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New Montessori School

Bid Documents
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Volume 2 – Division 09-23

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SECTION 092116.23 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Gypsum board shaft wall assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each component of gypsum board shaft wall assembly.

1. Include manufacturer’s table of span ratings.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and support them on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with gypsum-shaftliner-board manufacturer's written instructions.

B. Do not install finish panels until installation areas are enclosed and conditioned.

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

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E90 and classified according to ASTM E413 by a testing and inspecting agency.

2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

A. Fire-Resistance Rating: As indicated on Drawings.

B. STC Rating: As indicated on Drawings.

C. Gypsum Shaftliner Board:

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

   a. American Gypsum.
   b. CertainTeed Gypsum.
   c. Georgia-Pacific Gypsum LLC.
   d. National Gypsum Company.
   e. USG Corporation.

2. Moisture- and Mold-Resistant Type X: ASTM C1396/C1396M; manufacturer's proprietary fire-resistive liner panels with ASTM D3273 mold-resistance score of 10 as rated according to ASTM D3274, 1 inch thick, and with double beveled long edges.

D. Non-Load-Bearing Steel Framing, General: Complying with ASTM C645 requirements for metal unless otherwise indicated and complying with requirements for fire-resistance-rated assembly indicated.

1. Protective Coating: Coating with equivalent corrosion resistance of ASTM A653/A653M, G40 unless otherwise indicated.

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

1. Depth: As indicated.
2. Minimum Base-Metal Thickness: As required by stud size, spacing, and spanbut not less than 0.030 inch.

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

1. Minimum Base-Metal Thickness: As required by stud size, spacing, and span.

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

H. Finish Panels: Gypsum board as specified in Section 092900 "Gypsum Board.".

I. Sound Attenuation Blankets: As specified in Section 092900 "Gypsum Board."

2.3 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with shaft wall manufacturer's written instructions.

B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 092900 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written instructions for application indicated.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

1. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E488/E488M conducted by a qualified testing agency.
2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency.

E. Reinforcing: Galvanized-steel reinforcing strips with 0.033-inch minimum thickness of base metal (uncoated).

F. Acoustical Sealant: Section 079219 "Acoustical Joint Sealants."

G. Gypsum Board Cants:

1. Gypsum Board Panels: As specified in Section 092900 "Gypsum Board," Type X, 1/2- or 5/8-inch panels.
2. Adhesive: Laminating adhesive as specified in Section 092900 "Gypsum Board."
3. Non-Load-Bearing Steel Framing: As specified in Section 092216 "Non-Structural Metal Framing."

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

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

3.2 PREPARATION

A. Sprayed Fire-Resistive Materials: Coordinate with gypsum board shaft wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft wall assemblies to comply with requirements specified in Section 078100 "Applied Fire Protection."

B. After sprayed fire-resistive materials are applied, remove only to extent necessary for installation of gypsum board shaft wall assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLATION

A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated and manufacturer's written installation instructions.

B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.

C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.

1. Elevator Hoistway: At elevator hoistway-entrance door frames, provide jamb struts on each side of door frame.
2. Reinforcing: Provide where items attach directly to shaft wall assembly as indicated on Drawings; accurately position and secure behind at least one layer of face panel.

D. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons and floor indicators, and similar items.

E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels while maintaining continuity of fire-rated construction.

F. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

G. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies.

H. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.

I. Gypsum Board Cants: At projections into shaft exceeding 4 inches, install gypsum board cants covering tops of projections.

1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches o.c. with screws fastened to shaft wall framing.
2. Where non-load-bearing steel framing is required to support gypsum board cants, install framing at 24 inches o.c. and extend studs from the projection to shaft wall framing.

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

3.4 PROTECTION

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

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

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

END OF SECTION 092116.23

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.
3. Grid suspension systems for gypsum board ceilings.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; and roof rafters and ceiling joists.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include applicable limiting heights tables.

B. Shop Drawings: For bracing of non-composite walls, framing of opening with proprietary headers and jamb, and seismic bracing of suspended ceilings.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs, tracks, and accessories.

B. Evaluation Reports: For embossed, high-strength steel studs and tracks, firestop tracks, post-installed anchors, and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

C. Evaluation Reports: For fire-rated composite accessories.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

A. Horizontal Deflection, composite wall assemblies: Unless otherwise noted, limited to 1/240 of the wall height based on horizontal loading of specified finishes.

1. For wall assemblies scheduled to receive tile limit deflection to 1/360 of the wall height.
2. For wall assemblies scheduled to receive plaster, limit deflection to L/360.

B. Horizontal Deflection, non-composite wall assemblies: Unless otherwise noted, limited to 1/240 of the wall height based on horizontal loading of specified finishes.

1. For wall assemblies scheduled to receive tile limit deflection to 1/360 of the wall height.
2. For wall assemblies scheduled to receive plaster, limit deflection to L/360.

C. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members," unless otherwise indicated.

D. Design Loads: Actual weight of material, but not less than the following:

1. Gypsum Wallboard, both sides: 7.5 lbs./sq. ft.
2. Gypsum Wallboard, single side: 5 lbs./sq. ft.

E. Design framing systems to accommodate deflection of primary building structure and construction tolerances and to withstand design loads with a maximum deflection of one inch.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C645 requirements for steel unless otherwise indicated.
1. Protective Coating: ASTM A653/A653M, G40 or coating with equivalent corrosion resistance of ASTM A653/A653M, G40, hot-dip galvanized unless otherwise indicated.

B. Studs and Tracks: ASTM C645. Use either conventional steel studs and tracks or embossed, high-strength steel studs and tracks.

1. Steel Studs and Tracks:

a. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection but not less than 0.0269 inch.
b. Depth: As indicated on Drawings.

2. Embossed, High Strength Steel Studs and Tracks: Roll-formed and embossed with surface deformations to stiffen the framing members so that they are structurally equivalent to conventional ASTM C645 steel studs and tracks.

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

1) ClarkDietrich.
2) MarinoWARE.
3) Telling Industries.

b. Minimum Base-Steel Thickness: Equivalent to conventional studs, as validated by third party testing, and meeting by horizontal deflection performance requirements.
c. Depth: As indicated on Drawings.

2.3 ACCESSORIES

A. Manufacturers: Provide framing accessories from the same manufacturer as primary framing or acceptable to framing manufacturer.

B. Minimum Base Metal Thickness: As required for structural integrity of framing system, but not less than thickness listed below as minimums.

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

1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 1-1/2-inch minimum vertical movement.

2. Single Long-Leg Track System: ASTM C645 top track with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
3. Double-Track System: ASTM C645 top outer tracks, inside track with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
4. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

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

E. Radius Framing: Steel sheet runner for non-load-bearing curves, bends, variable radii and arches using expandable ribbon technology.
   1. Minimum Base-Steel Thickness: 0.0259 inch.

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

   1. Minimum Base-Steel Thickness: 0.0269 inch.
   2. Contractor's Option: Subject to compliance with requirements, provide ClarkDietrich; Danback Fire-Retardant Treated Wood Backing Plate

G. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch-wide flanges.
   1. Depth: 1-1/2 inches.
   2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.

H. Hat-Shaped, Rigid Furring Channels: ASTM C645.
   1. Minimum Base-Steel Thickness: 0.0296 inch.
   2. Depth: 7/8 inch.

I. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.
   1. Configuration: Asymmetrical.

J. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.

   1. Depth: 3/4 inch.
   2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
   3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

K. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-steel thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

2.4 FIRE-RATED ACCESSORIES

A. Fire-rated Composite Accessories: Subject to compliance with listed fire-rated assemblies, the following accessories incorporating intumescent firestopping may be used in lieu of conventional accessories and field-applied firestopping.

B. Deflection Track: ClarkDietrich; BlazeFrame DL Deflection Track.

C. Flat Strap Backer: ClarkDietrich FSB for installation behind reveals in fire-rated assemblies.

D. Control Joints: ClarkDietrich FAS-093X for control joints in fire-rated assemblies.

2.5 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

B. Furring Channels (Furring Members): Provide one of the following:

1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
2. Steel Studs and Tracks: ASTM C645.

    a. Minimum Base-Steel Thickness: 0.0269 inch.
    b. Depth: As indicated on Drawings.

3. Embossed, High-Strength Steel Studs and Tracks: ASTM C645.

    a. Minimum Base-Steel Thickness: Equivalent to 0.0269 inch.
    b. Depth: As indicated on Drawings.

4. Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch deep.

    a. Minimum Base-Steel Thickness: 0.0296 inch.

5. Resilient Furring Channels: 1/2-inch-deep members designed to reduce sound transmission.

    a. Configuration: Asymmetrical.

C. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

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

    a. Armstrong World Industries, Inc; Drywall Grid Systems.
    b. USG Corporation; Drywall Suspension System or Wall-to-Wall Drywall Suspension System.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

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

1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

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

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

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: As required by horizontal deflection performance requirements unless otherwise indicated.
2. Multilayer Application: As required by horizontal deflection performance requirements unless otherwise indicated.
3. Tile Backing Panels: As required by horizontal deflection performance requirements unless otherwise indicated.

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

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

D. Install tracks 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 that penetrate 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 track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:

a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

E. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

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

3.5 INSTALLING CEILING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches o.c.
2. Carrying Channels (Main Runners): 48 inches o.c.
3. Furring Channels (Furring Members): 16 inches o.c.

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

C. Suspend hangers from building structure as follows:

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

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

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

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

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.

5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

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

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

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.

B. Related Requirements:

1. Section 061600 " Sheathing" for gypsum sheathing for exterior walls.
2. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.
3. Section 093013 "Ceramic Tiling" for tile backing panels installed as substrates for ceramic tile.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum wallboard.
2. Gypsum board, Type X.
3. Gypsum ceiling board.
4. Mold-resistant gypsum board.
5. Gypsum board, Type C.
6. Interior trim.
7. Joint treatment materials.
8. Sound-attenuation blankets.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockups for the following:

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

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

1.5 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

C. Ceiling and wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 INTERIOR GYPSUM BOARD

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

1. American Gypsum.
2. CertainTeed Gypsum.
3. Georgia-Pacific Gypsum LLC.
4. National Gypsum Company.
5. USG Corporation.

B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

C. Gypsum Board, Type C: ASTM C1396/C1396M. Manufactured to have increased fire-resistive capability.

1. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
2. Long Edges: Tapered.
3. Flexible Gypsum Board: ASTM C1396/C1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness. Thickness: 1/4 inch.
4. Long Edges: Tapered.

D. Gypsum Ceiling Board: ASTM C1396/C1396M.

1. Thickness: 1/2 inch.
2. Long Edges: Tapered.

E. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.3 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

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

    a. Cornerbead.
    b. L-Bead: L-shaped; exposed long flange receives joint compound.
    c. Expansion (control) joint.
    d. Curved-Edge Cornerbead: With notched or flexible flanges.

2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

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

2.5 AUXILIARY MATERIALS

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

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

1. Adhesives shall have a VOC content of 50 g/L or less.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

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

E. Acoustical Sealant: As specified in Section 079200 " Joint Sealants."

F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

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

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 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

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 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. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

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 C919 and with manufacturer's written instructions 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 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: Vertical surfaces unless otherwise indicated and where required for fire-resistance-rated assembly.
2. Ceiling Type: Ceiling surfaces.
3. Mold-Resistant Type: Culinary Lab, toilet rooms, locker rooms, laundry rooms, and elsewhere as indicated on Drawings.
4. Type C: Where required for specific fire-resistance-rated assembly indicated.

3.4 INSTALLATION OF 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.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise 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 for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.

2. Level 3: Where indicated on Drawings.
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 Section 099123 "Interior Painting."

4. Level 5: Where indicated on Drawings.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3.6 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

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

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

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

END OF SECTION 092900

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Quarry tile.
2. Porcelain tile.
3. Stone thresholds.
4. Waterproof/Crack Suppression membranes.
5. Crack isolation membrane.
6. Metal edge strips.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."

C. Face Size: Actual tile size, excluding spacer lugs.

D. Module Size: Actual tile size plus joint width indicated.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Initial Selection: For tile, grout, and accessories involving color selection.

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Assembled samples of mosaic tile mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
3. Stone thresholds in 6-inch lengths.
4. Metal edge strips in 6-inch lengths.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

C. Product Certificates: For each type of product.

D. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:
1. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.
2. Installer employs only Ceramic Tile Education Foundation Certified Installers orinstallers recognized by the U.S. Department of Labor as Journeyman Tile Layers for Project.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of each type of floor tile installation.
2. Build mockup of each type of wall tile installation.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each type from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.

1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
2. Obtain waterproof membrane and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
1. Waterproof/Crack Suppression membrane.
2. Metal edge strips.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.3 TILE PRODUCTS

A. Ceramic Tile Type **PT-1**: Unglazed porcelain tile.

1. Basis of Design: Subject to compliance with requirements, provide products indicated on Finish Schedule or comparable products by one of the following:
   a. Crossville.
   b. DalTile.
   c. Florida Tile.
   d. Garden State Tile.
   e. Trinity Tile.

2. Certification: Tile certified by the Porcelain Tile Certification Agency.
3. Face Size: 8 by 8 inches.
4. Thickness: 10 mm,.
5. Face: Plain with square edges.
6. Dynamic Coefficient of Friction: Not less than 0.42.
7. Tile Color and Pattern: As indicated by manufacturer's designations.
8. Grout Color: As indicated by manufacturer's designations.

B. Ceramic Tile Type **QT-1**: Unglazed square-edged quarry tile.

1. Basis of Design: Subject to compliance with requirements, provide product indicated on Finish Schedule or comparable product by one of the following:
   a. Metropolitan Ceramics by Crossville
   b. Daltile
   c. Florida Tile
2. Face Size: 6by 6 inches.
3. Thickness: 1/2 inch.
4. Wearing Surface: Nonabrasive, smooth.
5. Dynamic Coefficient of Friction: Not less than 0.42.

6. Tile Color and Pattern: As indicated by manufacturer's designations.
7. Grout Color: As indicated by manufacturer's designations.
8. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
   a. **QTB-1**: Base: Coved, face size 6 by 6 inches.

2.4 WATERPROOF/CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Custom Building Products; Custom® 9240 Waterproofing and Anti-Fracture Membrane.
   b. LATICRETE SUPERCAP, LLC; Laticrete 9235 Waterproof Membrane.
   c. MAPEI Corporation; Mapelastic™ 400.

C. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Custom Building Products; CBP-232 Waterproofing & Anti-Fracture Membrane RedGard Waterproofing and Crack Prevention Membrane.
   b. LATICRETE SUPERCAP, LLC; Laticrete Hydro Ban.
   c. MAPEI Corporation; Mapelastic™ AquaDefense.

2.5 SETTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

1. Cleavage Membrane: Asphalt felt, ASTM D226/D226M, Type I (No. 15); or polyethylene sheeting, ASTM D4397, 4.0 mils thick.
2. Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A185/A185M and ASTM A82/A82M, except for minimum wire size.
3. 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.

B. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15.

1. Subject to compliance with requirements, provide one of the following:
   a. Bostik;
   b. Custom Building Products; FlexBond Premium Crack Prevention Thin-set Mortar.

c. Laticrete; 257 Titanium.
d. Mapei; Ultraflex 3

2.6 GROUT MATERIALS

A. Water-Cleanable Epoxy Grout: ANSI A118.3.

1. Subject to compliance with requirements, provide one of the following:
   a. Bostik;
   b. Custom Building Products; CEG-IG 100% Solids Industrial Grade Epoxy Grout or CEG-Lite High Solids Commercial Epoxy Grout.
   c. Laticrete; Spectralock Pro.
   d. Mapei; Kerapoxy.

2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.

2.7 UNDERLAYMENT

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

2.8 MISCELLANEOUS MATERIALS

A. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless steel, ASTM A276/A276M or ASTM A666, 300 Series exposed-edge material.

1. Subject to compliance with requirements, provide products by one of the following:
   a. Blanke Corporation.
   b. Ceramic Tool Company.
   c. Schluter Systems.

B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.9 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile comply with the flatness tolerances for the tile installations indicated.
    a. For large format floor tile: 1/8 inch in 10 feet, with no more variance than 1/16 inch in two foot.
3. Verify that concrete substrates for tile floors installed with bonded mortar bed or thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
4. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
5. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

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

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from

other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION OF CERAMIC TILE

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
   a. Tile floors in wet areas.
   b. .
   c. Tile floors consisting of tiles 8 by 8 inches or larger.
   d. Tile floors consisting of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with joints no narrower than three times the dimensional variance in the tile, or the narrowest joint recommended by the manufacturer of the tile. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated on approved Shop Drawings. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

2. Provide joints where field of tile interfaces with restraining surface, such as at perimeter walls and columns.

I. Metal Edge Strips: Install at locations indicated.

3.4 INSTALLATION OF WATERPROOF/CRACK SUPPRESSION MEMBRANE

A. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

B. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.
1. Flood floor with a minimum of two inches of water for at least 24 hours, per ASTM D 5957. Repair leaks and retest.

3.5 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.6 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.7 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Slab on Grade:

1. Kitchen: TCNA F112 and ANSI A108.1C: Cement mortar bed (thickset) bonded to concrete.
   a. Ceramic Tile Type: Quarry Tile.
   b. Bond Coat for Cured-Bed Method: Improved modified dry-set mortar.
   c. Grout: Water-cleanable epoxy grout.

2. Single toilets without floor drains: TCNA F115; thinset mortar; epoxy grout.
   a. Ceramic Tile Type: Unglazed porcelain.
   b. Thinset Mortar: Improved modified dry set mortar.
   c. Grout: Water-cleanable epoxy grout.

3. Group Toilets with floor drains: TCNA F115; thinset mortar; epoxy grout.
   a. Ceramic Tile Type: Unglazed Porcelain.
   b. Bond Coat for Cured-Bed Method: Improved modified dry set mortar.
   c. Grout: water-cleanable epoxy grout.

B. Interior Floor Installations, Suspended concrete slab:

1. Group Toilets with floor drains: TCNA F125-Full; thinset mortar on waterproof/crack isolation membrane.
   a. Ceramic Tile Type: Porcelain.
   b. Bond Coat for Cured-Bed Method: Improved modified dry set mortar.
   c. Grout: water-cleanable epoxy grout.

C. Interior Wall Installations, Masonry or Concrete:

1. Kitchen: TCNA W202; thinset mortar.
   a. Ceramic Tile Type: Quarry Tile Base.
   b. Thinset Mortar: Improved modified dry set mortar.
   c. Grout: Water-cleanable epoxy grout.

2. Toilet Rooms: TCNA W202; thinset mortar.
   a. Ceramic Tile Type: Porcelain Base.
   b. Thinset Mortar: Improved modified dry set mortar.
   c. Grout: Water-cleanable epoxy grout.

D. Interior Wall Installations, Metal Studs or Furring:

1. Serving Line TCNA W244C or TCNA W244F: Thinset mortar on cementitious backer units or fiber-cement backer board.
   a. Ceramic Tile Type: Porcelain.
   b. Thinset Mortar: Improved modified dry set mortar.

c. Grout: Water-cleanable epoxy grout.

END OF SECTION 093013

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

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

1. Acoustical Panels: Set of 6-inch-square Samples of each type, color, pattern, and texture.
2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch-long Samples of each type, finish, and color.
3. Clips: Full-size seismic clips.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Structural members to which suspension systems will be attached.
3. Method of attaching hangers to building structure.

    a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.

4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical panels.
6. Items penetrating finished ceiling and ceiling-mounted items including the following:

    a. Lighting fixtures.
    b. Diffusers.
    c. Grilles.
    d. Speakers.
    e. Sprinklers.
    f. Access panels.
    g. Perimeter moldings.
7. Minimum Drawing Scale: 1/4 inch = 1 foot.

B. Qualification Data: For testing agency.

C. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

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

1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
3. Seismic Clips: Equal to 2 percent of quantity installed.

1.8 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of typical ceiling area as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

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

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

1.10 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E1264.
2. Smoke-Developed Index: 450 or less.

C. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

2.3 ACOUSTICAL PANELS – **ACT- 1**

A. Products: Provide one of the following: NO SUBSTITUTIONS

1. Armstrong World Industries; Fine Fissured High NRC #1810.
2. USG; High NRC-CAC Radar #22521.

B. Classification: Provide panels 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. Light Reflectance (LR): Not less than 0.85.

E. Ceiling Attenuation Class (CAC): Not less than 40.

F. Noise Reduction Coefficient (NRC): Not less than 0.70 .

G. Edge/Joint Detail: Square.

H. Thickness: 3/4 inch.

I. Modular Size: 24 by 24 inches.

J. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D3274, or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.

2.4 ACOUSTICAL PANELS – **ACT- 2**

A. Products: Provide one of the following: NO SUBSTITUTIONS

1. Armstrong World Industries; Calla, #2820.
2. USG; Mars #88134.

B. Classification: Provide panels as follows:

1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted.
2. Pattern: E (lightly textured).

C. Color: White.

D. Light Reflectance (LR): Not less than 0.85.

E. Ceiling Attenuation Class (CAC): Not less than 35.

F. Noise Reduction Coefficient (NRC): Not less than 0.88.

G. Edge/Joint Detail: Square.

H. Thickness: 1inch.

I. Modular Size: 24 by 24 inches.

J. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D3274, or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.

2.5 ACOUSTICAL PANELS – **ACT-3**

A. Products: Provide the following: NO SUBSTITUTIONS

1. USG; Sheetrock Ceiling Panels with washable vinyl face, #3260.

B. Classification: Provide panels as follows:

1. Type and Form: Type XX, high-density, ceramic- and mineral-base panels with scrubbable finish, resistant to heat, moisture, and corrosive fumes.
2. Pattern: G (smooth).

C. Color: White.

D. Light Reflectance (LR): Not less than 0.77.

E. Ceiling Attenuation Class (CAC): Not less than 35.

F. Edge/Joint Detail: Square.

G. Thickness: 1/2 inch.

H. Modular Size: 24 by 24 inches.

I. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D3274, or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.

2.6 ACOUSTICAL PANELS – **ACT- 4**

A. Products: Provide one of the following: NO SUBSTITUTIONS

1. Armstrong World Industries; Calla, #2820.
2. USG; Mars #88134.

B. Classification: Provide panels as follows:

1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted.

2. Pattern: E (lightly textured).

C. Color: White.

D. Light Reflectance (LR): Not less than 0.85.

E. Ceiling Attenuation Class (CAC): Not less than 35.

F. Noise Reduction Coefficient (NRC): Not less than 0.95 with sound batt.

G. Edge/Joint Detail: Square.

H. Thickness: 1inch.

I. Modular Size: 24 by 24 inches.

J. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D3274, or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.

K. Sound-Absorbent Batts: Provide width and length to completely fill concealed surface of pan, with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing according to ASTM E84, and to comply with the following requirements:

1. Unwrapped, Glass-Fiber Insulation: Black coated, unfaced, complying with ASTM C553, Type I, Type II, or Type III; treated to be nondusting; 1 inch thick.

L. Modular Size: As indicated on Drawings.

M. Attachment Devices: Corner brackets and metal extrusions factory embedded in back of panel.

N. Suspension System: Manufacturer’s standard deck hanging system of cables and anchors for suspension of individual units to structure above.

2.7 METAL SUSPENSION SYSTEM

A. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635/C635M and designated by type, structural classification, and finish indicated.

1. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" according to ASTM C635/C635M.

B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 15/16-inch-wide metal caps on flanges.

1. Products: Provide one of the following:

    a. Armstrong World Industries; Prelude XL #7301 with #7850 wall molding with 1-1/8-inch horizontal leg..
    b. USG; Donn DX 26 HD Grid with Donn #M 18 wall molding with 1-1/8-inch horizontal leg.

2. Structural Classification: Heavy-duty system
3. Face Design: Flat, flush.
4. Cap Material: Cold-rolled steel.
5. Cap Finish: Painted white.

2.8 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch-diameter wire.

C. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.

D. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

F. Expansion Sleeves: Expansion control in seismic design categories D, E, and F.

1. Armstrong World Industries; ES4.
2. USG Corporation; G1 or H.

2.9 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated.
2. Products: Provide one of the following, with 1-1/8-inch horizontal leg dimension.

    a. Armstrong World Industries; #7850.

b. USG Corporation; #M 18.

3. For circular penetrations of ceilings for sprinkler heads, provide edge moldings sized to permit one inch movement in all directions.

B. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.

1. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils. Comply with ASTM C635/C635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2. For acoustical clouds provide specialty trim pieces as indicated.

a. Basis of Design: Armstrong Ceiling Systems, 6-inch Axxiom trim.

2.10 ACOUSTICAL SEALANT

A. Acoustical Sealant: As specified in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

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

3.2 PREPARATION

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

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C636/C636M, seismic design requirements, and manufacturer's written instructions.

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

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

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 o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

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 precise fit.

1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
2. 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.
3. Install seismic clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.

4. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.
5. Protect lighting fixtures and air ducts according to requirements indicated for fire-resistance-rated assembly.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Periodic inspection during the installation of suspended ceiling grids according to ASCE/SEI 7.

B. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completion, but no panels have been installed. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.

1. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.
2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

C. Acoustical panel ceiling hangers, anchors, and fasteners will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes coordination requirements for the installation of the following:

1. Vinyl base.
2. Rubber stair accessories.
3. Vinyl molding accessories.

1.3 OWNER-FURNISHED PRODUCTS

A. Owner will furnish and install products in this Section under a separate contract.

B. Refer to Section 016400 “Owner-Furnished Products” for responsibilities of Contractors in relation to Work of this section.

1.4 ACTION SUBMITTALS

A. Product Data: Owner will provide product data for each type of product.

B. Samples for Verification: Owner will provide samples each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.

C. Product Schedule: Owner will provide product schedule for resilient base and accessory products, using same designations indicated on Drawings.

1.5 QUALITY ASSURANCE

A. Mockups: Owner will designate one classroom to serve as mockup of cleaning and buffing for Owner’s approval.

1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Coordinate with Owner's separate Contractor to provide temporary storage for resilient products and installation materials. Provide dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.7 FIELD CONDITIONS

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

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Schedule installation of resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 VINYL BASE

A. Products: Owner-furnished.

2.2 RUBBER STAIR ACCESSORIES

A. Products: Owner-furnished.

2.3 VINYL MOLDING ACCESSORY

A. Products: Owner-furnished.

2.4 INSTALLATION MATERIALS

A. Products: Owner-furnished.

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.

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

B. Correct unsatisfactory conditions.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

B. Testing of substrate for moisture and alkalinity is the responsibility of Owner's separate Contractor.

C. Preparation of substrate is the responsibility of Owner's separate Contractor, including, but not limited to, the removal of curing compounds and other incompatible coatings and the application of patching and leveling compound.

3.3 INSTALLATION

A. Resilient base and accessories shall be installed under separate contract.

B. Cover resilient products subject to wear and foot traffic until Substantial Completion.

3.4 CLEANING AND PROTECTION

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

B. Final Cleaning: Engage Owner's cleaning vendor to perform final cleaning and buffing after protective covers are removed.

END OF SECTION 096513

SECTION 096516 - RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes coordination requirements for the installation of the following:
   1. Vinyl sheet flooring.

1.3 OWNER-FURNISHED PRODUCTS

A. Owner will furnish and install products in this Section under a separate contract.

B. Refer to Section 016400 “Owner-Furnished Products” for responsibilities of Contractors in relation to Work of this section.

1.4 ACTION SUBMITTALS

1.5 QUALITY ASSURANCE

A. Mockups: Owner will designate one classroom to serve as mockup of cleaning and buffing for Owner’s approval.

   1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Coordinate with Owner’s separate Contractor to provide temporary storage for resilient products and installation materials. Provide dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive resilient sheet flooring during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during resilient sheet flooring installation.

D. Close spaces to traffic for 48 hours after resilient sheet flooring installation.

E. Schedule installation of resilient sheet flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 VINYL SHEET FLOORING

A. Products: Owner-furnished.

2.2 INSTALLATION MATERIALS

A. Products: Owner-furnished.

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.

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

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

3.2 PREPARATION

A. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

B. Testing of substrate for moisture and alkalinity is the responsibility of Owner's separate Contractor.

C. Preparation of substrate is the responsibility of Owner's separate Contractor, including, but not limited to, the removal of curing compounds and other incompatible coatings and the application of patching and leveling compound.

3.3 RESILIENT SHEET FLOORING INSTALLATION

A. Resilient sheet flooring shall be installed under separate contract.

B. Cover resilient products subject to wear and foot traffic until Substantial Completion.

3.4 CLEANING AND PROTECTION

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

B. Cover resilient sheet flooring until Substantial Completion.

C. Final Cleaning: Engage Owner's cleaning vendor to perform final cleaning and buffing after protective covers are removed.

END OF SECTION 096516

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes coordination requirements for the installation of the following:

1. Solid vinyl floor tile.

1.3 OWNER-FURNISHED PRODUCTS

A. Owner will furnish and install products in this Section under a separate contract.

B. Refer to Section 016400 “Owner-Furnished Products” for responsibilities of Contractors in relation to Work of this section.

1.4 ACTION SUBMITTALS

A. Product Data: Owner will provide product data for each type of product.

B. Samples: Owner will provide full-size units of each color, texture, and pattern of floor tile required.

C. Product Schedule: Owner will provide product schedule for floor tile using same designations indicated on Drawings.

1.5 QUALITY ASSURANCE

A. Mockups: Owner will designate one classroom to serve as mockup of cleaning and buffing for Owner’s approval.

1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Coordinate with Owner's separate Contractor to provide temporary storage for floor tile and installation materials. Provide dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than, in spaces to receive floor tile during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Schedule installation of floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 SOLID VINYL FLOOR TILE

A. Product: Owner-furnished.

2.2 INSTALLATION MATERIALS

A. Products: Owner-furnished.

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.

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

B. Correct unsatisfactory conditions.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

B. Testing of substrate for moisture and alkalinity is the responsibility of Owner's separate Contractor.

C. Preparation of substrate is the responsibility of Owner's separate Contractor, including, but not limited to, the removal of curing compounds and other incompatible coatings and the application of patching and leveling compound.

3.3 FLOOR TILE INSTALLATION

A. Resilient tile flooring shall be installed under separate contract.

B. Cover resilient products subject to wear and foot traffic until Substantial Completion.

3.4 CLEANING AND PROTECTION

A. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

B. Final Cleaning: Engage Owner's cleaning vendor to perform final cleaning and buffing after protective covers are removed.

END OF SECTION 096519

SECTION 096566 - RESILIENT ATHLETIC FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes coordination requirements for the installation of the following:

1. Sheet vinyl flooring.

1.3 OWNER-FURNISHED PRODUCTS

A. Owner will furnish and install products in this Section under a separate contract.

B. Refer to Section 016400 “Owner-Furnished Products” for responsibilities of Contractors in relation to Work of this section.

1.4 ACTION SUBMITTALS

A. Product Data: Owner will provide product data for each type of product.

B. Samples: Owner will provide samples of each color, texture, and pattern of resilient athletic flooring required.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resilient athletic flooring to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Coordinate with Owner’s separate Contractor to provide temporary storage for sheet vinyl flooring and installation materials. Provide dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store rolls upright.

1.7 FIELD CONDITIONS

A. Adhesively Applied Products:

1. Maintain temperatures during installation within range recommended in writing by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive flooring 48 hours before installation, during installation, and 48 hours after installation unless longer period is recommended in writing by manufacturer.
2. After postinstallation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55 deg F or more than 95 deg F.
3. Close spaces to traffic during flooring installation.
4. Close spaces to traffic for 48 hours after flooring installation unless manufacturer recommends longer period in writing.

B. Install flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 SHEET VINYL FLOORING

A. Product: Owner-furnished.

1. Game line paints are included in separate contract.

2.2 INSTALLATION MATERIALS

A. Products: Owner-furnished.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

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

3.2 PREPARATION

A. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient athletic flooring.

B. Testing of substrate for moisture and alkalinity is the responsibility of Owner's separate Contractor.

C. Preparation of substrate is the responsibility of Owner's separate Contractor, including, but not limited to, the removal of curing compounds and other incompatible coatings and the application of patching and leveling compound.

3.3 FLOORING INSTALLATION

A. Resilient athletic flooring shall be installed under separate contract.

B. Game line painting is included in separate Contract.

1. Cover resilient products subject to wear and foot traffic until Substantial Completion.

3.4 CLEANING AND PROTECTION

A. Protect flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

1. Do not move heavy and sharp objects directly over flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 096566

SECTION 096623 - RESINOUS MATRIX TERRAZZO FLOORING

1.1 GENERAL

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

A. Section Includes:

1. Thin-set, epoxy-resin terrazzo flooring.
2. Precast epoxy-resin terrazzo units.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealants installed with terrazzo.

1.4 ALTERNATES

A. See Section 012300 "Alternates" for description of alternates affecting items specified in this Section.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

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

a. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
b. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
c. Review special terrazzo designs and patterns.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include terrazzo installation requirements. Include plans, sections, component details, and relationship to other work. Show layout of the following:

1. Divider strips.
2. Control-joint strips.
3. Accessory strips.
4. Precast terrazzo jointing and edge configurations.
5. Terrazzo patterns.

C. Samples for Verification: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected. Label each terrazzo Sample to identify manufacturer's matrix color and aggregate types, sizes, and proportions. Prepare Samples of same thickness and from same material to be used for the Work, in sizes indicated below:

1. Terrazzo: 6-inch- square Samples.
2. Precast Terrazzo: 6-inch- square Samples.
3. Accessories: 6-inch- long Samples of each exposed strip item required.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For each type of terrazzo material or product.

C. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

D. Preinstallation moisture-testing reports.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For terrazzo to include in maintenance manuals.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications: Engage a terrazzo manufacturer with minimum 5 years documented manufacturing experience producing epoxy binder, and flexible crack isolation membranes; including the following:

1. Proof of NTMA membership.
2. Furnish documentation for at least 5 epoxy terrazzo projects of the same scope and complexity; installed in the past 5 years using material being submitted for this project.

B. Installer Qualifications: Submit proof of Contractor's membership in NTMA or IMI with a letter recognizing that they are a qualified installer in good standing and is acceptable to epoxy terrazzo manufacturer.

1. Furnish documentation for at least 3 epoxy terrazzo projects of the same scope and complexity; installed in the past 5 years using material being submitted for this project.
2. For each epoxy terrazzo project submitted, provide the following information:

    1) Project name.
    2) Square footage of terrazzo installed.
    3) Lineal footage of cast in place base.
    4) Address of facility with contact name and phone number.
    5) Contact name, address and phone number of prime contractor or construction manager.
    6) Field experience resumes of key project personnel including lead supervisor and field technicians to be used on this project.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups for terrazzo including accessories.

    a. Size: Minimum 100 sq. ft. of typical poured-in-place flooring condition for each color and pattern in locations directed by Architect.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.

B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.11 FIELD CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.

B. Field Measurements: Verify actual dimensions of construction contiguous with precast terrazzo by field measurements before fabrication.

C. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.

D. Close spaces to traffic during terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.

E. Control and collect water and dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain primary terrazzo materials from single source from single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.

B. Source Limitations for Aggregates: Obtain each color, grade, type, and variety of granular materials from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

A. NTMA Standards: Comply with NTMA's written recommendations for terrazzo type indicated unless more stringent requirements are specified.

2.3 EPOXY-RESIN TERRAZZO

A. Epoxy-Resin Terrazzo: Comply with manufacturer's written instructions for matrix and aggregate proportions and mixing.

1. Key Resin Company.
2. Knoxy Resin Systems.
3. Pro Terrazzo Systems.
4. Sherwin Williams Company
5. Terroxy Resin Systems, a division of Terrazzo & Marble Supply.

B. Mix Color and Pattern: Match Architect's sample .

C. Materials:

1. Moisture-Vapor-Emission-Control Membrane: Two-component, high-solids, high-density, low-odor, epoxy-based membrane-forming product produced by epoxy terrazzo manufacturer that reduces moisture emission from concrete substrate to not more than 3 lb of water/1000 sq. ft. in 24 hours.
2. Substrate-Crack-Suppression Membrane: Product of terrazzo-resin manufacturer, having minimum 120 percent elongation potential according to ASTM D412.

    a. Reinforcement: Fiberglass scrim.

3. Primer: Manufacturer's product recommended for substrate and use indicated.

4. Epoxy-Resin Matrix: Manufacturer's standard recommended for use indicated and in color required for mix indicated.

    a. Physical Properties without Aggregates:

        1) Hardness: 60 to 85 per ASTM D2240, Shore D.
        2) Minimum Tensile Strength: 3000 psi per ASTM D638 for a 2-inch specimen made using a "C" die per ASTM D412.
        3) Minimum Compressive Strength: 10,000 psi per ASTM D695, Specimen B cylinder.
        4) Chemical Resistance: No deleterious effects by contaminants listed below after seven-day immersion at room temperature per ASTM D1308.

            a) Distilled water.
            b) Mineral water.
            c) Isopropanol.
            d) Ethanol.
            e) 0.025 percent detergent solution.
            f) 1.0 percent soap solution.
            g) 5 percent acetic acid.
            h) 10 percent sodium hydroxide.
            i) 10 percent hydrochloric acid.
            j) 30 percent sulfuric acid.

    b. Physical Properties with Aggregates: For terrazzo blended according to manufacturer's recommendations with one part epoxy resin with three parts marble aggregate consisting of 60 percent No. 1 chips and 40 percent No. 0 chips that is ground and grouted to a 1/4-inch nominal thickness, and cured for 7 days at 75 deg F plus or minus 2 deg F and at 50 percent plus or minus 2 percent relative humidity.

        1) Flammability: Self-extinguishing, maximum extent of burning 1/4 inch according to ASTM D635.
        2) Thermal Coefficient of Linear Expansion: 0.0025 inch/inch per deg F according to ASTM C531.

5. Aggregates: Comply with NTMA gradation standards for mix indicated and contain no deleterious or foreign matter.

    a. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C131/C131M.
    b. 24-Hour Absorption Rate: Less than 0.75 percent.
    c. Dust Content: Less than 1.0 percent by weight.

6. Finishing Grout: Resin based.

2.4 STRIP MATERIALS

A. Thin-Set Divider Strips: L-type angle in depth required for topping thickness indicated.

1. Material: White-zinc alloy.
2. Top Width: 1/8 inch.

B. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material and color of divider strips and in depth required for topping thickness indicated.

C. Accessory Strips: Match divider-strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:

1. Edge-bead strips for exposed edges of terrazzo.

2.5 MISCELLANEOUS ACCESSORIES

A. Strip Adhesive: Epoxy-resin adhesive recommended by adhesive manufacturer for this use.

B. Anchoring Devices:

1. Strips: Provide mechanical anchoring devices or adhesives for strip materials as recommended by manufacturer and as required for secure attachment to substrate.
2. Precast Terrazzo: Provide mechanical anchoring devices as recommended by fabricator for proper anchorage and support of units for conditions of installation and support.

C. Patching and Fill Material: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.

D. Joint Compound: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.

E. Resinous Matrix Terrazzo Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by sealer manufacturer for use on terrazzo type indicated.

F. Sealer: Slip- and stain-resistant, penetrating-type sealer that is chemically neutral; does not affect terrazzo color or physical properties; and is recommended by terrazzo manufacturer Acrylic .

1. Surface Friction: Not less than 0.6 according to ASTM D2047.
2. Acid-Base Properties: With pH factor between 7 and 10.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Proceed with installation only after unsatisfactory conditions, including levelness tolerances, have been corrected.

3.2 PREPARATION

A. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.

B. Concrete Slabs:

1. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.

a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
b. Repair damaged and deteriorated concrete according to terrazzo manufacturer's written instructions.
c. Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer's written instructions.

C. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

D. Preinstallation Moisture Testing:

1. Testing Agency: Engage a qualified testing agency to perform tests.
2. Moisture Testing: Perform tests so that each test area does not exceed 500 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Moisture-Vapor-Emission Test: Maximum moisture-vapor-emission rate acceptable to manufacturer and installer when tested according to ASTM F1869 using anhydrous calcium chloride.
b. Relative Humidity Test: Maximum relative humidity measurement acceptable to manufacturer and installer when tested according to ASTM F2170 using in-situ probes.

3. Proceed with terrazzo installation only after concrete substrates pass moisture testing or after installation of moisture-vapor-emission-control membrane on substrate areas that fail testing.

E. Moisture-Vapor-Emission-Control Membrane: Install according to manufacturer's written instructions.

1. Install concrete substrates that fail preinstallation moisture testing.

F. Substrate-Crack-Suppression Membrane: Install to isolate and suppress substrate cracks according to manufacturer's written instructions.

1. Prepare and prefill substrate cracks with membrane material.
2. Install membrane at substrate cracks in areas to receive terrazzo.
3. Reinforce membrane with fiberglass scrim.

G. Protect other work from water and dust generated by grinding operations. Control water and dust to comply with environmental protection regulations.

1. Erect and maintain temporary enclosures and other suitable methods to limit water damage and dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

3.3 EPOXY-RESIN TERRAZZO INSTALLATION

A. Comply with NTMA's written recommendations for terrazzo and accessory installation.

B. Strip Materials:

1. Divider and Control-Joint Strips:

a. Locate divider strips in locations indicated.
b. Install control-joint strips in locations indicated.
c. Install control-joint strips with 1/4-inch gap between strips, and install sealant in gap.
d. Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.

2. Accessory Strips: Install in locations indicated.

C. Apply primer to terrazzo substrates according to manufacturer's written instructions.

D. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to manufacturer's written instructions.

1. Installed Thickness: 3/8 inch nominal.
2. Terrazzo Finishing: Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.

a. Rough Grinding: Grind with 24-grit or finer stones or with comparable diamond abrasives. Follow initial grind with 60/80-grit stones or with comparable diamond abrasives.
b. Grouting: Before grouting, clean terrazzo with water, rinse, and allow to dry. Apply and cure epoxy grout.
c. Fine Grinding/Polishing: Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted. Grind with 120-grit stones or with comparable diamond abrasives until grout is removed from surface.

3. Installation Tolerance: Limit variation in terrazzo surface from level to 1/4 inch in 10 feet; noncumulative.

3.4 REPAIR

A. Cut out and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.

3.5 CLEANING AND PROTECTION

A. Cleaning:

1. Remove grinding dust from installation and adjacent areas.
2. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow them to dry thoroughly.

B. Sealing:

1. Seal surfaces according to NTMA's written recommendations.
2. Apply sealer according to sealer manufacturer's written instructions.

C. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Substantial Completion.

END OF SECTION 096623

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes coordination requirements for the installation of the following:

1. Modular carpet tile.

1.3 OWNER-FURNISHED PRODUCTS

A. Owner will furnish and install products in this Section under a separate contract.

B. Refer to Section 016400 “Owner-Furnished Products” for responsibilities of Contractors in relation to Work of this section.

1.4 ACTION SUBMITTALS

A. Product Data: Owner will provide product data for each type of product.

B. Samples for Verification: Owner will provide 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-long Samples.

C. Product Schedule: Owner will provide product schedule for carpet tile, using same designations indicated on Drawings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Coordinate with Owner’s separate Contractor to provide temporary storage for carpet tile in compliance with the Carpet and Rug Institute's CRI 104.

1.6 FIELD CONDITIONS

A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not schedule delivery or installation of 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 levels planned for building occupants during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Products: Owner-furnished.

2.2 INSTALLATION ACCESSORIES

A. Products: Owner-furnished.

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.

B. Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Correct unsatisfactory conditions.

1. Installation of carpet tile indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Immediately before installation, sweep and vacuum clean substrates to be covered by carpet tile.

B. Testing of substrate for moisture and alkalinity is the responsibility of Owner’s separate Contractor.

C. Preparation of substrate is the responsibility of Owner’s separate Contractor, including, but not limited to, the removal of curing compounds and other incompatible coatings and the application of patching and leveling compound.

3.3 INSTALLATION

A. Carpet tile shall be installed under separate contract.

3.4 PROTECTION

A. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7.

B. 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 097217 – ABUSE-RESISTANT WALL COVERINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Vinyl wall covering.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data on physical characteristics, durability, fade resistance, and fire-test-response characteristics.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.

C. Shop Drawings: Show location and extent of each wall-covering type. Indicate seams and termination points.

D. Samples: For each type of wall covering and for each color, pattern, texture, and finish specified, full width by 36 inches long in size.

1. Wall-Covering Sample: From same production run to be used for the Work.
   a. Mark top and face of fabric.

E. Product Schedule: For wall coverings. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each wall covering, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wall coverings to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for installation.

1. Build mockups for each type of wall covering on each substrate required. Comply with requirements in ASTM F1141 for appearance shading characteristics.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for occupants after Project completion during the remainder of the construction period.

B. Lighting: Do not install wall covering until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates in accordance with test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2.2 VINYL WALL COVERING

A. Basis of Design: Subject to compliance with requirements, provide Koroseal Flex or comparable product by one of the following:

1. C/S Group.
2. Design-Tex, Inc.
3. Knoll, Inc.
4. Maharam.
5. Wolf-Gordon.

B. Description: Provide vinyl products in rolls from same production run and complying with the following:

1. FS CCC-W-408D for Type III, Heavy Duty.
2. ASTM F793/F793M for strippablewall coverings.

a. Category: V, Type III, Commercial Serviceability.

C. Total Weight: 35 oz per linear yard, excluding coatings.

D. Width: 54 inches.

E. Colors, Textures, and Patterns: As indicated on Drawings..

2.3 ACCESSORIES

A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application indicated and as recommended in writing by wall-covering manufacturer.

1. VOC Content: Not to exceed 250 g/L.

B. Primer/Sealer: Mildew resistant, complying with requirements in Section 099123 "Interior Painting" and recommended in writing by primer/sealer and wall-covering manufacturers for intended substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation surfaces being true in plane and vertical and horizontal alignment, maximum moisture content, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, and mildew.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
   a. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.

D. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

E. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 INSTALLATION OF WALL COVERING

A. Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.

B. Cut wall-covering strips in roll number sequence. Change the roll numbers at partition breaks and corners.

C. Install strips in same order as cut from roll, unless manufacturer recommends reversing every other strip..

D. Install wall covering without lifted or curling edges and without visible shrinkage.

E. Match pattern 72 inches above the finish floor.

F. Install seams vertical and plumb at least 6 inches from outside corners and 6 inches from inside corners unless a change of pattern or color exists at corner. Horizontal seams are not permitted.

G. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.

H. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

3.4 CLEANING

A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 097217

SECTION 097723 - FABRIC-WRAPPED PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes shop-fabricated, fabric-wrapped wall panels.

B. Related Sections:

1. Section 098433 "Sound-Absorbing Wall Units" for shop-fabricated, acoustical wall panels tested for acoustical performance.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include fabric facing, panel edge, core material, and mounting indicated.

B. Shop Drawings: For panel assembly and installation.

1. Include plans, elevations, sections, and mounting devices and details.
2. Include details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge profile and core materials.
3. Include details at cutouts and penetrations for other work.
4. Include direction of fabric weave and pattern matching.

C. Samples for Verification: For the following products:

1. Fabric: Full-width by approximately 36-inch-long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.
2. Panel Edge: 12-inch-long Sample(s) showing each edge profile, corner, and finish.
3. Core Material: 12-inch-square Sample at corner.
4. Mounting Devices: Full-size Samples.
5. Assembled Panels: Approximately 36 by 36 inches, including joints and mounting methods.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Electrical outlets, switches, and thermostats.
2. Items penetrating or covered by panels including the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Alarms.
e. Sprinklers.
f. Access panels.

B. Product Certificates: For each type of panel.

C. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of panel to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal instructions.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabric and panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.7 FIELD CONDITIONS

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

B. Lighting: Do not install panels until a permanent level of lighting is provided on surfaces to receive the panels.

C. Air-Quality Limitations: Protect panels from exposure to airborne odors such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.

D. Field Measurements: Verify panel locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace panels and components that fail in materials or workmanship within specified warranty period.

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

a. Fabric sagging, distorting, or releasing from panel edge.
b. Warping of core.

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Panels shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.2 FABRIC-WRAPPED WALL PANELS

A. Fabric-Wrapped Wall Panel **AWP-2** and **AWP-3**: Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back edge border of core.

1. Basis of Design: Provide Armstrong sound soak or comparable product by one of the following:

a. Armstrong World Industries.
b. Conwed.
c. Decoustic Limited.

d. Golterman & Sabo.

2. Panel Shape: Flat.

3. Mounting: Back mounted with manufacturer's standard metal clips or bar hangers, secured to substrate.
4. Core: Glass-fiber board.
5. Edge Construction: Manufacturer's standard chemically hardened core with no frame.
6. Edge Profile: Eased (small radius).
7. Corner Detail in Elevation: Square with continuous edge profile indicated.
8. Facing Material: As indicated on Drawings.
9. Nominal Core Thickness: 2 inches.

2.3 MATERIALS

A. Core Materials:

1. Glass-Fiber Board: ASTM C612; of type standard with manufacturer; nominal density of 6 to 7 lb/cu. ft., unfaced, and dimensionally stable, molded rigid board; and with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

B. Facing Material: Fabric from same dye lot; color and pattern as indicated by manufacturer's designations.
1. Fiber Content: 100 percent woven polyester.

C. Mounting Devices: Concealed on back of panel, recommended by manufacturer to support weight of panel, and as follows:
1. Metal Clips or Bar Hangers: Manufacturer's standard two-part metal "Z" clips, with one part of each clip mechanically attached to back of panel and the other part to substrate, designed to permit unit removal.

2.4 FABRICATION

A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.

B. Edge Hardening: For glass-fiber board cores, chemically harden core edges and areas of core where mounting devices are attached.

C. Facing Material: Apply fabric fully covering visible surfaces of panel; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.

1. Square Corners: Tailor corners.
2. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent panels.

D. Dimensional Tolerances of Finished Panels: Plus or minus 1/16 inch for the following:

1. Thickness.
2. Edge straightness.
3. Overall length and width.
4. Squareness from corner to corner.
5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric, fabricated panels, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting panel performance.

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

3.2 INSTALLATION

A. Install panels in locations indicated. Unless otherwise indicated, install panels with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with manufacturer's written instructions for installation of panels using type of mounting devices indicated. Mount panels securely to supporting substrate.

C. Align fabric pattern and grain with adjacent panels.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb and Level: Plus or minus 1/16 inch in 48 inches, noncumulative.

B. Variation of Joint Width: Not more than 1/16 inch wide from hairline in 48 inches, noncumulative.

3.4 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 097723

SECTION 097813 – METAL INTERIOR WALL PANELING

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. Stainless steel wall paneling.

B. Related Requirements:

1. Section 114000 "Food Service Equipment" for fabricated counters, tables, sinks and similar items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include the following:

B. Sustainable Design Submittals:

1. Product Data: For adhesives and sealants, indicating VOC content.

C. Shop Drawings: For wall panels. Include plans and elevations, indicating panel joints, trim, and interface with other work.

D. Samples: For metal wall paneling and trim accessories, in manufacturer's standard sizes.

1.4 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of construction contiguous with foodservice equipment by field measurements before fabrication. Indicate measurements on Shop Drawings.

B. Environmental Limitations: Do not deliver or install metal wall paneling until spaces are enclosed and weathertight and interior finishes, such as painting, are complete.

PRODUCTS

1.5 PERFORMANCE REQUIREMENTS

A. NSF Standards: Provide wall panels conforming to NSF standard 51.

B. Wall Panels: Stainless steel with strippable protective film on exposed surface.

1. Thickness: 0.0235 inch (24 ga.)
2. Stainless Steel Sheet: ASTM A240/A240M, type 304 austenitic stainless steel.
3. Finish: Directional satin finish, ASTM A480/A480M, No. 4.

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

1. ATI Specialty Metals; Monroe, NC.
2. Industrial Alloys, Inc.; Indian Trail, NC.
3. Progressive Alloy Steels Unlimited, Inc.; Hartsville, NC.
4. Stainless Architectural Supply.
5. Stainless Supply, a JW Metal Products Company; Monroe, NC.
6. Freedom Metals; Charlotte, NC.

D. Moldings and Trim: Provide stainless steel divider strips, inside and outside corners and end caps, to match wall panels and as required for complete installation.

1.6 MISCELLANEOUS MATERIALS

A. Installation Accessories, General: NSF certified for end-use application indicated.

B. Adhesives: One-component moisture curing polyurethane construction adhesive recommended by manufacturer of wall panels.

1. Basis of Design: Loctite PL Premium Polyurethane Constructon Adhesive.
2. VOC Content: Not to exceed 70 g/L.

C. Elastomeric Joint Sealant: ASTM C920; silicone. Type S (single component), Grade NS (nonsag), Class 25, Use NT (nontraffic) related to exposure, and Use M, G, A, or O as applicable to joint substrates indicated and complying with Section 079200 “Joint Sealants.”

1. Public Health and Safety Requirements:

a. Sealant is certified for compliance with NSF standards for end-use application indicated.
b. Washed and cured sealant complies with the FDA's regulations for use in areas that come in contact with food.

1.7 FINISHES

A. Stainless Steel Finishes:

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

a. Run grain of directional finishes with long dimension of each piece.
b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 2 - EXECUTION

2.1 EXAMINATION

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

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

2.2 PREPARATION

A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.

B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

E. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels and so that trimmed panels at corners are not less than 12 inches wide.

1. Mark plumb lines on substrate at trim accessory and panel joint locations for accurate installation.
2. Locate trim accessories and panel joints to allow clearance at panel edges according to manufacturer's written instructions.

2.3 INSTALLATION

A. Install metal wall paneling in accordance with manufacturer’s written recommendations and approved Shop Drawings.

B. Install inside and outside corners.

C. Install joint sealant in joints between equipment and wall panel surfaces with continuous joint backing unless otherwise indicated. Produce airtight, watertight, vermin-proof, sanitary joints.

2.4 CLEANING AND PROTECTING

A. Remove strippable protective film at Substantial Completion.

END OF SECTION 097813

SECTION 098400 – ACOUSTIC ROOM COMPONENTS

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 shop-fabricated, acoustical panel units tested for acoustical performance, including the following:

1. Sound-diffusing ceiling panels.
2. Sound-absorbing and diffusing wall panels.

1.3 DEFINITIONS

A. NRC: Noise Reduction Coefficient.

B. SAA: Sound Absorption Average.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include fabric facing, panel edge, core material, and mounting indicated.

B. Shop Drawings: For unit assembly and installation.

1. Include reflected ceiling plans, elevations, sections, and mounting devices and details.
2. Include details at joints and corners; and details at ceiling intersections and intersections with walls. Indicate panel edge profile and core materials.
3. Include direction of fabric weave and pattern matching.

C. Samples for Verification: For the following products:

1. Fabric: Full-width by approximately 36-inch-long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.
2. Panel Edge: 12-inch-long Sample(s) showing each edge profile, corner, and finish.
3. Core Material: 12-inch-square Sample at corner.
4. Mounting Devices: Full-size Samples.
5. Assembled Panels: Approximately 36 by 36 inches, including joints and mounting methods.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Electrical outlets.
2. Suspended ceiling components above ceiling units.
3. Structural members to which suspension devices will be attached.
4. Items penetrating or covered by units including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Alarms.
    e. Sprinklers.
    f. Access panels.

5. Show operation of hinged and sliding components covered by or adjacent to units.

B. Product Certificates: For each type of unit.

C. Sample Warranty: For manufacturer's special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of unit to include in maintenance manuals. Include fabric manufacturer's written cleaning and stain-removal instructions.

1.8 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. Mounting Devices: Full-size units equal to 5 percent of amount installed, but no fewer than five devices.

1.9 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials, fabrication, and installation.

1. Build mockup of typical ceiling area as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabric and unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.11 FIELD CONDITIONS

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

B. Lighting: Do not install units until a permanent level of lighting is provided on surfaces to receive the units.

C. Air-Quality Limitations: Protect units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.

D. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

1.12 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace units and components that fail in materials or workmanship within specified warranty period.

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

a. Acoustical performance.
b. Warping of core.

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain ceiling units specified in this Section and wall units specified in Section 098433 "Sound-Absorbing Wall Units" from single source from single manufacturer.

B. Manufacturers: Subject to compliance with requirements, provide basis of design products by Wenger or comparable products by one of the following:

1. AVL Systems.
2. Conwed.
3. Decoustics Limited
4. Golterman and Sabo.
5. Kinetics Noise Control.
6. Wenger Corporation.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 286.

2.3 SOUND-DIFFUSING CEILING UNITS

A. Sound-Diffusing Ceiling Panel **ACP-1**: Manufacturer's standard panel construction thermo molded plastic without fabric covering.

1. Basis of Design: Traditional Acoustics Panel Series, Ceiling Diffuser Panels.
2. Basis Panel Shape: Pyramidal.
3. Mounting: Lay-in with safety cable or seismic clip.
4. Acoustical Performance, Sound Absorption Coefficients, One-third Octave Band Center Frequency, Hz, for 48 by 48 inches (1219 by 1219 mm) unit, Mounting Type A.
   a. 125Hz = 0.27.
   b. 250Hz = 0.18.
   c. 500Hz = 0.09.

d. 1000Hz = 0.06.
e. 2000Hz = 0.03.
f. 4000Hz = 0.00.

2.4 SOUND-DIFFUSING AND -REFLECTING WALL UNITS

A. Sound-Diffusing Wall Panels: **AWP-4**. **AWP-5** add **AWP-6**. Manufacturer's standard panel construction consisting of molded thermoplastic panel, 0125 inch thick with fabric covering.

1. Basis of Design: Type I Convex Wall Diffuser.
2. Panel Shape: Radially curved flat panel.
3. Mounting: Back mounted with manufacturer's standard metal clips or bar hangers, secured to substrate.
4. STC: 23 per ASTM E90 and ASTM E413.
5. Acoustical Performance, Sound Absorption Coefficients, One-third Octave Band Center Frequency, Hz, for 48 by 48 inches (1219 by 1219 mm) unit, Mounting Type A.
   a. 125Hz = 0.18.
   b. 250Hz = 0.18.
   c. 500Hz = 0.13.
   d. 1000Hz = 0.10.
   e. 2000Hz = 0.12.
   f. 4000Hz = 0.16.

2.5 MATERIALS

A. Core Materials:
1. Fire-Retardant Formed Plastic: Manufacturer's standard formed plastic with flame-spread index of 25 or less and smoke-developed index of 25 or less according to ASTM E84 or UL 723.

2.6 FABRICATION

A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated, with facing material applied to face, edges, and back border of dimensionally stable core and with rigid edges to reinforce panel perimeter against warpage and damage.

B. Measure each area and establish layout of panels and joints of sizes indicated on Drawings within a given area.

C. Facing Material: Apply fabric facing fully covering visible surfaces of unit; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.

1. Square Corners: Tailor corners. Heat-seal vinyl fabric seams at corners.
2. Radius and Other Nonsquare Corners: Attach facing material so there are no seams or gathering of material.

3. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches adjacent units.

D. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:

1. Thickness.
2. Edge straightness.
3. Overall length and width.
4. Squareness from corner to corner.
5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric, fabricated units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.

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

3.2 INSTALLATION

A. Install units in locations indicated. Unless otherwise indicated, install units with edges in alignment with walls and other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

C. Align fabric pattern and grain with adjacent units.

3.3 INSTALLATION TOLERANCES

A. Variation from Alignment with Surfaces: Plus or minus 1/16 inch in 48 inches, noncumulative.

B. Variation from Level or Slope: Plus or minus 1/16 inch .

C. Variation of Joint Width: Not more than 1/16 inch wide from hairline in 48 inches, noncumulative.

3.4 CLEANING

A. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 098400

SECTION 098434 – WOOD FIBER ACOUSTIC PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes wood fiber acoustical wall and ceiling shapes and panels.

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 unit assembly and installation.

1. Include plans, elevations, sections, and mounting devices and details.
2. Include details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge profile and core materials.
3. Include details at cutouts and penetrations for other work.

C. Samples: For the following products:

1. Wood fiber panels in manufacture’s standard sizes.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Electrical outlets, switches, and thermostats.
2. Items penetrating or covered by units including the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.

d. Alarms.
e. Sprinklers.
f. Access panels.

3. Show operation of hinged and sliding components covered by or adjacent to units.

B. Product Certificates: For each type of unit.

C. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of unit to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal instructions.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.8 FIELD CONDITIONS

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

B. Lighting: Do not install units until a permanent level of lighting is provided on surfaces to receive the units.

C. Air-Quality Limitations: Protect units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.

D. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace units and components that fail in materials or workmanship within specified warranty period.

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

a. Acoustical performance.
b. Fabric sagging, distorting, or releasing from panel edge.
c. Warping of core.

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.2 SOUND-ABSORBING CEMENTITIOUS WOOD FIBER WALL PANELS

A. Sound-Absorbing Cementitious Wood Fiber Wall Panel **AWP-1**: Manufacturer's standard panel construction consisting of cementitious wood fiber panel direct mounted to wall using mounting method indicated.

1. Basis of Design Product: Armstrong, Tectum Direct-Attached Wall Panels

2. Mounting Type and Corresponding Noise Reduction Coefficient (NRC): ASTM C 423; Mounting C-40 (0.85).
3. Surface Texture: Unfaced, coarse.
4. Composition: Aspen wood fibers bonded with inorganic hydraulic cement.
5. Color: As scheduled.
6. Size: Custom sizes as indicated on Drawings.
7. Thickness: 1 inch, unless otherwise indicated on Drawings.
8. Edge Profile: Square four sides.
9. Flame Spread: ASTM E 1264; Class A.
10. Mounting: Screws: Manufacturer's standard painted head screws matching color selected for cementitious wood fiber panels, face secured to wood or metal furring with 1-1/2-inch airspace.

2.3 SOUND-ABSORBING CEMENTITIOUS WOOD FIBER CLOUDS

A. Sound-Absorbing Cementitious Wood Fiber Wall Panel **ACC-1** and **ACC-2**: Manufacturer's standard panel construction consisting of cementitious wood fiber panel suspended by cables from structural ceiling.

1. Basis of Design Product: Armstrong, Tectum Clouds.
2. Surface Texture: Unfaced, coarse.
3. Composition: Aspen wood fibers bonded with inorganic hydraulic cement.
4. Color: As scheduled.
5. Size: Custom sizes as indicated on Drawings.
6. Thickness: 1 inch, unless otherwise indicated on Drawings.
7. Edge Profile: Square four sides.
8. Flame Spread: ASTM E 1264; Class A.
9. Mounting: Screws: Manufacturer's standard lay-in ceiling cross tees embedded in back of panel and suspended by 12 ga. Hanger wire to structural ceiling.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric, fabricated units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.

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

3.2 INSTALLATION

A. Install units in locations indicated. Unless otherwise indicated, install units with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb and Level: Plus or minus 1/16 inch in 48 inches, noncumulative.

3.4 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 098434

SECTION 098436 - SOUND-ABSORBING CEILING UNITS

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 shop-fabricated, acoustical panel units tested for acoustical performance, including the following:

1. Acoustical Ceiling Clouds.
2. Sound-absorbing baffle panels.

1.3 DEFINITIONS

A. NRC: Noise Reduction Coefficient.

B. SAA: Sound Absorption Average.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For unit assembly and installation.

1. Include reflected ceiling plans, elevations, sections, and mounting devices and details.
2. Include details at joints and corners; and details at ceiling intersections and intersections with walls. Indicate panel edge profile and core materials.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Suspended ceiling components above ceiling units.

2. Structural members to which suspension devices will be attached.

B. Product Certificates: For each type of unit.

C. Sample Warranty: For manufacturer's special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of unit to include in maintenance manuals. Include fabric manufacturer's written cleaning and stain-removal instructions.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabric and unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.9 FIELD CONDITIONS

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

B. Lighting: Do not install units until a permanent level of lighting is provided on surfaces to receive the units.

C. Air-Quality Limitations: Protect units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.

D. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace units and components that fail in materials or workmanship within specified warranty period.

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

a. Acoustical performance.
b. Warping of core.

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Sound absorbing ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 286.

2.2 ACOUSTICAL CEILING CLOUDS – **ACC-3**

A. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

B. Basis of Design: Provide product indicated on Finish Legend or approved substitute.

C. Classification: Provide panels as follows:

1. Type and Form: glass-fiber base with membrane-faced overlay; Form 2, cloth. Binder shall not contain urea formaldehyde.
2. Pattern: E (lightly textured).

D. Color: White.

E. Light Reflectance (LR): Not less than 0.90.

F. Acoustical Performance: 1.18 Sabins.

G. Edge/Joint Detail: Square.

H. Thickness: 7/8inch.

I. Modular Size: As indicated on Drawings.

J. Attachment Devices: Corner brackets and metal extrusions factory embedded in back of panel.

K. Suspension System: Manufacturer’s standard deck hanging system of cables and anchors for suspension of individual units to structure above.

2.3 SOUND-ABSORBING CEILING UNITS

A. Sound-Absorbing Baffle Panel **ACC-4**: Manufacturer's standard panel construction consisting of polyester felt panels arrayed in quarter circle around aluminum rods suspended from structure.

1. Basis of Design: Provide MDC Zintra Quarter Baffles or substitute approved by Architect prior to Bid.
2. Facing Material: 100 percent polyester felt.
3. Acoustical Performance: Sound absorption NRC of 0.95

2.4 FABRICATION

A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated, with facing material applied to face, edges, and back border of dimensionally stable core and with rigid edges to reinforce panel perimeter against warpage and damage.

B. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:

1. Thickness.
2. Edge straightness.
3. Overall length and width.
4. Squareness from corner to corner.
5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabricated units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.

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

3.2 INSTALLATION

A. Install units in locations indicated. Unless otherwise indicated, install units with edges in alignment with walls and other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

C. Install acoustical ceiling clouds in accordance with manufacturer’s written instructions and approved Shop Drawings. Individual units shall be hung separately and, unless noted otherwise, level and at the same height above finished floor.

3.3 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 098436

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.

B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.

D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

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

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 QUALITY ASSURANCE

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

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

    a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
    b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

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

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

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

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

1.7 FIELD CONDITIONS

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

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in the Interior Painting Schedule for the coating category indicated or comparable products by one of the following

1. Glidden Professional (formerly ICI Paints).
2. Rose Talbert.
3. PPG Paints.
4. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

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

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMUs): 12 percent.

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

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

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

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

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

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

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

D. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

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.
3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
4. Paint entire exposed surface of window frames and sashes.
5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

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

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

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

3.4 FIELD QUALITY CONTROL

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

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

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

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

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

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

3.6 EXTERIOR PAINTING SCHEDULE

A. CMU Substrates:

1. Latex over Alkali-Resistant Primer System MPI EXT 4.2L:

a. Prime Coat: Primer, alkali resistant, water based, MPI #3.

1) PPG Architectural; PPG Paints, Perma-Crete Interior/Exterior Alkali Resistant Primer, 4-603XI.
2) Sherwin-Williams Company; Loxon Concrete and Masonry Primer, A24W8300.Intermediate Coat: Latex, exterior, matching topcoat.

b. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

1) PPG Architectural; PPG Paints, Speedhide Exterior 100% Acrylic Latex semi gloss, 6-9000XI.
2) Sherwin-Williams Company; Duration Exterior Acrylic Coating, K34W00251.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for shop priming structural steel.
2. Section 051300 “Steel Decking” for shop priming of steel deck scheduled to be field finishing.
3. Section 055113 "Metal Pan Stairs" for shop priming metal pan stairs.
4. Section 099600 "High-Performance Coatings" for tile-like coatings.

1.2 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.

B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.

E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

B. Sustainable Design Submittals:

1. Indicate VOC content.

C. Samples for Initial Selection: For each type of topcoat product.

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

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

E. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Custodial Maintenance Manual: Provide maintenance manual for Owner’s use. Include the following information:

1. Area Summary, an overview of entire project.
2. Area Detail, for each substrate, paint product system, color number and sheen.
3. Product Data Sheet for each product.
4. Safety Data Sheet for each product.
5. Sample of each paint color, minimum of 8 by 8 inches, with manufacturer's designation of color and sheen.
6. Cleaning and touch-up instructions.
7. Contact for local supplier.

1.5 QUALITY ASSURANCE

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

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

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

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

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

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

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

1.7 FIELD CONDITIONS

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

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in the Interior Painting Schedule for the coating category indicated or comparable products by one of the following

1. Glidden Professional (formerly ICI Paints).
2. Rose Talbert.
3. PPG Paints.
4. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

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

C. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 50 g/L.
3. Dry-Fog Coatings: 150 g/L.
4. Primers, Sealers, and Undercoaters: 100 g/L.
5. Rust-Preventive Coatings: 100 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Shellacs, Clear: 730 g/L.
9. Shellacs, Pigmented: 550 g/L.

D. Low-Emitting Materials: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

E. Colors: As indicated in a color schedule.

2.3 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Traffic Surfaces:

1. Water-Based Concrete Floor Sealer System MPI INT 3.2G:

a. First Coat: Sealer, water based, for concrete floors, matching topcoat.
b. Topcoat: Sealer, water based, for concrete floors, MPI #99.

1) PPG Architectural; PPG Paints, Perma-Crete Plex-Seal WB Interior/Exterior Clear Sealer, 4-6200.
2) Sherwin-Williams; H & C Wet Look Sealer, 50.048054.

B. CMU Substrates:

1. Latex System MPI INT 4.2A:

a. Block Filler: Block filler, latex, interior/exterior, MPI #4.

1) PPG Architectural; PPG Paints, Speedhide Interior/Exterior Hi Fill Latex Block Filler, 6-15XI.
2) Sherwin-Williams; PrepRite Interior/exterior Block Filler, B25W00025.

b. Intermediate Coat: Latex, interior, matching topcoat.

c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.

1) PPG Architectural; Glidden Professional, Speed-Wall Interior Latex Paint, Semi-Gloss, GPS-5110.
2) PPG Architectural; PPG Paints, Speedhide Pro-EV Zero Interior Wall & Ceiling Latex Semi-gloss, 12-510XI.
3) Sherwin-Williams; ProMar 400 Zero VOC Interior Latex Gloss, W21W04651.

C. Steel Substrates:

1. Institutional Low-Odor/VOC Latex System MPI INT 5.1S:

a. Prime Coat: Primer, rust inhibitive, water based MPI #107.

1) PPG Architectural; High Performance Coatings, Pitt-Tech Interior/Exterior DTM Industrial Primer, 90-712.
2) Sherwin-Williams; Pro Industrial, Pro-Cryl Universal Primer.

b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.

c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.

1) PPG Architectural; PPG Paints, Speedhide Zero Interior Zero VOX Latex Semi-Gloss, 6-4510XI.
2) Sherwin-Williams; Pro Industrial, Acrylic Semi-Gloss Coating, B66W00651.

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

a. Prime Coat: Shop primer specified in Section where substrate is specified.

b. Topcoat: Dry fall, latex (MPI Gloss Level 5), MPI #226.

1) PPG Architectural; Glidden Professional, Waterborne Eggshell Dry Fall, 1482.
2) PPG Architectural; PPG Paints, Speedhide Super Tech WB Interior 100% Acrylic Dry Fog Latex, 6-727XI.
3) Sherwin-Williams; Pro Industrial, Waterborne Acrylic Dryfall Semi-Gloss, B42W83.

D. Galvanized-Metal Substrates:

1. Institutional Low-Odor/VOC Latex System MPI INT 5.3N :

a. Prime Coat: Primer, galvanized, water based, MPI #134.

1) PPG Architectural; High Performance Coatings, Pitt-Tech Plus 4020 PF/Devflex 4020 PF
2) Sherwin-Williams; Pro Industrial, DTM Acrylic Prime/Finish, B66W00011.

b. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.

1) PPG Architectural; Speedhide Zero Interior Zero VOC Latex Semi-gloss, 6-4510XI.
2) Sherwin-Williams; Pro Industrial, Acrylic Semi-gloss coating, B66W00651.

E. Gypsum Board Substrates:

1. Latex over Latex Sealer System MPI INT 9.2A:

a. Prime Coat: Primer sealer, latex, interior, MPI #50.

1) PPG Architectural; Glidden Professional, PVA Drywall Interior Primer and Sealer, GPD-0000.
2) PPG Architectural; PPG Paints, Speedhide Zero Interior Zero VOC Latex Sealer, 6-4900-XI.
3) Sherwin-Williams; ProMar 200 Zero Interior Latex Primer, B28W02600/B28WQ2600.

b. Prime Coat: Latex, interior, matching topcoat.
c. Intermediate Coat: Latex, interior, matching topcoat.
d. Topcoat, ceilings and soffits: Latex, interior, flat (MPI Gloss Level 1), MPI #53.

1) PPG Architectural; PPG Paints, Speedhide Zero Interior Zero VOC Latex Flat, 6-4110XI.
2) Sherwin-Williams; ProMar 200 Zero Interior Latex Flat, B30W12651.

e. Topcoat, walls unless noted otherwise: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.

1) PPG Architectural; Glidden Professional, Speed-Wall Interior latex Paint Semi-Gloss, GPS_5110.
2) PPG Architectural; PPG Paints, Speedhide Zero Interior Zero VOC Latex Flat, 6-4110XI.
3) Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Gloss B21W12651.

END OF SECTION 099123

SECTION 099300 - STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood stains.
2. Transparent finishes.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.
2. Include preparation requirements and application instructions.
3. Indicate VOC content.

B. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

C. Samples for Verification: Sample for each type of finish system and in each color and gloss of finish required on representative samples of actual wood substrates.

1. Size: 8 inches long.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Custodial Maintenance Manual: Provide maintenance manual for Owner’s use. Include the following information:

1. Area Summary, an overview of entire project.
2. Area Detail, for each substrate, paint product system, color number and sheen.
3. Product Data Sheet for each product.
4. Safety Data Sheet for each product.
5. Sample of each stain color, minimum of 8 by 8 inches, with manufacturer's designation of color and sheen.
6. Cleaning and touch-up instructions.
7. Contact for local supplier.

1.4 DELIVERY, STORAGE, AND HANDLING

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

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

1.5 FIELD CONDITIONS

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

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

C. Do not apply exterior finishes in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed for the coating category indicated or comparable products by one of the following

1. Glidden Professional (formerly ICI Paints).
2. Rose Talbert.
3. PPG Paints.
4. Sherwin-Williams Company (The).

2.2 SOURCE LIMITATIONS

A. Source Limitations: Obtain each coating product from single source from single manufacturer.

2.3 MATERIALS, GENERAL

A. Material Compatibility:

1. Provide materials for use within each coating 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.

B. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.

2. Nonflat Paints and Coatings: 50 g/L.

C. Stain Colors: Match Architect's samples.

2.4 WOOD STAINS

A. Stain, Interior, Semitransparent, for Interior Wood: Solvent-based, oil or oil/alkyd, semitransparent, pigmented stain for new interior wood surfaces that are to be finished with a clear varnish.

1. Sherwin-Williams; Wood classics 250 VOC Oil Stain.

2.5 TRANSPARENT FINISHES

A. Varnish, Interior, Polyurethane, Oil Modified, Satin: Solvent-based, one-component, oil-modified polyurethane clear satin varnish for new or previously varnished or stained interior wood surfaces.

1. Sherwin-Williams; Minwax Oil-Modified Polyurethane.
2. Gloss and Sheen Level: Manufacturer's standard low-sheen finish.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Maximum Moisture Content of Interior Wood Substrates: 13 percent, when measured with an electronic moisture meter.

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

D. Proceed with finish application only after unsatisfactory conditions have been corrected.

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

3.2 PREPARATION

A. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.

1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

B. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.

1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

C. Interior Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Apply wood filler paste to open-grain woods to produce smooth, glasslike finish.
3. Sand surfaces exposed to view and dust off.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dry.

3.3 APPLICATION

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

1. Use applicators and techniques suited for finish and substrate indicated.
2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

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 finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from finish application. Correct damage 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 finished wood surfaces.

3.5 INTERIOR WOOD-FINISH-SYSTEM SCHEDULE

A. Wood Substrates, Wood Trim:

1. Polyurethane Varnish over Stain System:

    a. Stain Coat: Stain, semitransparent, for interior wood.
    b. First Intermediate Coat: Polyurethane varnish matching topcoat.
    c. Second Intermediate Coat: Polyurethane varnish matching topcoat.
    d. Topcoat: Varnish, interior, polyurethane, oil modified, satin.

END OF SECTION 099300

SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:

1. Exterior Substrates:
   a. Steel.

2. Interior Substrates:
   a. Concrete masonry units (CMUs).
   b. Steel.

B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for shop priming of structural steel with primers specified in this Section.
2. Section 099113 "Exterior Painting" for general field painting.
3. Section 099123 "Interior Painting" for general field painting.

1.3 DEFINITIONS

A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
B. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
C. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

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

1. Submit Samples on rigid backing, 8 inches square.

2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each coating system.

a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft..
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

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

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

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

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

1.7 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F.
B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in the Interior High-Performance Coating Schedule for the coating category indicated or comparable products by one of the following

1. Glidden Professional (formerly ICI Paints).
2. Rose Talbert.
3. PPG Paints.
4. Sherwin-Williams Company (The).

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
3. Products shall be of same manufacturer for each coat in a coating system.

C. Colors: As indicated in color schedule.

2.3 SOURCE QUALITY CONTROL

A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMUs): 12 percent.
3. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.
B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

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

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

1. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi at 6 to 12 inches.
2. Abrasive blast clean surfaces to comply with SSPC-SP 7/NACE No. 4.

E. Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or alkalinity of mortar joints exceeds that permitted in manufacturer's written instructions.

1. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi at 6 to 12 inches.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for coating and substrate indicated.
2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

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

1. Contractor shall touch up and restore coated surfaces damaged by testing.
2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, 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 coated surfaces.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel Substrates:

1. Pigmented Polyurethane over High-Build Epoxy System MPI EXT 5.1J:

a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.

1) PPG Architectural, Protective and Marine Coatings, Amercoat 235, AT235-72/AT235B.
2) Sherwin-Williams, Protective & Marine, Dura-Plate 235 Multi-Purpose Epoxy, B67W235/B67V235.

b. Intermediate Coat: Epoxy, high build, low gloss, MPI #108.

1) PPG Architectural, Protective and Marine Coatings, Aquaon High Build Epoxy, 97-131/97/97-137.
2) Sherwin-Williams, Protective & Marine, Macropoxy 646 Fast Cure Epoxy, B58W006/1058V00600.

c. Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.

1) PPG Architectural, Protective and Marine Coatings, Pitthane Ultra-Gloss 95-812 Series, 95-8001/95-819.
2) Sherwin-Williams, Protective & Marine, Acrolon 218 HS, B65W611/B65V600.

3.7 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. CMU Substrates:

1. Epoxy, High-Build System MPI INT 4.2R:

a. Prime Coat: Epoxy block filler, MPI #116.

1) PPG Architectural, Protective and Marine Coatings, Amerlock 400 BF, AK400B-x
2) Sherwin-Williams, Protective & Marine, Kem Cati-Coat HS Epoxy Filler/Sealer, B42W00400/B42V00401.

b. Intermediate Coat: High-build epoxy, matching topcoat.

c. Topcoat: High-build epoxy, gloss, MPI #98.

1) PPG Architectural, High Performance Coatings, HPC High Gloss Epoxy, 95-502/95-506

2) Protective & Marine, Tile-Clad High Solids, B62WZ0111/B60VZ0070, E 1.

B. Gypsum Board Substrates:

1. Epoxy System:

a. Prime Coat: Primer sealer, latex, interior, MPI #50.

1) Glidden Professional; PVA Drywall Interior Primer and Sealer, GPD-0000
2) PPG Architectural; Speedhide Zero Interior Zero VOC Latex Sealer, 6-490XI.
3) Sherwin-Williams; Emerald Acrylic Latex Semi-gloss, K38W00351.

b. Intermediate Coat: Epoxy, matching topcoat.
c. Topcoat: Epoxy, gloss, MPI #77.

1) Sherwin-Williams; Protective & Marine, Tile-Clad HS Epoxy, B62WZ111/B60VZ70.

END OF SECTION 099600

SECTION 099647 - INTUMESCENT PAINTING (MPI STANDARDS)

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. Intumescent paint for interior items and surfaces.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

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

1. Submit Samples on actual substrate, not less than 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For each intumescent paint.
1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

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

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

1.6 FIELD CONDITIONS

A. Apply waterborne intumescent paints only when temperatures of surfaces to be painted and ambient air temperatures are between 50 and 90 deg F.

B. Apply solvent-thinned intumescent paints only when temperatures of surfaces to be painted and ambient air temperatures are between 45 and 95 deg F.

C. Do not apply intumescent paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

D. Allow wet surfaces to dry thoroughly and to attain temperature and conditions specified before starting or continuing coating operation.

PART 2 - PRODUCTS

2.1 INTUMESCENT PAINT

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."

B. Surface-Burning Characteristics of Fire-Retardant Systems: As tested according to ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

C. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each material or coat, products and spreading rates shall be as recommended in writing by intumescent paint manufacturer for use on substrate indicated. Comply with requirements for fire-retardant coating classification and surface-burning characteristics indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with manufacturer's requirements for surface treatments, shop-primed surfaces, maximum moisture content, and other conditions affecting performance of the Work.

B. Begin coating only when moisture content of wood substrate is 15 percent or less when measured with an electronic moisture meter.

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

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

3.2 PREPARATION

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

B. Remove hardware and hardware accessories, plates, machined surfaces, light fixtures, and similar items already installed that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.

1. After completing coating operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants. Do not coat surfaces if surface moisture content or alkalinity exceeds that permitted in manufacturer's written instructions.

1. Remove incompatible primers, and reprime substrate with compatible primers as required to produce coating systems indicated.
2. Perform cleaning and coating application so dust and other contaminants from cleaning process do not fall on wet, newly coated surfaces.

3.3 INSTALLATION

A. Apply intumescent paints according to manufacturer's written instructions and to comply with requirements for listing and labeling for surface-burning characteristics specified.

1. Use equipment and techniques best suited for substrate and type of material being applied.
2. Coat surfaces behind movable items the same as similar exposed surfaces.

3. Apply each coat separately according to manufacturer's written instructions.

B. Apply coatings to prepared surfaces as soon as practical after preparation and before subsequent surface soiling or deterioration.

C. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Produce sharp lines and color breaks.

1. Clear Finishes: Produce a smooth surface film of even sheen using multiple coats.

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 coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating 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 coated surfaces.

3.5 INTERIOR INTUMESCENT PAINTING SCHEDULE

A. Wood Substrates, Reclaimed wood flooring and doors.

1. Clear, Fire-Retardant, Solvent-Based System, MPI INT 6.3SS:

a. Prime Coat: As recommended in writing by topcoat manufacturer.
b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
c. Topcoat: Fire-retardant topcoat, clear, alkyd, interior, MPI #66.

1) Sherwin-Williams; Flame Control Fire Retardant Intumescent Varnish.

END OF SECTION 099647

SECTION 101100 - VISUAL DISPLAY UNITS

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. Visual display board assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.

B. Shop Drawings: For visual display units.

1. Include plans, elevations, sections, details, and attachment to other work.
2. Show locations of panel joints. Show locations of field-assembled joints for factory-fabricated units too large to ship in one piece.
3. Include sections of typical trim members.

C. Samples: For each type of visual display unit indicated.

1. Visual Display Panel: Not less than 8-1/2 by 11 inches, with facing, core, and backing indicated for final Work. Include one panel for each type, color, and texture required.
2. Trim: 6-inch-long sections of each trim profile.

D. Product Schedule: For visual display units. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranties: For manufacturer's special warranties.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

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

a. Surfaces lose original writing and erasing qualities.
b. Surfaces exhibit crazing, cracking, or flaking.

2. Warranty Period: Life of the building.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

2.2 MARKER BOARDS

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

1. ADP Lemco.
2. Best-Rite; MororeCo, Inc.
3. Claridge Products and Equipment.
4. Egan Visual.
5. Ghent Manufacturing.

6. Marsh Industries., Inc.
7. Platinum Visual Systems.

B. Visual Display Board Assembly: Factory fabricated.

1. Corners: Square.
2. Width: As indicated on Drawings.
3. Height: As indicated on Drawings.
4. Mounting Method: Direct to wall.

C. Porcelain-Enamel Markerboard Panels: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction, consisting of moisture-barrier backing, core material, and magnetic porcelain-enamel face sheet with low-gloss finish. Laminate panels under heat and pressure with manufacturer's standard, flexible waterproof adhesive.

1. Face Sheet Thickness: 0.021 inch uncoated base metal thickness.
2. Manufacturer's Standard Core: Minimum 1/4- inch thick, with manufacturer's standard moisture-barrier backing..

D. Markerboard Panel: Porcelain-enamel-faced markerboard panel on core indicated.

1. Color: White.

E. Tackboard Panel: Natural-cork tackboard panel on core indicated.

F. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch-thick, extruded aluminum; standard size and shape.
1. Aluminum Finish: Clear anodic finish.

G. Chalktray: Manufacturer's standard; continuous.
1. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.

H. Display Rail: Manufacturer's standard, extruded-aluminum display rail with cork insert, end stops, designed to hold accessories.

1. Size: 1 inch high by full length of visual display unit.
2. Map Hooks: Two map hooks for every 48inches of display rail or fraction thereof.
3. Map Hooks and Clips: Two map hooks with flexible metal clips for every 48inches of display rail or fraction thereof.
4. Flag Holder: One for each room.
5. Aluminum Finish: Match finish of visual display assembly trim.

2.3 TACKBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ADP Lemco.
2. Best-Rite; MororeCo, Inc.
3. Claridge Products and Equipment.

4. Egan Visual.
5. Ghent Manufacturing.
6. Marsh Industries., Inc.
7. Platinum Visual Systems.

B. Visual Display Board Assembly: Factory fabricated.
1. Corners: Square.
2. Width: As indicated on Drawings.
3. Height: As indicated on Drawings.
4. Mounting Method: Direct to wall.

C. Tackboard Panel: Natural-cork tackboard panel on hardboard core.

D. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch-thick, extruded aluminum; standard size and shape.
1. Aluminum Finish: Clear anodic finish.

2.4 MATERIALS

A. Porcelain-Enamel Face Sheet: PEI-1002, Sheet steel with ceramic coating fused under high heat to both sides.
1. Basis of Design: Polyvision e3.

B. Natural-Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish; with surface-burning characteristics indicated.

C. Hardboard: ANSI A135.4, tempered. Product shall contain no added urea formaldehyde.

D. Particleboard: ANSI A208.1, Grade M-1. Product shall contain no added urea formaldehyde.

E. MDF: ANSI A208.2, Grade 130. Product shall contain no added urea formaldehyde.

F. Extruded Aluminum: ASTM B221, Alloy 6063.

G. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.
1. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

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

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. 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.

2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine walls and partitions for proper preparation and backing for visual display units.

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

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.

3.3 INSTALLATION

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches o.c. Secure tops and bottoms of boards to walls.

C. Visual Display Board Assembly Mounting Heights: Install visual display units at mounting heights indicated on Drawings, or if not indicated, at heights indicated below.
   1. Mounting Height: 36inches above finished floor to top of chalktray.

3.4 CLEANING AND PROTECTION

A. Clean visual display units in accordance with manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 101100

SECTION 101200 - DISPLAY CASES

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. Display cases.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for display cases. Include furnished specialties and accessories.
2. Include electrical characteristics for illuminated display cases**.**

B. Shop Drawings: For display cases.

1. Include plans, elevations, sections, and attachment details.
2. Show location of seams and joints in tackboard panels.
3. Include sections of typical trim members.
4. Include diagrams for wiring of illuminated display cases.

