the Owner in writing at least 10 days prior to the commencement of work in accordance with CFR 40 Part 61, Subpart M, state and local requirements to include the mandatory “Notification of Demolition and Renovation Record” form and other required notification documents. Notification shall be by Certified Mail - Return Receipt Requested. The Contractor shall furnish copies of the receipts to the Owner prior to the commencement of work.

B. The Contractor shall notify the Owner if any of the following occur:

1. If the Contractor or any of its subcontractors are served with notice of violation of any law, regulation, permit or license which relates to this Contract.

2. Proceedings are commenced which could lead to revocation of related permits or licenses.

3. Permits, licenses or other Owner authorizations relating to this Contract are revoked.

4. Litigation is commenced which would affect this Contract.

5. If the Contractor or any of its Subcontractors become aware that its equipment or facilities are not in compliance or may fail to comply in the future with applicable laws or regulations.

1.18 SUBMITTALS

A. The following shall be submitted to the Owner and/or the Owner's Representative **prior to the start of abatement operations**:

1. Manufacturer's catalog data

a. Manufacturer's catalog data for all materials and equipment to be used in the work, including brand name, model, capacity, performance characteristics and any other pertinent information.

2. Asbestos Abatement Work Plan

a. A written Asbestos Abatement Work Plan outlining the project sequencing, methods, etc. must be accepted in writing by the Owners' Representative prior to start of any site work.

3. Safety Plan

a. A written safety plan and comprehensive site-specific accident prevention plan at least 30 days prior to start of work. This plan must be accepted in writing by the Owners' Representative prior to start of any site work.

4. Employee Training and Certification of Worker Acknowledgement

a. Contractor shall submit the following training documentation for each employee to be engaged in the abatement work

i. Copy of certification of accreditation for completion of "workers" course (for workers) or "Contractor/Supervisor" Course (for Contractors and onsite supervisory staff) meeting the requirements of EPA's CFR 40 Part 763 or more stringent state criteria, and all subsequent annual refresher training certificates meeting same requirements.

ii. A copy of a Contractor generated form entitled Certificate of Workers Acknowledgment shall be completed for each employee.

5. Notifications

a. The Owner shall be notified in writing 10 days prior to the start of asbestos work. A copy of the written notification shall be provided to any rental company concerning the intended use of rental equipment and the possibility of asbestos contamination, the decontamination procedures that will be used prior to the return of the equipment. A copy of the rental company's written acknowledgment and agreement shall be included in the submittal.

6. Certificates

a. Vacuum, Filtration and Ventilation Equipment

b. Manufacturer's certifications showing compliance with ANSI Z9.2 for:

i. Vacuums

ii. Water filtration equipment

iii. Ventilation equipment

iv. Other equipment required for containing airborne asbestos fibers.

B. The following shall be submitted to the Owner and/or the Owner's Representative **during or following abatement operations**:

1. Initial Exposure Assessment

a. The Contractor shall ensure that a "competent person" conducts an initial exposure assessment immediately before or at the initiation of all operations to determine expected exposures. The assessment must be based on the competent person's review of all aspects of the Contractor's performance doing similar jobs. Only if similar controls are used and the work supervised by the same or similarly trained personnel, may past data be relied on. The assessment shall include consideration of all observations, information or calculations that indicate employee exposure to asbestos, including any previous monitoring conducted in the workplace, or of the operations of the Contractor that indicate the levels of airborne asbestos likely to be encountered on the job. However, the assessment may conclude that exposures are likely to be consistently below the PELs only as a conclusion of a "negative exposure assessment". The Contractor shall monitor employees at the beginning of the project. The exposure assessment shall be updated to reflect actual conditions based on the results of exposure monitoring.

2. Encapsulant

a. A certificate stating that encapsulant meets the applicable specified performance requirements.

3. Negative Exposure Assessment

a. Using a Negative Exposure Assessment, the Contractor may demonstrate that employee exposures will be below the PELs by data, which conform to the following criteria:

i. Objective data demonstrating that the product or material containing asbestos minerals or the activity involving such product or material cannot release airborne fibers in concentrations exceeding the TWA and excursion limit under those work conditions having the greatest potential for releasing asbestos; or

ii. Where the Contractor has monitored prior asbestos jobs for the PEL and the excursion limit within 12 months of the current or projected job, the monitoring and analysis were performed in compliance with CFR 29 Part 1926.1101; and the data were obtained during work operations conducted under workplace conditions "closely resembling" the processes, type of material, control methods, work practices, and environmental conditions used and prevailing in the Contractor's current operations, the operations were conducted by employees whose training and experience were no more extensive than that of employees performing the current job, and these data

show that under the conditions prevailing and which will prevail in the current workplace there is a high degree of certainty that employee exposures will not exceed the TWA and excursion limit; or

iii. The results of initial exposure monitoring of the current job made from breathing zone samples that are representative of the 8-hour TWA and 30-minute short-term exposures of each employee covering the operations that are most likely during the performance of the entire asbestos job to result in exposures over the PELs.

4. Field Tests

   a. Air sampling reports.

   b. Pressure differential recording local exhaust system.

   c. Asbestos disposal waste disposal record report.

5. Air Sampling Results

   a. Area Air Sampling (supplied by the Owner) and Personnel Air Sampling (provided by the Contractor)

   b. Air sample fiber counting shall be completed and results provided within 24 hours after completion of a sampling period. The Owner shall be notified immediately of any airborne levels of asbestos fibers in excess of established requirements. Written sampling results shall be provided within 5 working days of the date of collection. The air sampling results shall be documented on a daily air-monitoring log.

6. Pressure Differential Recordings

   a. Pressure differential recordings shall be provided daily on the same day collected. The Contractor's competent person shall review the readings prior to being submitted. The Owner shall be notified immediately of any variance in the pressure differential which could cause adjacent unsealed areas to have asbestos fiber concentrations in excess of 0.010 fibers per cubic centimeter (f/cc) or background, whichever is higher.

7. Records

   a. Respirator Program

      i. Records of the respirator program as required by ANSI Z88.2, CFR 29 Part 1910, Section 1910.134, CFR 29 Part 1926, Section 1926.58.

   b. Asbestos Waste Shipment

      i. Final completed copies of the Waste Shipment Record for all shipments of waste material as specified in CFR 40 Part 61, Subpart M and other required state waste manifest shipment records as specified herein. Detailed information of all asbestos waste disposals on the "MANDATORY WASTE

SHIPMENT RECORD" form in accordance with revised CFR 40 Part 61, Subpart M. Such completed forms signed and dated by the agent of the landfill shall be submitted within 3 days after date of delivery of ACM to the landfill.

1.19 PERSONAL PROTECTIVE EQUIPMENT

A. Respirators

Respiratory protection shall be worn by all individuals inside the work area from the initiation of the asbestos project until all areas have successfully passed clearance air monitoring:

1. Respirator Selection:

a. Where respirators are used, the Contractor shall select and provide, at no cost to the employee, the appropriate respirator, and shall ensure that the employee uses the respirator provided.

b. The Contractor shall select respirators from among those jointly approved as being acceptable for protection by the Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR 11.

c. The Contractor shall provide a tight fitting powered, air-purifying respirator in lieu of any negative-pressure respirator specified whenever:

1. An employee chooses to use this type of respirator, and

2. This respirator will provide adequate protection to the employee.

B. Respirator Program:

1. Where respiratory protection is used, the Contractor shall institute a respirator program in accordance with CFR 29 Part 1910.134. The Contractor shall permit each employee who uses a filter respirator to change the filter elements whenever an increase in breathing resistance is detected and shall maintain an adequate supply of filter elements for this purpose.

2. Employees who wear respirators shall be permitted to leave work areas to wash their faces and respirator face pieces whenever necessary to prevent skin irritation associated with respirator use.

C. Respirator Fit Testing:

1. The Contractor shall ensure that the respirator issued to the employee exhibits the least possible face piece leakage and that the respirator is fitted properly. The Contractor shall perform either quantitative or qualitative face fit tests at the time of initial fitting and at least every 6 months thereafter for each employee wearing a negative-pressure respirator. The qualitative fit tests may be used only for testing the fit of half-mask respirators where they are permitted to be worn or of full-face piece air purifying respirators where they are worn at levels at which half-face piece air purifying

respirators are permitted. A qualitative or quantitative fit test conforming to CFR 29 Part 1926, Appendix C shall be conducted by the Contractor for each Contractor worker required to wear a respirator, and for the Owner and authorized visitors who enter an asbestos regulated work area where respirators are required to be worn.

D. Whole Body Protection

1. Personnel exposed to asbestos shall be provided with whole body protection, as specified herein and such protection shall be worn properly. The Contractor and competent person supervisor shall select and approve the whole body protection to be used. The competent person shall examine work suits worn by employees at least once per work shift for rips or tears that may occur during performance of work. When rips or tears are detected while an employee is working, rips and tears shall be immediately mended, or the work suit shall be immediately replaced. Disposable whole body protection shall be disposed of as asbestos contaminated waste upon exiting from the asbestos regulated work area. Reusable whole body protection worn shall be either disposed of as asbestos contaminated waste upon exiting from the asbestos regulated work area or be properly laundered in accordance with CFR 29 Part 1926 and as specified in the Contractor's Asbestos Hazard Abatement Plan. A worker shall not remove asbestos abatement whole body protection from the work site to be cleaned.

2. Disposable-impermeable coveralls with a zipper front shall be provided. Sleeves shall be secured at the wrists, and foot coverings secured at the ankles.

3. Gloves shall be provided to protect hands. Cloth gloves may be worn inside the plastic or rubber gloves for comfort, but shall not be used alone. Where there is the potential for hand injuries (i.e., scrapes, punctures, cuts, etc.) an appropriate glove shall be provided and used.

4. An additional coverall similar to that required in paragraph Coveralls shall be provided when the abatement and control method employed does not provide for the exit from the asbestos regulated work area directly into an attached decontamination unit. Cloth work clothes shall be provided for wear under the protective coverall and foot coverings when work is being conducted in low temperature conditions. Cloth work clothes shall be either disposed of as asbestos contaminated material or properly laundered in accordance with CFR 29 Part 1926 and as specified in the Contractor's Asbestos Hazard Abatement Plan.

5. Cloth socks shall be provided and worn next to the skin. If rubber boots are not used, footwear and disposable foot coverings shall be provided. Rubber boots shall be used in moist or wet areas. Only rubber boots shall be removed from the asbestos regulated work area after being thoroughly decontaminated. All other protective foot covering shall be disposed of as ACM.

6. Hood type disposable head covering shall be provided. In addition, protective headgear (hard hats) shall be provided as required. Hard hats shall only be removed from the asbestos regulated work area after being thoroughly decontaminated.

7. Contact lenses shall not be worn in asbestos regulated work areas. When vision correction is necessary to perform the work task, prescription safety eyewear shall be used. Personnel engaged in asbestos abatement activities in the asbestos regulated

work area shall wear fog-proof goggles when the use of a full face-piece respirator is not required. Eye protection provided shall be in accordance with ANSI Z87.1.

8. All other items of whole body protection shall be provided as required and approved by the Contractor.

1.20 DECONTAMINATION UNIT AND LOAD OUT UNIT

A. Contractor shall take into account emergency egress issues related to the entire building when completing his abatement work plan. Decontamination and load out units will be sized, constructed and located so as to not impede ingress and egress to and from other portions of the building where abatement is not occurring.

B. Decontamination and load out units shall be the sized, constructed and located so as to not impede the access to ACM to be abated. If access to ACM above the decontamination and load out units require abatement personnel to utilize them to gain access (i.e. get on top of the units) to the ACM, they shall be constructed meeting all OSHA safety guidelines.

C. Provide each work area with separate personnel decontamination unit and equipment load out unit. Ensure that the decontamination unit is the only means of ingress and egress for the work area and that all equipment, bagged waste material and other material exit the work area only through the decontamination unit and equipment load out unit.

D. All persons entering and exiting the work area will follow the entry and exit procedures required by the applicable regulations and these specifications. Process all equipment and material exiting the work area through the decontamination unit and equipment load out unit and decontaminate as required by the specifications.

E. Construct walls and ceilings of decontamination unit and equipment load out unit airtight with at least 6 mil polyethylene sheeting and attach to existing building components or to a temporary framework. The decontamination unit and equipment load out unit may be combined if the size of the work area will not permit both.

F. Use a minimum of two layers of 6-mil opaque polyethylene to cover floor under decontamination unit. Construct doors from overlapping polyethylene sheets so that they overlap adjacent surfaces. Weight sheets at bottom so that they quickly close after release. Put arrows on sheets showing direction of overlap and travel.

G. Provide temporary water service connection to the decontamination unit and equipment load out unit. Provide backflow protection at the point of connection to the Owner's system.

H. Water supply must be properly pressured and temperature balanced at shower discharge.

I. Provide adequate temporary electric power with ground fault protection and overhead wiring throughout the decontamination unit and equipment load out unit. Provide a sub-panel for all temporary power in changing room.

J. Provide a decontamination unit consisting of serial arrangement of clean room, showers room and equipment room. Provide adequately sized decontamination unit to accommodate the number of employees scheduled for the project. The center chamber of the three chamber decontamination unit will be fitted with as many portable walk through shower stalls as necessary so that all employees will be able to go through the entire decontamination

procedure within 15 minutes. Construct decontamination unit of opaque or colored polyethylene for privacy. Construct decontamination unit so that it will not allow for parallel routes of exit without showering

1.21 WARNING SIGNS AND TAPE

A. Contractor shall ensure that all personnel understand the warning signs. Warning signs and tape printed in English and Spanish shall be provided at the regulated boundaries and entrances to asbestos regulated work areas. Signs shall be located at such a distance that personnel may read the sign and take the necessary protective steps required before entering the area. Warning signs shall be in vertical format conforming to CFR 29 Part 1910, and CFR 29 Part 1926, minimum 500 by 360 mm 20 by 14 inches and displaying the following legend in the lower panel:

B. Legend Lettering

1. Danger 3-inch Sans Serif Gothic or Block
2. Asbestos 1-inch Sans Serif Gothic or Block
3. Cancer and Lung Disease Hazard 1-inch Sans Serif Gothic or Block
4. Authorized Personnel Only 1-inch Sans Serif Gothic or Block
5. Authorized Personnel Only 1-inch Gothic
6. Respirators and Protective Clothing are required in this Area 1-inch Gothic
7. Spacing between lines shall be at least equal to the height of the upper of any two lines. Warning tape shall be provided

1.22 WARNING LABELS

A. Warning labels shall be affixed to all asbestos disposal containers used to contain asbestos materials, scrap, waste debris, and other products contaminated with asbestos. Containers with preprinted warning labels conforming to requirements specified herein are acceptable. Warning labels shall conform to CFR 29 Part 1926 and shall be of sufficient size to be clearly legible displaying the following legend:

DANGER

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

CANCER AND LUNG DISEASE

HAZARD

1.23 LOCAL EXHAUST SYSTEM

A. A local exhaust system shall be provided in the asbestos regulated work area in accordance with ANSI Z9.2 and CFR 29 Part 1926. The system will provide at least 4 air changes per hour inside of the containment. The local exhaust system shall be operated 24 hours per day, until the asbestos regulated containment area is removed and shall be leak proof to the filter and equipped with HEPA filters. Local exhaust equipment shall be sufficient to maintain a minimum pressure differential of minus 0.51 mm (0.02 inch) 0.02 inch of water column relative to adjacent, unsealed areas. Pressure differential shall be monitored continuously, 24 hours per day, with an automatic recording instrument. In no case shall the building ventilation system be used as the local exhaust system for the asbestos regulated work area. Filters on local exhaust system equipment shall conform to ANSI Z9.2 and UL 586. Filter shall be UL labeled. The local exhaust system shall terminate out of doors. All filters used shall be new at the beginning of the project and shall be periodically changed as necessary and disposed of as ACM waste.

B. Prior to the start of the abatement the Contractor shall inspect all negative air machines and insure that all gaskets are in place, that all HEPA filters in the units are properly seated and mechanical brackets that secure the HEPA filters are intact. This inspection will be conducted in conjunction with the Owners Representative prior to the start of abatement activities. All deficiencies associated with the negative air machines shall be repaired prior to the start of the abatement. All defective units shall be removed and replaced.

1.24 TOOLS

A. Vacuums shall be leak proof to the filter, equipped with HEPA filters, be of sufficient capacity and provide the necessary capture velocity at the nozzle or nozzle attachment to efficiently collect, transport and retain the ACM waste material. Power tools shall not be used to remove ACM unless the tool is equipped with effective, integral HEPA filtered exhaust ventilation capture and collection system or has otherwise been approved for use by the Owner. All residual asbestos shall be removed from reusable tools prior to storage and reuse. Reusable tools shall be thoroughly decontaminated prior to being removed from asbestos regulated work areas.

1.25 RENTAL EQUIPMENT

A. If rental equipment is to be used, written notification shall be provided to the rental agency, concerning the intended use of the equipment, the possibility of asbestos contamination of the equipment and the steps that will be taken to decontaminate such equipment. A written acceptance of the terms of the Contractor’s notification shall be obtained from the rental agency.

