SPECIFICATIONS

STEAM Building
San Rafael High School

150 Third Street
San Rafael, California 94901

SAN RAFAEL CITY SCHOOLS
Bond Program
Building for Student Success

HIBSER YAMAUCHI Architects, Inc.

300 27th Street | Oakland, CA 94612
Phone: (510) 446-2222 | Fax: (510) 446-2211

September 15, 2020

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CONCRETE FORMING AND ACCESSORIES

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: All labor, materials and equipment and all operations required to complete all formwork as indicated on the drawings; to produce shapes and configurations as shown, as required; and as specified herein, including:

1. Forms, shores, bracing, removal and other operations as necessary for all cast-in-place concrete and masonry placed.

2. Setting and securing anchor bolts and other metal items embedded in concrete into formwork, using materials and layouts furnished and delivered to jobsite as specified under other sections.

B. Related Sections:

1. Pertinent Sections of Division 03 specifying concrete construction.

2. Pertinent Sections of other Divisions specifying work to be embedded in concrete or work penetrating concrete foundations and formwork.

1.2 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 19A Concrete.

B. American Concrete Institute (ACI) 347 "Recommended Practice for Concrete Formwork".

C. American Plywood Association (APA) “Concrete Forming Guide”.

D. West Coast Lumberman Inspection Bureau (WCLIB) “Standard Grading Rules for West Coast Lumber”.

E. ACI SP-066 “ACI Detailing Manual”.

F. ACI 301 “Specifications for Structural Concrete”.

G. Concrete Reinforcing Steel Institute (CRSI) “Manual of Standard Practice”.

1.3 DESIGN REQUIREMENTS

A. Design, engineer, and construct formwork, shoring and bracing to conform to design and code requirements, resist imposed loads; resultant concrete to conform to required shape, line and dimension.

1.4 SUBMITTALS

A. Limitation of review: Structural Engineer's review will be required only where specifically requested for general architectural applications and features only. Contractor is responsible for structural stability, load-resisting characteristics and sufficiency of form work design.

1.5 QUALITY ASSURANCE

A. General: All form materials shall be new at start of work. Produce high quality concrete construction. Minimize defects due to joints, deflection of forms, roughness of forms, nonconforming materials, concrete or workmanship.

B. Reuse of Forms: Plywood forms may be reused, if thoroughly cleaned of all dirt, mortar, and foreign materials, and undamaged at edges and contact face. Reuse shall be subject to permission from the Architect without exception, and issued in writing. Reuse of any panel which will produce a blemish on exposed concrete, will not be permitted.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Form Materials:

1. Non-Exposed Surface Formwork Facing: Forms for concrete which is not exposed to view, may be of plywood as specified for exposed surfaces, or square edge 1x nominal Douglas Fir, Construction Grade, S4S.

2. Exposed Surface Formwork Facing:
   a. Forms for all exterior and interior concrete flat surfaces unless otherwise specified as board formed shall be new Douglas Fir Plywood (APA) ply, 5/8-inch, B-B Plyform, Class 1, Exterior Type, oiled and edged and edge-sealed conforming to U.S. Product Standard PS 1 in large sheet sizes to achieve joint patterns shown.
   b. All exposed concrete edges shall be chamfered 3/4" minimum or as noted on the drawings.

3. Exposed Surface Formwork - Special Pattern Form Liner:
   a. Forms for all exterior and interior concrete flat surfaces indicated shall be as designated by Architect.

B. Earth Forms: Allowed, subject to soil standing in excavations without ravel or caving.

C. Form Release Agent: Spray-on compound, not affecting color, bond or subsequent treatment of concrete surfaces. Maximum VOC content shall comply with local requirements and California Green Building Code.

D. Accessories: Types recommended by manufacturers or referenced standards to suit conditions indicated;

1. Anchors, spacers, void in-fill materials: sized to resist imposed loads.

2. Form Ties: Prefabricated rod, flat band, or wire snap ties with 1" break-back or threaded internal disconnecting type with external holding devices of adequate bearing area. Ties shall permit tightening and spreading of forms and leave no metal closer than 1" to surface.