C. Samples: For each exposed product and for each color and texture specified; not less than 8-1/2 by 11 inches for tackboard panels and 6 inches long for trim with factory finish.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For fabrics, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For display cases to include in maintenance manuals.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install display cases for indoor installations until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 DISPLAY CASES

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

1. ADP Lemco.
2. ASI Visual Display Products.
3. Claridge Products and Equipment, Inc.
4. Platinum Visual Systems.
5. ghent; a GMi Company.

B. Recessed Display Case: Factory-fabricated display case; with finished interior, operable glazed doors at front, and trim on face to cover edge of recessed opening.

1. Display Case Cabinet: Extruded aluminum.

2. Face Frame: Aluminum.
3. Aluminum Finish: Clear anodic.

C. Glazed Sliding Doors: Tempered glass; unframed; with extruded-aluminum top and bottom track; supported on nylon or ball-bearing rollers; with plastic top guide and rubber bumpers. Equip each door with ground finger pull and adjustable cylinder lock with two keys.

1. Thickness: Not less than 6 mm thick.

D. Shelves: 6-mm-thick tempered glass; supported on adjustable shelf standards and supports.

E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04102; with shelf brackets, B04112; recess mounted in rear surface. Provide standards extending full height of display case.

F. Back Panel: Manufacturer's standard natural-cork tackboard panel.

G. Illumination System: Concealed top-lighting system consisting of fluorescent-strip fixtures. Include lamps and internal wiring with single concealed electrical connection to building system. Coordinate electrical characteristics with power supply provided.

1. Ballasts: Low-temperature, high-power-factor, low-energy, fluorescent lamp ballasts that comply with Certified Ballast Manufacturers Association standards and carry its label.

a. Electrical Characteristics: Single phase, 120 V.

2.3 TACKBOARD PANELS

A. Polyester-Fabric-Faced Tackboard Panel: Polyester fabric factory laminated to 3/8-inch-thick, fiberboard backing.

2.4 MATERIALS

A. Fiberboard: ASTM C208.

B. Natural-Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish, integrally colored.

C. Extruded-Aluminum Bars and Shapes: ASTM B221, Alloy 6063.

D. Aluminum Tubing: ASTM B429/B429M, Alloy 6063.

E. Clear Tempered Glass: ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality Q3, with exposed edges seamed before tempering.

F. Fasteners: Provide screws, bolts, and other fastening devices made from same material as items being fastened, except provide hot-dip galvanized, stainless steel, or aluminum fasteners for exterior applications. Provide types, sizes, and lengths to suit installation conditions. Use security fasteners where exposed to view.

2.5 FABRICATION

A. Fabricate display cases to requirements indicated for dimensions, design, and thickness and finish of materials.

B. Use metals and shapes of thickness and reinforcing required to produce flat surfaces, and to impart strength for size, design, and application indicated.

C. Fabricate cabinets and door frames with reinforced corners, mitered to a hairline fit, with no exposed fasteners.

D. Fabricate shelf standards plumb and at heights to align shelf brackets for level shelves.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

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

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of illuminated units.

C. Examine walls and partitions for suitable framing depth if recessed units will be installed.

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

3.2 PREPARATION

A. Prepare recesses for display cases as required by type and size of unit.

3.3 INSTALLATION

A. General: Install units in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Recessed Display Cases: Attach units to wall framing with fasteners at not more than 16 inches o.c. Attach aluminum trim over edges of recessed display cases and conceal grounds and clips. Attach trim with fasteners at not more than 24 inches o.c.

C. Comply with requirements specified elsewhere for connecting illuminated bulletin boards.

D. Install display case shelving level and straight.

3.4 ADJUSTING AND CLEANING

A. Adjust doors to operate smoothly without warp or bind and so contact points meet accurately. Lubricate operating hardware as recommended in writing by manufacturer.

B. Touch up factory-applied finishes to restore damaged areas.

END OF SECTION 101200

SECTION 101416 - PLAQUES

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 metal plaques.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For plaques.

1. Include fabrication and installation details and attachments to other work.
2. Show plaque mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each plaque at least half size.

C. Samples for Initial Selection: For each type of plaque, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Product Schedule: For plaques. Use same designations indicated on Drawings or specified.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For plaques to include in maintenance manuals.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of plaques that fail in materials or workmanship within specified warranty period.

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

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.2 PLAQUES

A. Cast Plaque: Cast-metal plaque with background texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

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. A.R.K. Ramos.
b. ACE Sign Systems, Inc.
c. Erie Landmark Company; a division of Paul W. Zimmerman Foundries.
d. Gemini Incorporated.
e. Matthews International Corporation; Bronze Division.
f. Metal Arts.
g. Metallic Arts.
h. Signs & Decal Corp.
i. Southwell Company (The).Plaque

2. Material: Cast aluminum.
3. Plaque Thickness: 0.50 inch.
4. Finishes:

a. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.
b. Overcoat: Manufacturer's standard baked-on clear coating.

5. Background Texture: Smooth.

6. Integrally Cast Border Style: Raised flat band.
7. Mounting: Concealed studs.
8. Text and Typeface: Accessible raised characters and Braille Typeface as selected by Architect from manufacturer's full range and variable content as scheduled. Finish raised characters to contrast with background color, and finish Braille to match background color.
9. Size: Approximately 30 by 40 inches, as standard with manufacturer.

2.3 MATERIALS

A. Aluminum Castings: ASTM B26/B26M, alloy and temper recommended by plaque manufacturer for casting process used and for type of use and finish indicated.

B. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of plaques, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.

2. Plaque Mounting Fasteners:

a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of plaque, screwed into back of plaque, or screwed into tapped lugs cast integrally into back of plaque unless otherwise indicated.

2.5 FABRICATION

A. General: Provide manufacturer's standard plaques according to requirements indicated.

1. Preassemble plaques in the shop to greatest extent possible. Disassemble plaques only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match plaque finish.

6. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

2.6 GENERAL FINISH REQUIREMENTS

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

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

C. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.7 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

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.

B. Verify that plaque-support surfaces are within tolerances to accommodate plaques without gaps or irregularities between backs of plaques and support surfaces unless otherwise indicated.

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

3.2 INSTALLATION

A. General: Install plaques using mounting methods indicated and according to manufacturer's written instructions.

1. Install plaques level, plumb, true to line, and at locations and heights indicated, with plaque surfaces free of distortion and other defects in appearance.
2. Install plaques so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that plaque surfaces are clean and free of materials or debris that would impair installation.

4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of plaque. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place plaque in position and push until flush to surface, embedding studs in holes. Temporarily support plaque in position until adhesive fully sets.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed plaques and plaques that do not comply with specified requirements. Replace plaques with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as plaques are installed.

C. On completion of installation, clean exposed surfaces of plaques according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain plaques in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101416

SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Cutout dimensional characters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For signs.

   1. Include fabrication and installation details and attachments to other work.
   2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
   3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

   1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

   1. Dimensional Characters: Full-size Sample of dimensional character.
   2. Full-size Samples, if approved, will be returned to Contractor for use in the Project.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer of products.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

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

a. Deterioration of finishes beyond normal weathering.
b. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.

1. Uniform Wind Load: As indicated on Drawings.

2.2 DIMENSIONAL CHARACTERS

A. Cutout Characters: Characters with uniform faces; square-cut, smooth edges; precisely formed lines and profiles; and as follows:

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

a. A.R.K. Ramos.

b. ACE Sign Systems, Inc.
c. Erie Landmark Company, a division of Paul W. Zimmerman Foundries.
d. Gemini Incorporated.
e. Matthews International Corporation.
f. Metal Arts.
g. Metallic Arts.
h. Signs & Decal Corp.
i. Southwell Company (The).

2. Character Material: Sheet or plate aluminum.
3. Character Height: As indicated on Drawings.
4. Thickness: Manufacturer's standard for size of character but not less than 0.25 inch.
5. Finishes:

a. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.

6. Mounting: Projecting studs.
7. Typeface: As selected from manufacturer’s full range of at least twenty fonts.

2.3 DIMENSIONAL CHARACTER MATERIALS

A. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Aluminum Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
3. Sign Mounting Fasteners:

a. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly

mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.

2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
6. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

2.6 GENERAL FINISH REQUIREMENTS

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

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

2.7 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

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.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

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

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101419

SECTION 101423 - PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Panel signs.
2. Emergency Evacuation Signs
3. Building Identification Signs.
4. Field-applied, vinyl-character signs.

B. Related Requirements:

1. Electrical Drawings for illuminated, self-luminous, and photoluminescent exit sign units.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.

3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
4. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Panel Signs: Full-size Sample.
2. Field-Applied, Vinyl-Character Signs: Full-size Sample of characters on glass.
3. Full-size Samples, if approved, will be returned to Contractor for use in Project.

E. Product Schedule: For panel signs. Use same designations indicated on Drawings or specified.

1.6 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer of products.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

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

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

B. Braille: Grade 2, raised 1/32 inch above face of sign. Sign manufacturer shall provide braille translation.

2.2 PANEL SIGNS

A. Panel Signs: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Sole Source: Provide signage from a single source and a single manufacturer, except for building identification signage.
2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated int the Project include, but are not limited to, the following:

    a. Allen Markings.
    b. APCO Graphics, Inc.
    c. ASI
    d. Best Sign Systems.
    e. Inpro Corporation.
    f. Innerface Sign Systems.
    g. Mohawk Sign Systems.

3. Composite Sign: Foam PVC core with face sheet of 0.040-inch rigid vinyl sheet bonded to 0.060-inch backing.

    a. Composite-Sheet Thickness: Manufacturer's standard for size of sign but not less than ¼ inch.

4. Laminated-Sheet Sign: Sandblasted polymer face sheet with raised graphics laminated to acrylic backing sheet to produce composite sheet.

    a. Composite-Sheet Thickness: 0.25 inch.
    b. Subsurface Graphics: Reverse etch image.
    c. Color(s): As selected by Architect from manufacturer's full range.

5. Sign-Panel Perimeter: Finish edges smooth.

    a. Edge Condition: Square cut.
    b. Corner Condition in Elevation: Radiused.

6. Mounting: Surface mounted to wall with concealed anchors or screws.

7. Text and Typeface: Accessible raised characters and Braille typeface as selected by Architect from manufacturer's full range] and variable content as scheduled. Finish raised characters to contrast with background color, and finish Braille to match background color.

B. Mounting: Surface mounted to wall with countersunk flathead stainless steel fasteners.

C. Layout

1. Font: Upper Case, sans serif.
2. Graphic Symbols: 4 inches high.
3. Copy Position: Centered.
4. Braille: 1/2 inch below copy.
5. Colors: Copy and background in contrasting colors, as selected from manufacturer’s full range.

2.3 PANEL SIGN TYPES

A. Provide panel signs as indicated on the Drawings.

B. Sign: Fire Extinguisher

1. As specified in Section 104413

C. Sign: Kitchen Fire Extinguisher

1. Size: 12 by 12 inches
2. Copy: “DEPLOY FIRE EXTINGUISHER ONLY AFTER FIRE SUPPRESSION SYSTEM IS ACTIVATED”
3. Braille:
4. Location: Adjacent to Class K fire extinguisher in kitchen.

2.4 SECURITY SIGNAGE

A. Panel Sign: Exterior Doors

1. Size: 4 by 6 inches
2. Copy: Door number as shown on approved Shop Drawings.
3. Braille:
4. Location: Adjacent to stairway door.

B. Panel Sign: Fire Protection and Equipment

1. Size: 6 by 6 inches
2. Copy: Room name and number, to match approved Shop Drawings
3. Braille:
4. Location: At Electrical Room and other rooms containing controls for air conditioning, sprinkler risers and valves and other fire detection, suppression or controls.

C. Panel Sign: Electrical, Mechanical, Fire Suppression and Utility Closets

1. Size: 6 by 6 inches
2. Copy: “NO STORAGE”
3. Braille:
4. Location: Closets with doors smaller than 36 by 72 inches.
5. Additional Requirement: Tape off floor area where storage is prohibited.

D. Panel: Telecommunications

1. Size: 12 by 12 inches
2. Copy: Room Number and Name and “SENSITIVE ELECTRONIC EQUIPMENT NO STORAGE ALLOWED”
3. Braille:
4. Provide two at each telecommunication and facility security room.

2.5 WAYFINDING

A. Permanent Graphic Map: Framed panel sign with changeable message insert displaying building floor plans with exit routes marked, location of pull stations, fire extinguishers, and viewer position “You Are Here.” Design shall not require separate tool to change message insert.

1. Basis of Design: Subject to compliance with requirements, provide APCO Signs, Full View sign or comparable products from another manufacturer. Available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. APCO Graphics, Inc.
   b. ASI Sign Systems, Inc.
   c. Best Sign Systems, Inc.
   d. Innerface.
   e. Inpro Corporation.

2. Frame: Entire perimeter to hold changeable sign panel.

   a. Size: 27-3/4 by 17 inches.
   b. Material: Aluminum.
   c. Profile: Square.
   d. Corner Condition in Elevation: Radiused.
   e. Finish and Color: Brushed satin.

3. Lens: 1/8-inch non-glare acrylic.
4. Mounting: Surface mounted to wall with two-face tape.
5. Sign Insert: 60-80 lb. heavy uncoated paper

   a. Provide software for printing of sign display.

6. Location: At each key entry location.

B. Sign Type N, Evacuation Route:

1. Size: 12 by 12 inches
2. Copy: “EVACUATION ROUTE”.
3. Changeable Message: Slot to accept insert for Owner-provided map.

C. Directional Signage: As indicated on Drawings as WF-1

D. Modular Directories: As indicated on Drawings as WF-2 and WF3.

2.6 FIELD-APPLIED, VINYL-CHARACTER SIGNS

A. Field-Applied, Vinyl-Character Sign: Pre-spaced characters die cut from 3- to 3.5-mil thick, weather-resistant vinyl film with release liner on the back and carrier film on the front for on-site alignment and application.

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

a. Allen Markings.
b. APCO Graphics, Inc.
c. Inpro Corporation.
d. Mohawk Sign Systems.

2. Substrate: Glass.
3. Locations and Copy:
   a. Sidelights at Entrance Doors (Leaf 1): “NOTICE: PERSONS ENTERING CAMPUS ARE SUBJECT TO SEARCH PURSUANT TO SOUTH CAROLINA CODE 59-63-1110”
   b. Entrance Doors (Leaf 2): “WELCOME ALL VISITORS ARE REQUIRED TO REPORT TO THE SCHOOL OFFICE.”
   c. Windows: Room number in far-left corner of each bank of windows, easily readable from exterior.

2.7 BUILDING IDENTIFICATION SIGNS

A. Painted metal sign consisting of 4-inch red characters on a white reflective background, with two 1/4-inch-holes, centered, punched on each narrow side, for attachment to building.

1. Material: Aluminum sheet, 0.40-inch thick.
2. Size: 6 by 24 inches.
3. Copy: 4-digit building identification number, as assigned by FM Project Manager.
4. Font: Swiss 721 bt.
5. Anchors: #8-#10 by 1-1/4 inch.
6. Screws: #8 by 1-1/2- inch stainless steel, length as required.

2.8 PANEL-SIGN MATERIALS

A. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Aluminum Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.

D. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

E. Fiberglass Sheet: Multiple laminations of glass-fiber-reinforced polyester resin with UV-light stable, colorfast, nonfading, weather- and stain-resistant, colored polyester gel coat, and with manufacturer's standard finish.

F. Polycarbonate Sheet: ASTM C1349, Appendix X1, Type II (coated, mar-resistant, UV-stabilized polycarbonate), with coating on both sides.

G. PVC Sheet: Manufacturer's standard, UV-light stable, PVC plastic.

H. Plastic-Laminate Sheet: NEMA LD 3, general-purpose HGS grade, 0.048-inch nominal thickness.

I. Vinyl Film: UV-resistant vinyl film of nominal thickness indicated, with pressure-sensitive, permanent adhesive on back; die cut to form characters or images as indicated on Drawings and suitable for exterior applications.

J. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.9 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following unless otherwise indicated:

1. Use concealed fasteners and anchors with tamper/vandal resistant one-way heades.
2. For exterior exposure, furnish stainless-steel or hot-dip galvanized devices unless otherwise indicated.

2.10 GENERAL FINISH REQUIREMENTS

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

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Verify that anchorage devices embedded in permanent construction are correctly sized and located to accommodate signs.

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

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Refer to Life Safety Plans for location of exits.
2. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
3. Install signs so they do not protrude or obstruct according to the accessibility standard.
4. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
5. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Accessible Signage: Install in locations on walls according to the accessibility standard.

C. Building Identification Signs: Predrill into building with ¼-inch drill bit. Mount signs on right hand side of each façade of building, 24 inches from corner. Mount signs no higher than the first floor level or 18 inches below roof line on single story structures.

D. Fire Department Connection Signs: Mount FDC sign on building above connection between 8 and 12 feet above grade, clearly visible from approach side of building.

1. If necessary, provide additional signage on face of building or on primary approach with directional arrows to direct emergency vehicles to connection.

E. Mounting Methods:

1. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.

F. Field-Applied, Vinyl-Character Signs: Clean and dry substrate. Align sign characters in final position before removing release liner. Remove release liner in stages, and apply and firmly press characters into final position. Press from the middle outward to obtain good bond without blisters or fishmouths. Remove carrier film without disturbing applied vinyl film.

G. Signs Mounted on Glass, other than vinyl characters: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423

SECTION 101463- ELECTRONIC MARQUEE SIGNS

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. Electronic Marquee Signs.

1.3 COORDINATION

A. Furnish templates and tolerance information for placement of sign-anchorage devices embedded in permanent construction by other installers.

B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For signage.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.
4. Show locations of electrical service connections.
5. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer of products.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices and electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

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

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads indicated on the Drawings and within limits and under conditions indicated.
1. Uniform and concentrated loads need not be assumed to act concurrently.

B. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

C. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 DIGITAL SIGNS

A. Sign: Sign of hollow-box configuration; with smooth, uniform surfaces and support assembly; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles housing electronic message center.

B. Electronic Message Center: Type: Exterior, electronic, full color, LED, single-sided message center with web-based control center set into aluminum faced box.

C. Product: Owner-furnished, Contractor Installed.

2.3 MATERIALS

A. Refer to Section 04200 “Unit Masonry” for masonry materials and installation.Refer to Section 055000 “Metal Fabrications” for steel framing.

B. Aluminum Sheet: Flat sheet complying with ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties of not less than Alloy 5005-H32.

C. Backing Materials: Provided or recommended by decorative formed metal manufacturer.

D. Laminating Adhesive: Adhesive recommended by metal fabricator that will fully bond metal to metal, will prevent telegraphing and oil-canning, and is compatible with substrate and noncombustible after curing.

E. Isolation Coating: Manufacturer's standard bituminous paint.

2.4 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in locations concealed from view after final assembly.
2. Mill joints to tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed joints of flux, and dress exposed and contact surfaces.
4. Conceal fasteners and anchors unless indicated to be exposed; locate exposed fasteners where they will be inconspicuous.
5. Internally brace signs for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.

2.5 GENERAL FINISH REQUIREMENTS

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

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

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.6 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Verify that sign-support surfaces are within tolerances to accommodate signs.

C. Verify that anchorage devices embedded in permanent construction are correctly sized and located to accommodate signs.

D. Verify that electrical service is correctly sized and located to accommodate signs.

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

3.2 INSTALLATION

A. General: Install signs using installation methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.

3. Before installation, verify that sign components are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101463

SECTION 102113.17 - PHENOLIC-CORE TOILET COMPARTMENTS

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. Phenolic-core toilet compartments configured as toilet enclosures and urinal screens.

B. Related Requirements:

1. Section 102800 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings: For toilet compartments.

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of centerlines of toilet fixtures.
4. Show locations of floor drains.

C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each type of material, color, and finish required for toilet compartments, prepared on 6-inch-square Samples of same thickness and material indicated for Work.
2. Each type of hardware and accessory.

D. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of toilet compartment.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments 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. Door Hinges: Two hinge(s) with associated fasteners.
2. Latch and Keeper: Two latch(es) and keeper(s) with associated fasteners.
3. Door Bumper: Two door bumper(s) with associated fasteners.
4. Door Pull: Two door pull(s) with associated fasteners.
5. Fasteners: Ten fasteners of each size and type.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 75 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

2.2 PHENOLIC-CORE TOILET COMPARMENTS

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

1. Accurate Partitions Corp., an ASI Group Company.

2. American Sanitary Partition Corporation.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. Global Partitions Corp., an ASI Group Company.
6. Partition Systems International of South Carolina.

B. Toilet-Enclosure Style: Overhead braced.

C. Urinal-Screen Style: Wall hung.

D. Door, Panel, Screen, and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges. Provide minimum 3/4-inch-thick doors and pilasters and minimum 1/2-inch-thick panels.

E. Pilaster ShoesandSleeves (Caps): Formed from stainless steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.

F. Brackets (Fittings):
1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

G. Phenolic-Panel Finish:
1. Color and Pattern: As indicated by manufacturer's designations, with manufacturer's standard through-color core matching face sheet.
2. Edge Color: Through-color matching facing sheet color.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.

1. Hinges: Manufacturer's minimum 0.062-inch-thick stainless steel paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door. Mount with through-bolts.
2. Latch and Keeper: Manufacturer's heavy-duty surface-mounted cast-stainless steel latch unit designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through-bolts.
3. Coat Hook: Manufacturer's heavy-duty combination cast-stainless steel hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories. Mount with through-bolts.
4. Door Bumper: Manufacturer's heavy-duty rubber-tipped cast-stainless steel bumper at out-swinging doors. Mount with through-bolts.
5. Door Pull: Manufacturer's heavy-duty cast-stainless steel pull at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through-bolts.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

A. Aluminum Castings: ASTM B26/B26M.

B. Aluminum Extrusions: ASTM B221.

C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

D. Stainless Steel Castings: ASTM A743/A743M.

2.5 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Door Size and Swings: Unless otherwise indicated, provide 24-inch-wide in-swinging doors for standard toilet compartments and 36-inch-wide out-swinging doors with a minimum 32-inch-wide clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.

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

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels: 1/2 inch.
b. Panels and Walls: 1 inch.

2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.

a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113.17

SECTION 102123 - CUBICLE CURTAINS AND TRACK

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. Cubicle-curtain tracks and carriers.
2. Cubicle curtains.

B. Related Requirements:
1. Section 092216 "Non-Structural Metal Framing" for supplementary metal framing and blocking for mounting items requiring anchorage.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For each type of curtain fabric indicated, include durability, laundry temperature limits, fade resistance, applied curtain treatments, and fire-test-response characteristics.

B. Shop Drawings: For curtains and tracks.

1. Show layout and types of cubicles, sizes of curtains, number of carriers, anchorage details, and conditions requiring accessories. Indicate dimensions taken from field measurements.
2. Include details of blocking for track support.

C. Samples for Verification: For each type of product required, prepared on Samples of size indicated below:

1. Curtain Fabric: Not less than 10 inches square and showing complete pattern repeat, from dye lot used for the Work, with specified treatments applied. Mark top and face of material.
2. Mesh Top: Not less than 10 inches square.
3. Curtain Track: Not less than 10 inches long.
4. Curtain Carrier: Full-size unit.

D. Product Schedule: For curtains and tracks. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For curtains, tracks, and hardware to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

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. Curtain Carriers and Track End Caps: Full-size units equal to 3 percent of amount installed for each size indicated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Cubicle Curtains: Provide curtain fabrics with the following characteristics:

1. Laundering: Launderable to a water temperature of not less than 160 deg F.
2. Flame Resistance: Provide fabrics identical to those that have passed NFPA 701 when tested by a qualified testing agency acceptable to authorities having jurisdiction.

a. Identify fabrics with appropriate markings of a qualified testing agency.

2.2 CUBICLE-CURTAIN SUPPORT SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. A.R. Nelson Co.
2. Automatic Devices Company.
3. C/S Group.
4. Cubicle Curtain Factory.
5. Inpro Corporation.

B. Extruded-Aluminum Curtain Track: Not less than 5/8 inch wide by 1/2 inch high.

1. Track Minimum Wall Thickness: 0.058 inch.
2. Finish: Baked enamel, acrylic, or epoxy.

C. Curtain Track Accessories: Fabricate splices, end caps, connectors, end stops, coupling and joining sleeves, wall flanges, brackets, ceiling clips, and other accessories from same material and with same finish as track.

D. Curtain Roller Carriers: Two nylon rollers and nylon axle with chrome-plated steel hook.

E. Curtain Glide Carriers: One-piece nylon glide with chrome-plated steel hook.

F. Exposed Fasteners: Stainless steel.

G. Concealed Fasteners: Stainless steel.

2.3 CURTAINS

A. Fabric: Curtain manufacturer's standard, 100 percent polyester; inherently and permanently flame resistant, stain resistant, and antimicrobial.

B. Curtain Grommets: Two-piece, rolled-edge, rustproof, nickel-plated brass; spaced not more than 6 inches o.c.; machined into top hem.

C. Mesh Top: Not less than 22-inch-high mesh top.

1. Mesh: No. 50 nylon mesh.

D. Snap Attachments: Provide manufacturer's standard nickel-plated brass snap attachments for modular panels.

E. Curtain Tieback: Nickel-plated brass chain; one at each curtain termination.

2.4 CURTAIN FABRICATION

A. Continuous Curtain Panels:

1. Width: Equal to track length from which curtain is hung plus 10 percent of added fullness, but not less than 12 inches of added fullness.
2. Length: Equal to floor-to-ceiling height, minus depth of track and carrier at top, and minus clearance above the finished floor of 12 inches.
3. Top Hem: Not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web, and double lockstitched.
4. Mesh Top: Top hem of mesh not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web, and double lockstitched. Double lockstitch bottom of mesh directly to 1/2-inch triple thickness, top hem of curtain fabric.
5. Bottom Hem: Not less than 1 inch and not more than 1-1/2 inches wide, double thickness and double lockstitched.
6. Side Hems: Not less than 1/2 inch and not more than 1-1/4 inches wide, with double turned edges, and single lockstitched.
7. Vertical Seams: Not less than 1/2 inch wide, double turned and double stitched.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 INSTALLATION

A. Install tracks level and plumb, according to manufacturer's written instructions.

B. For tracks of up to 20 feet in length, provide track fabricated from single, continuous length.

1. Curtain-Track Mounting: Surface.

C. Surface-Track Mounting: Fasten tracks to ceilings at intervals recommended by manufacturer. Fasten tracks to structure at each splice and tangent point of each corner. Center fasteners in track to ensure unencumbered carrier operation. Attach track to ceiling as follows:
1. Attach track to suspended ceiling grid with manufacturer's proprietary clip.

D. Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories as required for a secure and operational installation.

E. Curtain Carriers: Provide curtain carriers adequate for 6-inch spacing along full length of curtain plus an additional carrier.

F. Cubicle Curtains: Hang curtains on each curtain track. Secure with curtain tieback.

END OF SECTION 102123

SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Corner guards.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
2. Include fire ratings of units recessed in fire-rated walls and listings for door-protection items attached to fire-rated doors.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.

1. Include plans, elevations, sections, and attachment details.

C. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:

1. Corner Guards: 12 inches long. Include example top caps.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of handrail.

B. Material Certificates: For each type of exposed plastic material.

C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
2. Keep plastic materials out of direct sunlight.
3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.

a. Store corner-guard covers in a vertical position.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.

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

a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

2.2 CORNER GUARDS

A. Surface-Mounted, Plastic-Cover Corner Guards: Manufacturer's standard assembly consisting of snap-on, resilient plastic cover installed over retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.

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

    a. Construction Specialties, Inc.
    b. Inpro Corporation.
    c. Korogquard Wall Protection.
    d. Nystrom
    e. Pawling Corporation.

2. Cover: Extruded rigid plastic, minimum 0.078-inch wall thickness; as follows:

    a. Profile: Nominal 2-inch-long leg and 1/4-inch corner radius.
    b. Height: 8 feet.
    c. Color and Texture: As indicated by manufacturer's designations.

3. Continuous Retainer: Minimum 0.060-inch-thick, one-piece, extruded aluminum.
4. Retainer Clips: Manufacturer's standard impact-absorbing clips.
5. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.3 MATERIALS

A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.

2.4 FABRICATION

A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.5 FINISHES

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

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

C. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

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

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing wall and door protection.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.

C. Provide anchoring devices and suitable locations to withstand imposed loads.

D. Adjust top caps as required to ensure tight seams.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Warm-air dryers.
3. Childcare accessories.
4. Custodial accessories.

B. Related Requirements:

1. Section 088300 "Mirrors" for frameless mirrors.

1.3 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.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Include electrical characteristics.

B. Samples: Full size, for each exposed product and for each finish specified.

1. Approved full-size Samples will be returned and may be used in the Work.

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

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCESSORIES

A. Source Limitations: Obtain accessories from single source from single manufacturer.

B. Provide accessories as scheduled or comparable products by one of the following:

1. ASI.
2. Bobrick.
3. Bradley.

C. Owner-Furnished Materials: As indicated on Toilet Accessory Schedule.

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 WARM-AIR DRYERS

A. Source Limitations: Obtain warm-air dryers from single source from single manufacturer. Provide products scheduled or comparable products by one of the following:
   1. Excel; Thin Air.
   2. Saniflow; Speedflow Plus.
   3. Pinnacle Hand Dryers.

B. High-Speed Warm-Air Dryer **WAD**:
   1. Description: High-speed, warm-air hand dryer for rapid hand drying.
   2. Mounting: Surface mounted , with low-profile design.
   3. Operation: Electronic-sensor activated with operation time of 10 to 20 seconds.
   4. Cover Material and Finish: Steel, with white enamel finish.
   5. Electrical Requirements: 115 V, 13 A, 1500 W.

2.4 MATERIALS

A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

B. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 hot-dip zinc coating.

C. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.

D. 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.

E. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).

F. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.5 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 PREPARATION

A. Confirm location of accessories and provide sufficient blocking to anchor accessories securely in place. Where indicated, also provide blocking for future installation of accessories.

3.2 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, when tested according to ASTM F446.

3.3 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 instructions.

END OF SECTION 102800

SECTION 104300 – EMERGENCY AID SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Cabinets for the Owner-provided bleeding control kits.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing semirecessed -mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For cabinets.

1. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Verification: For each type of exposed finish required, prepared on samples 6 by 6 inches square.

A. Product Schedule: For cabinets. Indicate whether recessed, semirecessed, or surface mounted.

1.4 COORDINATION

A. Coordinate size of cabinets to ensure that type and capacity of Owner-provided bleeding control kits are accommodated.

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

PART 2 - PRODUCTS

2.1 BLEEDING CONTROL CABINET

A. Basis of Design: Provide Rescue Essentials Bleeding Control Metal Indoor Cabinet or comparable product to accommodate Owner-furnished bleeding control kit. Available manufacturers include the following:

1. North American Rescue.
2. Rescue Essentials.
3. S.T.A.T. Medical Devices.
4. Modern Metal Products

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Cold-rolled steel sheet.

D. Recessed Cabinet:

1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

E. Cabinet Trim Material: Steel sheet.

F. Door Material: Steel sheet.

G. Door Style: Fully glazed panel with frame.

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

1. Provide projecting door pull and friction latch.
2. Provide continuous hinge, of same material and finish as trim,, permitting door to open 180 degrees.
3. Identification: Red vinyl ““BLEEDING CONTROL KIT”

2.2 MATERIALS

A. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.

1. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
2. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
3. Color: White .

2.3 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

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

C. Finish cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. 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 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 cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

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

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

C. Identification:

1. Apply vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

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

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

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

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

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

END OF SECTION 10430

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 extinguisher.

B. Related Requirements:

1. Section 104416 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets.

1. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required, prepared on samples 6 by 6 inches square.

D. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

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

1.5 COORDINATION

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

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Aluminum sheet.

1. Shelf: Same metal and finish as cabinet.

D. Recessed Cabinet:
1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

E. Semirecessed Cabinet: 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 backbend depth.

F. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.

G. Cabinet Trim Material: Same material and finish as door.

H. Door Material: Aluminum sheet.

I. Door Style: Vertical duo panel with frame.

J. Door Glazing: Tempered float glass (clear).

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

1. Provide projecting lever handle with cam-action latch.
2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

L. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.

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: Red.
4) Orientation: Vertical.

b. Number each fire extinguisher cabinet and bracket in consecutive order. Provide engraved three-layer laminated plastic nameplate, black letters on white background, on each device.

1) Program manager shall approve numbering system.

M. Materials:

1. Aluminum: ASTM B221 for extruded shapes and aluminum sheet, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet.

a. Finish: Mill Finish.

2. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.4 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. Miter corners and grind smooth.
3. Provide factory-drilled mounting holes.

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

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

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

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "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 unacceptable. 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 walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets will be installed.

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

3.2 PREPARATION

A. Prepare recesses for recessed and 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 or, if not indicated, at height indicated below:

1. Fire-Protection Cabinets: 42 inches above finished floor to top of fire extinguisher.

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

1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
2. Provide surface mounted cabinets where indicated.
3. 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.

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 Requirements:

1. Section 104413 "Fire Protection Cabinets."

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to fire extinguishers including, but not limited to, the following:

a. Schedules and coordination requirements.

1.4 ACTION SUBMITTALS

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

B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

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

1.7 COORDINATION

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

1.8 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 when testing interval required by NFPA 10 is within the warranty period.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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 FM Global.

2.2 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 one of the following:

a. Amerex Corporation.
b. Babcock-Davis.

c. Guardian Fire Equipment.
d. Larsens Manufacturing Company.
e. Potter Roemer, LLC.

2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
3. Valves: Nickel-plated, polished-brass body.
4. Handles and Levers: Manufacturer's standard.
5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Wet-Chemical Type: UL-rated 2-A:1-B:C:K, 2.5-gal. nominal capacity, with potassium carbonate-based chemical in stainless-steel container; with pressure-indicating gage.

C. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 MOUNTING BRACKETS

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

1. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.

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: Top of fire extinguisher to be at 42 inches above finished floor.

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

END OF SECTION 104416

SECTION 105113 - METAL LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Knocked-down staff lockers.

B. Related Requirements:

1. Section 105113.13 "Coin-Operated Metal Lockers" for coin-operated lockers used in public facilities for temporary storage of personal belongings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.

B. Shop Drawings: For metal lockers.

1. Include plans, elevations, sections, and attachment details.
2. Show locker trim and accessories.
3. Include locker identification system and numbering sequence.

C. Samples for Verification: For the following products, in manufacturer's standard size:

1. Lockers and equipment.

D. Product Schedule: For lockers. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate sizes and locations of concrete masonry bases for metal lockers.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

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

a. Structural failures.
b. Faulty operation of latches and other door hardware.

2. Damage from deliberate destruction and vandalism is excluded.
3. Warranty Period for Knocked-Down Metal Lockers: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain metal lockers and accessories from single source from single locker manufacturer.

1. Obtain locks from single lock manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: For lockers indicated to be accessible, comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.3 KNOCKED-DOWN STAFF WARDROBE METAL LOCKERS

A. Material: Cold-rolled steel sheet.

B. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet as follows:

1. Tops and Bottoms: 0.024-inchnominal thickness, with single bend at sides.
2. Backs and Sides: 0.024-inchnominal thickness, with full-height, double-flanged connections.
3. Shelves: 0.024-inchnominal thickness, with double bend at front and single bend at sides and back.

C. Frames: Channel formed; fabricated from 0.060-inchnominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.

D. Doors: Fabricated from 0.060-inch nominal-thickness steel sheet, with 0.024 inner pan, or 0.075-inch nominal thickness steel sheet with manufacturer's standard reinforcing angles, channels, or stiffeners, formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.

1. Door Style: Vented panel as follows:

a. Louvered Vents: No fewer than six louver openings at top and bottom for single-tier three louver openings at top and bottom for double-tier lockers.

E. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.

1. Continuous Hinges: Manufacturer's standard, steel, full height.

F. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry and vandal resistant.

1. Single-Point Latching: Nonmoving latch hook with steel padlock loop that projects through recessed cup and is finished to match metal locker body.

a. Latch Hook: Equip each door with one latch hook, fabricated from 0.105-inchnominal-thickness steel sheet; welded midway up full-height door strike; with resilient silencer.

G. Door Handle and Latch for Box Lockers: Stainless-steel strike plate with integral pull; with steel padlock loop that projects through metal locker door.

1. Padlock: Owner-furnished.

H. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inchhigh.

I. Equipment: Equip each metal locker with identification plate and the following unless otherwise indicated:

1. Double-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.

J. Accessories:

1. Continuous Sloping Tops: Fabricated from manufacturer's standard thickness, but not less than 0.036-inch nominal-thickness steel sheet.

a. Closures: Vertical-end type.

2. Recess Trim: Fabricated from 0.048-inch nominal-thickness steel sheet.
3. Filler Panels: Fabricated from manufacturer's standard thickness, but not less than 0.036-inch nominal-thickness steel sheet.
4. Boxed End Panels: Fabricated from 0.060-inch nominal-thickness steel sheet.

K. Finish: Manufacturer's standard baked enamel or epoxy powder coat.

1. Color(s): As selected by Architect from manufacturer's full range, using one color.

2.4 LOCKS

A. Combination Padlock: Provided by Owner.

2.5 FABRICATION

A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.

C. Equipment: Provide each locker with an identification plate and the following equipment:

1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.

2. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.

D. Knocked-Down Construction: Fabricate metal lockers using manufacturer's nuts, bolts, screws, or rivets.

E. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches above the floor.
2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.

F. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.

1. Sloping-top corner fillers, mitered.

G. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

H. Boxed End Panels: Fabricated with 1-inch-wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

2.6 ACCESSORIES

A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

B. Anchors: Material, type, and size required for secure anchorage to each substrate.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls, and elsewhere as indicated, for corrosion resistance.
2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 INSTALLATION

A. Install lockers level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
2. Anchor back-to-back metal lockers to floor.

B. Knocked-Down Lockers: Assemble with manufacturer's standard fasteners, with no exposed fasteners on door faces or face frames.

C. Equipment:

1. Attach hooks with at least two fasteners.
2. Attach door locks on doors using security-type fasteners.
3. Identification Plates: Identify metal lockers with identification indicated on Drawings.

a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
b. Attach plates to upper shelf of each open-front metal locker, centered, with a least two aluminum rivets.

D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
1. Attach filler panels with concealed fasteners. Locate filler panels where indicated on approved Shop Drawings.
2. Attach sloping-top units to metal lockers, with closures at exposed ends.
3. Attach boxed end panels using concealed fasteners to conceal exposed ends of nonrecessed metal lockers.

3.3 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

3.4 PROTECTION

A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105113

SECTION 105129 - PHENOLIC LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid phenolic cubbies.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for concealed wood support furring and blocking behind lockers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of locker.

B. Shop Drawings: For phenolic lockers.

1. Include plans, elevations, sections, and attachment details.
2. Show locations and sizes of cutouts and holes for items installed in lockers.

C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Phenolic panels, not less than 3 by 3 inches, for each type, color, pattern, and surface finish.
2. Exposed locker hardware and accessories, one unit for each type and finish.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranties.

1.4 MOCKUPS

A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of typical range of cubbies, comprising at a minium four cubbies in width and three cubbies high, as indicated on Drawings.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store lockers in manufacturer's original unopened packaging until ready for installation.

B. Do not deliver lockers until painting and similar operations that could damage lockers have been completed in installation areas. If lockers must be stored in other-than-installation areas, store only in areas where environmental conditions are the same as those in final installation location, and comply with requirements specified in "Field Conditions" Article.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install lockers until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between percent during remainder of the construction period.

B. Field Measurements: Where lockers are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.7 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that lockers can be supported and installed as indicated.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to replace phenolic locker components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain phenolic lockers from single source from single manufacturer.

1. Obtain locks from single lock manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: For lockers indicated to be accessible, comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

2.3 PHENOLIC LOCKERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide ASI Storage Solutions; an ASI Group company; Phenolic Cubbies or comparable product by one of the following:

1. Bobrick Washroom Equipment, Inc.
2. Bradley Corporation.

B. Construction Style: Manufacturer's standard means of factory assembly with machined joints, pins, and tamper-resistant mechanical fasteners.

C. Configuration: As indicated on Drawings.

D. Body: Fabricated from solid phenolic panels.

1. Side Panels: 1/2 inch thick.
2. Back Panel: 1/2 inch thick.
3. Top Panel: 1/2 inch thick.
4. Bottom Panel: 1/2 inch thick.

E. Doors: Fabricated from solid phenolic panels, 1/2-inch thick.

1. Continuous Hinge.

2. Self Latching.
3. Recessed handle.

F. Continuous Flat Top Panels: 1/2-inch-thick, solid phenolic panel.

G. Base: 1-inch-thick by 4-inch-high, solid HDPE plastic; black color.

H. Color: As selected by Architect from manufacturer's full range.

1. Edge (Core) Color: Color-Thru matching panel faces.

2.4 MATERIALS

A. Phenolic Panels: Solid phenolic with same color throughout material. Laminated surfaces are unacceptable.

2.5 ACCESSORIES

A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

B. Anchors: Material, type, and size required for secure anchorage to each substrate.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls, and elsewhere as indicated, for corrosion resistance.
2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

C. Wood Support Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content, treated with manufacturer's standard preservative-treatment process, as specified in Section 061000 "Rough Carpentry."

D. Number plates.

2.6 FABRICATION

A. Fabricate and supply factory preassembled lockers, complete with hardware and accessories.

B. Fabricate lockers square, rigid, without warp, and with finished faces flat and free of scratches, and chips. Factory machine components to suit attachments. Make joints tight and true.

1. Fabricate lockers using manufacturer's standard mortise and tenon construction.
2. Provide end panels as required to complete installation as indicated on Drawings.

C. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf minimum 15 inches above finished floor.

D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Trial fit assemblies at fabrication shop unable to be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices removable after trial fitting. Verify that parts fit as intended, and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
2. Use only locker manufacturer's brackets, nuts, bolts, screws, and other anchoring devices for assembly.

E. Shop cut openings, to maximum extent possible, to receive hardware, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify that furring is attached to concrete and masonry walls receiving lockers.

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

3.2 PREPARATION

A. Condition lockers to average prevailing humidity conditions in installation areas before installation.

B. Before installing lockers, examine factory-fabricated work for completeness and complete work as required, including removal of packing.

C. Thoroughly clean surfaces prior to installation.

3.3 INSTALLATION

A. Install lockers in accordance with manufacturer's written instructions.

B. Install lockers level, plumb, and true; use concealed shims.

C. Connect groups of lockers together with manufacturer's standard stainless steel, theft-proof fasteners, through predrilled holes in locker interior. Fit lockers accurately together to form flush, tight, hairline joints.

D. Locker Anchorage: Fasten lockers through back, near top and bottom, at ends with anchoring devices furnished, and spaced not more than 16 inches o.c.

E. Scribe and cut corner and filler panels to fit adjoining work using fasteners concealed where practical. Repair damaged finish at cuts.

F. Attach flat-top units to lockers, with end panels covering exposed ends.

3.4 PROTECTION

A. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. Clean exposed surfaces of lockers.

C. Touch up marred finishes to factory-finished appearance, or replace unrestorable lockers. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105129

SECTION 105613 - METAL STORAGE SHELVING

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. Four-post metal storage shelving.

1.3 COORDINATION

A. Coordinate sizes and locations of blocking and backing required for installation of metal storage shelving attached to wall and ceiling assemblies.

B. Coordinate locations and installation of metal storage shelving that may interfere with ceiling systems including lighting, HVAC, speakers, sprinklers, access panels, electrical switches or outlets, and floor drains.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, construction details, material descriptions, dimensions of individual components and profiles, and finishes for metal storage shelving.

B. Shop Drawings: For metal storage shelving.

1. Include plans, elevations, sections, and attachment details.
2. Include installation details of connectors, lateral bracing, and special bracing.

C. Samples: For each type of metal storage shelving and for each color specified, in the following sizes:

1. Vertical Supports: 12 inches tall.
2. Shelves: Full size, but not more than 24 inches wide by 12 inches deep.
3. Connectors: Full size.
4. Shelf-Label Holders: Full size.

D. Product Schedule: For metal storage shelving. Use same designations indicated on Drawings.

E. Delegated-Design Submittal: For seismic restraint of metal storage shelving.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Certificates: For metal storage shelving, accessories, and components, from manufacturer.

C. Product Certificates: For each type of metal storage shelving.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal storage shelving to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Shelf-Label Holders: Full-size units equal to 5 percent of amount installed for each type indicated, but no fewer than 10 holders.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install metal storage shelving until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for building occupants during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design metal storage shelving, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Seismic Performance: Metal storage shelving shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Seismic Component Importance Factor: 1.0.

2.2 FOUR-POST METAL STORAGE SHELVING

A. Open Four-Post Metal Storage Shelving: Complying with MH 28.1 and field assembled from factory-formed components. Shelves span between supporting corner posts that allow shelf-height adjustment over full height of shelving unit. Provide fixed top and bottom shelves, adjustable intermediate shelves, and accessories indicated.

1. Basis of Design: Subject to compliance with requirements, provide Clipper Open Storage Units by Penco Products, Inc. of comparable product by one of the following:

    a. Excalibur Shelving Systems, Inc.
    b. Lyon Workspace Products, LLC.
    c. Penco Products, Inc.
    d. Spacesaver Corporation.
    e. Tennsco.

2. Load-Carrying Capacity per Shelf: 350 lb.
3. Posts: Fabricated from hot-rolled steel; in box shape; with perforations at 1-1/2 inches o.c. to receive shelf-to-post connectors.

    a. Unit Configuration: Configure shelving units as individual, freestanding assemblies.
    b. Post Base: Bolt leveler.

4. Bracing: Manufacturer's standard, single or double diagonal cross bracing.

    a. Location: At unit back and ends as required for stability, load-carrying capacity of shelves, and number of shelves indicated.

5. Back Panel: One piece fabricated from cold-rolled steel sheet.
6. End Panels: Fabricated from cold-rolled steel sheet.
7. Solid-Type Shelves:

    a. Steel Sheet: Nominal thickness not less than 0.036 inch.
    b. Fabricate fronts and backs of shelves with box-formed edges, with corners lapped and welded.

8. Shelf-to-Post Connectors: Manufacturer's standard connectors.
9. Base: Open, with exposed post legs.
10. Steel Finish: Baked enamel or powder coat.

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

2.3 ANCHORS

A. Floor Anchors: Galvanized-steel, power-actuated fasteners or threaded concrete screws. Provide number per unit recommended by manufacturer unless additional anchors are indicated in calculations.

B. Wall Anchors: Manufacturer's standard, galvanized-steel anchors designed to secure metal storage shelving to adjacent wall. Provide two per shelving unit for each shelving unit adjacent to a wall unless additional anchors are indicated in calculations.

2.4 FABRICATION

A. Fabricate metal storage shelving components to provide field-assembled units that are square and rigid, with posts plumb and true and shelves flat and free of dents or distortion. Fabricate connections to form a rigid structure, free of buckling and warping.

1. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.
2. Build in straps, plates, brackets, and other reinforcements as needed to support shelf loading.
3. Cut, reinforce, drill, and tap metal fabrications to receive hardware, fasteners, and similar items.

B. Form metal in maximum lengths to minimize joints. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work. Form backs of shelving units of up to 48 inches wide from one piece.

C. Form edges and corners free of sharp edges or rough areas. Fold back and crimp exposed edges of unsupported sheet metal to form a hem on the concealed side; ease edges of metal plate to radius of approximately 1/32 inch. Shear and punch metals cleanly and accurately. Remove burrs.

D. Weld corners and seams continuously to develop strength, minimize distortion, and maintain the corrosion resistance of base metals. At exposed locations, finish welds and surfaces smooth and blended so surface is smooth after finishing and contour of welded surface matches that of adjacent surface. Weld before finishing components to greatest extent possible. Remove weld spatter and welding oxides from exposed surfaces before finishing.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Examine floors for suitable conditions where metal storage shelving will be installed.

C. Examine walls to which metal storage shelving will be attached for properly located blocking, grounds, or other solid backing for attachment of support fasteners.

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

3.2 PREPARATION

A. Vacuum and clean finished floor over which metal storage shelving is to be installed.

3.3 INSTALLATION

A. Install metal storage shelving level, plumb, square, rigid, true, and with shelves flat and free of dents or distortion. Make connections to form a rigid structure, free of buckling and warping.

1. Install exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
2. Install braces, straps, plates, brackets, and other reinforcements as needed to support shelf loading and as required for stability.
3. Adjust post-base bolt leveler to achieve level and plumb installation.
4. Anchor shelving units to floor with floor anchors through floor plate. Shim floor plate to achieve level and plumb installation.
5. Install seismic restraints.
6. Connect side-to-side and back-to-back shelving units together.
7. Install shelves in each shelving unit at equal spacing.
    a. Four-Post Metal Storage Shelving: Install four clips, one at each post, for support of each shelf; with clips fully engaged in post perforations.

B. Accessories:

1. Install finished end panels and trim at exposed ends of shelving units.
2. Shelf-Label Holders: Install one on each shelf.

    a. Install vertically aligned within each shelving unit.

3.4 ERECTION TOLERANCES

A. Erect four-post metal storage shelving to a maximum tolerance from vertical of 1/2 inch in up to 10 feet of height, not exceeding 1 inch for heights taller than 10 feet.

3.5 ADJUSTING

A. Adjust metal storage shelving so that connectors and other components engage accurately and securely.

B. Touch up marred finishes or replace metal storage shelving that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal storage shelving manufacturer.

C. Replace metal storage shelving components that have been damaged beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 105613

SECTION 107326 –WALKWAY COVERINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Aluminum Walkway Coverings.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for foundations for post-supported walkway coverings.
2. Section 042000 “Unit Masonry” for brick piers supporting walkway coverings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include styles, material descriptions, construction details, fabrication details, dimensions of individual components and profiles, hardware, fittings, mounting accessories, features, and finishes for walkway coverings.

B. Shop Drawings:

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include plans, elevations, sections, mounting heights, and attachment details.
3. Include diagrams for power wiring.
4. Show locations for blocking, reinforcement, and supplementary structural support.

C. Samples: For each exposed product and for each color and texture specified.

D. Delegated-Design Submittal: For canopies, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Welding certificates.

F. Sample Warranty: For special warranty.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Installer.
2. For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the state in which Project is located.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.6 FIELD CONDITIONS

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

1. Locate power for light fixtures by field measurements and indicate on Shop Drawings.

1.7 WARRANTY

A. Special Warranty: Manufacturer and fabricator agree to repair or replace components of walkway coverings that fail in materials or workmanship within specified warranty period.

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

a. Structural failures including framework.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
c. Faulty operation of operator.

B. Special Assembly Warranty: Manufacturer agrees to repair or replace components of canopy that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

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

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.

c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Five years from date of Substantial Completion.

C. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Structural Loads: Design walkway coverings in accordance with *The Aluminum Design Manual*, current edition, and ASCE-7.

1. Wind Loads: As indicated on Drawings.

C. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection of structural roofing made of formed metal sheets: L/60.
2. Deflection of secondary roof structural members supporting formed metal roofing: L/150.

2.2 WALKWAY COVERINGS

A. Manufacturers: Provide walkway coverings from one of the following:

1. East Texas Canopy, Inc., Whitehouse, TX.
2. E. L. Burns, Company.
3. Dittmar Architectural Aluminum, Inc., Winter Springs, FL.
4. InPro Fabrication, Fort Worth, TX.
5. Mapes Architectural Canopies, Lincoln, NE.

6. Peachtree Protective Covers, Lithia Springs, GA.
7. Perfection Architectural Systems, Orlando, FL.
8. TVM Tennessee Valley Metals, Inc., Timmonsville, SC.

B. Posts and Beams: Extruded aluminum, thickness as required for comply with structural performance.

C. Deck: Interlocking corrugated extruded aluminum sections:

1. Thickness As required by structural design, but not less than 0.078 inch.
2. Size: As required by structural design .
3. Soffit: Flat.

D. Fascia: Extruded aluminum fascia and gutter.

1. Thickness: Not less than 0.078 inch.
2. Style: As indicated on Drawings.
3. Depth: As indicated on Drawings.

2.3 MATERIALS

A. Sheet and Plate: ASTM B209.

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

C. Extruded Structural Pipe and Tubes: ASTM B429/B429M.

D. Structural Profiles: ASTM B308/B308M.

E. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

F. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.4 FABRICATION

A. Shop Assembly: Fabricate cross beams and columns into one-piece rigid bents with corners mitered and heli-arc welded to the extent that completed bents can be shipped on local, state, and federal highways without special permit. Provide bolted connections for bents required to be shipped unassembled.

2.5 ALUMINUM FINISHES

A. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Color and Gloss: As indicated by manufacturer's designations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for supporting members, blocking, inserts, installation tolerances, accurate locations of connections to building electrical system, lighting, and other conditions affecting performance of the Work.

1. Examine footings with Installer present in which bents will be set. Verify footing locations and elevations comply with shop drawings.
2. Examine building surfaces to which canopy will connect.

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

3.2 ERECTION

A. Erect walkway coverings in strict accordance with manufacturer's written installation instructions and approved Shop Drawings.

B. Weld frame connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

1. Field Welding: Comply with the following requirements:

a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
b. Obtain fusion without undercut or overlap.
c. Remove welding flux immediately.
d. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

C. Set bents plumb, straight, and true to line, adequately braced to maintain position until grout has cured.

D. Keep aluminum surfaces from direct contact with ferrous metal or other incompatible materials by applying one coat of clear acrylic coating.

E. Anchoring to In-Place Construction: Use anchors, fasteners, fittings, hardware, and installation accessories where necessary for securing canopies to structural support and for properly transferring load to in-place construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come in contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

G. Coordinate walkway covering installation with flashing and joint-sealant installation so these materials are installed in sequence and in a manner that prevents exterior moisture from infiltrating completed exterior wall and roof assemblies.

3.3 CLEANING AND PROTECTION

A. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION 107326

SECTION 113013 - RESIDENTIAL APPLIANCES

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 installation of Owner-furnished residential appliances as shown on the Drawings.:

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: Owner will provide product data for each type of product.

1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Product Schedule: For appliances. Use same designations indicated on Drawings.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintains, within 50 milesof Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

1.6 WARRANTY

A. Convey manufacturers’ special warranties to Owner.

PART 2 - PRODUCTS

2.1 RESIDENTIAL APPLIANCES

PART 3 - Owner will furnish residential appliances for installation by Contractor.EXECUTION

3.1 EXAMINATION

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

B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.

C. Examine walls, ceilings, and roofs for suitable conditions where overhead exhaust hoods and microwave ovens with vented exhaust fans will be installed.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 INSTALLATION

A. Install appliances according to manufacturer's written instructions.

B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

D. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After installation, start units to confirm proper operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

B. An appliance will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 DEMONSTRATION

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

END OF SECTION 113013

SECTION 114000 - FOODSERVICE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All work included under this Section is subject to Architect's provisions covering: Invitation to Bid, Proposal Form, Instructions to Bidders, General Conditions, and all other Supplementary General Conditions as may be added.

1.2 SCOPE OF WORK

A. All specified equipment to be delivered to the job site, freight prepaid, uncrated, assembled, and set in place, ready for final connections, where required, as specified in Divisions 220000 and 260000 of Performance Criteria.

B. Related Sections include the following:
   1. Division 220000/260000– Mechanical
      a. Provide all gas, water lines, drains, and other necessary work, including final connections to equipment.
      b. Provide all faucets, special switches, valves, traps, labor, and materials to make final connections to the equipment unless specified in this Section.
   2. Division 26 0000 - Electrical
      a. Provide all electrical utility lines, disconnect switches, and other work, including final connections to equipment.

1.3 DESCRIPTION

A. The extent of the Foodservice Equipment is on the Drawings, Equipment Schedule, and Specifications of this Section of Performance Criteria. Each model number includes the code *C013 as a suffix. This code is known as the Specifier Identification System. It is not to be removed by the bidders. Its purpose is to identify the specifier to the vendors providing the equipment when it is necessary to communicate questions, clarifications, and comments from before bid award through the final purchase. It is to be used on all correspondence, including fax and e-mail, when communicating with manufacturer representatives and factories.

B. The plans indicate the location of the equipment. Slight changes due to the varying dimensions of equipment and wall construction shall be permitted with approval by the Architect.

C. These typed Specifications shall be closely correlated with the Drawings and Schedule. Each complements the other, and cross-reference shall be necessary to fulfill the requirements of these Specifications. All information shown on Drawings and listed in Schedules are to be as part of the written Specifications.

D. Conflict in Plans and Specifications where changes, alterations, additions, or deductions are necessary, or where exceptions are concerning sizes, locations, and other details shown on plans, shall be reported in writing for a decision by the Architect.

E. The Contractor shall be responsible for seeing that the equipment can be entered through openings before doors and walls are finished.

1.4 WORK BY OTHERS

A. All Plumbing, Electrical, and Ventilation Work required in connection with this Section shall be done by the other Contractor unless specifically called for in the itemized Equipment Specifications. Work of others shall include but not be limited to exhaust fans and ductwork associated with the ventilation of the hood, roughing-in to points indicated on the mechanical, plumbing, electrical plans, and final connections from rough-in locations to various pieces of equipment requiring such connections and the supplying of all necessary materials and labor for this work except as specified or scheduled.

B. Tile bases, below the various item, is equipment shall be provided by others.

C. Refrigeration Work to be performed under this Section, except for electrical and plumbing connection to compressors, blower coils controls, etc., provided by others, is as listed in the itemized specifications.

D. All line and disconnect switches, safety cut-outs, control panels, fuse boxes, or other electrical controls, fittings, and connections shall be furnished and installed by others. Starting switches shall be provided by Foodservice Equipment Supplier as specified under General Specifications. Those starting switches furnished loose as standardized by Foodservice Equipment Supplier manufacturers (other than fabricated items) shall be installed and connected by others.

E. Any sleeves or conduit required for refrigeration and tubing lines shall be furnished and installed by others. Refrigeration alarm system connection by others.

F. Plumbing Trades shall confirm that all lines are flushed free of foreign matter before connecting equipment.

G. The electrical sub-contractor shall make all final connections to the equipment shown on Drawings or specified. It shall be the responsibility of the electrical sub-contractor to check all equipment to determine where starters, contractors, switches, and other items are required.

H. The plumbing sub-contractor shall make all final connections to the equipment shown on Drawings or specified, and it shall be the responsibility of the plumbing sub-contractor to provide traps, tailpieces, and fittings, water piping, floor drains, shut off valves, and all other necessary fittings. The Food Equipment Supplier shall provide faucets and all lever waste drains, hose reels with mixing valves to the plumbing subcontractor for connection and installation.

I. The mechanical sub-contractor shall make final connections to the equipment shown on Drawings or specified, and it shall be the responsibility of the mechanical sub-contractor to provide and install necessary ventilation facilities of sufficient capacity to operate the equipment. Mechanical work to be done by the Foodservice Equipment Supplier is listed in the itemized equipment specifications.

J. The General Contractor shall provide openings and passageways sufficient to sustain the weight of the Foodservice Equipment Supplier, and he shall provide openings and passageways of sufficient size to permit the delivery and erection of the equipment to their respective locations without dismantling. Coordination of these openings is critical for the equipment installation. The General Contractor shall provide a depressed floor for drains grates and walk-in cooler/freezer when noted.

1.5 QUALITY ASSURANCE

A. Pre Approved Contractors to include:
   1. Edward Don & Company: 1-800-777-4366

2. Manning Brothers Food Equipment Co.: 1-800-554-3004
3. Boelter Foodservice Design, Equipment & Supply: 770-535-3700

B. The equipment furnished under this Section to be supplied by one Kitchen Equipment Company.

C. Permits and Certificates:
1. All laws, codes, ordinances, and regulations bearing on the conduct of the work as drawn and specified shall be complied with and give all notices required. Any work upon which an inspection certificate by local authorities or any governing body is required, such Inspection Certificate or Certificates shall be obtained and paid.

D. Certificates of acceptance or completion as required and issued by the State, Municipal, or other authorities shall be procured and delivered to the Owners. The Owners may withhold payments that are due or which may become due until the necessary Certificates are obtained and delivered to Owners.

E. All safety devices and all accessories required to comply with regulations and governing codes shall be provided, regardless of whether or not specified or called for in the following technical divisions of the equipment list portion of this Section of Specifications.

F. Applicable Manufacturing Standards:
1. Special fabrication items shall be manufactured in compliance with Standard No. 2 of the National Sanitation Foundation Testing Laboratory and shall bear the NSF Seal of Approval.

G. Equipment pieces shall be manufactured in compliance with Standards No. 3, 4, 5, 6, 7, 8, 12, 13, 18, 20, 21, 25, 29, 35, 37, 51, 59 and 61, where applicable, of NSF Testing Laboratories and bear the Seal of Approval. This shall include any pending standards, which shall become applicable at the time equipment is delivered.

H. Electrical Equipment shall conform to the standards of the National Electrical Manufacturers Association (NEMA). Equipment shall have conveniently located control switches, enclosed case type, comply with State of South Carolina Electric Code, and bear the label from an approved Testing Laboratory. (UL or ETL)

I. Electrically heated and motor-driven fixtures shall be for the current shown in the Mechanical and Electrical plans. These items of equipment shall have mounted motor starters, switches, and controls. All shall be required for each fixture or complete Section of a fixture, or as specified.

J. Gas burning equipment to be designed for operation with the type of gas furnished and approved by the American Gas Association. The label or listing of the American Gas Association shall be accepted as conforming to this requirement. Installation of equipment shall conform to the standards as set forth by the American Gas Association and the National Plumbing Code. Where required, all gas equipment shall be furnished with a safety pilot and one hundred percent safety cut-off.

K. Miscellaneous Requirements:
1. Plumbing:
a. Provide chrome-plated faucets specified certified to NSF standard 61, Section 9. All backsplash-mounted faucets shall be provided with double male nipples having locknuts for rigidly securing the faucet to the backsplash. Nipple-locknut assembly shall be provided under this Section as part of the faucet.
b. Provide all wastes incorporated in the custom-built fabricated Foodservice Equipment. Provide all wastes with a chrome-plated tailpiece.

2. Electrical:
   a. Interwiring of Foodservice Equipment between heating elements, switches, starters, thermostats, outlets, motors, and solenoids shall be complete to the junction box, terminal box, or disconnect switch (should Specifications call for disconnect switch to be provided in this Section).
   b. Provide grounded receptacles specified under item No. of detail Specifications or as shown on the Contract Drawings. All receptacles are to be as specified and furnished with stainless steel faceplates.
   c. All electrically operated equipment to be per the codes, regulations, and the laws of the State of South Carolina.
3. Safety:
   a. All Foodservice Equipment provided under this Contract shall be manufactured and installed in conformance with the Williams-Steiger Occupational Safety Health Act of 1970.
4. Coordination:
   a. Coordinate with Project's plumbers and electricians to assist in cutting or knocking out holes in the stainless steel tables, counters, and cabinet bases to allow for efficient utility connections to equipment.

L. The Contractor shall be held responsible and liable for all changes or variances from Performance Criteria without written authorization from Architect for said changes or variations.

1.6 REFERENCES

A. The Drawings indicate the desired basic arrangement and dimensions of the equipment. Minor deviations may be substituted for approval provided basic requirements are met, and no significant rearrangement of service to the equipment is required to affect the proposed alteration. These deviations shall be made without expense to the Owner.

B. Operational and functional tests of the installed equipment are required. Defects or deficiencies shall be corrected to the satisfaction of the Architect or Owners at the expense of the Contractor. Consult the Mechanical and Electrical Connections Drawings and they're accompanying Specifications to determine additional requirements of the work and shall cooperate with all trades to ensure a satisfactory installation.

C. The electrical wiring of motors, motor starters, switches, and thermostats of the equipment shall be an integral part of the unit, which shall contain a junction box for the connection of electrical service. All motor-driven equipment shall have thermal overload and underload protection.

D. Furnish on each motor-driven appliance or electrically heated unit; a suitable mounted control switch or starter of proper type per UL or ETL Codes. All controls mounted on vertical surfaces of fixtures shall be set into recessed die-stamped stainless steel cups or otherwise indented to prevent damage to the control switch.

1.7 SUBMITTALS

A. Refer to Division 01 requirements for Submittals

B. FSEC shall verify all field measurements on the job site to ensure the proper fitting of all equipment. Within four (4) weeks after award of the Contract, FSEC is to electronically submit PDF format to the Architect for tentative approval, all dimensioned rough-in drawings, equipment submittal brochures, fabrication, and manufacturer's shop drawings.

1. Partial submittals will not be accepted and will be stamped Revise / Resubmit. The reproduction of original contract documents is not acceptable for use as a submittal.

C. After the initial review of submittal data, revise and resubmit only the datasheet, coversheets, or rough-in and shop drawings that have been modified or changed. The entire submittal is not required for a resubmission. After two resubmissions, the FSEC may be charged a fee for Camacho's continuous re-evaluation. This will be billed as an additional service.

D. Field Measurements
1. Measurements required to size and place Foodservice Equipment are to be verified with on-site field dimensions. Do not rely on or measure drawings for actual on-site dimensions. Dimensions shall be taken from the actual structure, giving given due consideration to any architectural, structural, or mechanical discrepancies that may occur during the construction of the building. Field dimensions shall be taken at the earliest opportunity so as not to delay deliveries. Notify FoodService Consultant of the earliest date and time. FSEC shall be responsible for the proper fit of all equipment furnished under this Section of the Contract. Gaps over ¼" wide are not acceptable.

E. Rough-In Drawings:
1. Prepare and submit rough-in drawings showing all utility rough-ins for kitchen equipment items, including items listed as "Future, Existing-Relocate, or Owner Furnished" (min. scale of ¼"=1'-0"). Drawings to indicate the size and location of all utilities, floor depressions, raised bases, and wall openings for equipment. The item numbers shown on the rough-in drawings shall be the same as shown on contract documents. Drawings shall be dimensioned to the stub up or stub out, not to the connection on the equipment. FSEC shall be responsible for conforming to these conditions with equipment and connections thereto. In the event rough-in has been completed before the award of the Contract, the FSEC shall thoroughly investigate and field verify the provided rough-in locations and provide equipment to suit building conditions.
2. Provide equipment floor plan with itemized equipment to include all utility loads.
3. Electrical rough-in plans are to be dimensioned to indicate the above-finished floor (AFF) height. 90º plug heads where available. Verify all NEMA plug types, length of cords, equipment connections lengths. Lengths are to be of adequate distance for outlets available and to allow equipment to be placed as shown on contract documents. Show convivence receptacle location.
4. Plumbing rough-in plans are to be dimensioned to indicate the above-finished floor (AFF) height.
5. Ventilation rough-in plans are to be dimensioned.
6. Special conditions plan indicating dimensions and locations of:
   a. Wall openings for pass-through equipment.
   b. Floor drains.
   c. Wall backing.
   d. Recessed or wall-mounted control panels
7. Provide a refrigeration system schematic piping plan indicating line size, elevation, trap locations, and all specified components required for the refrigeration system installation. The plan is to include equipment and parts provided by the Refrigeration Equipment Manufacturer. Verify refrigeration sizing is proper for line lengths determined by actual field conditions.

F. Equipment Cut Sheets:
1. The following instructions for Rough-In and Equipment submittal are in addition to any

requirements given elsewhere in the Documents.

2. Prepare and submit equipment cut sheets showing all manufacturer's data sheets describing equipment as specified. Include items listed as "Future, Existing-Relocate, or Owner Furnished." The item numbers shown on the submittal shall be the same as shown on contract documents. The equipment cut sheets are to be provided using Auto Quotes format or similar, including coversheets for each item. Where a piece of equipment is used and specified with multiple item numbers assigned, the first item is to be provided with a cover sheet and datasheet. For additional identical items, provide cover sheets only. Provide the following information on the coversheets:
   a. Project name.
   b. FSEC name.
   c. Foodservice Consultant name.
   d. Item Number.
   e. Equipment description.
   f. Quantity.
   g. Written specification/description of equipment provided.
   h. Accessories.
   i. Utilities.

G. Shop Drawings
1. Custom stainless steel equipment, walk-in cooler/freezer and refrigeration, exhaust hoods, utility distribution systems, dishwashers, scullery equipment, and other shop drawings shall be provided on similar size drawing sheets as contract documents. All shop drawings shall be detailed and fully dimensioned to a minimum scale of ¾" = 1' -0". Elevations and sections to be detailed to a minimum scale of 1-1/2" = 1' -0"). Show all materials, gauges, and methods of construction, including relation to adjoining and related work when cutting or close-fitting is required. Show all reinforcements, wall plates, and backing, anchorage, needed other work needed for a complete installation of fixtures. Drawings to show item number and quantity required for each detail. Omissions and discrepancies on approved drawings shall not relieve the FSEC of providing items as specified and shown on contract drawings.
2. Show adjacent walls, columns, and identify countertop equipment showing item numbers and descriptions.
3. Show all components that are included in fabricated equipment.
4. For equipment with load centers (panels), indicate total electrical calculations, including circuits. Provide an electrical diagram for on-site electricians.
5. Provide color, pattern, or finishes for laminated, fiberglass, paint, or stain for approval by the Architect/Owner.

H. Verify size and weight information of the service ware (glasses, plates, trays, cups, etc.) for self – leveling dispensing, ware washing, and mobile equipment with the Owner. Verify carts, racks, and dollies can fit into fixed equipment (roll-in refrigeration, combi ovens, walk-ins, counters, etc.)

1.8 HANDLING AND STORAGE

A. Protect metal and millwork product finishes from damage during shipping, storage, handling, installation, and construction of other work in the same spaces. Wrap and crate each item of equipment as needed for protection from damage.

B. Cover exposed stainless steel surfaces and millwork surfaces with self-adhesive protective paper, of a type recommended by the metal and millwork manufacturer, and do not remove until work is

installed and ready for cleaning and start-up.

1.9 SCHEDULING

A. Schedules and Reports:
1. Establish earliest and latest job site delivery dates of FSES provided equipment

B. Delivery of Owner furnished equipment for installation shall take place at a time to be determined by Owners, but not necessarily during regular working hours.

1.10 SUBSTITUTION

A. Substitution of Materials and Equipment:
1. Whenever a material, article, or piece of equipment is identified on the Drawings or in the Specifications by reference to manufacturers' or vendors' names, trade names, catalog numbers, or the like, it is so identified to establish a standard. Any material, article, or piece of equipment of other manufacturers or vendors which shall perform adequately the duties imposed by the general design, shall be considered equally acceptable provided, in the opinion of the Architect, it is of comparable substance, construction, appearance, and function. It shall not be purchased or installed without Architect's written approval. Substitute items shall be submitted to Architect at least ten days before the bid date for review and consideration. Acceptable items shall be so stated in an Addendum.

1.11 WARRANTY

A. Workmanship and Guarantees:
1. Equipment shall be delivered in an undamaged condition upon completion. All workmanship and labor shall be of the best in their respective fields and skilled mechanics of the trades involved.

B. All equipment, as specified in this Section, shall be guaranteed for one year from the time of substantial completion. If, at any time within this warranty period of one year, any equipment is found to be faulty due to poor workmanship, inferior or defective materials, replace said pieces or correct each defective part at no cost to Owners.
1. Refrigerated items shall have an additional four-year warranty on the compressor unit. On extended compressor warranty, only labor charges after the first year shall be paid.

C. At the end of the first year, assign extended warranties to Owners on equipment having more than one year warranty from the manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless steel shall be austenitic steel alloy and must meet the requirements of the American Iron and Steel Institute Designations for Type 201 and Type 304 Stainless steel. Type 430 Stainless steel (straight chrome - no nickel) shall not be acceptable for custom-built fabricated equipment.

B. All sheets shall have a natural mill finish of not less than commercial No. 4 on the exposed side and with not less than No. 2 on the unexposed side. All stainless steel shall be stretcher leveled, with a thickness of:
1. 14 Gauge - Not less than 0.075 Inch

2. 16 Gauge - Not less than 0.063 Inch
3. 18 Gauge - Not less than 0.050 Inch
4. 20 Gauge - Not less than 0.038 Inch

C. Welding shall be of electric arc or oxy-acetylene gas. Welding shall be done with a rod of the same material and full penetration in the entire length of the joint. Welds to be flat without buckles, voids, or imperfections. All welds shall be ground flush with adjacent surfaces, conditioned to eliminate slippery surfaces. All shear cuts or bends that tend to open the surface of the metal shall be rewelded, ground, and polished. All edges are to be ground and filed to eliminate sharp or rough edges.

D. When stainless steel sheets have the grain running in different directions, the sheets shall be so jointed, and welds run and finished in such a manner as to make the sheets appear as one continuous product.

E. Gauges:
1. All Gauges of metals, where specified, shall be manufactured to the standards set forth by the US. Standard for Sheet Metal.
2. Unless specified, no material shall be finished lighter than 20 gauge for custom-built fabricated equipment.

F. Sound-Deadening:
1. The undersides of dish tables shall be sound-deadened to no less than 1/8 inch thick and allowed to dry thoroughly before being finished with two coats of paint.

2.2 FABRICATION

A. Products manufactured by Atlanta Custom Fabricators, LTI, Inc, and Eagle Group, modified to comply with specifications, are acceptable.

B. Metal Tops for Tables:
1. Shall be constructed of 14 gauge stainless steel with butt joints welded, ground, and polished smooth, resulting in a one-piece top without joints and crevices. Tops are to be reinforced using 14 gauge stainless steel channel irons, 1 inch by 5 inches by 1 inch. Securely fastened to the underside, on 30-inch centers, by studs or welding in a vermin-proof manner. Freestanding ends are to be turned down 1-3/4 inch on bull-nose edge, or 2-inch rolled down the edge with all exposed corners rounded on a 2-1/2 inch radius, or bull-nose corner. Where the table borders on or is adjacent to the wall, there is to be a 4-inch high backsplash with a 1-inch turn back to the wall with welded enclosed ends, unless otherwise specified. See Drawings for typical details.
2. Sleeves:
a. Where legs, standards, pipes, or pipe chases come through a work area or tabletop, they shall pass through 3-inch high stainless steel sleeves, with the periphery fully welded and polished to match adjacent surfaces.

C. Sinks:
1. Shall be constructed of 14 gauge stainless steel sheets with all interior corners rounded on at least a 1/2 inch radius. All bottom corners shall be fully coved. All joints to be welded, ground, polished, and made to match adjacent surfaces. Provide each Sink with a 2-inch chromium-plated waste outlet with a stainless steel strainer and Chromium Plated tailpiece. Provide with a rotary lever handle waste valve. Wastes are to be depressed in sink bottoms, with bottoms inclining down towards the wastes. Waste for pot sink shall be rotary Model No. B-3940-01, T & S Brass; chrome draining, flat strainer with overflow. Wastes for prep

sinks shall be rotary Model No. B-3940, T & S Brass, chrome draining or approved Model by Component Hardware Group, Inc and T & S Brass and Bronze Works. The rotary handle shall have front stainless steel bracket support welded to the underside of the sink compartment. Backsplash against wall shall be eight inches high with two-inch turned back on 45-degree angles with enclosed welded ends. Support sinks on legs and gussets, as specified, with braces from front to rear only. See Drawings for backsplash typical details.

2. All backsplashes against the wall shall be sealed with clear Polysulphide Sealant.
3. Each compartment shall have a cut-out on the rear to accommodate overflow assembly provided with drain assembly. Overflow and drain assemblies shall be installed and made watertight.

D. Insert Sinks:
1. Shall be sized and shaped as specified with the same construction as required for other sinks except that no backsplash is required. The sinks are to be welded into tabletops. All welds are to be ground and polished smooth. Provide with wastes as specified for sinks.

E. Drain Tables and Drain Boards:
1. Shall be constructed of 14 gauge stainless steel, size, and shape as specified. They are to be made integral with sinks. The front and free ends are to be constructed with a minimum of 3 inches high 1-1/4 inch to 1-1/2 inch rolled rim on a 180-degree turn, unless otherwise specified. Backsplash shall be the same height as for sinks, same construction, and integrally welded with Sink. Construct drain tables or boards to allow liquids to drain into sinks.

F. Undershelves:
1. Undershelves are to be constructed in sections of 18 gauge stainless steel and notched out to fit around legs and be fixed type. Intermediate shelves are to be constructed of 18 gauge stainless steel and be fixed type construction unless otherwise specified.

G. Overshelves:
1. Overshelves shall be fabricated of 16 gauge stainless steel with edges rolled down or up and supported as specified.
2. Overshelves mounted on tabletops shall be supported by 16 gauge stainless steel tubular legs. Legs are to be securely fastened to the tabletop with fasteners similar to Model No. 1655000272, manufactured by Kason Foodservice or an approved Manufacturer.

H. Wall Shelves:
1. Wall Shelves shall be fabricated of 16 gauge stainless steel and the same construction as “Overshelves.” Secure brackets to the wall with stainless steel screws with expansion shields. Brackets shall be spaced on a maximum of 4 feet on the center.
2. Cantilevered Wall shelves shall be supported on the table’s extended rear legs with cantilevered supports of 14 gauge stainless steel flag brackets.

I. Hinged Doors:
1. Mount hinged doors on a lift-off welded stainless steel hinges Model No. M74-8000, manufactured by Component Hardware. Products manufactured by Kason Foodservice, modified to comply with specifications, are acceptable.
2. All corners shall be welded, ground, and filed smooth.

J. Drawers:
1. Lift out type drawer body, one-piece twenty inches by twenty inches by five inches deep, unless otherwise specified. Drawer pan stamped of 20 gauge stainless steel with inside radiused corners. Construct drawer face of double-wall stainless steel, 16 gauge exterior, and

20 gauge interior with integral horizontal pull. Fill the void in the drawer front with sound deadening material. Mount drawer pan in 18 gauge stainless steel cradle with roller bearing slides with stops. When fully extended, the drawer supports a minimum of 200 pounds. Enclose drawer in 18 gauge stainless steel housing on sides and rear. Design pan carrier to be full opening without tilting. Provide with manually operated release latches to allow drawer removal. Drawer assemblies shall be a positive self-closing type.

K. Legs, Braces, Gussets, Feet:
1. The height of tables and other fabricated items of equipment shall be as specified. Legs shall be of 1-5/8 inch outside diameter, stainless steel 16 gauge tube spaced at intervals of 60".
2. Legs are to be braced by 1-5/8 inch outside diameter stainless steel 16 gauge tube undershelf, welded to legs., 10 inches above the floor. Weld all around the periphery at the joint to legs and grind smooth. The braces shall be constructed to form rectangular, or "H" frames, and there shall be at least one brace welded to each leg.
3. Gussets shall be stainless steel NSF approved, cylindrical type with a setscrew. Leg gussets are to be welded to the underside of tables, to reinforcing channels, and underside of sinks. Gussets shall be Model No. A20-0206 manufactured by Component Hardware Group Inc. or comparable stainless steel gussets manufactured by Standard-Keil Hardware Manufacturing Company, United Showcase, Component Hardware, and Kason Foodservice.
4. Feet shall be stainless steel adjustable bullet shape, fully enclosed, tightly fitting the leg. Provide 1 inch up and down adjustment from the central position, at no time exposing any threads. Adjustments are to be easily made by hand without the use of tools. For counters and cabinet bases, the feet shall be the same as for above. Feet having the comparable quality to Component Hardware Group, Inc. and Kason Foodservice are approved. Legs for cabinet base shall be 8 inches high, including feet. Freestanding sinks shall be supported on legs and feet as specified, with bracing from front to rear only.
5. Where flanged feet are specified, provide stainless steel flanged feet, which can be securely fastened to the floor.

L. Casters:
1. Plate Type: Provide stainless steel swivel plate casters. Provide with 5-inch Ply-Loc gray wheels with 1-1/4" tread, zerk grease fittings, and seals, and a 250-pound capacity. Front casters to have brakes manufactured by Component Hardware Model No. CMPI-5RPB or equal manufactured by Jarvis Casters or Colson Caster.
2. Stem Type: Plate Type: Provide stainless steel swivel plate casters. Provide with 5-inch Ply-Loc gray wheels with 1-1/4" "tread, zerk grease fittings, and seals, and a 250-pound capacity. Front casters to have brakes manufactured by Component Hardware Model No. CM54-5RPB or equal manufactured by Jarvis Casters or Colson Caster.

M. Rough Edges:
1. All ends and edges which are rough or sharp shall be filed and ground to a safe, smooth finish before delivery to the job site.

2.3 MISCELLANEOUS ACCESSORIES

A. Water Filters:
1. Provide water filters for all ice-making, hot and cold beverage equipment, and all steam boilers. All filter units are to be provided with shut off valves and quick change filters.
2. FSEC to ensure water supply is comprehensively tested, and that water filter specified effectively treats water to within manufacturer's water standards.

B. Stainless Steel Enclosures:
   1. Provide 20 gauge stainless steel trim to fill in wall openings at Pass-Thru Cabinets. Trim will overlap the wall by approximately 2 inches and be within 1/2 inch of cabinets on the side. Provide for a 3 inch opening between the top of the cabinet and wall.

C. Stainless Steel Ceiling Panels:
   1. Type I exhaust hoods to be installed with a clearance to combustibles of not less than 18 inches. Foodservice Equipment Contractor to provide 20 gauge stainless steel wall and ceiling panels, extending 18 inches in all directions from Exhaust Hood, Item Number 30 Panels to be 304 series stainless steel with No. 3 finish.
   2. Wall panels to be 48" wide with vertical grain. Where all vertical panel joints occur, provide stainless steel trim strip with hidden fasteners. All panels to be sealed to wall with clear polysulfide sealant and held in place at edges w/ stainless steel screws. Provide bottom horizontal edge of panel with a 1" @ 45 degree bend to overlap the floor cove base.
   3. Verify ceiling panel sizes from Architect's reflected ceiling plan.

2.4 KITCHEN EQUIPMENT

A. It is the responsibility of the foodservice equipment dealer to ensure that any products by manufacturers listed as being acceptable to the original specification meet the design and performance specifications of the prime specification in every way.

B. The intent of the prime specification is to set forth the level of quality and features/options that are desired by the Owner. All features and options of the prime specification must be included with and product substituted from the list of approved manufacturers.

C. Reference Kitchen Floor Plan for the location of equipment. Obtain equipment of like families through the same manufacturer. All gas-fired equipment must have automatic ignition.

   1. AIR CURTAIN
      a. Mars Air Systems Model No. LPV242-1UU-SS*C013
      b. Air Curtain, for 42" wide door, unheated, stainless steel cabinet, stainless steel finish, cTLus.
      c. Provide unit with the following:
         1) Magnetic switches.
         2) MCPS-1UU Motor Control Panel, for unheated units, remote mounted, (1) 1/6 HP motor maximum, 220v/50/1-ph.
         3) 99-018 Magnetic Reed Switch, commercial plastic, surface mounted, 24v, NEMA 1.
         4) MCP-24V Transformer, panel mounted, 24v controller.
         5) Top mounting brackets.
      d. Products manufactured by Berner & Curtron, modified to comply with specifications, are acceptable.

   2. SPARE NUMBER

   3. SPARE NUMBER

   4. WALK-IN FREEZER
      a. Specified in Section 114100 – Food Storage Equipment.

5. WALK-IN COOLER
   a. Specified in Section 114100 – Food Storage Equipment.

6. WALK-IN SHELVING
   a. Eagle Group Model No. 2148E*C013
   b. Provide shelving units comprised of the following:
      1) (4 each) Shelf, wire, 48"W x 21"D, patented QuadTruss® design, includes (4) pairs of split sleeves per shelf, 800 lbs. capacity, EAGLEgard® hybrid epoxy finish with MICROGARD® antimicrobial protection, NSF
      2) (4 each) P74-E Post, stationary, 74"H, grooved in 1" increments, includes post cap & leveling bolt, EAGLEgard® hybrid epoxy finish with MICROGARD® antimicrobial protection, NSF
   c. (Item No. 6.1) Shelving, Eagle Group Model No. 2142E
   d. Provide shelving units comprised of the following:
      1) (4 each) Shelf, wire, 42"W x 21"D, patented QuadTruss® design, includes (4) pairs of split sleeves per shelf, 800 lbs. capacity, EAGLEgard® hybrid epoxy finish with MICROGARD® antimicrobial protection, NSF
      2) (4 each) P74-E Post, stationary, 74"H, grooved in 1" increments, includes post cap & leveling bolt, EAGLEgard® hybrid epoxy finish with MICROGARD® antimicrobial protection, NSF
   e. "S" clips are allowed at inner corners only.
   f. Where the shelf is below the evaporator coil, adjust the height to fit.
   a. Verify dimensions in field and coordinate with shelving unit and walk-in supplier to ensure a proper fit. Provide shelving with standard finish and accessories necessary for a complete installation.
   b. Products manufactured by Metro & Nexel, modified to comply with specifications, are acceptable.

7. UTILITY CART
   a. Lakeside Manufacturing Model No. 243*C013
   b. Utility Cart, 2-shelf with 36"W x 22"D x 40-5/8"H, shelf size 33"W x 21"D, stainless steel tubular U-frame, 20 gauge stainless steel shelves with reinforced edges, 500 lb. capacity, 21-1/2" shelf clearance, push handle on each short side, 5" non-marking cushion thread swivel casters, NSF (ships fully assembled).
   c. Provide unit with the following:
      1) Casters, 5", all swivel, No-Mark, cushion tread.
      2) Round corner bumpers (set of 4).
   d. Products manufactured by New Age & PVI, modified to comply with specifications, are acceptable.

8. SPARE NUMBER

9. SPARE NUMBER

10. HAND SINK
    a. Advance Tabco Model No. 7-PS-80*C013
    b. Hand Sink, wall-mounted, 14" wide x 10" front-to-back x 5" deep bowl, 20 gauge 304 stainless steel, splash mounted faucet, lever drain with overflow, P-trap, soap & towel dispenser, wall bracket, NSF, cCSAus.

c. Provide unit with the following:
   1) K-316-LU Wrist Handles Only (1 pair hot & cold 4" long blades).
   2) 7-PS-17 Welded Side Splash, 7-3/4"H (installed height), both sides, splash mounted faucets.
d. Products manufactured Eagle & IMC/Teddy, modified to comply with specifications, are acceptable.

11. PREP TABLE W/ SINK
   a. Atlanta Custom Fabricator
   b. Provide fabricated stainless steel Prep Table w/ Sink, size and shape as shown on Drawings. Provide one drawer and undershelf.
   c. Where shown on Drawings, cut out the top to accommodate a one-compartment sink. Sink compartment to be 24"x24"x14" deep. Provide lever waste for each sink compartment per section 2.2 D1. Paint exposed copper drain lines silver to match stainless steel table.
   d. Where adjacent to wall provide with a typical 8-inch high backsplash with 2-inch turnback on a 45-degree angle with enclosed welded ends. Front and left sides to have a marine edge. Refer to Drawing for typical tabletop construction details.
   e. (Item No.11.1) Faucet, Wall / Splash Mount, T&S Brass Model No. B-0231-CR-KIT, Pantry Faucet, double, wall mount, 8" centers, 12" swing nozzle, lever handles, stream regulator tip, quarter-turn Cerama cartridge, low lead, (2) 24" flex hose, 1/2" NPT, NSF, ADA Compliant.
   f. B-0199-01 Aerator, non-splash, 55/64" -27 female aerator threads, fits goosenecks & nozzles.
   g. Reference the listing of approved fabricators in Section 2. 2; Fabrication of this specification.
   h. Products manufactured by Chicago Faucet and Fisher, modified to comply with specifications, are acceptable.