1.26 PERSONNEL AIR MONITORING EQUIPMENT (CONTRACTOR PROVIDED)

A. The Contractor is responsible for all personnel sampling as outlined in Section 3.12 herein, and shall select and approve the air monitoring equipment to be provided and used by the Contractor for evaluation of personnel exposure levels to airborne asbestos fiber concentrations within the work area. The equipment shall include, but not be limited to:

1. Low-volume, battery powered, body-attachable, portable personal pumps that can be calibrated to a constant airflow up to approximately 3.5 liters per minute when

equipped with a sampling train of tubing and filter cassette, and a self-contained rechargeable power pack capable of sustaining the calibrated flow rate for a minimum of 10 hours. The pumps shall also be equipped with an automatic flow control unit, which shall maintain a constant flow even as filter resistance increases due to accumulation of fiber and debris on the filter surface,

2. Standard 25 millimeter diameter, 0.8 micrometer micron pore size, mixed cellulose ester membrane filters and cassettes with nonconductive barrels and shrink bands, to be used with low flow pumps in accordance with CFR 29 Part 1926, for personal air sampling,

3. Standard 25 millimeter diameter, 0.45 micrometer micron pore size, mixed cellulose ester membrane filters and cassettes with non-conductive barrels and shrink bands, to be used with high flow pumps when conducting environmental area sampling using NIOSH Pub No. 84-100 Methods 7400 and 7402 and the transmission electric microscopy method specified at CFR 40 Part 763,

4. Appropriate plastic tubing to connect the air sampling pump to the selected filter cassette,

5. A flow calibrator capable of calibration to within plus or minus 2 percent of reading over a temperature range of minus 4 degrees Fahrenheit to plus 140 degrees Fahrenheit and traceable to a National Institute for Standards and Technology (NIST) primary standard.

1.27 EXPENDABLE SUPPLIES

A. Glove Bag

1. Glove bags shall be provided as described in CFR 29 Part 1926. The glove bag assembly shall be prefabricated with a preprinted OSHA warning label and shall typically be constructed of 6 mil thick transparent polyethylene or polyvinyl chloride sheeting and at least two inward projecting long sleeves and an internal pouch. The glove bag shall be constructed and installed in such a manner that it surrounds the object or material to be removed and contains all asbestos fibers released during the process. The glove bag shall have sufficient capacity to hold removed materials and permit leak-tight sealing.

B. Duct Tape

1. Industrial grade duct tape shall be provided in 2 inch and 3 inch widths and shall be suitable for bonding sheet plastic and disposal containers specified herein.

C. Disposal Containers

1. Leak-tight disposal containers shall be provided for ACM generated as specified herein. Leak-tight means neither solids, liquids or dust can escape or spill out. All disposal containers shall be either pre-labeled or affixed with OSHA warning label as specified in CFR 29 Part 1926.

D. Disposal Bags

1. 6-mil thick leak-tight pre-labeled (OSHA warning label) bags shall be provided for placement of asbestos generated waste.

E. Leak-tight Wrapping

1. Two layers of 6-mil (minimum) thick polyethylene sheeting stock shall be used for the containment of removed asbestos-containing components or materials such as reactor vessels, large tanks, boilers, insulated pipe segments and other materials too large to be placed in disposal bags. Upon placement of the ACM component or material, each layer shall be individually leak-tight sealed with duct tape.

F. Fiberboard Drums

1. Fiberboard drums shall be provided if required by state or local requirements.

G. Cardboard Boxes

1. Heavy-duty corrugated cardboard boxes coated with plastic or wax to retard deterioration from moisture shall be provided if required by state and local requirements. Boxes shall fit into selected ACM disposal bags. Filled boxes shall be sealed leak-tight with duct tape.

H. Sheet Plastic

1. Sheet plastic shall be provided as specified herein and in the largest sheet size necessary to minimize seams, as indicated on the project drawings.

I. Polyethylene Sheet – General

1. 6-mil (minimum) thick polyethylene sheeting shall be clear, frosted and/or black and conform to ASTM D 4397.

J. Polyethylene Sheet – Flame Resistant

1. Where a potential for fire exists, 6-mil (minimum) thick flame-resistant polyethylene sheet shall be provided. Flame-resistant polyethylene film shall be frosted and/or black and shall conform to the requirements of NFPA 701.

K. Polyethylene Sheet-Reinforced

1. 6-mil thick reinforced polyethylene sheet shall be provided where high skin strength is required such as where it constitutes the only barrier between the asbestos regulated work area and the outdoor environment. The sheet stock shall consist of translucent, nylon-reinforced or woven-polyethylene thread laminated between two layers of polyethylene film. Film shall meet flame resistant standards of NFPA 701.

L. Viewing Inspection Window

1. Where feasible, a minimum of one clear 1/8-inch thick acrylic sheet, 18 inches by 24 inches, shall be installed as a viewing inspection window at eye level on a wall in each

containment enclosure. All such windows shall be sealed leak-tight with industrial grade duct tape.

M. Wetting Agents

1. Amended water shall meet the requirements of ASTM D 1331.

N. Removal Encapsulant

1. Removal encapsulant (a penetrating encapsulant) shall be provided when conducting removal abatement activities that require a longer removal time or are subject to rapid evaporation of amended water. The removal encapsulant shall be capable of wetting the ACM and retarding fiber release during disturbance of the ACM equal to or greater than provided by amended water

O. Strippable Coating

1. Strippable coating found in aerosol cans, will be used to adhere to surfaces and to be removed cleanly by stripping at the completion of work. Since these coatings have a hydrocarbon-carrying agent, its use shall be confined to well ventilate areas only.

P. Non-combustible Foam

1. All foam shall be Hilti CF 810 CJ Insulating Foam or an approved equivalent.

1.28 MATERIAL SAFETY DATA SHEETS

A. Material safety data sheets (MSDS) shall be provided for all hazardous materials brought onto the work-site. One copy shall be provided to the Owner's Representative on-site and one copy shall be included in the Contractor's Hazard Communication Program.

1.29 OTHER ITEMS

A. A sufficient quantity of other items shall be provided that may include, but not be limited to: scrapers, brushes, brooms, staple guns, tarpaulins, shovels, rubber squeegees, dust pans, other tools, scaffolding, staging, enclosed chutes, wooden ladders, lumber necessary for the construction of asbestos regulated containment work areas, UL approved temporary electrical equipment, material and chords, ground fault circuit interrupters, water hoses of sufficient length, fire extinguishers, first aid kits, portable toilets, logbooks, log forms, markers with indelible ink, spray paint in bright color to mark areas, project boundary fencing, etc.

1.30 PRECONSTRUCTION CONFERENCE

A. The Contractor, and the Contractor's designated onsite "competent person," shall meet with the Owners Representative and Owner prior to beginning work at a preconstruction conference to discuss the details of the Contractor's Asbestos Hazard Abatement Plan, including work procedures and safety precautions. Once accepted by the Owners Representative and Owner, the Asbestos Hazard Abatement Plan, will be enforced as if an addition to the specification.

PART 2 - PRODUCTS

2.1 ENCAPSULANTS

A. Encapsulant shall conform to USEPA requirements, shall contain no toxic or hazardous substances.

PART 3 - EXECUTION

3.1 GENERAL

A. Asbestos abatement work shown on plans and drawings shall be performed as specified herein. Personnel shall wear and utilize protective clothing and equipment as specified herein. Eating, smoking, drinking, or applying cosmetics shall not be permitted in the asbestos regulated work area. All hot work (burning, cutting, welding, etc.) shall be conducted under strictly controlled conditions in conformance with CFR 29 Part 1926. Personnel of other trades not engaged in asbestos abatement activities shall not be exposed at any time to airborne concentrations of asbestos unless all the administrative and personal protective provisions as required by the Contractors Asbestos Abatement Plan are complied with. The building heating, ventilating, and air conditioning system shall be shut down, all openings to the system capped leading into the abatement work area.

B. Electrical service shall be disconnected where necessary to facilitate wet removal. Temporary electrical service shall be provided by the Contractor as needed. Temporary power provided by the Contractor shall be adequate to power for the Owners' Representatives' air monitoring equipment.

C. If an asbestos spill occurs outside of the asbestos regulated work area, work shall be stopped and the Owners' Representative and Owner shall be notified. The condition shall be corrected to the satisfaction of the Owners' Representative and Owner including air sampling, prior to resumption of work.

3.2 PROTECTION OF ADJACENT WORK OR AREAS TO REMAIN

A. Asbestos abatement work shall be performed without damage or contamination of adjacent work or areas. Where such work or area is damaged or contaminated as verified by the Owners Representative using visual inspection and/or sample analysis, it shall be restored to its original condition or decontaminated by the Contractor at no expense to the Owner as deemed appropriate by the Owners Representative. This includes inadvertent spill of dirt, dust or debris in which it is reasonable to conclude that asbestos may exist. When these spills occur, work shall stop in all affected areas immediately and the spill shall be cleaned. When satisfactory visual inspection and/or sampling analysis results are obtained and have been evaluated by the Contractor and the Owners Representative, work may proceed.

3.3 FURNISHINGS, FIXTURES AND EQUIPMENT

A. Removal of Furnishings and Equipment

1. The Owner will remove all sensitive equipment and furniture from the work areas before asbestos abatement work begins.

B. Items to Remain

1. Contractor shall protect all existing data, smoke/fire alarm systems, access control systems, closed circuit television systems, telephone, electrical and fire suppression lines located in areas affected by abatement operations. Costs for repairs associated with damage incurred during abatement, demolition and put-back operations will be at the GC's expense.

3.4 BUILDING VENTILATION SYSTEM AND CRITICAL BARRIERS

A. Any building ventilating system supplying air into or returning air out of an asbestos regulated work area shall be shut down and isolated by lockable switch or other positive means in accordance with CFR 29 Part 1910, Section 1910.147, to prevent accidental start-up and isolated by airtight seals to prevent contaminant spread through the system. Air-tight critical barriers shall be installed on all building ventilating openings that supply, or return air from the building ventilation system or serves to exhaust air from the building, that are located inside the asbestos regulated work area. The critical barriers shall consist of air-tight rigid covers for building ventilation supply and exhaust grills where the ventilation system is required to remain in service during abatement. Edges to wall, ceiling and floor surfaces shall be sealed with industrial grade duct tape.

3.5 PRECLEANING

A. Surfaces shall be cleaned by HEPA vacuum and adequately wet wiped prior to establishment of containment.

3.6 ASBESTOS CONTROL AREA REQUIREMENTS

A. Regulated containment areas shall be established and maintained for each abatement work task. Viewing inspection window shall be installed on the wall of the containment enclosure, as specified herein. The following procedures shall be performed sequentially and each activity shall be completed before proceeding to the next. Various steps may be omitted for an individual containment area when that work is not specified on the drawings.

1. Furnishings in the asbestos regulated work area shall be cleaned, protected in place removed as specified herein.

2. Tools, scaffolding, staging, and incidentals necessary for the work shall be placed in the area to be isolated prior to erection of work area enclosed containment.

3. Building ventilating systems serving the work area shall be shutdown or isolated.

4. Power to the asbestos regulated work area shall be locked-out by switching off all breakers serving power or lighting to this area in accordance with CFR 29 Part 1910.

5. Surfaces shall be pre-cleaned as required herein.

6. Personnel Decontamination Unit shall be installed as specified. Load-Out unit shall be installed as specified herein.

7. Critical barriers shall be installed as required for building ventilation system and in the plenum space as required herein.

8. Local exhaust ventilation system shall be installed as specified.

9. Containment area shall be installed as required for each abatement task as specified.

3.7 CLEAN-UP

A. The Contractor shall maintain a clean work area by performing on a daily basis the following housekeeping functions at the end of each shift:

1. Loose ACM shall be prepared for disposal by packaging the waste and removing it from the work area to the load-out area.

2. Work area shall be HEPA vacuumed.

3. Polyethylene in work and high traffic areas shall be inspected and repaired.

4. Containment area shall be wet wiped if air sample results exceed prescribed level.

3.8 ASBESTOS HANDLING PROCEDURES

A. The Contractor shall employ proper handling procedures in accordance with CFR 29 Part 1926 and CFR 40 Part 61, Subpart M and the specification requirements herein. The specific abatement techniques and items identified shall be detailed in the Contractor's Asbestos Hazard Abatement Plan including but not limited to details of construction materials, equipment, and handling procedures. The following task descriptions detail the required abatement handling technique.

1. Removal of ACM From Interior Architectural System

a. After completion of all asbestos removal work, surfaces from which asbestos containing materials have been removed shall be wet wiped or sponged clean, or cleaned by some equivalent method to remove all visible residue. After the gross amounts of asbestos have been removed from every surface, all remaining visible accumulations of asbestos on floors shall be collected using plastic shovels, rubber squeegees, rubber dustpans and HEPA vacuum cleaners as appropriate to maintain the integrity of the containment barrier. When all insulation has been removed, workmen shall use HEPA vacuum cleaners to vacuum every surface. Particular attention shall be paid to those surfaces or locations that could harbor accumulations or residual asbestos dust.

2. Sealing Contaminated Items Designated for Disposal

a. Contaminated architectural, mechanical, and electrical appurtenances and other contaminated items designated for removal shall be coated with an asbestos lockdown encapsulant at the demolition site before being removed from the asbestos control area. These items need to be vacuumed prior to application of the lock-down encapsulant.

b. The asbestos lockdown encapsulant shall be tinted a contrasting color. It shall be spray-applied by airless method. Thoroughness of sealing operation shall be visually gauged by the extent of colored coating on exposed surfaces.

3.9 FINAL CLEANING AND PRE-VISUAL INSPECTION

A. The asbestos regulated work area shall be cleaned at the completion of the abatement by collecting, packing, and storing all gross contamination. A final cleaning shall include HEPA vacuum and wet cleaning of all exposed surfaces and equipment in the asbestos regulated work area. Upon completion of the cleaning, the Contractor's competent person shall conduct a pre-visual inspection of the cleaned area in preparation for the final inspection to be conducted with the Owners Representative. The Contractor shall re-clean, as necessary. Upon completion of the final cleaning, the Contractor and the Owners Representative shall conduct a final visual inspection of the cleaned work area in accordance with ASTM E 1368 and document the results on the Final Cleaning and Visual Inspection. If the Owners Representative rejects the abatement area as not meeting final cleaning requirements, the Contractor shall re-clean as necessary and have a follow-up inspection with the Owners Representative. Re-cleaning and follow-up re-inspections by the Owners Representative shall be at the Contractor's expense.

3.10 LOCKDOWN

A. Prior to removal of plastic barriers and after clean up of gross contamination and final visual inspection, a post removal (lockdown) encapsulant shall then be spray applied to foundation walls, underside of floors, and all vertical and horizontal surfaces within the work area. The abatement area shall include but not be limited to constructed enclosures, barriers, polyethylene sheeting that covers any furnishings, and equipment articles to be discarded, critical barriers, air locks, load out units for bag removal, and onsite constructed decontamination unit.

3.11 AIR MONITORING

Air Monitoring by the Contractor:

A. The Contractor shall provide daily 8-hour TWA PEL and daily 30-minute Excursion Limit personal breathing zone air monitoring in accordance with and in addition to 29 CFR 1926.1101(f), including all amendments, and Appendix A of the OSHA standard within the work sites throughout all asbestos work site enclosure, material stripping, removal, cleaning encapsulation operations, or any other activities which might disturb asbestos-containing materials to insure that the workers are adequately protected at all times.

B. Samples shall be collected by calibrated pumps whose flow rates can be determined to an accuracy of plus or minus 5 percent. Calibrate pumps both prior to and after each use with a representative filter in line.

C. Analysis of samples shall be done in accordance with 29 CFR 1926.1101(f) and Appendix A of the OSHA standard. The results of all samples shall be posted outside the containment area within 48 hours of sampling and maintained there until the project has been concluded. This data shall include both the results of individual samples and the results of 8 hour TWA and 30-minute Excursion Limit determinations. Posted results shall include a synopsis of work activities for which the results are representative. Records shall be made of each employee's personal monitoring results and the employee shall be notified of these results within 15 days either individually or by posting them in a central location in accordance with 29 CFR 1926.1101(f).

D. All analytical results from the Contractor's air monitoring shall be posted at the work site entrance as soon as they become available and not more than 48 hours from the time in which the samples were taken.

Air Monitoring by the Owner:

A. The Owner shall provide the services of an independent testing laboratory with qualified analysts and appropriate equipment to conduct sample analyses of area air samples using the methods prescribed in CFR 29 Part 1926 Section 1926.58 to include NIOSH Pub No. 84-100 Method 7400. Sampling performed in accordance with CFR 29 Part 1926 Section 1926.58 shall be performed by the Owners Representative. The Owners Representative shall perform final clearance air sampling utilizing Phase Contract Microscopy (PCM) analysis. For environmental quality control and final air clearance NIOSH Pub No. 84-100 Method 7400 (PCM) with optional confirmation of results by NIOSH Pub No. 84-100 Method 7402 Transmission Electron Microscopy (TEM) the mandatory EPA TEM Method specified at CFR 40 Part 763 shall be used. For environmental and final clearance samples, sampling will be conducted at a sufficient velocity and time to collect a sample volume necessary to establish the limit of detection of the method used at 0.01 f/cc. Asbestos fiber concentration confirmation of the total fiber concentration results of environmental, quality assurance and final air clearance samples, collected and analyzed by NIOSH Pub No. 84-100 Method 7400, may be conducted.