E. Corner Chamfers and Rustications: Filleted, wood strip or foam type; sizes and shapes as detailed, or 3/4 x 3/4 inch size minimum if not detailed; maximum possible lengths.

F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Inspect the substrate and the conditions under which concrete formwork is to be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected. Commencement of work indicates acceptance of substrates and conditions.

B. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.2 EARTH FORMS

A. If natural soil or compacted fill can be accurately cut and maintained, foundations and grade beams may be poured against earth without forming. Provide positive protection of trench top corners.

B. Maintain earth forms free of water and foreign materials.

3.3 ERECTION – FORMWORK

A. General: Construct formwork in accordance with calculations, and recommendations of Section 401 of ACI 347. Construct forms to the sizes, shapes, lines and dimensions shown, and as required to obtain accurate alignment, location, grades, level and plumb work in finished structure. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required. Use selected materials to obtain required finishes.

1. Construct cambers specified in concrete members and slabs in the formwork.

2. Schedule the work and notify other trades in ample time so that provisions for their work in the formwork can be made without delaying progress of the project. Install all sleeves, pipes, etc. for building services systems, or other work. Secure information about and provide for all openings, offsets, recessed nailing blocks, channel chases, anchors, ties, inserts, etc. in the formwork before concrete placement.
3. Deflection: Formwork and concrete with excessive deflection after concrete placement will be rejected. Excessive deflection is that which will produce visible and noticeable waves in the finished concrete.

4. Measure formwork for elevated structural slabs, columns, wall elevations points of maximum camber and submit in writing to the Architect/Engineer prior to placing concrete.

B. Formwork Construction: Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301. Uniform, substantial and sufficiently tight to prevent leakage of concrete paste, readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials. Tie, brace, shore, and support to insure stability against pressures from any source, without failure of any component part and without excessive deflection. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.

C. Provide all openings, offsets, inserts, anchorages, blocking, and other features of the work as shown or required. See INSERTS, EMBEDDED PARTS, AND OPENINGS for detailed requirements.

D. Warped, checked, or scuffed forms will be rejected.

E. Maintain membranes, reinforcing and other work free of damage; protect with plywood runway boards or other positive, durable means.

F. Align joints and make watertight. Keep form joints to a minimum.

G. Provide fillet and chamfer strips on external corners of exposed locations and as indicated to form patterns in finished work. Extend patterns around corners and into alcoves, on backs of columns and similar locations not otherwise shown.

1. Produce beveled, smooth, solid, unbroken lines, except as otherwise indicated to conform to patterns.

2. Form corners and chamfers with 3/4 inch x 3/4 inch strips, unless otherwise indicated, accurately formed and surfaced to produce uniformly straight lines and tight edge joints. Extend terminal edges to required limit and miter chamfer at changes in direction.

H. Unexposed corners may be formed either square or chamfered.

I. Ties and Spreaders: Arrange in a pattern acceptable to the Architect when exposed. Snap-ties may be used except at joints between pours where threaded internal disconnecting type shall be used.

J. Coordinate this section with other sections of work that require attachment of components to formwork.

K. Reglets and Rebates: Accurately locate, size, and form all reglets and rebates required to receive work of other trades, including flashing, frames, and equipment.

3.4 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not allow excess form coating material to accumulate in the forms or to come into contact with reinforcement or surfaces which will be bonded to fresh concrete.

D. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork will be rejected.

E. Leave no residue or stain on the face of the concrete, nor affect bonding of subsequent finishes or work specified in other sections.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

1. Provide openings in concrete formwork to accommodate work of other sections including those under separate contracts (if any). Size and location of openings, recesses and chases shall be in accordance with the section requiring such items. Accurately place and securely support items to be built into forms.

B. Construction Joints: Construct and locate generally as indicated on Drawings and only at locations approved by Structural Engineer, so as not to impair the strength of the structure. Form keys in all cold joints shown or required.