12. WALL SHELF
   a. Atlanta Custom Fabricator
   b. Provide fabricated 16-gauge, stainless steel Wall Shelf. Wall Shelf to be size and shape as shown on drawings.
   c. Unit to be mounted and located 24" above the working surface of Item No. 11, Prep Table with SInk.
   d. Shelf sides and rear to flange up 2". front to have 1-1/2" rolled down the edge. Support Shelf on the wall by heavy gauge stainless steel brackets or by approved alternate means.
   e. Reference the listing of approved fabricators in Section 2. 2; Fabrication of this specification.

13. CHEMICAL STORAGE SHELVING
   a. Eagle Group Model No. 2436E*C013
   b. Shelf, wire, 36"W x 24"D, patented design, includes (4) pairs of split sleeves per shelf, 800 lbs. capacity, EAGLEgard® hybrid epoxy finish with MICROGARD® antimicrobial protection, NSF
   c. P74-E Post, stationary, 74"H, grooved in 1" increments, includes post cap & leveling bolt, EAGLEgard® hybrid epoxy finish with MICROGARD® antimicrobial protection, NSF

d. Products manufactured by Metro & Nexel, modified to comply with specifications, are acceptable.

14. MOP SINK
    a. Eagle Group Model No. F2820*C013
    b. Mop Sink, floor mount, 32-5/8"L x 25-1/2" W x 15-1/2"H overall, 28" wide x 20" front-to-back x 8" deep bowl, 16 gauge top with "V" edge, full skirt, 2" NPS drain with stainless steel removable strainer plate, 304 stainless steel construction, NSF
    c. Provide unit with the following:
        1) 312688 Mop Holder, 18"W, holds (3) mops
    d. (Item No. 14.1), Service Faucet, T&S Brass Model No. B-0655-BSTP, Service Sink Faucet, 8" centers-adjustable from 7-3/4" to 8-1/4", 5-1/8" clearance wall to centerline of the faucet, 11-5/8" from wall to center of outlet, polished chrome-plated finish, with built in screwdriver stops
    e. Products manufactured by Chicago Faucet and Fisher, modified to comply with specifications, are acceptable.

15. SPARE NUMBER

16. SPARE NUMBER

17. SPARE NUMBER

18. LOCKER
    a. By Architect

19. SPARE NUMBER

20. SPARE NUMBER

21. SPARE NUMBER

22. SPARE NUMBER

23. WORKTABLE
    a. Atlanta Custom Fabricator
    b. Provide fabricated stainless steel WorkTable, size and shape as shown on Drawings. Provide two drawers and with undershelf. Reference Seet 4/QF701; Foodservice Elevations.
    c. Where adjacent to wall provide with a typical 8-inch high backsplash with 2-inch turnback on a 45-degree angle with enclosed welded ends. Front and left side to have rolled edge. Refer to Drawing for typical tabletop construction details.
    d. Reference the listing of approved fabricators in Section 2. 2; Fabrication of this specification.

24. WALL SHELF
    a. Atlanta Custom Fabricator
    b. Provide fabricated 16-gauge, stainless steel Wall Shelf. Wall Shelf to be size and shape as shown on drawings.
    c. Unit to be mounted and located 24” above the working surface of Item No. 23, WorkTable.

d. Shelf sides and rear to flange up 2". front to have 1-1/2" rolled down edge. Support Shelf on the wall by heavy gauge stainless steel brackets or by approved alternate means.
e. Reference the listing of approved fabricators in Section 2. 2; Fabrication of this specification.

25. FOOD PROCESSOR
a. Robot Coupe Model No. R602VV*C013
b. Food Processor, 7-liter stainless steel bowl with handle, continuous feed kit with kidney-shaped & cylindrical-shaped hoppers, includes (1) "S" blade (27124), (1) grating disc (28058), (1) slicing disc (28064), pulse function, variable speed, 300 - 3500 RPM, NEMA 5-20P, cETLus, ETL-Sanitation.
c. Provide unit with the following:
1) LP3DISC LP3Disc, (3) disc package includes: (1) 3/16" grating disc, (1) 1/4" x 1/4" julienne disc and (1) 3/16" slicing disc .
d. Products manufactured by Hobart & Berkel, modified to comply with specifications, are acceptable.

26. SPARE NUMBER

27. PROOFER & HEATED HOLDING CABINET
a. Wittco Model No. 1826-15-BC-IS*C013
b. Products manufactured by _ & _, modified to comply with specifications, are acceptable.

28. SMARTWALL SHELVING GRID
a. MetroModel No. 48SMTWALL14/18
b. Smartwall---48" section w/ 14" and 18" deep shelves
c. SW56K3 SmartWall Wall Track, 56", 12 gauge steel, Metroseal 3™ epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection; includes: hardware to join the track to another, NSF
d. (2 each) SWU45K3 SmartWall Upright, 45", Metroseal 3™ epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection, slots for grids/shelf supports at 1-1/2" increments; 26 slots total; sold by the piece
e. (2 each) SWS14K3 SmartWall Shelf Support, single, for 14"Deep shelf, Metroseal 3 epoxy with Microban antimicrobial product protection, actual dimensions (DxWxH 16-9/16" x 1-1/2" x 8-3/16"); compatible with Super Erecta® wire & solid shelves, MetroMax® Q, & MetroMax® i; (2) required per shelf
f. (2 each) SWS18K3 SmartWall Shelf Support, single, for 18"Deep shelf, Metroseal 3™ epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection, actual dimensions (DxWxH 20-9/16" x 1-1/2" x 8-3/16"); compatible with Super Erecta® wire & solid shelves, MetroMax® Q, & MetroMax® i; (2) required per shelf
g. 1448NK3 Super Erecta® Shelf, wire, 48"W x 14"D, Metroseal™ Green epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection, plastic split sleeves are included in each carton, NSF
h. 1848NK3 Super Erecta® Shelf, wire, 48"W x 18"D, Metroseal™ Green epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection, plastic split sleeves are included in each carton, NSF
i. WG1848K3 SmartWall Wire Grid, 48" x 18", Metroseal 3™ epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection; brackets not included, NSF
j. (4 each) PGHK6K3 SmartWall Prong Hook, 6", Metroseal 3™ epoxy-coated

corrosion-resistant finish with Microban® antimicrobial protection

k. (2 each) H210K3 SmartWall Storage Basket, 17-3/8"W x 7-1/2"D x 5"H, Metroseal 3™ epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection, NSF
l. PBA-GSDK3 SmartWall Light-Duty Grid Shelf, 18-1/2"W x 9"D, Metroseal 3™ epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection, NSF
m. (2 each) HK26C SmartWall Snap-On Hook, 3-1/2"H, chrome, style C - double, multi-purpose
n. All items to be packaged together, separate from any other items and marked with this item number
o. Products manufactured by Eagle & Nexel, modified to comply with specifications, are acceptable.

29. PREP TABLE W/ SINK
    a. Atlanta Custom Fabricator
    b. Provide fabricated stainless steel Prep Table w/ Sink, size and shape as shown on Drawings. Provide two drawers and undershelf. Reference Seet 3/QF701; Foodservice Elevations.
    c. Where shown on Drawings, cut out top to accommodate a two compartment sink. Each compartment to be 24"x24"x14" deep. Provide lever waste for each compartment per section 2.2 D1. Paint exposed copper drain lines silver to match stainless steel table.
    d. Where adjacent to wall provide with a typical 8 inch high backsplash with 2 inch turnback on 45 degree angle with enclosed welded ends. Front and left side to have marine edge. Refer to Drawing for typical tabletop construction details.
    e. (Itm No. 29.1) Faucet, Wall / Splash Mount, T&S Brass Model No. B-0231-CR-KIT, Pantry Faucet, double, wall mount, 8" centers, 12" swing nozzle, lever handles, stream regulator tip, quarter-turn Cerama cartridge, low lead, (2) 24" flex hose, 1/2" NPT, NSF, ADA Compliant
    f. B-0199-01 Aerator, non-splash, 55/64" -27 female aerator threads, fits goosenecks & nozzles
    g. Reference the listing of approved fabricators in Section 2. 2; Fabrication of this specification.
    h. Products manufactured by Chicago Faucet and Fisher, modified to comply with specifications, are acceptable.

30. EXHAUST HOOD
    a. Specified in the Mechanical Section

31. TWO BURNER RANGE
    a. Garland Model No. MST4S-E*C013
    b. Range, gas, 17", Add-A-Unit, (2) open burners, cast iron grate, storage base, electronic spark ignition, flame failure device, stainless steel front & sides, 6" adjustable legs, CE, CSA Flame, CSA Star, NSF.
    c. Provide unit with the following:
        1) Natural Gas.
        2) 3/4" Rear gas connection, including "Tee" in a manifold, end cap & cover.
        3) 2670200 Natural Gas Regulator, 3/4" NPT.
        4) (Electronic ignition) 120V/60/1-ph, 0.1 amps, NEMA 5-15P.
        5) M17BG Master Series Backguard/Flue Riser, 17" H x 17" W, stainless steel.
    d. Products manufactured by Vulcan & Southbend, modified to comply with

specifications, are acceptable.

32. CONVECTION STEAMER STACKED
    a. Cleveland Range Model No. (2) 22CET63.1*C013
    b. Convection Steamer, electric, boilerless, double stacked, on ES26304066E equipment stand, (9) full-size pan capacity, SureCook controls, 60-minute electro-mechanical timer & manual (continuous steaming) bypass switch, left-hand hinged door, controls on right, automatic drain & water level controls, KleanShield™ interior, standard treated & tap water connection, stainless steel exterior, 4" adjustable legs with flanged feet, UL, NSF.
    c. Provide unit with the following:
        1) Performance start-up included at customer request after the equipment is installed (Free Water Quality Check included)
        2) (VOS2) (2) 440-480v/60/3-ph, 10.1-12.0 kW, 13.2-14.4 amps, 3-wire
        3) WBT-QTI1-CR Optipure Water Treatment System, dual-cartridge, reduces sediments over 0.5 microns, reduces chlorine, includes (1) CTOS-Q10 Catalytic Carbon Filter & (1) CTOS-QCR activated carbon filter
        4) Second year limited warranty on water related parts only when purchasing a steamer and filter from Cleveland. Must include a completed Performance Start-Up (See Cleveland warranty statement for details)
    d. Products manufactured by Vulcan & Crown, modified to comply with specifications, are acceptable.

33. TILTING BRAISING PAN
    a. Groen Model No. BPP-30EC*C013
    b. Braising Pan, electric, 30-gallon capacity, 10" deep pan, 38" pan height, IPX6 water rated electronic Classic controls, power tilt, standard etch marks, faucet bracket, vent cover, round tubular open leg base, stainless steel construction, bullet feet, UL, UL, NSF.
    c. Provide unit with the following:
        1) (153300) 480v/60/3-ph, 14.0 amps.
        2) 2" Tangent draw-off with perforated strainer.
        3) Z079995 Lip Strainer.
        4) Z040602 Faucet, double pantry, with 48" spray hose.
    d. Products manufactured by Vulcan & Crown, modified to comply with specifications, are acceptable.

34. FLOOR TROUGH
    a. Eagle Group Model No. ASFT-2436-SG*C013
    b. Anti-Splash Floor Trough, 36"W x 24"D, stainless steel subway-style grating, 6" deep trough pan with built-in pitch toward drain, accommodates up to a 4" diameter drain pipe, stainless steel removable perforated basket, all-welded 14/304 stainless steel construction, NSF
    c. Reference 2/QF300; Foodservice Plumbing Plan.
    d. Products manufactured by Advance Tabco & IMC/Teddy, modified to comply with specifications, are acceptable.

35. DOUBLE CONVECTION OVEN
    a. BlodgettModel No. DFG-100 DBL
    b. Convection Oven, gas, double-deck, standard depth, capacity (5) 18" x 26" pans per compartment, (SSD) solid state digital controls, 2-speed fans, interior light,

simultaneous operated doors with glass, stainless steel front, sides & top, 6" stainless steel legs, flue connector, (2) 1/2 HP, 55,000 BTU each, cETL, NSF, CE

c. Provide unit with the following:
   1) Natural gas
   2) SSD Top Oven: Solid State digital with Pulse Plus® and Cook & Hold.
   3) SSD Bottom Oven: Solid State digital with Pulse Plus® and Cook & Hold.
   4) Draft diverter.
   5) 6" legs, adjustable, stainless steel (set).
   6) 48" flexible gas hose with quick disconnect & restraining device Products manufactured by Vulcan & Southbend, modified to comply with specifications, are acceptable.

36. SPARE NUMBER

37. WORKTABLE
   a. Atlanta Custom Fabricator
   b. Provide fabricated, stainless steel WorkTable, size and shape as shown on Drawings. Provide two drawers and an undershelf. Reference Seet 2/QF702; Foodservice Elevations.
   c. Where adjacent to wall provide with a typical 8 inch high backsplash with 2 inch turnback on 45-degree angle with enclosed welded ends. Front and left side to have rolled edge. Refer to Drawing for typical tabletop construction details.
   d. Reference the listing of approved fabricators in Section 2. 2; Fabrication of this specification.

38. WALL SHELF
   a. Atlanta Custom Fabricator
   b. Provide fabricated 16-gauge, stainless steel Wall Shelf. Wall Shelf to be size and shape as shown on drawings.
   c. Unit to be mounted and located 24” above the working surface of Item No. 37.
   d. Shelf sides and rear to flange up 2”. front to have 1-1/2” rolled down edge. Support Shelf on wall by heavy gauge stainless steel brackets or by approved alternate means.
   e. Reference the listing of approved fabricators in Section 2. 2; Fabrication of this specification.

39. POT RACK
   a. Eagle GroupModel No. WM96PR
   b. Pot Rack, wall mount, 96"W x 12"D x 16"H, double-bar design, constructed of 3/16" x 2" stainless steel flat bar, includes (16) double-pronged pot hooks, NSF
   c. Products manufactured by Advance Tabco & IMC/Teddy, modified to comply with specifications, are acceptable.

40. POT RACK SHELVING
   a. Eagle Group Model No. 2460Z*C013
   b. Shelf, wire, 60"W x 24"D, patented QuadTruss® design, includes (4) pairs of split sleeves per shelf, , EAGLEbrite® zinc finish, NSF
   c. (4 each) P74-Z Post, stationary, 74"H, grooved in 1" increments, includes post cap & leveling bolt, EAGLEbrite® zinc finish, NSF
   d. Products manufactured by Metro & Nexel, modified to comply with specifications, are acceptable.

41. 3-COMPARTMENT SINK
    a. Atlanta Custom Fabricator
    b. Provide fabricated 3 compartment pot and pan Sink, with drainboards, size, and shape as shown on Drawings. Provide with side and rear crossrails.
    c. Where adjacent to wall provide with a typical 8-inch high backsplash with 2-inch turnback at 45-degree angle with enclosed welded ends. Front and sides to have a 3" high raised rim with rolled edge.
    d. Where shown on Drawings, cut out top to accommodate a three-compartment sink. Sink compartment to be 20"x28"x14" deep. Provide lever waste for each sink compartment per section 2.2 D1. Paint exposed copper drain lines silver to match stainless steel table.
    e. (Item No. 41.1) (2 each) Faucet, Wall / Splash Mount, &S Brass Model No. B-0231-CR-KIT
    f. Pantry Faucet, double, wall mount, 8" centers, 12" swing nozzle, lever handles, stream regulator tip, quarter-turn Cerama cartridge, low lead, (2) 24" flex hose, 1/2" NPT, NSF, ADA Compliant.
    g. (2 each) B-0199-01 Aerator, non-splash, 55/64" -27 female aerator threads, fits goosenecks & nozzles
    h. Reference the listing of approved fabricators in Section 2. 2; Fabrication of this specification.
    i. Products manufactured by Chicago Faucet and Fisher, modified to comply with specifications, are acceptable.

42. SPARE NUMBER

43. DRY STORAGE SHELVING
    a. Eagle Group Model No. 2448Z*C013
    b. Provide shelving units comprised of the following:
        1) Shelf, wire, 48"W x 24"D, patented QuadTruss® design, includes (4) pairs of split sleeves per shelf, 800 lbs. capacity, EAGLEbrite® zinc finish, NSF
        2) P86-Z Post, stationary, 86"H, grooved in 1" increments, includes post cap & leveling bolt, EAGLEbrite® zinc finish, NSF
    c. Coordinate with Shelving Unit supplier to assure a proper fit. Provide shelving with standard finish and accessories necessary to ensure complete installation.
    d. "S" clips are allowed at inner corners only.
    e. Products manufactured by Metro & Nexel, modified to comply with specifications, are acceptable.

44. CAN RACK
    a. Channel Manufacturing Model No. CSR-99*C013
    b. Can Rack, Full Size, Heavy-Duty Series, 25.5"W x 35"D x 76"H, Aluminum Construction, (162) #10 Cans or (216) #5 Cans, Stationary, NSF,.
    c. Products manufactured by New Age & Eagle, modified to comply with specifications, are acceptable.

45. CLEAN DISH TABLE
    a. Atlanta Custom Fabricator
    b. Provide fabricated, stainless steel Clean Dishtable, size and shape as shown on drawings. Set table height to allow racks to move freely from Dishwasher onto table. Provide side and rear crossrails as shown on Elevation Drawings.

c. Where table is adjacent to wall, provide 8” high backsplash with welded enclosed ends. Provide front and end opposite of Dishwasher with 3” raised rolled rim.
d. Mount limit switch provided with Dishwasher on 3" stainless steel ledge at the end of the table. Secure wiring for limit switch to the underside of table top.
e. Reference the listing of approved fabricators in Section 2. 2; Fabrication of this specification.

46. DISHWASHER
a. Hobart Model No. CLPS66EN-BAS+BUILDUP*C013
b. Conveyor Dishwasher, single tank with a Power Scrapper, (202) racks/hour, insulated hinged doors, .62 gallons/rack, stainless steel enclosure panels, microprocessor controls with low temperature & dirty water indicators, NSF Pot & Pan mode, programable de-lime notification, power scrapper vent cowl curtain kit, Free factory start-up for installations within a 100-mile radius of a Hobart service office; installation beyond 100 miles will be charged at the quoted rate by the local Hobart service office
c. Provide unit with the following:
1) CLPS66EN-BASHTE15K Electric tank heat 15kW
2) (Item No. 46.1) CLPS66EN-BASERH30K 30kW electric booster
3) (Item No. 46.2) Drain tempering water
4) (Item No. 46.3) Blower Dryer, Hobart Model No. BDERLAX-STDDOM
5) (2 each) VNTHD/E-ADJ E-series vent hood domestic (adjustable)
6) CLPS66EN-BASELE0CD 480v/60/3-ph
7) Single Point (1) service connection.
8) CLPS66EN-BASHGTSTD Standard height
9) CLPS66EN-BASDIR0RL Right to left operation
10) CLPS66EN-BASFETSTD Standard feet
11) Hobart water softener.
12) PRESREG-1/20BR 1/2" brass pressure regulator – Standard with built-in booster heater models. Regulator must be installed before the booster (built-in or remote), as the water temperature to the regulator must not exceed 140F
13) CLE/TBL-SWITCH Table limit switch CLE-Series
14) Standard height, domestic, Blower Dryer Electric, 208/60/3 R-L
d. Products manufactured by Jackson & Meiko, modified to comply with specifications, are acceptable.

47. SOILED DISHTABLE
a. Atlanta Custom Fabricator
b. Provide fabricated, stainless steel, Soiled Dish Table, size and shape as shown on Drawings. Verify height and set up table to allow liquids to flow into pre-rinse Sink or dishwasher. Provide side and rear crossrails as shown on Elevation Drawings.

c. Provide unit with the following:
   1) Provide Soiled Dish Table with an 8” high backsplash where table is against wall. Seal table to wall. On operator’s side of Soiled Dish Table, provide a 3” high raised rim with rolled edge.
   2) Extend countertop into openings toward Dining Room where shown on Drawings. Counter to have a marine edge on Dining Room side to prevent spills. Close ends and notch counter to fit opening. On the dining room side, provide a 16-gauge stainless steel enclosure apron down to floor under the edge. Seal all crevices with NSF approved polysulphate clear sealant. Provide 16 gauge stainless steel pass window frame size and shape as shown on plan and details. Frame to be clam shell type.
   3) Where shown on Drawings, there shall be a pre-rinse sink. Cut-out waste to accommodate collar adapter of Disposer, Item No. "48". Over throat opening of disposer fabricate and install a removable stainless steel conical cover. Cover to set on stainless steel bands and have 2” clearance for waste to enter. Diameter to overlap throat opening by 1”. Weld Sink collar adapter of Item No 48, to cut-out for disposer mounting, similar to Model No. CC650, manufactured by Atlanta Custom Fabricators. Provide removable stainless steel rack guide flush with top.

d. (Item No. 47.1) Pre-Rinse Faucet Assembly, T&S BrassModel No. B-0133-CR-B08SK, EasyInstall Pre-Rinse Unit, 8" wall mount, quarter-turn cerama cartridges with check valves, lever handles, EasyInstall 18" riser, 44" flexible stainless steel hose, 1.07 GPM JeTSpray valve with swivel (B-0108), 6" wall bracket, 1/2" NPT male inlets, installation kit (B-0230-K), low lead, NSF
e. B-0230-K Installation Kit, (2) 1/2" NPT nipples, lock nuts & washers, (2) short "Ell" 1/2" NPT female x male
f. Products manufactured by Chicago Faucet and Fisher, modified to comply with specifications, are acceptable.

48. DISPOSER
   a. InSinkErator Model No. SS-200-7*C013
   b. Disposer Package, sink mount system, 6-5/8" diameter inlet, with #7 collar adaptor for sink installation, 2 HP motor, stainless steel construction, includes syphon breaker, (2) solenoid valves, (2) flow control valves, removable splash baffle, stainless steel sink stopper, programmable AquaSaver® Control Center AS-101 with water-saving technology, automatic water saving function, auto reversing, timed run, post flush, adjustable leg kit
   c. Provide unit with the following:
      1) (Item No. 48.1) Control panel, Model No. AS101K
      2) SYPHON STD Syphon breaker, 1/2" (11477).
   d. Omit vacuum breaker and provide B0455-04, manufactured by T &S Brass and Bronze Works.
   e. Products manufactured by Hobart & Salvajor, modified to comply with specifications, are acceptable.

49. SPARE NUMBER

50. HOSE REEL
   a. T&S Brass Model No. B-7242-01*C013
   b. Hose Reel System, open, 3/8" x 50' hose with high flow blue spray valve, with

ratcheting system & adjustable hose bumper, epoxy coated steel

c. 0RK2 Shut-Off Control Valve, 6" long, adjustable wall flange, polished chrome cross handle, blue index, includes: (2) bushings 1/2" male x 3/8" female NPT, rough brass body, 1/2" female NPT, ADA Compliant, ANSI, NSF
d. (2 each) B-CVV1-2 Check Valve, 1/2" NPT female, vertical
e. B-0512 Concealed Mixing Faucet, 4-arm handles, 3/8" NPT inlets & outlets, 3" centers
f. 0RK-SK Hose Reel Connector Kit, 18" riser, 36" flexible water connector hose, vacuum breaker, stainless steel quick disconnect, 1/2" female NPT elbow, 3/8" NPT, NSF
g. General-purpose w/ old standard high flow spray valve
h. Products manufactured by Chicago Faucet and Fisher, modified to comply with specifications, are acceptable.

51. HAND SINK
    a. Advance Tabco Model No. 7-PS-80*C013
    b. Hand Sink, wall-mounted, 14" wide x 10" front-to-back x 5" deep bowl, 20 gauge 304 stainless steel, splash mounted faucet, lever drain with overflow, P-trap, soap & towel dispenser, wall bracket, NSF, cCSAus
    c. Provide unit with the following:
        1) K-316-LU Wrist Handles Only, (1 pair hot & cold 4" long blades).
        2) 7-PS-17 Welded Side Splash, 7-3/4"H (installed height), both sides, splash mounted faucets.
    d. Products manufactured by Eagle & IMC/Teddy, modified to comply with specifications, are acceptable.

52. TRAY DRYING
    a. Channel Manufacturing Model No. ATDR-3*C013
    b. Tray Drying Rack, Mobile Drying Rack, 63"W x 30"D x 60"H, Aluminum Construction, 1.5" Slots, (3) shelves, (40) slots per shelf, 5" x 2" Stem Casters model # CSI5X1.5PU, NSF.
    c. Products manufactured by Metro & Nexel, modified to comply with specifications, are acceptable.

53. SPARE NUMBER

54. UTILITY CART
    a. Lakeside Manufacturing Model No. 243*C013
    b. Utility Cart, 2-shelf with 36"W x 22"D x 40-5/8"H, shelf size 33"W x 21"D, stainless steel tubular U-frame, 20 gauge stainless steel shelves with reinforced edges, 500 lb. capacity, 21-1/2" shelf clearance, push handle on each short side, 5" non-marking cushion thread swivel casters, NSF.
    c. Provide unit with the following:
        1) Casters, 5", all swivel, No-Mark, cushion tread.
    d. Products manufactured by New Age & PVI, modified to comply with specifications, are acceptable.

55. HAND SINK
    a. Advance Tabco Model No. 7-PS-80*C013
    b. Hand Sink, wall mounted, 14" wide x 10" front-to-back x 5" deep bowl, 20 gauge 304 stainless steel, splash mounted faucet, lever drain with overflow, P-trap, soap & towel dispenser, wall bracket, NSF, cCSAus

c. Provide unit with the following:
   1) K-316-LU Wrist Handles Only.
   2) 7-PS-17 Welded Side Splash, 7-3/4"H (installed height), both sides, splash mounted faucets.
d. Products manufactured by Eagle & Inc/Teddy, modified to comply with specifications, are acceptable.

56. WORKTABLE
   a. Atlanta Custom Fabricator
   b. Provide fabricated, stainless steel Work Table, size and shape as shown on Drawings. Provide one drawer and undershelf. Reference Seet 2/QF701; Foodservice Elevations.
   c. All sides to have rolled edge. Refer to Drawing for typical tabletop construction details.
   d. Reference the listing of approved fabricators in Section 2. 2; Fabrication of this specification.

57. PASS-THRU REFRIGERATOR
   a. Delfield Model No. GARPT1P-SH*C013
   b. Refrigerator, Pass-Thru, one-section, 23.0 cubic feet capacity, top-mounted self-contained refrigeration system, (4) half-height hinged solid doors (locking), (3) adjustable chrome wire shelves, 4.3" easyTouch® screen temperature display/control with remote monitoring, LED interior lighting, stainless steel exterior front, sides & interior, (4) 5" locking casters, GreenGenius™ R290 Hydrocarbon refrigerant, NEMA 5-15P, NSF, cULus.
   c. Provide unit with the following:
      1) Door hinged on right standard (Thermometer side)
      2) Door hinged on left standard (Rear)
      3) (11 pair) G263-CTM-0033 TS2 - 12"x20" pan or 18" x 26" pan bottom support (per section)
      4) Set of (4) 5" locking casters.
   d. Products manufactured by Traulsen & Victory, modified to comply with specifications, are acceptable.

58. PASS-THRU HEATED CABINET
   a. Delfield Model No. GAHPT1-SH*C013
   b. Heated Cabinet, Pass-Thru, one-section, 23.0 cubic feet capacity, (4) half-height hinged solid doors (locking), (3) adjustable chrome wire shelves, 4.3" easyTouch® screen temperature display/control with remote monitoring, incandescent interior lighting, stainless steel exterior front, sides & interior, (4) 5" locking casters, NEMA 6-20P, NSF, cULus.
   c. Provide unit with the following:
      1) Door hinged on right (Thermometer side).
      2) Door hinged on right (Rear).
      3) (Front - top) Half-height solid doors.
      4) (Front - bottom) Half-height solid doors.
      5) (Rear - top) Half-height solid doors.
      6) (Rear - bottom) Half-height solid doors.
      7) (11 pair) G263-CTM-0038 TS2-H - 12"x20" pan or 18" x 26" pan bottom support, for Heated Cabinet (per secion).
      8) Set of (4) 5" locking casters.
   d. Products manufactured by Traulsen & Victory, modified to comply with

specifications, are acceptable.

59. ICE MAKER
    a. Hoshizaki Model No. KM-520MAJ*C013
    b. Ice Maker, Cube-Style, 22"W, air-cooled, self-contained condenser, production capacity up to 556 lb/24 hours at 70°/50° (480 lb AHRI certified at 90°/70°), stainless steel finish, crescent cube style, R-404A refrigerant, NSF, UL.
    c. Provide unit with the following:
        1) H9320-51 Water Filtration System, single configuration, 18.4" H (manifold & cartridge)
        2) (Item No. 59.1) Ice Bin, Hoshizaki Model No. B-500SF, Ice Bin, 30"W, top-hinged front-opening door, 500-lb ice storage capacity, for top-mounted ice maker, stainless steel exterior, painted legs included, protected with H-GUARD Plus Antimicrobial Agent, ETL, ETL-Sanitation.
        3) Scoop Holder, San Jamar Model No. SI2000BK, Saf-T-Ice® Scoop Caddy, 9-1/8"W x 8"D x 11-3/10"H, accommodates ice scoops up to 86 ounces, self-closing hinged lid, crowned bottom, dishwasher safe, mounting hardware included, HDPE plastic, black, NSF
    d. Products manufactured by Manitowoc & Scotsman, modified to comply with specifications, are acceptable.

60. SPARE NUMBER

61. SPARE NUMBER

62. SPARE NUMBER

63. MILK COOLER
    a. Beverage Air Model No. ST34NS*C013
    b. Milk Cooler, cold wall, normal temperature, 34"W x 31-1/4"D x 41-1/8"H, 12.37 cu. ft., dual access, flat top carton capacities, (8) 13" x 13" x 11" or (4) 19" x 13" x 11 case capacities, self-latching doors/lids with safety bumpers, cylinder lock, wire floor racks, electronic control, auto defrost, stainless steel interior & exterior, R290 Hydrocarbon refrigerant, cULus, UL EPH Classified, UL-Sanitation.
    c. Provide unit with the following:
        1) Self-Contained refrigeration.
        2) 4" Heavy duty casters, (2) with brakes.
    d. Products manufactured by True & Continental, modified to comply with specifications, are acceptable.

64. HOT FOOD COUNTER
    a. Delfield Model No. SH-5-NU
    b. Hot Food Serving Counter, Electric, 5-pan capacity, 14-gauge stainless steel top, 18-gauge stainless steel exterior, 14-gauge galvanized bottom, enclosed base with no under storage, 5" swivel casters, 1/2" drain(s) for hot food wells plumbed to common valve

c. Provide unit with the following:
   1) E-74 Work Shelf, 10" fold-down, stainless steel
   2) DCFSFS FlexiShield™ Food Shield, flexible, single tier, converts to (3) positions; full service or (2) self service, glass ends, 1" stainless steel legs with flanged feet, (fully assembled), available in 1" increments up to 96" long, priced per linear inch, cUL, UL, NSF
   3) DCFSHHL Narrow halogen heatlamp with Xenon lights, per linear inch
   4) DCFHL 54" Radiant heat lamp with switch, per linear inch
   5) 34" height
   6) F Line-Up Interlock Device
d. Products manufactured by Advance Tabco, LTI, Inc., or pre-approved fabricator, modified to comply with specifications, are acceptable.

65. COLD FOOD COUNTER
a. Delfield Model No. SCSC-60-BP
b. Cold Food Serving Counter, 52" x 21.62" x 7" deep Bloomington style cold pan, drain with valve, reinforced stainless steel enclosed base, 5" casters, self-contained refrigeration, R290 Hydrocarbon refrigerant, 1/4 HP, cUL, UL, NSF
c. Provide unit with the following:
   1) 34" height
   2) F Line-Up Interlock Device
   3) E-60 Work Shelf, 10" fold-down, stainless steel
   4) DCFSFS FlexiShield™ Food Shield, flexible, single tier, converts to (3) positions; full service or (2) self service, glass ends, 1" stainless steel legs with flanged feet, (fully assembled), cUL, UL, NSF
   5) DCFSLED LED ight, per linear inch
d. Products manufactured by Advance Tabco, LTI, Inc., or pre-approved fabricator, modified to comply with specifications, are acceptable.

66. UTILITY COUNTER
a. DelfieldModel No. SC-50-NU
b. Solid Top Serving Counter, 50" long, 14 gauge stainless steel counter top, enclosed base, 5" swivel casters, NSF
c. Provide unit with the following:
   1) F Line-Up Interlock Device
   2) E-50 Work Shelf, 10" fold-down, stainless steel
   3) DCFSFS FlexiShield™ Food Shield, flexible, single tier, converts to (3) positions; full service or (2) self service, glass ends, 1" stainless steel legs with flanged feet, (fully assembled), available in 1" increments up to 96" long, priced per linear inch, cUL, UL, NSF
   4) DCFSHHL Narrow halogen heatlamp with Xenon lights, per linear inch
d. Products manufactured by Advance Tabco, LTI, Inc., or pre-approved fabricator, modified to comply with specifications, are acceptable.

67. CASH REGISTER COUNTER
a. Delfield Model No. SCS-30
b. Cashier Counter, 30" deep, stainless steel top, locking cash drawer, shelf, & base, 5" swivel casters, NSF

c. Provide unit with the following:
   1) SG7-D Ferruled holes, 3" diameter (each)
   2) Q-2 115/15A outlet with 10A breaker
   3) F Line-Up Interlock Device
d. Products manufactured by Advance Tabco, LTI, Inc., or pre-approved fabricator, modified to comply with specifications, are acceptable.

68. POINT OF SALE
   a. By Owner

69. TRAY SLIDE
   a. Atlanta Custom Fabricator
   b. Provide fabricated 16-gauge, stainless steel inverted "V" tray slide. Tray Slide to be size and shape as shown on drawings.
   c. Unit to be mounted on low wall in front of serving counter.

70. HAND SINK
   a. Advance Tabco Model No. 7-PS-80*C013
   b. Hand Sink, wall-mounted, 14" wide x 10" front-to-back x 5" deep bowl, 20 gauge 304 stainless steel, splash mounted faucet, lever drain with overflow, P-trap, soap & towel dispenser, wall bracket, NSF, cCSAus
   c. Provide unit with the following:
      1) K-316-LU Wrist Handles Only, (1 pair hot & cold 4" long blades).
      2) 7-PS-17 Welded Side Splash, 7-3/4"H (installed height), both sides, splash mounted faucets
   d. Products manufactured by _ & _, modified to comply with specifications, are acceptable.

PART 3 - EXECUTION

3.1 DEMONSTRATION AND INSTRUCTION MANUALS

A. At a time as designated by the Architect or Owners, demonstrate the operation, care, and minor maintenance of the equipment supplied. Supply the Architect with an affidavit signed by the Owners or Foodservice Manager/Director that this service was rendered and performed.

B. At the start of the operation, devote one full working day monitoring all equipment operation. The purpose of this day is to ensure equipment is in proper working order at the start.

C. Submit copies before final punch list. Submit to Owners at time of demonstrations two digital copies (flash drive, CD, or alternate digital device) containing:
   1. Instructions.
   2. Warranties.
   3. Parts list of all bought out items provided under this Section.
   4. List of names, addresses, and telephone numbers of local authorized servicing agencies.
   5. The videos are to show and detail the proper care and maintenance of equipment.

3.2 FIELD MEASUREMENTS

A. Field measurements shall be made, giving due consideration to any Architectural, Mechanical, or Structural discrepancies which may occur during the construction of the building. No extra

compensation shall be allowed for any difference between actual dimensions secured at the job site and the measurements indicated on the Contract Drawings.

B. Any differences that may be found during field measurements shall be submitted to the Architect for consideration before proceeding with the fabrication or supplying of any equipment.

3.3 INSTALLATION

A. Dispose of all packaging and debris per Construction Waste Management Plan.

B. Make arrangements for receiving equipment and make delivery into the building. Do not consign any equipment to the Owners or any other Contractor unless written acceptance from them and satisfactory arrangements have been made for the payment of freight and all handling charges.

C. Deliver all equipment into the building, uncrate, assemble, level and repair any damaged or abraded surfaces. Set equipment temporarily in its final locations, permitting the mechanical and electrical trades to take the necessary measures for the connection of the service lines; then move the equipment sufficiently to allow the installation of such service lines. After which realign equipment level and plumb, making the final erection as shown on the Contract Drawings. All equipment shall be installed so as to eliminate objectionable vibration.

D. The Contractor shall have a competent Foodservice Equipment foreman on the premises to assist in furnishing information and supervising the installation of Foodservice Equipment under this Section. This foreman shall verify the correct locations for Rough-Ins.

3.4 LUBRICATION - OIL AND GREASE

A. Each moving part in the entire food facilities installation shall be provided with suitable bearings with provision for greasing, or with grease gun connections suited to a high-pressure gun for distributing heavy oil or light grease. Points of lubrication shall be readily accessible.

END OF SECTION 114000

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SECTION 114100 – FOOD STORAGE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All work included under this Section is subject to Architect's provisions covering: Invitation to Bid, Proposal Form, Instructions to Bidders, General Conditions, and all other Supplementary General Conditions as may be added.

1.2 SCOPE OF WORK

A. All equipment specified to be delivered to the job site, uncrated, freight prepaid, assembled, and set in the proper area, where shown on Drawings, ready for final connections, where required, as specified in Divisions 22 0000 and 260000 and this Section of Contract Documents.

1.3 DESCRIPTION

A. The extent of the Walk-In Cold Storage and Refrigeration Systems is on the Drawings, Equipment Schedule, and Specifications of this Section of Contract Documents.

B. The plans indicate the location of the equipment. Slight changes due to the varying dimensions of equipment and wall construction will be permitted with approval by Architect.

C. This typed Specification will be closely correlated with the Drawings and Schedule. Each complements the other, and cross-reference will be necessary to fulfill the requirements of the Specifications. All information shown on Drawings and listed in Schedules will be incorporated as part of the written Specifications.

D. Conflict in Plans and Specifications where changes, alterations, additions, or deductions are necessary or where exceptions are taken, with regard to sizes, locations, and other details shown on Plans shall be reported in writing for decision by the Architect.

E. Responsible for seeing that the equipment can be entered through openings before doors and walls are finished.

F. A competent Walk-In Equipment foreperson shall be on the premises to assist in furnishing information to proper trades-persons on the project and supervising of Walk-In Unit installation under this Section.

1.4 QUALITY ASSURANCE

A. Permits and Certificates: All laws, codes, ordinances, and regulations bearing on the conduct of the work as drawn and specified to comply, and will give all notices required. Any work upon which an Inspection Certificate by local authorities and any governing body is required, such as Inspections certificate or certificates, will be obtained and be paid for.

B. All accessories shall be provided, whether specified or not, with equipment to comply with all governing codes.

C. Class I Panel: Manufacturer of pre-fabricated Walk-In Unit shall provide the unit with approved Class I Panels. The approved Manufacturer complying with Class 1 panel construction is

Thermokool. Compliance with this test includes a full corner testing of the Manufacturer's constructed panels. Pre-Approved Kolpak, American Panel and Bally

D. Walk-In Unit manufacturer complying with Paragraph 1.4, C, will submit Sample of Panel certification with submittals for verification.

E. Walk-In manufacturer will have received UL Seal of Approval and Factory Mutual's test approval for low CFC foam construction, and Manufacturer will submit a sample of approved Certificates for verification.

1.5 REFERENCES

A. The Drawings indicate the desired necessary arrangement and dimensions of the equipment. Minor deviations may be substituted for approval provided basic requirements are met, and no major rearrangement of service to the equipment is required to affect the proposed alteration; such deviations will be made without expense to the Owner.

B. At no expense to the Architect or Owner, Operational and functional tests of the installed equipment are required. Defects or deficiencies noted as a result of tests will be corrected to the satisfaction. Consult the Mechanical and Electrical connections Drawings and their accompanying specifications to determine additional requirements for the installation of the specified unit.

C. Verify with Mechanical and Electrical plans for electrical voltages, cycles, phases, and special requirements before ordering equipment.

1.6 SUBMITTALS

A. Specification Section 114000 – Foodservice Equipment, Part 1, General; 1.7 Submittals

1.7 HANDLING AND STORAGE

A. Protect metal finishes from damage during shipping, storage, handling, installation, and construction of other work in the same spaces. Wrap and crate each item of equipment as needed for protection from damage.

B. Cover exposed stainless steel surfaces with a self-adhesive protective paper of a type recommended by the metal manufacturer, and do not remove until work is installed and ready for cleaning and start-up.

1.8 SCHEDULING

A. Schedules and Reports: Establish the earliest and latest job site delivery dates of Owner furnished and Contractor installed items.

1.9 WARRANTIES

A. Walk-In Cooler/Freezer Unit will be guaranteed for ten years after the final approval of Architect, against poor workmanship and defective materials. Any defect within this period will be corrected at no charge to the Owner.

B. Compressors and coils will have a 1-year free service on parts and labor warranty and guarantee, and an additional 4-year warranty on the compressors.
1. On extended compressor warranty, only labor charges after the first year shall be paid.

C. Assign extended warranties to Owners at the end of the first year on all equipment having more than one year warranty from the Manufacturer.

PART 2 - PRODUCTS

2.1 WALK-IN COOLER/FREEZER UNIT

A. Furnish pre-fabricated, NSF-approved metal-clad Walk-In Cooler/Freezer Units. Size and shape, as shown on Drawings. Unit to be 8' -6" high.

B. As shown on Drawings, the Cooler/Freezer Unit shall be partitioned into compartments, size, and shape as designed.

2.2 MATERIALS

A. Walk-In floors:
1. Walk-in Cooler/Freezer floor is to be installed on the floor in the kitchen, as detailed on Drawings. Floor to quarry tile. Reference QF601; Foodservice Cooler/Freezer Details.

B. Insulation shall be of 4-inch thick "Foamed-In-Place" polyurethane. The Door will have the same type of insulation.

C. Exterior shall be of .040-gauge pebble embossed aluminum. Where units are adjacent to walls or columns, there shall be provided a matching trim to close spaces between the wall(s) and unit. All crevices are to be sealed with clear polysulfide sealant. Furnish a matching panel to the fastening area between the top of the unit and ceiling with a removable access panel for the required maintenance service on top of the unit.

D. Interior walls and ceiling will be of .40 gauge pebble embossed aluminum. Ceiling to be finished with baked white polyester on panels.

E. Door:
1. The Door will be a silliness-in fitting type or flush-mounted. Door to be metal clad with 22 gauge Type 304 stainless steel, with smooth corner seams. The bottom edge to contain an adjustable rubber wiper gasket. The Door will have heater cables in the Door jamb to prevent condensation and frost formation. The door hinge will be the self-closing type with lift-cam hinges. The Door will be provided with a safety release inside latch. Door to be supplied with hardware for locking with a padlock. Doorjamb and outer door edge surfaces shall be constructed of stainless steel. Plastic composition material shall not be accepted.
2. Provide at each three-hinged Door one set of polyester reinforced swinging doors, Model No. PP-C-080-3678-IP, manufactured of clear extruded vinyl with rounded edges, manufactured by Curtron Products, a Division of TMI, LLC. Products manufactured by Kason, modified to comply with specifications, are acceptable. The curtains shall be suitable for applications with temperatures as low as -40 degrees F and shall be made to properly fit over the entrance door opening. Swinging doors shall be supported on sides of the Door opening with mounting hardware on the inside of sections.
3. Provide 14 x 14 inch heated triple-pane observation window type with closed air spaces between panes. Windows shall be removable for easy replacement. Each Door shall be provided with an observation window.
4. Provide a door with an adjustable hydraulic door closer. Mount door closer on the exterior side of the Door. Adjust the closing speed at installation as required.
5. Walk-in monitor system with panic switch, motion detector, battery backups, dry contacts

and thermostatically controlled heater wires
6. (2 each) 36" high 1/8" aluminum treadplate kickplates and jamp guards with impact plates.
7. (2 each) pressure relief vents.
8. Enclosure panel with removable access panels.

F. Gaskets: All panel sections to be furnished with PVC compression gaskets. Tape or plain sealant not acceptable.

G. Lights will be LED type and provided with a break-proof and shatterproof guard. Provide each Section with flush-mounted light switches on the outside of Section.
1. The light fixture shall be Model LED48X62221N, manufactured by Component Hardware. Light fixtures shall be UL listed for wet and damp areas. UL listings dated 1991. Light fixtures manufactured by Lithonia Lighting, Hubbell Lighting, Inc, and Kason, which comply with specifications, are acceptable.
2. The fixture will be capable of withstanding temperatures as low as -40 degrees F and be provided with a shatterproof enclosure cover. Provide the following quantities.
   a. Cooler: Three fixtures, plus standard light over the Door.
   b. Freezer: Three fixtures plus, standard light over the Door.
3. Occupancy sensor motion detection light switch

H. Thermometer to be a minimum of 2-1/2 inch diameter and flush-mounted on outside of each Section and have a rust-resistant case.

2.3 CONDENSER AND EVAPORATOR UNIT

A. The length of the refrigeration line runs between each condensing unit and evaporator coil to be verified and confirmed with the Manufacturer before installation.

B. Provide unit with at least the following components:
1. Heavy-gauge housing for outside use.
2. Scroll motor compressor for Cooler Section with built-in overload protection.
3. Aluminum-finned, copper tube air-cooled condenser with direct driven condenser fan, arranged for horizontal airflow.
4. Refrigerant receiver with inlet, outlet, purge, relief and charging valves.
5. Suction and discharge line vibration eliminators.
6. Defrost controls.
7. Low-ambient pressure and starting controls.
8. Safety operating controls.

C. Safety controls will include:
1. High pressure cut-out with manual reset.
2. Magnetic control for the motor-compressor with ambient compensated manual reset overloads.
3. Operating control to be automatic recycling, low-pressure cut-out switch. A low ambient control system will be fully automated and will not require auxiliary heat or heated receivers.
4. Each Section is to be provided with a high-temperature alarm. Each alarm is to have a dry contact for wiring to a central or remote control point.

D. Each evaporator Unit to be supported on a metal angle iron frame constructed as part of the condensing unit. Propeller-fan, free delivery type, arranged for horizontal airflow. The evaporator coil will be of copper tube, aluminum-finned constructions housed in a heavy-gauge aluminum casing.

1. (Item No. 4) Walk-In Freezer: (Item No. 4.1) RE6E137DDA / (Item No. 4.2) RFO150E4SEANT
2. (Item No. 5) Walk-In Cooler: (Item No. 5.1) RE6A104ADA / (Item No. 5.2) RFO500L4SEANT

E. The balanced Refrigeration Systems for the specified Walk-In Unit's Sections will be capable of maintaining the required temperature for each Section as follows:
   1. Cooler 34 degree F to 38 degrees F
   2. Freezer -10 degree F to 0 degrees F

F. Reference Drawing sheet QF200 for Electrical Service.

G. Specialty Items:
   1. Provide a system with the following Specialty Items:
      a. Refrigerant sight glass and moisture indicator.
      b. Hermetically-sealed refrigerant-filter dehydrator.
      c. Liquid solenoid valve.
      d. Thermostatic expansion valve.
      e. Heat exchanger.
      f. Suction strainer and Armaflex insulation for suction line - complete.
   2. Condensate drain lines shall be of Type "L" copper tubing in Walk-In Unit, and directed to outside of the unit, into Floor Drain, where shown on Drawings. Provide condensate drain lines directed to the lowest possible level. Wrap all condensate drain lines in the freezer section with electrically heated cable tape.
   3. Run pipes through walls and ceiling panels in sleeves. All refrigerator sleeves shall be furnished as part of the installation. All plugs and cut-outs shall be fully resealed.
   4. A thermostat will control temperatures in refrigerated rooms mounted at each evaporator unit to close the liquid solenoid valve on a fall in room temperature, for automatic recycling pump-down and shut off of the condensing unit. The thermostat and solenoid valve circuit shall be connected to terminals in the evaporator unit casing.

H. The refrigeration system of the walk-in cooler/freezer will be equipped with a Eco-Smart demand frost electronic control system mounted to the evaporator coils. The system will be custom-designed for the walk-in coolers and freezer to control an exltric expansion valve in response to evaporator superheat and return air temperature

I. No power wiring is required between evaporator coils.

J. Demand defrost will be the default method for the system for freezers, off-cycle will be the default defrost method for coolers.

K. The room temperature range will be -40^{o}F to 80^{o}F. Medium temperature application is pre-set at 35^{o}F cut-out with air defrost. Low-temperature application is pore set at-10^{o}F cut -out room temperature with demand and defrost. The cut-in temperature differential is 5^{o}F by default. These setpoints can be field set at the job site if different settings are desired.

L. Approved Alternates: Heatcraft, KE2 Therm, and Master-Bilts Master Controller

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide on-site operational and functional testing of specified equipment. Testing and initial operation of this equipment will be supervised by a qualified representative of the balanced refrigeration system manufacturer. Defects or deficiencies will be corrected to the satisfaction of the Architect or Owner at the expense of the Contractor.

B. Certificate shall be filed with Architects certifying that equipment is operating based on MManufacturer's recommendations. Coordinate the performance of these services, and both the Manufacturer's representative and Contractor shall sign a certificate.

C. On completion of installation and testing, remove all packaging and debris from the site, clean all items of equipment as recommended by Manufacturer and leave equipment ready for use by the Owner.

D. Refrigeration Systems package shall be set on a pad located where shown on Architectural Drawings. Verify location from Drawings.

E. Provide junction boxes, one for each unit section, as shown on Drawings to connect service for lights and heater cable. Project Electrician will make connections from electric panels to control panel on compressors and to respective junction boxes.

F. Provide control wiring between evaporator units, compressor units, and related control items. All wiring shall be run in EMT (Electric Metallic Tubing). All wiring will be of type TW copper. Wiring and conduits sizing shall conform to the requirement of The State of North Carolina Electric Code. All conduits inside of units shall be of the "Seal-Tite" type.

G. Conduits, wiring, and refrigerant lines will be concealed within walls, ceilings, and floors of the building.

END OF SECTION

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SECTION 116143 - STAGE CURTAINS

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. Stage curtains.
2. Draw-curtain tracks.
3. Non-operable tracks.
4. Curtain rigging.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product and the following:

1. Tracks: Capability of each track to support the weight and operation of curtains that it supports.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and attachment details of curtains.
2. Include fabric assembly and hanging details.
3. Dimension operating clearances.
4. Include documentation of capacity of each batten, track, attachment, and rigging component to support loads.
5. Points of attachment for proscenium curtain and the corresponding static and dynamic loads imposed on structure.

C. Samples for Verification: Full width by minimum 12-inch-long section of each fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of fabric.

D. Delegated-Design Submittal: For stage-curtain systems and attachments to structure, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which tracks, battens, and other stage-curtain equipment will be attached.
2. Locations of lighting fixtures and cabling, ductwork, piping, and sprinklers.

B. Qualification Data: For Installer and professional engineer.

C. Product Certificates: For the following, from manufacturer:

1. Fabric: Provide name of flame-retardant chemical used, identification of applicator, treatment method, application date, allowable life span for treatment, and details of any restrictions and limitations.
2. Rigging: Compliance of suspended battens and tracks with requirements.

D. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For stage curtains and rigging to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Firm experience in provision of systems similar in complexity to that of the requirements of the project, and meet the following:

1. No less than ten years' experience with equipment and systems of the specified types under the same business name.
2. Experience with at least five comparable scale projects within the last two years.
3. Employs only fully trained stage riggers and mechanics for the erection of stage equipment.
4. The stage riggers will be completely familiar with the type of equipment to be installed. A competent and knowledgeable Job Superintendent will always be on the job when work is in progress.
5. Installation will be supervised by an ETCP certified rigger.
6. Maintain a fully staffed and equipped service facility.
7. Contractor shall attend pre-installation meetings to coordinate with other trades as required.

1.8 FIELD CONDITIONS

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

B. Field Measurements: Verify locations of supporting structural elements and construction contiguous with stage curtains and rigging by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 STAGE-CURTAIN SYSTEMS

A. Description: Complete stage-curtain systems, including stage curtains, tracks, and rigging; with necessary accessories for support and operation.

B. Source Limitations: Engage a single specialty firm to fabricate and install stage curtain systems. Each color, grade, finish, type, and variety of fabric shall be the product of a single manufacturer, from single source with resources to provide materials of consistent quality in appearance and physical properties. Confirm qualifications of available specialty firms including, but are not limited to, the following:

1. Georgia Stage.
2. Greenville Stage Equipment Company.
3. Iweiss.
4. MainStage
5. Northeast Stage.
6. Rose Brand
7. Stage Craft Industries.
8. QSD, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stage-curtain systems, including comprehensive engineering analysis and attachments to building structure, using performance requirements.

B. Structural Performance: Stage-curtain systems and attachments to structure shall withstand the effects of gravity and operational loads and the following loads and stresses:

1. Design Loads: Weight of curtains

C. Fire-Test-Response Characteristics: Provide stage curtains meeting the following requirements as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Flame-Propagation Resistance: Passes NFPA 701.

    a. Permanently attach label to each fabric of curtain assembly indicating whether fabric is inherently and permanently flame resistant or is treated with flame-retardant chemicals and whether it requires retreatment after cleaning or after a designated time period of use.
    b. Permanently attach 12-inch-square swatch of same fabric and dye lot for each fabric of a curtain assembly to the back of assembly for use as fire-resistance test strip.

2.3 CURTAIN FABRICS

A. General: Provide fabrics inherently and permanently flame resistant or chemically flame resistant by immersion treatment according to performance requirements indicated. Provide fabrics of each type and color from same dye lot.

B. Polyester Velour, Proscenium and Valence: Napped fabric of 100 percent polyester weighing not less than 22 oz./linear yd., with pile height approximately 75 mils; inherently and permanently flame resistant; 54-inch minimum width.

1. Basis of Design: Provide product indicated on Finish Legend or comparable product by one of the following:

    a. Dazian LLC.
    b. JB Martin Company.
    c. KM Fabrics, Inc.
    d. Milliken & Company.

2. Color/Texture/Pattern: As indicated by manufacturer's designations.

C. Polyester Velour, Back: Napped fabric of 100 percent polyester weighing not less than 15 oz./linear yd., with pile height approximately 75 mils; inherently and permanently flame resistant; 54-inch minimum width.

1. Basis of Design: Provide product indicated on Finish Legend or comparable product by one of the following:

    a. Dazian LLC.
    b. JB Martin Company.
    c. KM Fabrics, Inc.
    d. Milliken & Company.

2. Color/Texture/Pattern: As indicated by manufacturer's designations.

2.4 LINING

A. Polyester Lining: 100 percent polyester fabric; inherently and permanently flame resistant; 66-inch minimum width; 12 oz. per linear yard,color as selected from manufacturer’s full range.

1. Basis of Design: Georgia Stage Liner-Tex IFR.

2.5 CURTAIN-BOTTOM WEIGHTS

A. Provide one of the following as standard with manufacturer:

1. Individual Weights: Curtain manufacturer's standard segmented weights to suit each curtain type and location.
2. Proof Coil Chain: Grade 30, No. 8, zinc plated, 3/16 inch, ASTM A413/A413M.
3. Weight Tape: Curtain manufacturer's standard, continuous weight tape to suit each curtain type and location.

2.6 CURTAIN FABRICATION

A. General: Affix permanent label, stating compliance with requirements of authorities having jurisdiction, in accessible location on fabric not visible to audience. Provide vertical seams unless otherwise indicated. Arrange vertical seams so they do not fall on faces of pleats. Do not use fabric cuts less than one-half width. Orient velour fabric with the fabric nap down.

B. Vertical and Top Hems: Machine sew hems as follows unless otherwise indicated:

1. Vertical Hems: Minimum 2 inches wide,with not less than a 1-inch tuck and with no selvage material visible from front of curtain. Sew open ends of hems closed.
2. Turnbacks: Provide leading- and trailing-edge turnbacks for traveler curtains, formed by folding back not less than 12 inches of face fabric, with not less than a 1-inch tuck, and vertically secured by sewing.
3. Top Hems: Reinforced by double-stitching 3-1/2-inch-wide, heavy, jute or laminated synthetic webbing to top edge on back side of curtain with not less than 2 inches of face fabric turned under.

C. Fullness:

1. 50 Percent Fullness: Provide fullness, exclusive of turnbacks and hems, by sewing additional material into 3-inch double-stitched, flat, box pleats spaced at 12 inches o.c. along top hem reinforcement.

D. Grommets: Brass, No. 3, or No. 4.

1. Black Curtains: Provide brass or aluminum grommets with black finish.
2. Pleated Curtains: Center grommets on each box pleat and place 1 inch from corner of curtain; for snap hooks or S-hooks.

E. Bottom Hems: Machine sew hems as follows unless otherwise indicated:

1. For Curtains with Fullness: Provide weights in bottom hem as standard with manufacturer:

2. Floor-Length Curtains: Hems not less than 6 inches deep, with 1-inch weight tape sewn to top seam of the bottom hem, clear of the finished bottom edge, and with open ends of hems sewn closed.

    a. Floor-Length Curtains: Hems not less than 6 inches deep, with individual weights in individual closed pockets sewn above finished bottom edge of curtain, and with open ends of hems sewn closed.
    b. Floor-Length Curtains: Hems not less than 6 inches deep; with separate, interior, 100 percent cotton, heavy canvas chain pockets equipped with proof coil chain; with chain pockets sewn so that chain rides 2 inches above finished bottom edge of curtain; and with open ends of hems sewn closed.

3. Lining: For proscenium and valence, provide lining for curtain in same fullness as face fabric and finished 2 inches shorter than face fabric. Sew or otherwise securely attach lining to top hem of face fabric. Attach lining to face fabric alongside seams with 4-inch-long strips of heavy woven cotton tape.

F. Valence: Center lettering on valence and sew fringe to bottom hem.

2.7 CURTAIN ACCESSORIES

A. S-Hooks: Manufacturer's standard heavy-duty plated-wire hooks, not less than 2 inches long.

2.8 STEEL CURTAIN TRACK

A. Provide steel track and accessories manufactured specifically for theatrical use, sized to support weight of curtain and operation specified.

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

1. H & H Specialties.
2. Automatic Devices.

C. Steel Track: Roll-formed, galvanized, commercial-quality, zinc-coated steel sheet, ASTM A653/A653M; G60 coating designation; with continuous bottom slot and with each half of track in one continuous piece; black paint finish; complete with necessary accessories for support and operation.

1. Steel Thickness: As recommended by manufacturer for loads and operation.

    a. Heavy Duty: Minimum 0.079 inch.
    b. Medium Duty: Minimum 0.064 inch.

D. Clamp and Bracket Hangers: Steel clamps and brackets of sufficient strength required to support loads for attaching track to overhead support.

E. Track-Lap Clamp: Metal to match track channel for attaching two tracks at center overlap.

F. Heavy-Duty Track System: Equip track with heavy-duty components as recommended by manufacturer for loads and operation. Provide end stops for track.

1. Curtain Carriers: Standard carriers of plated steel with a pair of nylon or neoprene-tired ball-bearing wheels riveted parallel to body. Equip carriers with rubber or neoprene bumpers to reduce noise, and heavy-duty, plated-steel swivel eye and trim chain for attaching curtain snap or S-hook. Provide quantity of curtain carriers sufficient for track length, to suit curtain fabrication.

a. Master Curtain Carriers: One master carrier, for each leading curtain edge, of plated steel with two pairs of nylon or neoprene-tired ball-bearing wheels and with two line guides per carrier.

2. Pulleys: One dead-end, single-wheel pulley; one live-end, double-wheel pulley; and one adjustable pulley to maintain proper tension on operating line; each with not less than 5-inch molded-nylon- or glass-filled-nylon-tired ball-bearing sheaves enclosed in steel housings. Provide pulleys with steel housing finished to match track and with bracket for securing off-stage curtain end.

G. Medium-Duty Track System: Equip track with components as recommended by manufacturer for loads and operation. Provide end stops for track.

1. Curtain Carriers: Standard carriers of plated steel with a pair of nylon or neoprene wheels riveted parallel to body. Equip carriers with plated-steel swivel eye for attaching curtain snap or S-hook. Provide quantity of curtain carriers sufficient for track length, to suit curtain fabrication.

a. Master Curtain Carriers: One master carrier, for each leading curtain edge, of plated steel with two pairs of nylon or neoprene wheels and with two line clamps per carrier.

2. Pulleys: One dead-end, single-wheel pulley; one live-end, double-wheel pulley; and one adjustable pulley to maintain proper tension on operating line; each containing guarded ball-bearing sheaves enclosed in steel housings. Provide pulleys with steel housing finished to match track and with bracket for securing off-stage curtain end.

2.9 NON-OPERABLE TRACK

A. Provide steel or aluminum track and accessories manufactured specifically for theatrical use, sized to support weight of curtain.

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

1. H & H Specialties.
2. Automatic Devices.
3. Silent Gliss.

C. Application: Rear of platform, wall or ceiling mount with channel to secure curtain at floor level.

2.10 CURTAIN RIGGING

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

1. Automatic Devices Company.
2. Peter Albrecht Corp.
3. ETC.
4. J.R.Clancy.
5. H&H Specialties.

B. Battens: Fabricated from steel pipe with a minimum number of joints. Connect pipe at joints with a drive-fit pipe sleeve not less than 18 inches long, and secure with four flush rivets, plug welds, threaded couplings, or another equally strong method.

1. Steel Pipe: ASTM A53/A53M, Grade A, standard weight (Schedule 40), black, NPS 1-1/2 nominal diameter unless otherwise indicated.
2. Finish: Shop painted black, with a 1-inch-wide yellow stripe at center of each batten.

C. Supports, Clamps, and Anchors: ASTM A153/A153M, Class B, galvanized sheet steel in manufacturer's standard thicknesses, galvanized after fabrication.

D. Trim and Support Cable: 1/4-inch-diameter, 7x19 galvanized-steel cable with a breaking strength of 7000 lb. Provide fittings according to cable manufacturer's written instructions for size, number, and method of installation, including a drop-forged galvanized turnbuckle to allow for leveling.

E. Trim and Support Chain: ASTM A391/A391M, Grade 80, hardened alloy steel chain rated for overhead lifting.

F. Inserts, Bolts, Rivets, and Fasteners: Manufacturer's standard corrosion-resistant units.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for supporting members, blocking, installation tolerances, clearances, and other conditions affecting performance of stage-curtain work.

B. Examine inserts, clips, blocking, or other supports required to be installed by others to support tracks and battens.

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

3.2 INSTALLATION, GENERAL

A. Install stage-curtain system according to curtain and track manufacturer's written instructions and approved, sealed, Shop Drawings.

3.3 BATTEN INSTALLATION

A. Install battens by suspending at heights indicated with trim and supports spaced to support load, except do not exceed 10 feet between supports.

1. Cable Trim and Support: Secure cables either directly to structures or to inserts, eye screws, or other devices that are secure and appropriate to substrate and that are not subject to deterioration or failure with age or elevated temperatures. Attach other cable end to pipe clamps with turnbuckles, housed or fixed with nuts after adjustment, to prevent loosening.
2. Chain Trim and Support: Secure chain with load-rated terminations.

3.4 TRACK INSTALLATION

A. Batten-Hung Track: Install track by suspending from pipe batten with manufacturer's track clamp hangers attached to batten pipe clamps at track-support spacing, according to manufacturer's written instructions.

B. Track-Support Spacing: According to manufacturer's recommendations for applied loads, but not exceeding the following dimensions between supports:

1. Heavy-Duty Track: 72 inches.
2. Medium-Duty Track: 48 inches

C. Install track for center-parting curtains with not less than 24-inch overlap of track sections at center, supported by track lap clamps.

3.5 CURTAIN INSTALLATION

A. Track Hung: Secure curtains to track carriers with S-hooks.

END OF SECTION 116143

SECTION 116623 - GYMNASIUM EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Safety pads.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include assembly, disassembly, and storage instructions for removable equipment.

B. Shop Drawings: For gymnasium equipment.

   1. Include plans, elevations, sections, and attachment details.

C. Samples for Verification: For the following products:
   1. Pad Fabric: Wall padding minimum 3 inches square, and corner and column Samples minimum 3 inches long, with specified treatments applied. Mark face of material.

1.4 INFORMATIONAL SUBMITTALS

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For gymnasium equipment to include in operation and maintenance manuals.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify position and elevation of floor inserts and layout for gymnasium equipment.

PART 2 - PRODUCTS

2.1 SAFETY PADS

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

1. Draper Inc.
2. Performance Sports Systems.
3. Porter Athletic Equipment Company.

B. Pad Coverings: Provide safety pad fabric covering fabricated from puncture- and tear-resistant, not less than 14-oz./sq. yd PVC-coated polyester or nylon-reinforced PVC fabric treated with fungicide for mildew resistance; with fire-retardant-treated filler.

C. Wall Safety Pads: Padded wall wainscot panels designed to be attached in a continuous row; each panel section consisting of fill laminated to backer board with visible surfaces fully covered by seamless fabric covering, free of sag and wrinkles and firmly attached to back of backer board.

1. Backer Board: Not less than 3/8-inch-thick plywood, mat formed, or composite panel plywood per AWPA C27, Interior Type A.
2. Fill: Multiple-impact-resistant foam not less than 2-inch-thick bonded polyurethane, 6.0-lb/cu. ft. density.
3. Size: Each panel section, manufacturer's standard dimensions.
4. Number of Panel Sections: As indicated modular panel sections.
5. Installation Method: 1-inch top and bottom fabric attachment flange with exposed fasteners.
6. Fabric Covering Color(s): Single color as selected by Architect from manufacturer's standard colors.

D. Column Safety Pads: Pads covering exposed flange of columns to height indicated, consisting of filler matching wall pads, covered on both sides and all edges by fabric covering with backer board and manufacturer's standard anchorage to column.

E. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

F. Pad Coverings: Provide safety pad fabric covering that is fabricated from puncture- and tear-resistant, PVC-coated polyester or nylon-reinforced PVC fabric, minimum 14-oz./sq. yd. and treated with fungicide for mildew resistance; with surface-burning characteristics indicated.

G. Cutout Trim: Manufacturer's standard flanged cutout trim kits for fitting pads around switches, receptacles, and other obstructions.

2.2 MATERIALS

A. Softwood Plywood: DOC PS 1, exterior.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for court layout, alignment of mounting substrates, installation tolerances, operational clearances, and other conditions affecting performance of the Work.

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

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions.

B. Install gymnasium equipment after other finishing operations, including painting, have been completed unless otherwise indicated.

3.3 INSTALLATION OF SAFETY PADS

A. Mount with bottom edge at 4 inches above finished floor.

B. Cutout Trim: Limit cuts in face of padding so that cuts are securely and fully concealed behind trim-kit flange.

END OF SECTION 116623

SECTION 116823 – EXTERIOR BASKETBALL EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Basketball equipment.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include assembly, disassembly, and storage instructions for removable equipment.

B. Samples for Verification: For the following products:

1. Basketball Net: Full size.

1.5 INFORMATIONAL SUBMITTALS

A. Setting Drawings: For embedded items and cutouts required in other work.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For basketball equipment to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify position of basketball backboard.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace structural components of basketball equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Lifetime.

2. Exclusions: Rim and padding.

PART 2 - PRODUCTS

2.1 BASKETBALL EQUIPMENT

A. Basis-of-Design Product: Subject to compliance with requirements, provide Signature Series MVP from Goalsetter Systems, Inc. or comparable product by one of the following:

1. Basketball Products International.
2. Bison, Inc.
3. Draper, Inc.
4. IPI by Bison.
5. Performance Sports Systems.
6. Porter Athletic Equipment Company.
7. Spalding.

B. Source Limitations: Obtain from single source from single manufacturer.

C. Protruding fasteners or exposed bolt heads on front face of backboards are not permitted.

D. Connections: Manufacturer's standard connections or connections recommended in writing by manufacturer and complying with Section 055000 "Metal Fabrications" of size and type required to transfer loads to building structure.

E. Ground-set Backstops:

1. Offset Type: Manufacturer's standard assembly.
2. Safe Play Zone: Varies from 48 to 51 inches depending on height of goal.
3. Framing: 6- by 6-inch steel, 3/16-inch thick, designed to minimize vibration during play.

a. Center-Mast Frame: Welded and bolted or clamped with side sway bracing.
b. Finish: Manufacturer's standard polyester powder-coat finish.

4. Goal Height Adjuster: Adjustable from 6 to 10 feet to top of ring with gear-drive mechanism, locking in any position within adjustment range, with visible height scale attached to side of framing.

    a. Manual operation with detachable crank handle.

F. Basketball Backboards: Mounted on 1-1/2-inch by 1-1/2- inch structural steel frame.

1. Shape and Size:Rectangular, 72 by 42 inches width by height.
2. Material: Acrylic: 1/2 inch, clear.
3. Provide with predrilled holes or preset inserts for mounting goals, and as follows:
4. Direct Mount: Designed for mounting backboard frame to center mast of backstop, to maximize stress relief on backboard frame and glass.
5. Target Area and Border Markings: Marked in orange, with manufacturer's standard pattern and stripe width.

G. Basketball Goals: Basket ring complete with flanges, braces, attachment plate, and evenly spaced loops welded around underside of ring.

1. Single-Rim Basket Ring Competition Goal: Materials, dimensions, and fabrication per manufacturer's standard design.
2. Type:Fixed, Nonmovable.
3. Net Attachment: No-tie loops for attaching net to ring without tying.
4. Finish: Polyester powder-coat finish.

H. Basketball Nets: 12-loop-mesh net, between 15 and 18 inches long, sized to fit ring diameter, and as follows:

1. Cord: Made from white nylon.

2.2 MATERIALS

A. Steel: Material types, alloys, and forms recommended by manufacturer for type of use and finish indicated.

B. Anchors, Fasteners, Fittings, and Hardware: Gymnasium equipment manufacturer's standard corrosion-resistant or noncorrodible units; concealed; tamperproof, vandal- and theft-resistant design.

C. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight concrete with minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch-maximum-size aggregate.

2.3 IRON AND STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a

minimum dry film thickness of 2 mils. Comply with coating manufacturer's written instructions for pretreatment, applying, and baking.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for court layout, alignment of mounting substrates, installation tolerances, operational clearances, and other conditions affecting performance of the Work.

1. Verify critical dimensions.

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

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions and approved Shop Drawings.

B. Post and Footing Excavation: Excavate holes for posts and footings as indicated in firm, undisturbed or compacted subgrade soil.

C. Post Set with Concrete Footing: Comply with Section 033000 "Cast-in-Place Concrete" for measuring, batching, mixing, transporting, forming, and placing concrete.

1. Set equipment posts in concrete footing. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at the correct angle, alignment, height, and spacing.

a. Place concrete around posts and vibrate or tamp for consolidation. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

2. Embedded Items: Follow equipment manufacturer's written instructions and drawings to ensure correct installation of anchorages for equipment.

D. Permanently Placed Equipment: Install rigid, level, plumb, square, and true; anchored securely in concrete footing; positioned at locations and elevations indicated; and aligned with court layout.

E. Removable Gymnasium-Equipment Components: Assemble in place to verify that equipment and components are complete and in proper working order.

END OF SECTION 116823

SECTION 123583 – MUSIC INSTRUMENT STORAGE CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Storage cabinets for music instruments, uniforms and sheet music.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 COORDINATION

A. Coordinate installation of laboratory casework with installation of laboratory equipment.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Confirm composite wood products contain no added urea formaldehyde.

B. Shop Drawings: For music instrument storage cabinets.

1. Include plans, elevations, sections, and attachments to other work including blocking and reinforcements required for installation.
2. Indicate types and sizes of casework.
3. Indicate manufacturer's catalog numbers for casework.
4. Show fabrication details, including types and locations of hardware.
5. Indicate locations of and clearances from adjacent walls, doors, windows, other building components.

C. Samples: For casework finishes and materials requiring color selection.

D. Delegated Design Submittal: For music instrument storage cabinets indicated to comply with seismic performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and installer.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish complete touchup kit for each type and color of casework finish provided. Include fillers, stains, finishes, and other materials necessary to perform permanent repairs to damaged laboratory casework finish.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer that produces cabinets of types indicated for this Project similar to the basis of design product with a minimum of five years' experience and successful installations in projects of similar design and extent.

B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install music instrument storage cabinets until building is enclosed, utility roughing-in and wet-work are complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Established Dimensions: Where cabinets indicated to fit to other construction, establish dimensions for areas where casework is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

C. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before enclosing them, and indicate measurements on Shop Drawings.

1.10 WARRANTY

A. Special Warranty: Manufacturer's written warranty indicating manufacturer's intent to repair or replace components of music education storage casework that fail in materials or workmanship within 10 years from date of Substantial Completion. Failures are defined to include, but are not limited to, the following:

1. Fracturing or breaking of casework components including doors, panels, shelves, or hardware resulting from normal wear and tear and normal use other than vandalism.
2. Delamination or other failures of glue bond of components.
3. Warping of casework components not resulting from leaks, flooding, or other uncontrolled moisture or humidity.

4. Failure of operating hardware.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain music instrument storage cabinets from single source from single manufacturer unless otherwise indicated.

B. Provide the basis of design product or approved substitute.

C. Substitutions: Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time period allowed for substitution review:

a. Product data, including certified independent test data indicating compliance with requirements for acoustical performance.
b. Samples of each type of product specified, including but not limited to the following:

1) Door and casework panels.
2) Grille doors.
3) Hinges with through-bolting hardware.
4) Latches with through-bolting hardware.

c. Project references: minimum of 5 installations not less than 5 years old, with owner contact information.
d. List of successful installations of similar products available for evaluation by Architect.
e. Sample warranty.

2. Approved manufacturers shall meet separate requirements of Submittals.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Music instrument storage cabinet installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Design earthquake spectral response acceleration, short period (Sds) for Project is indicated on Drawings.

2. Component Importance Factor: 1.0.

B. Storage Casework Component Load Capacities:

1. Storage Casework Wire-Grille Door Hinge: Each weld capable of resisting 400 lbf (1779 N) pull test without visible damage or permanent deformation.

2. Storage Casework Full Grille Door Hinge= Full length door capable of supporting 315 lbs (143 kg). Through open and close cycle without permanent damage.
3. Robe and Uniform Storage Casework Garment Hanger Rods: Capable of supporting vertical load applied uniformly along width of unit of 200 lbf (890 N).
4. Music Library Storage:
    a. Floor point load for a 7-shelf unit at rated load is 800 psi (5516 kpa) per caster.
    b. Floor point load for a 6-shelf unit at rated load is 700 psi (4826 kpa) per caster.

2.3 MUSIC INSTRUMENT STORAGE CABINETS

A. Basis of Design: UltraStor Storage Cabinets as manufactured by Wenger Corporation. Modular instrument storage casework with integral bases, adjustable levelers, and through-bolted fastening, enabling owner reconfiguration of unit layout.

1. Acoustically enhanced instrument storage casework finished with interior lining of sound-absorbent material providing sound absorption and noise reduction properties.
2. Sound Absorption Average: Minimum SAA of 0.80, based upon sound absorption coefficient for twelve one-third octave bands from 200 to 2500 Hz, inclusive, with a minimum Noise Reduction Coefficient (NRC) of 0.75, per ASTM C 423 and ASTM E 795.
3. Acoustical Performance: Comply with manufacturer's published sound absorption data.
4. Wave grille doors in 5/16 inch (24 mm) and 1/4 inch (6.4 mm) diameter designed to reduce vibration.
5. Adjustable shelf system integrated into cabinet walls allowing shelf placement at increments common to musical instruments. No loose parts or tools required. Shelf system to include a latch to prevent unintended shelf movement.

B. Product Designations:

1. Drawings indicate sizes, configurations, and finish materials of music instrument storage cabinets by referencing designated manufacturer's catalog numbers. Other manufacturers' casework of similar sizes and door and drawer configurations, of same finish materials, and complying with the Specifications may be considered.

C. Side Panels and Divider Panels: Particleboard thermoset panel with no urea formaldehyde added, 3/4 inch (19 mm) thick. Side panels machined to accept unit-to-unit through-bolting.

D. Grille Doors: Bright basic steel wire, 5/16 and 3/16 inch (7.9 and 4.8 mm) diameter, or 5/16 and 1/4 inch (7.9 and 6.3 mm) diameter for AcoustiCabinets, with full 360 degree welds at T-joints.

E. Panel Doors: Particleboard thermoset panel with no urea formaldehyde added, 3/4 inch (19 mm) thick.

1. Panel Edge Banding: 3 mm thick, heat-bonded, with radiused and profiled edges and corners.

F. Shelving: Sized with adequate gap between shelving and casework side panels to allow air movement inside casework.

1. Up to 27 inches (686 mm) wide: Removable molded polyethylene shelf, with impact-resistant, radiused front edge, mounted to cabinet wall with self-locking clip.
2. Over 27 inches (686 mm) wide: For large instrument casework: Removable formed polyethylene shelf, ribbed, with high-impact-resistant, radiused front edge, supported by steel tube frame.
3. Tubular steel supports are included for shelves over 19 inches (483 mm) wide.

G. Corner cabinet revolving shelving: 0.053 inch (1.3 mm) min. thickness steel sheet bolted to revolving steel center post, with radiused hardboard deflector panel.

H. Flag Storage and Garment Ring: 5/16 inch (8 mm) diameter steel rod bolted to steel center post with 10 gauge steel brackets.

I. Flag Storage Bottom Shelf Pad: Carpet pad, adhered to steel shelf.

J. Filler Panels and Closure: 3/4 inch (19 mm) thick particleboard thermoset panels with no urea formaldehyde in Oyster color. Provide the following, cut to fit field conditions, where indicated:

1. Wall filler between cabinet side and wall.
2. Top filler between cabinet top and wall.
3. Top of cabinet closure panel between cabinet and finished ceiling or soffits.

K. Finished back panel for exposed cabinet backs.

2.4 CABINET HARDWARE

A. Butt Hinges: 2-3/4 inches (70 mm), 5-knuckle steel hinges made from 0.090 inch (2.29 mm) thick metal, ANSI/BHMA A156.9, Grade 1, with powder-coated finish, through-bolted to door and side panels and welded to grille door frames. Provide 2 hinges on compartment doors, and 4 hinges on full-height doors.

B. Slide Latch: 0.105 inch (2.67 mm) min. thickness steel, with padlock eye, powder-coat finish, through-bolted to panel door and side panel and welded to grille door frames. Latches securely without padlock. Provide with clear plastic label holder for use with standard size labels; number system available for user to print. Padlocks

2.5 MUSIC LIBRARY STORAGE CABINETS

A. Basis of Design: Music Library System as manufactured by Wenger Corporation.

1. Standard Width 7-Shelf Unit: 173G700 S, 16 inches (41 cm) wide; 12 inches x 34-1/2 inches x 10-1/2 inches (30 x 88 x 27 cm) of shelf space available; 4 shelves adjustable, 3 shelves fixed.
2. Oversized Width 7-Shelf Unit: 173G700 O, 19 inches (48 cm) wide; 15 inches x 34-1/2 inches x 10-1/2 inches (38 x 88 x 27 cm) of shelf space available; 4 shelves adjustable, 3 shelves fixed.

3. Standard Width 6-Shelf Unit: 173G600 S, 16 inches (41 cm) wide; 12 inches x 34-1/2 inches x 10-1/2 inches (30 x 88 x 27 cm) of shelf space available; 4 shelves adjustable, 2 shelves fixed.
4. Oversized Width 6-Shelf Unit: 173G600 O; 19 inches (48 cm) wide; 15 inches x 34-1/2 inches x 10-1/2 inches (38 x 88 x 27 cm) of shelf space available; 4 shelves adjustable, 2 shelves fixed.

B. Design and Construction:

1. Pull-out design, equally spaced shelves provide 10-1/2 inches (27 cm) of available height per shelf.
2. Units are constructed of 3/4 inch (19 mm) thick industrial grade composite wood with no added formaldehyde and polyester laminate finish in Wenger standard colors.
3. Shelves are reinforced with an aluminum extrusion that includes a slot with vinyl material for labeling with dry-erase markers.
4. Frame is 16-gauge, 1 inch (2.54 cm) square tubular steel, painted black.
5. Back panel is designed to fit on either side of unit for left or right hand use.
6. Includes four 8 inch (20 cm) diameter casters.
7. Each unit contains bumpers for control of side and outward movement.
8. Unit requires anchoring to floor and wall.
9. Each shelf rated at 100 lbs. (45 kg) maximum capacity.
10. Ten-year warranty.
11. Top closure, constructed particleboard that matches the end covers, supports up to 50 lb/lin.ft. (74 kg/m) loading.
12. Oblique file system accessory on standard 12 inch (30 cm) shelf widths.
13. Lock option (padlocks not included).

2.6 MATERIALS

A. Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.

B. Hardwood Plywood: HPVA HP-1, particleboard core except where veneer core is indicated.

C. Softwood Plywood: DOC PS 1.

D. Particleboard: ANSI A208.1, Grade M-2, manufactured without added urea formaldehyde.

E. MDF: Medium-density fiberboard, ANSI A208.2, Grade 130.

F. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.
1. Source Limitations: Obtain from single source from single manufacturer.

G. PVC Edgebanding for Plastic Laminate: Rigid PVC extrusions, through color with satin finish, 3.0 mm thick at doors and drawer fronts, 1.0 mm thick elsewhere.

H. Thermally Fused Laminate Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

1. Edgebanding for Thermally Fused Laminate (TFL) Panels: PVC or polyester edgebanding matching thermally fused laminate panels.

I. Polyethylene Shelves: High-density, one-piece, blow-molded or polyethylene, with radiused front edge, for abuse-resistant shelves. Same color throughout will not show scratches.

1. PVC Edge Banding: Radiused PVC extrusions, 1/8 inch (3 mm) thick.

2.7 FABRICATION

A. Panel Connectors: 1/4-20 by 1.77 inch (45 mm) panel connectors, with steel thread inserts, powder coated to match panels.

B. Cabinet Levelers: Leveling glides with 3/8 inch (9.5 mm) diameter threaded steel rod in steel corner brackets, minimum two each per cabinet side, accessible from within unit, and concealed in completed installation.

C. Carcass joinery includes lag screws powder coated to match substrate.

D. Back panel 7/32 inch (5.6 mm) reinforced with 3/4 inch (19 mm) stretchers panels held in a dado groove and lag screwed in place.

E. Fasteners: Manufacturer-recommended fasteners as required for casework substrate and project performance requirements, consisting of one or more of the following:

1. Sheet Metal Screws: SAE J78, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
2. Wood Screws: ASME B18.6.1.
3. Expansion Anchors in Concrete and Concrete Masonry Units: Carbon-steel, zinc plated.
4. Hardware supplied to anchor the cabinets to the wall and to adjacent casework

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Grade: Install cabinets in accordance with manufacturer’s written instructions and approved Shop Drawings.

B. Install cabinets level, plumb, and true in line; shim as required using concealed shims. Where cabinets abut other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

C. Install hardware uniformly and precisely. Set hinges snug and flat in mortises unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.

D. Adjust operating hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.3 CLEANING

A. Repair or remove and replace defective work as directed on completion of installation.

B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION 123550

SECTION 123653 - LABORATORY COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Epoxy Laboratory countertops.

B. Related Requirements:
   1. Section 064116 "Plastic Laminate-Clad Architectural Cabinets."

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

   1. Show locations and details of joints.

C. Samples: For each type of countertop-material finish, in manufacturer's standard sizes.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and fabricator.

B. Product Test Reports:
   1. Countertop Surface Material: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory countertop surface material with requirements specified for chemical and physical resistance.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that produces countertops material indicated for this Project that has been tested for compliance with SEFA 8 W.

B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

C. Installer Qualifications: Fabricator of countertops.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

PART 2 - PRODUCTS

2.1 COUNTERTOP MATERIALS

A. Epoxy: Factory-molded, modified epoxy-resin formulation with smooth, nonspecular finish.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Durcon Incorporated.
      b. LOC Scientific.
   2. Physical Properties:
      a. Flexural Strength: Not less than 10,000 psi.
      b. Modulus of Elasticity: Not less than 2,000,000 psi.
      c. Hardness (Rockwell M): Not less than 100.
      d. Water Absorption (24 Hours): Not more than 0.02 percent.
      e. Heat Distortion Point: Not less than 260 deg F.
   3. Chemical Resistance: Epoxy-resin material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
      a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.
      b. Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).
   4. Color: Black.

2.2 COUNTERTOPS

A. Countertops, General: Provide units with smooth surfaces in uniform plane, free of defects. Make exposed edges and corners straight and uniformly beveled. Provide front and end overhang of 1 inch.

B. Epoxy Countertops:
   1. Countertop Fabrication: Fabricate with butt joints assembled with epoxy adhesive and concealed metal splines.

a. Flat Configuration: 3/4 inch thick with continuous drip groove on underside 1/2 inch from overhang edge.

1) Edges and Corners: Rounded.
2) Backsplash: Integral coved.

b. Construction: Uniform throughout full thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of the Work.

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

3.2 INSTALLATION OF COUNTERTOPS

A. Comply with installation requirements in SEFA 2. Abut top and edge surfaces true in plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints where indicated on Shop Drawings.

B. Field Jointing: Where possible, make in same manner as shop-made joints, using dowels, splines, fasteners, adhesives, and sealants recommended by manufacturer. Shop prepare edges for field-made joints.

C. Fastening:
1. Secure epoxy countertops to cabinets with epoxy cement, applied at each corner and along perimeter edges at not more than 48 inches o.c.
2. Where necessary to penetrate countertops with fasteners, countersink heads approximately 1/8 inch and plug hole flush with material equal to countertop in chemical resistance, hardness, and appearance.

D. Provide scribe moldings for closures at junctures of countertop, curb, and splash with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.

E. Dress joints smooth, remove surface scratches, and clean entire surface.

F. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

3.3 CLEANING AND PROTECTING

A. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

B. Protect countertop surfaces during construction with 6-mil plastic or other suitable water-resistant covering. Tape to underside of countertop at a minimum of 48 inches o.c.

END OF SECTION 123653

SECTION 123661.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.
4. Solid surface material apron fronts.
5. Solid surface material countertops.
6. Solid surface window sills.
7. Solid surface material bench tops.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

C. Samples for Initial Selection: For each type of material exposed to view.

D. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.
2. One full-size solid surface material countertop, with front edge and backsplash, 8 by 10 inches, of construction and in configuration specified.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.

1. Build mockup of typical countertop as shown on Drawings as part of cabinet mockup.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.8 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.

1. Subject to compliance with requirements, provide product indicated on Finish Schedule or comparable product by one of the following:
   a. DuPont de Nemours, Inc.; Corian.
   b. Formica;
   c. Hanwha Surfaces.
   d. Transolid;
   e. Wilsonart;
2. Type: Provide Standard type unless Special Purpose type is indicated.
3. Integral Sink Bowls: Comply with CSA B45.5/IAPMO Z124.

4. Colors and Patterns: As indicated by manufacturer's designations.

B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Custom.

B. Configuration:

1. Front: Straight, slightly eased at top with separate apron, 6 inches high, recessed 1/4-inchbehind front edge.
2. Backsplash: Straight, slightly eased at corner.
3. End Splash: Matching backsplash.

C. Countertops: 3/4-inch-thick, solid surface material with front edge built up with same material.

D. Backsplashes: 1/2-inch-thick, solid surface material.

E. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.