1. Sampling Prior to Asbestos Work

    a. The baseline air sampling shall be established prior to the masking and sealing operations for each abatement area site. The background shall be established by performing area sampling in similar but uncontaminated sites in the building. Pre-abatement (NIOSH Pub No. 84-100 Method 7400, PCM, and EPA PCM Method specified at CFR 40 Part 763).Five backround samples will be collected from inside the building and be in locations both inside and outside the work area locations. To obtain an index of backround airborne fiber concentration. These PCM samples shall be analyzed immediately; and if any result in fiber concentration greater than 0.01 f/cc, asbestos fiber concentration shall be confirmed using NIOSH Pub No. 84-100 Method 7402 (TEM) at Owner expense.

2. Sampling During Asbestos Abatement Work

    a. The Owner shall provide area air sampling as indicated in CFR 29 Part 1926 Section 1926.58, and meet state and local requirements. Area air sampling shall be conducted at least once every shift, close to the work in the containment area, outside the clean room entrance to the containment area, (outside air lock for mini and modified containment areas), inside the clean room (inside the air lock for mini and modified containment areas), outside the load-out unit exit, if used, and at the exhaust discharge point of the local exhaust system.

3. Sampling After Final Clean-Up (Clearance Sampling)

    a. Prior to conducting final air clearance sampling, the Contractor and the Owners Representative shall conduct a final visual inspection of the Contractor’s final cleanup of the abated asbestos regulated work area as specified. Final clearance

air monitoring shall not begin until acceptance of this final cleaning by the Owners Representative. The Owners Representative will provide area sampling of airborne fibers using air sampling techniques as defined in the EPA 560/5-85-024 or as otherwise required by Federal or state requirements.

4. Air Clearance Failure

   a. Should clearance-sampling results fail to meet the final clean-up requirements, the Contractor shall pay all costs associated with all required re-cleaning, re-sampling and analysis until final clean-up requirements are met.

3.12 SITE INSPECTION

A. While performing asbestos removal work, the Contractor shall be subject to onsite inspection by the Owners Representative who may be assisted by or represented by quality assurance, safety and industrial hygiene personnel. If the work is found to be in violation of this specification, the Owner or his representative will issue a stop work order to be in effect immediately and until the violation is resolved. Standby time required to resolve the violation shall be at the Contractor's expense.

3.13 CLEAN-UP AND DISPOSAL

A. Housekeeping

1. Surfaces of the regulated work area shall be kept free of accumulation of asbestos-containing debris. Meticulous attention shall be given to restricting the spread of dust and debris during the abatement activities. HEPA filtered vacuum cleaners shall be used. The space shall not be blown down with compressed air.

B. Title to Materials

1. Material resulting from abatement work, except as specified otherwise, shall become the property of the Contractor and shall be disposed of as specified in applicable local, state, and Federal regulations and herein.

C. Collection and Disposal of Asbestos

1. Asbestos waste, asbestos contaminated water, scrap, debris, bags, containers, equipment, and asbestos contaminated clothing, shall be collected and placed in sealed leak-tight, containers (e.g. double 6-mil plastic bags), sealed 6-mil double wrapped polyethylene sheet, sealed fiberboard boxes or other approved containers. Waste within the containers must be wetted in case the container is breeched. A warning and Department of Transportation (DOT) label shall be affixed or preprinted on each bag. Waste asbestos material shall be disposed of at an EPA, state and local approved asbestos landfill. For temporary storage, sealed impermeable containers shall be stored in asbestos waste load-out unit or in a storage/transportation conveyance (i.e.; dumpster, roll-off waste boxes, etc.) in a manner as accepted by and in an area as assigned by the Owner. Procedure for hauling and disposal shall comply with CFR 40 Part 61, Subpart M, and state, regional, and local standards.

D. Asbestos Waste Shipment Record

1. The Contractor shall complete and provide final completed copies of the Waste Shipment Record for all shipments of waste material as specified in CFR 40 Part 61, Subpart M and other required state waste manifest shipment records within 3 days of delivery to the landfill.

APPENDIX

Asbestos Containing Materials Investigation Report

Broadcast Studio Construction Project

Performed by F&ME Personnel (dated September 25, 2014)

ASBESTOS CONTAINING MATERIALS INVESTIGATION REPORT

GREENHOUSE & ASSOCIATED BRICK STRUCTURE

UNIVERSITY OF SOUTH CAROLINA CAMPUS

COLUMBIA, SOUTH CAROLINA

PREPARED FOR:

UNIVERSITY OF SOUTH CAROLINA

University of South Carolina
743 Green Street
Columbia, South Carolina 29208

PREPARED BY:

F&ME Consultants
3112 Devine Street
Columbia, South Carolina 29205
(803) 254-4540

September 25, 2014

E5300.28

TABLE OF CONTENTS

F&ME CONSULTANTS

I. EXECUTIVE SUMMARY

As requested, F&ME Consultants has completed an update to the University of South Carolina's Asbestos Containing Materials (ACM) investigation of the greenhouse and associated brick structure located on the University's Columbia, South Carolina campus. This investigation update was performed accordance with SCDHEC, USEPA, and OSHA regulations.

It is our understanding that the University is interested in demolishing the subject building structures to make way for the construction of a broadcast studio. We also understand that the University's HAZMAT personnel performed an initial ACM investigation of the subject buildings on July 29, 2014. Utilizing the data from the initial investigation, F&ME performed an additional investigation to confirm the quantities and to determine if other ACM are associated with the structures. The scope of the additional ACM investigation was to identify, sample and assess materials suspected of containing asbestos that are located throughout the interior and exterior of the subject building structures. The field investigation was performed on September 10, 2014.

Of the suspect materials analyzed, the following were found to contain asbestos: the corrugated Transite heat shield panels; Transite board; gray exterior greenhouse window glazing, and the mud associated with the expansion tank fiberglass insulation. These ACM are in addition to the following materials confirmed to contain ACM by USC HAZMAT personnel: TSI elbows, exterior caulking, and interior white window glazing.

We sincerely appreciate the opportunity to assist you with this project. Should you have any questions or require additional information concerning this investigation, please do not hesitate to contact our office at (803) 254-4540.

Sincerely,

F&ME CONSULTANTS

James T. Timmons
Environmental Professional
Asbestos Consultant/ Management Planner
SCDHEC License No: MP-00196
Expiration Date 09/27/2014

Glynn M. Ellen
Senior Environmental Professional
Asbestos Consultant/ Management Planner
SCDHEC License No: ASB-22641
Expiration Date 02/25/2015

JTT/GME/jls

II. INTRODUCTION

As requested, F&ME Consultants has completed an update to the University of South Carolina's Asbestos Containing Materials (ACM) investigation of the greenhouse and associated brick sructure located on the University's Columbia, South Carolina campus. This investigation update was performed accordance with SCDHEC, USEPA, and OSHA regulations.

It is our understanding that the University is interested in demolishing the subject building structures to make way for the construction of a broadcast studio. We also understand that the University's HAZMAT personnel performed an initial ACM investigation of the subject buildings on July 29, 2014. Utilizing the data from the initial investigation, F&ME performed an additional investigation to confirm the results and to determine if other ACM are associated with the structures.

Therefore, The scope of this ACM investigation update was to identify, sample and assess materials suspected of containing asbestos that are located throughout the interior and exterior of the subject building structures that were not included in the USC inspection report, if any. The field investigation was performed on September 10, 2014.

The results, conclusions and recommendations from this investigation are representative of the conditions observed at the site on the date of the field inspection. F&ME does not assume responsibility for any changes in conditions or circumstances that occur after the inspection. Use of this document for bidding purposes is not recommended without prior consultation with F&ME.

III. INVESTIGATION RESULTS

The purposes of this investigation were to locate, sample, quantify and assess suspect ACM associated with the interior and exterior portions of subject building and to obtain laboratory analytical results for determining the existence or non-existence of asbestos fibers.

The subject buildings consist of a greenhouse and adjoining masonry brick structure. The greenhouse structure is constructed with glass panels and steel framing, including the roof. The masonry brick structure has a pitched, shingled roofing system. Both structures are slab-on-grade, with a portion of the greenhouse having an unfinished dirt floor.

The interior of the greenhouse primarily consists of a dirt floor and glass panels set in metal frames, which make up the exterior and interior walls as well as the roof. The interior finishes of the masonry brick structure are painted masonry brick and exposed concrete flooring. Exterior finishes include glass panels with metal frames (greenhouse), masonry brick, and a pitched, shingled roof.

Suspect materials identified during the initial investigation and the update include the following:

- TSI elbows (~21 L.F.)
- Exterior caulking (~120 L.F.)
- Interior white window glazing (~120 L.F.)

- Roofing shingles (~800 S.F.)
- Roofing felt paper (~800 S.F.)
- Corrugated Transite heat shield panels (~400 S.F.)
- Transite board (~140 S.F.)
- White sink undercoating (~8 S.F.)
- Gray exterior greenhouse window glazing (~1,875 L.F.)
- Silver paint on pipes (~160 L.F.)
- Mud associated with the expansion tank fiberglass insulation (~12 S.F.)

Remaining building materials (i.e. concrete, glass, wood, carpet, etc.) were not considered suspect.

Bulk samples of the suspect materials were analyzed by polarized light microscopy (PLM) in accordance with EPA 600/R-93/116. Confirmation transmission electron microscopy (TEM) was also performed on any non-friable organically bound materials that tested negative for asbestos content as per SCDHEC regulations effective May 27, 2011. A "first-positive stop" protocol was also requested, meaning that if a sample of a material was found to contain asbestos, then subsequent samples of that same material were not analyzed. Proper sampling and chain-of-custody protocol were followed to ensure appropriate handling and delivery of samples to the analytical laboratory. See Appendix A for the Sample Location Plan (Figure 2).

Based on the inspection report prepared by USC HAZMAT personnel, a total of fifteen (15) samples were collected. Due to activation of the "first-positive stop" protocol, only nine (9) were analyzed by PLM and two (2) were TEM-confirmed. The materials identified by USC HAZMAT personnel as ACM include the TSI elbows, exterior caulking, and interior white window glazing. Please see Appendix E, University of South Carolina ACM Inspection Report (dated 8/11/14), for a copy of the USC inspection report and associated analytical reports.

Furthermore, F&ME collected a total of eighteen (18) samples from additional suspect materials associated with the subject building structures during the investigation update. Due to implementation of the "first-positive stop" protocol, eight (8) samples were analyzed by PLM and two (2) were TEM-confirmed. Of the materials analyzed, the following were found to contain asbestos: the corrugated Transite heat shield panels; Transite board; gray exterior greenhouse window glazing, and the mud associated with the expansion tank fiberglass insulation. For more information regarding the location of the identified ACM, refer to the Homogeneous Area Plan (Figure 6) located in the appendix. Also see Table II, Summary of Asbestos Containing Materials, for the asbestos content of the ACM.

The appendices include a Site Vicinity Map (Figure 1), Sample Location Plan (Figure 2), a Homogeneous Area Plans (Figures 3 & 4), a Summary of Samples (Table I), a Summary of Asbestos Containing Materials (Table II), Physical Assessment Data Sheets, Bulk Sample Analysis Reports, the Chain of Custody, Personnel Certifications, a SCDHEC Regulation Summary, SCDHEC Abatement Project Forms, and a copy of the USC ACM Inspection Report.

IV. ACM DESCRIPTION & ASSESSMENT

The following items are descriptions and quantities of the ACM identified within the subject building during both the initial inspection and the update (also see Homogeneous Area Plans, Figures 3 & 4):

- HA-1 – TSI elbows (~21 L.F.)

  Asbestos-containing TSI elbows were observed associated with the domestic water line system in the brick structure. The elbows were noted to be in an intact condition. Prior to start of demolition activities, these elbows must be abated by a SCDHEC-licensed abatement contractor.

- HA-2 – Exterior caulking (~120 L.F.)

  Asbestos-containing exterior caulking was identified along the interface between the metal support framing for the glass and the perimeter wall of the greenhouse, as well as around all exterior doors and windows associated with the brick structure. This material was noted to be in an intact condition. Prior to start of demolition activities, this material must be abated by a SCDHEC-licensed abatement contractor.

- HA-3 – Interior white window glazing (~120 L.F.)

  Asbestos-containing interior white widow glazing was observed to be associated with all four (4) windows in the masonry brick structure. This material was noted to be in an intact condition. Prior to start of demolition activities, this material must be abated by a SCDHEC-licensed abatement contractor.

- HA-4 – Corrugated Transite heat shield panels (~400 S.F.)

  Asbestos-containing corrugated Transite heat shield panels were observed under the plant tables around the interior perimeter of the greenhouse. These panels were noted to be in an intact condition. Prior to start of demolition activities, the panels must be abated by a SCDHEC-licensed abatement contractor.

- HA-5 – Transite board (~140 S.F.)

  Asbestos-containing Transite boards were observed to be associated with the front and rear of the perimeter plant table tops. These boards were noted to be in an intact condition. Prior to start of demolition activities, the boards must be abated by a SCDHEC-licensed abatement contractor.

- HA-6 – Gray exterior greenhouse window glazing (~1,875 L.F.)

  Asbestos-containing gray exterior greenhouse window glazing was observed under the metal framing of the seams of the greenhouse window systems. This material was noted to be in an intact condition. Prior to start of demolition activities, this material must be abated by a

SCDHEC-licensed abatement contractor.

- HA-7 – Mud associated with the expansion tank fiberglass insulation (~12 S.F.)

  Asbestos-containing mud was observed on the fiberglass insulation covering the expansion tank located inside the brick structure. This material was noted to be in a significantly damaged and friable condition. Prior to start of demolition activities, this friable material must be abated by a SCDHEC-licensed abatement contractor.

Asbestos containing materials are categorized by SCDHEC as friable (a.k.a. regulated asbestos containing materials, or RACM), Category I non-friable ACM (packing, gaskets, floor coverings, asphalt roofing products, etc.) and Category II non-friable ACM (other non-friable materials not covered in Category I). SCDHEC regulates any disturbances of friable/RACM, requiring its removal prior to renovation or demolition activities.

SCDHEC also legally tracks the dumping of all ACM into landfills. Therefore, SCDHEC must be notified prior to abatement and demolition projects in order to arrange for the proper disposal of ACM and associated contaminated debris. Most landfills will not accept ACM or asbestos-contaminated debris. This is an important consideration for the owner because it is more expensive to dispose of ACM than normal debris. If the abatement/ demolition contractor selects a landfill that accepts ACM, the entire load of abatement/ demolition debris could be transported to the permitted landfill. However, since the ACM would be mixed in with the total demolition debris, all of the debris would be considered to be ACM resulting in higher disposal costs. Therefore, it is recommended that removal of all asbestos is conducted prior to and separate from building demolition activities.

Unlike SCDHEC, OSHA does not distinguish between friable and non-friable ACM, regulated and non-regulated ACM, and/or ACM in good condition versus ACM in poor/damaged condition. Instead, OSHA regulates all worker contact with asbestos.

This report has been prepared exclusively for the University of South Carolina, and shall not be disseminated in whole or part to other parties without prior consent from the University of South Carolina or F&ME Consultants, Inc. No other environmental issues are addressed in this report.

V. RECOMMENDATIONS

Based on our understanding that the subject building structures are scheduled to be demolished, it is recommended that the ACM identified herein be removed prior to the commencement of demolition activities. This work must be performed in accordance with all applicable regulations and guidelines (see attached information and SCDHEC forms).

If any concealed and/or inaccessible ACM are encountered during demolition activities, the affected contractor(s) must stop work, take appropriate actions, and notify the Owner/ Asbestos Consultant for an appropriate response action. The SCDHEC must be notified in the event that any additional ACM is discovered, as well as changes in the condition of identified ACM.

The SCDHEC's Standards of Performance for Asbestos Projects (R 61-86.1) includes requirements for abatement projects regarding notifications, project design, air sampling and

analysis, etc. For informational purposes, some of these requirements are summarized below:

Notifications. Written notification (SCDHEC Form 3430) must be submitted to SCDHEC at least two (2) calendar weeks prior to initiation of abatement activities for renovation/demolition projects that will impact ACM above a certain quantity. A copy of this inspection report and applicable fee payment must be attached to the notification. Additional fees may be required. Copies of all notifications and documents pertinent to the abatement operations must be posted on the job site during abatement work. The Owner/Operators must notify all parties involved with this project of the nature of the work as well as the locations and quantities of asbestos materials to be disturbed or those located near demolition/removal work areas. This notification requirement is also extended to any persons/employees who work near the demolition/removal work areas.

Project Design. Furthermore, abatement projects that will remove more than 3,000 square, 1,500 linear or 656 cubic feet of regulated asbestos-containing materials are required to have a licensed and certified Abatement Project Designer develop a project design prior to the commencement of any abatement activities. The Abatement Contractor is required to adhere to the design, which must address all information as directed by the regulations.