C. Locate and set in place items that will be cast directly into concrete.

D. Rough Hardware and Miscellaneous Metal: Set inserts, sleeves, bolts, anchors, angles, and other items to be embedded in concrete. Set embedded bolts and sleeves for equipment to template and approved shop drawings prepared by trades supplying equipment.

E. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

F. Wood Inserts and Nailers: Provide approved preservative-treated lumber. Set all required nailing blocks, grounds, and other inserts as required to produce results shown. Wood plugs shall not be used.

G. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

H. Piping: Do not embed piping in structural concrete unless locations specifically approved by Structural Engineer.

I. Conduit: Place conduit below slabs-on-grade and only as specifically detailed on structural drawings. Minimum clear distance between conduits shall be 3 diameters. Location shall be subject to Engineer's written approval and shall not impair the strength of the structure.

J. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

1. Provide openings for the introduction of vibrators at intervals necessary for proper placement.

2. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

K. Install Form Liner inserts in accordance with manufacturer's recommendations, to produce patterns and textures indicated.

L. Install waterstops in accordance with manufacturer's recommendations to provide continuous waterproof barrier.

3.6 FORM CLEANING

A. Clean forms as erection proceeds, remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

1. Remove all dirt, chips, sawdust, rubbish, water and foreign materials detrimental to concrete.

2. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

3.7 FOOTINGS

A. Verify elevations and provide final excavation required for footings prior to placing of concrete.

3.8 EQUIPMENT BASES

A. Form concrete bases for all mechanical and electrical equipment in accordance with approved shop details furnished by other sections.

B. Sizes and locations as indicated and as required to produce results shown.

C. Provide coved base for all equipment bases placed on concrete slabs.

3.9 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301.

3.10 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

B. Do not reuse wood formwork more than 2 times for concrete surfaces to be exposed to view. Do not patch formwork.

C. Clean and repair surfaces to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.

D. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets.

3.11 FORM REMOVAL

A. Do not loosen or remove forms before minimum curing period has elapsed without employment of appropriate alternate curing methods, approved by the Architect in writing.

B. Remove forms without damage to the concrete using means to ensure complete safety of the structure and without damage to exposed beams, columns, wall edges, chamfers and inserts. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Do not remove forms until the concrete has hardened sufficiently to permit safe removal and the concrete has attained sufficient strength to safely support imposed loads. The minimum elapsed time for removal of forms after concrete has been placed shall be as follows:

1. Columns and Walls: 7 days, provided members are not subjected to overhead loads.

2. Retaining Walls: 21 days minimum.

3. Footings: 7 days minimum. If backfilled immediately, side forms may be removed 24 hours after concrete is placed.

4. Beams, elevated slab, and similar overhead conditions: 28 days unless adequate shoring is provided.

D. Durations listed above are minimums and are subject to extension at the sole judgment of the Architect/Engineer.

E. Reshoring: Reshore members where and if required by Formwork Design Engineer.

F. Do not subject concrete to superimposed loads (structure or construction) until it has attained full specified design strength, nor for a period of at least 14 days after placing.

G. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

3.12 CLEANING

A. Remove excess material and debris associated with this work from the job site.

END OF SECTION

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Reinforcing steel work for all concrete and masonry work as indicated on the drawings and specified herein.

2. Coordinate this work with other work affected by these operations, such as forms, electrical work, mechanical work, structural steel, masonry and concrete.

B. Related Sections:

1. Pertinent Sections of Division 01 specifying Quality Control and Testing Laboratory services.

2. Pertinent Sections of Divisions 03 specifying concrete construction.

3. Pertinent Sections of Divisions 04 specifying masonry construction.

4. Pertinent Sections of other Divisions specifying work to be embedded in concrete or work penetrating concrete work.

1.2 REFERENCE STANDARDS

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC) Chapter 19A Concrete.