F. Joints: Fabricate straight countertops 8 feet or less in length without joints. Otherwise, fabricate countertops in sections for joining in field, with joints at locations indicated on Shop Drawings.

1. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.

G. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.

2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

H. Provide plywood subtops if countertops do not have adequate support from base cabinets.

2.3 WINDOWSILL FABRICATION

A. Fabricate windowsills according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Premium.

B. Sills: Not less than 1/2-inch-thick, solid surface material, and as indicated on Drawings.

C. Configuration: As indicated on Drawings.

D. Joints: Fabricate windowsills without joints, except where width of opening exceeds length of available materials.

E. Subsills: Plywood, exterior grade, 3/4 inch thickness, unless otherwise indicated on Drawings.

2.4 BENCH TOP FABRICATION

A. Fabricate bench top according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Premium.

B. Bench tops: Not less than 3/4-inch-thick, solid surface material, and as indicated on Drawings.

C. Configuration: As indicated on Drawings.

D. Joints: Fabricate bench tops without joints, except where width of bench exceeds length of available materials.

E. Subtops: Plywood, exterior grade, 1-1/4 inch thickness, unless otherwise indicated on Drawings.

2.5 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

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

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

D. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

E. Secure windowsills to subsills with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match windowsill, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

1. Install windowsills level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

F. Secure bench tops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match bench tops, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

1. Install bench tops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

G. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Install metal splines in kerfs in countertop edges at joints where indicated. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

H. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

I. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

J. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

K. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.16

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. This Section includes the following site and street furnishings:
   1. Benches.
   2. Precast Garden Benches
   3. Garden Planters
   4. Bicycle racks.
   5. Trash receptacles
   6. Flag Pole

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, field-assembly requirements, and installation details.

B. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Size: Not less than 6-inch- long linear components and 4-inch- square sheet components.

C. Product Schedule: For site and street furnishings. Use same designations indicated on Drawings.

D. Material Certificates: For site and street furnishings, signed by manufacturers.
   1. Wood Preservative Treatment: Include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
   2. Sustainably Harvested Wood: Include certification by manufacturer and from sources that participate in sustained yield programs.
   3. Recycled plastic.

E. Maintenance Data: For site and street furnishings to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of site and street furnishings through one source from a single manufacturer.

1.5 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. Bench Replacement Slats: Not less than two full-size units for each size indicated.
   2. Trash, Recycling Receptacle Inner Containers: Full-size units equal to 5 percent of amount installed for each size indicated, but no fewer than 2 units.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the following:
   1. Benches:
      a. 72” Palisade bench - backless
         Exterior grade non-finished,
         Woodgrain: Domestically sourced Thermally Modified Ash
         Landscape Forms (or approved equal)
         431 Lawndale Avenue, Kalamazoo MI, 49048 (800-521-2548)

   2. Precast Concrete Garden Benches
      a. Galet Series Concrete benches -Urbastyle by Wausau Tile
         Model and Quantity: GL.01 (1), GL.03 (1), GL.04 (2), GL.05 (1), GL.06 (2)
         Finish: Weatherstone
         Color: W30 Star
         Wausau Tile (or approved equal)
         9001 Bus. Hwy 51 Rothschild, WI 54474 (800-388-8728)

   3. Garden Planters
      a. 1500 Series Formed Steel planter
         Size: 18”x54”x18”
         Finish: Gloss Powder coated
         Color: To be selected from Manufacturer standard colors
         Maglin Site Furniture (or approved equal)
         999 18th Street, Suite 3000 Denver, CO (800-716-5506)

   4. Bicycle Racks:
      a. Ride Bicycle rack
         Finish: Polyester powder coated
         Color: Black
         Landscape Forms (or approved equal)
         431 Lawndale Avenue, Kalamazoo MI, 49048 (800-521-2548)

   5. Trash Receptacles:
      a. Plexus Litter Receptacle
         Finish: Powder coated Metal – Gloss Color: Black
         Landscape Forms (or approved equal)
         431 Lawndale Avenue, Kalamazoo MI, 49048 (800-521-2548)

6. Flag Pole:
   a. Architectural Series Internal halyard flag pole: Model EC25IH
   b. Finish: Satin
   a. Exposed Height: 25ft
   b. Overall Length: 28ft
   c. Diameter: 6” butt and 3.5” top
   d. Wall thickness: .188”
   e. Wind Speed: 120+ MPH flagged, 222 MPH un-flagged
   f. Mounting Device: galvanized steel foundation sleeve

   American Flagpole & Flag Co. (or approved equal)
   Lake Elmo, MN 55042. ASD. Toll Free
   Tel: (800) 426-6235. Fax (651) 777-1925.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; free from surface blemishes and complying with the following:
   1. Rolled or Cold-Finished Bars, Rods, and Wire: ASTM B 211.
   2. Extruded Bars, Rods, Wire, Profiles, and Tubes: ASTM B 221.
   3. Structural Pipe and Tube: ASTM B 429.
   4. Sheet and Plate: ASTM B 209.

B. Steel: Free from surface blemishes and complying with the following:
   1. Plates, Shapes, and Bars: ASTM A 36/A 36M.
   2. Steel Pipe: Standard-weight steel pipe complying with ASTM A 53, or electric-resistance-welded pipe complying with ASTM A 135.
   3. Tubing: Cold-formed steel tubing complying with ASTM A 500.
   4. Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A 513, or steel tubing fabricated from steel complying with ASTM A 569/A 569M and complying with dimensional tolerances in ASTM A 500; zinc coated internally and externally.
   5. Sheet: Commercial steel sheet complying with ASTM A 569/A 569M.
   6. Perforated Metal: From steel sheet not less than [0.0747-inch] [0.0897-inch] [0.1196-inch] nominal thickness; manufacturer's standard perforation pattern.
   7. Expanded Metal: From carbon-steel sheets, deburred after expansion, and complying with ASTM F 1267.

C. Stainless Steel: Free from surface blemishes and complying with the following:
   1. Sheet, Strip, Plate, and Flat Bars: ASTM A 666.
   2. Pipe: Schedule 40 steel pipe complying with ASTM A 312/A 312 M.
   3. Tubing: ASTM A 554.

D. Wood: Surfaced smooth on four sides with eased edges; kiln dried, free of knots, solid stock of species indicated.
   1. Ash (Fraxinus Spp): Clear grade.

E. Plastic: Color impregnated, color and UV-light stabilized, and mold resistant.

1. Polyethylene: Fabricated from virgin plastic HDPE resin.
2. Recycled Polyethylene: Fabricated from not less than 96 percent recycled, purified, fractional-melt plastic resin for not less than 90 percent recycled postconsumer waste by weight content HDPE.

F. Anchors, Fasteners, Fittings, and Hardware: Stainless steel ; commercial quality; tamperproof, vandal and theft resistant; concealed, recessed, and capped or plugged. Provide as required for site and street furnishings' assembly, mounting, and secure attachment.
1. Angle Anchors: For inconspicuously bolting legs of site and street furnishings to on-grade substrate; extent as indicated on Drawings.
2. Antitheft Hold-Down Brackets: For securing site and street furnishings to substrate; two per unit

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

H. 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. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer for exterior applications.

I. Galvanizing: Where indicated for steel and iron components, provide the following protective zinc coating applied to components after fabrication:
1. Zinc-Coated Tubing: External, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, polymer film. Internal, same as external or consisting of 81 percent, not less than 0.3-mil- thick, zinc pigmented coating.
2. Hot-Dip Galvanizing: According to ASTM A 123/A 123M, ASTM A 153/A 153M, or ASTM A 924/A 924M.

2.3 BENCHES

A. Frame: Cast iron

B. Wood Seat and Back: formed from evenly spaced parallel slats.

C. Arms: None.

D. Arm Material: Match frame.

E. Arm Height: As indicated on Drawings.

F. Seat Height: As indicated on Drawings.

G. Overall Height: As indicated on Drawings.

H. Overall Width: As indicated on Drawings.

I. Overall Depth: As indicated on Drawings. Consider retaining first paragraph below to help specify quality. When comparing similar products made from the same materials, heavier units often provide better quality. See Evaluations.

J. Seat Surface Shape: Contoured or dished.

K. Unit Configuration: As indicated on Drawings.

L. Assembled Configuration: As shape indicated on Drawings.

M. Installation Method: Anchored at finished grade to substrate indicated on Drawings.

N. Wood Finish: Manufacturer's standard finish.
1. Stain: Manufacturer's standard.

2.4 BICYCLE RACKS

A. Frame: Steel.
1. Tubing OD: Not less than 1-1/2 inches

B. Style: As indicated on Drawings.

C. Overall Height: As indicated on Drawings.

D. Overall Width: As indicated on Drawings.

E. Overall Depth: As indicated on Drawings.

F. Capacity: Designed to accommodate not less than two bicycles.

G. Security: Designed to lock wheel and frame.

H. Installation Method: Surface flange anchored at finished grade to substrate indicated on Drawings.

I. Steel Finish: Polyester Powder coated.
1. Color: Black.

J. Stainless-Steel Finish: Satin No. 4.

2.5 FABRICATION

A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.

B. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.

C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

D. Steel and Iron Components: Galvanized, galvanized and color coated, or color coated. Bare metal steel or iron components are not permitted.

E. Preservative-Treated Wood Components: Complete fabrication of treated items before treatment if possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces.

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

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

2.6 FINISHES, GENERAL

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

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester-TGIC, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

2.8 STEEL AND GALVANIZED STEEL FINISHES

A. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester-TGIC, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

B. PVC Finish: Manufacturer's standard, UV-light stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added; complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness.

2.9 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

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.

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 and street furnishings, where required.

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

C. Install site and street furnishings level, plumb, true, and [securely anchored] [positioned] 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. Posts Set into Voids in Concrete: Form or core-drill holes for installing posts in concrete to depth recommended in writing by manufacturer of site and street furnishings and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

F. 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 or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

3.3 CLEANING

A. After completing site and street furnishing installation, inspect components. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component.

END OF SECTION 129300

SECTION 133423 - FABRICATED STRUCTURES

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. Fabricated steel storage buildings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for storage buildings.

B. Shop Drawings: For storage buildings. Include plans, elevations, sections, details, accessories, and fastening and anchorage details, including mechanical fasteners.

1. Anchor-Bolt Plans: Submit anchor-bolt plans and templates. Include location, diameter, and projection of anchor bolts required to attach storage buildings to foundation. Indicate post reactions at each location.

C. Samples for Verification: For each type of exposed finish in manufacturer's standard sizes.

1. Include Samples of wall panels and accessories to verify finish selection.

D. Delegated-Design Submittal: For fabricated storage buildings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For storage buildings to include in maintenance manuals.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair finish or replace storage buildings that fail in materials or workmanship within specified warranty period.

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Fabricated storage buildings shall withstand the following loads and stresses within limits and under conditions indicated in accordance with ASCE/SEI 7:

1. Loads: As indicated on Drawings.

B. Seismic Performance: Fabricated storage buildings shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.

1. Loads: As indicated on Drawings.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 FABRICATED STEEL STORAGE BUILDINGS

A. Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.

B. Basis of Design: Provide Arrow Murrayhill Garage or approved substitute. Available manufacturers offering products that may be incorporated into the Project, subject to compliance with requirements, include, but are not limited to, the following:
1. Carolina Storage Buildings, Charleston, SC.
2. Champion Buildings, Inc., Wilkesboro, NC.
3. Liberty Sheds, Lexington, SC.
4. Suncast
5. Yardcraft
6. Big Buildings Direct

2.3 BUILDING FRAMEWORK

A. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:

1. Floor and Roof Systems: AISI S210.
2. Wall Studs: AISI S211.
3. Headers: AISI S212.
4. Lateral Design: AISI S213.

B. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch.
2. Flange Width: 1-3/8 inches.

C. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:

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

D. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch.

2.4 METAL ROOF PANELS

A. Exposed Fastener, Tapered-Rib, Metal Roof Panels: Formed with raised, trapezoidal major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.

1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024-inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

a. Exterior Finish: Siliconized polyester.
b. Color: As selected by Architect from manufacturer's full range.

2.5 METAL WALL PANELS

A. Exposed-Fastener, Tapered-Rib, Metal Wall Panels: Formed with raised, trapezoidal major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.

1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024-inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

a. Exterior Finish: Siliconized polyester.
b. Color: As selected by Architect from manufacturer's full range.

2.6 DOORS AND FRAMES

A. Swinging Personnel Doors and Frames: Metal building system manufacturer's standard doors and frames; prepared and reinforced at strike and at hinges to receive factory- and field-applied hardware according to BHMA A156 Series.

1. Steel Doors: 1-3/4 inches thick; fabricated from metallic-coated steel face sheets, 0.036-inch nominal uncoated steel thickness, of seamed, hollow-metal construction; with 0.060-inch nominal uncoated steel thickness, inverted metallic-coated steel channels welded to face sheets at top and bottom of door.

2. Steel Frames: Fabricate 2-inch-wide face frames from zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.060-inch nominal uncoated steel thickness.

3. Fabricate concealed stiffeners, reinforcement, edge channels, and moldings from either cold- or hot-rolled steel sheet.
4. Hardware:

   a. Provide hardware for each door leaf, as follows:

      1) Hinges: BHMA A156.1. Three antifriction-bearing, standard-weight, full-mortise, stainless-steel or bronze, template-type hinges; 4-1/2 by 4-1/2 inches, with nonremovable pin.
      2) Lockset: BHMA A156.2. Mortise, with lever handle type.
         a) Storeroom function with fail safe exiting.
      3) Threshold: BHMA A156.21. Extruded aluminum.
      4) Silencers: Pneumatic rubber; three silencers on strike jambs of single door frames and two silencers on heads of double door frames.
      5) Weather Stripping: Vinyl applied to head and jambs, with vinyl sweep at sill.

   b. Provide each pair of double doors with the following hardware in addition to that specified for each leaf:

      1) Astragal: Removable type.
      2) Surface Bolts: Top and bottom of inactive door.

5. Anchors and Accessories: Manufacturer's standard units, galvanized according to ASTM A123/A123M.
6. Fabrication: Fabricate doors and frames to be rigid; neat in appearance; and free from defects, warp, or buckle. Provide continuous welds on exposed joints; grind, dress, and make welds smooth, flush, and invisible.

2.7 FABRICATION

A. Factory fabricate complete storage buildings, with accessories and options installed at factory.

B. Factory preglaze doors.

C. Factory prewire storage buildings, ready for connection to service at Project site.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, including concrete bases; accurate placement, pattern, and orientation of anchor bolts; critical dimensions; and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical and communication systems to verify actual locations of connections before storage building installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 INSTALLATION

A. Install storage buildings in accordance with manufacturer's written instructions.

B. Set storage buildings plumb and aligned. Level baseplates true to plane, with full bearing on concrete bases.

C. Fasten storage buildings securely to concrete base with anchorage indicated.

D. Connect to electrical power service and communication systems.

3.3 ADJUSTING

A. Adjust doors and hardware to operate smoothly, easily, properly, and without binding. Confirm that locks engage accurately and securely without forcing or binding.

B. Adjust interior and exterior lighting controls.

C. Lubricate hardware and other moving parts.

D. After completing installation, inspect exposed finishes and repair damaged finishes.

END OF SECTION 133423

SECTION 142400 - HYDRAULIC ELEVATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Hydraulic passenger elevators.

B. Related Requirements:

1. Section 042000 "Unit Masonry" for setting sleeves, inserts, and anchoring devices in masonry and for grouting elevator entrance frames installed in masonry walls.
2. Section 051200 "Structural Steel Framing" for the following:
   a. Hoist beams.
3. Section 055000 "Metal Fabrications" for the following:
   a. Attachment plates and angle brackets for supporting guide-rail brackets.
   b. Structural-steel shapes for subsills.
   c. Pit ladders.
4. Division 22 for sump pumps in elevator pits.
5. Section 270528 "Telecom Infrastructure" for twisted pair conductors used for telephone service for elevators.
6. Section 283100 " Fire-Alarm System" for smoke detectors in elevator lobbies to initiate emergency recall operation and for connection to elevator controllers.
7. Section 312000 "Earth Moving" for excavating well hole to accommodate cylinder assembly and for the disposition of excavated material from the cylinder well hole.

1.3 DEFINITIONS

A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.

1.4 ACTION SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures; hoistway entrances; and operation, control, and signal systems.

B. Shop Drawings:

1. Include plans, elevations, sections, and large-scale details indicating service at each landing; coordination with building structure; relationships with other construction; and locations of equipment.
2. Include project-specific machine room layout drawn to scale. Clearly mark deviations from the Contract Drawings that are required by elevator manufacturer to comply with the Code or the manufacturer's requirements.
3. Include large-scale layout of car-control station.
4. Indicate maximum dynamic and static loads imposed on building structure at points of support as well as maximum and average power demands.

C. Samples for Initial Selection: For finishes involving color selection.

D. Samples for Verification: For exposed car, hoistway door and frame, and signal equipment finishes, 3-inch-square Samples of sheet materials and 4-inch lengths of running trim members.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Certificates: For elevator equipment, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Manufacturer Certificates: Signed by elevator manufacturer, certifying that the following construction as shown in the Contract Documents are adequate for elevator system being provided.

1. Hoistway and Pit.
2. Machine room layout and dimensions, including door location, size and swing.
3. Electrical Service.
4. Location and dimensions of all wall-mounted electrical devices and services.

D. Non-proprietary Affidavit: Manufacturer's signed statement that elevator equipment and diagnostic and maintenance equipment is non-proprietary. Provide signed affidavit on form attached or substantially equivalent form approved by Architect.

E. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

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

1. Submit manufacturer's/installer's standard operation and maintenance manual, in accordance with ASME A17.1/CSA B44 including diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.

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

C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard one-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer and has a minimum of five years' experience in the installation of that manufacturer's products. The installer shall have a local service office and a staff of qualified technicians.

B. Non-proprietary: Provide elevator equipment and diagnostic systems that are non-proprietary and may be serviced by any elevator maintenance firm without special tools or diagnostic equipment.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.9 COORDINATION

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

B. Furnish well casing and coordinate delivery with related excavation work.

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

1.10 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
2. Warranty Period: 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Subject to compliance with requirements, provide In-ground Elevator from MEI or comparable product by one of the following:

1. MEI Total Elevator Solutions (formerly Minnesota Elevator).
2. Otis Elevator Company; HydroFit.
3. Schindler Elevator Corporation; 330A.
4. Thyssen-Krupp; Endura

B. Major elevator components, including pump-and-tank units, plunger-cylinder assemblies, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1/CSA B44. The final machine room layout, required to meet the Code, shall be the responsibility of the elevator manufacturer. If installed machine room layout is found to be in violation of the Elevator Code, tThe Contractor will be responsible for corrections at no cost to the Owner.

B. Accessibility Requirements: Comply with Section 407 in the United States Access Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.

C. Seismic Performance: Elevator system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and shall comply with elevator seismic requirements in ASME A17.1/CSA B44.

1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
2. Project Seismic Design Category: As indicated on Structural Drawings.
3. Elevator Component Importance Factor: 1.25.

4. Design earthquake spectral response acceleration short period (Sds) for Project is indicated on Structural Drawings.
5. Provide earthquake equipment required by ASME A17.1/CSA B44.

2.3 ELEVATORS

A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturers' standard components shall be used, as included in standard elevator systems and as required for complete system.

B. Elevator Description:
Type:
1. Under-the-car single cylinder.
2. Rated Load: 3000 lb.
3. Rated Speed: 100 fpm.
4. Operation System: Single automatic operation.
5. Auxiliary Operations:
   a. Battery-powered lowering.
   b. Automatic operation of lights and ventilation fans.
6. Car Enclosures:

   a. Inside Width: Not less than 84inches from side wall to side wall.
   b. Inside Depth: Not less than 73inches from back wall to front wall (return panels).
   c. Inside Height: Not less than 93 inches to underside of ceiling.
   d. Front Walls (Return Panels): Satin stainless steel, ASTM A480/A480M, No. 4 finish with integral car door frames.
   e. Car Fixtures: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
   f. Side and Rear Wall Panels: Plastic laminate.
   g. Reveals: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
   h. Door Faces (Interior): Satin stainless steel, ASTM A480/A480M, No. 4 finish.
   i. Door Sills: Aluminum.
   j. Ceiling: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
   k. Handrails: 1/2 by 4 inchesrectangular satin stainless steel, at sides and rear of car. Provide two per wall.
   l. Floor prepared to receive resilient flooring (specified in Section 096500 "Resilient Flooring").

7. Hoistway Entrances:

   a. Width: 42 inches.
   b. Height: 96 inches.
   c. Type: Two-speed side sliding.
   d. Frames: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
   e. Doors: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
   f. Sills: Aluminum.

8. Hall Fixtures: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
9. Additional Requirements:

a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, ASTM A480/A480M, No. 4 finish.
b. Provide hooks for protective pads and one complete set(s) of full-height protective pads.

2.4 SYSTEMS AND COMPONENTS

A. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations.
1. Motor shall have wye-delta or solid-state starting.
2. Motor shall have variable-voltage, variable-frequency control.

B. Hydraulic Silencers: System shall have hydraulic silencer containing pulsation-absorbing material in blowout-proof housing at pump unit.

C. Piping: Size, type, and weight of piping as recommended by elevator manufacturer, with flexible connectors to minimize sound and vibration transmissions from power unit.

1. Cylinder units shall be connected with dielectric couplings.
2. Casing for Underground Piping: Schedule 40 PVC pipe complying with ASTM D1785, joined with PVC fittings complying with ASTM D2466 and solvent cement complying with ASTM D2564.

D. Hydraulic Fluid: Elevator manufacturer's standard fluid with additives as needed to prevent oxidation of fluid, corrosion of cylinder and other components, and other adverse effects.

E. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified in another Section.

F. Protective Cylinder Casing: PVC or HDPE pipe casing complying with ASME A17.1/CSA B44, of sufficient size to provide not less than 1-inch clearance from cylinder and extending above pit floor. Casing shall have means of monitoring effectiveness to comply with ASME A17.1/CSA B44.

G. Corrosion-Protective Filler: A nontoxic, petroleum-based gel formulated for filling the space between hydraulic cylinder and protective casing or fine sand . Filler shall be electrically nonconductive, displace or absorb water, and gel or solidify at temperatures below 60 deg F.

H. Car Frame and Platform: Welded steel units.

I. Guides: Polymer-coated, nonlubricated sliding guides or sliding guides with guide-rail lubricators. Provide guides at top and bottom of car frame.

2.5 OPERATION SYSTEMS

A. Provide manufacturer's standard microprocessor operation system as required to provide type of operation indicated.

B. Auxiliary Operations:

1. Single-Car Battery-Powered Lowering:
   a. When power fails, car is lowered to the lowest floor, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.
2. Automatic Operation of Lights and Fan: When elevator is stopped and unoccupied with doors closed, lighting, ventilation fan, and cab displays are de-energized after 5 minutes and are re-energized before car doors open.

2.6 DOOR-REOPENING DEVICES

A. Infrared Array: Provide door-reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.

B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door-reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.7 CAR ENCLOSURES

A. Provide steel-framed car enclosures with nonremovable wall panels, withcar roof, access doors, power door operators, and ventilation.

1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.

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

1. Subfloor:

   a. Exterior, underlayment-grade plywood, not less than 5/8-inch nominal thickness.

2. Floor Finish:

   a. Specified in Section 096519 "Resilient Flooring."
3. Stainless Steel Wall Panels: Flush, formed-metal construction; fabricated from stainless steel sheet.
4. Plastic-Laminate Wall Panels: Plastic laminate adhesively applied to manufacturer's standard honeycomb core with plastic-laminate panel backing and manufacturer's standard protective edge trim. Panels have a flame-spread index of 75or less, when tested according to ASTM E84. Plastic-laminate color, texture, and pattern as selected by Architect from plastic-laminate manufacturer's full range.
5. Fabricate car with recesses and cutouts for signal equipment.
6. Fabricate car door frame integrally with front wall of car.
7. Stainless Steel Doors: Flush, hollow-metal construction; fabricated from stainless steel sheet.
8. Sight Guards: Provide sight guards on car doors.

9. Sills: Extruded or machined metal, with grooved surface, 1/4 inch thick.
10. Metal Ceiling: Flush panels, with LED downlights in the center of each panel. Align ceiling panel joints with joints between wall panels.
11. Light Fixture Efficiency: Not less than 35 lumens/W.
12. Ventilation Fan Efficiency: Not less than 3.0 cfm/W.

2.8 HOISTWAY ENTRANCES

A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.

B. Fire-Rated Hoistway Entrance Assemblies: Door-and-frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252.

1. Fire-Protection Rating: As indicated on Drawings.

C. Materials and Fabrication: Manufacturer's standards, but not less than the following:
1. Star of Life Symbol: Identify emergency elevators with star of life symbol, not less than 3 inches high, on both jambs of hoistway door frames.
2. Stainless Steel Doors: Flush, hollow-metal construction; fabricated from stainless steel sheet.
3. Sight Guards: Provide sight guards on doors matching door edges.
4. Sills: Extruded or machined metal, with grooved surface, 1/4 inch thick.
5. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M.

2.9 SIGNAL EQUIPMENT

A. Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Provide vandal-resistant buttons and lighted elements illuminated with LEDs.

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

1. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.
2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.

C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

D. Firefighters' Two-Way Telephone Communication Service: Provide telephone jack in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Section 283100 "Fire-Alarm Systems."

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

1. Provide manufacturer's standard wall-mounted units.
2. Equip units with buttons for calling elevator and for indicating applicable direction of travel.
3. Provide telephone jack in each unit for firefighters' two-way telephone communication service specified in Section 283100 “Fire Alarm System.”

F. Hall Lanterns: Units with illuminated arrows; however, provide single arrow at terminal landings. Provide one of the following:

1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.
2. Units with flat faceplate for mounting with body of unit recessed in wall and with illuminated elements projecting from faceplate for ease of angular viewing.
3. Units mounted in both jambs of entrance frame.
4. Units mounted in both car door jambs.

G. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.

1. At manufacturer's option, audible signals may be placed on cars.

H. Emergency Pictorial Signs: As specified in Section 101423 “Panel Signs.”

2.10 FINISH MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, commercial steel, Type B, exposed, matte finish.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, commercial steel, Type B, pickled.

C. Stainless Steel Sheet: ASTM A240/A240M, Type 304.

D. Stainless Steel Bars: ASTM A276, Type 304.

E. Aluminum Extrusions: ASTM B221, Alloy 6063.

F. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS for flat applications and Type BKV for panel backing.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 INSTALLATION

A. Excavation for Cylinder: Drill well hole in elevator pit to accommodate installation of cylinder; comply with applicable requirements in Section 312000 "Earth Moving."

B. Provide well casing to retain well-hole walls.

C. Install cylinder in protective casing within well hole. Before installing protective casing, remove water and debris from well hole and provide permanent waterproof seal at bottom of well casing.

1. Fill void space between protective casing and cylinder with corrosion-protective filler.
2. Align cylinder and fill space around protective casing with fine sand.

D. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor. Seal between protectivecasing and pit floor with 4 inches of nonshrink, nonmetallic grout.

E. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor and braced at intervals as needed to maintain alignment. Anchor cylinder guides at spacing needed to maintain alignment and avoid overstressing guides.

F. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS workmanship and welding operator qualification standards.

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

H. Install piping above the floor, where possible. Install underground piping in casing.

1. Excavate for piping and backfill encased piping according to applicable requirements in Section 312000 "Earth Moving."

I. Lubricate operating parts of systems as recommended by manufacturers.

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

K. Leveling Tolerance: 1/4 inch, up or down, regardless of load and travel direction.

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

M. Locate hall signal equipment for elevators as follows unless otherwise indicated:
1. Place hall lanterns either above or beside each hoistway entrance.
2. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.

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

3.4 PROTECTION

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

1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage. If using elevator pads to protect cab provide new pads at Substantial Completion.
2. Provide strippable protective film on entrance and car doors and frames.
3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
5. Do not load elevators beyond their rated weight capacity.
6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate elevator(s).

B. Check operation of elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.6 MAINTENANCE

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

1. Perform maintenance during normal working hours.
2. Perform emergency callback service during normal working hours with response time of two hours or less.
3. Include 24-hour-per-day, 7-day-per-week emergency callback service with response time of two hours or less.

END OF SECTION 142400

Attachments: Non-Proprietary Equipment Affidavit

Non-Proprietary Equipment Affidavit

The elevator control equipment proposed for the project identified below shall be Non-Proprietary. The following provisions comprise a warranty representing compliance with established standards for Universal Serviceability and Maintainability:

- **Equipment Purchase Unrestricted**
  Any elevator company shall be allowed to purchase and install this equipment.

- **Spare Parts**
  Spare parts shall be available for sale for replacement or stock to be maintained at the building site, or the offices of any elevator contractor designated by the building owner to maintain their equipment.
  - No exchange-only provisions shall limit any parts purchase.
  - No building owner approval shall be required to processing any parts order.
  - A published price list shall establish reasonable list pricing for parts.

- **Diagnostics**
  The control system shall be provided together with all available diagnostic tool functions, either onboard or in a separate device.
  - Such maintenance, adjustment and troubleshooting device or system shall provide unrestricted access to all parameters, levels of adjustment, and flags necessary for maintenance of equipment.
  - No expiring software, degrading operation, or key shall be accepted. Any lost or damaged tool shall promptly be replaced or repaired at reasonable cost.

- **Training**
  Factory and/or on-site training shall be available from the original equipment manufacturer for enrollment by anyone who wishes to learn about installation, adjustment, maintenance and troubleshooting the equipment. Training fees shall be reasonable and appropriate.

- **Technical Support Hotline**
  A technical support hotline shall be provided by the original equipment manufacturer whereby anyone designated by the building owner shall be able to obtain assistance for installation, adjustment, maintenance or troubleshooting.

- **Engineering Support**
  The original equipment manufacturer shall provide engineering support to any maintaining contractor so designated by the building owner.

- **Documentation**
  Manuals, engineering drawings, circuit diagrams and prints shall be provided with the equipment at time of delivery. All documentation shall be available for replacement purchase, at reasonable cost, by any installing or maintaining elevator contractor or persons so designated by the building owner.

AFFIRMATION

The undersigned swears and affirms that the conditions described above are hereby made a part of the equipment proposal. The building owner, elevator contractor, and/or consultant shall reasonably rely upon these provisions.

_____
Project

_____
Controller Manufacturer

_____
Installing Company Officer Signature Date

_____
Printed Name & Title

SECTION 211313 - WET PIPE SPRINKLER SYSTEM

1.01 GENERAL:

A. Provide the design, fabrication, and installation of a complete automatic wet sprinkler system, fire pump and associated controller and appurtenances, and associated connections to the fire line as shown on the general layout plans. Include all accessories as required by NFPA 13, 14, 20 and 24, The International Building Code (IBC) and The International Fire Code (IFC). All equipment and devices installed under this contract shall be UL listed for their specific use and Factory Mutual approved. Installation shall meet the approval of all authorities having jurisdiction.

B. Documents affecting work in this section include, but are not limited to the General Conditions, Supplementary Conditions, Division 23 and Division 26.

C. The general sprinkler and standpipe system layout including devices and equipment shown, main locations, hose connections, specified materials, etc. shall be followed and provided as a minimum requirement of the contract. The licensed Sprinkler contractor shall be responsible for pipe sizing through hydraulic calculations and providing head layouts, equipment, and appurtenances that meet the requirements of NFPA, IBC, IFC, the Fire Sprinkler Specification Sheet and this specification.

D. The following sprinkler contractors are the only approved bidders for this project:

1) Coastal Sprinkler Company
2) Palmetto Automatic Sprinkler
3) Worsham Sprinkler Company
4) R.C. Jacobs Inc.
5) Armstrong & Johnston
6) Eastern Carolina Fire Protection, Inc.
7) Crawford Sprinkler Co.
8) Performance Fire Protection

Contractors may submit for prior approval a minimum of ten (10) day prior to bid. Prior approvals shall, at a minimum, consist of a complete company resume, a complete listing and description of completed projects relevant to this project, and a list of references for consideration to bid.

1.02 WORK INCLUDED:

A. Attention is directed to the instructions to bidders, General Conditions, and Special Conditions. All of these conditions are binding in their entirety to work under this section. The contractor shall familiarize himself with all necessary work required to properly perform the requirements of the contract. All work as specified shall be installed in accordance with all applicable local, state and federal codes, ordinances and standing orders in addition to NFPA 13, 14, 20 and 24 with years as specified on the Fire Sprinkler Specification Sheet.

B. This contractor shall obtain and pay all permits and fees associated with the plan review and installation of this system. Upon completion of work, the Contractor shall furnish the

Engineer a certificate of approval from the local authority having jurisdiction along with the closeout documents as outlined in this specification.

C. All materials utilized shall be standard catalogued products labeled as required by code. Similar types of equipment shall be by the same manufacturer. Each major piece of equipment shall bear the manufacturer's name, address, model, and serial number attached to the piece of equipment in accordance with NFPA 13 and 14.

D. This contractor is responsible for coordination with other trades to avoid interference, and for verification of actual field dimensions. All applicable cutting and patching shall be the responsibility of this contractor. All penetrations of masonry or concrete walls, floors, or partitions shall be core drilled and sleeved. Penetration clearances shall be as outlined in NFPA and the IBC.

1.03 QUALITY ASSURANCE:

A. This contractor shall be a licensed Sprinkler Contractor in the State of South Carolina and employ or contract on a regular basis for sprinkler system design, a professional engineer registered in the state of South Carolina or at least one person having passed the examination for a NICET Level III rating in automatic sprinkler system design. In addition, this contractor shall be capable of providing on-site emergency service within four (4) hours of notification.

1.04 SUBMITTALS:

A. Submit complete hydraulic calculations, product and material data and reproducible shop drawings with all information as required by NFPA for initial and final review to the engineer of record. The engineer will forward approved submittals to the Office of the State Department of Labor, Licensing and Regulation, Division of Fire and Life Safety, Office of State Fire Marshal for final approval. Submittal packages shall include all materials, calculations and information pertaining to the project. All submitted shop drawings shall be signed and sealed by the licensed contractor who prepared them. Shop drawings shall be generated in CAD. Hand drawings are not acceptable.

B. Work shall not commence until the submittal package is approved by the engineer and LLR. Partial submittals will be returned without review. The Contractor is entitled to two (2) shop drawing reviews and submission to LLR. The contractors will be charged for additional reviews at the Engineer of record's hourly rate.

C. Upon completion of the project, the contractor shall submit one set of record drawings along with appropriate operations/maintenance manuals, a copy of NFPA 25, aboveground and underground piping and fire pump test certificates for the owner's use.

1.05 DELIVERY AND STORAGE:

A. All equipment placed in storage shall be protected from the elements and damage by means of a lockable, weather tight storage container on-site or a bonded warehouse off-site. Stored equipment that is damaged or stolen shall be replaced at no cost to the owner.

1.06 INSTALLATION:

A. The sprinkler system shall be installed in accordance with NFPA 13, 14, 20, and 24 with editions as listed on the Fire Sprinkler Specification Sheet. The system shall be installed by an experienced firm regularly engaged in the installation of fire protection sprinkler systems in accordance with NFPA/(IBC/IFC) standards as a minimum. The Engineer may reject any proposed installer who cannot provide evidence of proper qualifications. All work shall be performed in accordance with the referenced standards, the specifications and the contract terms.

2.01 PRODUCTS:

A. Design:

1) The sprinkler system shall be designed as specified on the Fire Sprinkler Specification Sheet utilizing the Area/Density method. Distribution of water shall be essentially uniform throughout the remote area of operation. The total from any of the individual heads shall be not less than 100 percent of the specified density.

2) Piping shall be sized such that the specified flow density can be maintained during a fire situation. All calculations shall be based upon water flow information as specified on the Fire Sprinkler Specification Sheet. Friction and dynamic losses shall be calculated in accordance with the listed Hazen-Williams “C” values as outlined in NFPA 13.

3) The maximum velocity in any portion of the sprinkler system distribution piping shall not exceed 25 Ft/second unless otherwise approved by the engineer of record.

B. Materials:

1) Materials supplied for use in the sprinkler system shall conform to the respective publications as listed in NFPA and to the supplemental requirements of this specification.

2.02 ELECTRICAL WORK:

A. Electrical conduit and wiring shall be furnished and installed under Division 26 of these specifications. Signal devices, switches and all associated appurtenances required for the proper operation of the sprinkler system shall be provided by this contractor. Coordinate the interface of all supervisory devices with the fire alarm system with Division 26.

2.03 PIPE AND FITTINGS:

A. Underground Pipe and Fittings:

1) Underground fire line piping serving the building sprinkler system, when installed by this contractor, shall be pressure class 350, thickness class 51, ductile iron pipe rated at 350 PSI working pressure, minimum. Piping shall be manufactured in accordance with the requirements of ANSI/AWWA C151/A21.51. Piping, installation, thrust blocking restraints, flushing and testing shall meet the requirements of NFPA 24.

2) Underground dry Fire Department Connection piping shall be ductile iron piping as specified above, or Schedule 40 galvanized steel as allowed by NFPA 24.

B. Aboveground Pipe and fittings:

1) Pipe shall be Schedule 40 black steel pipe with screwed, flanged or grooved fittings that conform with NFPA 13. All piping shall be manufactured by Wheatland Tube, Allied Tube or Northwest Pipe and, regardless of ASTM minimum standards, shall be clearly identified continuously along it's length by the manufacturer as required by NFPA 13 for all pipe sizes. Pipe joints shall be in accordance with NFPA. Grooved piping shall be "roll-grooved". Cut groove pipe is not acceptable.

2) Fittings for sprinkler system piping shall be specifically listed for such service and manufactured by Star, Victaulic, Viking or Grinell. Fittings shall be rated for 300 PSI, except that fittings on the suction side of the fire pump may be rated for 175 PSI. The use of bushings shall be restricted to the requirements of NFPA 13. All reducers shall be made with one piece reducing fittings. Fittings utilizing mechanical branch connections "hole-cut" are prohibited.

3) Pipe hangers and braces shall be in accordance with NFPA 13 and UL and installed to seismically restrain the piping as outlined in the standard. Calculations for seismic restraints shall be submitted during shop drawing review. Calculation sheets shall be Tolco or approved equal. Seismic penetration clearances shall be maintained for piping passing through masonry or concrete construction and for sprinkler head penetrations through ceiling tiles located in seismically restrained ceiling grid systems per NFPA and the IBC respectively.

4) Pipe sleeves shall be provided for all pipe penetrations through walls, floors, partitions and roofs. Sleeves in masonry and concrete walls, floors, roofs, or fire rated construction shall be Sch. 40 steel and extend a minimum of ½" beyond sleeved surface on each side. Sleeves through gypsum board construction or any other frangible non-fire rated partition shall be rolled 24 gauge G90 galvanized steel, riveted to retain shape. Sleeves shall be of sufficient size to allow for seismic clearances as outlined above. In lieu of the required clearances, a flexible connection may be located on each side of the penetration as allowed in NFPA 13.

5) Escutcheons shall be provided at all finished surfaces were exposed piping passes through floors, wall or ceilings except at utility or equipment rooms. Escutcheons shall be chromium plated brass or chromium plated iron and set screw fastened. Escutcheons shall be oversized to cover penetrations as required for seismic clearances.

2.04 VALVES:

A. Gate Valves shall be installed on the discharge and suction side of the fire pump as required by NFPA 20. Valves on the discharge side shall be rated for 300 PSI working pressure. Valves shall be in accordance with AWWA C509, UL, FM approved and listed for use in fire service. Gate valves shall be as manufactured by Nibco, Kennedy, or prior approved equal.

B. Butterfly valves shall be installed in areas were space prohibits the installation of gate valves and where allowed by code. Butterfly valves shall be UL listed and FM approved and rated

for 300 PSI working pressure. Butterfly valves shall be as manufactured by Nibco, Kennedy, Victaulic, Tyco, or prior approved equal.

C. Check Valves shall be grooved, flanged or threaded and rated to 250 PSI, minimum working pressure. All valves shall be listed by UL and FM approved for fire service use. Valves shall be suitable for either vertical or horizontal installation with a ductile iron body, brass seat and rubber-faced clapper assembly. Valves shall be manufactured in accordance with ANSI/AWWA C606. Check valves shall be as manufactured by Nibco, Reliable, Victaulic, Viking, Tyco, or prior approved equal.

D. Post indicator valve shall be provided and installed by this contractor. Coordinate the installation and location with the site utility contractor. See detail, Civil plans and Fire Sprinkler general layout plans for approximate location. PIV shall be provided with optional tamper switch connected to sound the building fire alarm. Coordinate routing of conduits with Division 16. PIV shall be as manufactured by Nibco, Mueller, Clow, Kennedy, American Flow Control, or prior approved equal.

2.05 SPRINKLERS:

A. Sprinklers shall be UL and FM approved and specifically listed for their intended use. Sprinkler spacing with respect to obstructions, equipment and other special situations shall be as outlined in NFPA 13.

B. Sprinklers shall be automatic open, “Quick Response” type unless otherwise noted. Orifice size shall be standard ½” unless otherwise noted for extended coverage applications. Glass bulb temperature ratings for activation assembly shall be in accordance with NFPA 13. High and intermediate temperature heads shall be utilized in areas were higher temperatures are expected. The maximum working pressure rating of the sprinkler heads shall be suitable to withstand the maximum system pressure expected, but in no case less than 175 PSI. High pressure heads (300 PSI working pressure) shall be utilized when system pressure is capable of exceeding 175 PSI.

C. See notes on plans for sidewall, dry sidewall, extended coverage sidewall, dry pendent heads, and any other special head requirement. In areas where heads may be subject to mechanical damage, provide listed metal guards. Furnish spare sprinklers in accordance with NFPA 13.

2.06 FIRE DEPARTMENT CONNECTION:

A. The fire department Siamese connection shall be located as shown on the Fire Sprinkler plans and installed within 100 feet of the nearest fire hydrant in accordance with NFPA 13 and 14. FDC shall be installed complete with check valve, automatic drip, caps, chains, and permanently engraved nameplate. FDC shall be polished bronze finish with double clapper and independent self-closing clapper valves and 4” outlet diameter. Assembly shall be UL listed and FM approved. Provide wall mount or sidewalk mount as indicated on FS sheets. Lettering shall read “AUTO SPRINKLER”. FDC shall be as manufactured by Potter Roemer, Guardian, Elkhart, Allenco, or prior approved equal. Provide signage as required by NFPA 13. Coordinate hose connection requirements with local fire chief.

2.07 SPRINKLER RISER ASSEMBLY:

A. Each sprinkler system riser shall be provided with an alarm valve complete with retard chamber, alarm pressure switch, water motor alarm, flow switch, pressure gauges and trim

as required by NFPA 13. Valve assembly shall be rated for a minimum of 250 PSI working pressure or the maximum calculated system pressure, whichever is greater. Valve assembly shall be capable of vertical or horizontal installation. Alarm valve shall be Viking model J-1 with the above listed trim options or equal by Reliable, Tyco, or Victaulic. Provide 2" main drain to the building exterior. Alarm valves shall be UL listed and FM approved.

2.08 WATERFLOW INDICATORS:

A. Waterflow indicators shall be UL listed. Indicator shall be provided with flow sensitivity and adjustable time delay from 20 to 90 seconds. Pneumatic time delay shall absorb fluctuations in the water system to prevent false alarms. Indicators shall be as manufactured by Potter or System Sensor.

B. Locate indicators in branch piping as noted on each zone/floor level. Upon activation, waterflow indicators shall sound the building fire alarm. Coordinate required connections with Division 16.

2.09 TAMPER SWITCHES:

A. Valve tamper switches shall be located on each valve controlling sprinkler water flow to the building. Upon activation, tamper switches shall sound the building fire alarm. Switch shall be as manufactured by Potter, System Sensor, Acme, Edwards or Gamewell, and be UL listed and FM approved.

B. Tamper switches shall be located on control valves on branch piping serving zones on each floor, gate and butterfly valves in pump room (including backflow preventer isolation valves), and on the post indicator valve as required by NFPA.

2.10 IDENTIFICATION SIGNS:

A. Identification signs shall be provided for each riser/alarm valve assembly indicating hydraulic design information as required by NFPA13. Signs shall be metal engraved and permanently attached to each riser.

2.11 INSPECTOR'S TEST CONNECTION:

A. Provide test connections approximately 6 feet above the floor of each sprinkler system alarm/waterflow device and locate at the most hydraulically remote portion of the system. Provide test connection piping to a location where the water discharge will be readily visible and where the water may be discharged without damage. Test connections shall be as manufactured by "Test and Drain", AFG Manufacturing, Inc., or approved equal.

2.12 MAIN DRAINS:

A. Provide drain piping to discharge at safe points outside each building or to sight cones attached to drains to receive full flow from each drain under maximum pressure. Provide auxiliary drains as required by NFPA 13.

2.13 AUTOMATIC BALL DRIP:

A. Automatic ball drip shall be as manufactured by Potter Roemer, Elkhart or Allenco.

2.14 AUTOMATIC FIRE PUMP:

A. The fire pump shall be assembled by the pump manufacturer. An assembler of fire pumps not engaged in the design and construction of fire pumps shall not be considered a “fire pump manufacturer”. The manufacturer shall assume “unit responsibility “ for the complete fire pump which is defined as the responsibility for interface and successful operation of all system components supplied by the pumping system manufacturer.

B. Equipment provider shall be responsible for providing certified equipment start up and check out along with field certified owner’s training of the pumping system and components. Start up shall be by the pump manufacturer or a certified factory trained representative per the requirements of NFPA 20 with year edition as listed on the Fire Sprinkler Specification Sheet. System start up shall not be considered complete until the sequence of operation, including all alarms, have been sufficiently demonstrated to the owner or owner’s designated personnel. Contractor shall include multiple trips to the jobsite to include phased work, coordination with other trades and/or equipment providers, and multiple inspections by the Engineer, Architect, or the authority having jurisdiction.

C. Provide one (1) year parts and labor warranty from the date of factory start up.

D. Manufacturer

1) Contractor shall furnish and install ITT Industries A-C Fire Pump System UL listed and FM approved single stage, close coupled 1580 Series vertical in-line pump for fire suppression. The pump(s) shall conform to the standards of NFPA 20 with year addition as specified for the installation of centrifugal fire pumps. Other approved manufacturers subject to the requirements of these specifications are Peerless, Aurora, Fairbanks Morse, or prior approved equal.

2) The pump shall provide a rated capacity in GPM and differential pressure in PSI as indicated on the Fire Sprinkler Specification Sheet and the Fire Pump Schedule on the FS details sheet. At 150% of the rated capacity, the pump shall develop at least 65% of its rated head and shall not exceed 140% of the rated head at zero capacity (churn pressure). The pump shall be tested at the factory and a test curve shall be submitted showing the performance an horsepower requirements based on this test before final acceptance.

3) The pump shall be single stage, close coupled, vertical in-line design in cast iron bronze fitted construction with packing bearing directly on a bronze or stainless steel shaft sleeve. The casing shall be cast iron ASTM #278, Class 35, rated for minimum working pressures of 175 PSIG with 125# suction and discharge flanges located on a common centerline 180 degrees apart. When system pressures are capable of exceeding 175 PSI, the pump shall be furnished with ductile iron ASTM #536, Grade 65 casing and 250# discharge flanges. Tapped and plugged holes shall be provided for priming, vent drain and gauge connections.

4) The impeller shall be of a cast bronze ASTM#B584-875, enclosed type, balanced, keyed to the shaft and secured by a cap screw and lockwasher. Casing wear rings shall be made of bronze and easily replaced. The pump shall have a vertical pullout design that for easy servicing and split bronze packing glands. The stuffing box shall be furnished with impregnated yarn packing, lantern ring and a catch basin for piping leaking to drain. A rubber slinger shall be installed on the shaft before the motor to prevent the passage of liquid to the motor. The motor shall be the JP frame type. Name and data plates shall

be corrosion resistant and permanently secured to the pump. The pump manufacturer shall be ISO9001 certified.

5) The fire pump shall be furnished with the following accessories:

   A. ¾" casing relief valve
   B. 3 ½" dial suction and discharge gauges
   C. Eccentric suction reducer
   D. Concentric discharge increaser
   E. Hose valve test header – 2 ½" NST hose valves with caps and chains with quantity as outlined by NFPA 20 for the listed capacity of the pump.
   F. Flowmeter
   G. Main relief valve

2.15 MAIN FIRE PUMP CONTROLLER:

A. The main fire pump controller shall be factory assembled and wired with a engine generator set power transfer switch. The controller and transfer switch shall be a factory assembled, wired and tested unit and shall conform to all requirements of the listed edition of NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection and NFPA 70, National Electrical Code. The controller shall be listed by UL in accordance with UL218, FM approved for fire pump service and service entrance rated. The controller shall be Firetrol 1900 with FTA 900 Transfer switch for normal utility power and engine generator set emergency power. Equal products by Metron, Inc., or Cutler-Hammer may be provided subject to the requirements of this specification. Other manufacturers may apply for prior approval for consideration to bid.

B. The controller shall be of the combined manual and automatic type designed for Solid State Soft Starting of the fire pump motor having the horsepower, voltage, phase and frequency as specified on the plans. The controller components shall be housed in a NEMA Type 2, drip proof, wall mounted enclosure. All controller components shall be front mounted, wired and front accessible for maintenance. The minimum withstand rating of the controllers shall be not less than 100,000 Amps RMS symmetrical at 200-600 Volts. If the available system fault exceeds these ratings, the controllers shall be supplied with 200,000 Amps RMS symmetrical withstand rating.

C. The controller shall include a motor rated combination isolating disconnect switch/circuit breaker, mechanically interlocked and operated with a single, externally mounted handle. When energizing the controller, the interlocking mechanism shall sequence the isolating disconnect switch ON first, and then the circuit breaker. When de-energizing the controller the reverse shall occur. The isolating disconnect switch/circuit breaker shall be mechanically interlocked such that the enclosure door cannot be opened when the handle is in the ON position except by a hidden tool operated defeater mechanism. The isolating disconnect/switch shall be capable of being locked in the on position without affecting the trip characteristics of the circuit breaker. The circuit breaker trip curve shall be factory set, tested and sealed for the full load amps of the connected motor. The circuit breaker shall be capable of being field tested to verify actual pick up, locked rotor and instantaneous trip points after field installation without disturbing incoming line and load conductors.

D. The controller shall feature an Operator Interface with user keypad to monitor and display operating conditions including all alarms, events and pressure conditions which shall be displayed with a time and date stamp. The display shall be a 2-line, 20 character, vacuum fluorescent, dot matrix type for easy viewing at all angles and lighting conditions. The

display and interface shall be NEMA rated Type 2 protection and shall be fully accessible without opening the controller door. The display and user interface shall be capable of password protection. The controller operator interface shall be capable of displaying true RMS digital motor voltage and current measurements for all three phases simultaneously. Toggled readings are not acceptable. Voltage and current shall be measured by True RMS technology to provide accurate measurement of sine wave and non-sinusoidal waveforms.

E. Digital Status/Alarm Messages: The digital display shall indicate text messages for the status and alarm conditions of:

    1) Motor on, Minimum Run Time / Off Delay Time, Fail to Start, Under Voltage, Locked Rotor Trip, Over Frequency, Motor Over 320, Motor Overload, Printer Error, Pressure Error, Sequential Start Time, Local Start, Remote Start, System Battery Low, Over Voltage, Low Suction Pressure, Emergency Start, Drive Not Installed, Disk Error/near full. The sequential start timer and minimum run / off delay timer shall be displayed as numeric values reflecting the value of remaining time.

F. LED Visual Indicators: LED indicators, visible with the door closed, shall include:

    1) Power On, Pump Running, Alarm, Deluge Open, Phase Failure, Interlock On, Emerg. Isolating Switch Open, Low System Pressure, Transfer Switch Normal, Transfer Switch Emergency, Phase Reversal. In addition to the standard alarm contacts required by NFPA 20, the digital display module shall have N.O. and N.C. contacts for remote indications of any digitally displayed alarm N.O. and N.C. contacts for remote indication of up to 8 specified programmable alarms.

G. Data Logging: The digital display shall monitor the system and log the following data:

    1) Motor Calls/Starts, Last Trip Currents, Last Breaker Trip, Minimum Voltages, Maximum Voltages, Last Phase Failure, Last Phase Reversal, Min/Max Pressure, Elapsed Motor Run Time, Elapsed Power On Time, Maximum/Minimum Run Currents, Last Motor Run Time, Min/Max Frequency.

H. Event Recording shall be accomplished by a dot matrix impact printer to record all operational and alarm events. The printer shall use standard #16 bond paper. The printer shall automatically record all events and pressure settings and allow the user to select the pressure recording frequency based on either time or pressure deviation. The system shall have the capability to store up to 3000 events and allow the user access via the user interface. The controller shall include a floppy disk drive to store up to one year's worth of events and feature two independent communications ports to allow connectivity to computers, modems, or building management systems.

I. The controller shall be supplied with a solid state pressure transducer with a range of 0-300 PSI. The solid state pressure switch shall be used for both display of the system pressure and control of the fire pump controller. The START, STOP and SYSTEM PRESSURE shall be digitally displayed and adjustable through user interface. The transducer shall be mounted inside the controller to prevent accidental damage.

J. The sequence of operation of the controller shall be as follows: The controller shall be provided with a digitally set On Delay (Sequential Start) timer. The user interface shall display a message indicating the remaining time value on the On Delay Timer upon a call to start. The controller shall be field programmable for manual or automatic stop. If set for auto

stopping, the controller shall allow the user to select either a Minimum Run Timer or Off Delay Timer, both programmable through the user interface. The controller shall be fully programmable to allow up to 8 custom alarm messages to be displayed on the user interface. A restart delay timer shall be provided to allow for residual voltage decay prior to restarting the motor, at least 2 seconds but not more than 3 seconds shall elapse between stopping and restarting the pump motor. A weekly test timer and Lamp test feature shall be provided. The controller shall not start the fire pump motor under single phase conditions. If the motor is already running when a phase loss occurs, the controller shall continue to run the motor, but display a Phase Failure alarm.

K. The power transfer switch for generator set emergency power source shall be Firetrol FTA 900, or equal by manufacturer's as above listed. The transfer switch shall be housed within the fire pump controller enclosure, or attached directly to the fire pump controller such that the assembly constitutes a single unit, and service entrance rated. The power transfer switch shall include a motor rated disconnect/isolating switch capable of interrupting the motor locked rotor current. The disconnect/isolating switch shall be mechanically interlocked such that the enclosure door cannot be opened with the handle in the ON position except by a defeater mechanism, and be capable of being padlocked in the OFF position. An auxiliary contact shall be provided on the transfer switch to prevent starting of the emergency generator set when the transfer switch or the main fire pump controller are being serviced. The transfer switch circuitry shall be capable of sensing both the normal power source and emergency power source. Normal power source pickup shall be set at 95% voltage and Emergency power source pickup shall be set to pick up at 90% nominal voltage and 95% nominal frequency. All voltage/frequency sensing and time delays shall be field adjustable to accommodate individual installation requirements. The transfer signal shall be delayed one second to compensate for momentary, normal power outages. An automatic delay of three seconds shall be provided upon transfer to or from emergency power source. The transfer switch shall have the following LED'S: TRANSFER SWITCH NORMAL, TRANSFER SWITCH EMERGENCY, and EMERGENCY ISOLATING SWITCH OFF. TEST and TRANSFER BYPASS switches, and an audible alarm device with SILENCE ALARM pushbutton mounted on the enclosure cover shall be provided. Aux. contacts shall be provided to indicate transfer switch position, and the transfer switch shall be electrically operated/mechanically held and shall be capable of being operated by a manual transfer mechanism located on the switch.

2.16 JOCKEY PUMP:

A. Pump shall be as scheduled on plans. Match voltage and phase scheduled for the Fire Pump. Pump shall maintain pressure within the sprinkler/standpipe system and shall be piped as shown on the Fire Pump Detail. Pump shall be manufactured by above listed and approved
fire pump manufacturers. Provide 6" concrete pad for mounting pump.

2.17 JOCKEY PUMP CONTROLLER:

A. The controller shall be UL listed and of the same manufacturer as the main fire pump controller. Controller shall be Firetrol FTA500 or equal by above listed fire pump controllers. The controller shall incorporate a full voltage magnetic starter, main disconnect switch, motor fuse block with fuses, H.O.A. selector switch and pressure switch. The pressure switch shall have a range of 30-300 PSI with an adjustable differential range of 10-40 PSI. The pressure switch shall be of the diaphragm type utilizing snap-action type contacts and mounted inside the controller. A system pressure gauge shall be mounted with the pressure switch to assist in pressure switch adjustments and provide current system pressure. A running period timer

interlocked with the pressure switch shall be provided to keep the motor in operation at least 1 minute. The disconnect switch shall be mechanically interlocked such that the enclosure door cannot be opened with the handle in the ON position except with a defeater mechanism. The enclosure shall be NEMA Type 2 and all pushbuttons, selector switches and pilot lights shall be NEMA Type 12, Oiltight. No pushbuttons or pilot lights shall be mounted on the enclosure door. The control transformer shall be of the molded winding type with built-in molded terminals and fuse protected. Fuses shall be built into the transformer. The controller and jockey pump shall be factory tested prior to shipment.

3.01 INSTALLATION, TESTING AND CLEANING:

A. Aboveground piping, when complete, shall be purged of all air and hydrostatically tested to 200 PSI for a minimum of 4 hours and witnessed, approved, and documented by the engineer, owner, local authority having jurisdiction, and, if required, insurance underwriter. Any defects shall be repaired/replaced to the satisfaction of the engineer. The fire pump shall be factory started and tested in accordance with NFPA 20. Contractor shall notify engineer one week (min.) in advance to schedule test inspections. Contractor shall verify correct operation of complete system at the time of testing, and the interface with the building fire alarm system. Owner's training for the fire sprinkler system shall be coordinated and performed in conjunction with the fire alarm system training.

B. All equipment shall be installed in accordance with the manufacturer's literature including required service clearances, etc. All piping shall be installed concealed in areas having ceilings. Exposed and concealed piping shall be run parallel and perpendicular to the structure in a neat and workmanlike fashion, or shall be reworked. Install entire piping system such that it may be drained.

C. Entire sprinkler system shall be flushed, cleaned and disinfected. After pressure tests are complete, the system shall be thoroughly flushed with clear water to remove debris prior to introducing the chlorinating material. The chlorinating material shall be liquid chlorine, calcium hydrochlorite, or sodium hypochlorite. The chlorinating material shall provide a dosage of not less than 50 ppm with a minimum retention time of 24 hours, and shall produce not less than 10 ppm of chlorine throughout the line at the end of the retention period. All installed valves connected to the system shall be operated during the chlorinating period. After the chlorinating period, the system shall be flushed with clear water until residual chlorine is less than 1.0 ppm. From several points in the system, the contractor shall collect samples for bacterial examination and send the samples to a testing lab. Disinfection documentation shall be included in the closeout documents. The disinfection process shall be repeated until tests indicate the absence of bacteria after two (2) full days.

D. Provide reproducible record drawings, closeout documents and test certificates for complete system in accordance with NFPA and the contract documents. Additionally, provide a copy of NFPA 25, Inspection, Testing, and Maintenance of Water Based Fire Protection Systems, for the owner's use.

END OF SECTION 211313

SECTION 221113 - WATER DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Contractor shall furnish all labor, materials, and equipment necessary for a complete and fully operational installation. Materials shall include pipe, fittings, valves, services, and other appurtenances required as shown on the plans or specified. Work shall include all clearing, grubbing, excavation, shoring, backfilling, bedding, ditching, diking, pumping, bailing, draining, flushing and testing or similar task required to install water lines. Work shall include all provisions necessary to protect and maintain roads, buildings, fences, culverts, storm drains, underground utility lines or any other existing structures. Work shall include the furnishing of traffic control measures acceptable to City of North Charleston or the Owner of the affected street. Work shall include clean-up, restoration, and grassing.

1.2 QUALITY ASSURANCE

A. Perform work in accordance with all applicable codes.

B. Valves: Manufacturer’s name and pressure rating marked on valve body.

C. All material or products which come into contact with drinking water shall be third party certified as meeting the specifications of the American National Institute/National Sanitation Foundation Standard 61, Drinking Water System Components – Health Effects. The certifying party shall be accredited by the American National Standards Institute. PVC piping shall bear the approval of the National Sanitation Federation (NSF).

D. All pipe, fittings, packing, jointing materials, valves and fire hydrants shall conform to Section C of the American Water Works Standards (AWWA).

E. Where water mains which have been previously used for conveying potable water have been authorized by the Engineer for reuse, they must meet applicable criteria from AWWA Section C, ANSI/NSF 61, and ASTM D1785 or D2241. The mains must be thoroughly cleaned and restored practically to their original condition.

F. Asbestos cement pipe shall not be used in potable water systems except in the repair of existing asbestos cement lines.

G. Thermoplastic pipe shall not be used above grade.

H. 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, setting meters or valves, or other appurtenances which will expose the material to the water.

I. Lubricants which will support microbiological growth shall not be used for slip-on joints.

J. The use of vegetable shortening is prohibited.

K. The use of solvent-weld PVC pipe and fittings in water mains 4-inches and larger is prohibited.

L. All pipe material, solder and flux shall be lead-free (less than 0.2 percent lead in solder and flux and less than 8.0 percent lead in pipes and fittings).

M. All standards cited in this specification shall refer to the latest revision of that standard under the same specification number or to superseding specifications under a new number.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Inspect materials delivered to the site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Store PVC piping and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

B. Deliver and store valves in shipping containers with labeling in place.

C. Handle pipe, fittings, valves, hydrants, and other accessories in such manner to ensure delivery to the trench in sound undamaged condition. Take special care to avoid injury to coatings and linings of pipe and fittings. Damaged materials shall be repaired or replaced. Do not leave rubber gaskets and plastic piping that are not to be installed immediately out in the sunlight, but store under cover of direct sunlight.

1.4 DUCTILE IRON WATER PIPE

A. Provide for all water mains. All sizes of pipe shall be laying length of 18-feet to 20-feet. All buried pipe shall be pressure class as follows:

Pipe Diameter (in.)	Pressure Class
4” – 12”	350
14” – 20”	250
24”	200
30” – 64”	150

B. Pipe wall thickness shall be in accordance to bury depth as shown on drawing: ANSI/AWWA A21.50/C115.

C. Flange pipe or Victaulic grooved pipe shall be class 53.

D. Use cement mortar lining: ANSI/AWWA C104/A21.4, standard thickness.

E. Use rubber gaskets and lubricant: ANSI/AWWA C111/A21.11.

F. No metric sized pipe shall be permitted.

G. All pipe to be shipped with gaskets, glands, and bolts unless specified otherwise.

H. All pipe lengths must be tested to 500 psi working pressure prior to shipping.

I. Accepted products: American Cast Iron Pipe Company, Griffin Pipe Company, U.S. Pipe Company, and McWane Cast Iron Pipe Company.

1.5 DUCTILE IRON PIPE JOINTS

A. General:
1. Ductile iron pipe and fittings shall be furnished with push-on joints, push-on restrained joints, mechanical joints, flanged joints, and grooved joints as required.
2. Pipe ends (spigot end, bell and socket) for all pipe shall be gauged with suitable gauges at sufficiently frequent intervals to ensure compliance to the standard dimensions of ANSI/AWWA C151/A21.5.
3. Provide rubber gaskets and lubricants complying with ANSI/AWWA C111/A21.11 for mechanical or push-on joints.

    a. Natural rubber gaskets are not acceptable.
    b. Lubricants, which will support microbiological growth, shall not be used for slip-on joints.
    c. Vegetable shortening shall not be used to lubricate joints.

B. Push-on Joints
1. Provide push-on joints complying with ANSI/AWWA 21.11/C11 as modified by ANSI/AWWA C151/A21.51.
2. Accepted products: Fastite, Tyton, and Bell-tite

C. Mechanical Joints: Provide mechanical joints complying with ANSI/AWWA 21.11/C11 as modified by ANSI/AWWA C151/A21.51.

D. Flanged Joints
1. Provide flanged joints complying with ANSI/AWWA C115/A21.15.
2. Gaskets

    a. Provide ASTM D1330, Grade I rubber, full face type gaskets.
    b. Thickness: Up to 10-inch pipe diameter – 1/16-inch; Larger than 10-inch pipe diameter – 1/8-inch.
    c. Certified as suitable for chlorinated and chloraminated potable water

E. Restrained Joints
1. Provide restrained joint pipe and fittings on all piping at each fitting, valve, fire hydrant connection and on pipe joints as shown on the plans.
2. Conform to ANSI/AWWA A21.11/C111 as modified by ANSI/AWWA C151/A21.51.
3. Accepted Products:

a. American Cast Iron Pipe: Fast Grip, Flex-Ring, Field Flex-Ring or Lock-Ring.
b. US Pipe: TR Flex or Field Lok 350 Gaskets.
c. Griffin Pipe: Snap-Lok Restrained Joint, or Talon RJ Gasket.
d. EBAA: Series 1100 Megalug Restraint Gland.
e. Ford: Series 1400 Restraint Gland.
f. Sigma: One-Lok Series SLD Restraint Gland.
g. McWane: Sure Stop 350 Restraint Gasket.
h. For connections to PVC pipe: EBAA Megalug series 2000PV or Ford Series 1500 Restraint Gland.

F. Bolts, Nuts, and All-Threaded Rod
1. Tee bolts and nuts shall be made of high strength low alloy steel (ASTM A307), Cor-Ten (ASTM A242), 304 stainless steel, or 316 stainless steel.
2. Nuts and bolts used for flange connections shall be grade 316 stainless steel.
3. All fasteners shall have minimum yield strength of 45,000 psi. Material type shall be marked on the fasteners.
4. All-thread rod shall be grade 316 stainless steel.
5. Stainless steel materials shall contain sufficient chromium to resist corrosion, oxidation, and rust.
6. Materials shall be sound, clean, and coated with a rust resistant lubricant, approved for use with potable water.
7. Threads shall be in accordance with ANSI B1.1, Unified Inch Screw Threads, and with B1.2, Screw Threads, Gages and Gaging, conforming to the coarse thread series (UNC) Unified Coarse, with threads Class 2A Internal and Class 2B external.
8. Bolts 3/4” and smaller shall be furnished with heavy hex heads conforming to ANSI B18.2.1.
9. Bolts larger than 3/4” may have either standard or heavy hex heads conforming to ANSI B18.2.1.

1.6 DUCTILE IRON PIPE FITTINGS

A. General

1. Use cement mortar lining: ANSI/AWWA C104/A21.4, Standard thickness or epoxy lining.
2. Compact fittings for piping 3-inch through 48-inch may be provided in accordance with ANSI/AWWA C153/A21.53.88.
3. No metric sized fittings shall be permitted.
4. All fittings are to be shipped with gaskets, glands, nuts, and bolts unless specified otherwise.

5. Provide joint restraint at each fitting, valve and fire hydrant connection unless specified otherwise herein or indicated on the drawings.

B. Mechanical joint fittings shall conform to ANSI/AWWA A21.53/C153 or ANSI/AWWA A21.10/C110.

C. Flanged Fittings
1. Conform to ANSI/AWWA A21.10/C110.
2. Fitting flanges shall have facing and drilling which match AWWA/ANSI C115/B16.1 except where class 250 flanges are specifically noted.
3. No metric sized fittings shall be permitted.
4. All fittings are to be shipped with gaskets, glands, nuts, and bolts unless specified otherwise.

D. Sleeves, 4-inch and Larger
1. Provide full-length mechanical joint ductile iron solid sleeve, 12-inch minimum length, where needed to make piping connections.
2. Provide cut-in sleeve, ductile iron, with mechanical restraint joint where installing fittings in an existing line.

E. Accepted products: Tyler Union, Star Pipe Products, and Sigma Corporation

1.7 TAPPING SLEEVES

A. Tapping sleeve sizes 4-inch through 36-inch shall conform to the following criteria:

1. Provide ductile iron MJ type tapping split-type sleeve with flanged outlet.
2. Provide bolts, follower rings and gaskets on each end of the sleeve.
3. Provide for minimum working pressure of 150 psi.
4. Provide square or hexagonal head bolts with hexagonal nuts. All square and hexagonal head bolts and hexagonal nuts shall be Cor-Ten steel, 304 stainless steel, or 316 stainless steel.
5. Provide 3/4-inch NPT test plug on top of outlet.
6. Accepted products:

a. 4-inch through 24-inch: Mueller H-615 and American Flow Control Series 2800.
b. 30-inch through 36-inch: JCM 414 Fabricated Mechanical Joint Tapping Sleeve with fusion bonded epoxy coating.

B. Taps on mains 42-inch or larger shall be reviewed on a case-by-case basis.

1.8 VALVES

A. General

1. All valves shall in conformance with the latest revision of all reference standards of AWWA or ANSI.

2. 4-inch through 12-inch: Use resilient wedge gate valves.
3. 16-inch and larger: Use butterfly valves unless specified otherwise.
4. All valves shall “Open Right” unless on Navy Base in which case the valve shall “Open Left”.
5. Provide a 2-inch ductile iron wrench nut with direction of valve operation clearly visible when looking down on the nut. Hold-down nut or bolt will be Type 316 stainless steel. Wrench nuts will be color coded red for “Open Right” and black for “Open Left”.
6. Provide stem extensions on all valves where the top of the operator nut is located greater than 36-inches below the top of the valve box.
7. All valves shall be equipped with a non-rising stem.

B. Gate Valves

1. All valves will meet or exceed all requirements of AWWA C509 or AWWA C515.
2. Outer valve body will have raised lettering cast in, providing manufacturers name, valve size, year of manufacture, pressure rating, location of casting and each part is to be clearly marked indicating ductile or cast iron.
3. All valves will be electrostatically, fusion-bonded epoxy coated, minimum 8-mil thickness inside and out, conforming to ANSI/AWWA C550 Standards.
4. Resilient wedge to be ductile or cast iron fully encapsulated with EPDM elastomer, including guide path and will be US Food and Drug Administration approved for potable water and have an EPDM visible marking.
5. All valves will have a minimum 250 psi working pressure and a 500 psi static pressure.
6. Valve stem material will be bronze, brass, or Type 304 stainless steel.
7. Valves will have two upper O-ring seals on the stem above the thrust collar and at least one O-ring seal below the collar so designed to allow for replacement of the upper O-rings with the valve under full operating pressure.
8. Valves will have thrust washers located above and below the thrust collar to insure smooth frictionless operation.
9. All exterior bonnet and thrust collar bolting, whether recessed or exposed, are to be Type 316 stainless steel and marked by type.
10. Waterway seat area will be smooth without ridges or cavities and valves will have full size bore throughout the flow-way.
11. All valves will be hydrostatically pressure tested prior to shipment in compliance with AWWA C509 or AWWA C515 standards and be covered by the Manufacturer’s Ten Year Limited Warranty from the date of purchase by the end user.
12. Accepted products: Mueller, American AVK, American Flow Control, and US Pipe.

C. Butterfly Valves

1. Provide butterfly valves conforming to AWWA Standard C504 for Class 150B, unless otherwise specified.
2. Resilient and elastomer seats are to be synthetic rubber (EPDM).
3. Shafts to be turned, ground and polished, constructed of 18-8 Type 316 stainless steel

a. Shafts to be one piece design.
b. Attach disc to shaft with stainless steel tapered pins and locking nuts.

4. Spray coat all interior wetted ferrous surface with two-component epoxy applied to a normal thickness of 3 to 4 mils. Coating material to be AWWA and US Food and Drug Administration approved for use with potable water.
5. Provide operators with not less than maximum operator torque, as determined in accordance with Appendix A of AWWA C504, to operate valves under actual line pressures and velocities.

a. Provide worm and gear, or traveling nut type, self-locking to prevent the valve disc from creeping or fluttering when it is in any intermediate position between open and closed.
b. Gear operators to be permanently lubricated, totally enclosed, with adjustable stops for the open and closed position.
c. All exterior fasteners shall be 316 stainless steel.

6. Epoxy coated inside and outside conforming to AWWA C550.
7. Ends shall be mechanical joint conforming to ANSI/AWWA C111/A21.11.
8. Rated for a 150 psi working pressure.
9. Accepted products: Mueller, DeZurik, and Pratt.

D. Tapping Valves, 24-inch and Smaller

1. Conform to the requirements for gate valves as specified in Item 2 above, Gate Valves.
2. Accepted products: Mueller, American AVK, American Flow Control, and US Pipe.

E. Tapping Valves, 30-inch and Larger

1. Conform to the requirements for gate valves as specified in Item 2 above, Gate Valves.
2. Bronze seat, double disk type conforming to AWWA C500, or resilient seated wedge conforming to AWWA C515.
3. Equipped with 4-inch by-pass valves.
4. Rated for a 200 psi working pressure.
5. Accepted product: Mueller.

F. Air Release Valves

1. Air release valves shall automatically exhaust accumulated air from a fluid system while the system is pressurized and operational at pressures up to 150 PSI.
2. The valve shall have ASTM A126 Class B cast iron body and cover with a threaded inlet and outlet connection. Valves shall have a Type 316 stainless steel float and a replaceable seat of Buna-N or other suitable material. Venting orifice and internal linkage mechanism shall be Type 316 stainless steel.
3. House air release valve in concrete manhole sections with vented lid. See Construction Details.

4. Accepted products:
   a. 1-inch valves – Simple lever type GA Figure 910.
   b. 2-inch valves – Compound lever type GA Figure 920.
   c. 3-inch valves – Compound lever type FA Figure 922.

G. Combination Air Valves

1. Combination air valves for water shall employ the Kinetic principle to exhaust large quantities of air during the filling of a pipeline or vessel. The valve shall be capable of venting air up to sonic velocity without blowing shut; closing only after all the air has been vented. The valve shall continue to release small quantities of air under pressure as often as needed to keep the system free of accumulated air. The valve shall automatically open to allow air to re-enter during draining or whenever a negative pressure occurs.
2. Body and cover shall be ASTM A126 Class B cast iron with Type 316 stainless steel floats and replaceable seats of Buna-N or other suitable material. Internal linkage mechanism shall be Type 316 stainless steel.
3. All fasteners shall be Type 316 stainless steel.
4. Air release orifice shall be suitable for 150 PSI maximum working pressure.
5. Valves 4-inch in size and smaller shall be one-piece body with NPT connections. Larger valves shall be dual-body with a flanged inlet per ANSI B16.1 Class 125 and an outlet cowl.
6. House air release valve in concrete manhole sections with vented lid. See Construction Details.
7. Accepted products:
   a. Valves up to 4-inch – GA Figure 945.
   b. Valves 6-inch and larger – GA Figure 950.

H. Valve Boxes

1. Provide at each buried valve.
2. Shall be full cast or ductile iron with iron covers suitable for heavy traffic use and conform to ASTM A-48, Class 20 Specifications.
3. Valve boxes shall be screw type and have a 5 1/4-inch inside shaft diameter.
4. Have the word “WATER” cast into the cover.
5. Coat box and cover with two (2) shop coats of bitumastic paint.
6. No part of the valve box or riser is to rest on the buried valve.
7. Accepted products:
   a. Products of Tyler Union #6850 Series.
   b. Bingham & Taylor #4905 Series of US manufacture only.
   c. AFC Box with external stem and locking lid.
   d. East Jordan Ironworks #8550 Series.

I. Valve Box Protection Ring

1. Provide at each valve box in unpaved areas a precast concrete protection ring with the following:
   a. Two (2) rings of #3 reinforcing steel; one (1) 21-inch diameter and one (1) 15-inch diameter or;
   b. One (1) ring of #3 reinforcing steel, 19-inch in diameter with fiber-mesh

concrete.
2. Inside dimensions to be 9 1/4-inch.
3. Outside diameter to be 27-inch.
4. Provide 5-inch thickness at interior with a continuous slope to 2-inch thickness at the outside.
5. Minimum concrete strength 3000 psi.
6. Minimum weight of 110 lbs.

1.9 FIRE HYDRANTS

A. Compression type, opening against pressure and closing with pressure, comply with ANSI/AWWA C502 dry-barrel fire hydrants, existing nation standards and ANSI B26.

B. Hydrants shall have a 6-inch mechanical joint connection with a 5 1/4-inch main valve. EPDM rubber will be specified on all hydrants and hydrant replacement parts to protect against chloramine deterioration.

C. 6-inch bell connection, two (2) 2 1/2-inch hose connections, one (1) 4 1/2-inch pumper nozzle with mechanical removal feature, set screw, lock ring, etc., and shall conform to ANSI B26, but will not have chains attaching the hydrant clip to the upper barrel.

D. Hydrants shall have a 1 1/2-inch pentagon shaped operating stem nut and shall “Open Right” (clockwise) unless on the Navy Base in which case hydrants shall “Open Left” (counterclockwise). Arrow shall be cast in top of hydrant indicating direction of opening.

E. National Standard screw threads on outlet nozzles.

F. Two-part breakable safety flange shall be integral parts of barrel casting at least 2-inch above bury line.

G. Barrel lengths shall generally be for 3 1/2-foot bury.

H. Interior shall be two-part thermosetting or fusion bonded, coated holiday free to a minimum thickness of 4 mils conforming to AWWA C550: Standard for Protective Interior Coatings for Valves and Hydrants.

I. Exterior coating shall be as follows.

1. Hydrant barrel will be painted Industrial Safety Yellow, enamel or epoxy coated.
2. Weather cap (bonnet), operating nut, and nozzle caps will be painted Industrial White enamel
3. Exterior hydrant parts below ground will be asphaltic or epoxy coated.

J. All bronze or brass internal working parts in contact with service water are to be maximum 16% in zinc content and 79% minimum in copper.

K. Retaining bolts from shoe to lower barrel shall be 316 stainless steel.

L. Upper assembly shall be provided with a grease or oil reservoir that automatically lubricates all operating stem threads and bearing surfaces each time of operation. The system shall be completely sealed from waterway and external contaminants. The reservoir is to have an external filler point that does not require dismantling any portion of the hydrant during regular maintenance and all hydrants are to be completely lubricated with food grade product prior to leaving the factory.

M. Exterior casting shall indicate type, design, date, and location of manufacturer.

N. Upper and lower main stem rods shall be steel, stainless steel, or bronze in accordance with AWWA C502.

O. Accepted products:

1. Mueller Company: Super Centurion A-423.

2. American Darling: B-84-B.

3. American AVK: Series 2780.

P. Fire Hydrant Concrete Collar

1. Provide at each fire hydrant in unpaved areas a poured in place concrete ring around the fire hydrant barrel with the following:
   a. Two (2) rings of #3 reinforcing steel; one (1) 21-inch diameter and one (1) 15-inch diameter or;
   b. One (1) ring of #3 reinforcing steel, 19-inch diameter with fiber mesh concrete.
2. Outside diameter to be 27-inches.
3. Provide 6-inch thickness.
4. Minimum concrete strength 3000 psi.
5. Minimum weight of 250 lbs.

1.10 POLYETHYLENE ENCASEMENT

A. All buried ductile iron pipes, fittings, and appurtenances shall be wrapped in a polyethylene encasement meeting all the requirements for ANSI/AWWA C105/A21.5, Polyethylene Encasement for Ductile Iron Pipe Systems.

B. In addition, polyethylene encasement for use with ductile iron pipe systems shall consist of three layers of co-extruded linear low density polyethylene (LLDPE), fused into a single thickness of not less than eight mils.

C. The inside surface of the polyethylene wrap to be in contact with the pipe exterior shall be infused with a blend of antimicrobial biocide to mitigate microbiologically influenced corrosion and a volatile corrosion inhibitor to control galvanic corrosion.

D. Accepted product: V-Bio.

1.11 METALLIC DETECTION TAPE

A. Provide 2-inch wide metallic detection tape on all buried piping.

1. Provide 5.0 mil overall thickness with no less than a 50 gauge solid aluminum foil core.
2. Foil to be visible from both sides.
3. No inks or printing extended to the edges of the tape.
4. Encase printing to avoid ink rub-off.
5. Tensile strength – 28 lbs/inch
6. Use heat set Mylar inks.

B. Locate 12-inch below ground surface in pipe trench.

C. Color to be Safety Precaution Blue

D. Wording on tape to indicate “Potable Water” at no greater than 24-inch on center.

1.12 SERVICES

A. Taps.

1. DIP water mains
   a. Services less than 1 1/2-inch: Direct tap.
   b. Services 1 1/2-inch to 2-inch: Tapping saddle.
   c. Services greater than 2-inch: Tapping sleeve.
2. Existing PVC water mains
   a. Services 1-inch to 2-inch: Tapping saddle.
   b. Services larger than 2-inch: Tapping sleeve.

B. Tapping Saddles.

1. Provide of the following materials:
   a. Body – Ductile Iron ASTM-A536.
   b. Bales and strips – Type 304 or 316 stainless steel.
   c. Studs – Type 304 or 316 stainless steel.
   d. Hardware – Type 304 or 316 stainless steel.
   e. Iron pipe thread.
2. Provide double strap for all sizes or wide strap, double bolted.
3. Finish – Provide fusion bonded nylon to an average thickness of 12 mils.
4. Accepted products:
   a. Smith Blair: 317.
   b. Ford: FCD 202.
   c. Mueller: DR2S.
   d. JCM: 406.
   e. Romac: 202N.

C. Service Line Piping.

1. Minimum size, 1-inch.
2. Services 1-inch to 2-inch, provide Type K copper tubing, 0.065” minimum thickness, suitable for underground water services and supplied in conformance with ASTM B88.
3. Services greater than 2-inch, provide ductile iron pipe.

D. Corporation Valves.

1. Corporation Valves will have NPT thread inlets. The outlet connection will be CTS/OD, conductive compression (grip nut) type outlets.
2. Accepted products:
   a. Mueller: 300 Corp, Model # B-25028N.
   b. Ford: Ball Corp, Model # FB1100-X-Q-NL.
   c. A.Y. McDonald: Ball Corp, Model # 74704-BG.

E. Meter Box.

1. 3/4-inch service, accepted products:
   a. Ford: 5/8-inch x 3/4-inch Long Yokebox # LYLBB244-C15177-004-NL, angle ball valve inlet, straight ball valve outlet with quick joint connections, and CPW logo lid for electronic reading, equipped with removable plug.
   b. A.Y. McDonald: Part # 776-208ABVV 337X300X005 for 5/8-inch x 3/4 -inch CTS straight ball valve outlet with grip nut, non-locking CPW logo lid, touchread hole with removable plug.
2. 1-inch service, accepted products:
   a. Ford: Yokebox # YLB111-C15177-007-NL, 1-inch female IPT straight ball valve inlet, 1-inch female IPT straight outlet: 10-inch from meter to grade level, 13 1/2-inch overall depth, 15-inch base diameter, 12 3/8-inch top overall diameter. Non-locking lid equipped with 2-inch touchread plug for AMR setup.
   b. A.Y. McDonald: Part # 75-410BCGG 447 Straight 1-inch FNPT ball valve inlet x Straight 1-inch FNPT outlet, 10-inch meter centerline to grade level. Non-locking lid equipped with 2-inch touchread hole with removable plug for AMR setup.
3. 1 1/2-inch and 2-inch service:
   a. CPW# - #P.C.1.5-2. Size: 29-5/8” Long x 16-1/8” Wide x 14” Deep. Material is ASTM A-48, Class 35B iron base with two piece iron lid rated for heavy traffic embossed with Palmetto tree, crossed cannons and “Commissioners of Public Works, Charleston, S.C.”
   b. Accepted products: J&M Foundry and Star Pipe Products, Part # MBXCHARLESTON.

F. Meter Setter.

1. Meter setters for 1 1/2-inch and 2-inch flanged meters are constructed of brass \ and copper tubing, ball valve inlet with padlock wing, check valve outlet, brace pipe eyelet on FIP 90 deg Ells on inlet and outlet sides of set-up.

2. Accepted products:
   a. Ford: # VBH 76-15-44-66-Q-NL for 1 1/2-inch and # VBH 77-15-44-77-Q-NL for 2-inch.
   b. Mueller: #B-2422-2N for 1 1/2" or 2’ with 15” riser and 110 compression connection.
   c. A.Y. McDonald: 721-615WDGG 660 for 1 1/2-inch and 721-715WDGG 770 for 2-inch.

G. Curb Stops.

1. Provide curb stops for 1 1/2-inch and 2-inch services.
2. Accepted products:
   a. Mueller: Model # B-25209N.
   b. A.Y. McDonald: Model # 76100-WG.
   c. Ford: Model # B44-XXX-Q-NL.

H. Couplings.

1. Provide couplings for service line connections.
2. Accepted products:
   a. Straight Couplings, 1-inch x 3/4-inch
      1) Mueller: Model # H-15403N
      2) Ford: Model # C44-34-Q-NL
      3) A.Y. McDonald: Model # 74758G
   b. Y Branch, 1-inch x 3/4-inch x 3/4-inch
      1) Mueller: Model # H-15343N
      2) Ford: Model # Y44-243-Q-NL
      3) A.Y. McDonald, Model # 708YSG
   c. 90 Degree Bends, 1 1/2-inch and 2-inch
      1) Mueller: Model # H-15526N
      2) Ford: Model # L44-XX-Q-N
      3) A.Y. McDonald: Model # 74761G

1.13 OPERATION OF CHARLESTON WATER SYSTEM VALVES AND HYDRANTS

A. Only Charleston Water System personnel shall operate Charleston Water System valves or hydrants unless otherwise directed or approved by Charleston Water System.

B. Approval for non-Charleston Water System personnel to operate Charleston Water System valves or hydrants shall be determined on a case-by-case basis.

C. All hydrant and blow-off operations shall be done in a manner so that private property is not impacted and there shall be no flooding of streets or roadways or any other traffic problems created.

1.14 HANDLING OF MATERIALS

A. Store rubber gaskets and polyethylene film under cover and out of direct sunlight. Do not store nuts, bolts, glands, and other accessories directly on the ground. Keep all materials free of dirt and debris. Store per manufacturer's recommendations.

B. Keep valves off the ground and keep interior free of dirt and debris. Do not expose valve interior to direct sunlight. Store and maintain, if necessary, per manufacturer's recommendations.

C. Keep inside of pipe free of dirt and debris.

D. Handle pipe and fittings per manufacturer's recommendations so as to ensure delivery to the trench in sound, undamaged condition.

E. Use pinch bars, slings or tongs for aligning or turning pipe.

F. Use care not to damage pipe linings.

1.15 TRENCH EXCAVATION

A. Trench excavation shall be made via open cut and true to the lines and grades shown on the plans, unless boring is necessary or required. Banks of the trenches shall be cut in vertical, parallel planes equidistant from the pipe centerline. The horizontal distance between such planes, or the overall width of trench, shall vary with the size of the pipe to be installed. See Construction Details.

B. Bell holes for bell-and-spigot pipe shall be excavated at proper intervals so that the barrel of the pipe will rest for its entire length upon the bottom of the trench. Bell holes shall be large enough to permit proper installation of joints in the pipe.

C. When muck, quicksand, soft clay, swampy or other material unsuitable for foundations or sub-grade is encountered such material shall be removed and replaced with crushed stone (slag is not acceptable).

D. After excavation, the area between the final pipe grade and the trench soil bottom shall be filled with crush stone materials as required, compacted to proper grade, and made ready for pipe laying (slag is not acceptable).

E. Debris encountered in trench excavation for water mains and other pipelines shall be removed for the overall width of trench which shall be as shown on the plans. It shall be removed to a depth of 6-inches below the bottom of the pipe for pipes smaller than 24-inch; 8-inches below the bottom of the pipe for pipes 24-inch to 36-inch; and 12-inches below the bottom of the pipe for pipes larger than 36-inch, if debris extends to such depth.