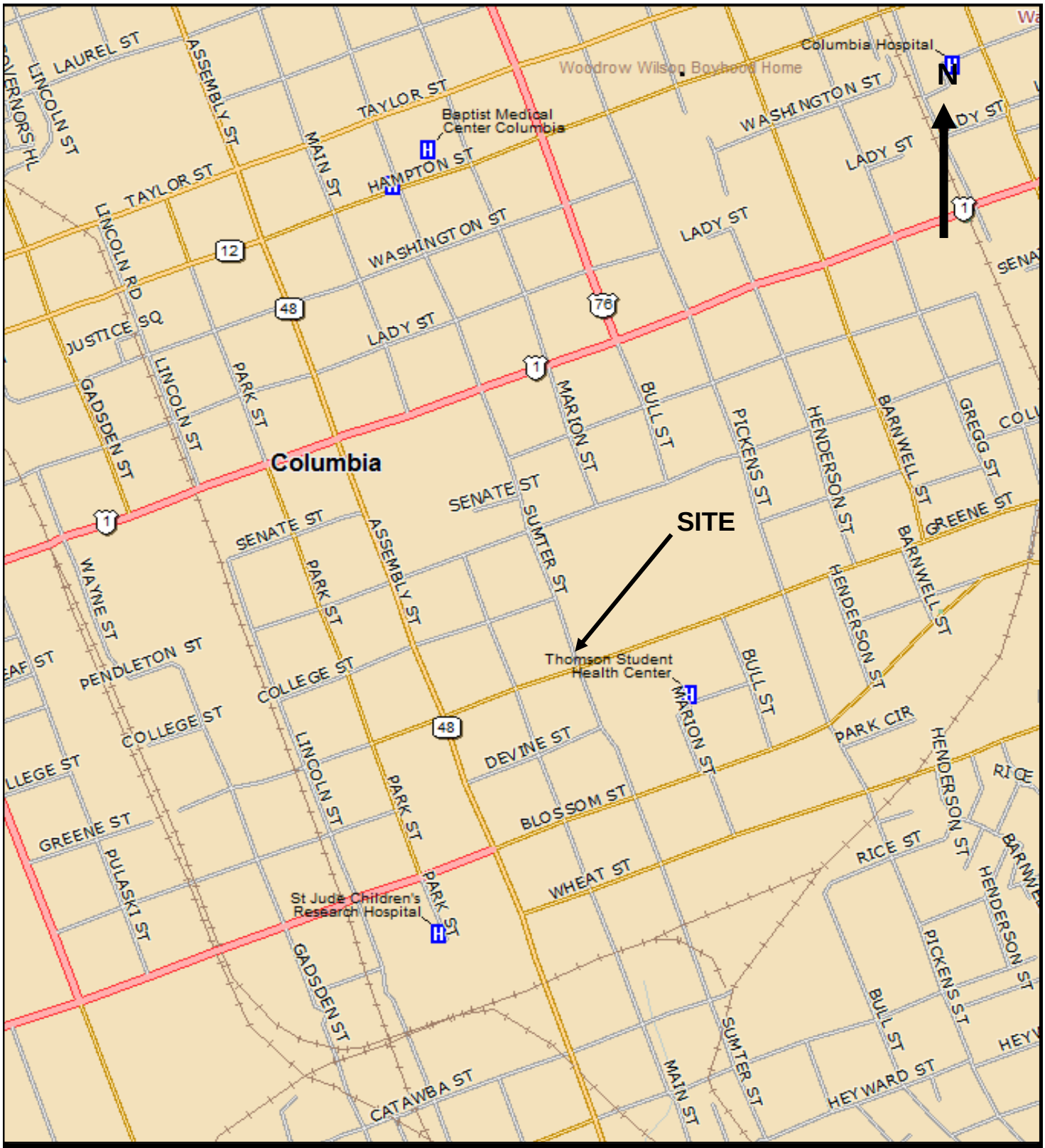
Air Monitoring. The Abatement Contractor is responsible for daily personal air sampling for Abatement Workers in compliance with current OSHA standard 29 CFR 1926.1101, where applicable. All remaining air monitoring services required for a renovation project (i.e. backgrounds, areas, and clearances) will be provided by the Owner or the Owner's Representative, as required by SCDHEC.

APPENDIX A

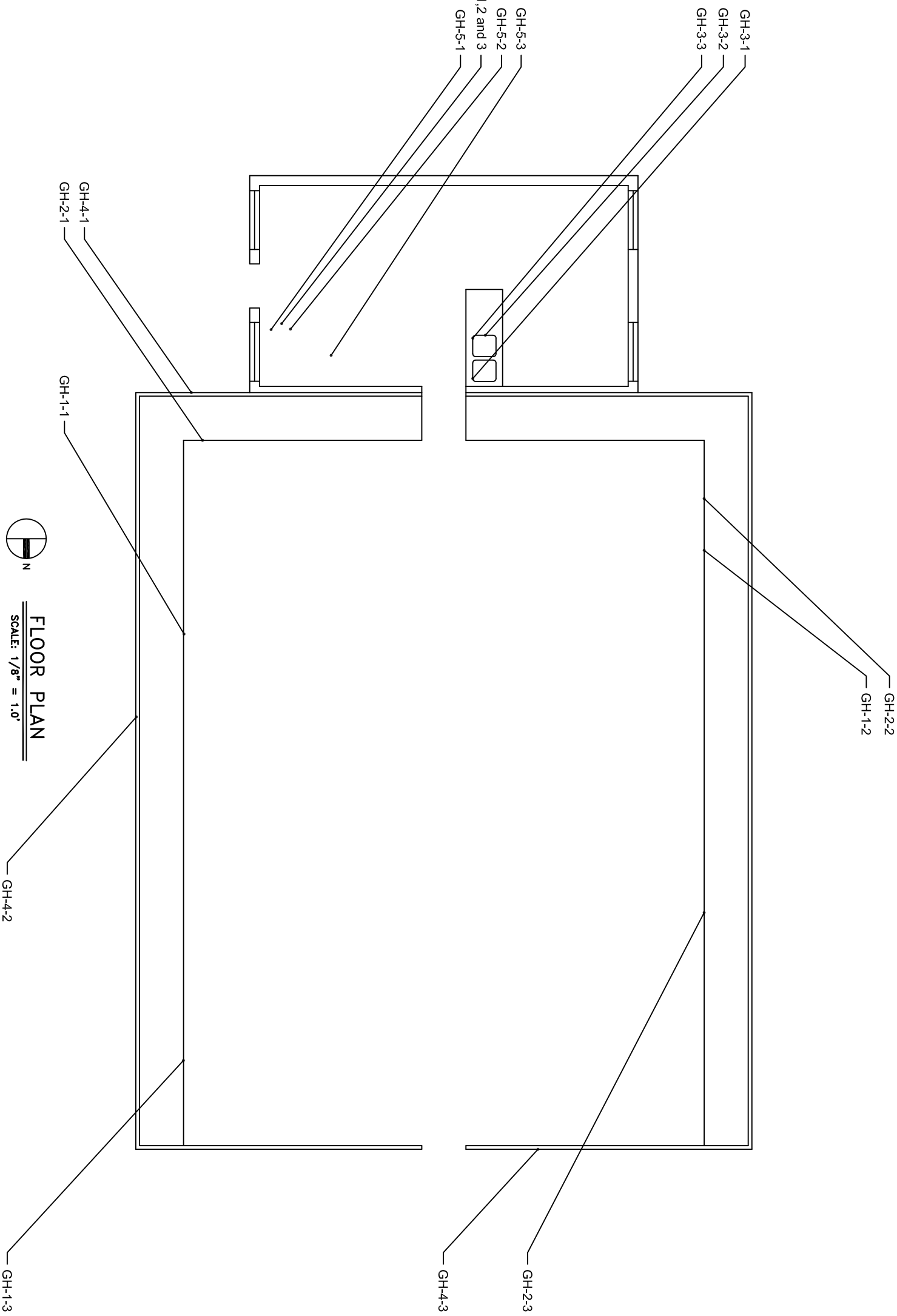
Site Vicinity Map (Figure 1)

Sample Location Plan (Figure 2)

Homogeneous Area Plans (Figures 3 & 4)



F&ME CONSULTANTS	**SITE VICINITY MAP** **Greenhouse & Associated Block Structure** **Columbia, South Carolina**			
UNIVERSITY OF SOUTH CAROLINA	**Prepared By:**	**MSM**	**Scale:**	**N.T.S.**
	Checked By:	**JLS**	**Project:**	**E5300.28**
	Approved By:	**GME**	**Figure:**	**1**



FLOOR PLAN

SCALE: 1/8" = 1.0'

NOTE: Sample locations for samples collected during initial investigation by USC HAZMAT personnel not shown on plan.

FIGURE NUMBER: #2

F&ME CONSULTANTS PROJECT NUMBER: E5300.28

SAMPLE LOCATION PLAN

University of South Carolina

ASBESTOS CONTAINING MATERIALS INVESTIGATION
USC GREENHOUSE DEMOLITION
Columbia, South Carolina
USC Project Number: H27-9905

F&ME CONSULTANTS
GEOTECHNICAL - ENVIRONMENTAL - MATERIALS
COLUMBIA, SOUTH CAROLINA

ORIGINAL:

REVISIONS:
1
2
3

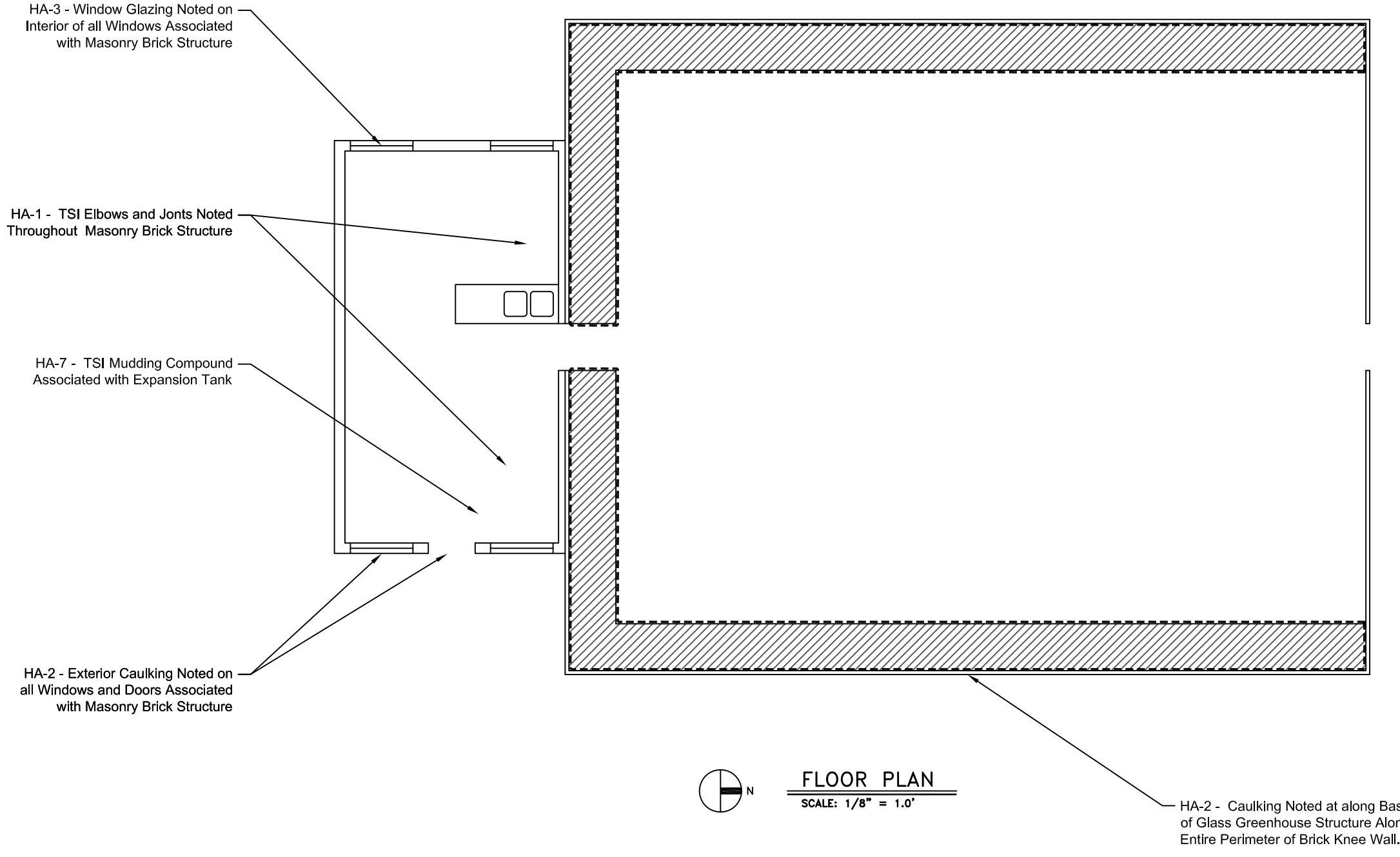
SCALE
1/8" = 1.0'

DRWN. BY: GME
CHKD. BY: JLS
APPR. BY: GME

NOTES:

HA-4 - Corrugated Transite Heat Shields under Wood Plant Tabletops.

HA-5 - Transite Boards on Perimeter of Wood Plant Tabletops.



FLOOR PLAN
SCALE: 1/8" = 1.0'

DRWN. BY: GME
CHKD. BY: JLS
APPR. BY: GME
NOTES:

ORIGINAL:
REVISIONS:
1
2
3

SCALE
1/8" = 1.0'

F&ME
CONSULTANTS
GEOTECHNICAL - ENVIRONMENTAL - MATERIALS
COLUMBIA, SOUTH CAROLINA

HOMOGENEOUS AREA PLAN

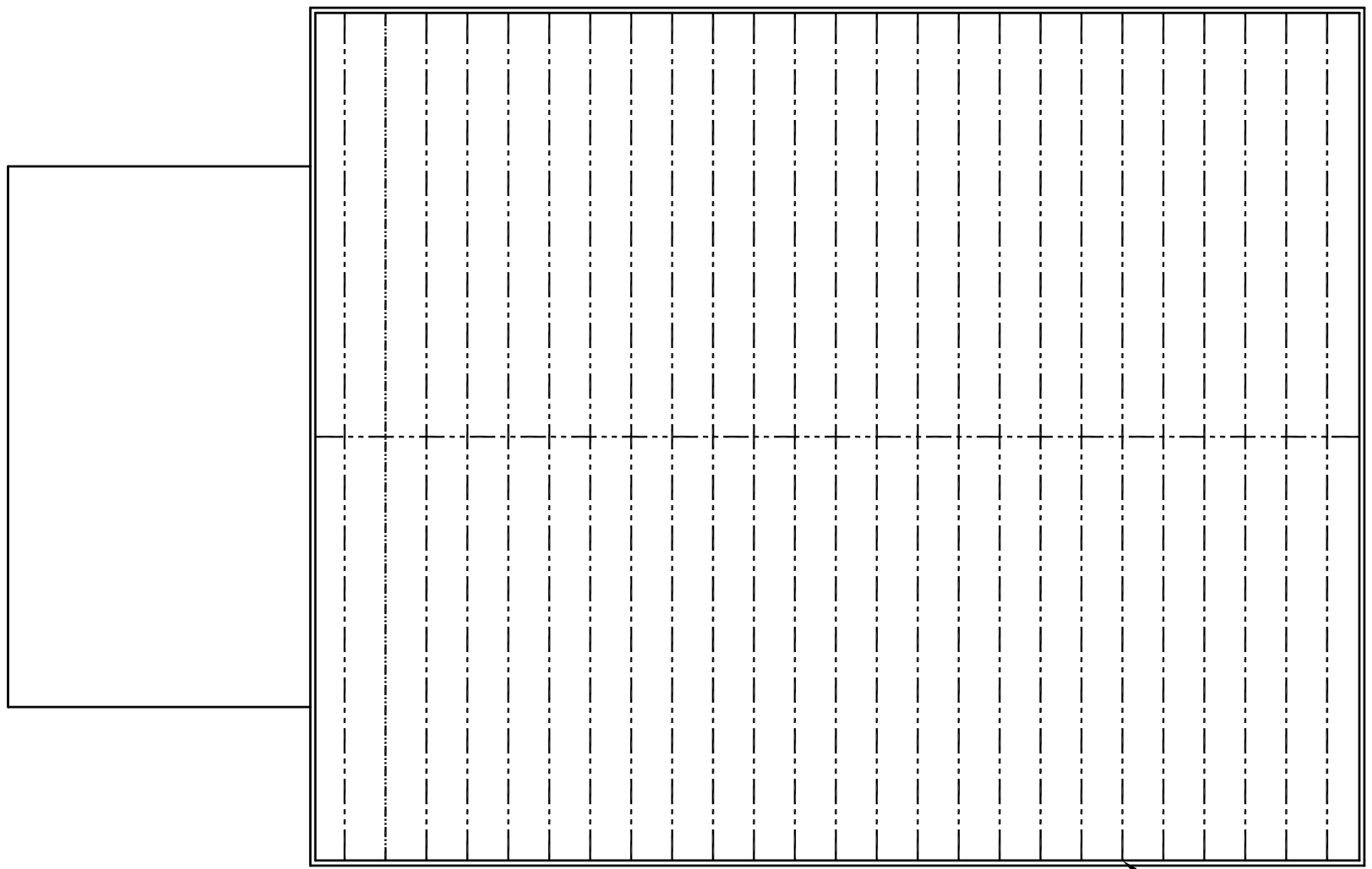
University of South Carolina

ASBESTOS CONTAINING MATERIALS INVESTIGATION
USC GREENHOUSE DEMOLITION
Columbia, South Carolina
USC Project Number: H27-9905

F&ME CONSULTANTS PROJECT NUMBER:
E5300.28

FIGURE NUMBER:
#3

HA-6 - Window Glazing/Caulking under Metal Framing of Glass Panels on Greenhouse
(Not all Shown on Drawing)



N

ROOF PLAN
SCALE: 1/8" = 1.0'

HA-6 Glazing/Caulking found under all metal framing associated with the existing greenhouse, to include walls louvered openings and roof. Glazing/caulking found at interface of metal framing and existing brick kneewall.