B. American Concrete Institute (ACI) 301 “Specifications for Structural Concrete for Buildings”.

C. ACI 318 “Building Code Requirements for Reinforced Concrete and Commentary”.

D. ACI SP-066 “ACI Detailing Manual”.

E. American Society for Testing and Materials (ASTM) A1064 “Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete”.

F. ASTM A615 “Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement”.

G. ASTM A706 “Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement”.

H. American Welding Society (AWS) D1.4 – “Structural Welding Code for Reinforcing Steel”.

I. Concrete Reinforcing Steel Institute (CRSI) “Manual of Standard Practice”.

1.3 SUBMITTALS

A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. Submit for review prior to fabrication.

B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer.

C. Shop Drawings: Show complete fabrication and placing details of all reinforcing steel. Comply with requirements of ACI SP-66. Include:

1. Bar sizes and schedules;

2. Shapes of bent bars, layout and spacing of bars, location of splices.

3. Stirrup spacing, arrangements and assemblies,

4. References to Contract Document detail numbers and designations.

5. Wall elevations corresponding to elevations shown in Contract Documents.

D. Product Data: Submit manufacturer's product data, specifications, location and installation instructions for proprietary materials and reinforcement accessories. Provide samples of these items upon request.

E. Certificates: Submit all certifications of physical and chemical properties of steel for each heat number as manufactured, including location of material in structure as specified below in Article titled QUALITY ASSURANCE. All materials supplied shall be tagged with heat numbers matching submitted Mill Test Report analyses.

F. Samples: Provide to the Owner's Testing laboratory as specified in Article SOURCE QUALITY CONTROL.

1.4 QUALITY ASSURANCE

A. Perform work of this Section in accordance with CRSI DA4, CRSI P1, ACI 301, and ACI 318.

B. Requirements of Regulatory Agencies, refer to pertinent Sections of Division 01 and CBC.

C. Certification and Identification of Materials and Uses: Provide Owner's Testing Agency with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in

sufficient time to allow inspection and all material identification/test information listed below.

1. Provide manufacturer's Mill Test Reports for all materials. Include chemical and physical properties of the material for each heat number manufactured. Tag all fabricated materials with heat number.

2. Provide letter certifying all materials supplied are from heat numbers covered by supplied mill certificates. Include in letter the physical location of each grade of reinforcing and/or heat number in the project (i.e. foundations, walls, etc.).

3. Unidentified Material Tests: Where identification of materials by heat number to mill tests cannot be made, Owner's Testing Agency shall test unidentified materials as described below.

D. Testing and Inspection: Tests and Inspections required by Independent Testing Agency are specified below in Articles SOURCE QUALITY CONTROL and FIELD QUALITY CONTROL. Duties and limitations of Independent Testing Agency, test costs and test reports in conformance with pertinent Sections of Division 01.

1.5 DELIVERY, STORAGE AND HANDLING

A. Comply with pertinent requirements of Division 01.

B. Deliver reinforcement to project site in bundles marked with durable tags indicating heat number, mill, bar size and length, proposed location in the structure and other information corresponding with markings shown on placement diagrams.

C. Handle and store materials above ground to prevent damage, contamination or accumulation of dirt or rust.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Reinforcing Steel: Deformed billet steel bars, ASTM A706 Grade 60 or ASTM A615 Grade 60.

1. Welded reinforcement shall be ASTM A706, or A615 meeting carbon requirements of AWS D1.4. Welding shall conform with AWS D1.4.

2. All reinforcement to be unfinished.

3. ASTM A615 reinforcement at special structural concrete walls, concrete coupling beams, and special concrete moment frames shall have maximum yield stress of 78,000 psi and the tensile strength shall be greater than 125% of the actual yield strength. Test ASTM A615 reinforcement for conformance to these criteria prior to fabrication and/or installation.

B. Welded Wire Reinforcement: ASTM A1064.

C. Tie Wire: No. 16 AWG or heavier, black annealed.

D. Concrete Blocks: On-grade conditions only, as required to support reinforcing bars in position.

E. Reinforcing Supports: Plastic or galvanized steel chairs, bolsters, bar supports, or spacers sized and shaped for adequate support of reinforcement and construction loads imposed during concrete placement, meeting ACI and CRSI standards.