F. In all cases, materials deposited shall be placed so that in the event of rain, no damage will result to the work.

G. The sides of all excavations shall be sufficiently sheeted, shored and braced whenever necessary to prevent slides, cave-ins, settlements or movement of the

banks and to maintain the excavation clear of obstructions. Maintain the walls of the excavation properly in place and protect all persons and property from injury or damage. Sheeting, shoring or bracing materials shall not be left in place unless as shown by the plans or permitted by Charleston Water System. All sheeting and bracing shall be left in place until the trench has been backfilled 1-foot above the top of the pipe.

1.16 TRENCH BACKFILL

A. The backfilling of pipeline trenches shall be started immediately after the pipe work has been inspected.

B. The initial backfill, placed to a height of 1-foot above the top of the pipe, shall consist of approved backfill material free from organic matter and deleterious substances, containing no rocks or lumps over 2-inch in any dimension. It shall be carefully placed and compacted throughout the entire area to be backfilled.

C. Backfill shall be deposited in 6-inch layers (before compaction) and thoroughly compacted with power tools to 95% of theoretical maximum density, modified Proctor ASTM-D-1557.

D. Where pipe trenches are cut across or along pavement, the trenches shall be backfilled in accordance with applicable permits.

E. Backfilling around structures shall be done in the manner specified above for pipe trenches by power tamping for the full depth of cut from the bottom of the finished grade.

F. Metallic Detection Tape

1. Provide 2-inch wide metallic detection tape for all buried water mains.

2. Locate 12-inches below ground surface above pipe.

G. All backfilling shall be done in such a manner as will not disturb or injure the pipe or structure over or against which it is being placed. Any pipe or structure injured, damaged or moved from its proper line or grade during backfilling operations shall be uncovered, repaired, and then re-backfilled as herein specified.

H. All excavations suspected of not meeting compaction requirements shall be tested for conformance by a Charleston Water System approved testing lab. Tests shall be performed at the locations and depths directed by Charleston Water System. Tests shall be at the expense of the installing contractor.

1.17 PIPE AND APPURTENANCES

A. General

1. Inspect pipe for damage. Remove damaged and unacceptable pipe. Keep interior and joint surfaces clean and free of foreign materials. Install a mechanical joint of push-on ductile iron plug or cap whenever work stops for a period of one (1) day or greater.
2. Replace pipe where any part of coating or lining is damaged.
3. Lower pipe and accessories into trench by means of derrick, ropes, belt slings, or other equipment approved by the pipe manufacturer.
4. Do not dump or drop any of the materials into the trench.
5. Except where necessary in making connections to other lines, lay pipe with the bells facing in the direction of laying.
6. Rest the full length of each section of pipe solidly on the pipe bed, with recesses excavated to accommodate bells, couplings, and joints.
7. Bell pipe using manufacturer's approved leverage bar. Do not use machinery to bell pipe. Home line is to be clearly visible when pipe is joined.
8. Do not lay pipe in water or when trench conditions are unsuitable for the work. Keep water out of the trench until jointing is completed.
9. Re-lay pipe that has the grade or joint disturbed after laying.

B. Alignment and Grade

1. Install pipe to the alignment and profile shown on the approved drawings.
2. Fittings, valves and other appurtenances shall be located where shown on the approved plans, with the pipe being cut if necessary to assure accurate placement.
3. Cutting Pipe
   a. Cut pipe neatly and without damage to the pipe or lining.
   b. Unless otherwise recommended by the pipe manufacturer, cut pipe with milling type cutter, rolling pipe cutter, or abrasive saw cutter. Do not flame cut. Use wheel cutters when practical.
   c. Cuts must be even and perpendicular with length of pipe.
   d. Dress cut ends of pipe in accordance with manufacturer's directives for the type of joint to be made.
   e. Cut ends and rough edges should be ground smooth and, for push-on type connection, the cut end must be beveled slightly.
4. Pipe lines intended to be straight shall be so laid.
5. Where vertical or horizontal alignment requires deflection from straight lines or grade, do not exceed 75% of maximum deflection recommended by the pipe manufacturer or AWWA Standard 600.
6. If alignment requires deflection exceeding recommended limits, furnish bends to provide angular deflections within the allowable limits.

C. Jointing Pipe and Appurtenances

1. Mechanical, Push-On, and Restrained Joint

   Join pipe with mechanical or push-on type joints in accordance with the manufacturer's recommendations. Provide all special tools and devices, such as special jacks, chokers, and similar items required for proper installation. Lubricants for the pipe gaskets shall be used and shall be manufacturer's standard. All mechanical joints used on hydrants, hydrant leads, taps and valves

shall have restraining glands.

2. Flanged

Prior to connecting flanged pipe, the faces of the flanges shall be thoroughly cleaned of all oil, grease, and foreign material. The rubber gaskets shall be checked for proper fit and thoroughly cleaned. Care shall be taken to ensure proper seating of the flange gasket. Bolts shall be tightened so that the pressure on the gasket is uniform. Torque-limiting wrenches shall be used to ensure uniform bearing insofar as possible. If joints leak when the hydrostatic test is applied, the gaskets shall be removed and reset and bolts re-tightened.

D. Installation of Restraining Glands

1. Adjoining surfaces shall be clean, lubricated and meet the requirements of ANSI/AWWA C111/A21.11.
2. Install using assembly recommendations established in ANSI/AWWA C111/A21.11 as well as installation instructions provided by the manufacturer.
3. If twist-off nuts are provided, tighten screws until nuts break loose.

E. Polyethylene Encasement

1. For all ductile iron pipe, valves, fittings and appurtenances, install V-Bio polyethylene encasement in accordance with AWWA C600 and ANSI/AWWA C105/A21.5 and also in accordance with recommendations and practices of the AWWA M41, Manual of Water Supply Practices – Ductile Iron Pipe and Fittings.
2. The polyethylene wrap shall be overlapped one foot in each direction at joints and secured in place around the pipe, and any wrap at tap locations shall be taped tightly prior to tapping and inspected for any needed repairs following the tap.
3. Close all open ends and damaged areas securely with poly-tape. If damaged polyethylene encasement cannot be repaired, replace with new encasement.
4. All installations shall be carried out by personnel trained and equipped to meet these requirements.

1.18 TIE-IN TO EXISTING MAINS

A. General

1. Tie-ins to existing mains shall be done by use of wet taps using tapping sleeve and tapping valve or by installation of a tee and valve.
2. Developer’s Engineer or Contractor shall coordinate with the assigned Charleston Water System Construction Inspector to schedule wet tap or tee installation. A minimum of three (3) working days shall be allowed for scheduling.

B. Wet Taps

1. Tapping sleeve shall be installed on the water main with the tapping flange and

valve at the 3 o'clock or 9 o'clock position.
2. Provide thrust blocking behind tapping sleeve.
3. Pressure test the tapping sleeve and valve at 150 psi. Pressure shall hold steady for 15 minutes.
4. Tap main thru the tapping valve.
5. When tap is complete, remove pipe coupon from shell cutter and provide to the Charleston Water System Construction Inspector.
6. Encase tapping sleeve, pipe and valve in polywrap.
7. Backfill and set valve box.
8. See Construction Details.

C. Tee and Valve

1. Cut out section of main to allow the installation of the tee with a solid sleeve.
2. Install tee and solid sleeve.
3. Add valve to the branch side of tee.
4. Shut new valve on branch side of tee, restore water to main and check for leaks.
5. Encase new tee, sleeve, pipe and valve in polywrap.
6. Backfill and set valve box.
7. See Construction Details.

1.19 SETTING VALVES AND VALVE BOXES

A. Valves shall be carefully handled, cleaned and checked for operation prior to backfilling. Care shall be taken to ensure that no dirt, rock, or other obstacles that would interfere with the operation are left in the valve.

B. Center valve box on the valve, setting plumb. Valve box shall not rest on any part of the valve. See Construction Details.

C. Tamp earth fill around each valve box to a distance of 4-feet on all sides, or to the undisturbed trench face if less than 4-feet.

D. Install shaft extensions plumb without any binding.

E. Valves shall be installed in a position such that the plane of operation or rotation for the operating nut is parallel to the ground surface.

F. Fully open and close each valve to manufacturer's specifications to assure that all parts are in working condition. All valves shall be left in the fully open position unless directed by Charleston Water System.

G. Place valve box protection ring around top of valve box. Top of the ring is to be level with top of valve box and no more than 1-inch above finish grade. See Construction Details.

1.20 INSTALLATION OF AIR RELEASE VALVES

A. Install air release valve using tapping sleeve, 6-inch tee with tapped blind flange, or welded on boss.

B. Set valve in the vertical position and plumb.

C. Provide valve vault. See Construction Details.

1. Air release valves shall be enclosed in a 5-foot diameter precast manhole with a flat top slab.
2. Maintain minimum 12-inch clearance between top of air release valve and bottom of top slab.
3. Base shall be formed using solid concrete blocks set on a 12-inch deep bed of compacted No. 57 stone.
4. Provide manhole frame and cover.

1.21 FIRE HYDRANTS

A. Installation

1. Inspect hydrant carefully, ensuring that all foreign material is removed from the barrel. Inspect materials upon receipt for damaged or missing items. Store rubber gaskets under cover, out of direct sunlight. Do not store nuts, bolts, glands, and other appurtenances directly on the ground. Keep interiors free of dirt and debris.
2. Hydrants shall be carefully handled, cleaned and checked for operation prior to backfilling. Care shall be taken to ensure that no dirt, rock and other obstacles that would interfere with the operation are left in the hydrant.
3. Provide proper anchorage to fire hydrant installations by means of retainer glands.
4. Rotate fire hydrant offset fitting so hydrant is plumb and at the elevation detailed or install extension kit as necessary to position the bury line at finished grade.
5. Install stone drainage bed. Fire hydrants must be provided with a gravel pocket or dry well. Hydrant drains must not be connected to or be located within ten (10) feet of a wastewater sewer.
6. Provide polyethylene wrap around boot. Ensure weep holes just above the boot are not obstructed.
7. Fully open and close each hydrant to manufacturer’s specification to assure that all parts are in working condition.

B. Acceptance

1. Prior to acceptance by Charleston Water System, if paint is damaged or otherwise not acceptable, hydrants shall be repainted in accordance with these standards.
2. Under the direction of the Charleston Water System Inspector, the Developer’s Engineer or the Developer’s Engineer’s Representative shall perform a flow test on all newly installed fire hydrants. Flow test results shall be furnished to CWS as part of the final project closeout package.

3. All hydrants shall be bagged until South Carolina Department of Health and Environmental Control (SCDHEC) permit to operate has been received and Charleston Water System has commissioned.

1.22 SERVICES

A. General

1. All residential water services shall be located at the approximate mid-point of the property. Provide straight alignment perpendicular to the road centerline from the meter to the main. See Construction Details.
2. 1-inch direct taps are required for 3/4-inch and 1-inch services on ductile iron mains, and will have NPT threads. All taps will be located at the 2 o'clock or 10 o'clock position on the main under system pressure, and must be installed in accordance with AWWA Standard C-600: Service Taps.
3. Saddle taps are required on all PVC mains and when making 1 1/2-inch and 2-inch taps on ductile iron mains. Taps will be made with through-the-saddle style tapping machines, using coupon-type tapping bits under system pressure. The tapered iron drill bit shall be used where saddles are required on ductile iron. All saddle taps are to be located at the 2 o'clock or 10 o'clock position on the main.
4. When direct tapping on pipe encased in polyethylene wrap, cover the area of the pipe to be tapped with dielectric tape to protect the polyethylene wrap from additional damage. Make an "X" shaped cut at the tap location prior to making the tap. When using a saddle on ductile iron, remove only the portion of wrap that will allow the saddle gasket to come in complete contact with the pipe. Repair all rips or cuts with polyethylene tape, cover the saddle with wrap on all pipe and the copper service for 3-feet from the main.

B. Service Line Installation

1. All service lines will be installed with a minimum of 36-inches to a maximum of 48-inches of cover on all street crossings, and a minimum of 24-inches under all open ditches.
2. PVC sleeves are optional on service lines crossing streets, driveways or parking areas. The Contractor may install a capped 4-inch Schedule 40 PVC water service carrier pipe to provide the flexibility of installing the water service line at a later date during the construction period. The carrier pipe will be used to install copper water service lines. The carrier pipe shall be installed a minimum of 36-inches and a maximum of 60-inches below the surface of the road and made easily accessible. The carrier pipe shall be flagged with direct burial electronically detectable tape.
3. Swing joints, double 90-degree bends at the service tap, are required on all 1 1/2-inch and 2-inch services to allow for expansion and contraction to the service and to assist in establishing the correct grade for street crossings.

C. Meter Box and Meter Vault Installation

1. Install meter box or meter vault within road right-of-way, outside of the paved

roadway or in a Charleston Water System easement.

2. Provide straight alignment perpendicular to the road centerline from the meter box to the main.
3. Locate meter box or meter vault either completely inside or completely outside of paved sidewalks. No portion of a meter box shall be inside an ADA sidewalk ramp.
4. Do not locate meter box or meter vault in driveways, under or behind parking spaces, or in any other areas that could inhibit access for operation and maintenance.
5. Meter boxes for 3/4-inch and 1-inch services shall be placed on a 6-inch bed of gravel.
6. Meter boxes for 1 1/2-inch and 2-inch services shall utilize a spacer between the flanges to stabilize the setup during installation and backfill procedures.
7. Set top of meter boxes or meter vault at final finished grade. See Construction Details.

D. Charleston Water System Meter Installation

1. The following requirements shall be met prior to Charleston Water System installing a meter:
   a. Meter box or meter vault shall be flush and level to final finished grade.
   b. Water shall be on at the meter box or meter vault.
   c. Meter box or meter vault shall be tied to house, unit, condo, apartment, etc.
2. Contractor shall provide assistance when meters are being installed where it is not readily evident as to which customer the meter is serving.

1.23 HYDROSTATIC TESTING

A. General

1. Conduct a hydrostatic pressure test on all newly installed water mains, including connected service lines, in accordance with AWWA C600.
2. Conduct test on each main or on sections of main between valves.
3. Clean and flush mains of dirt and foreign material prior to conducting test.
4. If concrete thrust blocking is installed, do not perform hydrostatic test until at least five (5) days after placement of blocking.
5. Test pressure shall be minimum of 150 psi based on the elevation of the lowest point of the section of main being tested and corrected to the elevation of the test gauge.
6. Slowly fill main in order to expel air through the air release valves or other installed appurtenances and to avoid excessive surge pressures at air vent opening(s).
7. Test shall be conducted in the presence of the Developer’s Engineer or his representative and witnessed by a Charleston Water System representative. Schedule with CWS Inspector a minimum of 72 hours prior to scheduled test.
8. Main installation will not be accepted if the quantity of makeup water required for the test if greater than the calculated testing allowance.

B. Hydrostatic Pressure Test

1. After filling water main and before applying test pressure, the main shall be maintained at the working pressure for a sufficient period of time for it to stabilize with respect to line movement, water absorption by the lining, etc. This may require several cycles of pressurizing and bleeding of trapped air.
2. A suitable test pump, furnished by the Contractor, shall be connected to the main by means of a tap, or other suitable method, and the proper test pressure slowly applied to the main. Test pressure shall not vary by more than +/- 5 psi for the duration of the test and shall at no time during the test drop below 150 psi. The test shall be conducted for a minimum of two (2) hours.
3. Test pressure shall be maintained within the tolerance by adding makeup water through the pressure test pump into the main. The amount of makeup water added to the main (i.e. leakage) shall be accurately measured (in gallons per hour) by suitable methods and shall not exceed the applicable testing allowance.
4. Testing allowance is defined as the maximum quantity of makeup water that is added into the main undergoing hydrostatic pressure testing, or any valved section thereof, in order to maintain pressure within +/- 5 psi of the specified test pressure. No water main installation will be accepted if the quantity of makeup water is greater than that determined by the following formula:

   $L = (SD\sqrt{P}) / 148{,}000$

   Where:
   L = testing allowance (makeup water), in gallons per hour
   S = length of pipe tested, in feet
   D = nominal diameter of pipe, in inches
   P = average test pressure during the hydrostatic test, in pounds per square inch (gauge)
5. Acceptance of any main shall be determined on the basis of the testing allowance only. If any test discloses that the quantity of makeup water (i.e. leakage) is greater than the testing allowance as determined above, repairs or replacements shall be made to the main and the main retested. Any visible leaks shall be immediately repaired regardless of the allowance used for testing.
6. During the pressure test, any exposed pipe, fittings, valves, hydrants, and joints shall be carefully examined. Any damage or defects discovered during or following the pressure test shall be repaired or replaced with new material and the test repeated until satisfactory results are obtained.
7. Certified test results shall be provided by the Developer's Engineer to the assigned CWS PARS with the project closeout package.

1.24 DISINFECTION

A. Conduct disinfection in accordance with AWWA C651 before being placed in service.

1. Upon completion of testing, disinfect all water mains in accordance with

SCDHEC requirements.

2. Newly laid valves or other appurtenances shall be operated several times while line is filled with chlorinating agent.
3. If bacteriological test results fail, to meet results specified, repeat procedures until satisfactory results are obtained.

B. Procedure

1. Flush line to extent possible with available pressure and outlets, prior to disinfection.
2. Apply chlorine as liquid chlorine and chlorine compound such as calcium hypochlorite with known chlorine content. Water from the existing distribution system or other source of supply should be controlled so as to flow slowly into the newly laid pipeline during the application of chlorine.
3. Apply through corporation cock in top of main, at beginning of section being sterilized.
4. Use proper feeder and flow regulator to introduce chlorinating agent.
5. Application rate shall not be less than 50 ppm.
6. Retain chlorinated water in main not less than 24 hours.
7. At end of retention period, at least 10 ppm of chlorine shall remain in the water at the extreme end of section.
8. Flush the system with potable water and the sampling program begins.
9. Dechlorinate chlorinated water used for disinfecting in accordance with the requirements of SCDHEC.

C. Acceptance

1. Provide two (2) separate samples for each sample location, taken at 24 hour intervals, free of coliform bacteria. The Developer's Engineer or contractor shall pull samples in accordance with SCDHEC specifications. Provide a copy of sample results to Charleston Water System.
2. Sample locations shall be as required by SCDHEC and, at a minimum, at the following locations:
   a. The tie-in location of new and existing water mains.
   b. The end of all dead-end mains.
   c. At intervals of no more than 1,200-feet.
3. All sample locations are to be given an identifying label.

END OF SECTION 221113

SECTION 22 1313 - SANITARY SEWER SYSTEM

PART 1 - GENERAL

A. All sanitary gravity sewers shall be constructed of either PVC or Ductile Iron unless otherwise specified in the Special Conditions or shown on the plans. Tunnel liners and casing pipes shall be installed at railroad, street, or highway crossings when shown on the plans.

B. All PVC and ductile iron sewer pipe and fittings shall be suitably marked at their places of manufacture to show their class, strength, or thickness, as applicable.

1.2 PVC PIPE

A. Poly-Vinyl Chloride (PVC) gravity sewer pipe and fittings shall conform to the requirements of ASTM Specification D-3034 and ASTM D-2321. PVC material shall have a cell classification of 12454-B or C as defined in ASTM D-1784. Wall thickness shall be SDR 35. Joints shall be integral bell and spigot type with compression type rubber gaskets. Joints shall conform to ASTM specifications D-3212. Couplings for PVC pipe to PVC pipe shall be PVC "Closure" or "Stop" couplings and shall meet ASTM D 3034. Couplings for PVC pipe to Ductile iron pipe shall be as manufactured by Fernco or equal.

1.3 DUCTILE IRON PIPE

A. Ductile iron gravity sewer pipe shall conform to the requirements of AWWA C151 (ANSI Specification A21.51.) The pipe class, bedding, and loading shall comply with North Charleston Sewer District details. When loading conditions are beyond those shown in the details, the Engineer will submit design computations to the Owner. The pipe class shall be as shown on the plans. Bedding shall be as shown on the trench details. Joints shall be "push-on" which conform to the requirements of ANSI Specification A21.11. Ductile iron fittings shall conform to the requirements of ANSI Specification A21.10, Class 350 in sizes 24 inches and smaller and Class 250 in sizes larger than 24 inches typically unless laying conditions and depth of cover require heavier pressure class.

B. All fittings for ductile iron gravity sewer pipe, including but not limited to Wyes, Tees, Saddles, Bends, Crosses, Sleeves, Plugs, Caps, Reducers, and Glands, shall be “Fastite” or “Mechanical Joint” fittings conforming to the requirements of ANSI/AWWA C110/A21.10 (Standard fittings, 3” thru 48”) or ANSI/AWWA C153/A21.53 (Compact fittings, 3” thru 48”) with the joints meeting the requirements of ANSI/AWWA C111/A21.11 (Rubber-gasket joints) and shall be pressure rated at the same rating as the mainline sewer pipe but in no case less than

250 psi. Fastite type fittings shall meet or exceed the requirements as set forth in ANSI/AWWA C 111/A 21.11 and may be used only in non-pressurized in-line locations and below ground installations. Mechanical joint fittings shall meet or exceed the requirements as set forth in ANSI/AWWA C111/A21.11.

All fittings shall be manufactured from ductile iron grade 70-50-05 (min. tensile strength – 70,000 psi; min. yield strength – 50,000 psi, min. elongation – 5%) as specified in AWWA C110 or C153 and ASTM A536. Compact fittings shall not be permitted unless specifically called for in the project specifications and/or project plans or approved in writing by the Project Engineer. Approval of compact fittings shall be limited to those locations where space and dimensional limits warrant the use of such fittings. Note: Couplings for ductile iron pipe to ductile iron pipe shall be ductile iron mechanical joint sleeves, only.

C. All ductile iron gravity sewer pipe and fittings shall be coated on the interior with a 40 mil thickness of Protecto 401. The exterior surface of the pipe and fittings shall have a bituminous coating with a minimum thickness of one mil. Protecto 401 lined pipe and fittings must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. shall be placed inside the pipe for fittings for lifting, positioning, or laying.

Ductile iron sewer pipe and fittings exposed to sewer gas on the exterior surface such as when located in wet wells or valve pits shall be coated with a 40 mil thickness of Protecto 401 on the interior and Tnemec coating on exterior surfaces of the pipe.

1.4 WYES AND SERVICES

A. Wyes and Saddles shall meet the requirements for sewer fittings as set forth in paragraph 2.03 (b and c) above and shall be of the same material and strength as the sewer mains on which they are installed. **Saddle type fittings shall not be used on new construction or existing mains, unless specifically called for in the project plans and/or specifications or approved in writing by the Engineer.** Saddle type fittings, if permitted, may be used only, for 4” or 6” services on existing sanitary sewer mains of 12 inches or less in diameter. For **ductile iron** mains 16 inches or greater in diameter, “CB” Romac tapping saddles as manufactured by Romac Industries Inc. or an approved equal may be used. Unless otherwise specified in the project plans and/or specifications, house services shall be constructed of 4 inch diameter SDR-35 PVC pipe or 350 psi Ductile Iron pipe. For taps and services on an existing Owner maintained PVC or VCP sewer main (6 inches in diameter) that are being repaired by trenchless construction methods, flexible saddles as manufactured by DEW/HPI or an approved equal shall be required. Flexible Saddles shall be affixed to the main by bands or straps as provided by the manufacturers and by using a two part epoxy glue uniformly spread over the contact surface of the saddle.

B. Wye branches shall be placed in sanitary sewer lines at all points shown on the plans or specified herein. If such branches are not to be used immediately they shall be closed with watertight plugs with joints as specified for the sewer pipe.

C. Wyes shall be placed in sanitary sewers so as to properly serve each existing house and each vacant lot facing or butting on the street or alley in which the sewer is being laid, and at such other locations as may be designated by the Engineer.

D. The Contractor, shall measure the distance to the tap or tee from the downstream manhole to obtain the information required for the "As-Built" records. As-built data shall be marked on the plans and turned over to the Owner at the end of the project.

E. The location of all wyes, cleanouts, and house sewers installed in the work shall be identified on the as-built plans and in the field.

1.5 PIPE LAYING

A. Before sewer pipe is placed in position in the trench the bottom and sides of the trench shall be carefully prepared and the necessary bracing and sheeting installed. Each pipe shall be accurately placed to the exact line and grade called for on the plans.

B. Each piece of pipe and special fitting shall be carefully inspected before it is placed and no defective pipe shall be laid in the trench. Pipe laying shall proceed upgrade, starting at the lower end of the grade and with the bells upgrade. Pipe shall be straight when placed in the trench. Curved pipe shall not be laid. Trench bottoms found to be at incorrect grade after pipe laying operations have begun shall be corrected and brought to exact line and grade. Any fill required to bring the trench bottom to grade, shall be pipe foundation material or pipe embedment material as specified herein, as applicable.

C. Bell holes shall be of sufficient size to allow ample room for properly making the pipe joints. The bottom of the trench between bell holes shall be carefully graded so that the pipe barrel will rest on a solid foundation for its entire length.

D. Each joint shall be laid so that it will form a close concentric joint with adjoining pipe and so as to avoid sudden offsets or inequalities in the flow lines. The inside of all bells and the outside of all spigots shall be wiped to remove all dirt, water, or other foreign matter. Joint lubricants shall be compatible with the pipe and gasket materials and shall be as recommended by the pipe manufacturer.

E. All jointing of pipe and fittings shall be in accordance with the pipe manufacturers recommendations.

F. Any leaks or defects discovered at any time after completion of the work shall be repaired immediately. All pipe in place shall be carefully protected from damage until the backfilling operations have been completed. Any pipe which has been disturbed shall be taken up, the joint cleaned and remade and the pipe re-laid at Contractor's expense.

G. Water shall not be allowed to run or stand in the trench while pipe laying is in progress or before the joints are completed or before the trench has been backfilled. The Contractor shall not open up at any time more trench than his available pumping facilities are able to dewater.

H. As the work progresses the interior of all pipe in place shall be thoroughly cleaned. After each line of pipe has been laid it shall be carefully inspected and all dirt, trash, rags, and other foreign matter removed from the interior. When pipe laying is not in progress (for any period exceeding 4 hours), the contractor shall place a watertight plug in the last section of pipe which has been laid. The Contractor shall install temporary watertight plugs in the proposed sewer line at any manhole that is incomplete, at the open end of the pipeline prior to leaving the job site daily and elsewhere as dictated by good engineering and construction practices. All installed pipe shall be backfilled or otherwise securely tied down to prevent flotation in the event water enters or rises

in the trench. The plugs as installed shall prevent infiltration or the introduction of any foreign material into either the existing or proposed systems. Upon completion of all construction, the Contractor will be responsible for the complete removal of all watertight plugs.

I. Backfilling of trenches shall be started immediately after the pipe is in place and the joints completed.

1.6 DEFLECTION TESTS

A. After backfilling trenches all gravity sewer pipes shall be lamped and visually inspected for pipe alignment. Each run of pipe must present a full circle when viewed from one of the connected manholes. Any run of pipe which does not present a full circle will be removed and reinstalled.

B. After backfilling trenches all PVC sewer pipe shall be tested for initial diametric deflections by the use of a Go-No-Go type mandrel which is acceptable to the Engineer. The initial diametric deflection shall not exceed five percent (5%) of the base inside diameter as defined in ASTM D-3034. Deflection test will be performed after trench is no longer subject to construction traffic loading and a minimum of thirty (30) days after the completion of trench backfill.

Nominal Pipe Size	Pipe I.D. (SDR 35)	Required Mandrel O.D.
8"	7.665"	7.28"
10"	9.563"	9.08"
12"	11.361"	10.79"
15"	13.898"	13.20"

C. The mandrel shall be pulled through each section of pipe from manhole to manhole. The mandrel must slide freely through the pipe with only a nominal hand force applied. No mechanical device shall be used in pulling the mandrel. Any pipe which refuses the mandrel shall be removed and replaced. Such sections shall be re-tested for deflection after completion of backfill.

D. Mandrel testing may be performed by the Owner at any time prior to the expiration of the one year warranty. Any pipe which refuses the mandrel shall be replaced by the contractor as described above.

1.7 LEAKAGE AND INFILTRATION

A. All pipe and manhole joints shall be as near watertight as it is practicable to construct them with the material and methods specified herein. Any leaks into the sewer shall be repaired or corrected as authorized by the Engineer regardless of infiltration test results. When directed by the Engineer, any desired section shall be isolated and tested separately.

B. No sooner than 10 days following completion of backfill, the Contractor along with the Engineer, will be required to determine the level of the ground water table. If the ground water table is above the top of the pipe, the sewer line shall be tested for infiltration. If ground water table is less than 2 feet above the top of the pipe, the sewer line shall be low pressure air tested. Each test shall be as performed as follows:

1. Infiltration

a. The infiltration into each section of the sewer shall be measured in wet weather by the temporary installation of suitable metal or wooden weirs as authorized by the Engineer. These weirs shall be furnished, installed and removed by the Contractor. Infiltration tests limits shall be applied to single reaches of pipe, up to one mile in length, of the same diameter. All gravity sewer infiltration shall not exceed two hundred (200) gallons per inch of pipe diameter per mile per day.

2. Air Testing of Gravity Sewers

a. The Contractor shall conduct low pressure air tests on all completed sections of gravity sewer. Air tests for PVC and DIP lines will be performed in accordance with ASTM C828. Air testing shall conform to ASTM F-1417 (PVC Pipe). Air test results will be used to evaluate materials and construction methods on the sewer line sections, and successful air tests shall be mandatory for the acceptance of the sewers 24 inches in diameter and smaller.

a) Air test will not be required on pipe with diameters exceeding 24 inches. Acceptance of pipes exceeding 24" will be based on infiltration tests and/or visual inspection of the joints.
b) The Contractor shall furnish an air compressor of the necessary capacity along with all necessary plugs, valves, pressure gages, air hoses, connections, and other equipment necessary to conduct the air tests. Plugs in sewers 18 inches in size and larger shall be connected by steel cable for thrust reaction.
c) Compressor capacity shall be sufficient to pressurize the sewer main to 4 PSIG within a time equal to or less than the required test time. The following equation may be used to insure compliance with this requirement:

$$\frac{C = 0.17 \times D2 \times L + Q}{T}$$

Where: C = Required Compressor Capacity (cfm)
T = Required Test Time (min) L = Length of Test Section (feet)
D = Pipe Internal Diameter (feet) Q = Allowable Air Loss Rate (cfm)

d) The following allowable air loss rates will be used for all pipe tests:

Pipe Size	**Q (cfm)**	**Pipe Size**	**Q (cfm)**

4"	2.0	15"	4.0
6"	2.0	18"	5.0
8"	2.0	21"	5.5
10"	2.5	24"	6.0
12"	3.0		

e) The sewer section shall be plugged at both ends and air pressure shall be applied until the pressure inside the pipe reaches 4 PSIG. When a stable condition has been reached, the pressure shall be bled back to 3.5 psig. At 3.5 psig, the time and pressure shall be observed and recorded. If groundwater is present at the sewer, the height of groundwater above the top of the pipe shall be added to the above air pressure readings (height of water in feet X 0.433 = air pressure in psig). A minimum of 5 readings will be required for each test.

f) If the time for the air pressure to decrease from 3.5 psig to 2.5 psig is equal to or greater than that shown in the following table, the pipe shall be presumed to be free from defect. When these times are not attained, pipe breakage, joint leakage, or leaking plugs are indicated and the cause must be determined and corrected. After repairs have been made, the sewer sections shall be retested. This process shall be repeated until all sewer sections pass the air test.

Minimum Test Times for Pipe

Pipe-Size	4"	6"	8"	10"	12"	15"	18"	21"	24"
25	0:04	0:10	0:17	0:22	0:26	0:31	0:36	0:44	0:53
50	0:09	0:20	0:35	0:44	0:53	1:02	1:12	1:29	1:47
75	0:13	0:30	0:53	1:06	1:20	1:34	1:48	2:14	2:40
100	0:17	0:40	1:11	1:29	1:47	2:05	2:24	2:58	3:33
LENGTH									
125	0:22	0:50	1:29	1:51	2:13	2:36	3:00	3:43	4:27
150	0:26	1:00	1:47	2:13	2:40	3:07	3:36	4:27	5:20
175	0:31	1:10	2:04	2:35	3:07	3:39	4:12	5:12	6:14
200	0:35	1:20	2:22	2:58	3:33	4:10	4:48	5:57	7:07
225	0:40	1:30	2:40	3:20	4:00	4:41	5:24	6:41	8:00
OF 250	0:44	1:40	2:58	3:42	4:27	5:13	6:00	7:26	8:54
275	0:49	1:50	3:16	4:05	4:53	5:44	6:36	8:10	9:47
300	0:53	2:00	3:33	4:27	5:20	6:15	7:12	8:55	10:41
PIPE									
325	0:58	2:10	3:51	4:49	5:47	6:47	7:48	9:40	11:34

P	**350**	1:02	2:20	4:09	4:11	6:14	7:18	8:25	10:24	12:28
E	**375**	1:06	2:30	4:27	5:34	6:40	7:49	9:01	11:09	13:21
	400	1:11	2:40	4:45	5:56	7:07	8:21	9:37	11:54	14:14
T										
E	**425**	1:15	2:50	5:02	6:18	7:34	8:52	10:13	12:38	15:08
S	**450**	1:20	3:00	5:20	6:40	8:00	9:23	10:49	13:23	16:01
T	**475**	1:24	3:10	5:38	7:03	8:27	9:54	11:25	14:07	16:55
E	**500**	1:29	3:20	5:56	7:25	8:54	10:26	12:01	14:52	17:48
D										
	525	1:33	3:30	6:14	7:47	9:21	10:57	12:37	15:37	18:42
	550	1:38	3:40	6:31	8:09	9:47	11:28	13:13	16:21	19:35
	575	1:42	3:50	6:49	8:32	10:14	11:60	13:49	17:06	20:28
	600	1:47	4:00	7:07	8:54	10:41	12:31	14:25	17:51	21:22

g) For testing a sewer system with one or more installed service lateral pipes, an effective pipe length shall be added to the total sewer main pipe length. The equation used to calculate Effective Pipe Length is as follows:

$$Le = \frac{d2 \times l}{D2}$$

Where: Le = Effective Pipe Length (added to Total Test Length)
d = Diameter of Service Lateral Pipe (inches)
l = Length of Sewer Lateral (feet)
D = Diameter of Sewer Main Pipe being tested (inches)

1.8 MANHOLES

A. General

1. Manholes shall be constructed to the sizes, shapes and dimensions and at the locations shown on the plans. Unless otherwise shown on the plans, man-holes shall be as follows:

8" to 18" pipe ..… 4' diameter .... 5" thick walls
21" to 36" pipe ..…5' diameter .... 5" thick walls
39" to 54" pipe ..…6' diameter .... 6" thick walls
54" and larger ..…8' diameter .... 8" thick walls

2. The height or depth of each manhole will vary with the location, but it shall be such as will place the top at the finished grade of the pavement or landscaped ground surface (ex. Grassed lawn) or to the elevations shown on the plans and the invert at the elevation shown on the plans. Manhole top elevations shall be greater than or equal to the fifty (50)

year flood elevation, unless watertight covers are provided. The number of joints shall be minimized. No riser sections for manholes up to six feet (6') tall and no more than 1 riser for each additional 4 feet in height. One additional section will be allowed for transition manholes.

B. Drop Manholes

1. **Drop Manholes are required where the invert differential is 24 inches or more.** Drop manholes shall be similar in construction to the standard manhole except that a drop connection of pipe and fittings of the proper size and material shall be constructed outside the manhole and supported by Class B concrete or material as indicated on the plans.

C. Manhole Construction

1. Manholes shall be composed of precast reinforced components with tongue and groove joints. Manholes shall conform to the requirements of ASTM Specification C478, except as modified herein.
2. Concrete: Concrete shall conform to ASTM C478 and as follows:

Compressive strength:	5,000 psi minimum at 28 days.
Air Content:	5 - 7 %
Alkalinity:	Adequate to provide a Life Factor, Az = Calcium Carbonate Equivalent times Cover over Reinforcement, no less than 0.35 for bases, risers and cones.
Cementitious Materials:	Minimum of 564 pounds per cubic yard
Coarse Aggregates:	ASTM C33. Sound, Crushed, Angular Granitic Stone only. Smooth or rounded stone shall not be used. Free from organic impurities.
Chemical Admixtures:	ASTM C494. Calcium Chloride or admixtures (if used) containing calcium chloride shall not be used.

Air Entraining Admixtures (if used): ASTM C260.

Absorption shall not exceed six (6) percent.

3. Reinforcing: Reinforcing steel shall be ASTM A615 grade 60 deformed bar, ASTM A82 wire or ASTM A185 welded wire fabric.
4. Lifting Loops: Lift loops shall be ASTM A416 steel strand. Lifting loops made from deformed bars shall not be allowed.
5. Wall Thickness: The minimum wall thickness of the manhole riser sections shall be as shown in the table above. Cone sections shall have a minimum wall thickness of eight (8) inches at their top. The minimum thickness of the bottom shall be six (6) inches for manholes four (4) feet in diameter and eight (8) inches for all sizes greater than four (4) feet in diameter. Suitable openings for inlet and outlet sewer pipe shall be cast or cored into the base sections and into riser sections for drop connections. These openings shall be circular, accurately made, and located as required for each manhole.

D. Manhole Components

1. Precast Manufacturing: Precast components shall be manufactured in conformance with ASTM C478. Wall and inside slab finishes resulting from casting against forms standard for the industry shall be acceptable. Exterior slab surfaces shall have a float finish. Small surface holes, normal color variations, normal form joint marks, and minor depressions, chips and spalls will be tolerated. Dimensional tolerances shall be those set forth in the appropriate references and specified below.
2. Certification: Precast manufacturer shall manufacture all precast components with one or more of the following testing methods.

   Plant shall be certified by the National Precast Concrete Association (NPCA) Plant certification program.

   Plant shall be certified by the Prestressed Concrete Institutes (PCI) Plant certification program.

   Manufacturing process of components delivered shall have been randomly tested by a Owner approved outside agency (such as a State Department of Transportation) no less than 5 weeks prior to manufacture. Test results covering no less than one component in 100 and certification from cement manufacturer and aggregate supplier certifying chemical content will be furnished to the Owner upon request. Minimum test shall cover concrete strength and absorption.

   Components delivered shall be tested by a certified outside testing agency. Test results covering no less than one component in 25 and certification from cement manufacturer and aggregate supplier certifying chemical content will be furnished to the Owner upon request. Minimum test shall cover concrete strength and absorption.

   Joints: For joints utilizing O-Ring seals, the maximum slope of the vertical surface shall be 2 degrees. The maximum annular space at the base of the joint shall be 0.10". The manhole sections shall be joined as specified herein.

   Lift Inserts and Holes: If used for handling Precast Components, lift holes and inserts shall be sized for a precision fit with the lift devices, and shall comply with OSHA Standard 1926.704.

   Step Holes: Step holes shall be cast or drilled in the Bases, Risers and cones to provide a uniform step spacing of 12" or 16". Cast step holes shall be tapered to match the taper of the steps.

3. Precast Base Sections: Base sections shall have the base slab cast monolithically with the walls, or have an approved galvanized or PVC waterstop cast in the cold joint between the base slab and the walls. Where extended base manholes are required, the width of the base extensions shall be no less than the base slab thickness. The bottom step in base section shall be a maximum of 20" from the top of the invert Bench.
4. Precast Riser Sections: The minimum Lay length of Precast Riser Sections shall be equal to the step spacing used by that manufacturer.
5. Precast Concentric and Eccentric Cone Sections: Precast Cone Sections shall have an inside diameter at the top of no less than 24" and no more than 26". The width of the top

ledge shall be no less than eight inches (8") and no less than the wall thickness required for the cone section. Concentric cones shall be used only for Shallow Manholes.

6. Precast Transition Cone Sections: Transition Cone Sections shall provide an eccentric transition from 60 inch and larger manholes to 48 inch diameter risers, cones and flat slab top sections. The minimum slope angle for the cone wall shall be 45 degrees. A minimum of (6') height is required between the bench
7. Precast Transition Top Sections: Transition Top Section shall provide an eccentric transition from 60 inch and larger manholes to 48" diameter risers, cones, and flat slab top sections. Transition Top sections shall be furnished with vents as shown on the manhole details. The maximum amount of fill over the transition top section shall be 20 feet. Transition tops shall not be used in areas subject to vehicle traffic.
8. Precast Flat Slab Top Sections: Standard Flat Slab Top Sections shall have an access opening with an inside diameter at the top of no less than 24" and no more than 26" and shall be designed for HS-20 traffic loadings as defined in ASTM C890. Items to be cast into Special Flat Slab Tops shall be sized to fit within the manhole ID and the top and bottom surfaces.
9. Precast Grade Rings and Brick: Precast Grade Rings or Brick shall be used to adjust ring and covers to finished grade. No more than 12 vertical inches of grade rings or brick will be allowed per manhole. Grade Rings shall conform to ASTM C478 and shall be no less than 4" in height. All brick used shall be solid shall be made from Concrete, Clay, or Shale and shall be of standard building size.

   Steps: Provide steps in Bases, Risers, Cones, Transition Cones, and Transition Top sections aligned vertically on 12" or 16" centers. Secure steps to the wall with a compression fit in tapered holes. Steps shall not be vibrated or driven into freshly cast concrete. Steps shall not be grouted in place. The steps shall be a Copolymer Polypropylene Plastic reinforced with a 1/2" diameter grade 60 bar and have serrated tread and tall end lugs. Step pullout strength shall be a minimum of 2000 lbs when tested according to ASTM C497. The minimum width shall be 12 inches. Rubber or plastic covered steel steps shall be as manufactured by Delta Pipe Products Co., M. A. Industries, Inc., or equal. All manhole steps shall comply with the requirements of OSHA.
10. Lifting Devices: Lifting devices complying with OSHA Standard 1926.704 for handling the Precast Components shall be provided by the Precast Manufacturer.
11. Coatings: Where shown on the plans, the interior/exterior of the manhole walls shall be coated with 21 mils of Coal Tar Epoxy, Koppers 300M or equal. The coating shall be spray applied according to the manufacturer's recommendations by an applicator with a minimum of 5 years experience. The joints between precast sections shall not be coated. Use butyl rubber rope as specified above to seal the interior horizontal joint surface.
12. Joint Sealing Materials: Joints shall be sealed by **TWO** Seals. Each seal shall be as described in one of the following paragraphs:

    a. Internal Butyl Rubber Rope(s) - Internal Butyl Seal(s) shall consist of a plastic or paper-backed butyl rubber rope no less than 14 feet long and no less than 1" in diameter. When manholes are larger than 4' diameter or have a larger than normal space between the joints the length and or diameter of the rope shall be increased as required to achieve a seal.

       Butyl Rubber Material: Butyl rubber shall conform to Federal Specification SS-S210A, AASHTO M-198, Type B - Butyl Rubber and as follows: maximum of 1% volatile matter and suitable for application temperatures between 10 and 100

degrees F. Butyl Rubber shall be applied to clean, dry surfaces only. Use of two (2) independent wraps of Butyl Rubber qualifies for the requirement of two seals.

b. Internal O-Ring Gasket - Internal O-Ring Gasket shall conform to ASTM C443, and be installed according to the Precast Manufacturer's recommendation.

c. Internal Rubber Gasket - Internal Rubber Gasket shall conform to ASTM C361, and be installed according to the Precast Manufacturer's recommendation. Internal Rubber Gasket shall be F114 Manhole Gasket as manufactured by Forsheda Pipe Seal Corp. or preapproved equal.

E. Manhole Sleeves and Entrance Joints

1. Flexible manhole sleeves or flexible manhole entrance joints shall be installed on all pipe entering and leaving precast manholes. Manhole openings shall be accurately core drilled or cast in place. Sleeve and Joint material shall be of high quality synthetic rubber which complies with the requirements of ASTM Specification C 923. Sleeve hardware (clamps, bands, straps, draw bolts, nuts, etc.) shall be stainless steel and make a watertight union. Sleeves shall be Kor-N-Seal I, Kor-N-Seal II, or Contour Seal, as manufactured by National Pollution Control Systems, Inc., flexible connectors model 72, 73, 74, 107, 117, 126, 127, 128, 1610, or 1612 as manufactured by EPCO, or shall be as manufactured by Lock Joint a subsidiary of Gifford-Hill-American, Inc. or comparable sleeves as manufactured by the Press Seal Gasket Corporation; or equal. Flexible manhole entrance joints shall be cast into the wall of the manhole base to form a tight waterstop. Joints shall be watertight under a 30 foot head of water. Flexible manhole entrance joints shall be A-LOK Joints as manufactured by the A-LOK Products Corp., Press Wedge II as manufactured by the Press Seal Gasket Corp., or equal. Flexible manhole sleeves and flexible manhole entrance joints shall be installed in accordance with instructions of their manufacturer. Installation on steep grades may require pipe openings cast or cored with a vertical angle. Alternative entrance joint connections must be approved by the Owner prior to construction.

F. Placing Manhole Sections

The Contractor shall excavate to the required depth and remove materials that are unstable or unsuitable for a good foundation. Prepare a level, compacted foundation extending 6-inches beyond the manhole base.

The base shall be set plumb and level, aligning manhole invert with pipe invert.

Thoroughly clean bells and spigots to remove dirt and other foreign materials that may prevent sealing. Unroll the Butyl Sealant rope directly against base of spigot. Leave protective wrapper attached until sealant is entirely unrolled against spigot. Do not stretch. Overlap from side to side - not top to bottom. For rubber gaskets follow manufacturer's recommendations for installation.

Risers and cones shall be set so that steps align, taking particular care to clean, prepare and seal joints.

G. Manhole Final Finishing

After placement of manhole frame and vacuum testing, perform the final finishing to the manhole interior by filling all chips or fractures greater than 1/2" in length, width or depth (1/8" deep in inverts) with non-shrink grout. Grout the interior joints between the precast concrete sections with non-shrink grout.

When manhole cone top opening is less than manhole frame base inside flange diameter, cone top shall be chamfered or grouted to prevent injury on sharp edges. Shaper edges or rough finishes shall be removed providing a smooth surface throughout the manhole. Clean the interior of the manhole, removing all dirt, spills, or other foreign matter.

H. Connection to Existing Manholes

1. Any connection with 16-inch and smaller pipe at an existing precast or cast-in place manhole will require the Contractor to core the necessary opening through the manhole wall and install a flexible manhole to pipe connector. Connector shall be as specified elsewhere. Connections to existing brick manholes do not required coring and an opening may be carefully hammered or sawed. Connections to existing manholes with 18-inch and larger pipe may be cored or sawed as approved by the Engineer. When noted on the plans or directed in writing by the municipality, a connection to an existing manhole may be made without using flexible pipe connectors.
   Whenever a connection is made without a flexible pipe connector, it shall utilize non-shrink grout and a brick and mortar collar. The existing manhole bench and invert shall be repaired as specified under manhole materials and installation.

I. Manhole Inverts

1. Manhole inverts shall be constructed of brick and cement grout or precast concrete and shall have a "U" shaped cross section of the same diameter as the invert of the sewers which they connect. "U" shaped inverts shall be constructed to a minimum depth of 6" for 8" sewers (unless full depth is required in Special Conditions) and to full pipe diameter depth of the outlet sewer main for larger mains. The manhole invert shall be carefully formed to the required size and grade by gradual and even changes in sections. Changes in direction of flow through the sewer, whether horizontal or vertical, shall be made with true tangent curve(s) with as large a radius as the size of the manhole will permit. Manhole benches shall slope a minimum of 2" to the lip of the "U" shaped invert. Provide a ½ manhole inside diameter radius at the intersection of 2 or more channels. The minimum concrete thickness in the invert of the channel shall be 2-inches, not including the manhole base thickness.
2. When the fall between the inlet and the outlet holes is not available from precast company, the contractor shall construct the invert using 4000 PSI concrete or non-shrink grout. Non-shrink grout (minimum 2" thickness on invert channel and on bench) may be plastered over layered brick and mortar in lieu of solid non-shrink grout invert.
3. Inverts shall meet the following additional requirements:

   Pipe Openings: Pipe openings shall provide clearance for pipe projecting a minimum of 2" inside the manhole. The crown of small I.D. pipe shall be no lower than the crown of the outlet pipe.

   Trough: The fall across the manhole invert shall be as noted on the plans.

Bench: Float finish benches to provide a uniform slope from the high point at the manhole wall to the low point at invert trough. Provide a radius (1/8" to 1" range is acceptable) at the edge of the bench and trough.

Gradual smooth sided depressions and high spots shall be allowed so long as diameter of invert channel ranges from 1/4" less than or 1/2" more than the nominal pipe diameter are maintained. Voids, chips, or fractures over 1/8 inch in diameter or depth shall be filled with a non-shrink grout and finished to a texture reasonably consistent with the bench surface.

J. Manhole Frame and Cover Construction

1. Manhole frames and covers shall be made of cast iron conforming to the minimum requirements of ASTM Specification A48, Class 35B. All castings shall be made accurately to the required dimensions and shall be sound, smooth, clean and free from blisters and other defects. Defective castings which have been plugged or otherwise treated shall be rejected. The contact surfaces between the cover and its corresponding supporting ring in the frame shall be machined so that the cover will rest on the ring for the full perimeter of the contact surfaces. Frame and cover shall be coated with water-based bituminous coating.
2. All frames and covers shall comply with AASHTO HS20 loading requirements. When a frame is designated as not for use in pavement applications (**"N"**) a reduced height traffic bearing frame may be used in lieu of the standard frame for the purpose of adjusting grade. All manhole frames shall be equipped to accept a cam-lock cover. However, only those frame & covers designated on the plans as watertight (**"W"**) or lock down (**"L"**) shall have covers equipped with cam-locks. When cam-locks are required, covers shall be furnished with two stainless steel, pentagon headed cam-locks. Frames and covers designated as watertight (**"W"**), shall have a cover equipped with a one piece gasket permanently attached in a groove in the manhole cover. An o-ring gasket may be placed in a dove tailed groove in the bottom of the cover if cam-lock feature provides sufficient pressure to prevent cover movement and subsequent wear of gasket. Otherwise gasket shall be double edged and placed in a groove in the side of the manhole cover.
3. All covers shall have two 5/8-inch diameter lifting bars set into the cover to allow for lifting by a chain hoist. There shall be no holes or perforations in covers. For models other than those listed as preapproved, the manufacturer's shop drawings shall be sent to the Engineer for review and acceptance by the North Charleston Sewer District prior to manufacturing and shipping of castings to the job site.
4. Pre-approved Heavy Duty Standard Frames include:

   USF 755-NR Ring (with tooling for Bi-Loc Cover) as manufactured by U.S. Foundry & Mfg. Corp.

   1045Z1-1040AGS (with tooling for Bi-Loc Cover) as manufactured by East Jordan Iron Works, Inc.
5. Pre-approved Reduced Height Frames include model:

   USF 763 Ring (with tooling for Bi-Loc Cover) as manufactured by U.S. Foundry & Mfg. Corp.

   1046Z1 (with tooling for Bi-Loc Cover) as manufactured by East Jordan Iron Works, Inc.

6. Manhole Frame Placement

After the manhole has been set in its final position, set the manhole frames to the required elevation using no more than 12-inches of precast concrete grade rings, or bricks (maximum three layers) sealing all joints between cone, adjusting rings, and manhole frame. When grade rings are used apply a 2" X 1/4" strip of butyl between the rings, the frame, and the cone. When bricks are used, grout with Cement mortar. Where manholes are constructed in paved areas, the top surface of the frame and cover shall be tilted so as to conform to the exact slope, crown and grade of the existing pavement adjacent thereto. Manhole Frames which are placed above final grade will have frames attached to manhole cone section by means of a minimum of three symmetrically placed 1/2-inch diameter stainless steel anchors and stainless steel washers or shall have frames recast into the manhole cone or slab by a North Charleston Sewer District approved process.

K. Manhole Submittal Data

1. Drawings and descriptive data on manholes, (including wall thicknesses, vertical dimensions, and deflection angles), concrete used in manufacture of manholes and precast inverts, rubber gaskets, joint sealant, flexible manhole sleeves and joints, frames and covers, inverts, and manhole steps shall be submitted to the Engineer for review prior to their manufacture.

L. Manhole Delivery, Storage, and Handling

1. The Contractor shall coordinate delivery with the manufacturer and handle and store the Manhole Components in accordance with the ASTM C891 and the manufacturer's recommendations using methods that will prevent damage to the components and their joint surfaces.

M. Grouts

1. All grouts used on manhole interiors shall be "non-shrink" grouts, and Grout used on manhole exteriors shall be either "non-shrink" or standard cement mortar grouts, as specified in Item V, Concrete Construction, of the specifications.

1.9 VACUUM TESTING OF MANHOLES

A. Vacuum testing of manholes shall be required on no less than ten percent of the manholes installed. In addition, no less than five (2) manholes will be tested. The Engineer will select which manholes shall be tested after construction. Vacuum Testing each manhole prior to backfilling is recommended as most repairs must be made on the manhole exterior. Vacuum testing is not required on manholes with pipe connections in excess of 30" diameter.

B. Vacuum test the assembled manhole after completing pipe connections and sealing. The vacuum test shall be as follows:

1. Plug pipes with suitably sized and rated pneumatic or mechanical pipeline plugs. Place plugs a minimum of 6" beyond the manhole wall and brace to prevent displacement of the plugs or pipes during testing.
2. Position the vacuum tester head assembly to seal against the interior surface of the top of the cone section and inflate according to the manufacturer's recommendations.
3. Draw a vacuum of 10" of mercury, close the valve on the vacuum line and shut off the vacuum pump.
4. Measure the time for the vacuum to drop to 9" of mercury. The manhole shall pass when the time to drop to 9" of mercury meets or exceeds the following:

Manhole I.D. (inches)	48	60	72	84	96	120
Time (seconds)	60	75	90	105	120	150

5. If the manhole fails the test, remove the head assembly and coat the manhole interior with a soap and water solution and repeat the vacuum test for approximately 30 seconds. Leaking areas will have soapy bubbles. Make the necessary repairs and repeat the test until the manhole passes.

1.10 EXISTING UTILITIES AND SEPARATION REQUIREMENTS

A. The Contractor will be required to excavate to determine the precise location of utilities, or other underground obstructions, which are shown on the Construction Plans. Such location and excavation shall be at least 500 feet ahead of construction or as noted in the Special Conditions Section of this document.

B. All utility owners shall be notified prior to excavation or tunneling. The Palmetto Utility Protection Service (1-800-922-0983) shall be notified to locate utilities. The Contractor will be fully responsible for damage to any utilities if the owners have not been properly notified as required by the Underground Damage Prevention Act. All damage to such structures and pipelines and all damage to property or persons resulting from damage to such structures and pipelines shall be borne by the Contractor and shall be completely repaired within a reasonable time. No claim shall be made against the North Charleston Sewer District for damage or delay of the work on account of the proximity of, or the leakage from, such structures and pipelines. Where high pressure gas lines are to be crossed, they shall be uncovered by hand excavation methods before other excavation near them is started.

C. Utility owners may, at their option, have representatives present to supervise excavation in the vicinity of their utilities. The cost of such supervision, if any, shall be borne by the Contractor.

D. Conflicts with underground utilities may necessitate changes in alignment and/or grade of this construction. All such changes will be approved by the Engineer before construction proceeds.

E. When underground obstructions not shown on the Construction Plans are encountered, the Contractor shall promptly report the conflict to the Engineer and shall not proceed with construction until the conflict is resolved.

F. All sewers shall be constructed with a minimum of three (3) feet of cover, unless justified by the applicant and approved by the North Charleston Sewer District and SCDHEC (e.g., use of ductile iron pipe may have cover less than three (3) feet).

G. Separation of Sewers and Water Mains:

Potable Water Supply Interconnections. There shall be no physical connections between a public or private potable water supply system and a sewer, or appurtenance thereto which may permit the passage of any sewage or polluted water into the potable supply. No potable water pipe shall pass through or come into contact with any part of a sewer manhole.

Horizontal and Vertical Separation from Potable Water Mains. Sewers shall be laid at least 10 feet horizontally from any existing or proposed potable water main. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot separation, SCDHEC may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the sewer closer to a potable water main, provided that the potable water main is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the potable water main is at least 18 inches above the top of the sewer.

Crossings. Sewers crossing potable water mains shall be laid to provide a minimum vertical separation of 18 inches between the outside of the potable water main and the outside of the sewer. This shall be the case where the potable water main is either above or below the sewer. Whenever possible, the potable water main shall be located above the sewer main.
Where a new sewer line crosses a new potable water main, a full length of pipe shall be used for both the sewer line and potable water main and the crossing shall be arranged so that the joints of each line shall be as far as possible from the point of crossing and each other. Where a potable water main crosses under a sewer, adequate structural support shall be provided for the sewer line to prevent damage to the potable water main while maintaining line and grade.

Special Conditions. When it is impossible to obtain the distances specified above, SCDHEC may allow an alternative design. Any alternative design shall:

a. Maximize the distances between the sewer line and the potable water main and the joints of each.
b. Use pipe materials which meet the requirements as specified in Regulation 61-58.4 (D)(1) for the sewer line.
c. Allow enough distance to make repairs to one of the lines without damaging the other.

Sewer Manholes. No potable water pipe shall pass through or come into contact with any part of a sewer manhole.

H. When a sewer main or lateral crosses an existing water main or other utility, the Contractor shall make the installation in accordance with the minimum specifications of the Controlling Agency and in accordance with the following minimum requirements. When a sewer main or lateral crosses or parallels an existing utility, the following clearance requirements are to be met

or ferrous sewer pipe with water tight joints shall be used for a distance of ten feet outside said point of crossing or until horizontal separation requirements are achieved.

1. Min. Vertical Separation for Sewer Crossings:

Storm Sewers -	12" Vertical
Under Water -	18" Vertical
Over Water -	18" Vertical * Sewer over water requires that both pipes shall be Ferrous pipe with a 20 foot jointless span centered at crossing. *
Cable -	24" Vertical
Power -	24" Vertical
Gas -	24" Vertical

2. Horizontal Separations:

Storm Sewers -	5'
Water Mains -	10'
Water Supply -	100' (AS-I Waters, Class I or Class II impounded reservoirs).
Water Supply -	50' (WS-I, WS-II,WS-III, B, SA, or SB Waters – Natural High Water)
Stream, Lake or Impoundment -	10'
Building Foundation -	5'
Basement -	10'
Ground Water Lowering and Surface Drainage Ditch	10’
Swimming Pool -	10'
Private Wells -	25'
Public Wells -	50'

1.11 BORING AND JACKING

A. Steel Encasement pipe for Boring and Jacking shall be welded or seamless, consisting of Grade "B" steel as specified in ASTM A139. Encasement pipe and joints shall be leak proof construction, capable of withstanding dead loads and live loads specific to the site. Steel pipe shall have a minimum yield strength of 35,000 psi. The encasement pipe and method of boring shall meet the requirements of AASHTO or A.R.E.A., as applicable.

B. Boring and Jacking - Spiral Weld or Smooth Wall Steel Encasement Pipe, may be jacked through dry bores slightly larger than the pipe, bored progressively ahead of the leading edge of the advancing pipe as spoil is mucked by the auger back through the pipe. As the dry boring operation progresses, each new section of encasement pipe shall be butt-welded to the section previously jacked into place. Continuous checks shall be made as to the elevation, grade and alignment of each successive section of encasement as well as the tracks (rails) upon which the boring rig travels.

C. Bore Pits (or Tunnel Pits) shall be shored, as described under shoring and shielding herein, well marked, lighted, and not left unattended except as approved by the Engineer. Requirements for stabilization and dewatering of bore pits shall be as previously specified. The angle of repose method (sloping pit walls) for creating a safe working area shall not be used unless specifically allowed or approved by the Engineer.

D. If voids are encountered or occur outside of encasement pipes, grout holes shall be installed in the top section of the encasement pipe at ten (10) foot centers and the voids filled with 1:3 Portland Cement grout at sufficient pressure to prevent settlement in the roadway/railway.

E. Boring operations shall be continuous to their completion, and unnecessary or prolonged stoppages shall not be allowed.

F. In the event an obstruction is encountered during the boring or jacking operations, the auger is to be withdrawn and the excess pipe is to be cut off, capped, and filled with 1:3 Portland Cement Grout at sufficient pressure to fill all voids before reapplying to the Controlling Agency for a new bore site or permission to tunnel.

G. Completed casing installations shall be such as to prevent the formation of a waterway under the road or railbed.

H. The Controlling Agency shall have full authority to require remedial measures and/or to stop all work if, in its opinion, said work will cause any damage to the roadway/railway section or endanger traffic.

I. The Contractor shall notify the Controlling Agency and the municipality such that acknowledgement shall be received a minimum of five (5) working days prior to beginning any work within roadway or railway rights-of-way. If required, 24 hours notice will be given prior to completion.

1.12 FLOW INTERRUPTIONS AND BYPASS PUMPING

A. When the flow of an existing sewer must be interrupted and/or bypassed, the Contractor shall, before beginning any construction, submit a work schedule which will minimize the interruption and/or bypassing of wastewater flow during construction. This schedule must be approved by the North Charleston Sewer District and (if appropriate) the owners of the private collection system and may require night, holiday, and/or weekend work.

B. If pumping is required, an identical standby pump shall be on site in the event of failure of the primary pump. If, at any time during construction, effluent from the existing sewer is not fully contained by the bypass system, gravity service will be restored by a temporary tie to the new construction and work will be suspended until the problem is resolved to the satisfaction of the Engineer. The Contractor shall be responsible for any fines levied as a result of effluent reaching surface waters. The contractor will be required to verify his method of handling sewer flows during construction by pumping at peak flows for 1 hour as approved by the Engineer.

1.13 REPAIRS ON NEW CONSTRUCTION

A. All leaks shall be repaired by identifying and exposing the defective section of pipe and completing repairs. Chemical grouting or internal or external wiping of joints with cement grout are specifically not approved as methods for repairing leaks on new pipelines, regardless of the pipe material approved Methods of Repair as follows:

B. PVC or DUCTILE IRON: Defective or damaged pipe shall be removed and replaced with sound new pipe. The pipe shall be re-connected with approved couplings. Joint leaks may be repaired with bell clamps specifically approved by the Engineer.

C. Manholes: Defective or damaged manhole components shall be removed and replaced with sound new components unless repairs are approved by the Engineer.

1. Leaks through the manhole joints or walls or around pipe collars, may be repaired with non-shrink grout applied (internally if approved by the Engineer), otherwise externally.
2. Leaks around boots or gaskets used to join pipe to manholes shall be repaired as recommended by the manufacturer. In the absence of specific recommendations, such leaks shall be repaired by internal grouting with non-shrink grout or external concrete collars as directed by the Engineer.
3. Lift Holes leaving less than 2" of wall thickness shall be plugged from the outside using non-shrink grout. Penetrating lift Holes shall be plugged from the inside and outside using non-shrink grout.

1.14 ABANDONMENT OF EXISTING SEWERS AND MANHOLES

A. Manholes which are to be abandoned will first have both influent and effluent lines plugged inside the manhole with watertight masonry. The manhole will then be filled with incompressible material (crushed stone or as approved), to a point three feet (3'-0") below the finish grade. The remainder of the manhole shall be broken down and removed. Then the excavation shall be backfilled to finish grade as specified under trench backfill.

B. Abandoned mains at active manholes shall be completely disconnected from the manhole by cutting the pipe outside the manhole and then plugging the abandoned main and the manhole wall with watertight masonry. The invert shall then be rebuilt to conform with the standard details.

C. Exposed sections of abandoned mains shall be removed to a point not less than 5 feet from the adjacent banks or surface waters. The remaining ends of the pipe shall be plugged with watertight masonry. Concrete piers or collars in the creek channel shall be removed completely. Concrete piers or collars not located in the creek channel shall be removed to a point three feet (3'-0") below the finish grade. Steel piers shall be cut off three feet (3'-0") below finish grade.

D. The minimum length of watertight masonry plugs will be the diameter of the abandoned pipe plus one foot.

1.15 HANDLING AND STORAGE OF MATERIALS

A. The Contractor shall be responsible for the safe storage of materials furnished by or to him, and accepted by him and intended for the work, until they have been incorporated in the completed

project. The interior of all pipe, manholes and other accessories shall be kept free from dirt and foreign materials at all times.

B. The Contractor is responsible for the delivery and site distribution of all materials.

C. Ductile iron pipe and cast iron accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Pipe shall not be loaded, unloaded, or transported by placing lifting forks inside the barrel or the pipe. PVC pipe, all pipe accessories, precast concrete manholes, and manhole frame and covers will be unloaded with hoists and/or as recommended by the respective manufacturers. Under no circumstances shall such materials be dropped. Pipe handled on skid-ways shall not be skidded or rolled against pipe already on the ground.

D. In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. Pedestrian or vehicular traffic shall not be unduly inconvenienced in placing of material along the streets or right-of-way, as applicable.

E. The Contractor will string in advance no more than the amount of pipe and material that can be installed within four (4) weeks or less as approved by the Engineer. All the materials shall be placed in such a manner as not to hinder access, endanger or impede traffic, or create a public nuisance. Materials strung through residential areas (or any area with maintained lawns) shall be placed in such a manner as not to restrict normal maintenance of established lawns, and must either be installed within two (2) weeks or removed to an approved storage yard, as required by the Engineer.

F. The Contractor will be responsible for locating and providing storage areas for construction materials and equipment. Unless prior written consent from the owner of the proposed storage area is received by the Engineer, the Contractor will be required to store all equipment and materials within the limits of the right-of-way and temporary construction easement provided. The materials and equipment storage shall comply with all local and state ordinances throughout the construction period.

G. The Contractor shall be responsible for the safeguarding of materials and equipment against fire, theft, and vandalism and shall not hold the municipality responsible in any way for the occurrence of same.

H. At the direction of the Engineer, the Contractor shall remove materials which have been damaged beyond repair from the site to prevent accidental placement.

1.16 CARE OF COATINGS AND LININGS

A. Precast manholes, pipe and fittings, including rings and covers, steps, straps, etc., shall be so handled that the coating or lining will not be damaged. If, however, any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a manner satisfactory to the Engineer.

1.17 OWNER NOTICE AND PREPARATION OF SITE

A. The Owner will secure rights-of-way or easements where required through private lands. The Contractor shall be responsible for any damage to buildings, walls, fences, utility poles, bridges, utilities, railroad, or other improvements encountered whether public or private. All such improvements shall be carefully protected from damage, and, in case of damage or removal, shall be completely repaired or re-stored to its original or better condition. All damage to such improvements and all damage to property or persons resulting from damage to such improvements shall be the responsibility of the Contractor. Special care shall be taken in trenching near buildings, roads and railroads, to avoid or minimize all delays, damage, or injury thereto.

B. Prior to any operation, the contractor shall give advance notice to all owners and/or tenants within the project.

1.18 HUBS SET BY THE CONTRACTOR

A. As a minimum, centerline hubs and offset stakes will be set by the Contractor at each manhole. Cut sheets will show the vertical distance from the offset stakes to the inlet and outlet pipe inverts at each manhole.

B. Laser beams may be used to set line and grade when the contractor provides adequate and accurate equipment for the Engineer to check line and grade at each cut stake (lock levels shall not be considered adequate). If lasers are used, grades shall be checked at each manhole. Fans may be used in conjunction with laser beams only if approved by the Engineer. The contractor shall keep close check of his laser for variations in line and grade. No variations in line or grade shall be corrected between manholes without relaying that portion of the line which has deviated from line or grade unless otherwise approved by the Engineer.

END OF SECTION 221313

SECTION 224000

PLUMBING

PART ONE - GENERAL:

1.01 APPLICABLE PROVISIONS:

A. General and Special Conditions are a part of this Section of the specifications and shall be consulted in detail for information pertaining to the work under this Section. Conditions of Sections 230100, 230200, and 230300 shall be a part of this Section also. Provide seismic support for plumbing systems per specification section 230548.

B. Drawings and specifications are complementary, and what is called for by either shall be as binding as if called for by both.

C. Contractor shall provide complete submittal to comply with Specification Section 230300, Paragraph 2.02. Partial submittals will be disapproved.

1.02 SCOPE:

A. Provide all plant, labor, equipment, material, and operations required for the installation of a complete, safe, and quietly operating sanitary system in accordance with specifications and drawings and subject to terms and conditions of the contract.

B. All permit, and inspection fees shall be included in this contract. All tap, meter, and impact fees are not to be included.

1.03 QUALITY ASSURANCE:

A. Before construction of project starts, check locations and inverts of existing and proposed pipes, sewers, and mains. Review other drawings for project; check grades, elevations, location of structural elements, locations and sizes of chases, type and methods of existing and new construction of floors, walls, partitions, etc. Report to Architect before start of construction any unsatisfactory condition or conflict between plumbing and other trades. No extra charge will be approved after start of construction for work resulting from failure to follow these instructions.

B. Unless otherwise shown, piping to be installed concealed, straight without sags or pockets, and graded for drainage. Cut pipe ends square and ream; before assembly, clean of all dirt, scale, and chips. Solder joints according to fittings manufacturer's recommendations. Apply pipe compound to external threads only. Run cold water pipe at least 12 inches away from the source of heat. Make adequate provision for expansion and contraction of pipes.

C. Liability for damages to buildings, contents of buildings, or site property during construction and guarantee period resulting from workmanship, materials or equipment supplied under this specification is a part of this contract.

D. Plumbing Contractor shall coordinate the location of all drain lines below slab with the General Contractor. The Plumbing Contractor shall install drain lines to avoid all column footings, grade beams, and pile caps. Sleeve all pipes thru walls or footings. Piping under footings shall also be sleeved.

E. Plumbing Contractor shall patch solid or pour concrete for any foundation block removed or broken out for the installation of this work.

1.04 PROTECTION OF FIXTURES, EQUIPMENT, AND MATERIALS:

A. Protect against theft and damage.

B. Protect pipe openings and drains by plugs or caps. Clear all stoppages.

C. Protect finish on all fixtures and chrome trim during construction and cleanup. Avoid any exposure to acid fumes on the chrome.

1.05. SOLDER:

A. Any pipe, solder, or flux used shall be "lead free". The Federal Safe Drinking Water Act defines "lead free" as: "less than 0.2 percent lead in solder and flux, and less than 8.0 percent lead in pipes and fittings." See Section 224050, 1.01, F.4 for allowed products.

1.06 LAYOUT:

A. The Contractor shall make layout drawings for work that is to be installed under this Division of the Contract. The Contractor shall be responsible for all dimensions and space conditions. The Contractor shall coordinate his work with that of all trades. Particular care shall be exercised over lay-in and gypsum board ceilings, location of sleeves, and fixture spacing

B. All work and testing of piping above ceiling areas shall be completed before installation of ceiling tile or carpet.

1.07 PAINTING:

A. Clean and prepare exposed un-plated metal surfaces for painting. Pickle galvanized surfaces.

B. Except for asphalt-coated metal, apply two coats of oil paint for all exposed un-plated metal surfaces. Apply to exposed asphalt-coated metal surface two coats of paint manufactured for application to this type surface. Colors shall be selected by Architect.

C. Size insulation jackets that are in exposed locations and apply two coats of oil paint of colors selected by Architect.

D. Touch up factory finish on heaters, burners, pumps, etc. to match; sand, prime and cover all scratches or rust.

1.08 EQUIPMENT FOUNDATIONS:

A. Set all floor mounted equipment on 6" high concrete pads reinforced with 6 x 6, 10/10 Mesh. Pads shall be approximately 6" larger than equipment base and have 1" x 1" chamfer on all edges. Pads to have carborundum brick rubbed finish. Surface finish shall be uniformly smooth. All water heaters shall be provided with a 16-gauge, galvanized steel drain pan with welded watertight seams. Drain pan shall be provided with a ¾" ball valve and piped to funnel drain. See water heater schedule.

B. See detail on plans.

1.09 CONSTRUCTION WATER:

A. Install temporary water service to supply water for construction purposes. Plumbing Contractor shall locate and maintain two hose bibs at locations directed on site by General Contractor.

B. At completion of project, Plumbing Contractor shall remove all temporary lines, valves, meter, hose bibs, etc. This is to be done prior to fine grading around the building.

C. Connect to existing line beyond existing meter pit, on site as directed. Coordinate the connection with the Owner on site.

1.10 WATER SERVICE:

A. Connect to the existing water main at location indicated on drawings. New piping shall be type "K" copper below grade.

B. Backflow preventer shall be furnished and installed as indicated on drawing.

1.11 ACCESS DOOR AND PANELS:

A. Furnish to General Contractor factory fabricated doors and panels for installation at all places where specialties, valves, equipment, shock arrestors, etc., are inaccessible. Access means to be of adequate size for intended service and of approved manufacture, finish and type. Instruct General Contractor where to install access means and check for proper location. Panels installed in fire-rated ceiling or wall shall have same hourly fire ratings.

B. Access doors to be a minimum 14-gauge steel, in prime coat, with concealed hinges and flush key operated locking device. Doors shall be furnished to suit specific building construction. Size to suit specific requirements (minimum size of 12" x 12"). Submit shop drawings for approval.

C. Note the Water Piping Plans for some locations in suspended gypsum ceiling and/or chase walls of the gang toilets.

D. See detail of hose reel piping. Access panel required at check valve location in wall of kitchen at each reel location.

1.12 INSTALLATION PROCEDURE:

A. Prior to starting installation, furnish to the General Contractor and all Sub-Contractors concerned copies of approved shop drawings showing location of equipment, piping, etc.

B. Schedule meetings with other trades before and during installation to avoid conflicts and assure that pipes and equipment are installed in the best manner, taking into consideration head-room, maintenance, appearance, and replacement.

1.13 TESTS:

A. Leak test hot and cold-water pipes at 150 psi hydrostatic pressure before covering. Block off equipment and accessories not designed for test pressure.

B. Test entire drainage and venting system by plugging all necessary openings and filling system with water to the level of the top of the highest vent stack. Not less than 10 feet of water pressure will be acceptable.

C. Notify Architect/Engineer 24 hours in advance of all planned tests so Representative may be present.

D. Contractor shall test the entire drainage and vent system by means of a “smoke test” at the time of final inspection. Contractor shall use the manhole at front entry and grease trap where applicable as means to introduce” smoke” into DWV system.

E. At project completion, all below slab/grade drained and waste piping shall be video recorded to verify proper grade and installation. Video shall be turned over to the district maintenance department as part of the project closeout documentation.

F. Contractor shall get dimensions of actual location of all underground piping on as-built plans and provide photo graphed documentation of installation in trenches prior to back filling. A minimum of 2 dimensions from building reference points shall be provided and inverts indicated.

END OF SECTION

SECTION 224010

DRAIN, WASTE, AND VENT PIPING

PART ONE - PRODUCTS:

1.01 SOIL, WASTE, DRAIN, AND VENT PIPING:

A. Run horizontal pipe, graded uniformly, not less than 1/4" per foot for pipes 2" and smaller, and 1/8" per foot for larger pipes unless otherwise noted on drawings. Offset piping as required to pass obstacles.

B. Change size by reducing fittings. Change direction by 45 degrees wyes and long-sweep bends. Use short-sweep bends only with written approval. No horizontal pipe to be drilled, tapped, or welded. Saddle hubs and bands, tapped tees, and crosses will not be approved.

C. Unless otherwise noted, soil, waste and drain piping to be service weight bell and spigot cast iron. All piping shall be asphalt coated. "No-Hub" may be used above ground only. Pipe shall be from Charlotte, AB&I, or Tyler Foundry Company.

D. Building drain shall be run as indicated on floor plans. See Civil Plans for connections.

E. Materials to conform with Tables 702.1, 702.2, 702.3, "International Plumbing Code", and/or local plumbing code. If a conflict exists between codes, the most stringent shall apply.

F. No-hub pipe may be used above grade for soil, waste, drain, condensate, roof drain, overflow drain, and/or vent piping.

G. Contractor shall install long sweep quarter bends at vent and condensate drain locations in any fire rated wall. Any no hub band installed in a fire rated assembly shall be covered by a UL rated “collar” to match rating of the wall.

H. Lavatory and sink drain "arms" shall be DWV copper. Waste arms serving urinals shall be Schedule 40 threaded red brass pipe with threaded red brass fittings.

I. Drain, Waste and Vent piping above slab may be no-hub cast iron, Schedule 40 galvanized steel, or DWV copper. All DWV pipe and fittings shall be made in the USA.

J. Condensate and storm drain bell and spigot cast iron piping, below grade or outside building, shall be service weight cast iron with drainage pattern fittings. Pipe shall be handled, installed, bedded, and backfilled per manufacturer’s printed recommendations.

K. Plastic, PVC, or copper flanges shall not be used on urinals.

L. Joints and Connections:

SECTION 224010

DRAIN, WASTE, AND VENT PIPING

1. Joints in bell and spigot or between such pipe and threaded pipes or caulking ferrules to be "push" joint with compression gaskets of neoprene with approved lubricant. Material shall be Ty-Seal, Charlotte-Seal, or prior approved equal.

2. Screwed joints to be American Standard Taper Pipe Thread.

3. No-hub pipe and fittings shall be coupled with heavy duty neoprene sleeve and stainless steel band couplings. Couplings shall be "Husky White SD2000" by Anaheim, "Clamp-All" 80 lb. bands, Mission “Heavy-Duty” blue couplings, or Proflow “yellow" heavy duty bands by Ideal. Charlotte and Wade “Wide Body” couplings are not approved.

4. Join earthenware fixtures to soil pipe by brass floor flange wiped or iron floor flange connection caulked gas and water tight. Gasket fixture to flange with graphited ring, not with putty or rubber gasket.

5. Joints at floor drains, and cleanouts shall be packed with white oakum, filled with a single pour of molten lead not less than 1" deep, and caulked.

6. Joints in acid waste pipe and drainage fittings shall be made with factory approved heat fusion methods below grade and mechanical joints above slab.

END OF SECTION

SECTION 224040

FLOOR DRAINS, CLEANOUTS, FLASHING & SLEEVES

PART ONE – GENERAL:

1.01 PIPE CLEANOUTS:

A. Install cleanouts at the base of each stack, not over 50 feet in horizontal 3”-inch lines, at 75 feet in 4-inch lines, at turns greater than 45 degrees, and where shown. This applies outside as well as in the building. Extend outside cleanouts to surface. See detail on drawings for pad. All threaded parts of the assembly shall be metal.

B. Cleanouts, in general, to be pipe size up to 4 inches; not less than 4 inches for larger pipes. Cleanouts to be heavy brass ferrules and heavy brass plug with raised nut. Except as specified, cleanouts in walls or floors on grade to be extended flush and fitted with heavy polished brass plug with recessed socket. Cleanouts are listed in Schedule on plans. Products shall be by Zurn, Josam, Wade, or Smith.

C. Cleanouts shall be lead caulked into cast iron soil pipe to provide rigid joints. Extend lead joints past first horizontal fitting. In the event underground piping is specified or value engineering to be PVC, connect to the cast iron with a “double hub” section of pipe with lead and oakum joints. This applies inside as well as outside building. Any "loose" cleanouts or pads shall be reworked. Do not install no-hub band below grade to attach cleanout.

D. All interior cleanouts shall be provided with "vandal-proof" screws. At completion of project, furnish to Owner one "tool" to operate each size screw on project.

E. All cleanouts installed in an area to receive Dex-O-Tex flooring shall have an integral wide flange. See Architectural Finish Schedule.

1.02 FLASHING:

A. Where pipes pass through roof, flash as recommended by the manufacturer of the roofing system. Metal roofs shall have Dektite Model #1 or #3 enclosing the pipe and extending 8" in all directions. Equal flashing assembly shall be by Custom Curb or Portals Plus, Inc. Built up or shingle roofs shall have 4-pound lead boot flashings. Turn lead down into the vent pipe. Furnish lead flashing as specified on plans. Deliver to Roofer for installation prior to start of roofing work.

B. Vent pipes shall extend a minimum of 12" above roof.

C. Provide support for vent stacks at roof with U bolts and uni-strut or angle installed between roof purlins, truss, or bar joist.

SECTION 224040

FLOOR DRAINS, CLEANOUTS, FLASHING & SLEEVES

1.03 FLOOR DRAINS:

A. Unless indicated otherwise, floor drains shall be three-inch minimum size and shall be cast iron with Nikaloy brass suitable strainer. Furnish clamping collars where membranes are used - otherwise all drains shall have integral seepage pan. Drains are scheduled on plans. All threaded parts of the assembly shall be metal. All drains shall be furnished with caulk outlets. Products shall be by Zurn, Josam, Wade, or Smith.

B. Drains shall be provided with cast iron deep seal P-traps. All drain, trap outlets, and piping to connection into trunk line shall be lead caulked into cast iron soil pipe for rigidity. In the event underground piping is specified or value engineered to be PVC, connect to the cast iron with a “double hub” section of pipe with lead and oakum joints. Any "drains" found to be "loose" shall be reworked prior to pouring floor.

C. Do not block-out for drains; pour into floor slab. Recess drains in large areas 3/4" below finish floor. Floor slope by General Contractor. Drains in small areas or under servicing counters, or equipment shall be flush with finish floor.

D. Do not use no-hub bands to install any floor drain that is in the ground floor slab.

E. Drains shall be equipped with "vandal-proof" screws in strainer tops. Provide Owner with "tool" for each size screw at completion of job.

F. Drains located in areas with Dex-O-Tex floor finish shall have wide flange cast integrally with drain body or a steel plate welded to drain body. Drains with a sheet metal flange are not acceptable.

G. See Note #9 for drains that required trap primer (1/2") connections. All trap primers shall be by drainage connection, no connection to the domestic water piping. Do not install any device above ceiling for this purpose.

1.04 PIPE SLEEVES AND ESCUTCHEONS:

A. Where pipes pass through masonry construction, install sleeves sized to allow 1/2-inch clearance entirely around the passing pipe and insulation. Install sleeves during construction of walls, ceilings, and floors. Extend vertical sleeves a minimum of one inch above finished floor. Install sleeves in a water proof manner. Caulk with packing and waterproof plastic compound. Sleeves in bearing walls and floors shall be made of Schedule 40 steel pipe. Sleeves on other masonry walls shall be made of steel pipe or sections of cast iron pipe. Sleeves shall be flush with each side of masonry wall.

B. Install chromium plated steel escutcheons where pipes and conduit pass through finished walls and ceilings. Install chromium plated cast brass escutcheons where pipes and conduits pass through finished floors.

C. See details for fireproofing of pipes through sleeves in firewalls and floors. Extend insulation on all pipes through fire walls or floors. Contractor shall use a "UL" assembly without substitution. See hourly rating noted on each sheet of plans to identify firewalls.

D. All copper lines shall be sleeved where whey pass through concrete or block.

1.05 FIXTURE CARRIERS

A. Wall hung fixtures shall be supported on wall plate hangers with rectangular steel tube legs bolted to the floor slab. Use of pipe supports is not allowed.

B. Carriers shall be manufactured by Smith, Wade, Zurn, Josam, Watts or MIFAB.

1.06 TRAP PRIMERS

A. Floor Drains noted to have trap primer connection shall have ½" IPS threaded connection. Route ½" soft copper from floor drain up in wall at fixture indicated. Cover copper piping below slab and in block with slip on vinyl jacket.

B. Trap primer shall connect to P-trap of fixture. See note 9 on plans. Do not connect to water lines.

C. Trap primer shall be model #2698 1 1/2" Chrome by J.R. Smith or equals by Zurn.

D. Primer tube shall be ½" chrome plated copper with compression fitting or stainless-steel flex hose of the exact length to go from trap to wall without undue sag.

END OF SECTION

SECTION 224050

DOMESTIC WATER PIPING

PART ONE – GENERAL:

1.01 HOT AND COLD WATER PIPING:

A. Unless otherwise indicated, run concealed, pitched to assure venting along drainage. Valve main water service near entry and valve all submains and branches as indicated on plans. Install drain valve at low point in domestic water riser room and check valves in cold water to mixing fittings where tempered water is valved. Handles of below grade valves shall be within 12" of surface of finish grade.

B. Pipe outside building to be run at least 30" below finished grade. Pipe inside building shall be at least 8" below finished slab. All copper pipes below grade shall be protected with two coats of black asphaltum. Hang pipes from structural system. In areas with ceiling, the pipe shall be concealed. Install all supplemental galvanized steel angles or uni-strut needed to provide proper support for pipe hangers at specified hanger spacing.

C. Unless otherwise required, branches to small fixtures to be 1/2" ID for single fixture and 3/4" ID for two fixtures; 1" ID or larger to single flush valve. All pipe sizes indicated are "nominal" pipe size.

D. Hot and cold water piping to be hard drawn copper; type "L" above ground; type "K" underground; soldered wrought copper fittings. Provide soft drawn copper for below slab work in kitchen and first floor lab classrooms with island fixtures to eliminate joints below floor. All domestic water piping and fittings shall be manufactured by Cerro Tube and Nibco respectively . All domestic water pipe and fittings shall be made in the USA.

E. Tables 303 and 603, "Materials" for Plumbing Installation of the International Plumbing Code applies.

F. Joints and connections:

1. Screwed; American Standard Taper Thread with non-toxic compound on male threads only.

2. Use hard solder (nickel and silver) capable of withstanding water at 200 psi and 250 degrees F. Use soldering nipples or couplings between screwed and soldered pipe and fittings.

3. Final connections at equipment, heaters, valves, pump, etc., to be by unions. Unions shall match material of adjacent pipes. Where pipe materials change, install EPCO insulating unions, or "Clearflow" fittings by Perfection Corp.

4. Contractor shall use 95.6%/4%/0.4% Tin, Copper and Silver "Silvabrite" 100 or Taramet “Sterling” Solder. Solder shall be lead, nickel and antimony fre. The use of 50/50 solder is not allowed.

G. Contractor shall hang or support water lines in chases and isolate copper lines from the cast iron stacks, hangers, chair carriers, etc.

H. Contractor shall provide support in stud walls for water supply to each fixture or hosebib

equal to "Holdrite" #108-26 copper plated 24 gauge steel bracket. Solder pipe to bracket. Screw brackets to studs.

I. Contractor shall isolate all copper water lines from contact with concrete, block or mortar.

J. Contractor shall stop and seal insulation within wall. Do not allow insulation to penetrate face of block or gypsum board.

K. Contractor shall solder 8" long “L” shaped copper strap to each hosebib or fixture supply in block walls and anchor it into cell of block work filled with mortar mix. Loose supply piping will not be accepted.

L. Contractor shall provide solid metal stud blocking in stud walls for flush valve standoff brackets.

1.02 AIR CHAMBERS:

A. Install vertically at each hot and cold supply for each fixture on the project including but not limited to water closets, urinals, sinks, lavatories, showers, electric water coolers, eye washes, etc. Chambers shall be one pipe size larger than branch supply size and not less than 18" high and shall be in addition to water hammer arrestors as located on plans and specified below. Where necessary to avoid obstructions, offset chambers within the wall. Chambers shall be insulated the same as pipe and shall not be in contact with any ferrous metal. Provide additional support in wall and insulate.

B. See detail on plans. Do not install air chambers above ceiling. Chamber may be made up using ¾” and 1” pre-made 18” long tubing sections by Sioux Chief.

1.03 WATER HAMMER ARRESTORS:

A. Water hammer arrestors (i.e. shock arrestors, shocks, etc.) shall be constructed entirely of stainless steel treaded nipple compression chamber and bellows. Units shall be pre-charged and permanently sealed at the factory.