DRWN. BY: GME
CHKD. BY: JLS
APPR. BY: GME
NOTES:
ORIGINAL:
REVISIONS: 1 2 3
SCALE 1/8" = 1.0'

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CONSULTANTS
GEOTECHNICAL - ENVIRONMENTAL - MATERIALS
COLUMBIA, SOUTH CAROLINA

HOMOGENEOUS AREA PLAN
University of South Carolina
ASBESTOS CONTAINING MATERIALS INVESTIGATION
USC GREENHOUSE DEMOLITION
Columbia, South Carolina
USC Project Number: H27-9905

F&ME CONSULTANTS PROJECT NUMBER:
E5300.28

FIGURE NUMBER:
#4

APPENDIX B

Summary of Samples (Table I)

Summary of Asbestos Containing Materials (Table II)

Summary of Inspection

Physical Assessment Data Sheets

Bulk Asbestos Analytical Reports

Chain of Custody

TABLE I. SUMMARY OF SAMPLES

Sample ID	Sample Description
USC HAZMAT Personnel Inspection Samples (collected 7/29/2014)	
1	2 ply black shingle
2	2 ply black shingle
3	2 ply black shingle
4	Felt paper
5	Felt paper
6	Felt paper
7	Window glazing, interior
8	Window glazing, interior
9	Window glazing, interior
10	TSI elbow materials
11	TSI elbow materials
12	TSI elbow materials
13	Caulking
14	Caulking
15	Caulking
F&ME Investigation Update Samples (collected 9/10/2014)	
GH-1-1	Corrugated Transite panel
GH-1-2	Corrugated Transite panel
GH-1-3	Corrugated Transite panel
GH-2-1	Transite facia panel
GH-2-2	Transite facia panel
GH-2-3	Transite facia panel
GH-3-1	White sink undercoating
GH-3-2	White sink undercoating
GH-3-3	White sink undercoating
GH-4-1	Grey vertical window glazing
GH-4-2	Grey vertical window glazing
GH-4-3	Grey vertical window glazing
GH-5-1	Silver paint
GH-5-2	Silver paint
GH-5-3	Silver paint
GH-6-1	Mud material associated with fiberglass expansion tank
GH-6-2	Mud material associated with fiberglass expansion tank
GH-6-3	Mud material associated with fiberglass expansion tank

TABLE II. SUMMARY OF ASBESTOS CONTAINING MATERIALS

Sample ID	Sample Description	% Asbestos
USC HAZMAT Personnel Inspection Samples (collected 7/29/2014)		
7	Window glazing, interior	3% Chrysotile
8	Window glazing, interior	First Positive Stop
9	Window glazing, interior	First Positive Stop
10	TSI elbow materials	5% Chrysotile
11	TSI elbow materials	First Positive Stop
12	TSI elbow materials	First Positive Stop
13	Caulking	5% Chrysotile
14	Caulking	First Positive Stop
15	Caulking	First Positive Stop
F&ME Investigation Update Samples (collected 9/10/2014)		
GH-1-1	Corrugated Transite panel	15% Chrysotile
GH-1-2	Corrugated Transite panel	First Positive Stop
GH-1-3	Corrugated Transite panel	First Positive Stop
GH-2-1	Transite fascia panel	20% Chrysotile
GH-2-2	Transite fascia panel	First Positive Stop
GH-2-3	Transite fascia panel	First Positive Stop
GH-4-1	Gray vertical window glazing	15% Chrysotile
GH-4-2	Gray vertical window glazing	First Positive Stop
GH-4-3	Gray vertical window glazing	First Positive Stop
GH-6-1	Mud material associated with fiberglass expansion tank	5% Chrysotile
GH-6-2	Mud material associated with fiberglass expansion tank	First Positive Stop
GH-6-3	Mud material associated with fiberglass expansion tank	First Positive Stop

SUMMARY OF INSPECTION

The following tables summarize the physical assessment data, sampling and assessment results.

As exhibited on these tables, coding is used to abbreviate the asbestos containing materials' (ACM) locations, characteristics and results. These codes are as follows:

TYPES OF ACM:

Misc. = Miscellaneous

Sur. = Surfacing

TSI = Thermal System Insulation

ACM LOCATIONS:

Homogeneous areas = Indicated by Roman Numerals, Room Number or Area Designation

Functional Space No.:	Functional Space Type:
1.	I = Interior
2.	E = Exterior

ACM CHARACTERISTICS:

F = Friable

NF = Non-Friable

ASSESSMENT RESULTS:

(Refer to Physical Assessment Data)

POTENTIAL FOR DISTURBANCE:

(Refer to Physical Assessment Data)

PHYSICAL ASSESSMENT CATAGORIES:

1. Damaged or significantly damaged friable thermal system insulation ACM.
2. Damaged friable surfacing ACM.
3. Significantly damaged friable surfacing ACM.
4. Damaged or significantly damaged friable miscellaneous ACM.
5. ACM with potential for significant damage.
6. ACM with potential for damage.
7. Any remaining friable ACM or friable suspect ACM.
8. Non-friable ACM.

CLASSIFICATION FOR HAZARD POTENTIAL:

(Tabular Display)

Hazard Rank	**ACM Condition**	**ACM Disturbance Potential**
7	Significantly Damaged	Any
6	Damaged	Potential for Significant Damage
5	Damaged	Potential for Damage
4	Damaged	Low
3	Good	Potential for Significant Damage
2	Good	Potential for Damage
1	Good	Low

PHYSICAL ASSESSMENT DATA SHEET

F&ME CONSULTANTS

Building: USC Greenhouse & Associated Brick Structure

Functional Space No: 1 **Type:** I **Location:** (See Homogeneous Area Plan)

Type of Suspect Material: X **TSI** _____ **Surfacing** _____ **Misc.**

Description: HA-1, TSI elbow material

Approximate Amount of Material (SF or LF): 21 L.F.

Condition:

Percent Damage: **X** >0% _____ <10% _____ >10% _____ <25% _____ >25%

Extent of Damage : **X** Localized _____ Distributed

Type of Damage: **X** Deterioration **X** Water _____ Physical

Description:

Asbestos-containing TSI elbows were observed associated with the domestic water line system in the brick structure. The elbows were noted to be in an intact condition. Prior to start of demolition activities, these elbows must be abated by a SCDHEC-licensed abatement contractor.

Overall Condition Rating: Sig. Damaged _____ Damaged _____ Good X

Potential for Disturbance:

	High	Moderate	Low	Friable ACM
Frequency of Potential Contact:			**X**	
Influence of Vibration			**X**	
Frequency of Air Erosion			**X**	
Potential of Water Erosion			**X**	

Overall Potential Disturbance Rating:

Potential for Sig. Damage	Potential for Damage	Low Potential for Damage
		7

Overall Hazard Rank #:

Sig. Damaged	Pot. Sig. Damage	Potential Damage	Low Pot. Damage
			1

Comments: Potential for Disturbance and Hazard Ranking assessed is based on current usage of the facility. Impending demolition activities may impact this material.

Signed: _____ **Date:** **09/10/2014**

PHYSICAL ASSESSMENT DATA SHEET

F&ME CONSULTANTS

Building: USC Greenhouse & Associated Brick Structure

Functional Space No: 2 **Type:** E **Location:** (See Homogeneous Area Plan)

Type of Suspect Material: ____ **TSI** ____ **Surfacing** X **Misc.**

Description: HA-2, Exterior caulking

Approximate Amount of Material (SF or LF): 120 L.F.

Condition:

Percent Damage: **X** >0% ____ <10% ____ >10% ____ <25% ____ >25%

Extent of Damage : **X** Localized ____ Distributed

Type of Damage: **X** Deterioration **X** Water ____ Physical

Description:

Asbestos-containing exterior caulking was identified along the interface between the metal support framing for the glass and the perimeter wall of the greenhouse, as well as around all exterior doors and windows associated with the brick structure. This material was noted to be in an intact condition. Prior to start of demolition activities, this material must be abated by a SCDHEC-licensed abatement contractor.

Overall Condition Rating: Sig. Damaged ____ Damaged ____ Good X

Potential for Disturbance:

	High	Moderate	Low	Friable ACM
Frequency of Potential Contact:			**X**	
Influence of Vibration			**X**	
Frequency of Air Erosion			**X**	
Potential of Water Erosion			**X**	

Overall Potential Disturbance Rating:

Potential for Sig. Damage	Potential for Damage	Low Potential for Damage
		8

Overall Hazard Rank #:

Sig. Damaged	Pot. Sig. Damage	Potential Damage	Low Pot. Damage
			1

Comments: Potential for Disturbance and Hazard Ranking assessed is based on current usage of the facility. Impending demolition activities may impact this material.

Signed: ____ **Date:** **09/10/2014**

PHYSICAL ASSESSMENT DATA SHEET

F&ME CONSULTANTS

Building: USC Greenhouse & Associated Brick Structure

Functional Space No: 1 **Type:** I **Location:** (See Homogeneous Area Plan)

Type of Suspect Material: ____ **TSI** ____ **Surfacing** X **Misc.**

Description: HA-3, Interior white window glazing

Approximate Amount of Material (SF or LF): 120 L.F.

Condition:

Percent Damage: **X** >0% ____ <10% ____ >10% ____ <25% ____ >25%

Extent of Damage : **X** Localized ____ Distributed

Type of Damage: **X** Deterioration **X** Water ____ Physical

Description:

Asbestos-containing interior white widow glazing was observed to be associated with all four (4) windows in the masonry brick structure. This material was noted to be in an intact condition. Prior to start of demolition activities, this material must be abated by a SCDHEC-licensed abatement contractor.

Overall Condition Rating:	Sig. Damaged	Damaged	Good
	____	____	X

Potential for Disturbance:

	High	Moderate	Low	Friable ACM
Frequency of Potential Contact:	____	____	**X**	____
Influence of Vibration	____	____	**X**	____
Frequency of Air Erosion	____	____	**X**	____
Potential of Water Erosion	____	____	**X**	____

Overall Potential Disturbance Rating:

Potential for Sig. Damage	Potential for Damage	Low Potential for Damage
____	____	**8**

Overall Hazard Rank #:

Sig. Damaged	Pot. Sig. Damage	Potential Damage	Low Pot. Damage
____	____	____	**1**

Comments: Potential for Disturbance and Hazard Ranking assessed is based on current usage of the facility. Impending demolition activities may impact this material.

Signed: ____ **Date:** **09/10/2014**

PHYSICAL ASSESSMENT DATA SHEET

F&ME CONSULTANTS

Building: USC Greenhouse & Associated Brick Structure

Functional Space No: 1 **Type:** I **Location:** (See Homogeneous Area Plan)

Type of Suspect Material: ____ **TSI** ____ **Surfacing** X **Misc.**

Description: HA-4, Corrugated Transite heat shield panels

Approximate Amount of Material (SF or LF): ~400 S.F.

Condition:

Percent Damage: **X** >0% ____ <10% ____ >10% ____ <25% ____ >25%

Extent of Damage : **X** Localized ____ Distributed

Type of Damage: **X** Deterioration **X** Water ____ Physical

Description:

Asbestos-containing corrugated Transite heat shield panels were observed under the plant tables around the interior perimeter of the greenhouse. These panels were noted to be in an intact condition. Prior to start of demolition activities, the panels must be abated by a SCDHEC-licensed abatement contractor.

Overall Condition Rating:	Sig. Damaged	Damaged	Good
	____	____	X

Potential for Disturbance:

	High	Moderate	Low	Friable ACM
Frequency of Potential Contact:			**X**	
Influence of Vibration			**X**	
Frequency of Air Erosion			**X**	
Potential of Water Erosion			**X**	

Overall Potential Disturbance Rating:

Potential for Sig. Damage	Potential for Damage	Low Potential for Damage
		8

Overall Hazard Rank #:

Sig. Damaged	Pot. Sig. Damage	Potential Damage	Low Pot. Damage
			1

Comments: Potential for Disturbance and Hazard Ranking assessed is based on current usage of the facility. Impending demolition activities may impact this material.

Signed: ____ **Date:** **09/10/2014**

PHYSICAL ASSESSMENT DATA SHEET

F&ME CONSULTANTS

Building: USC Greenhouse & Associated Brick Structure

Functional Space No: 1 **Type:** I **Location:** (See Homogeneous Area Plan)

Type of Suspect Material: ____ **TSI** ____ **Surfacing** X **Misc.**

Description: HA-5, Transite board

Approximate Amount of Material (SF or LF): ~140 S.F.

Condition:

Percent Damage: **X** >0% ____ <10% ____ >10% ____ <25% ____ >25%

Extent of Damage : **X** Localized ____ Distributed

Type of Damage: **X** Deterioration **X** Water ____ Physical

Description:

Asbestos-containing Transite boards were observed to be associated with the front and rear of the perimeter plant table tops. These boards were noted to be in an intact condition. Prior to start of demolition activities, the boards must be abated by a SCDHEC-licensed abatement contractor.

Overall Condition Rating: Sig. Damaged ____ Damaged ____ Good X

Potential for Disturbance:

	High	Moderate	Low	Friable ACM
Frequency of Potential Contact:			**X**	
Influence of Vibration			**X**	
Frequency of Air Erosion			**X**	
Potential of Water Erosion			**X**	

Overall Potential Disturbance Rating:

Potential for Sig. Damage	Potential for Damage	Low Potential for Damage
		8

Overall Hazard Rank #:

Sig. Damaged	Pot. Sig. Damage	Potential Damage	Low Pot. Damage
			1

Comments: Potential for Disturbance and Hazard Ranking assessed is based on current usage of the facility. Impending demolition activities may impact this material.

Signed: ____ **Date:** **09/10/2014**

PHYSICAL ASSESSMENT DATA SHEET

F&ME CONSULTANTS

Building: USC Greenhouse & Associated Brick Structure

Functional Space No: 2 **Type:** E **Location:** (See Homogeneous Area Plan)

Type of Suspect Material: ____ **TSI** ____ **Surfacing** X **Misc.**

Description: HA-6, Gray exterior greenhouse window glazing

Approximate Amount of Material (SF or LF): ~1,875 L.F.

Condition:

Percent Damage: **X** >0% ____ <10% ____ >10% ____ <25% ____ >25%

Extent of Damage : **X** Localized ____ Distributed

Type of Damage: **X** Deterioration **X** Water ____ Physical

Description:

Asbestos-containing gray exterior greenhouse window glazing was observed under the metal framing of the seams of the greenhouse window systems. This material was noted to be in an intact condition. Prior to start of demolition activities, this material must be abated by a SCDHEC-licensed abatement contractor.

Overall Condition Rating: Sig. Damaged ____ Damaged ____ Good X

Potential for Disturbance:

	High	**Moderate**	**Low**	**Friable ACM**
Frequency of Potential Contact:			**X**	
Influence of Vibration			**X**	
Frequency of Air Erosion			**X**	
Potential of Water Erosion			**X**	

Overall Potential Disturbance Rating:

Potential for Sig. Damage	Potential for Damage	Low Potential for Damage
		8

Overall Hazard Rank #:

Sig. Damaged	Pot. Sig. Damage	Potential Damage	Low Pot. Damage
			1

Comments: Potential for Disturbance and Hazard Ranking assessed is based on current usage of the facility. Impending demolition activities may impact this material.

Signed: ____ **Date:** **09/10/2014**

PHYSICAL ASSESSMENT DATA SHEET

F&ME CONSULTANTS

Building: USC Greenhouse & Associated Brick Structure

Functional Space No: 1 **Type:** I **Location:** (See Homogeneous Area Plan)

Type of Suspect Material: **X** **TSI** _____ **Surfacing** _____ **Misc.**

Description: HA-7, Mud associated with the expansion tank fiberglass insulation

Approximate Amount of Material (SF or LF): ~12 S.F.

Condition:

Percent Damage: _____ >0% _____ <10% _____ >10% _____ <25% **X** >25%

Extent of Damage : _____ Localized **X** Distributed

Type of Damage: **X** Deterioration _____ Water **X** Physical

Description:

Asbestos-containing mud was observed on the fiberglass insulation covering the expansion tank located inside the brick structure. This material was noted to be in a significantly damaged and friable condition. Prior to start of demolition activities, this friable material must be abated by a SCDHEC-licensed abatement contractor.

Overall Condition Rating: Sig. Damaged _____ Damaged _____ Good X

Potential for Disturbance:

	High	Moderate	Low	Friable ACM
Frequency of Potential Contact:			**X**	**X**
Influence of Vibration			**X**	**X**
Frequency of Air Erosion			**X**	**X**
Potential of Water Erosion			**X**	**X**

Overall Potential Disturbance Rating:

Potential for Sig. Damage	Potential for Damage	Low Potential for Damage
		4

Overall Hazard Rank #:

Sig. Damaged	Pot. Sig. Damage	Potential Damage	Low Pot. Damage
7			

Comments: Potential for Disturbance and Hazard Ranking assessed is based on current usage of the facility. Impending demolition activities may impact this material.