B. Units shall be sized: A, B, C, D, E or F and certified by the Plumbing and Drainage Institute (PDI).

C. Locate units as indicated on plans for each quick closing valve and flush valve or group of flush valves. See kitchen equipment piping details. Provide access door for each unit located in a chase or above a hard ceiling. Water hammer arrestors shall be provided as indicated on the plans in addition to air chambers as specified above.

D. Units shall be installed in a vertical position and be accessible for replacement.

E. Contractor shall furnish and install type “A” shock arrestor at each wall hydrant location.

F. Water hammer arrestors shall be manufactured or marketed under one of the following name brands: J.R. Smith, Wade, Josam, Zurn, Wade, or Watts.

1.04 WALL HYDRANT:

A. 3/4" hose thread, cast bronze, non-freeze, auto self-draining, box hydrant with integral vacuum breaker, hinged latching cast cover, loose key operator, length to suit wall thickness (12" min. length). Locate with aid of other drawings to avoid storm leaders, exterior electrical outlets, etc. Cover shall be nickel bronze and have “water” on door.

B. Contractor shall anchor piping within wall cavity, protect finish of hydrant, isolate copper from masonry, and align face of hydrant box to be flush and square with finish wall surface.

C. Hydrants shall be Zurn #1320-NB, Josam #71000, Smith #5519-NB, or equals by MIFAB, Watts, or Woodford.

D. Box hydrants , where indicated, shall be Zurn #1360-6, 3/4" hose thread, cast bronze, non-freeze, with flush hinged locking cover, polished nickel bronze scoriated face, bronze casing, 3' depth of bury, 24" x 24" x 6" thick concrete collar around each box. Box and collar to be flush with finish grade. Equals by Wade, Smith, Woodford or Mifab.

E. Roof hydrants, where indicated shall be Woodford model SRH-MS, non-freeze complete with all necessary mounting hardware, hydrant support and two-degree shim for pitch adjustment. Hydrant shall feature repair-in-place technology. Equals by Zurn, Wade, Smith or MIfab.

F. Twin-temp hydrants, where indicated, shall be Smith #5560-NB-QT-H ¾” hose thread, vacuum breaker, cast box with nickel bronze finish, hinged cover with cylinder lock, non-freeze loose key operator for hot and cold inlets, quarter turn on valves, length to suit wall thickness. Provide check valves in hot and cold water supplies. Equals by Zurn or Wade.

G. Control box for water supply for can wash, where indicated, shall be Smith model #3380 type 304 stainless steel box with hinged door with cylinder lock, integral screw driver stops on ½” hot and cold supplies, atmospheric vacuum breaker, all types “L” copper tubing. Box shall have flange for recess into masonry wall construction. Equals by Zurn or Wade.

1.05 HOSEBIB:

A. Locate as shown on plans by symbol "HB" or note.

B. Mount 16" above floor.

C. Provide 3/4" H.P.T. vacuum breaker in matching finish.

D. Unit shall be Model #387 polished chromium plated by Chicago Faucet, or equal by T&S, Bradley, or Mifab #9241.

1.06 VACUUM BREAKERS:

A. Unless otherwise specified, each interior and exterior hosebib and faucet having hose threads, and not equipped with a built-in vacuum breaker, shall be equipped with Nidel 3/4" HD vacuum breaker of finish to match hosebib or faucet. Equals by Watts or Wilkins.

B. At each location of connection to a piece of equipment that may have continuous pressure on the line, install a Watts #7C or equal. These are required at hose reels, food pulpers, and other locations that may have a submerged inlet that is under pressure.

1.07 VALVES:

A. Valves shall have the name or trademark of the manufacturers and the working pressure stamped or cast on the valve body. Valves shall be of one manufacturer listed below or prior approved in addendums. Valves found to be not as specified shall be removed.

B. All valves in each system, except for special types shall be the product of a single manufacturer.

C. All valves installed in horizontal lines shall be installed with the stems horizontal or above. Valve handwheels shall be oriented, when installed, to provide maximum accessibility for operation.

D. All valves that require packing shall be designed and constructed such that they can be packed under pressure.

E. Valve handwheels shall be malleable iron (except where specifically specified otherwise).

F. Domestic Water System:

1. Gate valve 4" in size and larger shall be iron body, bronze trim, non-rising stem, solid wedge, flange ends, and 200 psi W.O.G. Valve shall be Nibco F-619.

2. Ball valves 3" in size and smaller shall have bronze body, non-rising stem, solid ball, and solder ends for 200 pound W.O.G. Valves shall be: Apollo #70-100 or equal by Nibco 585-70, T or S.

3. Check valves 3" in size and smaller shall be horizontal swing type with bronze body, composition disc, and solder ends for 200 pound W.O.G. Valves shall be:

Crane	No. 1342
Hammond	IB941
Stockham	B-309
Nibco	S-413-W

4. Globe valves 2" in size and smaller shall have bronze body, rising stem, composition disc, and solder ends for 200 pound W.O.G. Valves shall be:

Crane	No. 1310
Hammond	IB423
Stockham	B-14-T
Nibco	S-211-W

5. Hose End Drain Valves shall be 3/4" in size with bronze body, non-rising stem, solid wedge, threaded inlet, and hose outlet with cap and chain for 200 pound W.O.G. Valves shall be:

Crane	No. 451
Jenkins	372
Kennedy	31
Nibco	T-585-70-HC

1.08 INSULATION:

A. After testing, clean pipes and fittings. Insulation shall be installed by factory authorized and trained personnel or Subcontractor.

B. Insulate all piping above slab with Certain-Teed 500 degrees Snap-On ASJ/SSL pipe insulation. Do not install fiberglass in locations that are not protected from the weather. Equals by Owens Corning Fiberglass SSL 1, Knauf, or Micr-Lok by Mansville are acceptable. Install factory “butt joint” strips and mastic to all ells and tees.

Hot Water and Hot Water Recirculation - 1" Thick for pipes 1 ½” and smaller
Hot Water - 2" Thick for pipes 2" and larger
Cold Water - 1/2" Thick

C. Insulate all fittings except unions with fiberglass inserts, to equal thickness of adjacent pipe insulation and finish with PVC fitting covers sealed as recommended by manufacturer. PVC covers shall be plenum rated and have a flame spread of 25 or less and a smoke development of 50 or less meeting requirements of NFPA 90A.

D. Insulate above grade lines and fittings which convey water from coolers, ice chest, and air conditioners with 3/4" thick closed cell elastomeric insulation (Armaflex, Rubatex, or Halstead). Seal joints with manufacturer's recommended glue. Do not split insulation or use tape.

E. Insulate all underground hot water and hot water recirculating lines and fittings with 1-1/2" thick Pittsburgh Corning Foamglas. Finish with cut back asphalt (Foster 60-25 or approved equal) reinforced with glass or nylon open weave cloth.

F. For pipe inside block cavity, Contractor shall install Armstrong #AP Armaflex self-sealing 1/2" thick closed cell elastomeric insulation on pipes up through 6" in diameter, and 1/2" thick closed cell flexible elastomeric block insulation sheet material for pipes larger than 6".

G. Insulation shall be continuous thru sleeves at each fire rated wall or floor. See details.

Do not “cut back” insulation at sleeves.

H. Foam plastic insulation is not acceptable.

1.09 CAST IRON ACCESS BOXES:

A. Cover valves below grade with Charlotte Pipe & Foundry Co., Style UTL-286 boxes, or equals. Set cover flush with finished grade and valve handle not over 12” below.

1.10 STERILIZATION OF HOT AND COLD WATER SYSTEM:

A. Sterilize with a solution containing not less than fifty (50) parts per million of available chlorine. Use sodium hypochlorite solution conforming to Federal Specification OB-441A, Grade D. Solution to remain in system for twenty-four (24) hours, opening and closing all valves several times. After sterilization, flush with clean water until chlorine is not greater than 0.2 parts per million.

B. Have a minimum of two (2) samples from most remote part of system taken 24 hours apart and tested by an independent testing laboratory approved by the State Health Department. Deliver certificates of approval to Architect. All laboratory fees are to be included in the Plumbing contract. The Contractor will be responsible for preventing use of water from systems for human consumption until tested and approved. Should any of the reports prove unfavorable, the entire disinfection and sampling process shall be repeated.

NOTE: Certificates indicating negative results of coliform and non-coliform growth must be procured before building can be accepted or occupied.

END OF SECTION 22 40 50

SECTION 224060

HANGERS, SUPPORTS AND FIRE STOPPING

PART ONE – GENERAL:

1.01 PIPE SUPPORTS:

A. Perforated strap hangers, chains, or wire will not be permitted on the job.

B. Support horizontal ferrous piping where run above ground with galvanized split ring hangers, turnbuckles and threaded rods, as manufactured by Grinnell Co., PHD Manufacturing, Michigan Hanger Co., or B-Line Systems. Hangers to be securely fastened to structure and spaced not over 5 feet apart for cast iron pipes and 8 feet apart for other ferrous pipes. Locate hangers as close to hubs or bands as possible. Hangers shall be equal to Michigan Hanger Co. #401.

C. Support horizontal copper piping where run above ground and all insulated pipe by means of oversize hangers with integral factory installed insulation shields. Hangers shall be spaced not over 6 feet apart for 1-1/2" and smaller pipes, and not over 8 feet apart for 2" and larger pipes. Insulation shall be continuous through the hangers. Hangers shall be equal to M-Co. #403 or PHD #455.

D. Support horizontal “plastic” acid waste piping by means of PHD #450 V clevis hanger and #450T support trough. Provide hangers on each side of trough joints, 10' length.

E. Furnish and install intermediate or supplementary steel required for proper support of piping and installation of hangers. Group parallel runs of pipe and support by common angle hangers of adequate dimensions.

F. Where pipe smaller than 1" is installed along the face of the wall, install Grinnell #153 hanger flange and CT-138R split-ring tubing hanger. Bolt to wall with lag screws, or toggle bolts. Contractor shall cut and seal pipe insulation around each hanger.

G. Where indicated and detailed on plans, support all domestic water lines in corridors on galvanized angle iron frames. Frames shall be bolted to block walls or through bolted to metal studs with oversized fender washers. Detail indicates the maximum size required. Submit shop drawing from a Registered Seismic Engineer for each condition for any condition of lesser number of lines, smaller diameter pipes, smaller angle or thinner angle iron. Frames shall be welded, drilled, cleaned and then hot dipped galvanized.

H. Provide seismic cable braces on drain, waste, vent, water, gas, and or specialty piping as noted on detail.

I. See details for fireproofing of pipes and pipe sleeves in firewalls and floors. Extend insulation on all pipes through pipe sleeve in firewalls or floors. Contractor shall use an “UL” assembly without substitution. See hourly rating noted on each plan to identify firewalls. All pipe penetrations of fire rated walls or floors (except coredrilled floors) shall

have a schedule 40 steel sleeve.

END OF SECTION

SECTION 224070

ELECTRIC WATER HEATER

1.01 ELECTRIC STORAGE HEATERS:

A. Shall be where shown on the Drawings and as specified on plans. Packaged self-contained water heater shall be fully equipped with immersion heaters, control thermostat, low pressure switch for element protection, fuses for each power circuit, ASME temperature and pressure relief valve, thermometer, pressure gauge, jacketed insulation, and integral support skid. Vessel shall carry a three-year non-prorated parts and labor warranty. Mount unit as noted on details.

B. Unit shall have a porcelainized glass lined tank. Heater shall have U.L. seal of certification, 150 psi working pressure. Install brass nipples, no galvanized fittings. Provide Dielectric unions as required.

C. All power wiring and final connections will be furnished by Electrical Contractor.

D. Circulator where indicated, shall be B&G PL-36B or equal by Grundfos, (3/4") bronze body, control by immersion aquastat. Control wiring shall be by the Plumber and material shall comply with Division 26 – Electrical Specifications.

E. Heater shall be the standard product of a manufacturer regularly engaged in the design, testing, and cataloging of complete UL approved units. Specified heater is a product of State Industries. Equal products by Rheem, A.O. Smith, or Lochinvar may be submitted. See Section 23 03 00 of the Specification.

F. Start-up sequence shall be provided by factory trained personnel. Start-up shall be scheduled so as to allow Contractor, Engineer, Architect, and Owner to have a representative present. A written report shall be furnished to the Engineer stating that the installation is in accord with manufacturer's recommendations.

G. The water heater shall include all standard equipment, shall fit properly into the space provide for it, and shall conform to the drawing requirements. The complete installation shall be in accordance with applicable state and local codes.

H. Mount on concrete pad as detailed. Provide seismic support per Specification Section 23 05 48.

I. Additional accessories shall include an ASME expansion tank and mixing valve as indicated on detail. Provide vacuum relief valve as required by the International Plumbing Code.

J. Heater shall be as scheduled on the plans. See detail for piping arrangement.

K. All power wiring and final connections will be by the Electrical Contractor.

SECTION 224070

ELECTRIC WATER HEATER

END OF SECTION

SECTION 224122 - INSTANTANEOUS WATER HEATER

1.01 PRODUCTS:

A. General - Water heater shall be Intellihot or prior approved equal. See schedule for model numbers, capacities, and fuel types. Heater shall operate at a minimum of 83% thermal efficiency and meet the requirements of ASHRAE 90.1.

B. Construction - Water heater shall be completely factory packaged consisting of three 250,000 BTUH input. Individual heaters (totaling 750,000 BTUH) piped, wired and with controls to provide redundancy yet operate as a single unit.

C. Assembly- Shall be insulated, enamel steel jackets, mounted on steel skids, and ETL approved.

D. Burners - Each water heater shall have a combination burner for natural and LP gas. Selection made by a switch.

E. Heat Exchanger - Each heater shall be provided with a single pass heat exchanger made of 316 L stainless steel, ASME stamped and carry a 10-year non-prorated warranty without any restrictions as to constantly flowing water through the exchanger.

F. Controls - Failure of any one heater shall not shut the entire system down. Should there be a failure of any heater, the outlet temperature shall remain the same, requiring that no water flow through the failed heater. Work load of each heater shall be equal. Outlet temperature shall be within +/- 2° F set point. Maximum efficiency is accomplished by immediately heating incoming cold water beginning with a flow of 0.5 gpm and an input of 30,000 BTUH. Turn down shall be 25:1. Heater shall operate at full capacity even with a gas pressure of only 2.5" Install round double wall type "B' gas vent piping thru roof as manufactured by Metalbestos or approved equal with size per manufacturer's requirements and the IFGC. See detail.

G. Factory Monitoring - For two years manufacturer shall monitor the operation of the water heater and provide at no cost any parts or controls that may be required.

H. Start-up - Start up shall be provided by factory trained person who is employed by the manufacturer or manufacturer's representative.

I. Accessories - Provide recirculation pump model B &G PL-36B or equal by Grundfos, ¾" bronze body, control by Aquastat. Control wiring shall be by the plumber and shall

comply with section 260000 of the specifications. Provide bronze fittings and/or Dielectric unions at connections to heater per manufacturer's literature.

END OF SECTION 224122

SECTION 224160

NATURAL GAS PIPING

1.01 GAS SYSTEM:

A. Provide a system of gas piping including connection to the gas meter. See notes and detail on plans. Meter and piping to site shall be by local gas utility company.

B. Connect to each gas consuming appliance and outlet. Install gas cock and union ahead of each connection. All work and materials shall meet local requirements and comply with the International Gas Code. Contractor shall provide letter of certification to the Engineer that gas system has been installed and tested per the International Gas Code.

C. Interior above grade pipe 2 ½" and smaller shall be Type A53 Schedule 40 black steel with screwed malleable iron fittings. Exterior above grade piping 2 ½" and smaller shall be Type A53 Schedule 40 galvanized steel with screwed malleable iron fittings. Gas piping 3" and larger shall be welded Type A53 Schedule 40 with welded fittings. Pipe shall be either black steel or galvanized as specified previously for threaded pipe. Weld joints and fittings on galvanized pipe shall be cold galvanized after fabrication. All gas piping and fittings shall be manufactured by Wheatland Tube or Allied Tube with domestic fittings. All gas pipe and fittings shall be made in the USA.

D. Pipe below grade shall be specially made for gas service and be plastic coated with primer and tape at welded joints. Holliday test all pipe after installation for voids in protective coating. Repair all defects prior to backfilling. Notify Engineer 24 hours prior to test. All below grade gas piping shall be manufactured by Wheatland Tube, or Allied Tube with domestic fittings.

E. Pipe below slab on grade shall be Type A53 Schedule 40 black steel as specified above within conduit poured in the slab. Conduit shall be Schedule 40 galvanized steel. Conduit shall be connected together and sealed gas tight. See plans for gas vents, conduit details, and special notes. Conduit shall be sized to allow removal of gas piping with last elbow in place.

F. Leak test all pipe before concealment and connection as required by local authority (or at 150 psig) and deliver certificate of approval, in triplicate, to Architect. Notify Engineer 24 hours prior to test so a Representative may be present during test.

G. Leak test completed system after installation of all fittings, valves, trim, etc., are in place and before any use by Owner. Test pressure shall be 4 psig and shall be scheduled so Owner, State Fire Marshal, Architect, and Engineer, as well as Contractor, may have a Representative present. Test shall be a minimum of 20 minutes.

H. Provide ten-foot ground rod at meter location. Bond gas line to ground rod and to main domestic cold-water line with bare #6 copper wire. Route wire through 1/2" EMT.

I. Valves:

1. Plug valves shall be bronze body and plug, threaded ends, and square head for 125-pound W.O.G. Valves shall be as manufactured by Nordstrom or equal.

2. Lubricated plug valves shall be factory lubricated and sealed and shall be rated for natural gas.

3. Provide one box end wrench to the Owner for each size and type of valve head.

4. Ball valves shall have bronze body, brass stem, chrome plated brass ball and reinforced Teflon seat, threaded ends and rated 600-pound W.O.G. Valves shall be: Apollo 70-100 or Nibco 585-70, T or S.

J. Provide union, ball valve, and flex hose rated for natural gas at connection to each appliance or equipment. See notes on kitchen plan and equipment schedule.

K. Provide type “B” vents from gas heaters thru roof, see detail.

END OF SECTION

SECTION 224220

ACID WASTE SYSTEM

1.01 ACID WASTE SYSTEM:

A. All pipe below grade, below floor slab on grade (1st floor only) or within non-fire-rated walls shall be schedule 40, fire retardant (blue) polypropylene thermoplastic pipe and fittings. Joints shall be made by heat fusion. Pipe and fittings shall conform to ASTM D4101. "Brown" line and/or "Blackline" combustible acid resistant pipe is not acceptable.

B. All pipe above slab, outside of walls, located within a ceiling plenum or other concealed, accessible location shall be schedule 40, (dark blue) Polyvinylidene Fluoride (PVDF) plenum rated piping. PVDF piping and fittings shall be certified to meet ASTM E-84 and UL 723 flame spread and smoke developed requirements. Accessible pipe may be joined with mechanical joints. Couplings shall utilize a 300 series stainless steel outer band with 5/16" bolts, nuts and washers plated to meet a 100-hour salt spray test per ASTM B117.

C. All piping that penetrates or is installed within any fire rated wall, floor, ceiling or any other rated assembly shall be Flowserve "Duriron" high silicon iron, "Kimax" glass pipe with beaded couplings, or (dark blue) PVDF pipe.

D. Installation, support, and testing shall be in accordance with the manufacturer's recommendations. Factory authorized representative shall visit site during installation and furnish written confirmation to the Engineer that installation is in accordance with accepted factory requirements.

E. Contractor has the option to install the entire job with Duriron high silicon cast iron pipe or with glass pipe. Use "Kimax" EPS protected pipe below grade. Below grade Duriron piping shall be bell and spigot with lead caulk joints and Red Stripe Sealite No. 312A acid resistant rope packing. Above grade Duriron piping shall be mechanical joint with an inner sleeve of PTFE and an outer sleeve of neoprene rubber held with 300 series stainless steel couplings.

F. See detail on plans for dilution pit inside a pre-cast manhole.

G. Acid waste and vent system piping shall be by Orion Industries, R&G Sloan, Fuseal II, Zurn, Kimax or Duriron.

END OF SECTION

SECTION 224230

ROOF DRAINAGE

1.01 ROOF DRAINAGE:

A. Furnish all labor, materials, equipment, and plant required for the complete installation of all roof drains, overflow drains, piping, insulation, nozzles, etc., to route roof drainage to site storm drain lines as indicated.

B. Roof and overflow drains shall be as furnished by Plumbing Contractor and installed by the Plumbing and Roofing Contractor. The Roofing contractor is responsible for cutting all openings in the roof, and flashing the sump of the roof drain watertight. The plumbing contractor is responsible for all other work involving the complete installation of roof drains. Piping between roof drains and connection point is included in this section of the specifications. Piping from overflow drains includes penetrating thru the exterior walls to the nozzle fittings.

C. Piping above floor slab shall be no-hub cast iron where concealed and Schedule 40 galvanized steel pipe with screwed fittings where drain lines are exposed. Pipe below slab shall be service weight cast iron. All roof drainage pipe and fittings shall be made in the USA.

D. Provide hanger within 3' of drain body for support.

E. Provide Schedule 40 galvanized threaded steel nipples and elbows at each drain.

F. Connection into site storm drain system shall be by this Contractor as indicated on plans. Field verify exact locations and inverts.

G. Roof drains shall be J.R. Smith Model #1010-AD-E-C-R-U-T with threaded outlets, under deck clamps, sump receiver, aluminum vandal proof domes, extensions for insulation, and 4 lb. lead flashing. Equal products by Zurn or Wade are acceptable. Overflow drains shall be the same with 2" internal dam.

H. Leak test all roof drain piping by plugging pipe at each opening. Fill drains with water, level with roof, for two hours. Test shall be performed in the presence of the Engineer, Contractor, and Owner’s representative.

I. See Section 22 40 10 for pipe, fittings, and jointing.

J. Secondary flashing clamp is not required and shall not be installed.

1.02 INSULATION:

A. After testing, clean pipes and fittings. Insulation shall be installed by factory authorized and trained personnel or Subcontractor.

B. Insulate all piping above slab with Certain-Teed 500 degrees Snap-On ASJ/SSL pipe

insulation. Do not install fiberglass in locations that are not protected from the weather Equals by Owens Corning Fiberglass SSL 1, Knauf, or Micr-Lok by Mansville are acceptable. Install factory “butt joint” strips and mastic to all ells and tees.

Roof Drainage – 1” Thick above ceiling and ½” Thick in walls.

C. Insulate all fittings except unions with fiberglass inserts, to equal thickness of adjacent pipe insulation and finish with PVC fitting covers sealed as recommended by manufacturer. Where piping runs through an air plenum, PVC covers shall have a flame spread of 25 or less and a smoke development of 50 or less meeting requirements of NFPA 90A.

D. Foam plastic insulation is not acceptable.

E. For pipe inside block cavity, Contractor shall install Armstrong #AP Armaflex self-sealing 1/2" thick closed cell elastomeric insulation on pipes up through 6" in diameter, and 1/2" thick closed cell flexible elastomeric block insulation sheet material for pipes larger than 6".

F. Insulation shall be continuous thru sleeves at each fire rated wall or floor. See details. Do not “cut back” insulation at sleeves.

G. Insulate body of drains with 2”, 1pcf duct wrap. Cover fittings and seal to deck vapor tight.

H. See Section 22 40 60 for hangers and fire stopping.

END OF SECTION

SECTION 224240

CONDENSATE DRAINAGE

1.01 CONDENSATE DRAINAGE:

A. Work Included:

1. Furnish all labor, materials, equipment, and plant required for the complete installation of all piping, hangers, insulation, catch basins, traps, sleeves, firestopping, etc., to route condensate from air handlers to the exterior.

B. Products:

1. Condensate piping above slab shall be no-hub cast iron and below slab shall be bell and spigot cast iron as specified for soil, waste, and drain piping with drainage fittings.

2. Drain piping from P & T valves shall be Type "L" copper with wrought copper fittings.

C. Executions:

1. All condensate and P & T piping shall be installed at a minimum uniform grade of 1% unless otherwise noted.

2. Provide riser clamps at each floor.

3. Condensate piping shall be installed as specified for soil, waste, and drain piping.

4. P & T drain piping shall be installed as specified for domestic water piping.

5. See "Insulation" section of this Specification for work included.

6. See notes on plans.

1.02 INSULATION:

A. After testing, clean pipes and fittings. Insulation shall be installed by factory authorized and trained personnel or Subcontractor.

B. Insulation shall be as follows: Condensate - 3/4" Thick

C. Insulate all fittings except unions with fiberglass inserts, to equal thickness of adjacent pipe insulation and finish with PVC fitting covers sealed as recommended by manufacturer. Where piping runs through an air plenum, PVC covers shall have a flame spread of 25 or less and a smoke development of 50 or less meeting requirements of NFPA 90A.

D. Insulate above grade lines and fittings which convey water from coolers, ice chest, and

air conditioners with 3/4" thick closed cell electrometric insulation (Armaflex, Rubatex, or Halstead). Seal joints with manufacturer's recommended coating. Do not split insulation or use tape.

E. For pipe inside block cavity, Contractor shall install Armstrong #AP Armaflex self-sealing 1/2" thick closed cell elastomeric insulation on pipes up through 6" in diameter, and 1/2" thick closed cell flexible elastomeric block insulation sheet material for pipes larger than 6".

F. Insulation shall be continuous thru sleeves at each fire rated wall or floor. See details. Do not “cut back” insulation at sleeves.

G. Foam plastic insulation is unacceptable.

H. See Section 22 40 60 for hangers and firestopping.

END OF SECTION

SECTION 224250

PIPE AND VALVE INDENTIFICATION

PART ONE – GENERAL:

1.01 IDENTIFICATION OF PIPING:

A. General:

1. The following piping system shall be provided with identification as hereinafter specified:

MARKER PIPING SYSTEM	MARKER BACKGROUND COLOR	LETTERS
Domestic Cold-Water Supply	Dark Blue	White
Domestic Hot Water Supply (140)	Dark Red	White
Domestic Hot Water Circulation (115)	Light Red	White
Gas Piping	Yellow	Black

B. The legend and letter colors for the pipe marking system shall be in accordance with applicable provisions of ANSI Standard A13.1-1981.

C. Shop drawings submitted to the Architect/Engineer shall show complete details of the marking system, including colors and legends.

D. Marking System:

1. All piping that is accessible for maintenance operations (except piping in finished spaces) will be identified with semi-rigid plastic (not pressure-sensitive) identification markers.

2. Direction of flow arrows are to be included on each marker unless otherwise specified.

3. In conformance with "Scheme for the Identification of Piping System" (ANSI A13.1-1981), each marker must show:

   a. Approved color-coded background.
   b. Proper color of legend in relation to background color.
   c. Approved legend letter size.
   d. Approved marker length.

4. Locations for pipe markers shall be as follows:

   a. Adjust to each valve and fitting (except on plumbing fixtures and equipment).
   b. At each pipe passage through wall, floor, and ceiling construction.
   c. At each passage to underground.

d. On all horizontal pipe runs - marked every 25 feet.
e. Near each branch.
f. Near access doors.

5. Pipe marking shall be as follows:

   a. SETMARK Type SNA markers on pipes 3/4" thru 5" (Snap On).
   b. SETMARK Type STR markers on pipes 6" and larger (Snap On).
   c. Pipe identification system shall be SETMARK outdoor grade plastic acrylic.
   d. Pipe markers as manufactured by Seton Nameplate Co., New Haven, CT 06506 (1-800-243-6624) or approved equal. Equal products by Brady Corp. (1-800-635-7557).

6. For pipes under 3/4" O.D. (too small for color bands and legends), brass identification tags 1 1/2" in diameter with depressed 1/3" high black-filled letters above 1/2" black-filled numbers will be fastened securely at specified locations.

1.02 VALVE IDENTIFICATION:

A. Valve Tags:

1. All valves shall be tagged and numbered with 19-gauge polished brass tags. Contractor shall furnish valve schedule mounted in main mechanical room. Schedule shall be mounted in glass frame.

2. Provide ceiling valve marker for valves located above lay-in ceilings. Attached marker to adjacent ceiling grid.

END OF SECTION

SECTION 224300

CONNECTIONS TO KITCHEN EQUIPMENT

1.01 CONNECTIONS TO KITCHEN EQUIPMENT:

A. This Contractor shall provide all wastes, vents, and water piping valves, fittings, traps, and connections as required for kitchen equipment indicated on the plans. The sizes of connections shown in the kitchen equipment schedule, and the locations shown on the plans shall be verified and in accordance with the kitchen equipment furnished and set in another section of these Specifications. All exposed waste piping 2" and smaller and all exposed water piping shall be chrome plated brass pipe and fittings.

B. Provide all necessary piping, valves, fittings, specialties, and connections as required for kitchen equipment as shown or called for on plans. Pipe indirect drains to floor, sinks or drains as indicated. Use DWV copper. See details of hose reel, dish machine, booster heater, etc. for items to be furnished by the Plumbing Contractor.

C. Stops are to be furnished on all hot and cold-water lines to equipment, located at equipment and in an accessible position.

D. P-traps and continuous sink waste shall be chrome plated adjustable cast brass, 17 gauge, and be as specified in Section 22 45 00.

E. Equipment Contractor shall provide and Plumbing Contractor shall install all kitchen faucets, tail pieces and lever handle waste.

F. Prior to roughing, obtain shop drawings on equipment to be furnished.

G. Provide T & S #HG-4 stainless steel braid hose with “Yellow” extruding coating. Hose shall have quick disconnect and “Swivelink” ends.

H. Install T&S “Surelink” restraining cable set on each item of cooking equipment on casters. Anchor restraining cable to floor.

I. Contractor shall provide Symmons model #5-225-CK thermostatic mixing valves for all hand washing sinks in kitchen. Tempered water shall be delivered at 115 degree to hot water valve of faucet.

J. Contractor shall provide Watts #7C inline backflow preventers at each water connection to kitchen equipment per DHEC requirements.

END OF SECTION

SECTION 224310

LAB/SCIENCE EQUIPMENT CONNECTIONS

1.01 CONNECTIONS TO LAB/SCIENCE EQUIPMENT:

A. See special notes on Science Equipment Layout Sheet on plans.

B. Provide all necessary piping and connections as required for lab equipment as shown or called for on plans. The interconnecting piping within the tables and fume hoods is to be by this Contractor.

C. Furnish and install ½" bronze sweat valves and risers on cold water supplies to all lab faucets. Locate to permit easy accessibility. Note master cutoff valves recessed in walls for air, vacuum, and gas piping.

D. Plumbing Contractor to install all gooseneck faucets, vacuum breakers, and gas turrets that are provided with the lab equipment. The Contractor shall connect to aforementioned items on all lab equipment, or on wall above countertop.

E. Plumbing Contractor shall provide and install all sink tail pieces, polypropylene p-traps, polypropylene drum traps, supply stops, and plug valves.

F. Equipment Contractor shall drill all tops and furnish and install all sinks with strainers.

G. All exposed pipe shall be chrome plated brass or painted as directed on site.

END OF SECTION

SECTION 224410 –PACKAGED VARIABLE SPEED DOMESTIC WATER BOOSTER SYSTEM

1.01 DOMESTIC BOOSTER SYSTEM:

A. Furnish and install a UL listed, factory skid mounted vertical prefabricated model 70VS duplex, variable speed pressure booster system as manufactured by B&G or SyncroFlow, Inc. The system shall be capable of providing constant system pressure of 80 psig while supplying flow rate from 0 GPM to value scheduled on the plans with a suction pressure of 17 psi minimum.

B. Pumps and Motors: Pumps 1 and 2 shall be variable speed, single stage, end suction, close-coupled design with all-bronze construction, equipped with sleeve mounted mechanical carbon/ceramic shaft seal capable of 175 psi working pressure. Pumps shall be B&G model 1531 with total dynamic head and flowrates as scheduled on plans. Pumps shall be fitted with high-efficiency inverter duty motors and shall be non-overloading at duty point.

C. Pump package components: Pumps shall be provided with discharge and suction isolation ball valves, discharge check valves, copper suction and supply headers as sized on the plans and a thermal build up protection sensor located in the discharge header. Base shall be constructed of formed steel, primed and finish painted. Package shall be rated for a maximum working pressure of 135 psi at 225 degrees F. Provide a factory pre-charged, ASME code and NB stamped 60 gallon, 125 psig rated accumulation tank as manufactured by B&G or Wessels. Construction features shall include an air fill valve, an air pressure gauge, and drain valve, and a replaceable F.D.A. approved flexible membrane to separate air and water. No water shall come in contact with the metal walls of the tank. The accumulation tank shall ship pre-charged to the proper design conditions.

D. Factory Prefabrication: The system shall be factory prefabricated, including full port ball valves on the suction and discharge of each pump as well as copper suction and discharge manifolds complete with anti-vibration pads. The only field connections required will be system headers, tank, over temperature drain tube, and one incoming power connection at the control panel. All welding shall be done by ASME Section 9 certified welders.

E. Pump Sequencing: The lag pumps shall be sequenced on and off by factory set pressure switches and minimum run timers. System shall include individual pump temperature probes with a common purge valve.

F. Variable Frequency Drive and Controls: Packaged pumping system shall be provided with a UL listed, NEMA 1 Technologic 502 controller and Danfoss variable speed drives (provide a drive for each motor) with package mounted system pressure sensor set to 80 PSI discharge pressure maximum and bronze discharge check valves. Pump controller shall be programmed to avoid pump flow surges, hunting, and system over pressurization. Controller shall be provided with a flow sensor and have a configurable analog input to provide end of curve pump protection. Controller shall be capable of controlling up to four pumps in parallel. The controller and drives shall be capable of both manual and automatic pump alternation and be equipped with an optional auto/manual bypass. The hydraulic stabilization program shall utilize a PID control function and be infinitely adjustable. The controller operator interface shall have the following features: Multi-fault memory and recall, green power on light, yellow warning light, red fault light and Soft touch keypad switches. Controller shall, at a minimum, be capable of performing the following pressure booster functions:

Low suction pressure cut out, high system pressure cut out, no flow shut down to turn the pumps off automatically when system demand is low enough to by supplied by the accumulation tank. Shutdown due to no flow shall not require any external flow meters, flow switches, or pressure switches to determine when a no flow condition exists. The controller shall be compatible with the building energy management system (EMS) with a RS-485 port to provide remote system start/stop, system failure alarm, and one 4-20mA output. The following points shall be communicate to the EMS: analog inputs, pump/AFD on/off status, system percent speed, system start/stop command, system operation mode, KW and system flow in GPM.

G. Power: Pumping package shall be provided with a single point power connection and service disconnect with voltage and phase as scheduled on the plans. All interconnecting controls and power wiring shall be factory installed.

H. Factory Test and Certifications: The booster system and its component parts shall undergo a complete operating low test from zero to 100% design flow rate under the specified suction and net system pressure condition.

I. Submittal Data: The submittal data for the pumping system shall include, but not be limited to: pump curves, individual computer data sheets, system drawings, and complete description of control panel with wiring diagram, sequencing data, instrumentation, alarms, and copy of certificate of $1,000,000.00 minimum liability insurance.

J. Guarantee: The pumping system shall be guaranteed in writing by the manufacturer for a period of one (5) years from date of acceptance of system or factory start up whichever is earliest against defect in design, material, or construction.

K. Start-Up Services: The service of a factory trained representative shall make a visit to the job site to check installation and perform start-up and instruct operating personnel.

END OF SECTION 224010

SECTION 224500

PLUMBING FIXTURES AND TRIM

PART ONE - GENERAL:

1.01 QUALITY ASSURANCE:

A. Unless otherwise specified, all plumbing fixtures shall be the product of a single manufacturer. Fixtures are to be new, first quality, and in perfect condition, supplied complete with supply pipes, individual fixture stop valves, traps, bolt caps, faucets, vacuum breakers, strainers, flushing valves, correct hole punching for faucet furnished, set screw type escutcheons, nipples, tubing covers cut to length, supports, etc., as required. Metal parts to be heavily chromium plated, including traps, exposed pipe and escutcheon plates.

B. All electric water coolers, drinking fountains, bubblers, faucets, hot and cold-water dispensers, ice makers, supply stops, and end point control valves shall comply with requirements of ANSI/NSF Standard 61. Certification of NSF compliance shall be displayed on these products or packaging.

C. All vitreous china fixtures shall be white.

D. All spaces between fixtures and walls, counter tops, or floors shall be sealed with a white non-hardening caulking compound.

E. Contractor shall anchor lavatories and water coolers to wall at bottom so as to prevent "lifting" off of wall.

PART TWO - PRODUCTS:

2.01 FIXTURES:

A. Fixtures listed below and/or shown on drawings are those of American Standard except as otherwise specified. The name or model number given herein shall be a guide to quality. Equal fixtures by Kohler, Eljer, Crane, Zurn or prior approved equal are acceptable. Acrylic showers shall be Aqua-Bath as specified, equal by Aquarius, or prior approved equal. Electric water coolers shall be as specified by Halsey-Taylor, or equal by Elkay, Acorn Aqua. Express lavatories shall be as specified by Acorn as specified, equal Willoughby Industries, or prior approved equal. See Section 230300 for substitutions. Do not mix manufacturers unless specified.

B. Fixture traps, wall nipples, and supply stops shall be cast brass construction, polished chrome-plated. P-traps shall be 17 gauge and have cast brass nuts and cleanout plug. Provide set screws in all escutcheons.

1. Provide traps for all fixtures as listed below:

Water Coolers: 1-1/4" x 1-1/2" #8902-F TA-140-CF Z-8701-CE

Lavatories:	1-1/4" x 1-1/2" #8902-F	TA-140-CF	Z-8701-CE
Sinks:	1-1/2" x 1-1/2" #8912-F	TA-150-CF	Z-8702-CE

2. Sink waste shall be as follows:

1 1/2" x 16" end outlet	#111C16G17	#WE150L16	#Z-8752
1 1/2" x 21" end outlet	#111C21G17	#WE150L21	#Z-8754
1 1/2" x 16" center outlet	#113C16G17	#WC150L16	#Z-8758
1 1/2" x 21" center outlet	#113C21G17	#WC150L21	#Z-8760

3. Fixture supplies shall be as listed below:

Water Coolers:	#165-F	LA-10-CF	#Z-8800-LR-CE
Lavatories:	#165-F	LA-10-CF	#Z-8800-LR-CE
Sinks:	#2165-F	LA-12-CF	#Z-8802-LR-CE
Water Closets:	#166-F	CA-10-CF	#Z-8800-CR-CE
Wheel Chair:	#158-HWC-F	LSH-15 BKWC	#Z-8855-WL-LK-CE

4. Strainers shall be as listed below:

Lavatories:	#155-A	SG7	#Z-8743
Sinks:	#151	SB-8H	#Z-8740
H/C Lav.	#155-WC	7WC	#Z-8746
H/C Sink:	#1000WC	SB8CWC	#Z-8748

C. Faucets by Chicago Faucet Company, T&S Brass Company, Symmons, Zurn Aqua-Spec, or prior approved equal will be accepted. Do not mix manufacturers, except as specified. All faucets shall be provided with complete vandal proof aerators, handles, and accessories.

D. Closet seats shall be white solid plastic, open front, round or elongated to match bowl, have self-sustaining check hinges, and be as follows:

Bemis:	#1655-SS/C	#955-SSC
Beneke:	#527-SS	#323-5
Olsonite:	#95-CC/SS	#97-CC/SS
Church:	#9500-SSC	#1580-C or 397-SSC
Centoco:	#1500-STS/CC/SS	#300-CC/SS

E. Flush valves shall be furnished at each water closet and urinal. Valves shall be exposed with non-hold open handles, screw driver angle stop, vacuum breaker, adjustable tailpiece, sweat solder adapter, vandal proof cap, set screw in the escutcheon, and be as follows:

Water Closet:

Sloan “Regal” #111-XL-YK

Zurn “Aquaflush”	#Z-6000-WSI-PL-YK

Urinal:

Sloan “Regal”	#186-1-XL-YK
Zurn “Aquaflush”	#Z-6003-WSI-PL-YK

F. Flush valve handles on all handicapped (P-1) water closets shall be turned to the wide side of the toilet area or stall. The height of the flush valve handle for handicapped water closets and urinals shall not be above 44" and shall comply with ADA requirements.

G. Flush valves for all water closets and urinals shall be furnished with a stand off bracket, solid ring, and threaded rod, similar to "YK" variation. The bracket to be field installed on supply tube between the top of fixture and the diaphragm of each flush valve.

H. See Specification Section 15050 for prior approvals. Equal products by Engineered Brass Company, McGuire, Zurn Industries, or Dearborn Brass may be used.

J. Provide wall carriers for all wall hung water closets as specified. Where space is not available, back-to-back carriers shall be provided. Mount all water closets at heights as specified to comply with both adult and child ADA requirements as outlined by OSF and ANSI/ICC A117.1.

2.02 HANDICAPPED PROTECTION:

A. Furnish and install at each handicapped accessible lavatory or sink a Model #102-W Handi Lav-Guard Insulation Kit as manufactured by Truebro. At offset wheel chair lavatories provide Model #105-W.

B. All trap and supply insulators shall be smooth, white, flame retardant vinyl and comply with requirements of the A.D.A., ANSI/ICC A117.1.

PART THREE - EXECUTION:

3.01 INSTALLATION:

A. Securely support by approved brackets, chairs, bolts, and metal expansion inserts. Where chases are provided or adjacent space in undeveloped area use through bolts and heavy steel load distributing plate, in addition to any other means specified. Do not use plastic shields to carry load of fixtures.

B. No plumbing fixtures, devices, or piping shall be installed that will provide a cross-connection or interconnection between a distribution supply for drinking or domestic purposes and a polluted supply such as a drainage system or a soil or waste pipe that will make possible the backflow of sewage, polluted water, or waste into the water supply system. Antisyphon devices shall be provided on all fixtures having submerged inlets or

threaded outlets.

C. Protection: Protect all plumbing fixtures and trim against injury from building materials, acid, tools, and equipment. Fixtures shall be covered with building paper pasted over all china and/or enameled surfaces and crate set over. Chromium plated surfaces shall be protected by a heavy coat of Vaseline. Damaged fixtures by any cause shall be replaced at no cost to the Owner.

D. Layout: Work must be accurately laid out and roughed-in so that all piping will be straight and true, without bends or offsets, and no such bends or offsets will be accepted. Inverting traps or turning traps are not acceptable.

E. Replacement of Materials: The floor and wall tile work will be installed by others. This Contractor shall work harmoniously with these other Contractors and shall render all reasonable assistance; he shall give correct measurements for cutting, drilling, and fitting to and around all fixtures and piping, and if work is incorrectly cut or drilled through the act of negligence of this Contractor in not furnishing or in withholding the necessary information, after having been requested in writing by these Contractors so to do, then such damaged work must be replaced with new and properly cut work, at this Contractor's expense.

F. Contractor shall provide wall escutcheon plates with set screws on drain and water lines to cover all pipe penetrations through cabinets.

3.02 PIPE ROUGHING:

A. Supply, waste and vent piping sizing shall be as listed for each fixture in "Fixture Schedule" on plans. Transition to specified stop size as required.

B. Supplies to each fixture shall contain an air chamber (see detail). Air chambers are required in addition to shock absorbers as shown on plans at locations of “quick closing” valves.

3.03 ROUGHING HEIGHTS:

A. Install fixtures in accordance with the roughing heights as shown on Plumbing Plans. Coordinate with Architectural case work and elevations prior to rough-in.

3.04 COORDINATION:

A. Coordinate the roughing of electric water coolers with the Electrical Contractor so that the receptacle is located within cooler cabinet and is accessible for disconnect.

B. Anchor cooler to carrier plate top and bottom.

C. Coordinate the cutting of all cabinet tops and backs by the General Contractor. Plumber shall furnish a template for each size sink and counter top lavatory, and have water and

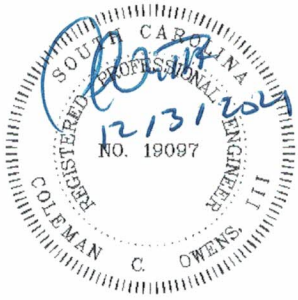
drain piping stubbed out of the wall prior to the setting of millwork.

D. Coordinate the installation of all pipe work with the Masonry Contractor. Mason shall cut and patch around all lines, chair carriers, and sleeves if they are in place as walls are laid up. Any work installed after that time shall be the Plumber's responsibility to patch or repair to match original.

END OF SECTION

DIVISION 23

SECTION 230100 – GENERAL MECHANICAL



PART ONE – GENERAL:

1.01 SCOPE:

A. The General Conditions and Special Conditions are a part of these specifications.

B. Drawings and specifications are complementary each to the other and what is called for by either shall be as binding as if called for by both.

C. Provide all supervision, labor, material, equipment, machinery, plant and any other items necessary for a complete, safe and quietly operating mechanical system.

D. Examine other drawings and specifications and bring to the attention of the Architect prior to bid time any omissions or discrepancies in this Division.

1.02 CODES, RULES, PERMITS, FEES, APPLICABLE PROVISIONS:

A. The Contractor shall comply with all local, municipal and state laws and the latest revision of the regulations of the National Electric Code, the International Building Code, the International Plumbing Code, the International Gas Code and the International Mechanical Code, in the performance of his work wherever these laws and regulations may apply.

B. The Contractor shall give all required notices, obtain necessary permits and pay all required fees.

C. Deliver to Architect, permit and licenses, including certificates from local and state health departments approving complete sanitary and water systems. Furnish certificates from fire department approving fire protection system and equipment.

D. Before and/or at completion of work, the Engineer shall cause to be made any and all tests which he may consider necessary. Should it develop during tests that the work is defective and does not comply with these specifications, such changes as are necessary shall be made to put the work in proper condition and the expense of such subsequent tests shall be borne by this Contractor.

E. The following requirements are supplementary to the tests specified for individual equipment and/or systems in this section of these specifications:

DIVISION 23

SECTION 230100 – GENERAL MECHANICAL

PART ONE – GENERAL:

1.01 SCOPE:

A. The General Conditions and Special Conditions are a part of these specifications.

B. Drawings and specifications are complementary each to the other and what is called for by either shall be as binding as if called for by both.

C. Provide all supervision, labor, material, equipment, machinery, plant and any other items necessary for a complete, safe and quietly operating mechanical system.

D. Examine other drawings and specifications and bring to the attention of the Architect prior to bid time any omissions or discrepancies in this Division.

1.02 CODES, RULES, PERMITS, FEES, APPLICABLE PROVISIONS:

A. The Contractor shall comply with all local, municipal and state laws and the latest revision of the regulations of the National Electric Code, the International Building Code, the International Plumbing Code, the International Gas Code and the International Mechanical Code, in the performance of his work wherever these laws and regulations may apply.

B. The Contractor shall give all required notices, obtain necessary permits and pay all required fees.

C. Deliver to Architect, permit and licenses, including certificates from local and state health departments approving complete sanitary and water systems. Furnish certificates from fire department approving fire protection system and equipment.

D. Before and/or at completion of work, the Engineer shall cause to be made any and all tests which he may consider necessary. Should it develop during tests that the work is defective and does not comply with these specifications, such changes as are necessary shall be made to put the work in proper condition and the expense of such subsequent tests shall be borne by this Contractor.

E. The following requirements are supplementary to the tests specified for individual equipment and/or systems in this section of these specifications:

1. Concealed or insulated work shall remain uncovered until required tests have been completed, but in the event that the project construction requires it, the Contractor shall make arrangements for tests on portions of the work involved as the project progresses.

2. The Architect shall be notified in advance of all tests and shall be represented at such tests. The cost of labor, material, instruments, etc., required for tests shall be borne by the Contractor, except where specified elsewhere.

3. Acceptance tests for operation and performance as specified and/or required for all equipment and systems shall be in the presence of the Architect, a representative of the Owner, as well as representatives of agencies having jurisdiction, upon completion of the work.

1.03 DRAWINGS:

A. Project Drawings: The Drawings accompanying this specification are generally diagrammatic and do not show all details of bolts, nuts, connections and the like, required for the complete system and do not indicate the exact location of piping, fixtures, equipment, etc., unless definitely dimensioned or noted. While these drawings shall be followed as closely as possible, all dimensions shall be checked at the building and any necessary changes shall be made in accord with structural and architectural conditions, equipment to be installed or with the work of the different trades, without any additional cost to the Owner and as directed by the Architect. The drawings and specifications are complimentary to the other and what is called for by one shall be as binding as if called for by both. Any component item under this contract shall be furnished and installed by the Contractor without extra charge.

1.04 EXAMINATION OF CONDITIONS:

A. It is understood and agreed that the Contractor has, by careful examination, satisfied as to the nature and location of the work, the conformation of the ground, the character, quality and quantity of the materials to be encountered, the general and local conditions and all other matters which can affect the work under this contract.

1.05 PROJECT COORDINATION AND COORDINATION DRAWINGS:

A. Coordinate work with other trades to avoid interference and establish necessary space requirements and tie-ins for each trade.

B. Prior to starting installation, furnish to the General Contractor and all Subcontractors concerned, copies of approved shop drawings showing location of equipment, piping, etc.

C. Schedule periodic meetings with other trades before and during installation to avoid conflicts and assure that pipes and equipment are installed in the best manner, taking into consideration head-room, maintenance, appearance and replacement.

D. The mechanical contractor shall produce either AutoCAD or Revit coordination drawings including the mechanical, electrical, plumbing, and fire sprinkler systems to be installed in order to avoid installation conflicts during construction. Coordination meetings shall be held after completion of these drawings to resolve potential installation conflicts. Additionally, a 3-dimensional drawing of the proposed mechanical room piping and equipment layout shall be generated and submitted to the engineer for approval prior to any pipe or equipment installation in the main mechanical room. This drawing shall include all equipment to be installed in this space. Any mechanical equipment, ductwork, or associated appurtenance that is installed prior to receiving written coordination drawing approval from the engineer is subject to removal and replacement of all installed material at the contractor's expense. This relates to coordination and installation deficiencies with respect to the requirements of the contract documents as identified by the engineer or architect.

END OF SECTION 230100

SECTION 230200 – GENERAL COMPLETION

PART ONE – GENERAL:

1.01 GENERAL REQUIREMENTS FOR INSTALLATION:

A. Piping, fixtures, equipment, etc. shall be located to avoid interference with structural and architectural conditions or with the work of different trades. Provide off-sets where necessary to avoid footings, piers, columns, beams, windows, piping, electrical fixtures and other systems, etc. Specifically inform the General Contractor as to the correct size and location of all chases, openings, supports, sleeves, etc. required for the system. Furnish and install sleeves, inserts, bolts, etc. and all arrange for the cutting of walls, floors, roofs, etc. and the proper closing of all openings. Cutting of construction, where unavoidable, must be done by the General Contractor but shall be paid for by this Contractor. No part of the building may be broken out, cut, burned or permanently removed without the approval of the Architect.

PART TWO – PRODUCTS:

2.01 WORKMANSHIP AND MATERIALS:

A. Workmanship shall be of the best quality and none but competent mechanics skilled in their trades shall be employed. The Contractor shall furnish the services of an experienced superintendent who will be constantly in charge of the erection of the work until completed and accepted.

B. Unless otherwise hereinafter specified, all materials and equipment shall be new, of best grade and as listed in printed catalogs of the manufacturer. Each article of its kind shall be the standard products of a single manufacturer.

C. The Architect shall have the right to accept or reject material, equipment and/or workmanship and determine when the Contractor has complied with the requirements herein specified. Where departures from indicated arrangements are required, written approval for such changes shall be obtained from Architect's representative.

D. All manufactured materials shall be delivered and stored in their original containers. Equipment shall be clearly marked or stamped with the manufacturer's name and rating.

E. All material and equipment used on this project shall be stored in a weatherproof bonded warehouse. Contractor shall submit insurance certificate to the Architect prior to storing any materials or equipment. No equipment, materials or roof-top heat pumps used on this project shall be stored outside exposed to the weather. Before final payment can be made, a notarized statement with the material invoiced to the Owner must be furnished to the Architect.

2.02 DIVISION OF WORK:

A. Coordinate all opening locations with General Contractor, see paragraph 2.04.

B. This Contractor shall furnish roof curbs and caps. Curbs and caps to be installed and flashed by the General Contractor, unless otherwise noted.

C. Furnish door grilles to General Contractor for installation.

D. Refer to the Electrical and Control Sections of this specification. The Electrical Subcontractor shall provide all wiring except:

1. Temperature Control Wiring
2. Equipment Control Wiring
3. Interlock Wiring

The Electrical Subcontractor shall furnish all power wiring complete from power source to motor or equipment junction box, including power wiring through starters. Electrical Subcontractor shall install all starters not factory mounted on equipment. The Mechanical Subcontractor shall, regardless of voltage, provide all temperature control wiring for equipment provided under this Division. The Mechanical Subcontractor shall furnish all starters and contactors to the Electrical Subcontractor and shall provide and be responsible for over-load heaters in all starters furnished. Over-loads shall be provided in each ungrounded conductor.

2.03 FINISHES:

A. Finishes for all water coolers, grilles, registers, diffusers, room fan coil units, room air conditioning units, louvers and any other item exposed to view shall be selected by Architect and shall be equivalent to baked enamel. Submit color charts along with submittal data.

2.04 OPENINGS – CUTTING, REPAIRING:

A. This Contractor shall cooperate with the work to be done under the other sections in providing information as to openings required in walls, slabs and footings for all piping and equipment, including sleeves, where required.

B. All drilling, cutting and patching required for the performance of work under this Section shall be performed by the General Contractor and the cost thereof shall be borne by this Contractor.

C. Holes in Concrete: Sleeves shall be furnished, accurately located and installed in for before pouring of concrete. This Contractor shall pay all additional costs for cutting of holes as the result of the incorrect location of sleeves. All holes through existing concrete shall be either core drilled or saw cut. All holes required shall have the approval of the Structural Engineer prior to cutting or drilling. All penetrations shall be grouted all around with cement.

2.05 EXCAVATION AND BACKFILL:

A. General: The Contractor shall do all excavating and backfilling necessary to receive the work shown on the drawings.

Excavations shall be made to the proper depth and the trenches shall be graded uniformly to provide a solid bearing along the entire length of the pipe. Bell holes shall be provided in trenches at the joints in hub and spigot pipe to facilitate caulking and so that piping will not be supported in hubs. All trenches shall be excavated so that pipes will have at least six (6) inches clearance on each side. Pipes in fill or loose sand shall have trench bottom tamped to 95% maximum density compaction prior to laying pipe.

B. Dewatering and Shoring: Pumps shall be furnished as required to keep trenches dry during the laying and jointing of the mains. Provide shoring where required, maintaining trenches against settlement until final acceptance.

C. Backfilling: Do not fill any trenches until all piping has been inspected. After the work is installed, tested, inspected and approved, the trenches shall be refilled in six (6) inch layers with clean, damp earth, with each layer thoroughly tamped before proceeding with additional layers. Remove from site all excess earth, rock and other debris resulting from excavation and backfill work.

2.06 NAMEPLATES:

A. On all manufactured equipment, provide engraved plastic nameplates as manufactured by Seton Nameplate Co., Columbia-Engravers, International Nameplate Co. or equal. Unless otherwise noted, nameplates shall be 1/16” thick plastic with white letters on a black background. Attach nameplates with two (2) round-head chrome plated screws.

B. Unless otherwise noted, letters identifying equipment in equipment rooms to be ½” high. All other letters shall be 1/8” high. Hand lettering, under typing tape, embossed letters on plastic, etc. will not be acceptable.

2.07 CLEANING EQUIPMENT AND MATERIALS:

A. Provide for the safety and good condition of all materials and equipment until final acceptance by the Owner. Protect all materials and equipment from damage. Provide adequate and proper storage facilities during the progress of the work. Special care shall be taken to provide for bearings, open connections, pipe coils, pumps and similar equipment.

B. All fixtures, piping, finished surfaces and equipment shall have all grease, adhesive labels and foreign materials removed.

C. All piping shall be drained and flushed to remove grease and foreign matter. Pressure regulating assemblies, traps, flush valves and similar items shall be

thoroughly cleaned. Remove and thoroughly clean and reinstall all strainer screens after the system has been in operation for ten (10) days.

2.08 CLEANING UP:

A. Remove from the premises all unused material and debris resulting from the performance of work under this section.

2.09 DAMAGES:

A. Cost of repairing damage to building, building contents and site during the construction and guarantee period resulting from this work including damage to ceilings or walls is a part of this contract.

2.10 FINISHED PLANS:

A. As-Build Drawings: Upon completion of work, the Contractor shall furnish and deliver to the Owner two (2) sets of as-built drawings to correspond in size to the tracings, showing among other things, layouts of utility systems and functional systems (such as air distribution, water, storm drainage and sanitary sewer). All pertinent dimensions and elevations of buried work shall be given.

2.11 INSTRUCTIONS:

A. Provide a hard-back, three-ring file folder containing all warranties, catalog data and the manufacturer's recommendations and the frequency with which each is to be done. Each sheet shall be initialed by the manufacturer's agent as being correct. Provide columns on each sheet so that they may be dated by maintenance personnel when each individual function is performed. Contractor shall furnish a typed maintenance manual in hard-back, three-ring binder explaining all maintenance functions. The Contractor shall instruct and demonstrate each maintenance function to the Owner's Representative. The Owner's Representative shall in turn, sign the maintenance sheets indicating his/her understanding of the instructions. Coordinate all equipment start-ups with the Owner so that they may be present.

B. The Contractor shall instruct the Owner's Representative in complete detail as to the proper operation of the overall system. Advise the Owner as to where to order common replacement items. Deliver to the Owner, the manufacturer's agent's name, address and telephone number of each piece of equipment.

C. The Contractor shall provide a complete listing of filter sizes and counts of all mechanical equipment to Owner's Representative.

2.12 GUARANTEE:

The Contractor agrees:

A. To correct defects in workmanship, materials, controls, equipment and operation of the system for a period of one (1) year from the date of final completion and acceptance of the work. Equipment and materials, repaired or replaced during this one (1) year guarantee period (including refrigerant charge) are guaranteed for an additional year following date of correction.

B. That the systems installed will safely, quietly and efficiently perform their respective functions in accordance with the design.

C. To service completely the systems for a period of one (1) year.

   This work shall include: Adjustment of belts and drives, care of cooling towers (where applicable), complete oiling and greasing of mechanical equipment and labor for changing of air filters. Replacement filters will be furnished by the Owner.

END OF SECTION 230200

SECTION 230300 – BASIC MATERIALS AND METHODS

PART ONE – GENERAL:

1.01 APPROVALS AND SUBSTITUTIONS:

A. All requests for substitutions shall be submitted so as to be received by the Engineer at least ten (10) days before bid date and must be approved before award of contract.

B. Contract prices shall be based on material and equipment as specified, unless written approval is obtained for any deviations. Requests for substitutions before bid date may be submitted by Contractors or by Equipment Manufacturer's Representatives.

C. Requests for approvals shall be submitted in the form of a letter (with one [1] copy minimum) on a letterhead of submitting firm, along with a self-addressed stamped return envelope. Letter shall be addressed to the Engineer and referenced to this project. Faxed requests are not acceptable.

D. If there are no deviations between the items submitted and the plans and specifications then the submittal letter should contain the statement, "Items are in accordance with plans and specifications with no deviations." An item with deviations from the plans and specifications may be submitted for approval consideration. Letter should then state, "Item submitted is in accordance with plans and specifications, except for the following deviations." Deviations should then be listed in itemized form.

E. Items approved shall not be construed as authorizing deviations from the plans and specifications. Contractor shall be responsible for verifying all dimensions with available space conditions with provisions for proper access, maintenance and part replacement and for coordination with other trades – electrical, plumbing, structural, etc. for proper services and construction requirements.

F. Where such approved deviations require a different quality and arrangement of ductwork, piping, wiring, conduit and equipment from that specified of indicated on the drawings, the Subcontractor shall furnish and install any such ductwork, piping, structural supports, insulation, controllers, motors, starters, electrical wiring and conduit and any other additional equipment required by the system at no additional cost to the Owner.

PART TWO – PRODUCTS AND EXECUTION:

2.01 MANUFACTURER'S INSTRUCTIONS:

A. Prior to purchasing equipment, procure product manufacturer's application, installation and operating instructions for use in conjunction with the system design drawings and specifications during construction. If there is any conflict between the manufacturer's publications and the design drawings and specifications, immediately notify the Engineer in writing. Upon notification by the Engineer, proceed in accordance with his/her instructions.

2.02 SHOP DRAWINGS:

A. The Subcontractor shall submit for approval detailed shop drawings of all equipment and all material required to complete the project and no material or equipment may be delivered to the job site or installed until the Subcontractor has in his possession the approved shop drawings for the particular material or equipment. The shop drawings shall be complete as described herein. The Subcontractor shall furnish the number of copies required by the General Contractor and Special Conditions of the contract but in no case less than six (6) copies. Partial submittals will be disapproved.

B. Prior to delivery of any material to the job site and sufficiently in advance of requirements to allow Architect ample time for checking, submit for approval detailed dimensional drawings or cuts showing construction, size, arrangement, operating clearances, performance characteristics and capacity. Each item of equipment proposed shall be a standard catalog product of an established manufacturer and of equal quality, finish and durability to that specified.

C. Samples, drawings, specifications and/or catalogs submitted for approval shall be properly labeled indicating specific service for which material or equipment is to be used, section and article number of specifications governing, Contractor's name and name of project.

D. Catalogs, pamphlets or other documents submitted to describe items on which approval is being requested shall be specific and identification in catalog, pamphlet, etc. of each item submitted shall be clearly made in ink. Data of a general nature will not be accepted.

E. Approval by the Architect and/or Engineer of shop drawings for any material, apparatus, devices and layouts shall not relieve this Contractor from the responsibility of furnishing same of proper dimension, size, quantity, quality and all performance characteristics to efficiently perform the requirements and intent of the contract documents.

   In addition, approval shall not relieve this Contractor from responsibility for errors of any sort on the shop drawings. If the shop drawings deviate from the contract documents, this Contractor shall advise the Architect and/or Engineer of the deviations in writing accompanying the shop drawings, including the reasons for deviations.

F. Failure of the Subcontractor to submit shop drawings in ample time for checking shall not entitle him/her to an extension on contract time and no claim for extension by reason of such default will be allowed.

END OF SECTION 230300

MECHANICAL COMMISSIONING REQUIREMENTS

PART ONE - GENERAL

1.1 SUMMARY

A. This Section includes requirements for commissioning the building systems and their subsystems and equipment. This Section supplements the general requirements specified in Division 1 Section "General Commissioning Requirements."

B. Related Sections include the following:

1. Division 1 Sections "General Commissioning Requirements" and "System Commissioning Requirements" for general requirements for commissioning processes that apply to this Section.

1.2 DEFINITIONS

A. BoD: Basis of Design.

B. CxA: Commissioning Authority.

C. OPR: Owner's Project Requirements.

D. Systems, Subsystems, and Equipment: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, and equipment.

E. TAB: Testing, Adjusting, and Balancing.

1.3 SYSTEMS TO BE COMMISSIONED

A. The following systems are to be commissioned for this project:

1. HVAC
    a. Air Handling Units-Outside Air
    b. Boilers/Chillers
    c. Building Automation System, including interfaces with other systems
    d. Cooling Towers
    e. Ductwork, dampers, grilles, diffusers, and sheetmetal accessories
    f. Exhaust Fans
    g. Piping, valves, and hydronic accessories
    h. Pumps
    i. Terminal Equipment (AC Units, Unit Heaters, fans, etc.)
2. Plumbing
    a. Domestic Water Heater

1.4 COMMISSIONING TEAM

A. Members Appointed by Contractor(s): Individuals, each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

B. Members Appointed by Owner:

1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

1.5 CONTRACTOR'S RESPONSIBILITIES

A. Contractor and HVAC, Electrical, Plumbing, and Fire Protection subcontractors shall assign representatives with expertise and authority to act on behalf of the Contractor/Subcontractor and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:

1. Work with the CxA to identify schedule requirements for all commissioning activities, and incorporate these activities into the overall project schedule, to ensure all required commissioning scope is properly completed prior to Occupancy.
2. Participate in commissioning meetings.
3. Certify that Work is complete and systems are operational according to the Contract Documents, including calibration of instrumentation and controls.
4. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend and implement corrective action.
5. Provide schedule for operation and maintenance data submittals, equipment startup, and testing to CxA for incorporation into the commissioning plan.
6. Gather and submit operation and maintenance data for systems, subsystems, and equipment to the CxA, as specified in Division 1 Section "Operation and Maintenance Data," within 45 days of submittal approval.
7. Provide technicians who are familiar with the construction and operation of installed systems and who shall participate in functional performance testing of installed systems, subsystems, and equipment.
8. Complete installation checklists prior to startup and provide to CxA, for all commissioned equipment.

9. Develop and coordinate an overall training program, including manufacturer training, classroom training, and field demonstration training sessions.
10. Provide qualified instructors to perform training sessions for Owner's operation and maintenance personnel.
11. Participate in final review at acceptance meeting.
12. Provide personnel to assist or perform seasonal or deferred testing as defined under other sections of the Specifications.

1.6 COMMISSIONING DOCUMENTATION

A. Index of Commissioning Documents: CxA shall prepare an index to include storage location of each document.

B. OPR: A written document, prepared by Owner, that details the functional requirements of Project and expectations of how it will be used and operated. This document includes Project and design goals, measurable performance criteria, budgets, schedules, success criteria, and supporting information.

C. BoD Document: A document, prepared by Architect, that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

D. Commissioning Plan: A document, prepared by CxA, that outlines the process, organization, reporting, and documentation requirements of the commissioning process, and shall include, but is not limited to the following:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports. Identification of the relationship of these documents to other functions and a detailed description of submittals that are required to support the commissioning processes.
2. Description of the organization, layout, and content of commissioning documentation (including systems manual) and a detailed description of documents to be provided along with identification of responsible parties.
3. Identification of systems and equipment to be commissioned.
4. Description of testing procedures along with identification of parties involved in performing and verifying tests.
5. Identification of items that must be completed before the next operation can proceed.
6. Description of responsibilities of commissioning team members.
7. Description of observations to be made.
8. Description of requirements for operation and maintenance training, including required training materials.
9. Description of expected performance for systems, subsystems, equipment, and controls.
10. Process for completing prestart and startup checklists for systems, subsystems, and equipment to be verified and tested.

11. Step-by-step procedures for testing systems, subsystems, and equipment with descriptions for methods of verifying relevant data, recording the results obtained, and listing parties involved in performing and verifying tests.

E. Certificate of Readiness: Certificate of Readiness shall be signed by Contractor, Subcontractor(s), Installer(s), and CxA certifying that systems, subsystems, equipment, and associated controls are ready for testing. Completed construction checklists signed by the responsible parties shall accompany this certificate.

F. Test Reports: CxA shall record test data, observations, and measurements on test procedures and test logs. Photographs, forms, and other means appropriate for the application shall be included with data. CxA shall compile test reports and include them in systems manual and commissioning report.

G. Issues Log: CxA shall prepare and maintain an issues log that describes design, installation, and performance issues that are at variance with the OPR, BoD, and Contract Documents. Identify and track issues as they are encountered, documenting the status of unresolved and resolved issues.

H. Commissioning Report: CxA shall document results of the commissioning process including unresolved issues and performance of systems, subsystems, and equipment. The commissioning report shall indicate whether systems, subsystems, and equipment have been completed and are performing according to the OPR, BoD, and Contract Documents. The commissioning report shall include, but is not limited to, the following:
    1. Lists and explanations of substitutions; compromises; variances in the OPR, BoD, and Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. This report shall be used to evaluate systems, subsystems, and equipment and shall serve as a future reference document during Owner occupancy and operation. It shall describe components and performance that exceed requirements of the OPR, BoD, and Contract Documents and those that do not meet requirements of the OPR, BoD, and Contract Documents. It may also include a recommendation for accepting or rejecting systems, subsystems, and equipment.
    2. Commissioning plan.
    3. Testing plans and reports.
    4. Corrective modification documentation.
    5. Issues log.
    6. Completed test checklists.
    7. Listing of off-season test(s) not performed and a schedule for their completion.
    8. Commissioning report.
    9. Operation and maintenance data as specified in Division 1 Section "Operation and Maintenance Data."

1.7 COORDINATION

A. Reporting: CxA shall distribute commissioning field reports, periodically updated issues logs, test results, and other documents generated by the CxA to the commissioning team. All information will be copied to the Owner's representatives. The Contractor shall respond to all items noted in each commissioning field report within seven (7) days. The response shall note the intended action or response by the Contractor, and indicate a date for correction or resolution of the issue.

B. Scheduling: The Contractor shall incorporate key commissioning activities and milestones into the overall construction schedule to ensure that commissioning can be successfully completed prior to Substantial Completion. The CxA will provide input to the Contractor as to activity durations, sequences, and logic ties, and other activities required to completed as prerequisites to commissioning process activities.

C. Commissioning Meetings: CxA shall conduct periodic commissioning meetings of the commissioning team to review the issues log, progress on the commissioning plan, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.

D. Testing Coordination: Contractor shall coordinate sequence of testing activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting, and to ensure all testing activities can be completed prior to Occupancy, including allowance for time to correct any deficiencies.

E. Manufacturers' Field Services: Contractor shall coordinate services of manufacturers' field services. Contractor shall give CxA at least seven days notice prior to any special testing or startup services by manufacturers.

F. Coordination among subcontractors: Contractor shall maintain a master file of construction checklists, startup reports, manufacturer field tests, and other related information. The General Contractor shall be responsible for distributing construction checklists to all necessary subcontractors. The General Contractor shall ensure proper completion of each checklist by each subcontractor, collect completed checklists, and notify the CxA upon completion by all involved subs for each checklist.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 BASIC COMMISSIONING PROCESS

A. The following outlines the basic process of commissioning.
   1. Commissioning during construction begins with a scoping meeting conducted by the CxA where the commissioning process is reviewed with the commissioning team members.
   2. Additional meetings will be required throughout construction, scheduled by the CxA with necessary parties attending, to plan, scope, coordinate, schedule future

activities and resolve problems.

3. CxA maintains and distributes a Master Issues Log to track all deficiencies through to resolution.
3. Equipment documentation is submitted to the CxA during normal submittals, including detailed start-up procedures.
4. The CxA works with the Contractor in developing startup plans and startup documentation formats, including providing the Contractor with construction checklists to be completed, during the startup process.
5. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with construction checklists being completed before functional testing.
6. The Contractor and Subcontractors, under their own direction, execute and document the construction checklists and perform startup and initial checkout. The CxA documents that the checklists and startup were completed according to the approved plans. This may include the CxA witnessing start-up of equipment.
7. The functional test procedures are executed by the Contractor, under the direction of, and documented by the CxA.
8. Items of non-compliance in material, installation or setup are corrected at the Contractor's expense and the system retested.
9. The CxA reviews the O&M documentation for completeness.
10. Commissioning is completed before Substantial Completion.
11. The CxA reviews, pre-approves and coordinates the training provided by the Contractor and verifies that is was completed.
12. Deferred and seasonal testing is conducted by the Contractor, as specified or required, under the direction of the CxA. The CxA coordinates the scheduling through the Contractor.
13. The CxA performs post-occupancy evaluations after approximately two months and ten months of occupancy to identify any issues or deficiencies. Deficiencies shall be addressed by the Contractor prior to expiration of any warranties.

3.2 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

3.3 CONTRACTOR'S RESPONSIBILITIES

A. The following responsibilities are in addition to those specified in Division 1 Section "General Commissioning Requirements."

B. Mechanical subcontractor:

1. Attend procedures meeting for TAB Work.
2. Certify that TAB Work is complete.
3. Attend coordination meeting between HVAC Instrumentation and Control and TAB subcontractors.

C. HVAC Instrumentation and Control Subcontractor:

1. With the CxA, review control designs for compliance with the OPR and BoD,

controllability with respect to actual equipment to be installed, and recommend adjustments to control designs and sequence of operation descriptions.

2. Attend coordination meeting between CxA and TAB subcontractor to review plan for using controls system in TAB effort.
3. Provide calibration procedures and documentation that all components of the Building Automation System including control sensors, meters, damper actuators, valve actuators, etc. are properly calibrated and reading accurately. Where manufacturer's calibrations are used, the BAS contractor shall demonstrate that manufacturer's calibration provides an accurate reading.
4. Initiate trending for each system monitored by the BAS as requested by the CxA. Retrieve trending data and forward to CxA at intervals requested.

D. TAB Subcontractor:

1. Contract Documents Review: With the CxA, review the Contract Documents before developing TAB procedures.

    a. Verify the following:

        1) Accessibility of equipment and components required for TAB Work.
        2) Adequate number and placement of duct balancing dampers to allow proper balancing while minimizing sound levels in occupied spaces.
        3) Adequate number and placement of balancing valves to allow proper balancing and recording of water flow.
        4) Adequate number and placement of test ports and test instrumentation to allow reading and compilation of system and equipment performance data needed to conduct both TAB and commissioning testing.
        5) Air and water flow rates have been specified and compared to central equipment output capacities.

    b. Identify discontinuities and omissions in the Contract Documents.
    c. This review of the Contract Documents by the TAB Subcontractor satisfies requirements for a design review report as specified in Division 23 Section "Testing, Adjusting, and Balancing."

2. Additional Responsibilities:

    a. Participate in functional performance testing.
    b. Complete construction checklists where indicated as needing TAB measurements such as motor voltage, current, etc.
    c. Perform calibration checks of all sensors and gauges as defined in the construction checklists.

E. Plumbing Subcontractor:

1. With the Mechanical and Electrical Subcontractor, coordinate installations and connections between and among electrical, HVAC and plumbing systems, subsystems, and equipment.
2. Participate in functional performance testing of plumbing systems, with vendors

and subcontractors for each system tested.

3.4 TESTING PREPARATION

A. The Mechanical Subcontractor shall complete the following prerequisites for Testing:

1. Certify that HVAC systems, subsystems, and equipment have been completed, calibrated, and started; are operating according to the OPR, BoD, and Contract Documents; and that Certificates of Readiness are signed and submitted.
2. Submit results and reports from all manufacturer startup or special field-testing services within seven days of completion.
3. Pipe cleaning, flushing, hydrostatic tests, and chemical treatment requirements are specified in Division 23 piping Sections. HVAC subcontractor shall prepare pipe system cleaning, flushing, and hydrostatic testing. CxA shall review and comment on plan and final reports. Plan shall include the following:
    a. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed Drawings for each pipe sector showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
    b. Description of equipment for flushing operations.
    c. Minimum flushing water velocity.
    d. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.
4. Certify that HVAC instrumentation and control systems have been completed and calibrated; are operating according to the OPR, BoD, and Contract Documents; and that pretest set points have been recorded.
5. Certify that TAB procedures have been completed, and that TAB reports have been submitted, discrepancies corrected, and corrective work approved.
6. Complete all construction checklists and correct any deficiencies prior to functional testing.
7. Perform preliminary check of systems and intersystem performance after approval of construction checklists for systems, subsystems, and equipment.
8. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shut down, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
9. Verify each operating cycle after it has been running for a specified period and is operating in a steady-state condition.
10. Observe and verify the position of each device and interlock identified on checklists. Sign off each item as acceptable or failed. Repeat this test for each operating cycle that applies to system being tested.
11. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
12. Annotate checklist or data sheet when a deficiency is observed.
13. Verify equipment interface with monitoring and control system and TAB criteria; include the following:

a. Supply and return flow rates for VAV and constant volume systems in each operational mode.
b. Operation of terminal units in both heating and cooling cycles.
c. Minimum outdoor-air intake in each operational mode and at minimum and maximum airflows.
d. Building pressurization.
e. Total exhaust airflow and total outdoor-air intake.
f. Operation of indoor-air-quality monitoring systems.

14. Verify proper responses of monitoring and control system controllers and sensors to include the following:

    a. For each controller or sensor, record the indicated monitoring and control system reading and the test instrument reading. If initial test indicates that the test reading is outside of the control range of the installed device, check calibration of the installed device and adjust as required. Retest malfunctioning devices and record results on checklist or data sheet.
    b. Report deficiencies and prepare an issues log entry.

3.5 CONSTRUCTION CHECKLIST VERIFICATION

A. Contractors shall notify the CxA when prefunctional checklists for a particular system have been completed, in preparation for system functional testing.

B. The CxA will review the completed checklists for completeness.

C. Efforts required by the CxA to recheck failed checklists, or to field-verify additional components beyond the initial sampling plan caused by improper completion of the checklists by the Contractor, shall be billed to the Owner on an hourly basis. The Contractor shall reimburse the Owner for these efforts.

D. All checklists associated with each functional performance test procedure shall be completed and approved by the CxA prior to functional performance testings.

3.6 TAB VERIFICATION

A. TAB subcontractor shall coordinate with CxA for work required in Division 23 Section "Testing, Adjusting, and Balancing." TAB subcontractor shall copy CxA with required reports, sample forms, checklists, and certificates.

B. Contractor, HVAC subcontractor, and CxA shall witness TAB Work.

C. TAB Preparation:

1. TAB subcontractor shall provide CxA with data required for "Pre-Field TAB Engineering Reports" specified in Division 23 Section "Testing, Adjusting, and Balancing."

a. CxA shall use this data to certify that prestart and startup activities have been completed for systems, subsystems, and equipment installation.

D. Ductwork Air Leakage Testing (if applicable):

1. Architect will identify, for HVAC subcontractor and CxA, portions of duct systems to have ductwork air leakage testing. Ductwork air leakage testing shall be performed according to Division 23 Section "Metal Ducts," and shall be witnessed by the CxA.
2. On approval of preliminary ductwork air leakage testing report, the CxA shall coordinate verification testing of ductwork air leakage testing. Verification testing shall include random retests of portions of duct section tests, reported in preliminary ductwork air leakage testing report. The HVAC subcontractor shall perform tests using the same instrumentation (by model and serial number) as for original testing; the CxA shall witness verification testing.

3.7 TESTING

A. Functional Performance Tests of systems and intersystem performance shall be completed after construction checklists for systems, subsystems, and equipment have been approved.

B. Functional Performance Testing will be done under the direction of the CxA. The responsible subcontractors and vendor representatives shall operate and manipulate equipment and controls as directed.

C. Scope of HVAC System Testing:

1. Testing scope shall include entire HVAC installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. It shall include measuring capacities and effectiveness of operational and control functions.
2. Test all operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.
3. Test all interfaces between the HVAC, controls, and other systems, including fire alarm, domestic water, heating, etc.
4. Initiate and retrieve trend data for all data points, for first four weeks following successful testing.

D. Scope of Plumbing System Testing:

1. Testing scope shall include central equipment for water heating through distribution systems to each fixture. It shall include measuring capacities and effectiveness of operational and control functions.
2. Verify interfaces with the Building Automation System are correct and operational.

E. Deferred Testing:

1. If tests cannot be completed because of a deficiency outside the scope of the system, the deficiency shall be documented and reported to Owner. Deficiencies shall be resolved and corrected by appropriate parties and test rescheduled.
2. Initial testing shall be performed with simulated loads where necessary, based on seasonal conditions. Contractor shall provide personnel to assist CxA with completion of testing after occupancy, when seasonal conditions permit actual performance under summer and winter design conditions.

F. Testing Reports:

1. Reports shall include measured data, data sheets, and a comprehensive summary describing the operation of systems at the time of testing.
2. Include data sheets for each controller to verify proper operation of the control system, the system it serves, the service it provides, and its location. For each controller, provide space for recording its readout, the reading at the controller's sensor(s), plus comments. Provide space for testing personnel to sign off on each data sheet.
3. Prepare a preliminary test report. Deficiencies will be evaluated by Architect to determine corrective action. Deficiencies shall be corrected and test repeated.
4. If it is determined that the system is constructed according to the Contract Documents, Owner will decide whether modifications required to bring the performance of the system to the OPR and BoD documents shall be implemented or if tests will be accepted as submitted. If corrective Work is performed, Owner will decide if tests shall be repeated and a revised report submitted.

END OF SECTION

MECHANICAL COMMISSIONING REQUIREMENTS

PART ONE - GENERAL

1.1 SUMMARY

A. This Section includes requirements for commissioning the building systems and their subsystems and equipment. This Section supplements the general requirements specified in Division 1 Section "General Commissioning Requirements."

B. Related Sections include the following:

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    a. Domestic Water Heater

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B. Members Appointed by Owner:

1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

1.5 CONTRACTOR'S RESPONSIBILITIES

A. Contractor and HVAC, Electrical, Plumbing, and Fire Protection subcontractors shall assign representatives with expertise and authority to act on behalf of the Contractor/Subcontractor and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:

1. Work with the CxA to identify schedule requirements for all commissioning activities, and incorporate these activities into the overall project schedule, to ensure all required commissioning scope is properly completed prior to Occupancy.
2. Participate in commissioning meetings.
3. Certify that Work is complete and systems are operational according to the Contract Documents, including calibration of instrumentation and controls.
4. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend and implement corrective action.
5. Participate in procedures meeting for testing.
6. Provide schedule for operation and maintenance data submittals, equipment startup, and testing to CxA for incorporation into the commissioning plan. Update schedule on a weekly basis throughout the construction period.
7. Provide updated As-Built and Project Record Documents to the CxA on a daily basis.
8. Gather and submit operation and maintenance data for systems, subsystems, and equipment to the CxA, as specified in Division 1 Section "Operation and Maintenance Data," within 45 days of submittal approval.
9. Provide technicians who are familiar with the construction and operation of installed systems and who shall participate in functional performance testing of installed systems, subsystems, and equipment.
10. Complete construction checklists, provided by the CxA, for all commissioned equipment.

11. Develop and coordinate an overall training program, including manufacturer training, classroom training, and field demonstration training sessions.
12. Provide qualified instructors to perform training sessions for Owner's operation and maintenance personnel.
13. Participate in final review at acceptance meeting.
14. Provide personnel to assist or perform seasonal or deferred testing as defined under other sections of the Specifications.

1.6 COMMISSIONING DOCUMENTATION

A. Index of Commissioning Documents: CxA shall prepare an index to include storage location of each document.

B. OPR: A written document, prepared by Owner, that details the functional requirements of Project and expectations of how it will be used and operated. This document includes Project and design goals, measurable performance criteria, budgets, schedules, success criteria, and supporting information.

C. BoD Document: A document, prepared by Architect, that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

D. Commissioning Plan: A document, prepared by CxA, that outlines the process, organization, reporting, and documentation requirements of the commissioning process, and shall include, but is not limited to the following:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports. Identification of the relationship of these documents to other functions and a detailed description of submittals that are required to support the commissioning processes.
2. Description of the organization, layout, and content of commissioning documentation (including systems manual) and a detailed description of documents to be provided along with identification of responsible parties.
3. Identification of systems and equipment to be commissioned.
4. Description of testing procedures along with identification of parties involved in performing and verifying tests.
5. Identification of items that must be completed before the next operation can proceed.
6. Description of responsibilities of commissioning team members.
7. Description of observations to be made.
8. Description of requirements for operation and maintenance training, including required training materials.
9. Description of expected performance for systems, subsystems, equipment, and controls.
10. Process for completing prestart and startup checklists for systems, subsystems, and equipment to be verified and tested.

11. Step-by-step procedures for testing systems, subsystems, and equipment with descriptions for methods of verifying relevant data, recording the results obtained, and listing parties involved in performing and verifying tests.

E. Construction Checklists and Functional Performance Test Procedures: CxA shall develop construction checklists and functional performance test procedures for each system, subsystem, or equipment including interfaces and interlocks, and include a separate entry, with space for comments, for each item to be tested. Provide space for testing personnel to sign off on each checklist. Specific checklist and test procedure content requirements are specified in Division 1 Section "System Commissioning Requirements." Each checklist, regardless of system, subsystem, or equipment being tested, shall include, but not be limited to, the following:

1. Name and identification code of tested item.
2. Test number.
3. Time and date of test.
4. Indication of whether the record is for a first test or retest following correction of a problem or issue.
5. Dated signatures of the person performing test and of the witness, if applicable.
6. Individuals present for test.
7. Deficiencies.
8. Issue number, if any, generated as the result of test.

F. Certificate of Readiness: Certificate of Readiness shall be signed by Contractor, Subcontractor(s), Installer(s), and CxA certifying that systems, subsystems, equipment, and associated controls are ready for testing. Completed construction checklists signed by the responsible parties shall accompany this certificate.

G. Test Reports: CxA shall record test data, observations, and measurements on test procedures and test logs. Photographs, forms, and other means appropriate for the application shall be included with data. CxA shall compile test reports and include them in systems manual and commissioning report.

H. Corrective Action Documents: CxA shall document corrective action taken for systems and equipment that fail tests. Include required modifications to systems and equipment and revisions to test procedures, if any. Retest systems and equipment requiring corrective action and document retest results.

I. Issues Log: CxA shall prepare and maintain an issues log that describes design, installation, and performance issues that are at variance with the OPR, BoD, and Contract Documents. Identify and track issues as they are encountered, documenting the status of unresolved and resolved issues.

J. Commissioning Report: CxA shall document results of the commissioning process including unresolved issues and performance of systems, subsystems, and equipment. The commissioning report shall indicate whether systems, subsystems, and equipment have been completed and are performing according to the OPR, BoD, and Contract Documents. The commissioning report shall include, but is not limited to, the following:

1. Lists and explanations of substitutions; compromises; variances in the OPR, BoD, and Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. This report shall be used to evaluate systems, subsystems, and equipment and shall serve as a future reference document during Owner occupancy and operation. It shall describe components and performance that exceed requirements of the OPR, BoD, and Contract Documents and those that do not meet requirements of the OPR, BoD, and Contract Documents. It may also include a recommendation for accepting or rejecting systems, subsystems, and equipment.
2. OPR and BoD documentation.
3. Commissioning plan.
4. Testing plans and reports.
5. Corrective modification documentation.
6. Issues log.
7. Completed test checklists.
8. Listing of off-season test(s) not performed and a schedule for their completion.

K. Systems Manual: CxA shall gather required information and compile systems manual. Systems manual shall include, but is not limited to, the following:

1. OPR and BoD, including system narratives, schematics, and changes made throughout the Project.
2. Project Record Documents as specified in Division 1 Section "Project Record Documents."
3. Final commissioning plan.
4. Commissioning report.
5. Operation and maintenance data as specified in Division 1 Section "Operation and Maintenance Data."

1.7 COORDINATION

A. Coordination drawings: Contractor shall prepare coordination drawings showing coordination between trades for all above-ceiling areas, sleeves, and mechanical and electrical equipment rooms. Contractor shall conduct a review meeting with the commissioning team of the coordination drawings prior to commencing any rough-in of commissioned systems, and any comments by the commissioning team shall be addressed and incorporated in the coordination drawings prior to rough-in.

B. Reporting: CxA shall distribute commissioning field reports, periodically updated issues logs, test results, and other documents generated by the CxA to the commissioning team. All information will be copied to the Owner’s representatives. The Contractor shall respond to all items noted in each commissioning field report within seven (7) days. The response shall note the intended action or response by the Contractor, and indicate a date for correction or resolution of the issue.

C. Scheduling: The Contractor shall incorporate key commissioning activities and milestones into the overall construction schedule to ensure that commissioning can be successfully completed prior to Substantial Completion. The CxA will provide input to

the Contractor as to activity durations, sequences, and logic ties, and other activities required to completed as prerequisites to commissioning process activities.