Signed: _____ **Date:** **09/10/2014**

EMSL Analytical, Inc.
706 Gralin Street, Kernersville, NC 27284
Phone/Fax: (336) 992-1025 / (336) 992-4175
http://www.EMSL.com greensborolab@emsl.com

EMSL Order:	021405108
CustomerID:	FMEC62
CustomerPO:	E5300.28
ProjectID:	

Attn: **Glynn Ellen**
F & ME Consultants
3112 Divine Street

Columbia, SC 29205

Phone:	(803) 254-4540
Fax:	(803) 254-4542
Received:	09/11/14 10:00 AM
Analysis Date:	9/15/2014
Collected:	

Project: **E5300.28 USC Broadcast Studio Abatement Design**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos				Asbestos	
Sample	**Description**	**Appearance**	**%**	**Fibrous**	**%**	**Non-Fibrous**	**%**	**Type**
GH-1-1 *021405108-0001*	Corrugated Transite Panel	Brown/Gray/Tan Fibrous Heterogeneous	<1%	Cellulose	85%	Non-fibrous (other)	**15%**	**Chrysotile**
GH-1-2 *021405108-0002*	Corrugated Transite Panel						**Stop Positive (Not Analyzed)**	
GH-2-1 *021405108-0003*	Transite Facia panel	Gray/Tan/Beige Fibrous Heterogeneous	<1%	Cellulose	80%	Non-fibrous (other)	**20%**	**Chrysotile**
GH-2-2 *021405108-0004*	Transite Facia panel						**Stop Positive (Not Analyzed)**	
GH-3-1 *021405108-0005*	Sink Undercoating	Beige Fibrous Homogeneous	15%	Cellulose	1% 84%	Mica Non-fibrous (other)	**None Detected**	
GH-3-2 *021405108-0006*	Sink Undercoating	Beige Fibrous Homogeneous	15%	Cellulose	1% 84%	Mica Non-fibrous (other)	**None Detected**	
GH-4-1 *021405108-0007*	Window Glazing	Brown/Gray Fibrous Heterogeneous	1%	Cellulose	84%	Non-fibrous (other)	**15%**	**Chrysotile**
GH-4-2 *021405108-0008*	Window Glazing						**Stop Positive (Not Analyzed)**	
GH-5-1 *021405108-0009*	Silver Paint	Silver/Beige Non-Fibrous Heterogeneous	<1%	Cellulose	100%	Non-fibrous (other)	**None Detected**	

Analyst(s)

Kristie Elliott (2)
Scott Combs (6)

Stephen Bennett, Laboratory Manager
or other approved signatory

Initial report from 09/15/2014 10:05:23

EMSL Analytical, Inc.
706 Gralin Street, Kernersville, NC 27284
Phone/Fax: (336) 992-1025 / (336) 992-4175
http://www.EMSL.com greensborolab@emsl.com

EMSL Order:	021405108
CustomerID:	FMEC62
CustomerPO:	E5300.28
ProjectID:	

Attn: **Glynn Ellen**
F & ME Consultants
3112 Divine Street

Columbia, SC 29205

Phone:	(803) 254-4540
Fax:	(803) 254-4542
Received:	09/11/14 10:00 AM
Analysis Date:	9/15/2014
Collected:	

Project: **E5300.28 USC Broadcast Studio Abatement Design**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos				Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**		**% Non-Fibrous**		**% Type**
GH-5-2 *021405108-0010*	Silver Paint	Silver/Green/Beige Non-Fibrous Homogeneous	<1%	Cellulose	100%	Non-fibrous (other)	**None Detected**
GH-6-1 *021405108-0011*	Mud material	Gray/Tan Fibrous Heterogeneous	25% 1%	Min. Wool Cellulose	69%	Non-fibrous (other)	**5% Chrysotile**
GH-6-2 *021405108-0012*	Mud material						**Stop Positive (Not Analyzed)**
GH-6-3 *021405108-0013*	Mud material						**Stop Positive (Not Analyzed)**

Analyst(s)

Kristie Elliott (2)
Scott Combs (6)

Stephen Bennett, Laboratory Manager
or other approved signatory

Initial report from 09/15/2014 10:05:23

EMSL Analytical, Inc.
706 Gralin Street, Kernersville, NC 27284
Phone/Fax: (336) 992-1025 / (336) 992-4175
http://www.EMSL.com greensborolab@emsl.com

EMSL Order:	021405108
CustomerID:	FMEC62
CustomerPO:	E5300.28
ProjectID:	

Attn: **Glynn Ellen**
F & ME Consultants
3112 Divine Street

Columbia, SC 29205

Phone:	(803) 254-4540
Fax:	(803) 254-4542
Received:	09/11/14 10:00 AM
Analysis Date:	9/17/2014
Collected:	

Project: **E5300.28 USC Broadcast Studio Abatement Design**

Test Report: Asbestos Analysis of Non-Friable Organically Bound Materials by TEM via EPA/600/R-93/116 Section 2.5.5.1

SAMPLE ID	DESCRIPTION	APPEARANCE	% MATRIX MATERIAL	% NON-ASBESTOS FIBERS	ASBESTOS TYPES
GH-3-3 *021405108-0014*	Sink Undercoating	Gray/White Non-Fibrous Heterogeneous	100	None	No Asbestos Detected
GH-5-3 *021405108-0015*	Silver Paint	Silver Non-Fibrous Homogeneous	100	None	No Asbestos Detected

Analyst(s)

Stephen Bennett (2)

Stephen Bennett, Laboratory Manager
or other approved signatory

Initial report from 09/17/2014 10:01:22

OrderID: 021405108

Chain of Custody

Asbestos Lab Services

EMSL Analytical, Inc.
706 Gralin Street
Kernersville, NC 27284

Phone: (336) 992-1025
Fax: (336) 992-4175
http://www.emsl.com

Please print all information legibly.

Company:	F&ME Consultants	*Bill To:*	F&ME Consultants
Address1:	3112 Devine Street	*Address1:*	P.O. Box 5855
Address2:		*Address2:*	
City, State:	Columbia, South Carolina	*City, State:*	Columbia, South Carolina
Zip/Post Code:	29205	*Zip/Post Code:*	29250
Country:	USA	*Country:*	USA
Contact Name:	Glynn Ellen	*Attn:*	Jim Kelleher
Phone:	803 254-4540	*Phone:*	803 777-1208
Fax:	803 254-4542	*Fax:*	803 777-1028
Email:	glynn@fmecol.com jshannon@fmecol.com	*Email:*	jkelleher@fmecol.com
EMSL Rep:	Jason McDonald	*P.O. Number:*	E5300.28
Project Name/Number:	E5300.28 USC Broadcast Studio Abatement Design		

MATRIX			TURNAROUND			
☐ Air	☐ Soil	☐ Micro-Vac	☐ 3 Hours	☐ 6 Hours	☐ Same Day or 12 Hours*	☐ 24 Hours (1day)
☑ Bulk	☐ Drinking Water		☐ 48 Hours (2 days)	☑ 72 Hours (3 days)	☑ 96 Hours (4 days)	☐ 120 Hours (5 days)
☐ Wipe	☐ Wastewater		☐ 144+ hours (6-10 days)			

TEM AIR, 3 hours, 6 hours, Please call ahead to schedule. There is a premium charge for 3-hour tat, please call 1-800-220-3675 for price prior to sending samples. You will be asked to sign an authorization form for this service.
***12 hours (must arrive by 11:00a.m. Mon -Fri.), Please Refer to Price Quote**

PCM - Air	TEM Air	TEM WATER
☐ NIOSH 7400(A) Issue 2: August 1994	☐ AHERA 40 CFR, Part 763 Subpart E	☐ EPA 100.1
☐ OSHA w/TWA	☐ NIOSH 7402	☐ EPA 100.2
☐ Other:	☐ EPA Level II	☐ NYS 198.2
PLM - Bulk	**TEM BULK**	**TEM Microvac/Wipe**
☑ EPA 600/R-93/116	☐ Drop Mount (Qualitative)	☐ ASTM D 5755-95 (quantative method)
☐ EPA Point Count	☐ Chatfield SOP - 1988-02	☐ Wipe Qualitative
☐ NY Stratified Point Count	☐ TEM NOB (Gravimetric) NYS 198.4	
☐ PLM NOB (Gravimetric) NYS 198.1	☐ EMSL Standard Addition:	**XRD**
☐ NIOSH 9002:		☐ Asbestos
☐ EMSL Standard Addition:	**PLM Soil**	☐ Silica NIOSH 7500
SEM Air or Bulk	☐ EPA Protocol Qualitative	
☐ Qualitative	☐ EPA Protocol Quantitative	**OTHER**
☐ Quantitative	☐ EMSL MSD 9000 Method fibers/gram	☐

OrderID: 021405108 05108

Chain of Custody

Asbestos Lab Services

EMSL Analytical, Inc.
706 Gralin Street
Kernersville, NC 27284

Phone: (336) 992-1025
Fax: (336) 992-4175
http://www.emsl.com

Please print all information legibly.

Client Sample # **GH-1-1 to GH-6-3** **Total Samples #:** 18

Relinquished: Jim Timmons **Date:** 09/10/2014 **Time:** 17:00

Received: _____ **Date:** 9/11/14 **Time:** 10:00

Relinquished: _____ **Date:** 9/12/14 **Time:** 0850

Received: _____ **Date:** _____ **Time:** _____

NOTE: FIRST POSITIVE STOP PROTOCAL. ALSO, FOR SAMPLES DENOTED WITH AN ASTERICK (*), IF THE FIRST TWO SAMPLES AS PLM AND IF THE RESULTS ARE NEGATIVE, RUN LAST SAMPLE AS TEM BULK FOR NEGATIVE CONFIRMATION. SOUTH CAROLINA GUIDELINES.

	SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME (if applicable)
1	GH-1-1	Corrugated Transite panel	
2	GH-1-2	Corrugated Transite panel	
3	*GH-1-3	Corrugated Transite panel	
4	GH-2-1	Transite facia panel	
5	GH-2-2	Transite facia panel	
6	*GH-2-3	Transite facia panel	
7	GH-3-1	White sink undercoating	
8	GH-3-2	White sink undercoating	
9	*GH-3-3	White sink undercoating	
10	GH-4-1	Grey vertical window glazing	
11	GH-4-2	Grey vertical window glazing	
12	*GH-4-3	Grey vertical window glazing	
13	GH-5-1	Silver paint	
14	GH-5-2	Silver paint	
15	*GH-5-3	Silver paint	
16	GH-6-1	Mud material associated with fiber glass expansion tank	
17	GH-6-2	Mud material associated with fiber glass expansion tank	
18	GH-6-3	Mud material associated with fiber glass expansion tank	
19			
20			
21			
22			
23			
24			
25			

APPENDIX C

Personnel Certifications

SCDHEC ISSUED
Asbestos ID Card

James T Timmons

		Expires
SUPERAHERA	SA-02244	05/09/15
AIRSAMPLER	AS-00423	05/09/15
CONSULTMP	MP-00196	09/27/14

SCDHEC ISSUED

Asbestos ID Card

Glynn M Ellen

		Expires
SUPERAHERA	SA-00455	02/24/15
CONSULTMP	ASB-22641	02/25/15
AIRSAMPLER	AS-00079	02/24/15
CONSULTPD	PD-00098	06/12/15

APPENDIX D

SCDHEC Regulation Summary
SCDHEC Abatement Project Forms

Air Quality

Asbestos - Regulatory Information

RENOVATIONS & DEMOLITIONS

Note: This information should serve as a guide only and is not intended to replace the regulations. For additional information concerning DHEC and EPA regulations, contact DHEC's Asbestos Section at (803) 898-4289. Information regarding the OSHA asbestos standards may be obtained from the South Carolina Department of Labor, Licensing and Regulation at (803) 734-9669.

APPLICABILITY

Renovation and demolition of most facilities, including buildings, structures, and other installations, are subject to State and Federal asbestos regulations. Certain residential buildings may be exempt unless the property was used in the past for non-residential purposes (contact the Asbestos Section for additional information) or is part of a larger development such as highway right-of-way, mall development, urban renewal or other type of similar development. The facility owner and the renovation or demolition contractor are both responsible for ensuring compliance with these regulations.

DEFINITIONS

Renovation means altering a facility or one or more facility components in any way, including the stripping or removal of regulated asbestos-containing material (RACM) from a facility component. "Remodeling" is considered renovation.

Demolition is the wrecking or taking out of any load-supporting structural member of a facility and any related handling operations. Structural burns are prohibited by State Open Burning Regulations.

INSPECTION FOR ASBESTOS

Before a facility or a portion of a facility is renovated or demolished, the owner/operator of the facility or renovation or demolition activity must ensure that the facility or portion of the facility being renovated or demolished has been thoroughly inspected for the presence of asbestos. The inspection must be performed by a person who has been trained and licensed as an Asbestos Building Inspector or management planner in accordance with State training and licensing requirements.

The inspector must identify, quantify, and assess the condition of all suspect asbestos-containing materials, either friable or non-friable, on interior and exterior portions of the facility. The inspector must also comply with the procedures specified in 40 CFR 763.86 in determining sampling locations and the number of representative samples to be collected. In addition, the

inspector is required to prepare a written report detailing the findings of the inspection. At a minimum, the report must include information required in 40 CFR 763.85 (a)(4)(vi)(A)-(E), as well as the date of inspection and the name, license number, and signature of the licensed Asbestos Building Inspector or Management Planner who performed the inspection and completed the report. A legible copy of the building inspection report must be provided to the Department prior to each demolition, and upon request for renovations. **(Note: "BUILDING INSPECTIONS" can be consulted for a detailed explanation of the aforementioned sampling and reporting protocols.)**

A building inspection will only be acceptable if performed **within three years** prior to the demolition or renovation. If an inspection report is more than three years old, then it must be confirmed and verified by a licensed Asbestos Building Inspector or Management Planner.-

FRIABLE ASBESTOS-CONTAINING MATERIALS

If friable asbestos-containing materials (e.g., pipe insulation) are present, they must be removed prior to being disturbed during renovation or demolition activities. Removal (abatement) must be performed by trained, licensed persons using procedures detailed in State and Federal regulations.

A project design must be prepared for each asbestos abatement project involving the abatement of greater than 3,000 square feet, 1,500 linear feet and/or 656 cubic feet of RACM in a facility to be reoccupied. Such designs must be prepared by a person licensed by the Department as an Asbestos Project Designer.

NON-FRIABLE ASBESTOS-CONTAINING MATERIALS

During renovations, removal of non-friable materials (e.g., vinyl-asbestos floor tiles and sheet flooring, mastics, asphaltic roofing, and asbestos-cement siding and roofing tiles) may be regulated. Applicability is dependent upon the removal methods to be used. If it can be anticipated that non-friable materials will be ground, crumbled, sanded, abraded, chipped or pulverized, the removal is subject to the same rules as removal of friable materials.

Prior to any demolition, non-friable asbestos-cement products (e.g., transite siding, exterior siding and roofing shingles) must be removed. Asbestos-containing sheet flooring and floor tiles, as well as asphaltic roofing products, need not be removed if they are in good condition and have not become brittle and are not peeling, cracking, or crumbling. Otherwise, they must also be removed prior to demolition. If it can be anticipated that non-friable materials will be ground, crumbled, sanded, abraded, chipped or pulverized, the materials must be removed and the removal is subject to the same rules as removal of friable materials. The amount of any non-friable asbestos that will remain in place during demolition must also be indicated on the written notification form.

All asbestos-containing materials must be removed if the facility will be demolished by non-standard demolition techniques such as implosion, explosion, or intentional burning.

NOTIFICATION FOR RENOVATIONS AND DEMOLITIONS

Prior to removing regulated asbestos-containing materials, written notification must be submitted to the Department (up to 10 working days in advance, depending on the amount of asbestos to be removed). The notification must include certain required items of information about the owner, the contractor, the facility, and the asbestos removal project. Required fees must be submitted along with the notification. You must obtain a permit from the Department prior to the renovation activity.

Prior to the demolition of any regulated facility, written notification must be submitted to the Department *at least 10 working days* in advance **even if a building inspector determines that asbestos is not present at the facility.** The notification must include certain required items of information about the owner, the contractor, the facility, and the demolition project. Required fees and a copy of the building inspector's report must be submitted along with the notification of demolition. You must obtain a permit from the Department prior to the demolition activity.

DISPOSAL

Never burn any asbestos-containing waste material.

Non-asbestos-containing demolition debris and debris which contains only non-regulated roofing or flooring may be disposed of at a DHEC-approved disposal site for cellulosic or inert waste. Waste consolidation activities involving grinding, cutting, or compacting of non-friable asbestos-containing materials will subject these materials to more stringent State and Federal asbestos disposal regulations.

Regulated asbestos waste must be handled by properly licensed asbestos abatement personnel and disposed of at a landfill permitted to accept regulated asbestos waste. A list of approved landfills may be obtained from the Asbestos Section.

REGULATORY REQUIREMENTS FOR BUILDING INSPECTION

As required by the National Emission Standard for Hazardous Air Pollutants (NESHAP) and SCDHEC Regulation 61-86.1, an owner/operator shall ensure that a building inspection to detect the presence of asbestos-containing materials (ACM) has been performed prior to any renovation or demolition activity at a regulated facility.

Under SCDHEC Regulation 61-86.1, Section VI.A.6., an inspection cannot have been performed more than three years prior to a renovation or demolition activity. If more than three years have elapsed since the most recent inspection, the previous inspection shall be confirmed and verified by a licensed building inspector and/or management planner.

SCDHEC Regulation 61-86.1 requires that all inspections be performed by persons trained and licensed as either a building inspector and/or management planner. In order to be licensed in these disciplines, persons must have successfully completed a Department approved initial training course specific to inspecting for ACM in a building and/or a course specific to

management planning for ACM in a building. Persons must also have taken and passed an examination at the end of the course with a score of 70 percent or above.

In performing inspections, SCDHEC Regulation 61-86.1 requires that a building inspector and/or management planner comply with the requirements of Section VI, Asbestos Building Inspection Requirements. An inspection shall include samples from suspect friable and non-friable ACM on interior and exterior portions of a facility or its facility components.

In performing inspections, SCDHEC Regulation 61-86.1 requires that a building inspector and/or management planner follow specific sampling procedures. According to Section IV.B.3.a of the regulation, a building inspector and/or management planner shall comply with the procedures specified in **40 CFR 763.86** in determining sampling locations and the number of representative samples to be collected. An inspection shall include samples from suspect friable and non-friable ACM on interior and exterior portions of a facility or its facility components.

Under 40 CFR Part 763.86, suspect ACM are divided into three categories: surfacing materials, thermal system insulation (commonly referred to as TSI), and miscellaneous materials. SCDHEC Regulation 61-86.1, Section VI contains sampling procedures specific to each category of material.

Surfacing material includes, but is not limited to, joint compound, plaster, and painted, troweled on, or spray-applied textured material. To remain in compliance with SCDHEC Regulation 61-86.1, surfacing materials on exterior and interior portions of a facility shall be sampled according to procedures outlined in SCDHEC Regulation 61-86.1, Section VI.D.1. (a)-(c):

- A licensed asbestos inspector shall collect, in a statistically random manner, a minimum of three bulk samples from each homogeneous area of any surfacing that is not assumed to be ACM, and shall collect the samples as follows:

- At least three bulk samples shall be collected from each homogeneous area that is 1,000 or fewer square feet (sf) or linear feet (Lf) in size.
- At least five bulk samples shall be collected from each homogeneous area that is greater than 1,000 but fewer than or equal to 5,000 sf or Lf.
- At least seven bulk samples shall be collected from each homogeneous area that is greater than 5,000 sf or Lf.

Thermal system insulation (TSI) is any material that is applied to pipes, fittings, boilers, breeching, tanks, ducts, or other facility components for the purpose of preventing heat loss or gain, water condensation, or for other purposes. ***Miscellaneous Material*** is any material that is not considered a surfacing material or thermal system insulation and includes, but is not limited to, flooring, roofing, mastics, gaskets, cementitious materials, caulkings, ceiling tiles, fire doors, wall boards, and flexible duct connections. To remain in compliance with SCDHEC Regulation 61-86.1, TSI and miscellaneous materials on exterior and interior portions of a facility shall be sampled in accordance with procedures outlined in SCDHEC Regulation 61-86.1, Section VI.D.2:

- A licensed asbestos inspector shall collect, in a statistically random manner, at least three bulk samples from each homogeneous area of TSI and any miscellaneous material that is not assumed to be ACM.
- In accordance with ASTM E2356, and any subsequent amendments and editions, negative results for non-friable organically bound materials (NOB) shall be verified with at least one TEM analysis.
- NOBs include flooring, roofing, mastics, adhesives, caulks, and glazing.
- If an accredited inspector has determined the thermal system insulation to be fiberglass, foam glass, rubber, or other non-suspect material, then bulk samples are not required.

SCDHEC Regulation 61-86.1, Section VI.C requires that a building inspector and/or management planner prepare a written asbestos building inspection report to include the following:

- A title page denoting: (1) The client's name, company, address, and telephone number, and the name and exact location of the facility inspected; (2) the date the inspection was performed; (3) the date the inspection report was written; and (4) the printed name and telephone number of the inspector(s), and his or her affiliated company name, address, and telephone number.
- A cover letter to the building owner or owner's representative that describes the purpose of the inspection; a general synopsis of the inspection and results; and the name, title, and signature of the inspector(s) and report writer, if different.
- A detailed narrative of the physical description of the building or part of the building affected by the renovation or demolition operation that includes: (1) The square footage of the building or part of the building affected by the renovation or demolition operation; (2) The building materials used in the construction of the exterior, roof, interior, and basement or crawlspace of the building affected by the demolition or affected by the renovation materials operation; (3) An estimated or exact quantity (square or linear feet) for all suspect materials whether sampled for or assumed to be asbestos that may be affected by the renovation or demolition operation; (4) Also include a description of non-suspect materials excluding: glass, metals, kiln brick, cement, fiberglass, concrete, pressed wood, cinder block, and rubber.
- An executive summary that details: (1) The type of suspect ACM (e.g., TSI, floor tile, mastic), total square or linear footage, and the total number of samples collected for each separate homogenous area affected by the renovation or demolition operation; (2) The date of the inspection, type, condition, quantity, sample results, and exact location of ACM positively identified or assumed to be ACM in the part of the building affected by the renovation or demolition operation; (3) A list of the homogeneous areas identified; (4) Whether the material is accessible for the building or part of the building affected by the renovation or demolition operation; and (5) The material's potential for disturbance for the building or part of the building affected by the renovation or demolition operation.
- For renovation and demolition operations, the inspector's determination that ACM is friable or non-friable.
- Except when suspect ACM materials are assumed to be asbestos, include a complete, clear, legible copy of all laboratory bulk sample results.

- Clear, legible drawings and/or photographs to clarify the scope of the renovation or demolition operation. Illustrate the exact location of each sample collected. For facilities that involve a trade secret or confidential component or an affected area process, a request for a variance may be submitted.
- The printed name and signature of each accredited inspector who collected the samples, and a clear legible copy of his or her Department issued asbestos building inspector or management planner license

D H E C

PROMOTE PROTECT PROSPER

ASBESTOS ABATEMENT PROJECT LICENSE APPLICATION

BUREAU OF AIR QUALITY • ASBESTOS SECTION • 2600 BULL STREET • COLUMBIA • SC • 29201

TYPE OF OPERATION: ☐ Standard Removal ☐ Emergency Removal ☐ Enclosure ☐ Encapsulation ☐ Cleanup ☐ Disposal

FOR OFFICE USE Postmark/Received:	Original ☐ / Revised ☐ / Cancellation ☐ (check one)	Project License I.D. (For Revisions/Cancellations):

I. FACILITY OWNER: _____

MAILING ADDRESS: _____

CITY: _____ STATE: _____ ZIP: _____

CONTACT PERSON: _____ PHONE: ( ) _____

II. REMOVAL CONTRACTOR: _____

MAILING ADDRESS: _____

CITY: _____ STATE: _____ ZIP: _____

CONTACT PERSON: _____ PHONE: ( ) _____

E-MAIL ADDRESS: _____ E-MAIL PERMIT ☐ OR MAIL PERMIT ☐

FEDERAL I.D. NUMBER: _____

DHEC CONTRACTOR LICENSE NO. (If applicable): _____ EXPIRATION DATE: _____

III. FACILITY NAME: _____

STREET ADDRESS: _____

CITY: _____ STATE: _____ COUNTY: _____

SITE (ROOM, FLOOR, WING, UNIT, MACHINE, ETC.): _____

BUILDING SIZE: _____ NO. OF FLOORS: _____ AGE IN YEARS: _____

PRESENT USE: _____ PRIOR USE: _____ FUTURE USE: _____

IV. PROCEDURES, INCLUDING ANALYTICAL METHOD IF APPROPRIATE, USED TO DETECT THE PRESENCE OF ASBESTOS MATERIAL:

FACILITY OR FACILITY COMPONENT SURVEYED BY (INSPECTOR NAME): _____

COMPANY: _____ PHONE: ( ) _____

DHEC LICENSE NUMBER: _____ EXPIRATION DATE: _____

V. PROJECT DESIGN PERFORMED BY (IF APPLICABLE): _____

COMPANY: _____ PHONE: ( ) _____

DHEC LICENSE NUMBER: _____ EXPIRATION DATE: _____

VI. ASBESTOS-CONTAINING MATERIALS (ACM) ***TO BE REMOVED ONLY:***

TYPE (TSI, SURFACING, FLOORING, ROOFING, ETC.)	**AMOUNT** (SQUARE FEET, LINEAR FEET, CUBIC FEET)	**CONDITION** (CIRCLE ONE)
		☐ FRIABLE ☐ NON-FRIABLE
		☐ FRIABLE ☐ NON-FRIABLE
		☐ FRIABLE ☐ NON-FRIABLE
		☐ FRIABLE ☐ NON-FRIABLE

VII. SCHEDULED DATES OF REMOVAL: START DATE: _____ COMPLETION DATE: _____

WORK DAYS: _____ WORK HOURS: _____

APPLICATIONS MUST BE SUBMITTED WITH FEES PRIOR TO THE SCHEDULED START DATE AS FOLLOWS:

NESHAP PROJECTS: 10 WORKING DAYS
SMALL PROJECTS: 4 WORKING DAYS
MINOR PROJECTS: 2 WORKING DAYS

FEE SCHEDULE FOR FRIABLE ASBESTOS-CONTAINING MATERIALS:

10 CENTS PER SQUARE FOOT OR LINEAR FOOT
MINIMUM FEE OF $25.00
MAXIMUM FEE OF $1000.00

Non-Friable (NESAP-sized) Projects: 4 working days. No fee for non-friable ACM.

For additional information concerning regulatory requirements call or visit our Web site at http://www.scdhec.gov/environment/baq/asbestos.aspx

VIII. DESCRIPTION OF PLANNED ABATEMENT WORK & METHOD(S) TO BE USED:

IX. DESCRIPTION OF WORK PRACTICES & ENGINEERING CONTROLS TO BE USED TO PREVENT EMISSIONS OF ASBESTOS AT THE RENOVATION SITE:

X. WASTE TRANSPORTER #1: _____

MAILING ADDRESS: _____

CITY: _____ STATE: _____ ZIP: _____

CONTACT PERSON: _____ PHONE: (_____)_____

WASTE TRANSPORTER #2: _____

MAILING ADDRESS: _____

CITY: _____ STATE: _____ ZIP: _____

CONTACT PERSON:_____ PHONE: (_____)_____

XI. WASTE DISPOSAL SITE: _____

MAILING ADDRESS: _____

CITY: _____ STATE: _____ ZIP: _____

CONTACT PERSON: _____ PHONE: (_____)_____

TEMPORARY ASBESTOS STORAGE CONTAINMENT AREA LICENSE NUMBER (IF APPLICABLE): _____

XII. DESCRIPTION OF EMERGENCY REMOVAL (**PLEASE ATTACH A LETTER FROM THE FACILITY OWNER EXPLAINING THE NATURE OF THE EMERGENCY**)

DATE & HOUR OF EMERGENCY (MM/DD/YY): _____

DESCRIPTION OF SUDDEN, UNEXPECTED EVENT:

EXPLANATION OF HOW THE EVENT CAUSED UNSAFE CONDITIONS AND/OR WOULD CAUSE EQUIPMENT DAMAGE AND/OR AN UNREASONABLE FINANCIAL BURDEN:

XIII. DESCRIPTION OF PROCEDURES TO BE FOLLOWED IN THE EVENT THAT UNEXPECTED ASBESTOS IS FOUND OR PREVIOUSLY NON-FRIABLE ASBESTOS MATERIAL BECOMES CRUMBLED, PULVERIZED OR REDUCED TO POWDER:

XIV. *I CERTIFY THAT AN INDIVIDUAL TRAINED IN THE PROVISIONS OF REGULATION (40 CFR PART 61, SUBPART M) WILL BE ON-SITE DURING THE RENOVATION AND EVIDENCE THAT THE REQUIRED TRAINING HAS BEEN ACCOMPLISHED BY THIS PERSON WILL BE AVAILABLE FOR INSPECTION DURING NORMAL BUSINESS HOURS.*

_____/_____
(SIGNATURE OF OWNER/OPERATOR) (DATE)

XIV. *I CERTIFY THAT THE ABOVE INFORMATION IS CORRECT.*

_____/_____
(SIGNATURE OF OWNER/OPERATOR) (DATE)

D H E C

PROMOTE PROTECT PROSPER

DEMOLITION LICENSE APPLICATION

BUREAU OF AIR QUALITY • ASBESTOS SECTION • 2600 BULL STREET • COLUMBIA • SC • 29201

TYPE OF OPERATION: ☐ Total Demolition ☐ Partial Demolition ☐ Ordered Demolition

FOR OFFICE USE Postmark/Received:	Original/Revised/Cancellation (circle one)	Project License I.D. (For Revisions/Cancellations):

I. FACILITY OWNER: _____

MAILING ADDRESS: _____

CITY: _____ STATE: _____ ZIP: _____

CONTACT PERSON: _____ PHONE: (_____) _____

II. IS ASBESTOS PRESENT IN THE FACILITY?: YES ☐ / NO ☐ (check one)

III. DEMOLITION CONTRACTOR: _____ FEDERAL ID NO.: _____

MAILING ADDRESS: _____

CITY: _____ STATE: _____ ZIP: _____

CONTACT PERSON: _____ PHONE: (_____) _____

E-MAIL ADDRESS: _____ E-MAIL PERMIT ☐ OR MAIL PERMIT ☐

FEDERAL I.D. NUMBER: _____

ASBESTOS REMOVAL CONTRACTOR (If applicable): _____

MAILING ADDRESS: _____

CITY: _____ STATE: _____ ZIP: _____

CONTACT PERSON: _____ PHONE: (_____) _____

IV. FACILITY NAME: _____

STREET ADDRESS: _____

CITY: _____ STATE: _____ COUNTY: _____

SITE (ROOM, FLOOR, WING, UNIT, MACHINE, ETC.): _____

BUILDING SIZE: _____ NO. OF FLOORS: _____ AGE IN YEARS: _____

PRESENT USE: _____ PRIOR USE: _____ FUTURE USE: _____

V. PROCEDURES, INCLUDING ANALYTICAL METHOD IF APPROPRIATE, USED TO DETECT THE PRESENCE OF ASBESTOS MATERIAL:

FACILITY OR FACILITY COMPONENT SURVEYED BY (INSPECTOR NAME): _____

COMPANY: _____ PHONE: (_____) _____

DHEC LICENSE NUMBER: _____ EXPIRATION DATE: _____

VI. NON-FRIABLE MASTIC, GLUE, AND ADHESIVE ASBESTOS-CONTAINING MATERIALS ***REMAINING IN PLACE DURING DEMOLITION*** *(IF APPLICABLE):*

TYPE (MASTIC, GLUE, AND ADHESIVE)	**AMOUNT** (SQUARE FEET)

VII. SCHEDULED DATES OF DEMOLITION (YOU MUST SPECIFY DATES):

START DATE: _____ COMPLETION DATE: _____

WORK DAYS: _____ WORK HOURS: _____

- ***Applications must be mailed along with a $50.00 fee (payable to SCDHEC) at least 10 working days prior to the scheduled start date. Faxes will not be accepted.***
- ***A copy of an asbestos survey report (no older than 3 years) must accompany the application.***

For additional information concerning regulatory requirements call or visit our Web site at http://www.scdhec.gov/environment/baq/asbestos.aspx

VIII. DESCRIPTION OF PLANNED DEMOLITION METHOD(S) TO BE USED:

☐ BULLDOZER	☐ LOADER	☐ WRECKING BALL	☐ MANUAL	☐ BURNING	☐ IMPLOSION/EXPLOSION

IF OTHER PLEASE DESCRIBE:

IX. DESCRIPTION OF WORK PRACTICES & ENGINEERING CONTROLS TO BE USED TO PREVENT EMISSIONS OF ASBESTOS AT THE DEMOLITION SITE:

X. WASTE TRANSPORTER #1: _____

MAILING ADDRESS: _____

CITY: _____ STATE: _____ ZIP: _____

CONTACT PERSON: _____ PHONE: ( ) _____

WASTE TRANSPORTER #2: _____

MAILING ADDRESS: _____

CITY: _____ STATE: _____ ZIP: _____

CONTACT PERSON: _____ PHONE: ( ) _____

XI. WASTE DISPOSAL SITE: _____

MAILING ADDRESS: _____

CITY: _____ STATE: _____ ZIP: _____

CONTACT PERSON: _____ PHONE: ( ) _____

XII. IF DEMOLITION ORDERED BY GOVERNMENT AGENCY, PLEASE IDENTIFY THE AGENCY BELOW: (PLEASE ATTACH A COPY OF THE ORDER)

NAME: _____ TITLE: _____

AUTHORITY: _____

DATE OF ORDER (MM/DD/YY): _____ DATE ORDERED TO BEGIN(MM/DD/YY): _____

XIII. DESCRIPTION OF PROCEDURES TO BE FOLLOWED IN THE EVENT THAT UNEXPECTED ASBESTOS IS FOUND OR PREVIOUSLY NONFRIABLE ASBESTOS MATERIAL BECOMES CRUMBLED, PULVERIZED, OR REDUCED TO POWDER:

XIV. *I CERTIFY THAT AN INDIVIDUAL TRAINED IN THE PROVISIONS OF REGULATION (40 CFR PART 61, SUBPART M) WILL BE ON-SITE DURING THE DEMOLITION INVOLVING RACM AND EVIDENCE THAT THE REQUIRED TRAINING HAS BEEN ACCOMPLISHED BY THIS PERSON WILL BE AVAILABLE FOR INSPECTION DURING NORMAL BUSINESS HOURS.*

_____/_____
(SIGNATURE OF OWNER/OPERATOR) (DATE)

XV. *I CERTIFY THAT THE ABOVE INFORMATION IS CORRECT.*

_____/_____
(SIGNATURE OF OWNER/OPERATOR) (DATE)

- ***Applications must be mailed along with a $50.00 fee (payable to SCDHEC) at least 10 working days prior to the scheduled start date. Faxes will not be accepted.***
- ***A copy of an asbestos survey report (no older than 3 years) must accompany the application.***

For additional information concerning regulatory requirements call or visit our Web site at http://www.scdhec.gov/environment/baq/asbestos.aspx

D H E C
PROMOTE PROTECT PROSPER

Asbestos Waste Shipment Record

1. **SCDHEC ASBESTOS ABATEMENT PROJECT LICENSE:**

Generator Information

2. Waste Generator/Owner Name & Address:	Work Site Name & Physical Address:	Waste Generator/Owner Telephone Number ( )
3. Abatement Contractor Name & Address:		Abatement Contractor Telephone Number ( )
4. Name of waste disposal site (WDS), mailing address, and physical site location:		WDS Telephone Number: ( )

5. Description of Waste Materials (please circle): Friable (Regulated) / Nonfriable (Nonregulated)	6. Bags of Containers: No. Type _____ Drums _____ Bags _____ Bulk Load	7. Total Quantity: m3 (yd3)

8. Special handling instructions & additional information:

9. Generator's/Contractor's Certification: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked and labeled. The contents are in all respects in proper condition for transport by highway according to applicable international and government regulations.