D. Commissioning Meetings: CxA shall conduct periodic commissioning meetings of the commissioning team to review the issues log, progress on the commissioning plan, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.

E. Pretesting Meetings: CxA shall conduct pretest meetings of the commissioning team to review startup reports, pretest inspection results, testing procedures, testing personnel and instrumentation requirements, and manufacturers' authorized service representative services for each system, subsystem, equipment, and component to be tested.

F. Testing Coordination: Contractor shall coordinate sequence of testing activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting, and to ensure all testing activities can be completed prior to Occupancy, including allowance for time to correct any deficiencies.

G. Manufacturers' Field Services: Contractor shall coordinate services of manufacturers' field services. Contractor shall give CxA at least seven days notice prior to any special testing or startup services by manufacturers.

H. Coordination among subcontractors: Contractor shall maintain a master file of construction checklists, startup reports, manufacturer field tests, and other related information. The General Contractor shall be responsible for distributing construction checklists to all necessary subcontractors. The General Contractor shall ensure proper completion of each checklist by each subcontractor, collect completed checklists, and notify the CxA upon completion by all involved subs for each checklist.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 BASIC COMMISSIONING PROCESS

A. The following outlines the basic process of commissioning.
   1. Commissioning during construction begins with a scoping meeting conducted by the CxA where the commissioning process is reviewed with the commissioning team members.
   2. Additional meetings will be required throughout construction, scheduled by the CxA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.
   3. CxA maintains and distributes a Master Issues Log to track all deficiencies through to resolution.

3. Equipment documentation is submitted to the CxA during normal submittals, including detailed start-up procedures.
4. The CxA works with the Contractor in developing startup plans and startup documentation formats, including providing the Contractor with construction checklists to be completed, during the startup process.
5. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with construction checklists being completed before functional testing.
6. The Contractor and Subcontractors, under their own direction, execute and document the construction checklists and perform startup and initial checkout. The CxA documents that the checklists and startup were completed according to the approved plans. This may include the CxA witnessing start-up of selected equipment.
7. The CxA develops specific equipment and system functional performance test procedures. The Contractor reviews the procedures.
8. The functional test procedures are executed by the Contractor, under the direction of, and documented by the CxA.
9. Items of non-compliance in material, installation or setup are corrected at the Contractor's expense and the system retested.
10. The CxA reviews the O&M documentation for completeness.
11. Commissioning is completed before Substantial Completion.
12. The CxA reviews, pre-approves and coordinates the training provided by the Contractor and verifies that is was completed.
13. Deferred and seasonal testing is conducted by the Contractor, as specified or required, under the direction of the CxA. The CxA coordinates the scheduling through the Contractor.
14. The CxA performs post-occupancy evaluations after approximately two months and ten months of occupancy to identify any issues or deficiencies. Deficiencies shall be addressed by the Contractor prior to expiration of any warranties.

3.2 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

A. Training Preparation Conference: Before operation and maintenance training, CxA shall convene a training preparation conference to include Owner's operation and maintenance personnel, Contractor, and subcontractors. In addition to requirements specified in Division 1 Section "Demonstration and Training," perform the following:

1. Review the OPR and BoD.
2. Review installed systems, subsystems, and equipment.
3. Review instructor qualifications.
4. Review instructional methods and procedures.
5. Review training module outlines and contents.
6. Review course materials (including operation and maintenance manuals).
7. Inspect and discuss locations and other facilities required for instruction.
8. Review and finalize training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.

9. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

B. Training Modules: The commissioning team shall jointly develop an instruction program that includes individual training modules for each system, subsystem, and equipment as specified in Division 1 Section "Demonstration and Training."

3.3 CONTRACTOR'S RESPONSIBILITIES

A. The following responsibilities are in addition to those specified in Division 1 Section "General Commissioning Requirements."

B. Mechanical subcontractor:

1. Attend procedures meeting for TAB Work.
2. Certify that TAB Work is complete.
3. Attend coordination meeting between HVAC Instrumentation and Control and TAB subcontractors.

C. HVAC Instrumentation and Control Subcontractor:

1. With the CxA, review control designs for compliance with the OPR and BoD, controllability with respect to actual equipment to be installed, and recommend adjustments to control designs and sequence of operation descriptions.
2. Attend coordination meeting between CxA and TAB subcontractor to review plan for using controls system in TAB effort.
3. Provide calibration procedures and documentation that all components of the Building Automation System including control sensors, meters, damper actuators, valve actuators, etc. are properly calibrated and reading accurately. Where manufacturer’s calibrations are used, the BAS contractor shall demonstrate that manufacturer’s calibration provides an accurate reading.
4. Initiate trending for each system monitored by the BAS as requested by the CxA. Retrieve trending data and forward to CxA at intervals requested.

D. TAB Subcontractor:

1. Contract Documents Review: With the CxA, review the Contract Documents before developing TAB procedures.

    a. Verify the following:

        1) Accessibility of equipment and components required for TAB Work.
        2) Adequate number and placement of duct balancing dampers to allow proper balancing while minimizing sound levels in occupied spaces.
        3) Adequate number and placement of balancing valves to allow proper balancing and recording of water flow.
        4) Adequate number and placement of test ports and test instrumentation to allow reading and compilation of system and

equipment performance data needed to conduct both TAB and commissioning testing.

5) Air and water flow rates have been specified and compared to central equipment output capacities.

b. Identify discontinuities and omissions in the Contract Documents.

c. This review of the Contract Documents by the TAB Subcontractor satisfies requirements for a design review report as specified in Division 23 Section "Testing, Adjusting, and Balancing."

2. Additional Responsibilities:

a. Participate in functional performance testing.

b. Complete construction checklists where indicated as needing TAB measurements such as motor voltage, current, etc.

c. Perform calibration checks of all sensors and gauges as defined in the construction checklists.

E. Plumbing Subcontractor:

1. With the Mechanical and Electrical Subcontractor, coordinate installations and connections between and among electrical, HVAC and plumbing systems, subsystems, and equipment.

2. Participate in functional performance testing of plumbing systems, with vendors and subcontractors for each system tested.

3.4 COMMISSIONING DOCUMENTATION

A. The following are in addition to documentation specified in Division 1 Section "General Commissioning Requirements."

B. BoD HVAC: Owner will provide BoD-HVAC documents, prepared by Architect and approved by Owner, to the CxA and Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

C. Construction Checklists and Functional Performance Test Procedures: CxA shall develop construction checklists and functional performance test procedures for all commissioned systems, subsystems, and equipment, including interfaces and interlocks with other systems. CxA shall prepare separate checklists for each mode of operation and provide space to indicate whether the mode under test responded as required. In addition to the requirements specified in Division 1 Section "General Commissioning Requirements," checklists shall include, but not be limited to, the following:

1. Calibration of sensors and sensor function.

2. Testing conditions under which test was conducted, including (as applicable) ambient conditions, set points, override conditions, and status and operating conditions that impact the results of test.

3. Control sequences.

4. Strength of control signal for each set point at specified conditions.
5. Responses to control signals at specified conditions.
6. Sequence of response(s) to control signals at specified conditions.
7. Electrical demand or power input at specified conditions.
8. Power quality and related measurements.
9. Expected performance of systems, subsystems, and equipment at each step of test.
10. Narrative description of observed performance of systems, subsystems, and equipment. Notation to indicate whether the observed performance at each step meets the expected results.
11. Interaction of auxiliary equipment and interfaces with other systems.
12. Issues log.

3.5 TESTING PREPARATION

A. The Mechanical Subcontractor shall complete the following prerequisites for Testing:

1. Certify that HVAC systems, subsystems, and equipment have been completed, calibrated, and started; are operating according to the OPR, BoD, and Contract Documents; and that Certificates of Readiness are signed and submitted.
2. Submit results and reports from all manufacturer startup or special field-testing services within seven days of completion.
3. Pipe cleaning, flushing, hydrostatic tests, and chemical treatment requirements are specified in Division 23 piping Sections. HVAC subcontractor shall prepare pipe system cleaning, flushing, and hydrostatic testing. CxA shall review and comment on plan and final reports. Plan shall include the following:
    a. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed Drawings for each pipe sector showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
    b. Description of equipment for flushing operations.
    c. Minimum flushing water velocity.
    d. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.
4. Certify that HVAC instrumentation and control systems have been completed and calibrated; are operating according to the OPR, BoD, and Contract Documents; and that pretest set points have been recorded.
5. Certify that TAB procedures have been completed, and that TAB reports have been submitted, discrepancies corrected, and corrective work approved.
6. Complete all construction checklists and correct any deficiencies prior to functional testing.
7. Perform preliminary check of systems and intersystem performance after approval of construction checklists for systems, subsystems, and equipment.

8. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shut down, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
9. Verify each operating cycle after it has been running for a specified period and is operating in a steady-state condition.
10. Observe and verify the position of each device and interlock identified on checklists. Sign off each item as acceptable or failed. Repeat this test for each operating cycle that applies to system being tested.
11. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
12. Annotate checklist or data sheet when a deficiency is observed.
13. Verify equipment interface with monitoring and control system and TAB criteria; include the following:

    a. Supply and return flow rates for VAV and constant volume systems in each operational mode.
    b. Operation of terminal units in both heating and cooling cycles.
    c. Minimum outdoor-air intake in each operational mode and at minimum and maximum airflows.
    d. Building pressurization.
    e. Total exhaust airflow and total outdoor-air intake.
    f. Operation of indoor-air-quality monitoring systems.

14. Verify proper responses of monitoring and control system controllers and sensors to include the following:

    a. For each controller or sensor, record the indicated monitoring and control system reading and the test instrument reading. If initial test indicates that the test reading is outside of the control range of the installed device, check calibration of the installed device and adjust as required. Retest malfunctioning devices and record results on checklist or data sheet.
    b. Report deficiencies and prepare an issues log entry.

3.6 CONSTRUCTION CHECKLIST VERIFICATION

A. Contractors shall notify the CxA when prefunctional checklists for a particular system have been completed, in preparation for system functional testing.

B. The CxA will review the completed checklists for completeness.

C. The CxA will field-verify random samples of the contractor-completed checklists. The sampling rate will be defined in the Commissioning Plan.

D. The commissioning plan will define failure criteria for each component. Based on the random sampling, the CxA will determine if the prefunctional construction checklists for each system have been properly and completely filled out by the installing contractors. Any items noted as deficient during field-verification will be reported to the Commissioning Team. Any components that are found to exceed the failure criteria

established in the commissioning plan will require that the Contractor recheck all checklists prior to proceeding.

E. Efforts required by the CxA to recheck failed checklists, or to field-verify additional components beyond the initial sampling plan caused by improper completion of the checklists by the Contractor, shall be billed to the Owner on an hourly basis. The Contractor shall reimburse the Owner for these efforts.

F. All checklists associated with each functional performance test procedure shall be completed and approved by the CxA prior to functional performance testings.

3.7 TAB VERIFICATION

A. TAB subcontractor shall coordinate with CxA for work required in Division 23 Section "Testing, Adjusting, and Balancing." TAB subcontractor shall copy CxA with required reports, sample forms, checklists, and certificates.

B. Contractor, HVAC subcontractor, and CxA shall witness TAB Work.

C. TAB Preparation:

1. TAB subcontractor shall provide CxA with data required for "Pre-Field TAB Engineering Reports" specified in Division 23 Section "Testing, Adjusting, and Balancing."

    a. CxA shall use this data to certify that prestart and startup activities have been completed for systems, subsystems, and equipment installation.

D. Ductwork Air Leakage Testing (if applicable):

1. Architect will identify, for HVAC subcontractor and CxA, portions of duct systems to have ductwork air leakage testing. Ductwork air leakage testing shall be performed according to Division 23 Section "Metal Ducts," and shall be witnessed by the CxA.
2. On approval of preliminary ductwork air leakage testing report, the CxA shall coordinate verification testing of ductwork air leakage testing. Verification testing shall include random retests of portions of duct section tests, reported in preliminary ductwork air leakage testing report. The HVAC subcontractor shall perform tests using the same instrumentation (by model and serial number) as for original testing; the CxA shall witness verification testing.

E. Verification of Final TAB Report:

1. CxA shall select, at random, 10 percent of report for field verification.
2. CxA shall notify TAB subcontractor ten days in advance of the date of field verification; however, notice shall not include data points to be verified. The TAB subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.
3. Failure of an item is defined as follows:

a. For all readings other than sound, a deviation of more than 10 percent.

4. Failure of more than 10 percent of selected items shall result in rejection of final TAB report.

F. If deficiencies are identified during verification testing, CxA shall notify the HVAC subcontractor and Architect, and shall take action to remedy the deficiency. Architect shall review final tabulated checklists and data sheets to determine if verification is complete and that system is operating according to the Contract Documents.

G. CxA shall verify that TAB Work has been successfully completed.

3.8 TESTING

A. Functional Performance Tests of systems and intersystem performance shall be completed after construction checklists for systems, subsystems, and equipment have been approved.

B. Functional Performance Testing will be done under the direction of the CxA. The responsible subcontractors and vendor representatives shall operate and manipulate equipment and controls as directed.

C. Perform tests using design conditions whenever possible.

1. Simulate conditions by imposing an artificial load when it is not practical to test under design conditions and when written approval for simulated conditions is received from CxA. Before simulating conditions, calibrate testing instruments. Set and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
2. Alter set points when simulating conditions is not practical and when written approval is received from CxA.
3. Alter sensor values with a signal generator when design or simulating conditions and altering set points are not practical. Do not use sensor to act as signal generator to simulate conditions or override values.

D. Scope of HVAC System Testing:

1. Testing scope shall include entire HVAC installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. It shall include measuring capacities and effectiveness of operational and control functions.
2. Test all operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.
3. Test all interfaces between the HVAC, controls, and other systems, including fire alarm, domestic water, heating, etc.
4. Initiate and retrieve trend data for all data points, for first four weeks following successful testing.

E. Scope of Plumbing System Testing:

1. Testing scope shall include central equipment for water heating through distribution systems to each fixture. It shall include measuring capacities and effectiveness of operational and control functions.
2. Test all operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and verify proper response of system controllers and sensors.
3. Verify interfaces with the Building Automation System are correct and operational.

F. Detailed Testing Procedures: CxA, with commissioning team, shall prepare detailed testing plans, procedures, and checklists for all commissioned systems, subsystems, and equipment.

G. Deferred Testing:

1. If tests cannot be completed because of a deficiency outside the scope of the system, the deficiency shall be documented and reported to Owner. Deficiencies shall be resolved and corrected by appropriate parties and test rescheduled.
2. Initial testing shall be performed with simulated loads where necessary, based on seasonal conditions. Contractor shall provide personnel to assist CxA with completion of testing after occupancy, when seasonal conditions permit actual performance under summer and winter design conditions.

H. Testing Reports:

1. Reports shall include measured data, data sheets, and a comprehensive summary describing the operation of systems at the time of testing.
2. Include data sheets for each controller to verify proper operation of the control system, the system it serves, the service it provides, and its location. For each controller, provide space for recording its readout, the reading at the controller's sensor(s), plus comments. Provide space for testing personnel to sign off on each data sheet.
3. Prepare a preliminary test report. Deficiencies will be evaluated by Architect to determine corrective action. Deficiencies shall be corrected and test repeated.
4. If it is determined that the system is constructed according to the Contract Documents, Owner will decide whether modifications required to bring the performance of the system to the OPR and BoD documents shall be implemented or if tests will be accepted as submitted. If corrective Work is performed, Owner will decide if tests shall be repeated and a revised report submitted.

END OF SECTION

MECHANICAL COMMISSIONING REQUIREMENTS

SECTION 23 61 90 - CONDENSING BOILER – HOT WATER (GAS)

PART ONE – GENERAL:

1.01 The hot water boiler shall be capable of 94% thermal efficiency per DOE / BTS 2000 and up to 99% efficient at low fire rates with low return water temperature. Boiler shall feature inward-fired burner technology with seamless modulation capable of 20 to 1 turndown with no minimum flowrate required. The complete packaged boiler with burner, controls and trim shall be UL approved. Boiler shall meet all applicable requirements of ASHRAE 90.1.

1.02 The unit shall have performance and output ratings as scheduled on plans.

1.03 Boiler shall be Patterson-Kelley P-K Mach, Lochinvar Crest Hellcat or prior approved equal.

PART TWO – PRODUCTS:

2.01 Unit shall be assembled and wired with burner, controls, trim and skid type base installed at the factory. Unit shall be equipped with pre-mix, surface burner with proportional gas/air control and variable speed blower motor. Gas train shall meet UL795, FM and CSD-1 requirements. Unit shall have hot surface ignition system with electronic ignition control with pre and post purge. Electronic operating control shall include digital readout, firing cycle status lights and high limit temperature control with manual reset. Temperature and pressure gauges shall be provided on the supply outlet and the gas train shall be equipped with high and low gas pressure switches.

2.02 The pressure vessel shall consist of vertical fire tubes and steel boiler construction with a medium mass design. Vessel shall be ASME “H” stamped and provided with a 150 PSI design pressure with a 150 PSI relief valve. Condensing fire tubes shall be vertically oriented and coated with PVDF polymer. Economizer section shall be stainless steel. MODBUS controls shall be provided to interconnect multiple boilers and shall have a full color touch screen programmable user interface. Controller shall be Bacnet/LonWorks compatible and be connected to the building automation system. Entire boiler shall be provided with a 10 year parts and labor warranty.

2.03 Controls shall be 120V, 60 cycle single phase. Boiler shall be provided with the following options: Audible alarm for any failure, MODBUS connection cable, remote alarm relay, combustion air interlock, float-type low-water cutoff with blowdown, air vent valve, high and low water pressure safety switches, water flow switch, gas pressure gauge and UL approved vent cap for direct combustion air.

PART THREE – EXECUTION:

3.01 BOILING OUT:

A. Before being placed in service, boiler shall be thoroughly boiled out for a period of 24 hours. The solution to be used in the boiler for the boiling out process shall consist of ten (10) pounds of trisodium phosphate per 100 gal. of water. Upon completion of boiling out, the boiler shall be thoroughly flushed out with potable water.

3.02 Emergency disconnect switch shall be provided on the wall near the boiler room entrance to allow rapid and complete shut down of the boiler in the event of an emergency.

3.03 The boiler manufacturer's representative shall start-up, adjust and test the boiler. The Owner's representative shall be instructed in the proper operation and maintenance of the boiler. The manufacturer shall submit a written start up report. A pre-start up check list shall be submitted with the product submittal for the contractor's use.

3.04 Install round double wall type-B gas vent through roof as manufactured by Metal Bestos or approved equal. Size per manufacturer's requirements and the IFGC. See details.

END OF SECTION 23 61 90

SECTION 237000 – Hot and Chilled Water Blower Coil Units

PART ONE – GENERAL:

1.01 SYSTEM DESCRIPTION:

A. Indoor mounted concealed fan coil unit consisting of components designed to provide air to a conditioned space as required meeting specified performance requirements for ventilation, heating, cooling, filtration and distribution. Unit shall be assembled for fan blow through and shall be arranged to discharge conditioned air horizontally as shown on contract drawings.

1.02 QUALITY ASSURANCE:

A. Unit performance shall be certified in accordance with A.R.I. Standard 441. Unit shall meet all applicable requirements of ASHRAE 90.1.

B. Coils shall be tested and certified in accordance with A.R.I. Standard 410 Coil Certification Program.

C. Insulation and insulation adhesive shall comply with NFPA 90A requirements for flame spread and smoke generation.

D. Unit shall be stored and handled in accordance with the unit manufacturer's instructions.

E. Units shall be Daikin, Envirotec or prior approved equal.

PART TWO – PRODUCTS:

2.01 EQUIPMENT:

A. Base units shall be complete with two (2) water coils, a condensate pan insulated with ½" closed cell foam, one (1) or more centrifugal fans and motors, 18 gauge galvanized steel casing panels insulated with ½" glass fiber insulation meeting NFPA 90A requirements and a three (3) speed fan switch (off, low, med, high) mounted on the side of the unit.

B. Cabinets shall be constructed of cold rolled steel, bonderized and coated with a baked enamel finish. Access panels have positive locking quarter turn fasteners for easy removal. Fasteners have a slotted head as standards. Optional tamper proof heads are available.

C. Coils shall be 2-row, 3-row, 4-row, 3-row split, 4-row split or 5-row split depending on unit size. Coils have aluminum fins (10/in.) mechanically bonded to staggered ½" O.D. copper tubes. Sweat connections are 5/8" O.D. copper. All coils are leak tested at a minimum air pressure of 350 psig and are suitable for working pressures of up to 250 psig. Each coil shall have a manual air vent.

D. Motors shall be three (3) speed tap wound type with built-in thermal overload protection. Motor bearings are sleeved type with oil tubes and oversized oil reservoirs for positive lubrication and minimum service requirements.

E. Fans shall be centrifugal forward curved type. Fan wheels are statically and dynamically balanced. Fan wheels and housings are constructed of galvanized steel.

F. Filter – 1" throw-away filter.

G. Drain pan shall be 18 gauge galvanized steel and is pitched for positive drainage when unit is level. Pan shall project under entire length of coil including headers and return bends. Provide a float switch in pan to de-energize unit if pan fills with condensate.

H. Entire unit shall be provided with a manufacturers 5 year parts and labor warranty.

END OF SECTION 237000

SECTION 237031 – AIR-COOLED SCROLL CHILLER

PART 1: GENERAL

1.01 SUMMARY

A. Section includes design, performance criteria, refrigerants, controls, and installation requirements for air-cooled scroll compressor chillers.

1.02 REFERENCES

A. Comply with applicable Standards/Codes of AHRI 550/590, ANSI/ASHRAE 15, ETL, cETL, NEC, and OSHA as adopted by the State.

B. Units shall meet the efficiency standards of the current version of ASHRAE Standard 90.1, and FEMP standard 2012.

1.03 SUBMITTALS

A. Submit shop drawings and product data in accordance with the specifications.

B. Submittals shall include the following:

1. Dimensioned plan and elevation view drawings, required clearances, and location of all field connections
2. Summary of all auxiliary utility requirements such as electricity, water, etc. Summary shall indicate quality and quantity of each required utility.
3. Single line schematic drawing of the field power hookup requirements, indicating all items that are furnished.
4. Schematic diagram of control system indicating points for field interface/connection.
5. Diagram shall fully delineate field and factory wiring.
6. Installation and operating manuals.

1.04 QUALITY ASSURANCE

A. Qualifications: Equipment manufacturer must specialize in the manufacture of the products specified and have five years experience with the type of equipment and refrigerant offered.

B. Regulatory Requirements: Comply with the codes and standards specified.

C. Chiller manufacturer plant must be ISO Registered.

1.05 DELIVERY AND HANDLING

A. Chiller shall be delivered to the job site completely assembled and charged with refrigerant and oil by the manufacturer.

B. Comply with the manufacturer's instructions for rigging and handling equipment.

1.06 WARRANTY

A. Standard Warranty (Domestic): The refrigeration equipment manufacturer's guarantee shall be for a period of one year from date of equipment start-up but not more than 18 months from shipment. The guarantee shall provide for repair or replacement due to failure by material and workmanship that prove defective within the above period, excluding refrigerant.

B. 1st Year Labor Warranty: Entire unit

C. Extended Compressor Warranty: None.

D. Extended Unit Warranty: Entire unit (no pumps), four (4) years parts and labor.

E. Refrigerant Warranty: Five (5) years R410A refrigerant.

F. Delay Warranty Start: None.

1.07 MAINTENANCE

A. Maintenance of the chillers shall be the responsibility of the owner and performed in accordance with the manufacturer's instructions.

PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Daikin Applied or prior approved equal. Manufacturer's to be considered for prior approval shall provide a complete submittal to engineer for review a minimum of 20 days PRIOR to bid for consideration.

2.02 UNIT DESCRIPTION

A. Provide and install as shown on the plans factory-assembled, factory-charged air-cooled scroll compressor packaged chillers in the quantity specified. Each chiller shall consist of hermetic tandem scroll compressor sets (total four compressors), brazed plate evaporator, air-cooled condenser section, microprocessor-based control system and all components necessary for controlled unit operation.

B. Chiller shall be functionally tested at the factory to ensure trouble free field operation

2.03 DESIGN REQUIREMENTS

A. Flow Range: The chiller shall have the ability to support variable flow range down to 40% of nominal design (based on AHRI conditions).

B. Operating Range: The chiller shall have the ability to control leaving chilled fluid temperature from 15F to 65F.

C. General: Provide a complete scroll compressor packaged chiller as specified herein and as shown on the drawings. The unit shall be in accordance with the standards referenced in section 1.02 and any local codes in effect.

D. Performance: Refer to the schedule of performance on the drawings. The chiller shall be capable of stable operation to a minimum percentage of full load

(without hot gas bypass) of 17%. Performance shall be in accordance with AHRI Standard 550/590.

E. Acoustics: Sound pressure levels for the unit shall not exceed the following specified levels. All manufacturers shall provide the necessary sound treatment (parts and labor) to meet these levels if required. Sound data shall be provided with the quotation. Test shall be in accordance with AHRI Standard 370.

Sound Pressure (at 30 feet)											
63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	**Overall dBA**	75% Load dBA	50% Load dBA	25% Load dBA
Sound Power											
63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	**Overall dBA**	75% Load dBA	50% Load dBA	25% Load dBA

2.04 CHILLER COMPONENTS

A. Compressor

1. The compressors shall be sealed hermetic, scroll type with crankcase oil heater and suction strainer. The compressor motor shall be refrigerant gas cooled, high torque, hermetic induction type, two-pole, with inherent thermal protection on all three phases and shall be mounted on RIS vibration isolator pads. The compressors shall be equipped with an internal module providing compressor protection and communication capability.

B. Evaporator

1. The evaporator shall be a compact, high efficiency, dual circuit, brazed plate-to-plate type heat exchanger consisting of parallel stainless steel plates. Vent and drain connections shall be provided in the inlet and outlet chilled water piping by the installing contractor.

2. The evaporator shall be protected with an external, electric resistance heater plate. The evaporator shall be insulated with 1.5” (38mm) thick CFC and HCFC-free closed-cell flexible elastomeric foam insulation material with 100% adhesive coverage. Suction piping to the compressors shall be insulated with similar foam insulation material of 0.75” (19 mm) thickness. The insulation shall have an additional outer protective layer of 3mm thick PE embossed film to provide superior damage resistance. Insulation without the protective outer film shall not be acceptable. UV resistance level shall meet or exceed a rating of ‘Good’ in accordance with the UNI ISO 4892 - 2/94 testing method. This combination of a heater plate and insulation shall provide freeze protection down to -20°F (-29°C) ambient air temperature.

3. The water-side maximum design pressure shall be rated at a minimum of 435 psig (3000 kPa). Evaporators shall be designed and constructed according to, and listed by Underwriters Laboratories (UL).

C. Condenser

1. Condenser fans shall be propeller type arranged for vertical air discharge and individually driven by direct-drive fan motors. The fans shall be equipped with a heavy-gauge vinyl-coated fan guard. Fan motors shall be TEAO type with permanently lubricated ball bearings, inherent overload protection, three-phase, direct-drive, 1140 rpm. Each fan section shall be partitioned to avoid cross circulation.

2. Coil shall be microchannel design and shall have a series of flat tubes containing multiple, parallel flow microchannels layered between the refrigerant manifolds. Tubes shall be 9153 aluminum alloy. Tubes made of 3102 alloy or other alloys of lower corrosion resistance shall not be accepted. Coils shall consist of a two-pass arrangement. Each condenser coil shall be factory leak tested with high-pressure air under water. Condenser coils shall include baked epoxy coating providing 6000+ hour salt spray resistance (ASTM B117-90) applied to both the coil and the coil frames.

D. Refrigerant Circuit

1. Each of the two refrigerant circuits shall include a replaceable-core refrigerant filter-drier, sight glass with moisture indicator, liquid line solenoid valve (no exceptions), expansion valve, and insulated suction line.

E. Construction

1. Unit formed sheet metal components shall be painted using a corrosion resistant paint system, for aesthetics and long-term durability. Paint system will include a base primer with a high-quality polyester resin topcoat. Painted galvanized parts shall be G60 or greater and finished, unabraded panel surfaces shall be capable to be exposed to an ASTM B117 salt spray environment and exhibit no visible red rust at a minimum of 3,000 hours exposure. Finished, abraded surfaces shall be tested per ASTM D1654, having a mean scribe creepage not exceeding 1/16” at 1,000 hours minimum exposure to an ASTM B117 salt spray environment.

2. Upper condenser coil section of unit shall have protective, 12 GA, PVC-coated, wire grille guards.

F. Control System

1. A centrally located weatherproof control panel shall contain the field power connection points, control interlock terminals, and control system. Box shall be designed in accordance with NEMA 3R rating. Power and starting components shall include factory circuit breaker for fan motors and control circuit, individual contactors for each fan motor, solid-state compressor three-phase motor overload protection, inherent fan motor overload protection and two power blocks (one per circuit) for connection to remote, contractor supplied disconnect switches. Hinged access doors shall be lockable. Barrier panels or separate enclosures are required to protect against accidental contact with line voltage when accessing the control system.

2. Shall include high short circuit current rating of 65,000 amps (25,000 amps at 575Volt) with single-point disconnect switch

G. Unit Controller

1. An advanced DDC microprocessor unit controller with a 5-line by 22-character liquid crystal display provides the operating and protection functions. The controller shall take preemptive limiting action in case of high discharge pressure or low evaporator pressure. The controller shall contain the following features as a minimum:
2. The unit shall be protected in two ways: (1) by alarms that shut the unit down and require manual reset to restore unit operation and (2) by limit alarms that reduce unit operation in response to some out-of-limit condition. Shut down alarms shall activate an alarm signal.
3. Shutdown Alarms
   a. No evaporator water flow (auto-restart)
   b. Sensor failures
   c. Low evaporator pressure
   d. Evaporator freeze protection
   e. High condenser pressure
   f. Outside ambient temperature (auto-restart)
   g. Motor protection system
   h. Phase voltage protection (Optional)
4. Limit Alarms
   a. Condenser pressure stage down, unloads unit at high discharge pressures.
   b. Low ambient lockout, shuts off unit at low ambient temperatures.
   c. Low evaporator pressure hold, holds stage #1 until pressure rises.
   d. Low evaporator pressure unload, shuts off one compressor.
5. Unit Enable Section
   a. Enables unit operation from either local keypad, digital input, or BAS
6. Unit Mode Selection
   a. Selects standard cooling, ice, glycol, or test operation mode
7. Analog Inputs:
   a. Reset of leaving water temperature, 4-20 mA\
   b. Current Limit
8. Digital Inputs
   a. Unit off switch
   b. Remote start/stop
   c. Flow switch
   d. Ice mode switch, converts operation and setpoints for ice production
   e. Motor protection
9. Digital Outputs
   a. Shutdown alarm; field wired, activates on an alarm condition, off when alarm is cleared
   b. Evaporator pump; field wired, starts pump when unit is set to start
10. Condenser fan control - The unit controller shall provide control of condenser fans based on compressor discharge pressure.
11. Building Automation System (BAS) Interface

a. Factory mounted DDC controller(s) shall support operation on a BACnet®, Modbus® or LONMARK ® network via one of the data link / physical layers listed below as specified by the successful Building Automation System (BAS) supplier.
b. BACnet MS/TP master (Clause 9)
c. BACnet IP, (Annex J)
d. BACnet ISO 8802-3, (Ethernet)
e. LONMARK FTT-10A. The unit controller shall be LONMARK® certified.
f. The information communicated between the BAS and the factory mounted unit controllers shall include the reading and writing of data to allow unit monitoring, control and alarm notification as specified in the unit sequence of operation and the unit points list.
g. For chillers communicating over a LONMARK network, the corresponding LONMARK eXternal Interface File (XIF) shall be provided with the chiller submittal data.
h. All communication from the chiller unit controller as specified in the points list shall be via standard BACnet objects. Proprietary BACnet objects shall not be allowed. BACnet communications shall conform to the BACnet protocol (ANSI/ASHRAE135-2001). A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided along with the unit submittal.

2.05 OPTIONS AND ACCESSORIES

A. The following options are to be included:

1. Low Ambient Control: Provide fan cycling control to allow unit operation down to 32°F

2. Ground Fault Protection: Factory installed circuit breaker to protect equipment from damage from line-to-ground fault currents less than those required for conductor protection.

3. Phase loss with under/over voltage protection and with LED indication of the fault type to guard against compressor motor burnout.

4. BAS interface module to provide interface with the BACnet MSTP protocol.

5. The following accessories, if selected, are to be included:
   a. Spring vibration isolators for field installation
   b. Rubber-in-shear vibration isolators for field installation
   c. Factory-mounted thermal dispersion type flow switch
   d. Field-mounted, paddle type, chilled water flow switch field wired to the control panel
   e. Wye strainer, to be installed at the evaporator inlet and sized for the design flow rate , with perforation diameter of 0.063" with blowdown valve and Victaulic couplings (factory mounted or field installed)
   f. 115V GFI convenience outlet

B. Optional Factory-Installed Pump Package: None

1. These pump package accessories, if selected, will also be included:

a. Water pressure gauges on the pump suction and discharge
b. Expansion tank with size increments from 4.4 to 90 gallons, field installed (small sizes can be factory mounted
c. Air separator with air vent, field installed
d. Storage tanks, vertical, insulated, 150, 300, 600, 1000 gallon sizes with optional immersion heater, field installed.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install in strict accordance with manufacturer's requirements, shop drawings, and contract documents.

B. Adjust and level chiller in alignment on supports.

C. Coordinate electrical installation with electrical contractor.

D. Coordinate controls with control contractor.

E. Install a field-supplied or optional manufacturer-supplied strainer in the chilled water return line at the evaporator inlet that meets manufacturer perforation size specifications.

3.02 START-UP

A. Provide testing and starting of machine, and instruct the Owner in its proper operation and maintenance. Authorized factory representative shall perform a complete demonstration of the Chiller(s) performance and features. Training shall be performed with the Controls Contractor and shall be video taped. Two (2) copies of the taped training session shall be delivered to the owner.

END OF SECTION 237030

SECTION 237100 – SPLIT SYSTEM HEAT PUMPS

PART ONE – GENERAL:

1.01 Units shall be provided complete with indoor and outdoor sections, refrigerant piping and factory installed controls. Systems shall be A.R.I. 210 and 270 rated, UL listed and meet all applicable requirements of ASHRAE 90.1.

1.02 Heat pump system shall be as manufactured by Trane, Daikin or prior approved equal. Provide complete submittal to Engineer for approval 10 days prior to bid.

PART TWO – PRODUCTS:

2.01 INDOOR UNIT:

A. Indoor unit shall be constructed of galvanized steel with baked enamel finish properly reinforced for maximum rigidity and shall be internally insulated. Casing shall be sectionalized construction consisting of fan section, coil section, electric heater section, filter section as indicated and drain pan. Removable panels shall be furnished to provide access to internal parts and shall be gasketed to minimize leakage.

B. Evaporator coil shall be manufacturer's standard of sufficient size to provide the heating and/or cooling requirements as specified. Provide factory mounted non-bleed thermal expansion valve and low ambient cooling down to 30 degrees.

C. Coils: Evaporator coils shall be dipped and baked with Epoxy, Phenolic, or Heresite coated aluminum fins mechanically bonded to seamless copper tubing. As an alternative, either copper/copper or aluminum/aluminum is acceptable. Provide subcooling circuit(s).

D. Evaporator fan shall be centrifugal double inlet forward curve blade type and shall be variable speed. Fans shall be statically and dynamically balanced and shall have permanently lubricated bearings and shall be complete with built-in thermal overload protection.

E. Electric heaters shall be the open coil type designed to fit within the unit. Heater shall be complete with contactors, control transformers, automatic thermal high limit, fusible links for each heater circuit and fan interlock. Heaters shall be UL listed. Provide single point power.

2.02 OUTDOOR UNIT:

A. Outdoor unit shall be fabricated of heavy G-90 gauge galvanized steel with baked enamel finish for weatherproof installation and vertical air discharge. The unit shall be readily accessible for maintenance and shall be complete with all operating and safety controls ready for electrical connection. Units shall be provided with factory supplied louvered coil guards.

B. Motor compressor shall be the unit manufacturer's standard for heat pump service. Provide factory-assembled and pre-wired units suitable for outdoor use consisting of cabinet, compressor(s), condensing coil and fan(s), integral subcooling circuit(s), internal thermal overload protection, suction line accumulator, filter drier, crankcase heaters, hard start capacitor, and controls. Provide expansion valve(s) and check valves for split system heat pump unit(s). Accessories shall be factory mounted. Provide heat pump condensing unit fully charged from the factory for up to 15 feet pf piping. Unit shall be designed to operate at temperatures as high as 115 F. Cooling capacities shall be matched with air handling unit that is ARI certified. The unit shall be UL listed.

C. Condenser fan shall be the propeller type arranged for vertical discharge. Fan shall be statically and dynamically balanced. Fan motor shall have permanently lubricated bearings and shall have built-in thermal overload protection.

D. Coils: Condenser coils shall be dipped and baked with Epoxy, Phenolic, or Heresite coated aluminum fins mechanically bonded to seamless copper tubing. As an alternative, either copper/copper or aluminum/aluminum is acceptable. Provide subcooling circuit(s).

E. Performance Ratings: Energy Efficiency Rating (SEER) not less than 13.00 SEER per ARI, as a matching system.

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2.03 CONTROLS:

A. Units shall have factory wired controls, including all components necessary for standard sequences of heating and cooling. Provide controls in accordance with Controls section of these specifications.

PART THREE – EXECUTION:

3.01 OUTDOOR UNIT:

A. Mount unit with clearances as recommended by manufacturer. Provide vibration isolators of the cork and neoprene type under the outdoor unit. Securely mount unit with anchor bolts through isolators into support base.

3.02 INDOOR UNIT:

A. Support indoor unit on 2 ½" x 2 ¼" angle iron with four (4) spring type vibration isolators.

B. Provide four (4) 16 gauge galvanized steel straps of sufficient size to secure unit to angle supports.

C. Install indoor unit with manufacturer's required minimum clearances to all service panels.

3.03 INDOOR UNIT AUXILIARY DRAIN PAN:

A. Provide an auxiliary drain pan of 16 gauge galvanized steel a minimum 2" deep with all welded seams. Pan shall extend a minimum of 3" beyond unit casing on all sides. Provide a float switch in pan to de-energize unit if pan fills with condensate.

3.04 REFRIGERANT PIPING:

A. Refrigerant piping shall be type "ACR" copper with silver brazed joints and cleaned and capped wrought copper fittings installed in accordance with manufacturer's instructions.

B. Contractor shall note the length of the refrigerant lines. The following items shall be provided as specified above and in accordance with the heat pump manufacturer's recommendations for "long line" applications as necessary:

1. Liquid and suction line sizing
2. Indoor and outdoor thermal expansion valves
3. Refrigerant charge by the "weigh-in" method
4. Oil return (only if required by manufacturer)
5. Crankcase heater, "hard start" gear and liquid filter/dryer accessories for heat pump units

3.05 CONDENSATE PIPING:

A. Condensate piping shall be type "L" hard copper full size of indoor unit connection 1" minimum with P-trap and cleanout tee with plug at trap. Route condensate drain as indicated.

3.06 INSULATION:

A. Insulation shall be provided on refrigerant suction and condensate piping. Insulation shall be ¾" thick "Rubatex" or "Armaflex." Seal all joints with adhesive. Provide 1" thick "Rubatex" or "Armaflex" on refrigerant suction piping 1 ½" O.D. and larger. Insulation shall not be cut lengthwise to install. All exterior refrigerant piping shall be covered with 22 gauge aluminum or 24 gauge stainless steel jackets and banded 4' on center.

B. All piping shall be hung with clevis type hangers complete with insulation saddles. Route liquid line above suction and tie wrap 4' o.c. with 3/8" wide nylon straps without compressing insulation. Pipe hangers shall be as manufactured by Michigan Hanger Co., Grinnell or B-Line. Hangers equal to M-CO #403.

3.07 WARRANTY:

A. Heat pump systems shall be provided with a warranty of five (5) years for parts and labor for entire system, including compressors. Warranty shall be provided to the owner in writing by the heat pump manufacturer.

3.08 INSTALLATION:

A. Heat pumps shall be installed in strict accordance with the manufacturer's recommendations.

END OF SECTION 237100

SECTION 237410 – ROOFTOP CENTRAL STATION AIR HANDLING UNIT

PART ONE: GENERAL:

1.01 Provide AHUs fully factory assembled. As shipped from the AHU Manufacturer, AHUs shall meet the performance requirements designed to provide air to a conditioned space as required meeting specified performance requirements for ventilation, cooling, filtration and distribution, as shown on the equipment schedule. Units shall be for indoor or outdoor application and shall have all components and options as indicated on the schedule or drawings. Furthermore, units shall be constructed as detailed hereinafter and all units shall ship in one piece.

1.02 QUALITY ASSURANCE

A. Receive and unload the AHUs. Inspect the units as they arrive on the job site. Notify the trucking company, AHU Manufacturer, and Owner of any shipping damage immediately.

B. Ensure equipment pads, curbs, or support platforms are level prior to setting the units. Use spreader bars to hoist the unit to avoid damaging units.

C. Coils shall be tested and certified in accordance with ARI Standard 410 Coil Certification Program and units either UL or ETL certified.

D. Provide all final chilled water and drain piping connections. Release the fan spring isolator shipping restraints. Provide all electrical connections as required. Install filter media in filter frames. Operating units without filter media is strictly prohibited.

E. If indoor equipment is to be stored for any length of time prior to installation, the mechanical contractor shall store the units in a covered, indoor environment.

F. Metal nameplates shall be provided on the units. All information contained on the nameplate shall be etched or burned into the surface to prevent fading. Information shall include:

G. Job name, sales order number, unit tagging, and service model number. MCA, MOP, and maximum fuse/HACR circuit breaker size. Voltage, frequency, phase, Hp, FLA, and inverter input current for all motors.

1.03 ACCEPTABLE MANUFACTURERS

A. Rooftop Units shall be Daikin Model OAH. Rooftop AHU manufacturers shall comply with all specifications, performance data, efficiency, dimensional requirements, warranty, as they apply to all manufacturers. All AHU Manufacturer's that are not basis of design shall deliver a complete submittal to the Engineer for review 20 days prior to the bid date. Submittal shall include the following:

1.04 SUBMITTALS

A. Provide dimensioned arrangement drawings for each AHU including a plan and elevation view of the assembled unit with overall dimensions, support locations, weights, electrical, piping, and connection locations, as specified. Compliance with all

specification requirements, including unit construction, component options and factory tests, listed herein.

B. All performance data, including capacities and airside and waterside pressure drops, for components. Fan curves shall be provided for fans with the design operating points indicated. Unit ducted discharge sound power levels in dB shall be provided for 63, 125, 250, 500, 1000, 2000, 4000, and 8000 Hz in accordance with ARI-260. Include verification that factory performance tests will be conducted as listed herein.

C. Brand and model of fans, fan motors, coils, air filters, dampers, outside and return air measuring stations, variable frequency drives, combination starter/disconnects, being furnished.

PART TWO: UNIT CONSTRUCTION:

2.01 CASING PERFORMANCE

A. With all openings sealed, the suction side (or discharge side for positive pressure) of the test blower shall be connected to the test house with a short piece of 6" diameter ductwork.

B. Water level in two manometers will be set to zero. U-tube manometer will be set to zero by sliding u-tube up or down on the scale and adding water if necessary. Incline manometer will be set to zero by sliding scale left or right and adding red dye if necessary. U-tube manometer will be connected to the unit. The incline manometer will be connected to the orifice plate to measure the pressure differential across the plate.

C. The suction side (or discharge side for positive pressure) of the test blower will be connected to the 6" diameter ductwork containing a calibrated orifice. The blower discharge duct (or inlet to the blower for positive) will be equipped with a VFD to adjust flow rate.

D. The blower will be allowed to run on low speed. The VFD will be increased gradually. The water level in the U-tube manometer connected to the unit will be monitored. This procedure will be monitored until the U-tube manometer indicates required pressure as indicated above.

E. When pressure inside the unit has stabilized, the pressure differential across the orifice plate will be recorded. Using the manufacturer's calibration chart, the pressure differential will be converted to CFM air leaking through the unit. This value will be recorded.

F. During the positive pressure test, panel deflection tests shall be performed using instruments with an accuracy of +/- 0.001". Measuring devices shall be initialized and calibrated on panels under zero pressure, and shall register 0.000" deflection. The entire unit shall be pressurized to 10" w.g., positive pressure, and the panel defection shall be measured and recorded.

G. Provide documentation validating the units meet the requirements under the above mentioned controlled conditions.

H. Under supply air temperature of 50°F dry bulb and design conditions on the exterior of the unit of 96°F dry bulb and 80°F wet bulb, with circulating air, condensation shall not form on the casing exterior, for each unit. The AHU Manufacturer shall provide tested casing thermal performance plotted on a psychrometric chart for each unit. The design condition on the exterior of the unit shall also be plotted on the chart. Thermal performance data based on anything other than actual tested casing enclosures for each unit construction will not be accepted. Calculations/Tested data for individual panels only and predicted calculations for unit thermal performance are not acceptable.

I. Instrument calibration shall be traceable to NIST (National Institute of Standards and Technology). Provide a copy of the latest certification report to the engineer.

J. Utilize Multiple Thermo-Couples on the unit casing, including panel faces, panel-to-panel joints, unit corners, panel-to-roof joints, structural members, door hinges, and all seams and joints to measure and record the thermal conductivity of each surface type on the exterior of the entire unit. Utilize two thermo-couples to measure temperature at each location on the exterior of the unit casing and utilize multiple sensing points to control the ambient temperature/dew point temperatures within the test facility.

K. The ambient air conditions within the test facility shall be compensated for air-density at the specific location for the amount of feet above sea level.

L. Redundant measurement devices shall be incorporated to verify test data. Agreement between the calibrated sensors shall confirm the data taken is accurate. These redundant measurements shall be recorded and provided in the test report to show agreement between the calibrated sensors confirms the data taken is accurate. Description of the test facility and location of redundant measuring sensors shall be detailed in the test report.

    - Tolerances:
    - Temperature sensors +/- 0.5%
    - Dew point +/- 1.0%

M. Provide documentation validating the units meet the requirements under the above mentioned controlled conditions.

2.03 BASES AND FLOORS

A. Base shall be constructed from 10 gauge welded steel channels around the perimeter and 10 gauge welded steel cross members. The steel base will be constructed from 10 gauge galvanized and then painted. The maximum cross-member spacing shall be 24" on center with members located adequately to support fan, coils, and other large components. The height of each base channel shall be a minimum of 6 inches. Each unit shall be provided with removable lifting lugs. Structural framework shall fully support the unit casing and all components during installation such that no section deflects more than L/1000 during rigging of that section, where L is defined as the distance between lifting lugs.

B. Floor shall be constructed from 16 gauge smooth clear-coated galvanized steel to withstand salt spray test in accordance with ASTM B117 for a minimum of 500 consecutive hours. As an alternative to clear-coated steel, the interior floors shall be

painted. The floor surface shall be welded, all spaces and joints completely sealed with dams around all bottom penetrations.

C. Provide insulation with a minimum R-value of 12 underneath the entire unit floor. Insulation shall completely fill the panel cavity in all directions so that no voids exist. A galvanized steel liner shall be attached to the underside of the unit base and cross members, ensuring that the floor insulation is completely encapsulated, where applicable to meet NFPA 90A. Outdoor units shall have internal piping cabinet, with opening of 24” x 36”.

2.04 WALLS

A. Wall assemblies shall be defined to include all unit wall panels around the air tunnel perimeter, including all channels, structural members and seams exposed to both the interior and exterior of the unit. The wall assemblies, as defined, shall be provided as thermal break type that ensures that no member on the exterior of the wall assembly has through metal contact with any member on the interior of the unit.

B. Wall assemblies shall be solid double-wall construction with clear-coated galvanized steel solid exterior and interior to withstand salt spray test in accordance with ASTM B117 for a minimum of 500 consecutive hours. The fan section and discharge plenum shall have perforated double wall panels on the interior walls, in addition to the solid double-wall panels. For perforated wall liners, a triple-wall panel shall be provided. This triple-wall panel shall be constructed such that two layers of the panel are solid, with the afore-mentioned class of thermal break between them to isolate the supply air from contact with the outside panel. The third, inner liner shall be perforated. The rest of the unit shall have a solid interior wall liner. All spaces and joints of wall assemblies shall be completely sealed.

C. Provide insulation with a minimum R-value of 12 throughout all unit wall assemblies, except for the fan and discharge sections, which shall be provided with a minimum R-value of 20. Foam injected solid double-wall panels shall be provided. Fiberglass is not acceptable for unit construction, but is required in the separate perforated acoustical panels as described below. Insulation shall completely fill the panel cavity in all directions so that no voids exist and settling of insulation is prevented. Wall assemblies shall comply with NFPA 90 A. Insulation in perforated sections shall be completely wrapped with long-strand fiberglass cloth to prevent erosion of insulation into the air stream. Use of Mylar is not acceptable.

D. Removable wall access panels shall be provided in coil sections for service removal of components.

2.05 ACCESS DOORS

A. Door assemblies shall be defined to include interior and exterior unit door panels, door frames, and door channels. The door assemblies, as defined, shall be provided as thermal break type that ensures that no member on the exterior of the door assembly has through metal contact with any member on the interior of the unit.

B. Access doors shall be constructed of foam injected solid double-wall panels. Provide interior and exterior door panels of the same construction as the interior and exterior wall panels, respectively. Insulation that meets a minimum R-value of 12 shall be provided throughout all door assemblies. Insulation shall completely fill the panel cavity

in all directions so that no voids exist and settling of insulation is prevented. Door assemblies shall comply with NFPA 90 A.

C. All doors shall be full height doors that extend from the bottom go the unit casing to the top of the casing. All doors shall open against pressure to ensure an airtight seal and to prevent a safety hazard. Provide 24” doors for all filter sections, provide 2-24” and 1-30” doors for fan section, provide 1-36” door for all outdoor unit coil sections, as these coil sections have an internal pipe chase, and provide 1-18” door for all discharge plenum/gas heat sections.

D. Door hinges shall be 304 stainless steel continuous type. Door handles shall be Allegis design. All handles shall fasten against the door frame with a roller cam to eliminate wear of the door frame. Ventlok handles are not acceptable.

2.06 ROOFS

A. Roof assemblies shall be defined to include exterior unit roof panels, interior unit ceiling panels, and all roof channels exposed to both the interior and exterior of the unit. The roof assemblies, as defined, shall be provided as thermal break type that ensures that no member on the exterior of the roof assembly has through metal contact with any member on the interior of the unit.

B. Roof assemblies shall be solid double wall construction with clear-coated galvanized steel solid exterior and interior to withstand salt spray test in accordance with ASTM B117 for a minimum of 500 consecutive hours. The fan section and discharge plenum shall have perforated double wall panels on the interior ceilings, in addition to the solid double-wall panels, as described under wall assemblies. Exterior roof panels and interior ceiling panels shall be of the same construction as the exterior and interior wall panels, respectively. Sections in units with perforated interior wall liners shall have perforated interior ceiling liners. For perforated liners, a triple-wall panel shall be provided. This triple-wall panel shall be constructed such that two layers of the panel are solid, with the afore-mentioned class of thermal break between them to isolate the supply air from contact with the outside panel. The third, inner liner shall be perforated. All spaces and joints of roof assemblies shall be completely sealed.

C. Provide insulation with a minimum R-value of 12 throughout all unit roof assemblies, except for the fan and discharge sections, which shall be provided with a minimum R-value of 20. Foam injected solid double-wall panels shall be provided. Fiberglass is not acceptable for unit construction, but is required in the separate perforated acoustical panels as described below. Insulation shall completely fill the panel cavity in all directions so that no voids exist. Roof assemblies shall comply with NFPA 90 A. Insulation in perforated sections shall be completely wrapped with long-strand fiberglass cloth to prevent erosion of insulation into the air stream. Use of Mylar is not acceptable.

D. Outdoor unit roofs shall incorporate a standing seam on the exterior to ensure a rigid roof construction. Outdoor roofs shall be sloped, not less than 1/8” per foot for water drainage. On outdoor units, rain gutters shall be provided over all doors to direct rain away from the door assembly.

2.07 UNIT PAINT

A. External surfaces of all unit casings, both indoor and outdoor, shall be prepared and painted resulting in a minimum 1.5 mil thick coating when dry. Paint shall be able to

withstand a salt spray test in accordance with ASTM B117 for a minimum of 500 consecutive hours. Paint shall be AHU Manufacturer's standard color. For units requiring a color other than the AHU Manufacturer's standard color, the Architect shall provide a quantity of four 2" x 2" paint samples to the AHU Manufacturer at the time of submittal approval.

PART THREE – UNIT COMPONENTS:

3.01 WEATHER HOODS

A. Outside and exhaust air weather hoods shall be fabricated from the same material as the unit exterior. Hoods shall be furnished with drain gutters and wire mesh bird screen. Inlet hoods shall be provided with a moisture eliminator that ensures no entrainment of water into the unit for the velocity at which the hood is selected.

3.02 DAMPERS

A. Approved manufacturers: Arrow and Ruskin. Ultra low-leak modulating parallel dampers shall be provided Dampers shall be galvanized double-skin airfoil design for minimal pressure drop. Leakage rate shall not exceed 3 cfm/square foot at 1" w.g. All leakage testing and pressure ratings shall be based on AMCA Standard 500-D. All dampers shall be factory mounted, inside the unit casing.

3.03 OUTSIDE AIRFLOW MEASURING STATIONS

A. Approved manufacturers: Ruskin and Trane-Traq. Airflow measurement stations shall be provided as indicated in the outside air path as indicated on the drawings to measure airflow. Damper blades shall be galvanized steel and housed in a galvanized steel frame. Leakage rate shall not exceed 3 cfm/square foot at 1" w.g. The airflow measuring device shall adjust for temperature variations. Output shall be provided from station as a 2-10 VDC signal. Signal shall be proportional to air velocity. The accuracy of the measuring station shall be no greater than +/-5%. Airflow measuring stations shall be factory mounted, inside the unit casing.

3.04 AIR FILTERS

A. Approved manufacturers: AAF, Airguard, and Farr. Pleated media filters shall be 2" with average efficiency equal to 25-35% when tested in accordance with ASHRAE 52.1 Filter media shall be of non-woven fibers with metal grid support. Filters shall be UL Class 2 when tested in accordance with UL Standard 900.

B. Filters shall be provided with front-loading frames. Filter holding frames shall be constructed of galvanized steel and equipped with foam gaskets to seal filters against filter frames. Frame seams shall be sealed to eliminate air bypass. Front-loading frames shall be equipped with filter fasteners of the same material as the filter frame. Filter fasteners shall be capable of being installed without the use of special tools, bolts or nuts. Filter holding frames shall be of a universal type to accommodate standard filters of the same nominal size as well as appropriate fasteners.

3.05 HOT AND CHILLED WATER COILS

A. Approved manufacturers: Heatcraft and Trane. Coils shall have same-end header connections. Water coils shall have non-ferrous headers. Water coils shall have vent and drain taps and MPT connections. Grommets shall be provided at coil casing penetrations around the coil piping. Grommets shall be designed to seal the opening under positive and negative pressure.

B. Chilled water coils shall have 0.0075" thick aluminum fins. Fins shall be mechanically bonded to 5/8" OD seamless copper tubes with 0.020” thick walls. Fins shall have collars drawn, belled and firmly bonded to the tubes by means of mechanical expansion. Coils shall be circuited for counter-flow heat transfer. Coil casings shall be constructed of 304 Stainless Steel. Maximum of 120 fins per foot shall be provided.

C. Each AHU shall have a maximum of one coil, with one supply connection and one return connection.

D. Chilled water coils shall be proof and leak tested under water. Proof test shall be at 300 psig and leak test shall be at 200 psig.

3.06 DRAIN PANS

A. Cooling coil sections shall be provided with 304 stainless steel primary drain pans. Primary drain pans shall extend under the entire coil, including headers and return bends. Primary drain pans shall be sloped a minimum of 1/8” per foot, shall be a minimum of 2” deep, and shall be double-sloped (sloped in 2 planes) to positively drain. Drain connections shall be of the same material as the primary drain pan and shall extend a minimum of 1-1/2” beyond the base to ensure adequate room for field piping of condensate drain traps. Any coil support member located inside a primary drain pan shall be of the same material as the drain pan.

3.07 FANS

A. Approved manufacturers: Comefri, and Twin Cities. Fans shall be tested, rated and certified in accordance with ANSI/AMCA Standard 210 for air delivery and shall bear the AMCA seal. The fan balancing process, including vibration limits and documentation, shall be performed in accordance with ANSI/AMCA Standard 204.

B. Fan shall be housed centrifugal DWDI high-efficient AF blades. The HP characteristic of all fans shall be non-overloading.

C. Fan bearings shall be heavy duty, grease lubricated, self-aligning, antifriction pillow block type. Fan bearings shall be rated for a minimum average life (L-50) per ANSI/ABMA of 200,000 hours at design operating conditions. For easy accessibility, lubrication lines for fan bearings shall extend to the drive side of the fan, on the unit interior.

3.08 FAN MOTORS

A. Approved manufacturers: A.O. Smith and Baldor. Motors shall be end mounted, located directly behind the fan to minimize fan assembly width dimension perpendicular to

airflow and to allow for internal mounting of factory mounted starters and variable frequency drives.

B. Motors shall be inverter ready, ODP, and of the voltage, phase, frequency. Motors shall be premium efficiency. Motors shall be 1800 rpm. The motor shall be provided with a heavy duty, adjustable, steel base. Motors shall be NEMA Design B, with Class B insulation.

3.09 V-BELT DRIVES (SHEAVES)

A. Sheaves for motors and fans shall be fixed pitch and shall be selected at a minimum service factor of 1.2. Sheaves shall have multiple grooves, requiring a minimum of two belts for operation.

3.10 VIBRATION ISOLATION

A. The entire fan and motor assembly shall be mounted on vibration isolators which have a 2” deflection to isolate the assembly from the unit housing. The discharge of housed fan assemblies shall be connected to the pressure-bulkhead panel (wall, floor, or roof) with flexible duct to prevent transmission of vibration to the unit casing. No metal-to-metal contact will be permitted between fixed and floating parts. Thrust restraints shall be provided as required to limit horizontal movement of fan assembly at design conditions. Fan base assemblies shall be rigidly tied to the unit base during shipment to prevent damage from shipping vibrations.

B. Each fan assembly shall be vibration tested prior to shipment. Measurements shall include both radial and axial displacement at each fan bearing using magnetic accelerometers connected to a vibration analyzer. Vibration shall not exceed limits specified herein.

PART FOUR – ELECTRICAL:

4.01 VARIABLE FREQUENCY DRIVE (VFD)

A. Approved manufacturers: ABB and Trane. Combination VFDs with bypass shall be provided, mounted, and wired by the AHU manufacturer for all VAV units. Combination VFDs shall be properly sized, mounted, wired to the fan motors, and commissioned by the AHU Manufacturer. Combination VFDs shall include the VFD, a circuit breaker disconnect, bypass circuitry, a Hand-Off-Bypass Auto-Bypass Hand switch, manual speed control, and a control transformer.

B. VFDs shall be high-performance PWM AC drives that generate a sine-code, variable voltage/frequency, three phase output for optimum speed control. VFDs shall be digitally based using a common microprocessor control logic circuit board for the Hp ratings. All programming shall be maintained in non-volatile RAM memory so the program will be maintained when power is removed.

C. Output current overload shall be rated at 110% of motor FLA for one minute. VFDs shall have the following minimal protective features: current limited stall prevention, auto restart after momentary power loss, speed search for starting into rotating motor, anti-windmill, phase-to-phase short circuit protection, and ground fault protection. The VFD shall have an ambient service temperature rating of -10 to 120°F, and humidity rating to

95% non-condensing. The VFD shall be UL508 listed and shall conform to applicable NEMA, NFPA, and IEC standards.

D. Digital operator keypads and displays shall be provided with each VFD and shall provide local control and readout for: run/stop, speed, reset, volts, amps, kilowatts, and diagnostics.

4.02 COMBINATION STARTER/DISCONNECTS

A. Approved manufacturers: ABB, Allen Bradley, and Danfoss. Combination starter/disconnects shall be provided by the AHU manufacturer for all constant volume units Starter/disconnects shall be properly sized, mounted, wired to the fan motor, and commissioned by the AHU Manufacturer.

B. Starter/disconnects shall be IEC or NEMA type. NEMA starter/disconnects shall include fusible disconnects with UL listed, time-delay, Class RK1 fuses for Type 2 coordinated protection. IEC starter/disconnects shall include circuit breakers. Starter/disconnects shall include a control transformer with fusing and secondary grounding, a Hand-Off-Auto switch, two normally-open auxiliary contacts, overload heaters and manual reset overloads.

4.03 FACTORY-INSTALLED MOTOR WIRE TERMINATION, VFD AND COMBINATION STARTER/DISCONNECT ENCLOSURES

A. VFDs and Combination starter/disconnects, shall be factory mounted on the drive side of the fan section on the interior of the unit, accessible from the unit exterior through an access door, for outdoor and indoor units.

B. Any welds shall be properly finished with no rough edges. Enclosures shall house circuit breaker disconnects, bypass circuitry, Drive-OFF-BypassAuto-BypassHand switches, manual speed controls. VFDs and starter/disconnects shall have a manual shut down switch located on the outside of the access door.

4.04 FACTORY COMMISSIONING of VFDs AND COMBINATION STARTER/DISCONNECTS

A. After mounting and wiring of VFDs, combination starter/disconnects on the AHUs, trained factory personnel shall ensure proper operation of each VFD, starter/disconnect through a thorough factory test. Testing shall include a Hypot test of unit wiring to insure that no weaknesses exist in wiring or motor. Each starter/disconnect shall be energized and the fan run to ensure the starter/disconnect will operate properly and that the fan rotation is correct. Each VFD shall be energized and the fan run to ensure the VFD will operate throughout the usable range of the drive and that the fan rotation is correct. Each VFD with bypass shall also be tested in the bypass position to ensure the bypass is operational.

PART FIVE – EXECUTION AND WARRANTIES:

5.01 General:

A. Entire unit shall be provided with 5 year factory parts and labor warranty.
B. Units shall be installed on seismic/vibration curbs. See seismic specifications for requirements. Provide condensate drainage as noted on details.

END OF SECTION 237410

SECTION 237470 – VENTILATION AIR DEHUMIDIFICATION UNITS W/ HOT WATER HEAT

PART ONE – GENERAL:

1.01 Unit shall be self-contained as indicated consisting of filters, evaporators, fans and motors, heat exchangers, outside air intake, cooling coil, condensate collector and drain, variable frequency drives, single point power connection and factory installed controls with 24V remote control center. The units shall be designed in accordance with UL requirements and be A.R.I rated.

1.02 Units shall be UL listed, A.R.I. rated and meet all applicable requirements of ASHRAE 90.1.

1.03 Units shall be as manufactured by Novelaire.

PART TWO – PRODUCTS:

2.01 BASE FRAME:

A. The base of the package shall be an all welded structural "C" channel steel frame and shall be painted with one (1) coat of metal primer followed by two (2) coats corrosion and weather resistant 100% acrylic latex paint. Lugs for lifting the unit shall be an integral part of the structural frame.

2.02 UNIT CASING:

A. Unit shall be built for outdoor use with 2" double wall watertight construction. Walls and roof shall have an 18 gauge galvannealed steel outer skin with a 22 gauge inner liner (aluminum in dehumidification coil section/galvannealed steel in other area of unit). Two inches (2"), 1.5# density fiberglass insulation shall be secured between the inner and outer skins. All roof and side wall seams shall be positively sealed to prevent water and air leakage. All bolts and sheet metal screws that penetrate the unit casing shall be gasketed.

B. Floors shall be constructed of 16 gauge aluminized steel with all seams welded throughout and shall have approximately 2" of closed cell foam insulation installed beneath. Entire exterior of unit shall be painted with two (2) coats corrosion and weather resistant 100% acrylic latex paint. Paint shall pass ASTM B117 500 hour salt fog resistance test and ASTM D4585 500 hour moisture condensation test.

C. Access shall be provided for inspection/maintenance of fans, motors and drives, filters, coils, drains and all control components. Access doors shall be gasketed insulated double wall construction with heavy duty hinges for rigidity and air tight enclosure. Outside air inlet hood as indicated shall have a bird screen.

2.03 HEAT EXCHANGER SECTIONS:

A. The heat recovery wrap-around and pre-cool/re-heat heat exchanger modules shall be passive non-rotational devices constructed of galvannealed housing and aluminum heat transfer surface. The heat transfer surface shall consist of hermetically sealed 1" 3003 aluminum tubes (heat pipes) with integral internal circumferential wicking and exterior fins. Tubes shall be charged with R-22 refrigerant unless otherwise specified. Heat pipe coils shall be seven (7) row minimum and A.R.I. rated.

B. Heat exchangers shall have a pressure drop and thermal effectiveness as scheduled and be capable of withstanding 10" W.C. of differential pressure between air streams. Air flow through the heat exchanger shall be counter-flow.

C. Heat exchangers for the outside air inlet and exhaust section shall be a rotational total recovery wheel with effectiveness and total MBH transferred as scheduled on the mechanical plans.

2.04 FAN SECTIONS:

A. The supply and exhaust fans shall be centrifugal plenum type heavy duty Class I or II with non-overloading backward inclined or airfoil wheels, AMCA certified. Fan wheel shall be statically and dynamically balanced. Flexible duct connections shall be provided to isolate the fan from the cabinet housing.

B. Bearings shall be heavy duty grease lubricated self-aligning ball or roller pillow block type.

C. Fan performance shall be based on tests and procedures performed in accordance with AMCA Publication 211 and Publication 311 and comply with the requirements of the AMCA Certified Ratings Program. Fan shall bear the AMCA seal.

2.05 MOTORS & DRIVES:

A. Fan, motor and belt drive shall all be mounted on a spring isolated chassis (minimum isolation efficiency of 90-95%). Belt drives shall have a minimum service factor of 1.5. Motor electrical connections are to be factory pre-wired to the unit control panel. Motor shall be mounted on adjustable sliding type base.

B. Unit shall be provided with variable frequency drives for both exhaust and supply fans and one (1) single point power connection. Variable frequency drives shall be provided with an optional three (3) connector key operated drive-off bypass selector switch to bypass drive in the event of drive failure. Drives shall be furnished with Seimans FLN driver for compatibility with control system.

2.06 DAMPERS:

A. General: All dampers shall be of the low leakage type with blade edge and side seals. Dampers shall be constructed of galvanized steel (14 gauge frames/16 gauge blades) with self lubricating porous bronze bearings.

B. Outside & Exhaust Air Shut-off Dampers: Parallel blade damper with electric two (2) position operators shall be provided to prevent infiltration of unconditioned air into the building when unit is not in operation.

C. Recirculation Air Damper: Parallel blade damper with electric modulating position actuator shall be provided to allow for space dehumidification when in the unoccupied mode without the introduction of outside air.

2.07 DEHUMIDIFICATION AND HOT WATER HEATING COILS:

A. Cooling/dehumidification and heating coils shall be sized to provide moisture removal and total energy capacity indicated on the equipment schedule. Coils shall be fabricated of copper tubes, aluminum fins, galvanized steel casings with performance certified by A.R.I. standards. All coils shall be fully tested for leaks. Cooling coil drain pan(s) shall be fully welded 16 gauge stainless steel and shall be sloped towards drain lines.

2.08 FILTERS:

A. Control panel(s) shall be provided with hinged access doors and an approved locking device in a NEMA 3R enclosure. Full operating and maintenance instructions shall accompany each unit. The control system shall include the following components required for automatic operation:

1. Main power distribution block, factory wired to unit disconnect switches

2. Fused disconnect switches for motors and controls, ACCU and optional electric heat

3. Main control panel with motor starters and overloads, branch motor circuit fuses, fused control power transformer and terminals for interconnecting control wiring (occupied/unoccupied mode and smoke detector safeties).

4. DDC controls for staging ACCU as required to control space humidity and for control of optional electric heat to maintain 70 degrees F. (adj.) supply air temperature.

5. Outside air and supply air temperature sensors and outside air and space humidity transducers shall be provided. Space humidity transducer shall be field mounted and wired by Controls Contractor.

6. Air flow stations for supply and exhaust air streams accurate from 100% flow to 100 FPM.

B. All factory supplied components are fully wired and tested prior to shipment and all major electrical components are UL listed. All electrical wiring shall be enclosed in liquid tight electrical conduit. For roof mounted units, all wiring shall enter unit from below inside roof curb. Provide access sleeve as required.

PART THREE – EXECUTION:

3.01 Unit shall be provided with factory start-up and check-out by manufacturer's personnel, no exceptions.

3.02 Mount unit on seismic vibration/isolation curb per Specification Section 238900.

3.03 Provide type "L" hard copper P-trap assembly at each condensate drain connection with threaded cleanout plug full size of unit connection a 1" minimum. Depth of trap shall be sufficient for drainage with static pressure of unit.

3.04 See details and schedules for additional requirements, piping connections, etc.

3.05 Contractor shall provide auxiliary drain pan for unit as detailed. Auxiliary pan shall be constructed of 16GA galvanized steel with cold galvanized watertight welded seams. Seismic isolators shall be installed within the pan. Contractor shall drill bolting holes through base of pan to attach to concrete mezzanine/platform and seal all penetrations watertight with 3M Type 5200 marine grade adhesive caulk/sealant watertight.

3.06 Warranty: Entire unit shall be provided with a 5 year factory parts and labor warranty.

END OF SECTION 237470

SECTION 237520 – VENTILATION FANS

PART ONE – GENERAL:

1.01 Ventilation fans shall be as manufactured by ACME, Greenheck, Penn, Cook or prior approved substitute.

PART TWO – PRODUCTS:

2.01 Exhaust fans shall be centrifugal with automatic back draft damper. Fan and motor shall be enclosed in a weather tight housing of single unit construction and one (1) piece curb cap and base section. Motor, with adjustable pitch pulley and drive assembly shall be located out of the air stream. Fan shall be of the non-overloading radial discharge wheel type of all aluminum both dynamically and statically balanced for quiet operation. Provide a motor disconnect switch at the fan. All fan motors shall have built in thermal overload protection. Curb cap furnished with the exhaust fans furnished shall be coordinated with the General Contractor. Exhaust fans shall be of capacities and sizes as scheduled on the drawings.

2.02 Ceiling mounted exhaust fans shall be forward curve centrifugal. Fan motor shall be permanently lubricated and shall have built in thermal overload protection, back draft damper and disconnect switch. Exhaust ducts shall be routed full size to weatherproof discharge cap unless otherwise noted. Exhaust grilles shall be all aluminum. All ceiling exhaust fans shall be provided with adjustable speed controllers.

2.03 Sidewall fans shall be belt driven axial type. Propellers shall be constructed with die formed galvanized steel blades riveted to a steel hub. Propellers shall be statically and dynamically balanced. Motors shall be of heavy duty ball bearing type. Fan shafts shall be mounted in permanently lubricated sealed ball bearing pillow blocks. Bearings shall be selected for a minimum average life in excess of 200,000 hours at maximum cataloged operating speeds. Drives shall be sized for a minimum of 150% of driven horsepower. Motor sheaves shall be adjustable for final system balancing. Drive frame assemblies shall be formed galvanized steel construction. Fan panels shall have pre-punched mounting holes, formed flanges with welded corners and a deep formed inlet venturi. Fans shall bear the AMCA Certified Ratings Seals for both air and sound performance. Provide motor side OSHA type fan guard.

PART THREE – EXECUTION:

3.01 Roof mounted fans shall be provided with all aluminum prefab curbs. Curbs shall be provided to match the roof slope on the architectural plans. Not shims will be allowed and the roof curb on the top elevation must be true and level. Curbs shall be complete with cant strip. All curbs and caps shall be installed in accordance with roof bonding requirements. These curbs may be fabricated in accordance with the specifications by the following manufacturers: Custom Curbs, Chattanooga, TN and Thybar Corporation,

Addison, IL 60101. The curb units shall be equal to Custom Curb Model CRC-1 and CES-1 as applicable.

3.02 Openings for mounting will be provided under another section of these specifications; however, this Contractor shall verify sizes, heights, etc. required for fan installation. See Section 230400 – General Completion.

END OF SECTION 237520

SECTION 23 75 80 – KITCHEN EXHAUST HOOD SYSTEM (VARIABLE VOLUME)

PART ONE – GENERAL:

1.01 Hood system shall be complete consisting of Greenheck/Accurex Model XXEW, double shell hood complete with lights, filters, fire extinguisher system and model XKSFB make up and exhaust fan package complete with prefab combination curb or equal by Captive-Aire. See plans.

1.02 Single shell hoods where required shall be Greenheck “GC” for dish machine hood complete with lights and “GO” for over with interior baffles, lights, filters and fire extinguisher system, 18-gauge type 304 stainless steel or equal by Captive-Aire. Kiln hood shall be Greenheck/Accurex Model GO.

PART TWO – PRODUCTS & EXECUTION:

2.01 EXHAUST HOOD:

A. The hood shall be fabricated from 18-gauge type 304 stainless steel interior liner and type 304 stainless steel exterior panels, polished to #3 mill finish on all exposed surfaces. Construction of hood shall be in accordance with all NFPA 96 requirements, shall be UL classified 91G6, bear the NSF seal of approval and conform to all local and state building codes. All seams and joints to be heliarc welded, ground and polished to blend. Caulking of any type is not permitted on interior hood surfaces. Hood is to be provided with structural hanging brackets, factory welded on centers of 5’0” or less. The supply plenum is to be lined with 1” thick insulation to prevent condensation. The supply registers shall be perforated face and shall have integral adjustable dampers. Stainless steel closure panels from top of hood to ceiling shall be provided with hood. Hood lights shall be UL listed incandescent and be pre-wired to a junction box on top of hood. The grease filters shall be UL listed stainless steel baffle type grease eliminators, easily removable grease tray with removable cup. A flush mounted control panel on face of canopy shall control hood lights and fans. Provide indicator lamps for fans. Where multiple hood sections are required, stainless steel closure caps shall be provided to cover any gaps between sections.

2.02 FULL FLOOD FIRE SUPPRESSION SYSTEM:

A. The hood(s) shall contain a factory engineered and pre-piped, UL listed, Wet Chemical, Amerex KP restaurant fire suppression system. The system piping shall be installed in the hood at the time of construction above the hood or within the supply plenum and shall be concealed from view. No exposed piping is acceptable, with the exception of appliance drops.

B. A certified local Amerex distributor shall be selected by the factory for final system hook-up. The system shall be capable of automatic detection and actuation and/or remote duct(s), plenum(s), filter area(s), and cooking equipment.

C. Accessories shall be available for mechanical or electrical gas line shut-off applications and two (SPDT) single pull double throw microswitches for activation of the shunt trip breaker (provided by others) for electrical equipment.

D. The system shall also include the PRM mechanical release module, agent cylinder, agent, pneumatic linear detection tubing, liquid-tight fittings, remote manual pull station, and Schedule 40 black iron pipe with chrome sleeving for exposed areas.

E. Control contacts shall be provided for interlock with building fire alarm system. Fuel shut-off devices, including electrical contactors, shall be furnished for installation by applicable trades. It shall be the responsibility of the hood manufacturer to supply final installation, hook-up and certification of system at job site by licensed system installer.

2.03 FLEX CONNECT UTILITY SYSTEM:

A. Provide Accurex model XMIV-GHC FlexConnect UDS as shown on plans and in accordance with the following specification:

1. The Flex Connect Utility Distribution System (UDS) shall be wall type. Service risers and horizontal raceway with removable access panels to be constructed of 16-gauge type 304 stainless steel with #4 finish. The service risers will be able to accommodate both electrical and/or plumbing. The horizontal raceway will be divided into separate compartments for plumbing and electrical. Flanged foot pedestals are provided at each field joint on the horizontal chase when the unit is 192” or longer.

2. Plumbing: The horizontal plumbing compartment is to include manifolds for gas, hot water, and cold water. The 2” gas manifold (single or looped) will include welded threadolet connections. The gas connections are space 12” apart and are alternately sized as ¾” or 1 ¼” every other connection. The 1” hot and cold water manifolds will include ¾” plumbing drops every 24” along the horizontal raceway. All plumbing drops are capped below the chase, ready for easy connection to any cooking appliance. The gas manifold is supplied with one (1) 2” electric gas valve, shipped loose. Provide hood with integral backflow preventer for hot and cold water supplies to comply with DHEC. Watts #7C individual Backflow preventers at each supply connection to equipment may be provided in lieu of integral backflow. Coordinate all plumbing connections with final kitchen shop drawings approved by the Architect.

3. Electrical: Integral Service Panel for Appliance Receptacles shall include an incoming electrical service riser on the right end with a main undervoltage trip breaker with ampere rating as scheduled. The unit will have individual branch breaker(s) for each equipment receptacle located either on the service riser or horizontal chase directly inline with the equipment receptacle. The unit will have light and fan toggle control switches located on the end of the electrical service riser and a covered 120/1 phase, 20-amp convenience outlet on both service riser ends. Equipment receptacles are fastened in the

specified location under the horizontal chase. Coordinate all electrical requirements with final kitchen shop drawings approved by the Architect.

2.04 VARIABLE VOLUME KITCHEN HOOD:

A. The variable shall automatically control the speed of the exhaust (and make-up if applicable) fan to ensure optimal hood performance. The system includes the following components: I/O Processor, Keypad, Temperature Sensors, Optic Sensors, Electric Motor Starters (VFD's which replace magnetic starters for 3 phase motors), and cables.

B. The hood manufacturers shall integrate this pre-engineered system into new construction kitchen hoods. The I/O Processor, Keypad, Electronic Motor Starters (VFD's) shall be mounted in the utility cabinet, the Temperature Sensors shall be mounted in the exhaust collar, and the Optic Sensors shall be mounted inside the ends of the hood with air purge units (APU) mounted on top of the hood.

C. Standard System Components:

1. I/O Processor
2. Keypad
3. Temperature Sensor
4. Optic Sensor with air purge unit
5. Electronic motor starters (VFD's)
6. Plug and play cables

D. Responsibilities: The hood manufacturer is to pre-mount all variable volume system components at the factory. All variable volume system components shall be factory pre-wired. The variable volume system shall be pre-programmed at the factory. For non-packaged supply and exhaust fans, hood manufacturer and startup personnel shall coordinate all field interconnection and control wiring with the electrical contractor.

E. The Electrical Contractor shall field wire the I/O Processor inside the utility cabinet with an input of 115/1 or 230/1 VAC from a dedicated circuit. The output wiring shall be connected to the hood lights. The Electrical Contractor shall field wire the electric motor starters inside the utility cabinet by connecting 3 phase input power from the circuit breakers. The output wiring shall be connected to the respective fan motor. The input and output wiring shall be run in separate conduit for each starter. (Note: If there is a heated MUA unit, a separate circuit must feed the controls. Do not use the motor circuit. Also, a control cable with at least four (4) conductors shall be run from the MUA Processor to the I/O Processor.) The Electrical Contractor shall connect plug and play cables from I/O Processor to each hood. Electrical Contractor shall start-up the system by pressing the light and fan switch on the keypad to verify hood lights function and fans proceed to minimum speed. Correct fan rotation as necessary.

F. Test and Balance Contractor shall air balance the system by pressing the 100% switch on the keypad. Speed adjustments on the direct drive fans to be made at the electronic motor starters (VFD).

2.05 FAN PACKAGE (See Fan Schedule):

A. Provide roof top pre-engineered combination exhaust and supply fan package in sizes and quantities as shown on plans. The fan package assembly shall be a complete system containing both exhaust and supply fan components complete.

B. The exhaust fan shall be constructed of heavy gauge aluminum. The fan wheel and cone shall be aluminum and of the high performance centrifugal blower type statically and dynamically balanced. The exhaust fan shall be constructed as to include a built-in grease drain. The wheel shaft shall be mounted in heavy duty ball bearings. Drives shall be sized for 165% of driven horsepower. Motor pulleys shall be of the adjustable type for final system balancing made of cast iron and be keyed to motor and wheel shafts. The entire drive assembly shall be mounted in rubber vibration isolators. The exhaust fan assembly shall also include a rigid bird screen mounting within the discharge perimeter and a thermal barrier insulating the wheel compartment from the drive compartment. The fan shall be AMCA approved for sound and air performance and also shall be UL listed for grease removal in accordance with Underwriters Laboratories' standards.

C. The supply fan unit shall be the belt driven double width double inlet forward curved centrifugal blower type. The blower assembly shall be mounted on vibration isolators. Drives shall be sized for a minimum of 165% of driven horsepower. All exterior housing components of the supply unit shall be constructed on minimum 18-gauge galvanneal steel painted with a weatherproof finish. Heavy gauge adjustable angle iron support legs shall be furnished as required. The inlet of the unit shall contain a bird screen and a bank of washable, removable air filters. Filters shall be of 1" aluminum mesh type coated with filter adhesive compounded and shall be UL classified.

D. The total fan package shall be furnished with a pre-wired control center which shall include, but not be limited to: a master fused disconnect for main power connection, VFD's with thermal overloads and manual reset, fused 24V control transformer and distribution terminal strip for control wiring connection. All electrical components shall be UL listed and wired in compliance with the National Electric Code. Wiring shall be complete requiring single point connection for power service and one (1) point connection for low voltage control harness. Motors shall be inverter duty.

E. Furnish motorized back draft damper as integral part of supply unit. Damper unit shall open upon energizing of supply fan and close upon shut-off of supply fan.

Part Three - Execution:

3.01 Furnish prefab roof curb constructed of a minimum 18-gauge galvanized steel with integral wood nailer, run-off cant and 1" rigid insulation. Provide curb

extensions as required for exhaust fan to meet NFPA requirements for discharge height.

3.02 The final fire suppression nozzle layout shall be coordinated and based on the final equipment layout under the hood. Coordinate with the general contractor and kitchen equipment supplier.

3.03 The kitchen hood fire suppression system shall be successfully tested a minimum of two (2) times as required by the Architect/Engineer by discharging liquid through the heads to verify that the system is properly installed and functional. The liquid used may be chemical agent, water or other substitute liquid that is acceptable to the manufacturer. After these tests, the entire system shall be cleaned and dried to eliminate potential of corrosion. Dry gas testing is not acceptable. All tests shall be in compliance with the Office of School Facilities and LLR Division of Fire and Life Safety policies.

END OF SECTION 23 75 80

SECTION 237600 – ELECTRIC UNIT HEATERS

PART ONE - GENERAL:

1.01 Unit shall be blow-through design with motor and fans in air stream ahead of resistance heaters. Entire unit shall be UL listed.

PART TWO – PRODUCTS:

2.01 Heating coils shall be provided with automatic reset thermal protection. Provide built-in circuit breakers for unit.

2.02 Motor and fan assembly shall be direct drive with automatic reset overload protection.

2.03 Ceiling mounted units shall have internally insulated cabinet panels and front inlet and discharge panels suitable for recess mounting in ceiling. Units shall have integral thermostats.

2.04 Vertical units shall be provided with radial type diffusers.

2.05 Units shall be Chromalox, Markel or approved substitute.

PART THREE – EXECUTION:

3.01 Provide controls for unit heaters in accordance with Controls Section of these specifications.

END OF SECTION 237600

238021
VAV SYSTEM TERMINAL UNIT – HOT WATER HEAT

PART ONE – GENERAL:

1.01 SYSTEM DESCRIPTION:

A. Ceiling mounted variable air volume control box for installation in a ceiling that permits access to the unit. Manufacturer shall supply unit(s) of the design, number, size and performance as shown on the equipment drawings and in schedules. Units are for use in conjunction with air distribution manifolds, ceiling mounted diffusers and electric controls.

1.02 QUALITY ASSURANCE:

A. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation and UL 181 requirements for anti-erosion properties.

B. Units shall be tested and certified in accordance with A.R.I. Standard 880.

1.03 DELIVERY, STORAGE & HANDLING:

A. Units shall be stored, handled, and installed per manufacturer's recommendations.

1.04 MANUFACTURER:

A. Units shall be manufactured by Price, Envirotec, Trane, or prior approved substitute.

PART TWO – PRODUCTS:

2.01 EQUIPMENT:

A. General: Factory assembled pressure independent system and externally powered variable air volume control box. Unit shall be complete with an inflatable bellows, damper, air flow indicator and stops for minimum and maximum airflow settings, removable access panel, collars for duct connections and all required special features. Control box shall be clearly marked with an identification label that lists such information as unit nominal cfm, maximum and minimum factory set airflow and coil type when applicable.

B. Unit Cabinet:

1. Constructed of galvanized steel with inlet and outlet collars for duct connections.

2. Insulated with 1" thick, 1 ½ lb/cu. ft density glass fiber insulation with double wall construction. Insulation shall be completely encapsulated with 26-gauge galvanized steel.

3. Removable panel shall provide access to internal components.

C. Damper Assembly:

1. Factory calibrated, consisting of a swing damper controlled by an internally mounted system powered inflatable bellows and an externally mounted electric actuator.

2. Bellows shall be capable of withstanding up to 10" w.g. internal pressure.

3. Equipped with manually field adjustable stops to set minimum and maximum damper opening limits.

D. Controls:

1. Controls for VAV boxes will be direct digital per Controls Specifications.

2. VAV box ddc controller, electric damper actuator and velocity pressure sensor will be provided by the Control Contractor to the VAV box. Manufacturer for factory installation wiring and setup. VAV box manufacturer will provide a control transformer (coordinate with Controls Contractor) and terminal strip for field power and control wiring (coordinate with Controls Manufacturer).

E. Operating Characteristics:

1. Unit operation shall be pressure independent throughout the entire operating range. Cfm limiters that provide pressure independence only at maximum airflow are not acceptable.

2. Minimum and maximum airflow rates shall be maintained throughout the operating static pressure range of the unit.

F. Hot Water Heating Coil: Coil shall be copper construction mounted in a galvanized steel casing and factory installed on the base units as shown on the equipment drawings. VAV units shall be of capacity as specified on the VAV Box schedule. VAV boxes shall be 24 volt powered and controlled by the building automation system. All piping appurtenances as shown on the hot water coil detail on the plans shall be provided by the mechanical contractor. Hot water control valves shall be provided and installed by the controls contractor.

G. Air Distribution Manifold (Octopus): An air distribution manifold shall be field installed on the base unit. Refer to equipment schedule. The manifold shall be:

1. Equipped with 8”, 10” or 12” diameter collars in the quantity and configuration specified on the equipment drawings. Each collar shall include a locking butterfly balancing damper.

2. Insulate with duct wrap glass fiber insulation per Specifications. Insulation shall extend over electric heating section and seal to pre-insulated VAV box vapor tight.

3. Air distribution manifolds shall be provided unless ductwork is shown and otherwise indicated on plans.

END OF SECTION

SECTION 238070 - DUCTWORK (LOW AND MEDIUM PRESSURE)

PART ONE - GENERAL:

1.01 Ductwork, including exhaust, shall conform to all applicable requirements of the latest issue of NFPA Pamphlet No. 90A. All ductwork, elbows, take-offs, transitions, and etc., shall conform to the recommendations of SMACNA duct construction standards as a minimum requirement, unless otherwise indicated by the contract documents.

1.02 Ductwork shall be installed to operate without noise or vibration, and shall be air tight. The Contractor shall be responsible for measuring at the building all conditions, space available, piping, light fixtures, ceiling heights, and etc. that affect ductwork installation prior to fabrication. Ductwork shall be constructed as job progresses, not in advance.