Print Name:	Signature:	Date:

Transporter Information (Acknowledgment of Receipt of Materials):

10. Name, title, address, telephone number:	Signature:	Date:
11. Name, title, address, telephone number:	Signature:	Date:

Disposal Site Operator

12. Discrepancy: Bags or Containers Total Quantity

13. Waste Disposal Site Owner or Operator certification of receipt of asbestos materials covered by this manifest except as noted in item 11.

Print Name:	Signature:	Date:

Please forward a completed copy of this record to: SCDHEC, Bureau of Air Quality, Asbestos Section, 2600 Bull Street, Columbia, SC 29201
(803) 898-4389 office. (803) 898-4281 fax.

APPENDIX E

University of South Carolina ACM Inspection Report (dated 8/11/14)

University of South Carolina
743 Greene Street
Columbia SC 29208
(803) 777-1208

Date of Inspection: 7/29/14
Date Written Report: 8/11/14

Darryl Washington II
University of South Carolina (ABI-00568)
743 Greene Street, Columbia, SC 29208
(803) 917-0291

Eric Melaro
University of South Carolina (BI-01296)
743 Greene Street, Columbia, SC 29208
(803) 509-3376

Facility Inspected:
Greenhouse
University of South Carolina
820 Sumter Street, Columbia, SC 29201

Cover Letter for Greenhouse

Purpose of Inspection: This building will be demolished.

Green House
University of South Carolina
820 Sumter Street, Columbia, SC 29201

Asbestos was detected in the window glazing and TSI elbows on the interior of the Greenhouse. Asbestos was also detected in the caulking under the metal track system of the Greenhouse. Asbestos was not detected in the shingles and felt paper sampled from the Greenhouse.

Narrative of Building
Greenhouse

The Greenhouse is constructed of brick, wood, concrete blocks and floor, metal, glass and a shingled roof. Part of the Greenhouse sets on bare ground (dirt floor). The Greenhouse is approximately 2634 square feet and was constructed in 1965. The 2-ply roof shingles and underlying felt paper, window glazing, TSI elbows and caulking under the metal track system were the only suspect materials identified from the Greenhouse.

Exterior of Greenhouse

1. Brick
2. Wooden facial boards
3. Metal door and frame, window frames and track system
4. Glass
5. 2-ply shingles and underlying felt paper
6. Caulking

Interior of Greenhouse

1. Concrete blocks and floor
2. Wooden roof trusses and support
3. TSI elbows
4. Window glazing

Asbestos Containing Materials

1. Window glazing
2. TSI elbows
3. Caulking

Non Asbestos Containing Materials

1. Concrete blocks and floor
2. Wooden facial boards, roof trusses and support
3. Brick
4. Metal door and frame, window frames and track system
5. Glass
6. 2-ply shingles and underlying felt paper

Executive Summary
Greenhouse

Date of Inspection: 7/29/14

Suspect Material Positive for Asbestos

1. TSI elbows
   - Quantity – 12 linear feet
   - Number of Samples – 3
   - Condition – Good
   - Location – Interior of building
   - Potential for Disturbance – Low
2. Caulking
   - Quantity – 120 linear feet
   - Number of Samples – 3
   - Condition – Good
   - Location – Under the metal track system
   - Potential for Disturbance – Low
3. Window Glazing
   - Quantity – 120 linear feet
   - Number of Samples – 3
   - Condition – Good
   - Location – interior of windows
   - Potential for Disturbance – Low

Suspect Material Negative for Asbestos

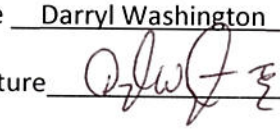
1. 2-Ply Shingles
   - Quantity – 800 square feet
   - Number of Samples – 3
   - Condition – Good
   - Location – Roof of Building
   - Potential for Disturbance – Low
2. Felt Paper
   - Quantity – 800 square feet
   - Number of Samples – 3
   - Condition – Good
   - Location – Roof of Building
   - Potential for Disturbance – Low

Both materials were confirmed negative for asbestos by TEM analysis.

Signature Sheet for Inspectors

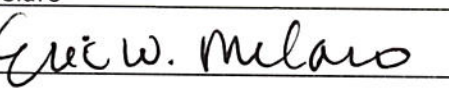
Title Asbestos Building Inspector

Name Darryl Washington

Signature 

Title Asbestos Building Inspector

Name Eric Melaro

Signature 

NOTE: A copy of the Department issued asbestos building inspector licenses is attached.

SCDHEC ISSUED
Asbestos ID Card

Darryl H Washington

Expires

CONSULTBI BI-00568 09/25/14

SCDHEC ISSUED
Asbestos ID Card

Eric W Melaro

Expires

CONSULTBI BI-01296 09/25/14

EMSL Analytical, Inc.
706 Gralin Street, Kernersville, NC 27284
Phone/Fax: (336) 992-1025 / (336) 992-4175
http://www.EMSL.com greensborolab@emsl.com

EMSL Order:	021404180
CustomerID:	UNSC62
CustomerPO:	
ProjectID:	

Attn: **USC Hazmat**
University of South Carolina
743 Greene Street
Columbia, SC 29208

Phone:	(803) 777-7000
Fax:	(803) 777-3990
Received:	07/30/14 10:00 AM
Analysis Date:	7/30/2014
Collected:	

Project: **Green House Behind Lieber**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos			Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**		**% Non-Fibrous**	**% Type**
1 *021404180-0001*	2 Ply Black Shingle	Brown/Gray/Black Fibrous Homogeneous	8%	Glass	92% Non-fibrous (other)	**None Detected**
2 *021404180-0002*	2 Ply Black Shingle	Brown/Gray/Black Fibrous Homogeneous	8%	Glass	92% Non-fibrous (other)	**None Detected**
3 *021404180-0003*	2 Ply Black Shingle	Brown/Gray/Black Fibrous Heterogeneous	8%	Glass	92% Non-fibrous (other)	**None Detected**
4 *021404180-0004*	Felt Paper	Black Non-Fibrous Homogeneous	65%	Cellulose	35% Non-fibrous (other)	**None Detected**
5 *021404180-0005*	Felt Paper	Black Fibrous Homogeneous	65%	Cellulose	35% Non-fibrous (other)	**None Detected**
6 *021404180-0006*	Felt Paper	Black Non-Fibrous Heterogeneous	65%	Cellulose	35% Non-fibrous (other)	**None Detected**
7 *021404180-0007*	Window Glazing	Gray Fibrous Homogeneous			97% Non-fibrous (other)	**3% Chrysotile**
8 *021404180-0008*	Window Glazing					**Stop Positive (Not Analyzed)**
9 *021404180-0009*	Window Glazing					**Stop Positive (Not Analyzed)**

Analyst(s)

Kristie Elliott (7)
Nicole Shutts (2)

Stephen Bennett, Laboratory Manager
or other approved signatory

Initial report from 07/31/2014 08:56:15

EMSL Analytical, Inc.
706 Gralin Street, Kernersville, NC 27284
Phone/Fax: (336) 992-1025 / (336) 992-4175
http://www.EMSL.com greensborolab@emsl.com

EMSL Order:	021404180
CustomerID:	UNSC62
CustomerPO:	
ProjectID:	

Attn: **USC Hazmat**
University of South Carolina
743 Greene Street
Columbia, SC 29208

Phone:	(803) 777-7000
Fax:	(803) 777-3990
Received:	07/30/14 10:00 AM
Analysis Date:	7/30/2014
Collected:	

Project: **Green House Behind Lieber**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos				Asbestos
Sample	Description	Appearance	%	Fibrous	%	Non-Fibrous	% Type
10 *021404180-0010*	TSI Elbow Material	Gray Non-Fibrous Homogeneous	10% 1%	Min. Wool Cellulose	84%	Non-fibrous (other)	**5% Chrysotile**
11 *021404180-0011*	TSI Elbow Material						**Stop Positive (Not Analyzed)**
12 *021404180-0012*	TSI Elbow Material						**Stop Positive (Not Analyzed)**
13 *021404180-0013*	Caulk	Gray Fibrous Homogeneous			95%	Non-fibrous (other)	**5% Chrysotile**
14 *021404180-0014*	Caulk						**Stop Positive (Not Analyzed)**
15 *021404180-0015*	Caulk						**Stop Positive (Not Analyzed)**

Analyst(s)

Kristie Elliott (7)
Nicole Shutts (2)

Stephen Bennett, Laboratory Manager
or other approved signatory

Initial report from 07/31/2014 08:56:15

THIS IS THE LAST PAGE OF THE REPORT.

EMSL Analytical, Inc.
706 Gralin Street, Kernersville, NC 27284
Phone/Fax: (336) 992-1025 / (336) 992-4175
http://www.EMSL.com greensborolab@emsl.com

EMSL Order:	021404180
CustomerID:	UNSC62
CustomerPO:	
ProjectID:	

Attn: **USC Hazmat**
University of South Carolina
743 Greene Street
Columbia, SC 29208

Phone:	(803) 777-7000
Fax:	(803) 777-3990
Received:	07/30/14 10:00 AM
Analysis Date:	7/31/2014
Collected:	

Project: **Green House Behind Lieber**

Test Report: Asbestos Analysis of Non-Friable Organically Bound Materials by TEM via EPA/600/R-93/116 Section 2.5.5.1

SAMPLE ID	DESCRIPTION	APPEARANCE	% MATRIX MATERIAL	% NON-ASBESTOS FIBERS	ASBESTOS TYPES
3 *021404180-0003*	2 Ply Black Shingle	Black Fibrous Heterogeneous	100	None	No Asbestos Detected
6 *021404180-0006*	Felt Paper	Brown/Black Fibrous Heterogeneous	100	None	No Asbestos Detected

Analyst(s)

Stephen Bennett (2)

Stephen Bennett, Laboratory Manager
or other approved signatory

Initial report from 07/31/2014 17:53:43

OrderID: 021404180

4180

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

Asbestos Bulk Building Material Chain of Custody

EMSL Order Number *(Lab Use Only).*

EMSL ANALYTICAL, INC
200 ROUTE 130 NORTH
CINNAMINSON, NJ 08077
PHONE (800) 220-3675
FAX: (856) 786-5974

Company: University of South Carolina	**EMSL-Bill to:** ☒ Same ☐ Different If Bill to is Different note instructions in Comments" *Third Party Billing requires written authorization from third party*
Street: 743 Greene Street	
City: Columbia **State/Province:** SC	**Zip/Postal Code:** 29208 **Country:** US
Report To (Name): USC Hazmat	**Telephone #:** 803-509-3376
Email Address: asbestos@mailbox.sc.edu	**Fax #:** **Purchase Order:**
Project Name/Number: Green House	**Please Provide Results:** ☐ Fax ☒ Email
U.S. State Samples Taken: SC	**CT Samples:** ☐ Commercial/Taxable ☐ Residential/Tax Exempt

Turnaround Time (TAT) Options* – Please Check

☐ 3 Hour ☐ 6 Hour ☒ 24 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☐ 1 Week ☐ 2 Week

*For TEM Air 3 hr through 6 hr, please call ahead to schedule. *There is a premium charge for 3 Hour TEM AHERA or EPA Level II TAT. You will be asked to sign an authorization form for this service. Analysis completed in accordance with EMSL's Terms and Conditions located in the Analytical Price Guide*

PLM - Bulk (reporting limit)	TEM – Bulk
☒ PLM EPA 600/R-93/116 (<1%)	☒ TEM EPA NOB – EPA 600/R-93/116 Section 2.5 5.1
☐ PLM EPA NOB (<1%)	☐ NY ELAP Method 198 4 (TEM)
Point Count ☐ 400 (<0 25%) ☐ 1000 (<0 1%)	☐ Chatfield Protocol (semi-quantitative)
Point Count w/Gravimetric ☐ 400 (<0.25%) ☐ 1000 (<0 1%)	☐ TEM % by Mass – EPA 600/R-93/116 Section 2.5.5.2
☐ NIOSH 9002 (<1%)	☐ TEM Qualitative via Filtration Prep Technique
☐ NY ELAP Method 198 1 (friable in NY)	☐ TEM Qualitative via Drop Mount Prep Technique
☐ NY ELAP Method 198.6 NOB (non-friable-NY)	**Other**
☐ OSHA ID-191 Modified	☐
☐ Standard Addition Method	

☒ **Check For Positive Stop – Clearly Identify Homogenous Group** **Date Sampled:**

Samplers Name: **Samplers Signature:**

Sample #	HA #	Sample Location	Material Description

Client Sample # (s): **Total # of Samples:** 15

Relinquished (Client): **Date:** **Time:**

Received (Lab): KE **Date:** 7/30 **Time:** 10:00

Comments/Special Instructions:

FX 7950 03516 2401

Controlled Document – Asbestos COC – R6 – 11/29/2012

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UNIVERSITY OF SOUTH CAROLINA

Sample Analysis

Building # GREEN HOUSE BEHIND LIEBER Type of Analysis: Lead / Asbestos Date: 7/29/14 Turn Around Time 24 HRS

Area	Sample ID	Material Sampled	Material Location	F/NF	Cond	Quantity	Pot to Disturb
A	1	2 PLY BLACK SHINGLE	ROOFING MATERIAL OF BRICK BUILDING	NF	G	800 SQ FT	LOW
A	2	2 PLY BLACK SHINGLE	ROOFING MATERIAL OF BRICK BUILDING	NF	G	800 SQ FT	LOW
A	3	2 PLY BLACK SHINGLE (Item 28 NC)	ROOFING MATERIAL OF BRICK BUILDING	NF	G	800 SQ FT	LOW
B	4	FELT PAPER	ROOFING MATERIAL OF BRICK BUILDING	NF	G	800 SQ FT	LOW
B	5	FELT PAPER	ROOFING MATERIAL OF BRICK BUILDING	NF	G	800 SQ FT	LOW
B	6	FELT PAPER (Item 28 NC)	ROOFING MATERIAL OF BRICK BUILDING	NF	G	800 SQ FT	LOW
C	7	WINDOW GLAZING	FRONT LEFT WINDOW	F	G	120 LIN FT	LOW
C	8	WINDOW GLAZING	FRONT RIGHT WINDOW	F	G	120 LIN FT	LOW
C	9	WINDOW GLAZING (Item 28 NC)	REAR LEFT WINDOW	F	G	120 LIN FT	LOW
D	10	TSI ELBOW MATERIAL	ELBOW OF ENTRY DOOR	F	G	12 LIN FT	LOW

License # BI-00568 FM# FM00407855 Signature [signature] Requestor ANN DERRICK

Send lab results in PDF and CSV format as soon as possible to: asbestos@mailbox.sc.edu

OrderID: 021404180

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UNIVERSITY OF SOUTH CAROLINA

Sample Analysis

Building # GREEN HOUSE BEHIND LIEBER Type of Analysis: Lead / Asbestos Date: _____ Turn Around Time 24 HRS

Area	Sample ID	Material Sampled	Material Location	F/NF	Cond	Quantity	Pot to Disturb
D	11	TSI ELBOW MATERIAL	LAST LINE NEAR EXIT DOOR TO GREEN HOUSE	F	G	12 LIN FT	LOW
D	12	TSI ELBOW MATERIAL	1 LINE NEAR EXIT WINDOW	F	G	12 LIN FT	LOW
E	13	CAULK	ON BOTTOM PERIMETER WALL OF GREEN HOUSE EAST	NF	G	120 LIN FT	LOW
E	14	CAULK	ON BOTTOM PERIMETER WALL OF GREEN HOUSE EAST	NF	G	120 LIN FT	LOW
E	15	CAULK (Team # MG)	ON BOTTOM PERIMETER WALL OF GREEN HOUSE SOUTH	NF	G	120 LIN FT	LOW
					G		LOW

License # BI-00568 FM# FM00407855 Signature _____ Requestor ANN DERRICK

Send lab results in PDF and CSV format as soon as possible to: asbestos@mailbox.sc.edu

OrderID: 021404180