PART TWO - PRODUCTS:

2.01 LOW PRESSURE DUCTWORK:

A. Low pressure and exhaust ductwork shall be galvanized sheet steel constructed to the requirements of SMACNA Table 1-5 for 2" W.G. static pressure, unless otherwise noted. Duct and fitting sealing requirements shall be in accordance with SMACNA Table 1-2, Seal Class “C”. Duct tape is not allowed. Seismic restraints shall be provided for all ducts with a cross sectional area of 6 SF and larger in accordance with the International Building Code. Gauges and reinforcing shall be as follows:

MAXIMUM SIDE INCHES	STEEL U.S. STANDARD GAUGE*	TYPE OF TRANSVERSE JOINT CONNECTIONS	BRACING
Up to 24	24	S, Drive, Pocket or Bar Slips, 7'-10" OC	None
25 to 30	24	S, Drive, 1" Pocket or 1" Bar Slips 7'-10" O.C.	1" x 1" x 1/8" Angles 4' O.C.
31 to 40	22	Drive, 1" Pocket or 1" Bar Slips on Centers	1" x 1" x 1/8" Angles 4' O.C.
41 to 60	22	1-1/2" Angle Connections 1-1/2" Pocket or 1-1/2" Bar Slips with 1-3/8" x 1/8" Bar reinforcing 7'-10" OC	1-1/2" x 1-1/2" x 1/8" Angles 4' O.C.

Continued:

MAXIMUM SIDE	STEEL U.S. STANDARD	TYPE OF TRANSVERSE

INCHES	GAUGE*	JOINT CONNECTIONS	BRACING
61 to 90	20	1-1/2" Angle Connections 1-1/2" Pocket or 1-1/2" Bar Slips with 1-3/8" x 1/8" Bar reinforcing 3'-9" OC	1-1/2" x 1-1/2" x 1/8" Angles 2' O.C.
91 and Up	18	2" Angle Connections, 1-1/2" Pocket, or 1-1/2" Bar Slips with 1-3/8" x 1/8" Bar Reinforcing 3'-9" OC	1-1/2" x 1-1/2" x 1/8" Angles 2' O.C.

B. Double wall round ducts shall be manufactured by United Sheet Metal, Monroe Metals, Inc., or Eastern Sheetmetal. Construction shall be as follows:

ROUND DUCT DIAMETER IN INCHES	SPIRAL SEAM GAUGE	LONGITUDINAL SEAM GAUGE
3" thru 8"	30	28
9" thru 14"	28	26
15" thru 26"	26	24
27" thru 36"	24	22
37" thru 50"	22	20
51" thru 60"	20	18
61" thru 84"	--	16

NOTES FOR ROUND DUCT CONSTRUCTION:

1. The inside diameter and outside diameter of duct and fittings must be controlled for proper mating of components.

2. Fittings and requirements for sealing shall be in accordance with SMACNA Standards.

3. Ducts shall be provided with a "grip-tight" finish suitable for final painting by the Contractor.

4. All components, fittings, and boots of double wall duct system shall be submitted as shop drawings for approval.

2.02 ROUND INSULATED FLEXIBLE DUCTS AND SPIN-IN COLLARS:

A. Insulated flexible ducts shall consist of an inner core of acoustically transparent CPE inner film or perforated corrugated aluminum with sound attenuating features complete with a factory applied exterior jacket of R-6.0 fiberglass insulation and reinforced metalized vapor barrier with 0.05 ASTM E96 permeance rating. Duct shall be UL listed as Class 1 air duct, standard UL 181 with flame spread and smoke developed ratings of 25 and 50 respectively. Minimum working pressure shall be 4" W.G. positive. Flexible ducts shall be:

1. Flexmaster 1MR6 – Acoustical Insulated
2. Clevaflex – Clevaform DB-series-type DBA acoustical duct
3. Thermoflex MKE 6.0 – Acoustic Insulated

B. Spin-in collars shall be constructed of galvanized steel with scoop and damper.

2.03 MEDIUM PRESSURE DUCTWORK:

A. All supply ductwork from the air handling units to VAV boxes shall be classified medium pressure.

B. Rectangular ducts shall be constructed to the requirements of SMACNA Table 1-6 for 3" W.G. static pressure

C. Round ducts to VAV boxes shall be constructed to the requirements of SMACNA Table 3.2 for 3" W.G. static pressure. All such duct shall be single wall spiral seam. No "snaplock" seams are permitted. Round duct takeoffs shall be bell mouth type.

D. Duct and fitting sealing requirements shall be in accordance with SMACNA Table 1-2, Seal Class "B".

PART THREE - EXECUTION:

3.01 *GAUGE STAMPS: Turned out and on bottom of ducts.

3.02 All supply and return duct elbows with an inside radius of less than 3/4 of duct width shall have single thickness turning vanes; all square elbows shall have double thickness turning vanes.

3.03 All exhaust duct elbows shall have not less than 6" inside radius; all square elbows shall have single thickness turning vanes.

3.04 Splitter dampers and branch take-off extractors shall be installed where indicated and shall be adjustable and shall have locking quadrants.

3.05 Flexible duct connections shall be provided where ductwork connects to equipment and shall be Ventglas 30 oz. woven glass fabric double coated with neoprene, fire retardant, waterproof, airtight, and UL listed.

3.06 Duct sizes indicated on plans are interior dimensions. Increase metal duct sizes as

required for acoustical or interior insulation.

3.07 All ductwork shall be supported by 1" x 1/8" galvanized iron straps with a maximum spacing of eight feet. Straps shall be bolted or clamped to the structure, and be turned and fastened to bottom of the duct so that duct weight is not on the fastening screws.

3.08 Provide 1/2" diameter test holes with caps for insertion of thermostat or test instruments at all locations required to perform operations under paragraph "Balancing".

3.09 Provide duct access doors to afford easy access to entering air side of items requiring maintenance or inspection (such as thermostats, fire damper, smoke damper, etc.). Doors to be of ample size for service required (18" x 12" minimum) and provided with frame, brass hinges, handle, clamping device, and gasket for air tight joint.

3.10 Round flexible ducts shall be installed in extended condition free of sags and kinks, using only the minimum length required to make the connection. Abrupt bends and turns that crimp the duct and restrict the air flow will not be permitted. Horizontal supports shall be 3/4" wide, 22 gauge flat galvanized steel sheet banding material. Flexible ducts shall be supported on 36" centers. Maximum allowable length of a flexible duct shall be 8 feet. If extended runout is indicated, round galvanized steel shall be used for runout length in excess of 8 feet.

3.11 The entire duct system shall be free from rattles. If rattles exist after ductwork has been installed, the labor and materials necessary to eliminate rattles shall be done at the expense of this Contractor.

3.12 Air flow stations shall be provided to modulate outside air to air handling units as indicated on plans. Stations shall be Brandt Instrument Mod. 8000 Series “E-Bar”. Coordinate interface with controls.

3.13 All return duct connections to air devices shall be rectangular unless otherwise indicated on plans. Use of flexible duct is prohibited on any return or exhaust ductwork.

3.14 Prior to insulation of medium pressure ductwork, Contractor shall perform duct air leak test in conformance with Specification Section 239950.

3.15 Where ceiling plenum returns are used, the return duct shall be fitted with a bell mouth entry covered with 1" x 1" galvanized hardware cloth.

3.16 All rectangular branch takeoffs shall be 45 degree entry type per SMACNA Figure 2-6. No straight tap or butt fittings allowed.

3.17 Kitchen hood exhaust ductwork systems shall be constructed to the requirements of NFPA 96. Ductwork shall be minimum 18 gauge 316 stainless steel with all seams and joints sealed liquid tight with a continuous external weld. Dishwasher hood exhaust shall be 16 gauge stainless steel.

3.18 All medium pressure duct (primary, ventilation, standard and return) shall be stenciled 8’ O.C. on bottom of duct, after final inspection throughout project. Letters shall be 2” minimum, color shall be blue.

END OF SECTION 238070

SECTION 23 81 00- SPLIT SYSTEM HEAT PUMPS (DUCTLESS FAN-COIL)

PART ONE – GENERAL:

1.01 Units shall be provided complete with indoor and outdoor sections, refrigerant piping and factory installed controls. Systems shall be A.R.I. rated, UL listed and meet all applicable requirements of ASHRAE 90.1.

1.02 Heat pump system shall be as manufactured by Mitsubishi, Daikin or Sanyo.

PART TWO – PRODUCTS:

2.01 INDOOR UNIT:

A. Indoor unit shall be self contained console type for wall or ceiling as indicated. Unit shall have supplemental electric heat and ventilation air connection.

B. Evaporator coil shall be manufacturer's standard of sufficient size to provide the heating and/or cooling requirements as specified and shall be complete with quick-attach fittings for pre-charge tubing as applicable.

C. Evaporator fan shall be statically and dynamically balanced and shall have permanently lubricated bearings and shall be complete with built-in thermal overload protection.

D. Electric heaters shall be the open coil type designed to fit within the unit. Heater shall be complete with contactors, control transformers, automatic thermal high limit, fusible links for each heater circuit and fan interlock. Heaters shall be UL listed.

2.02 OUTDOOR UNIT:

A. Outdoor unit shall be fabricated of heavy gauge galvanized steel with baked enamel finish for weatherproof installation and vertical air discharge. The unit shall be readily accessible for maintenance and shall be complete with all operating and safety controls ready for electrical connection. Units shall be provided with factory supplied coil guards.

B. Motor compressor shall be the unit manufacturer's standard for heat pump service and shall be complete with internal thermal overload protection, crankcase heater and suction line accumulator.

C. Condenser fan shall be the propeller type arranged for vertical discharge. Fan shall be statically and dynamically balanced. Fan motor shall have permanently lubricated bearings and shall have built-in thermal overload protection.

D. Each outdoor unit shall be provided with filter-drier.

2.03 CONTROLS:

A. Units shall have factory wired controls, including all components necessary for standard sequences of heating and cooling.

PART THREE – EXECUTION:

3.01 OUTDOOR UNIT:

A. Mount unit with clearances as recommended by manufacturer. Provide vibration isolators of the cork and neoprene type under the outdoor unit. Securely mount unit with anchor bolts through isolators into support base. Provide factory coil guards.

3.02 REFRIGERANT PIPING:

A. Refrigerant piping shall be type “ACR” copper with silver brazed joints and cleaned and capped wrought copper fittings installed in accordance with manufacturer’s instructions.

3.03 CONDENSATE PIPING:

A. Condensate piping shall be type “L” hard copper full size of indoor unit connection 1” minimum with P-trap and cleanout tee with plug at trap. Route condensate drain as indicated.

3.04 INSULATION:

A. Insulation shall be provided on refrigerant suction and condensate piping. Insulation shall be ¾” thick “Rubatex” or “Armaflex.” Seal all joints with adhesive. Insulation shall not be cut lengthwise to install. All exterior refrigerant piping shall be covered with 22 gauge aluminum or 24 gauge stainless steel jacket.

B. All piping shall be hung with clevis type hangers complete with insulation saddles. Route liquid line above suction and tie wrap 4’ o.c. with 3/8” wide nylon straps without compressing insulation. Pipe hangers shall be as manufactured by Michigan Hanger Co., Grinnell or B-Line. Hangers equal to M-CO #403.

3.05 WARRANTY:

A. Heat pumps shall be provided with a warranty of 1 year for parts and labor entire unit.

3.06 INSTALLATION:

A. Heat pumps shall be installed in strict accordance with the manufacturer’s recommendations.

END OF SECTION 238100

SECTION 238200 - DAMPERS

PART ONE - GENERAL:

1.01 Mechanical Contractor shall furnish and install all dampers as indicated on Drawings or called for under Specifications.

1.02 Dampers shall be as manufactured by Air Balance, Inc., Phillips-Aire, Ruskin Manufacturing Co., or Louvers and Dampers, Inc.

PART TWO - PRODUCTS:

2.01 MANUAL AND AUTOMATIC DAMPERS:

A. Manual and automatic dampers shall be of the multi-louver, opposed blade type equipped with an external operating shaft. Locking device shall be provided for manual dampers.

2.02 FIRE DAMPERS:

A. Fire dampers for low pressure and exhaust ductwork shall be parallel blade, dynamic positive closure, mounted in a galvanized steel channel frame. Dampers shall be curtain-type meeting all UL 555 and NFPA requirements. Damper shall be high free area style with blade package mounted out of airstream. Dampers in stainless steel ductwork shall be constructed of type 304 stainless steel. Fuse line shall be 160 degrees. Fire dampers shall have an UL label with a 1-1/2 hour rating for use in partitions with ratings of up to 2 hours. Fire dampers shall have an UL label with a 3 hour rating for use in partitions with ratings of up to 4 hours. All fire dampers shall be equipped with a switch package to remotely indicate damper blade position for remote monitoring by the building EMS.

B. Fire dampers shall be provided as follows:

1. In all duct passages through fire rated assemblies.

2. In all duct passages through floor.

3. In fire rated openings used for return air passages.

4. See Architectural floor plans for locations and ratings of all fire-rated assemblies.

C. Ceiling radiation dampers shall be installed at air device penetrations of a fire-rated ceiling. Dampers shall be UL listed with 165 degrees F fusible link. Phillips-Aire series 8 (rectangular) or 9 (round) dampers or approved equal.

2.03 SMOKE DAMPERS:

A. Smoke dampers shall be classified by Underwriters Laboratories as Leakage Rated Dampers for Use in Smoke Control Systems under the latest version of UL Standard 555S and shall bear a UL label. Smoke dampers and their operators shall be dynamic

type qualified under UL 555S to a minimum elevated temperature of 250 degrees F. Dampers shall be qualified at UL 555S Leakage Class II. Combination dampers shall comply with both UL 555 and UL 555S.

B. Electric operators shall be installed by the damper manufacturer at time of damper fabrication. Installation of damper with operator and smoke detectors shall be coordinated with controls contractor to provide a complete and operational smoke damper in accordance with NFPA 90A.

C. Provide smoke dampers and smoke detectors at each duct penetration of a smoke wall. Refer to architectural plan for locations of all smoke walls. Refer to control sections of Specifications for smoke detector hardware requirements. Detectors shall meet requirements of NFPA 72. All smoke dampers shall be equipped with an optional switch package to remotely indicate damper blade position for remote monitoring by the building EMS.

PART THREE - EXECUTION:

3.01 Fire and smoke dampers shall be provided with access doors to operate and reset. Provide identification markers with lettering a minimum of 1/2" high on each access door stating “fire damper” or “smoke damper” as applicable per requirements of I.B.C. 715.4, and I.M.C. 607.4. Areas around dampers shall be fire stopped with fire resistant materials consistent with UL tested assembly requirements.

3.02 Where fire and smoke dampers are located above a hard or security ceiling, Contractor shall provide access doors in ceiling to reach dampers. Coordinate door and frame style with Architectural Finish Schedule. Submit to Architect for approval.

END OF SECTION 238200

SECTION 23 84 60 – HOT AND CHILLED WATER DISTRIBUTION SYSTEMS

PART ONE - GENERAL:

PIPING INSTALLATION:

A. Piping shall be installed to provide adequate clearances between piping, adjacent surfaces and other systems to provide normal inspection, testing or servicing of piping and equipment and shall not interfere with normal designed use of the buildings or components. Piping shall be accurately cut and worked into place without forcing or springing. Low points shall be provided with drain valves and high points shall have manual air vents. Condensate drain lines from the air handling units shall be provided with traps and pitched in the direction of flow with a maximum pitch as space will allow. All vertical pipes shall be plumb and all changes in pipe sizes shall be made with reducing fittings. Provide all items, balancing cocks, try-cocks gauge connections etc. as required by the balance and test section.

EQUIPMENT INSTALLATION:

A. Equipment installation shall be strictly in accordance with these specifications, and the installation instructions of the manufacturers. Equipment mounted on concrete foundations shall be grouted before piping is installed. All piping shall be installed in such a manner as not to place a strain on any of the equipment. Flanged joints shall not be bolted tight unless they match adequately.

PIPE AND FITTINGS:

A. CHILLED AND HOT WATER PIPING (**MAINS AND RUNOUTS INSIDE BUILDING ONLY**) See Plans

SUMMARY

This Section includes pipe and fitting materials, joining methods and specialty items for the following:

Hot-water heating piping.
Chilled Water piping.

RELATED SECTIONS

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

REFERENCE DOCUMENTS

A. ASTM F 2389-07 - Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems- no European equivalent

B. CSA B137.11 - Polypropylene (PP-R) Pipe and Fittings for Pressure Applications

C. NSF/ANSI 14 – Plastic Piping System Components and Related Materials

DEFINITIONS

A. Definitions shall be in accordance with local mechanical codes and ASTM F 2389.

SUBMITTALS

A. Material list naming each product to be used identified by manufacturer and product number, in accordance with Section 01 30 00.

QUALITY ASSURANCE

A. Material shall be certified by NSF International as complying with NSF 14, and ASTM F 2389 or CSA B137.11.

B. Material shall comply with manufacturers specifications.

C. Manufacture of PP-R pipe must also manufacture same PP-R resin.

D. Special Engineered products shall be certified by NSF International as complying with NSF 14.

E. Provider of material shall have an Aquatherm certified master trainer on staff and have at least 8 years of experience in the US with this

F. Supplier of material shall have at least 8 years of experience in the US with job names and reference of same ages or greater.

PART 2 – PRODUCTS

PIPE AND PIPING PRODUCTS

A. Pipe shall be manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389 or CSA B137.11. The supplier of the pipe MUST also be the manufacture of the PP-R resin. The pipe shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipe shall be made in an extrusion process. Hydronic hot water and heating piping shall contain a fiber layer (faser) to restrict thermal expansion. All pipe shall comply with the rated pressure requirements of ASTM F 2389 or CSA B137.11. All pipe shall be certified by NSF International as complying with NSF 14, and ASTM F 2389 or CSA B137.11.

B. Pipe shall be Aquatherm® Mulit-Layer Faser Composite-PPR reinforced piping suitable for chilled and hot water service, available from Aquatherm 7.3, NA or Niron Clima PP-RCT-SDR7.3 Series. Piping specifications and ordering information are available at www.aquatherm.com.

FITTINGS

A. Fittings shall be manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389. The fittings shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All fittings shall be certified by NSF International as complying with NSF 14, and ASTM F 2389 or CSA B137.11.

B. Fittings shall be Aquatherm® Green Pipe® available from Aquatherm, NA. Fittings specifications and ordering information are available at www.aquatherm.com.

WARRANTY

A. Manufacturer shall warrant pipe and fittings for 10 years to be free of defects in materials or manufacturing.

B. Warranty shall cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system due to defects in materials or manufacturing.

C. Warranty shall be in effect only upon submission by the contractor to the manufacturer valid pressure/leak test documentation indicating that the system was tested and passed the manufacturer's pressure/leak test.

SMOKE AND FIRE RATINGS

A. Where indicated on the drawings that a Plenum-rated Piping System is needed, then the pipe shall be wrapped and/or insulated with standard pipe insulation, field installed. The pipe wrap or insulation shall meet the requirements of CAN/ULC-S102.2-03 or ASTM E84. The system shall have a Flame Spread Classification of less than 25 and Smoke Development rating of less than 50.

UV PROTECTION

A. Where indicated on the drawings that the pipe will be exposed to direct UV light for more than 30 days, it shall be provided with a Factory applied, UV-resistant coating or alternative UV protection.

THERMAL AND VAPOR BARRIER

A. Where standard pipe insulation is indicated on the drawings or in these specifications, the contractor shall provide a thermal (radiant, conductive, and convective) and vapor barrier insulation. The insulation products shall be provided with thickness or as indicated on the drawings or elsewhere in these specifications. The standard pipe insulation shall be UV resistant, CFC-free, non-porous, non-fibrous, and resist mold growth.

PART 3 - EXECUTION

PIPING APPLICATIONS

A. Install listed pipe materials and joining methods below in the following applications:

1. Aboveground: Polypropylene (PP-R) piping in SDR 7.3. All hot and chilled water piping shall rated for a minimum hydrostatic pressure of 150 PSI at 180 degrees F.

FUSION WELDING OF JOINTS

A. Install fittings and joints using socket-fusion, elecrofusion, or butt-fusion as applicable for the fitting or joint type. All fusion-weld joints shall be made in accordance with the pipe and fitting manufacturer's specifications and product standards.

B. Fusion-weld tooling, welding machines, and electrofusion devices shall be as specified by the pipe and fittings manufacturer.

C. Prior to joining, the pipe and fittings shall be prepared in accordance with ASTM F 2389 and the manufacturer's specifications.
D. Joint preparation, setting and alignment, fusion process, cooling times and working pressure shall be in accordance with the pipe and fitting manufacturer's specifications

PIPING INSTALLATIONS

A. Install hangers and supports at intervals specified in the applicable Plumbing or Mechanical Code and/or as recommended by pipe manufacturer.
1.
B. Support vertical piping at each floor and as specified in the applicable Plumbing or Mechanical Code. Piping 2" (63mm) or smaller shall be installed with mid-story guides.
2.
C. Fire stopping shall be provided to both be compatible with the Aquatherm Piping and meet the requirements of ASTM E 814 or ULC S115 , "Fire Tests of Through-Penetration Firestops". Pipe insulations or fire resistive coating shall be removed where the pipe passes through a fire stop and, if required by the firestop manufacturer, for 3 inches beyond the firestop outside of the fire barrier.
3.
D. When installed in systems with pumps in excess of 7.5 HP, piping shall be protected from excessive heat generated by operating the pump at shut-off conditions. Where the possibility exists that the pump will operate with no flow, the protection method shall be a temperature relief valve or comparable level of protection, set to a maximum temperature of 185°F.

E. If heat tracing or freeze protection is specified for the piping, it should be installed on the pipe interior or exterior. It must be suitable for use with plastic piping and be self-regulating to ensure that the surface temperature of the pipe and fittings will not exceed 70°C (158°F).

F. While still accessible all piping shall be pressure/leak tested to the manufacturer's standards. Tests shall be carried out using water, compressed air or a mixture of the two. The test pressure shall be 1.5 times the operating pressure or 150 psi, whichever is greater. Any leaks detected shall be repaired at the contractor's expense by removing the leaking part and replacing with new parts welded per the pipe manufacturer's guidelines. See www.aquatherm.com for additional details and forms.

G. The pipes should be flushed with cold water after finishing the installation. Inspect and test piping systems following procedures of authorities having jurisdiction and as specified by the piping system manufacturer

MECHANICAL ROOM AND EXTERIOR PIPING:.

A. Hot and chilled water piping (exterior and inside mechanical room): 1 ½ inches in diameter and larger shall be black steel, plain and beveled, seamless Schedule 40 conforming to ASTM A53, Grade B, Type S, or ASTM A106, Grade B. Fittings shall be standard weight steel, weld type. Pipe 1 ¼ inches in diameter and smaller shall be type "K" hard copper conforming to ASTM B88 with wrought copper fittings. Joints in copper pipe shall be silver brazed. All pipe and fittings shall be manufactured by Wheatland Tube or Allied Tube with steel weld bend fittings. Copper pipe shall be as manufactured by Cerro Tube or Mueller with Nibco or Mueller fittings. Horizontal piping shall be

reduced in size by eccentric reducers with flat side up. Vertical piping shall be reduced in size by concentric reducers. All steel pipe and fittings shall be made in the USA.

B. Drip pan drain lines shall be Type "L" hard copper. Drain lines shall be provided with "P" traps.

VALVES:

A. All valves installed within the chilled and hot water systems shall be metallic. Gate valves 2 inches and smaller, bronze body, 125 pound class, solid wedge, Nibco Fig. T or S111; 2 1/2 inches and larger, iron body, bronze trimmed, solid wedge, non-rising stem, 250 pound class for steam, 125 pound class for water, Nibco Fig. F-669 for steam and Fig. F-619 for water.

B. Globe valves 2 inches and smaller, bronze body, renewable disc, 200 pound class for steam, 125 pound class, for water, Nibco Fig. T or S211 for water and Fig. T-256-AP for steam; 2 1/2 inches and larger, iron body, bronze trim, 125 pound class for water, 250 pound class for steam, bolted bonnet, renewable seat and disc, Nibco Fig. F718-B for water and Fig. F768-B for steam.

C. Check valves 2 inches and smaller, bronze body, horizontal swing, regrinding type, "Y" pattern, renewable disc, 125 pound class for water, 200 pound class for steam, Nibco Fig. T-413-B for water and Fig. T-453-B for steam; 2 1/2 inches and larger, iron body, bronze trim, bolted bonnet, horizontal swing, renewable seat and disc, Nibco Fig. F-918-B.

D. Strainers 2 inches and smaller, bronze body, 0.333" monel mesh screen, standard 125 pound class, Sarco Type BT; 2 1/2 inches and larger, semi-steel body, 1/16" perforations for 2 1/2" to 3" inclusive and 1/8" perforations for 4" and above brass screen, standard 125 pound class, Sarco Type AF-125.

E. Ball valves shall be provided for all water source heat pump hose kit. Isolation valve 2” and smaller. 2 1/2” and larger isolation valves shall be gate valves as specified. Ball valves shall be Nibco S-FP-600A.

F. All valves shall be as hereinbefore specified or equal to figure numbers by Hammond, Nibco, Crane, or Milwaukee. All valves furnished shall be of the same manufacturer.

PIPING APPURTENANCES:

A. Pipe Sleeves: Pipe sleeves shall be provided where pipes and tubing pass through masonry or concrete walls, floors, roofs, and partitions. Sleeves in outside walls below and above grade, in floor, or in roof slabs, shall be steel pipe. Sleeves in partitions shall be 24 gauge zinc-coated sheet steel. Space between pipe, tubing, or insulation and the sleeve shall be not less than 1/4 inch. Sleeves shall be held securely in proper position and location before and during construction. All sleeves shall be of sufficient length to pass through entire thickness of walls, partitions, or slabs. Sleeves in floor slabs shall extend 2 inches above the finished floor. Space between the pipe or tubing and the sleeve shall be firmly packed with 1 1/2 PCF fiberglass and caulked tight.

B. Floor, Wall and Ceiling Plates: Plates on exposed pipes shall be chromium-plated steel or nickel-plated cast iron; all other plates shall be painted cast iron, malleable iron, or steel.

C. Flashing for Buildings: Where pipes pass through building roofs and outside walls, proper flashing shall be provided and shall be made tight and waterproof.

D. Unions and flanges: Unions or flanges shall be placed where necessary to permit easy disconnection of piping and apparatus, and as indicated. Each connection having a screwed-end valve shall have a union. Unions shall be used on piping under 2 inches in diameter, and flanges shall be used on piping 2 1/2 inches and over in diameter. Dielectric unions or flanges shall be installed between ferrous and non-ferrous piping, equipment, and fittings; except that bronze valves and fittings may be used without dielectric couplings for ferrous-to ferrous or non-ferrous to non-ferrous connections. Dielectric fittings shall utilize a non-metallic filler which will prevent current flow from exceeding 1 percent of the short circuit current. The spacer shall be suitable for the pressure and temperature of the service.

E. Expansion Tank: Expansion tank shall be welded steel designed for not less than 125 psig working pressure and shall be constructed and tested in accordance with Section VIII of the ASME Boiler Pressure Vessel Code. Tank shall be zinc coated (galvanized) inside and out after fabrication. Tank shall include a properly sized Airtrol tank fitting, Drain-O-Tank fitting gauge glass, pressure reducing valve, ASME relief valve and air gap between relief outlet and drain. The design working pressure of the tank shall be either the head imposed on it by the system or 150 psig, whichever is greater. Install tanks on angle iron cradles suspended from the ceiling structure with rods attached. Expansion tanks shall be manufactured by Bell & Gossett, John Wood Co., or Wessels Co.

F. Thermometers: Shall be 9" scale, corrosion resistant baked enamel finished aluminum case mercury-in-glass red reading type, industrial series fitted with bulb chamber and separable socket with extension neck to suit insulation thickness. Thermometers shall be adjust angle type and shall be as manufactured by H.O. Trerice, Marshalltown, Marsh Instrument Co., or prior approved equal.

Scales:

0 - 100	Degrees F.	Chilled Water
0 - 200	Degrees F.	Hot Water

G. Pressure Gauges: Shall be stainless steel or cast aluminum case with 4 1/2" dial and 1/4" bottom connection. Gauges for water service shall have brass needle valves and brass snubber. Gauges for steam service shall have brass needle valve, brass snubber and steel syphon. Pressure gauges shall be as manufactured by H.O. Trerice Co., Marshalltown, Marsh Instrument Co., or prior approved equal.

Scale

0 - 100	PSI

H. Flow Meters: Shall be provided where indicated and shall be installed as per

manufacturer's instruction. The meter shall be direct reading in gallons per minute and shall be rated for 240 degrees F. maximum temperature, 150 PSI operating pressure and 225 PSI test pressure. Flow meters shall be manufactured by Presso, Flow Design, Metraflex or prior approved equal.

I. Flow Stations: Shall be provided as indicated. Stations shall be Presso "Bin", or prior approved equal. Provide one differential pressure meter set to Owner at completion of project.

J. Flexible Connectors: Shall be provided where indicated and on all piping passing through the building expansion joint line. Flexible connectors shall be constructed of an annular inner corrugated stainless steel close pitched hose and protected by stainless steel overbraid. Braided stainless steel hoses must be suitable for temperatures up to 850 degrees F. The rated working pressure of the braided metal hose must have a minimum 4:1 safety factor. Flexible connectors shall be manufactured by Flex-Hose Co., Metraflex, Mason Industries, VMC, or prior approved equal.

K. Expansion loops shall be provided with dimensions as indicated on drawings. Four moment/alignment guides shall be provided for each loop. The first guide shall be four pipe diameters from the base of the loop, and the second guild shall be 14 pipe diameters from the first guide. Provide supplemental steel as required to attach to structure. Guides shall be Grinnell Fig. 256 or equal by Michigan or B-Line.

L. Circuit setters shall be provided as indicated, for water source ventilation air units. Setters shall be Bell & Gossett, Hays Fluid Control, or prior approved equal.

M. Auto flow valves shall be provided for all water source heat pumps. Auto flow valves shall be matched to unit being served and shall automatically limit flow to 10% of specified value, over a 40 to 1 differential pressure of 2 to 80 PSID. Valve body shall be rated for 400 PSI working pressure, valve shall be as manufactured by Hays Fluid control

PIPE HANGERS:

A. Provide all rods, clamps, inserts, etc. as required to properly support all pipe.

B. Pipe hangers shall be Michigan Figure Numbers as follows or equal by PHD. Provide additional pipe saddles 16 gauge galvanized rolled steel x 24" long at each hanger as detailed.

C. Insulated hot and chlled water piping - Figure No. 403.

PIPE SIZE	MAXIMUM SPAN - FEET	MINIMUM ROD SIZE - DIAMETER
1"	8 FEET	3/8
1 1/2"	8 FEET	3/8
2"	8 FEET	3/8
3"	8 FEET	1/2
4"	8 FEET	5/8
5"	8 FEET	5/8
6"	8 FEET	3/4
8"	8 FEET	3/4

10”	8 FEET	1”
12”	8 FEET	1”

HOT AND CHILLED WATER PUMPS:

A. Pumps shall be end suction base mounted flexible coupled centrifugal pumps constructed of cast iron housing and bronze impeller with internally flushed mechanical seals. Pump seals shall be suitable for ethylene glycol. Bearings shall be ball type and shall be efficiently sealed and isolated to prevent loss of oil or entrance or dirt or water. Pump and motor shall be mounted on a common fully open groutable base and shall be complete with ANSI and OSHA rated coupling guard with viewing window. Pump volute shall have integrally cast pedestal volute support. (Over hung pump volutes will not be accepted.) Volute shall include gauge ports at nozzles and vent and drain ports. A center drop out spacer coupling shall be furnished to facilitate and access the pumps working components without disturbing motor or piping and for ease of maintenance. Pump shall be a true back pull out design. Pumps for variable speed applications shall be furnished with an inverter duty motor and an EDPM coupling sleeve. Motors shall be scheduled horsepower, speed, voltage and enclosure design and meet NEMA specifications and Epact 92 Energy Efficient Standards. Motors shall be non-overloading at any point on the pump curve and shall be selected so that the operating point on the selected impeller curve will lie at or to the left (shut-off side) of, and not more than five percent below the maximum efficiency for the impeller. Motors shall be premium efficiency.

B. Pumps shall be installed on foundations as indicated, properly leveled, grouted and realigned by the Installing Contractor per the manufacturer’s installation manual. Each pump shall be factory aligned, checked, and started by the manufacturer’s qualified representative. A start-up report shall be submitted to the Engineer.

C. All pipe connections to the pumps shall have not less than five pipe diameters of straight pipe before any fittings. For all pump suction connections, provide a suction diffuser as manufactured by Bell & Gossett Co., or prior approved equal.

D. Pumps shall be Model 1510 as manufactured by Bell & Gossett, Peerless, Crane, or Taco.

E. All condenser water pumps scheduled for variable frequency operation shall be provided with inverter duty motors. VFD’s shall be provided by Controls Contractor. See control specification.

AIR SEPARATORS:

A. Shall be designed with tangential openings (straight through connections will not be accepted), ASME designed to create a low velocity vortex where air is separated and removed from the circulating water. Air separator shall be designed and constructed per ASME Section VIII, Division I. Construction shall be of cast iron for 2 1/2" and smaller and steel construction for 3" and larger. Air separator shall include a galvanized steel strainer and stainless steel collector tube. Maximum working pressure shall be 125 psig minimum and maximum operating temperature of 350 degrees F. Air separators shall be Bell & Gossett “Rolairtrol” or prior approved equal.

CLEANING SYSTEM:

A. Water piping system shall be cleaned out using a hot (200degrees F) solution of trisodium phosphate mixed one pound to fifty gallons of water or per chemical manufacturer's recommendations. Remove or valve off any item subject to damage. If required by manufacture's specification and or written instructions, control valves shall be removed and spacers provided. Condenser water pumps shall circulate the solution for 12 hours after which the system shall be drained down and completely flushed not less than 3 times. While cleaning system strainers each time. At no time during cleaning or flushing shall water flow through water source heat pumps or ventilation air units. Fill shall be done with clean water initially treated with corrosion inhibitors per manufacturers recommendations. Water treatment shall include (12) month madatory testing and treatment to coincide with warranty period.

TESTS:

PIPING SYSTEMS:

A. All piping systems shall be tested after the lines have been cleaned and before any insulation covering has been applied. Piping systems shall be tested at a pressure of 1 1/2 times the design working pressure and in no case less than 150 psig. All piping shall be hydrostatically tested using water not exceeding 100 degree F. In the tests, gages, traps, and other apparatus which may be damaged by the test shall be removed or valved off from the system before the tests are made. A calibrated test pressure gauge shall be installed in the system to observe any loss in pressure. The required test pressure shall be maintained for a sufficient length of time to enable an inspection to be made of all joints and connections. All defects which develop during testing shall be rectified, and the piping systems shall be retested until they show no defect of weakness and are tight.

IDENTIFICATION TAGS AND COLOR CODES:

3.01PIPE MARKING:

A. After all piping has been painted with the proper color code; all piping shall be coded and marked with PERMA-CODE pipe markers as manufactured by W. H. Brady Company or an approved pipe marker company. Markers shall be applied to properly label piping as follows:

1.) 2 1/4" width markers on all pipes 3" diameter and larger, 1 1/2 width markers on all pipe smaller than 3" in diameter.

2.) An arrow marker with each pipe content marker. The arrow always pointing away from the pipe marker and in the direction of flow. In flow is possible in both directions use a double-headed arrow marker.

3.) Apply pipe content marker and arrow marker as follows:

a. At each valve to show proper identification of contents and direction of flow.
b. At every point of pipe entry or exit where a pipe goes through a wall.
c. On each riser and "T" joint.

d. Every 50 feet on long continuous lines. (Alternate method: Identify long continuous lines at every bay or aisle.)

B. Markers shall be applied where there are not obstructions, and shall be secured by spiral wrapping with banding tape, color matching service, at each end of the marker.

C. Identification of piping: All steel piping, bare and insulated, shall be given two (2) coats of finished paint. (One [1] coat primer / one [1] coat finish paint). Painting of pipe shall occur after Engineer's inspection of chilled and hot water piping and pressure testing and prior to insulation. All insulated pipe shall also be painted on the exterior surface of the insulation with paint as recommended by manufacturer. Paint shall be Glidden Industrial Enamel (with colors indicated below) or Sherwin-Williams, Devoe Paints or other approved paint manufacturers. Samples of colors or and paint shall be submitted for approval before application. Paint shall comply with low VOC LEED requirements.

CODING	**GLIDDEN**
Chilled Water Supply & Return	Green
Hot Water Supply & Return	Orange

D. Drains and Vents: Same color as system served.

E. Tanks: Will be painted the same color as the most significant dangerous liquid or gas (For example: Tank, Steam and Hot water - Safety Orange) flowing to, through and from the tank.

F. Identification tags and plates: All equipment, gauges, thermometers, valves, and controllers shall be provided with tags numbered and stamped for their use. Plates and tags shall be of brass or suitable nonferrous material and shall be securely mounted or attached. All circuit setters shall be tagged with final balanced GPM at project completion.

G. Location chart: Provide a framed location chart and diagram showing numbers and location of every valve and shut-off cock. Attach chart in location as directed.

END OF SECTION 23 84 70

SECTION 238620 - INSULATION (DUCTWORK, HOT AND CHILLED WATER PIPING)

PART ONE - GENERAL:

1.01 All insulation shall have a composite fire and smoke hazard rating which shall include insulation, jacket, facing, and adhesive. Flame spread rate shall not exceed 25 with smoke development not in excess of 50. Accessories (adhesives, mastics, cements, tapes) shall be rated as specified for insulation. Samples of all types of insulation shall be submitted for approval. Piping and duct work shall be tested, thoroughly cleaned and approved before insulation is applied.

PART TWO - PRODUCTS:

2.01 Duct insulation shall be as manufactured by Manville, Certain-Teed, Owens-Corning, Knauf, or approved substitute.

2.02 Pipe insulation shall be Armaflex or Rubatex.

PART THREE - EXECUTION:

3.01 SUPPLY, RETURN AND OUTSIDE AIR DUCTWORK:

A. All concealed ductwork, including flexible duct connections, diffuser boots, and backs, VAV box heater/ manifold sections, etc. shall be insulated with 2" thick, 1 pcF density, flexible insulation with factory applied vapor barrier consisting of Foil-Scrim-Kraft. Insulation shall be secured to ductwork with Benjamin Foster 85-20 adhesive. All joints shall be stapled and finished with a 3" wide strip of glass fabric and mastic.

B. All transfer air ducts shall be insulated internally with ¾" Armaflex S.A. as detailed for return air sound trap on plans. Insulation shall be secured with weld pins.

C. All ductwork serving ventilation air vents shall be insulated as described above for supply and return ductwork.

3.03 PIPING (CHILLED, HOT AND CONDENSATE WATER):

A. All chilled and condensate water piping shall be insulated using closed-cell, flexible elastomeric molded pipe insulation. All joints shall be sealed using Armstrong 520 adhesive. All seams, longitudinal and butt joints, shall be covered with Armaflex insulation tape, 2" wide. Butt joints shall be wrapped first with the longitudinal seam tape butted to the wrap. Where multiple layers are required, all seams shall be staggered, and insulation tape shall be applied to outermost seams only. Insulation thicknesses shall be as follows:

Service	Pipe Size	Insulation Thickness
Condensate	All	3/4"
Chilled Water (Interior)	All	1 ½"
Chilled Water (Exterior)	All	2"
Hot Water	All	2"

B. Fittings shall be insulated in strict accordance with manufacturer's recommendations using materials as specified in Paragraph 3.04 A. Mitered and radius covers shall be prefabricated as shown in manufacturer's literature. All seams in fitting covers shall be sealed with adhesive and covered with insulation tape as described above.

C. All materials and methods described above shall be in strict accordance with manufacturer's recommendations unless specifically otherwise indicated.

D. Interior chilled water piping as labeled above refers to all chilled water piping located within a conditioned space.

3.05 APPURTENANCES:

A. Insulate pump impeller casings, compression tanks, valves, cocks, strainers and all other specialties.

B. Drip pan drain lines shall be insulated with 3/4" thick insulation installed per paragraph 3.04.

C. Provide not less than 16 gauge galvanized steel shields, 24" long, 180 degree bend, inserted between the hanger and insulation for chilled water piping insulation. Provide integral pipe supports sealed in the insulation as recommended by manufacturer.

3.06 OUTDOOR PIPING:

A. In Addition to insulation requirements, all outdoor chilled water piping shall be covered with 24 gauge stainless steel jacket banded 4” O.C. with stainless steel bands of same gauge.

END OF SECTION 238620

SECTION 238700 – FOUNDATION & SUPPORTS

PART ONE – GENERAL:

1.01 Provide all necessary foundations, supports, pads, bases, and piers required for all air conditioning equipment and for all other equipment furnished under this contract.

PART TWO – PRODUCTS & EXECUTION:

2.01 For rotating machinery, and for all equipment where foundations are indicated, furnish and install concrete pads as shown. All pads shall be extended 6" beyond machine base in all directions with top edge chamfered and be 6" thick, unless otherwise noted.

END OF SECTION 238700

SECTION 238900 - VIBRATION AND SEISMIC CONTROL

PART ONE - GENERAL:

1.01 All vibration isolation and seismic control materials specified herein shall be provided by a single manufacturer to assure single responsibility for their proper performance. Installation of all vibration and seismic control materials specified herein shall be accomplished following the manufacturer's written instructions.

1.02 The Contractor shall furnish a complete set of shop drawings and other necessary information, of all mechanical equipment to receive vibration isolation and seismic devices, to the vibration isolation and seismic control materials manufacturer. The information to be furnished shall include operating weight of the equipment to be isolated, distribution of weight to support points and dynamic characteristics along with any internal isolation systems to be analyzed. The Contractor shall also furnish a complete layout of piping and ductwork to be isolated, including vertical risers, showing size or weight and support points of the piping and ductwork system, to the vibration isolation and seismic control materials manufacturer, for selection and layout of mountings.

1.03 The vibration and seismic control materials manufacturer shall use the above listed information to design a complete system of vibration and seismic mounts in accordance with the contract documents along with the 2015 International Building Code Section 1607, SMACNA “Seismic Restraint Manual”, and ASHRAE, Chapters 43 and 50. The vibration and seismic control materials Contractor shall analyze all “multiple degrees of freedom” systems, and provide properly designed isolation systems avoiding all resonance frequencies. To accomplish this, the vibration and seismic control materials supplier shall employ an Engineer registered in the State of South Carolina to design all isolation and restraint systems and prepare a complete set of calculations and shop drawing submittals with his professional Engineer’s seal certifying that the design meets all requirements of these contract documents. A seismic design “errors and omissions” insurance certificate must accompany submittals from the vibration and seismic Engineer. Manufacturer’s product liability insurance certificates are not acceptable.

1.04 The vibration and seismic control Engineer or his designated representative shall inspect the project upon completion of the applicable work and provide written certification that the installation is in compliance with the approved shop drawing submittals. This certification shall also bear the professional Engineer’s seal and shall become part of the contract closeout documents. All seals shall be signed and dated appropriately.

1.05 Vibration and seismic control systems shall be provided by Vibration Mounting and Controls, Mason Industries, Consolidated Kinetics, or prior approved equal.

PART TWO - PRODUCTS AND EXECUTION:

2.01 VIBRATION ISOLATION:

A. All mechanical equipment shall receive external vibration isolation. Internal component isolation of equipment shall not be considered equivalent, but shall be considered when analyzing systems with multiple degrees of freedom.

B. Vibration isolators shall be selected based upon known operating weight distributions and dynamic characteristics of the isolated equipment, with the quantity and location as required by the component drawing. Isolator type shall be tabulated for each isolated piece of equipment. Complete calculations of vibration analysis shall be included with submittals, including but not limited to fundamental and harmonic frequencies.

C. Isolators shall have either known non-deflected heights of spring element or calibration markings so that, after adjustment, when carrying their load, the deflection under load can be verified to determine if the load is within the proper range of the isolator and if the correct degree of vibration isolation is being provided.

D. Isolators shall function in the linear portion of the load versus deflection curve. Theoretical vertical natural frequency shall not differ from the design objectives by more than + 10%.

E. Spring mounts shall have seismic housings as required by Paragraph 2.02.

F. Isolation of equipment shall be as follows:

1. Suspended equipment shall be isolated form the building structure by means of noise and vibration isolators. Units shall be supported with spring and neoprene type isolators, springs to be as described above. Isolators shall be VMC Series RSH.

2. Roof mounted equipment shall be isolated from the building structure by means of a structural aluminum or hot dipped galvanized structural steel isolation curb. The structural spring isolation curbs shall bear directly on the roof support structure and be flashed and waterproofed into the roof's membrane waterproofing system. Roof curbs shall be installed to accommodate the pitch of roof. Contractor shall provide and install all supplemental steel required for seismic attachment of curb to structure as designed by manufacturer. Field fabricated curbs shall not be used. Curb shall come factory assembled. No bolt together corners will be allowed. The curb shall consist of a rigid lower section containing properly spaced pockets with fully adjustable spring isolators. All springs shall be color coded for proper identification and spring pocket shall allow for easy removal or replacement of any spring without disturbance of the supported equipment. Pockets shall have removable waterproof covers to allow for spring adjustment. Spring pockets shall contain combination vertical and horizontal restraint in conjunction with a 1/4 inch thick neoprene rubber bushing which will resist wind and seismic forces. All springs shall be installed in series with a 1/4 inch thick neoprene acoustical cup or pad. Curbs supplied shall be factory acoustically lined with 1 inch 3 PCF duct liner. An air tight neoprene seal

shall be incorporated into the curb design to prevent air leakage or infiltration. Air seal must not be exposed so that it could be damaged or that in the event of the air seal failure, water could leak into the curb's interior. Wood nailer and flashing shall be provided and curbs shall be manufactured to NRCA standards. Curbs shall include a means of incorporating a sound barrier package, consisting of two layers of waterproof gypsum board furnished and installed by the Mechanical Contractor. Additionally, mechanical contractor shall fill all voids between acoustic gypsum board package and roof decking with acoustic style R-19 batt insulation under entire footprint of each rooftop unit. Individual pier supported curbs are not acceptable. Roof equipment supports to be VMC type P or R.

3. Mechanical equipment as noted shall be mounted on a rigid structural steel base. The equipment including the base shall be mounted on or suspended from vibration isolators as applicable. Base shall be VMC Type WFB.

4. Floor mounted equipment as noted shall be provided with a noise and vibration isolated structural steel concrete slab inertia base mounted on isolators. Spring mounts shall be recessed at corners. Inertia base shall be VMC Type MPF or WPF as applicable.

2.02 SEISMIC CONTROL:

A. All mechanical equipment, piping, ductwork, etc. shall be provided with seismic restraints in accordance with the 2003 International Building Code, 2000 International Mechanical Code, and SMACNA Seismic Restraint Manual, Latest Edition requirements, as a minimum.

1. All equipment, isolated or not, shall be bolted to the structure to allow for seismic acceleration with no failure or displacement. All connections shall be positive bolted type; no friction clamps of any kind are allowed.

2. Provide cable and connection sets for suspended equipment at each of four corners secured to the building structure.

3. Provide seismic roof curb systems fastened to roof structure for roof top equipment.

4. Floor mounted equipment shall be provided with seismically housed springs or springs with seismic snubbers as determined by the equipment to be isolated.

END OF SECTION 238900

SECTION 239140 - BUILDING AUTOMATION SYSTEM

PART ONE - GENERAL:

1.01 SCOPE OF WORK:

A. The Building Automation System (BAS) manufacturer shall furnish and install a fully integrated building automation system, incorporating direct digital control (DDC) for energy management, equipment monitoring and control, and subsystems as herein specified. The installation of the control system shall be performed under the direct supervision of the controls manufacturer with the shop drawings, flow diagrams, bill of materials, component designation or identification number and sequence of operation all bearing the name of the manufacturer.

B. All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems and not custom designed specially for this project. All systems and components shall have been thoroughly tested and proven in actual use for at least two years.

C. BAS manufacturer shall be responsible for all BAS and Temperature Control wiring for a complete and operable system. All control wiring required for this installation is included in this contract and shall be color coded. All control wiring shall be in conduit. Conduit, wiring sizes, and type of insulation shall be in accordance with DIVISION 26 - ELECTRICAL, and shall conform to the latest issue of the National Electrical Code. All electrical equipment shall bear UL labels. Each control circuit shall be protected by a circuit breaker of the proper size.

1.02 WORK BY OTHERS:

A. Mechanical Contractor installs all wells, valves, taps, dampers, flow stations, etc. furnished by BAS manufacturer.

B. Electrical Contractor provides:

1. Wiring of all power feeds through all disconnects and starters to electrical motors.

2. Wiring of any remote start/stop switches and manual or automatic motor speed control devices not furnished by BAS manufacturer.

C. Products furnished but not installed under this section:

1. Section 238460 - Hot Water and Chilled Water Distribution Systems:

a. Control Valves
b. Flow Switches
c. Temperature Sensor Wells and Sockets.

2. Section 238070 - Ductwork:

a. Air-flow Stations.

1.03 RELATED WORK:

A. Division 01 - General and Special Conditions
B. Division 23 - Mechanical
C. Division 26 - Electrical

1.04 QUALITY ASSURANCE:

A. The BAS system shall be designed, installed, commissioned, and serviced by factory trained personnel. Manufacturer shall have an in-place support facility within 100 miles of the site with technical staff, spare parts inventory and necessary test and diagnostic equipment.

B. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.

C. BAS shall comply with UL 916 PAZX and 864 UDTZ, European Community, and other subsystem listings as applicable, and herein specified, and be so listed at the time of bid.

D. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Section 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.

E. The manufacturer of the building automation systems shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.

F. This system shall have a documented history of compatibility by design for a minimum of 15 years. Future compatibility shall be supported for no less than 10 years. Compatibility shall be defined as the ability to upgrade existing field panels and extend new field panels on a previously installed network.

1.05 SUBMITTALS:

A. Submit 10 complete sets of documentation in the following phased delivery schedule:

1. Valve and damper schedules
2. Equipment data cut sheets
3. System schematics, including:
   a. Sequence of Operations
   b. Point Names
   c. Point Addresses

d. Interface Wiring Diagrams
e. Panel Layouts
f. System Riser Diagrams

4. Auto-CAD compatible as-built drawings.

B. Upon project completion, submit operation and maintenance manuals, consisting of the following:

1. Index sheet, listing contents in alphabetical order.
2. Manufacturer's equipment parts list of all functional components of the system, Auto-CAD disk of system schematics, including wiring diagrams.
3. Description of sequence of operations.
4. As-built interconnection wiring diagrams.
5. Operator's Manual.
6. Trunk cable schematic showing remote electronic panel locations, and all trunk data.
7. List of connecting data points, including panels to which they are connected and input device (ionization detector, sensors, etc.)
8. Conduit routing diagrams.

1.06 WARRANTY:

A. Provide all services, materials and equipment necessary for the successful operation of the entire BAS system for a period of one year after beneficial use.

B. The adjustment, required testing, and repair of the system includes all computer equipment, transmission equipment and all sensors and control devices.

C. The on-line support services shall allow the local BAS subcontractor to dial out over telephone lines to monitor and control the facility's building automation system. This remote connection to the facility shall be within 2 hours of the time that the problem is reported. The coverage shall be extended to include normal business hours, after business hours, weekends, and holidays.

D. If the problem cannot be resolved with on-line support services, the BAS manufacturer shall dispatch the appropriate personnel to the job site to resolve the problem within three (3) hours of the time that the problem is reported.

PART TWO - PRODUCTS:

2.01 ACCEPTABLE MANUFACTURER:

A. System shall be manufactured by Siemens (

2.02 NETWORKING COMMUNICATIONS:

A. The design of the BAS shall network operator workstations and stand-alone DDC Controllers. The network architecture shall consist of two levels, a high performance peer-to-peer building level network and DDC Controller floor level local area networks

with access being totally transparent to the user when accessing data or developing control programs.

B. The design of BAS shall allow the co-existence of new DDC Controllers with existing DDC Controllers in the same network without the use of gateways or protocol converters.

C. Peer-to-Peer Building Level Network:

1. All operator devices either network resident or connected via dial-up modems shall have the ability to access all point status and application report data or execute control functions for any and all other devices via the peer-to-peer network. No hardware or software limits shall be imposed on the number of devices with global access to the network data at any time.

2. The network shall support a minimum of 100 DDC controllers and PC workstations.

3. Each PC workstation shall support a minimum of 4 peer-to-peer networks hardwired or dial up.

2.03 DDC CONTROLLER FLOOR LEVEL NETWORK:

A. This level of communication shall support a family of application specific controllers and shall communicate with the peer-to-peer network through DDC Controllers for transmission of global data.

B. Telecommunication Capability:

1. Auto-dial/auto-answer communications shall be provided to allow DDC Controllers to communicate with remote operator stations and/or remote terminals via telephone lines, as indicated in the sequence of operations.

2. Auto-dial DDC Controllers shall automatically place calls to workstations to report alarms or other significant events. The auto-dial program shall include provisions for handling busy signals, “no answers” and incomplete data transfers. Alarm shall account for severity and time of day in placing calls.

3. Operators at dial-up workstations shall be able to perform all control functions, all report functions and all database generation and modification functions as described for workstations connected via the network. Routines shall be provided to automatically answer calls from remote DDC Controllers. The fact that communications are taking place with remote DDC Controllers over telephone lines shall be completely transparent to an operator.

2.04 DDC CONTROLLER:

A. DDC Controllers shall be 16-bit stand-alone, multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input-output point modules. Controller

size shall be sufficient to fully meet the requirements of this specification and the attached point I/O schedule. Each controller shall support a minimum of three (3) Floor Level LAN Device Networks.

B. Each DDC Controller shall have sufficient memory to support its own operating system and databases, including:

1. Control processes
2. Energy management applications
3. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
4. Historical/trend data for points specified
5. Maintenance support applications
6. Custom processes
7. Operator I/O
8. Dial-up communications
9. Manual override monitoring

C. Each DDC Controller shall support firmware upgrades without the need to replace hardware.

D. Provide all processors, power supplies and communication controllers so that the implementation of a point only requires the addition of the appropriate point input/output termination module and wiring.

E. DDC Controllers shall provide a minimum two RS-232C serial data communication ports for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals. DDC Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers or terminals.

F. As indicated in the point I/O schedule, the operator shall have the ability to manually override automatic or centrally executed commands at the DDC Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.

1. Switches shall be mounted either within the DDC Controllers key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides.

2. DDC Controllers shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. DDC Controllers shall also collect override activity information for reports.

G. DDC Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LEDs or analog indication of value shall also be provided for each analog output. Status indication shall be visible without opening the panel door.

H. Each DDC Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all panel components. The DDC Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.

I. Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standards 587-1980.

J. In the event of the loss of normal power, there shall be an orderly shutdown of all DDC Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.

1. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.

2. Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.

K. Provide a separate DDC Controller for each AHU or other HVAC system as indicated in Section 3.02, Sequence of Operation. It is intended that each unique system be provided with its own point resident DDC Controller.

2.05 DDC CONTROLLER RESIDENT SOFTWARE FEATURES:

A. General:

1. The software programs specified in this Section shall be provided as an integral part of DDC Controllers and shall not be dependent upon any higher level computer for execution.

2. All points shall be identified by up to 30 character point names and 16 character point descriptors. The same names shall be used at the PC workstation.

3. All digital points shall have user defined two-state status indication (descriptors with minimum of 8 characters allowed per state (i.e. summer/winter)).

B. Control Software Description:

1. The DDC Controllers shall have the ability to perform the following pre-tested control algorithms:

a. Two-position control
b. Proportional control
c. Proportional plus integral control
d. Proportional, integral, plus derivative control

e. Automatic tuning of control loops.

C. DDC Controllers shall have the ability to perform any or all the following energy management routines:

1. Time-of-day scheduling - up to a year in advance
2. Calendar-based scheduling
3. Holiday scheduling
4. Temporary schedule overrides
5. Start-Stop Time Optimization (automatically coordinated with TOD scheduling)
6. Automatic Daylight Savings Time Switchover
7. Night setback control
8. Enthalpy switchover (economizer)
9. Peak demand limiting
10. Temperature-compensated duty cycling.

D. DDC Controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.

1. A single process shall be able to incorporate measured or calculated data from any and all other DDC Controllers on the network. In addition, a single process shall be able to issue commands to points in any and all other DDC Controllers on the network. Database shall support 30 character, English language point names, structured for searching and logs.

2. Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of a dial-up connection to a remote device such as a printer or pager.

3. DDC Controller shall provide a HELP function key. Enhanced context sensitive on-line help with task orientated information from the user manual.

4. DDC Controller shall be capable of comment lines for sequence of operation explanation.

E. Alarm management shall be provided to monitor and direct alarm information to operator devices. Each DDC Controller shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost. At no time shall the DDC Controller's ability to report alarms be affected by either operator of activity at a PC workstation, local I/O device or communications with other panels on the network.

1. All alarm or point change reports shall include the point's English language description and the time and date of occurrence.

2. The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of six priority levels shall be

provided for each point. Point priority levels shall be combined with user definable destination categories (PC, printer, DDC Controller, etc.) to provide full flexibility in defining the handling of system alarms. Each DDC Controller shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point.

3. Alarm reports and messages will be directed to a user-defined list of operator devices or PCs based on time (after hours destinations) or based on priority.

4. In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 200 character alarm message to more fully describe the alarm condition or direct operator response.

5. In dial-up applications, operator-selected alarms shall initiate a call to a remote operator device.

F. A variety of historical data collection utilities shall be provided to manually or automatically sample, store and display system data for points as specified in the I/O summary.

1. Any point, physical or calculated, may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each DDC Controller's point group. Two methods of collection shall be allowed: either by a pre-defined time interval or upon a pre-defined change of value. Sample intervals of 1 minute to 7 days shall be provided. Each DDC Controller shall have a dedicated RAM-based buffer for trend data and shall be capable of storing a minimum of 10,000 data samples. All trend data shall be available for use in 3rd party personal computer applications (i.e. Microsoft Excel, Lotus 123).

2. DDC Controllers shall also provide high resolution sampling capability for verification of control loop performance. Operator-initiated automatic and manual loop tuning algorithms shall be provided for operator-selected PID control loops as identified in the point I/O summary.

a. Loop tuning shall be capable of being initiated either locally at the DDC Controller, from a network workstation or remotely using dial-in modems. For all loop tuning functions, access shall be limited to authorized personnel through password protection.

G. DDC Controllers shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.

H. The peer-to-peer network shall allow the DDC Controllers to access any data from or send control commands and alarm reports directly to any other DDC Controller of combination of controllers on the network without dependence upon a central or intermediate processing device. DDC Controllers shall send alarm reports to multiple

workstations without dependence upon a central or intermediate processing device. The peer-to-peer network shall also allow any DDC Controller to access, edit, modify, add, delete, back up, and restore all system point database and all programs.

I. The peer-to-peer network shall allow the DDC controllers to assign a minimum of 50 passwords access and control priorities to each point individually. The logon password (at any PC workstation or portable operator terminal) shall enable the operator to monitor, adjust and control the points that the operator is authorized for. All other points shall not be displayed on the PC workstation or portable terminal (e.g. all base building and all tenant points shall be accessible to any base building operators, but only tenant points shall be accessible to tenant building operators). Passwords and priorities for every point shall be fully programmable and adjustable.

2.06 FLOOR LEVEL NETWORK APPLICATION SPECIFIC CONTROLLERS (ASC):

A. Each DDC Controller shall be able to extend its performance and capacity through the use of remote application specific controllers (ASCs) through Floor Level LAN Device Networks.

B. Each ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor. Provide the following types of ASC's as a minimum:

1. Central System Controllers
2. Terminal Equipment Controllers
3. Lighting Control (See Electrical Plans for Location)

C. Each ASC shall be capable of control of the terminal device independent of the manufacturer of the terminal device.

D. Central System Controllers:

1. Provide for control of central HVAC systems and equipment including, but not limited to, the following:

   a. Air handling unit systems.

2. Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. Provide a hand/off/automatic switch for each digital output for manual override capability. Switches shall be mounted either within the controller's key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides. In addition, each switch position shall be supervised in order to inform the system that automatic control has been overridden.

3. Each controller shall support its own real-time operating system. Provide a time clock with battery backup to allow for stand-alone operation in the event

communication with its DDC Controller is lost and to insure protection during power outages.

4. All programs shall be field-customized to meet the user's exact control strategy requirements. Central System controllers utilizing pre-packaged or canned programs shall not be acceptable.

5. Programming of central system controllers shall utilize the same language and code as used by DDC Controllers to maximize system flexibility and ease of use.

6. Each controller shall have connection provisions for a portable operator's terminal. This tool shall allow the user to display, generate or modify all point databases and operating programs.

7. Provide a door-mounted interface terminal to allow for direct-user access to the controller.

    a. The terminal shall provide the user with the following functionality as a minimum:

        1. View and set date and time
        2. Modify and override time-of-day schedules
        3. View points and alarms
        4. Monitor points
        5. Command and modify setpoints.

E. Terminal Equipment Controllers:

1. Provide for control of each piece of equipment, including, but not limited to, the following:

    a. Ventilation Air Units
    b. Air handling/Blower Coil Units
    c. Variable Speed Pumps.

2. Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. Analog outputs shall be 24V floating control, allowing for interface to a variety of modulating actuators. Terminal controllers utilizing proprietary control signals and actuators shall not be acceptable.

3. Each controller performing space temperature control shall be provided with a matching room temperature sensor. The sensor may be either RTD or thermistor type.

4. Each room temperature sensor shall include a terminal jack integral to the sensor assembly. The terminal jack shall be used to connect a portable laptop or similar operator's terminal to control and monitor all hardware and software points associated with the controller.

5. Each room sensor shall also include the following auxiliary devices:

   - Setpoint Adjustment Dial
   - Temperature Indicator
   - Override Switch.

6. The setpoint adjustment dial shall allow for modification of the temperature by the occupant. Setpoint adjustment may be locked out, overridden or limited as to time or temperature through software by an authorized operator at the central workstation, MBC or via the portable programming tool.

7. The temperature indicator shall be a LCD thermometer and shall be visible without removing the sensor cover.

8. The override switch shall initiate override of the night setback mode to normal (day) operation when activated by the occupant. The override function may be locked out, overridden or limited as to the time through software by an authorized operator at the central workstation, MBC or via the portable programming tool.

2.07 PORTABLE OPERATOR'S TERMINAL (POT):

A. Provide industry standard, commercially available portable operator terminals with a LCD display of and a full-featured keyboard. The POT shall be handheld and plug directly into all DDC Controllers and Floor Level Network Controllers as described below. Provide a user-friendly, English language-prompted interface for quick access to system information, not codes requiring look-up charts.

B. Functionality of the portable operator's terminal connected at any DDC Controller:

1. Access all DDC Controllers on the network.

2. Backup and/or restore DDC Controller data bases for all system panels, not just the DDC Controller connected to.

3. Display all point, selected point and alarm point summaries.

4. Display tending and totalization information.

5. Add, modify and/or delete any existing or new system point.

6. Command, change setpoint, enable/disable any system point.

7. Program and load custom control sequences as well as standard energy management programs.

8. Acknowledge alarms.

C. Functionality of the portable operator's terminal connected to any application specific

controller:

1. Provide connection capability at either the Floor Level Network Controller or a related room sensor to access controller information.

2. Provide status, setup and control reports.

3. Modify, select and store controller data base.

4. Command, change setpoint, enable/disable any controller point.

D. Connection of the POT to a DDC or ASC Controller shall not interrupt nor interfere with normal network operation in any way, prevent alarms from being transmitted or preclude centrally-initiated commands and system modification.

E. Portable operator terminal access to controller shall be password-controlled. Password protection shall be configurable for each operator based on function, points (designating areas of the facility), and edit/view capability.

2.08 PERSONAL COMPUTER OPERATOR WORKSTATION HARDWARE:

A. Existing operator workstation shall control BAS.

2.09 WORKSTATION OPERATOR INTERFACE:

A. Basic Interface Description:

1. Operator workstation interface software shall minimize operator training through the use of English language prompting, 30 character English language point identification, on-line held, and industry standard PC application software. Interface software shall simultaneously communicate with up to 4 Building Level Networks and share data between any of the 4 networks. The software shall provide, as a minimum, the following functionality:

   a. Real-time graphical viewing and control of environment
   b. Scheduling and override of building operations
   c. Collection and analysis of historical data
   d. Point database editing, storage and downloading of controller databases
   e. Alarm reporting, routing, messaging, and acknowledgment.

2. Provide a graphical user interface which shall minimize the use of keyboard through the use of a mouse or similar pointing device and “point and click” approach to menu selection. There shall be a minimum of 8 pre-defined function keys to allow quick access to frequently used applications.

3. The software shall provide a multi-tasking type environment that allows the user to run several applications simultaneously. BAS software shall run within a 32 bit operating system such as Windows NT. These Windows applications shall run simultaneously with the BAS software. The mouse or Alt-Tab keys

shall be used to quickly select and switch between multiple applications. The operator shall be able to work in Microsoft Word, Excel, and other Windows based software packages, while concurrently annunciating on-line BAS alarms and monitoring information.

a. Provide functionality such that any of the following may be performed simultaneously on-line, and in any combination, via user-sized windows. Operator shall be able to drag and drop information between applications, reducing the number of steps (i.e. click on a point on the alarm screen and drag it to the dynamic trend graph application to initiate a dynamic trend).

1. Dynamic color graphics and graphic control

2. Alarm management, routing to designated locations, and customized messages

3. Year in advance equipment and report scheduling

4. Dynamic trend data definition and presentation

5. Graphic definition and construction

6. Program and point database editing on-line.

f. If the software is unable to display several different types of displays at the same time, the BAS Contractor shall provide at least two operator workstations.

g. Report and alarm printing shall be accomplished via Windows Explorer, allowing use of network printers.

4. Operator specific password access protection shall be provided to allow the user/manager to limit workstation control, display and data base manipulation capabilities as deemed appropriate for each user, based upon an assigned password. Operator privileges shall “follow” the operator to any workstation logged onto (up to 200 passwords shall be supported).

5. Operator Activity Tracking - An audit trail report to track system changes, accounting for operator initiated actions, changes made by a particular person or changes made to a specific piece of equipment, designated time frame, shall be printable and archived for future use. The operator activity tracking shall be in a tamper-proof buffer file.

6. Reports shall be generated on demand or via pre-defined schedule and directed to either CRT displays, printers or disk. As a minimum, the system shall allow the user to easily obtain the following types of reports:

a. A general listing of all or selected points in the network
b. List of all points currently in alarm

c. List of all points currently in override status
d. List of all disabled points
e. List of all points currently locked out
f. List of user accounts and access levels
g. List all weekly schedules
h. List of holiday programming
i. List of limits and deadbands
j. Custom reports from 3rd party software
k. System diagnostic reports including, list of DDC panels on line and communicating, status of all DDC terminal u nit device points
l. List of programs.

7. Scheduling and Override: Provide a graphical spreadsheet-type format for simplification of time-of-day scheduling and overrides of building operations. Schedules reside in both the PC workstation and DDC Controller to ensure time equipment scheduling when PC is off-line, PC is not required to execute time scheduling. Provide override access through menu selection or function key. Provide the following spreadsheet graphic types of a minimum:

   a. Weekly schedules
   b. Zone schedules, minimum of 200 unique zones
   c. Scheduling for up to 365 days in advance
   d. Schedule reports to print at PC.

8. Collection and Analysis of Historical Data:

   a. Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period of time. Any system point may be tended automatically at time-based intervals or change of value, both of which shall be user-definable. Trend data may be stored on hard disk for future diagnostics and reporting. Additionally, trend data may be archived to network drives or removable disk media for future retrieval.

   b. Trend data reports shall be provided to allow the user to view all trended point data. Reports may be customized to include individual points or predefined groups of at least six points. Provide additional functionality to allow predefined groups of up to 250 trended points to be easily transferred on-line to Microsoft Excel. DDC Contractor shall provide custom designed spreadsheet reports for use by the Owner to track energy usage and cost, equipment run times, equipment efficiency, and/or building environmental conditions. DDC Contractor shall provide setup of custom reports including creation of data format templates for monthly or weekly reports.

B. Dynamic Color Graphic Displays:

1. Color graphic floor plan displays and system schematics for each piece of mechanical equipment shall be installed under this contract. Graphics to be created include:

- Building floor plan with area temperatures displayed
- Each air handling unit
- Each VAV box (with CFM displayed)
- Each fan coil unit
- Chilled water system

2. The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection or text-based commands. Graphics software shall permit the importing of Autocad or scanned pictures for use in the system.

3. Dynamic temperature values, humidity values, flow values and status indication shall be shown in their actual respective locations and shall automatically update to represent current conditions without operator intervention and without pre-defined screen refresh rates.

   a. Sizable analog bars shall be available for monitor and control of analog values; high and low alarm limit settings shall be displayed on the analog scale. The user shall be able to “click and drag” the pointer to change the setpoint.

   b. Provide the user the ability to display blocks of point data by defined point groups; alarm conditions shall be displayed by flashing point blocks.

   c. Equipment state can be changed by clicking on the point block or graphic symbol and selecting the new state (on/off) or setpoint.

4. Colors shall be used to indicate status and change as the status of the equipment changes. The state colors shall be user definable.

5. The windowing environment of the PC operator workstation shall allow the user to simultaneously view several applications at a time to analyze total building operation or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.

C. System Configuration and Definition:

1. Network wide control strategies shall not be restricted to a single DDC Controller, but shall be able to include data from any and all other network panels to allow the development of Global control strategies.

2. Provide automatic backup and restore all DDC Controller databases on the workstation hard disk. In addition, all database changes shall be performed while the workstation is on-line without disrupting other system operations. Changes shall be automatically recorded and downloaded to the appropriate DDC Controller. Changes made at the DDC Controllers shall be automatically uploaded to the workstation, ensuring system continuity.

3. System configuration, programming, editing, graphics generation shall be performed on-line. If programming and system back-up must be done with the PC workstation off-line, the BAS Contractor shall provide at least 2 operator workstations.

D. Alarm Management:

1. Alarm Routing shall allow the user to send alarm notification to selected printers or PC location based on time of day, alarm severity, or point type.

2. Alarm Notification shall be provided via two alarm icons, to distinguish between routine, maintenance type alarms and critical alarms. These alarm icons shall be displayed when user is working in other Windows programs. The BAS alarm display screen shall be displayed when the user clicks on the alarm icon.

3. Alarm Display shall list the alarms with highest priority at the top of the display. The alarm display shall provide selector buttons for display of the associated point graphic and message.

4. Alarm messages shall be customizable for each point to display detailed instruction to the user regarding actions to take in the event of an alarm.

E. Workstation Communications:

1. Provide automatic dial-up communications for buildings as specified. Automatic dial-up communications shall include the following features as a minimum:

a. Dial-Out:

1. Manual dial-out from the workstation to remote networks shall be accomplishable using only a mouse to select and request the desired remote connection.

b. Dial-In:

1. Alarms shall automatically dial into the workstation for display at the terminal and for hard copy printout at the associated event printer.

2. Alarms shall, at the operator's option, dial into a stand-alone modem-printer to provide for real-time alarm printouts even when the workstation is off-line (such as when it is being used to run operator-selected 3rd party software).

3. Trend data shall be scheduled for automatic updating to the workstation at operator-selected times. The operator shall also have the option of manually collecting trend data at any time.

2.10 FIELD DEVICES:

A. All devices and equipment shall be approved for installation by the Mechanical Consulting Engineer.

B. Temperature Sensors - with accuracy of + .5 F @ 77 degrees F.

1. Digital room sensors shall have LCD display, day/night override button, and setpoint slide adjustment override options. The setpoint slide adjustment can be software limited by the automation system to limit the amount of room adjustment. Mount at 54 " aff as indicated.

C. Humidity Sensors - with accuracy of + 2% RH @ 77 deg. F. including hysteresis, linearity, and repeatability.

D. CO2 Sensor – With Tolerance 0-2000 PPM □ 100 PPM

E. Pressure Sensors - Setra

F. Dampers sized for specific application.

G. Damper Operators, sized for specific application.

H. Automatic Control Valves, sized for specific application.

I. Air Volume Measurement (accurate down to 100 ft./min.).

J. Smoke Detectors - BRK 120 V ionization duct type.

K. Firestats - for applications less than 2000 CFM.

L. Low Temperature Detection Stat.

M. Electric Thermostats.

N. Differential Pressure Switch.

O. Switch package for remote monitoring of blade position for fire and smoke detectors by the BAS.

2.11 DAMPER OPERATORS:

A. All damper operators shall be electric and shall be two-position or proportional as indicated. They shall be furnished in sufficient numbers and with sufficient power to insure satisfactory operation of the damper to provide tight close off. They shall be spring return type to return the damper to the normal positions indicated. Mark full open and full closed positions of all dampers. Marks shall be made with Bakelite nameplates, attached to ductwork.

2.12 VALVES:

A. All control valves shall have equal percentage modulating plugs to insure modulation of flow under varying loads. Valves shall be provided with proportioning operators of sufficient power to insure modulation and tight closing at pump shut off head. Valves shall be spring returned to either open or closed position in the event of failure as indicated in the description of operation. Valves 2" and smaller have brass bodies and screwed ends, 2-1/2" and larger shall have iron bodies and flanged ends. Maximum pressure drop for control valves is 5 psi.

2.13 VARIABLE FREQUENCY DRIVES:

A. Variable frequency drives shall be provided for each secondary chilled water pump. Drives shall be provided with optional three contactor, key operated drive-off-bypass selector switch to bypass drive in event of drive failure. Drives shall be as manufactured by Siemens or Danfoss and equipped with a Seimens FLN driver. Secondary chilled water pumps shall maintain chilled water loop pressure by means of a remote pressure sensor. Loop flow rate shall be monitored by a flow station.

PART THREE - EXECUTION:

3.01 PROJECT MANAGEMENT:

A. Provide a designated project manager who will be responsible for the following:

- Construct and maintain project schedule
- On-site coordination with all applicable trades and subcontractors
- Authorized to accept and execute orders or instructions from Owner/Architect
- Attend project meetings as necessary to avoid conflicts and delays
- Make necessary field decisions relating to this scope of work
- Coordination/single point of contact.

B. The Contractor shall collaborate with the Owner directly to determine the Owner's preference for naming conventions, etc. before entering the data in to the system.

3.02 START-UP AND COMMISSIONING:

A. When installation of the system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line. All testing, calibrating, adjusting and final field tests shall be completed by the manufacturer. Verify that all systems are operable from local controls in the specified failure mode upon panel failure or loss of power.

B. Provide any recommendation for system modification in writing to Owner. Do not make any system modification, including operating parameters and control settings, without prior approval of Owner.

3.03 TRAINING:

A. The manufacturer shall provide factory trained instructor to give full instruction to designated personnel in the operation of the system installed. Instructors shall be

thoroughly familiar with all aspects of the subject matter they are to teach. The manufacturer shall provide all students with a student binder containing product specific training modules for the system installed. All training shall be held during normal working hours of 8:00 A.M. to 4:30 P.M. weekdays.

B. Provide 40 hours of training for Owner's designated operating personnel. Training shall include:

- Explanation of drawings, operations and maintenance manuals
- Walk-through of the job to locate control components
- Operator workstation and peripherals
- DDC Controller and ASC operation/function
- Operator control functions including graphic generation and field panel programming
- Operation of portable operator's terminal
- Explanation of adjustment, calibration and replacement procedures
- Student binder with training modules.

C. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Manufacturer. If such training is required by the Owner, it will be contracted at a later date.

3.04 SEQUENCE OF OPERATION:

A. Chilled Water Pumps and Chillers / Hot Water Pumps and Boilers:

1. See Plans for Chilled and Hot water sequences..

B. VAV Air Handling Units:

1. Each air handling unit shall be optimally started and stopped by the BAS according to its occupied and unoccupied schedule. The AHU smoke dampers shall open, and then the supply fan shall ramp up to its cooling airflow (CFM).

2. During unoccupied hours and morning start up operation, the motorized outside air damper shall remain closed. When in occupied operation, the outside air damper shall modulate to maintain its minimum required outside airflow (CFM) as measured by a duct airflow station.

3. A duct static pressure transmitter shall be located at two-thirds the distance down the longest duct run, and shall allow the BAS to operate the supply fan inlet vanes in order to maintain the duct static pressure setpoint. A duct static pressure high limit switch shall shut down the air handling unit and alarm the BAS if its setpoint is exceeded.

4. The air handling unit supply air temperature shall be controlled to maintain its setpoint by modulating the chilled water valve.

5. AHU duct smoke detectors shall be provided and installed under this section of the Specifications. Wiring of the AHU duct smoke detectors to the fire alarm system shall be accomplished by Division 26. Interlock wiring for shutdown of the air handling units from the AHU duct smoke detectors shall be accomplished under this section of the Specifications. The AHU duct smoke detectors will alarm the BAS in the event that products of combustion are detected.

6. The AHU will be provided with a filter status airflow switch across the AHU filter bank which will alarm the BAS when the airflow pressure drop exceeds its setpoint.

C. Blower Coil and Air Handling Units:

1. See plans for sequences.

D. Exhaust Fans and Water Heaters:

1. The exhaust fans and water heaters shall be controlled as indicated on the equipment schedule by thermostat, wall switch, or the BAS. Exhaust fans in gang toilets shall be controlled by the BAS.

F. Ventilation Air Units:

1. An Electronic Thermostat Module (ETM) shall be provided for each unit. The ETM shall enable the unit for operation according to its individual occupied/unoccupied schedule. The ETM shall control the stages of cooling to maintain the space temperature and humidity setpoints.

2. Controls Contractor shall provide space humidity sensors as required.

3. During Occupied Mode the ventilation air units shall provide dehumidified air to each classroom as scheduled on the plans. See VAV – VAU Sequence of Operations.

4. During the Unoccupied Mode, the ETM may be reset to the Occupied Mode for an operator determined time period. The reset shall be activated by a signal from a local override switch on the room temperature sensor or by command from the operator's terminal. At the end of the operator determined time period, the ETM shall return to the Unoccupied Mode. During unoccupied mode, the VAU shall shut down in recirculation mode.

5. Programming of unit shall be as recommended by manufacturer.

3.05 MISCELLANEOUS:

A. Refer to the points list and plans for other monitoring and control points which are to be included, but are not covered in the Sequence of Operation.

B. The BAS Supplier shall provide to the Owner a complete set of text based software with appropriate licensing for this system for installation on three existing laptop computers provided by the Owner.

INPUT/OUTPUT POINTS LIST SUMMARY

CHILLED AND HOT WATER SYSTEM

(*Denotes on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points. These are located within the building controller cabinet. (See Specification Section 2.04 F.)

Point Description:	AI	AO	DI	DO
Primary CW/HW Pump Start/Stop and Status (typ. of 2)			X	X*
Secondary CW/HW Pump Start/Stop and Status (typ. of 2)			X	X*
Chiller Start/Stop and Status Including Counter (typ. of 2)				X*
CHW/hw Entering Temperature (typ. of 2)	X			
CHW/HW Leaving Temperature (typ. of 2)	X			
CHW/HW Setpoint Adjust (typ. of 2)		X		
Chiller/Boiler Alarm Contact (typ. of 2)				X
Chiller Run Time Meter (2)	X			
Chiller KWH Meter (2)	X			
Temperature Points	X			

INPUT/OUTPUT POINTS LIST SUMMARY

VAV AIR HANDLING UNITS (typical for each)

(* Denotes on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points. These are located within the building controller cabinet. See Section 2.04 F.)

Point Description:	AI	AO	DI	DO
Supply Fan Status			X	
Supply Fan Start/Stop (with HOA switch on controller)				X*
Smoke Damper Open/Close				X
Supply Fan VFD Control		X		
Supply Air Duct Temperature	X			
Supply Air Duct Static High Static	X		 X	
Duct Smoke Detector(s)			X	
Mixed Air Duct Temperature	X			
Filter Alarm			X	
Chilled/Hot Water Valve Control		X		
OA/RA Air Damper Control		X		
Outside Air Flow Station	X			
C02 (As applicable)	X			

INPUT/OUTPUT POINTS LIST SUMMARY
TYPICAL FOR ALL VAV BOXES

Point Description:	AI	AO	DI	DO
CFM	X			
Room Temperature or C02 Sensor	X			
Room Setpoint Adjustment	X			
Override Button			X	
Damper Control		X		
Electric Reheat				X

INPUT/OUTPUT POINTS LIST SUMMARY

VENTILATION AIR UNIT (TYPICAL OF EACH)

Point Description:	AI	AO	DI	DO
Supply Fan Start/Stop				X
Exhaust Fan Start/Stop				X
Supply VFD		X		
Exhaust VFD		X		
Supply Air Duct Static	X			
Outside Air Temperature	X			
Supply T-Initial	X			
Supply T-Coil	X			
Supply T-Final	X			
Exhaust Air Temperature	X			
Supply Air Temperature Setpoint Adjust		X		
Supply Air Humidity	X			
Supply Air Humidity Setpoint Adjust		X		
Building Static	X			
Exhaust Airflow Station	X			
Supply Airflow Station	X			
Duct Smoke Detectors			X	
Filter Alarm			X	
Chilled/Hot Water Valve		X		
Modulating Dampers		X		

INPUT/OUTPUT POINTS LIST SUMMARY

MISCELLANEOUS

Point Description:	AI	AO	DI	DO

Outside Air Temperature	X	
Outside Air R.H.	X	
Building KW Pulsemeter (provided by BAS Contractor)		X

See plans for additional control points for equipment and control sequences.

END OF SECTION 239140

SECTION 239950 - TESTING AND BALANCING AIR AND WATER SYSTEMS

PART ONE - GENERAL:

1.01 SCOPE:

A. The commissioning agent shall employ an independent testing and balancing firm specializing in total system testing and balancing. The balancing firm shall be a member of the Associated Air Balance Council (AABC). The balancing firm shall provide all labor, equipment, engineering and test equipment required to test, adjust, and balance all heating, ventilating, air-conditioning, and exhaust systems as hereinafter specified.

B. Approved Testing and Balancing Firms are:

1. TAB Services, Inc. – Atlanta, GA
2. Phoenix Agency, Inc. - Winston-Salem, NC

PART TWO - PRODUCTS AND EXECUTION:

2.01 The balancing contract shall incorporate the following:

A. Adjust and balance the complete mechanical system.

B. Upon completion of the air handling systems, the Contractor shall have the balancing firm perform the following tests and compile the following information of each item of equipment and submit four bound copies of this information to the Architect for approval.

2.02 All medium pressure ducts shall be duct air leak tested with less than 5% leakage prior to insulation.

2.03 All test equipment will be furnished by the Balancing Contractor and will remain his property. All instruments will have been calibrated within the last month.

2.04 The Balancing Firm will warrant solely that the system will be set to within 10% of the values as established by the plans and specifications and also adjust to minimize drafts in all areas.

2.05 Any changes that are required for the final balancing results as determined by the Balancing Contractor will be provided by the respective Contractors who are to supply and install such equipment under their contractual obligations. Such changes may encompass, but not necessarily restricted to, the changing of pulleys, belts, dampers, or adding dampers or access panels.

2.06 BALANCING PROCEDURE (AIR):

A. Before starting air balance, check the following items:

1. Check air filters to be sure they are clean and in position.
2. Check for proper belt tension and alignment.
3. Check fan and motor lubrication.
4. Check motor overload protectors or heaters for proper size.
5. Check for proper rotation.

B. Measure supply air volumes by means of the duct traverse method, taking a minimum of sixteen (16) readings. Seal duct access holes with metal snap-in-plugs. The use of duct tape to seal access holes will not be permitted.

C. Adjust balancing dampers for required branch duct air quantities. Dampers shall be permanently marked after air balance is complete.

D. Adjust grilles and diffusers to within 10% of individual requirements specified, and also adjust so as to minimize drafts in all areas.

E. The total air delivery in any particular fan system shall be obtained by adjustment of the particular fan speed.

F. The drive motor of each fan shall not be loaded over the corrected full load amperage rating of the motor involved.

G. All duct systems are to be balanced for lowest static pressure and lowest fan speed possible to deliver required air quantity.

H. Unless otherwise noted, adjust quantity of return air from space to pass 90% of air supplied to space.

I. Where splitter and volume dampers have been provided for balancing of air in ducts, balancing shall be done with register and diffuser volume dampers as fully open as possible.

J. Do not operate fans during times when construction process or cleaning would allow dirt or rubbish to accumulate in the system.

2.07 BALANCING PROCEDURE (WATER):

A. Flow stations are provided where indicated on the drawings.

B. Open all shut-off and balancing valves.

C. Balance secondary system to design flow in each circuit using balancing valve in the return lines at systems water circulating pumps.

D. The Contractor shall balance the primary water system by adjusting the balancing valves to achieve the specified GPM flow through the system.

E. The Contractor shall include in this contract the trimming of all pump impellers on project as required by ASHRAE 90.1, or as deemed necessary by Engineer/Owner.

2.08 CERTIFICATION:

Furnish to the Architect/Engineer two copies of the following data, signed by an authorized representative of the balancing firm who is a Registered Professional Engineer:

A. Air System Data:

1. Room

2. Supply or Return Size

3. Design CFM

4. Measured CFM

5. Percent of Design CFM

6. Equipment: (Air handling units and exhaust fans)

a. Installation Data:

1 - Manufacturer and model
2 - Size
3 - Arrangement, discharge, and class
4 - Motor HP, voltage, phase, cycle, and full load amps
5 - Location and local identification data

7. Design Data: (Data listed in schedules on drawings and specifications)

a. Recorded (test) Data:

1 - CFM
2 - Static pressure
3 - RPM
4 - Motor operating amps
5 - Motor operating B.H.P.

B. Water System Data:

1. Pumps:

a. Installation Data:

1 - Manufacturer and model

2 - Size
3 - Type drive
4 - Motor, HP, voltage, phase, and full load amps

b. Design Data:

1 - GPM
2 - Head
3 - RPM
4 - BHP and amps

c. Recorded Data:

1 - Discharge pressures
2 - Suction pressures
3 - Operating head
4 - Operating GPM
5 - No-load amps
6 - Full flow amps
7 - No-flow amps

2. Air Heating and Cooling Equipment:

a. Design Data:

1 - Load in BTUH or MBh
2 - CFM
3 - Entering and leaving water temperatures
4 - Entering and leaving air conditions (D.B. and W.B.)
5 - GPM
6 - Water pressure drop

b. Recorded Data:

1 - Load in BTUH or MBh
2 - CFM
3 - Entering and leaving water temperatures
4 - Entering and leaving air conditions (D.B. and W.B.)
5 - GPM
6 - Water pressure drop

2.09 FINAL AIR BALANCE:

A. Perform final air balance after building is occupied. On final air balance adjust air quantities as required to maintain space temperatures in building at design conditions plus or minus 2 degrees F. Submit data sheets on recorded temperatures. Indicate time of day and outdoor temperature on data sheets.

B. A preliminary Test and Balance Report shall be issued to the Mechanical Contractor and Engineer prior to the issuance of the final Testing and Balancing Report outlining all deficiencies in the installed system. These listed deficiencies shall be corrected and/or resolved prior to finalizing the Test and Balance Report.

END OF SECTION 239950