1. For use over formwork: Galvanized wire bar type supports complying with CRSI recommendations. Provide plastic tips where exposed to view or weather after removal of formwork. Do not use wood, brick, or other unacceptable materials.

F. Reinforcement Splice Couplers: For use only where specified on drawings. Submit other locations proposed for use to Engineer for review. "L-Series Bar Lock" Coupler Systems for Splicing Reinforcement Bars, UES ER-0319, by Dayton-Superior Corporation.

2.2 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4), unless specifically shown otherwise. Details not specifically shown or indicated shall conform to SP-066 and specified codes and standards.

1. Accurately shop-fabricate to shapes, bends, sizes, gauges and lengths indicated or otherwise required.

2. Bend bars once only. Discard bars improperly bent due to fabricating or other errors and provide new material; do not re-bend or straighten unless specifically indicated. Rebending of reinforcement in the field is not allowed.

3. Do not bend reinforcement in a manner that will injure or weaken the material or the embedding concrete.

4. Do not heat reinforcement for bending. Heat-bent materials will be rejected.

B. Unacceptable materials: Reinforcement with any of the following defects will not be permitted in the work.

1. Bar lengths, depths and bends exceeding specified fabrication tolerances.

2. Bends or kinks not indicated on Drawings or final shop drawings.

3. Bars with reduced cross-section due to rusting or other cause.

C. Tag reinforcement with durable identification to facilitate sorting and placing.

D. Shop Fusion Welded Stirrup/Tie/Spiral Cages

1. Shop fusion welding of stirrup/tie/spiral cages is permitted to aid in fabrication and handling. The following requirements shall be met.
2. All reinforcing bars receiving weld shall be ASTM A706.
3. Longitudinal holding wires shall be ASTM A1064.
4. Shop welding shall be performed by machines under a continuous, controlled process.
5. Quality control tests shall be performed on shop-welded specimens and the test results shall be available, upon request, to the Architect/Engineer.
6. Tack welding of reinforcing steel is not permitted.
7. Welding of any type shall not occur at 90°, 135°, or 180° bends. Circular ties and spirals may be shop fusion welded outside of areas with 90°, 135°, or 180° hook bends.
8. Longitudinal bars shall not be welded to stirrups/ties/spirals.

2.3 SOURCE QUALITY CONTROL

A. The Testing Agency, as specified in the Article QUALITY ASSURANCE, will perform the following:

1. Sampling and Tests of Reinforcing Bars per CBC 1910A.2.
2. Material Testing:
   a. Identified Steel: When samples are taken from bundled steel identified by heat number, matched with accompanying mill analyses as delivered from the mill, Owner's Testing Agency will perform one tensile test and one bend test per each ten tons or fraction thereof for each required size of reinforcing steel.
   b. Unidentified Steel: When identification of materials by heat number matched to accompanying mill analyses cannot be made, perform one tensile test and one bend test per each two and one-half tons or fraction thereof for each required size of reinforcing steel. Tests of unidentified steel shall be performed by the Owner's Testing Agency and costs for these tests shall be paid by the Contractor by deductive change order.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Inspect the conditions under which concrete reinforcement is to be placed. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Coordinate with work of other sections to avoid conflicts or interference. Bring conflicts between reinforcement and other elements to Architect's attention. Resolve conflicts before concrete is placed.

C. Notify Architect, Structural Engineer, and Authority Having Jurisdiction for review of steel placement not less than 48 hours before placing concrete.

3.2 PLACEMENT

A. General: Comply with the specified codes and standards, and Concrete Reinforcing Steel Institute recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

B. Clean bars free of substances which are detrimental to bonding. Maintain reinforcement clean until embedded in concrete.

C. Place reinforcement to obtain the minimum coverages for concrete protection. Do not deviate from required position. Maintain required distance, spacing and clearance between bars, forms, and ground.

D. Location and Support: Provide metal chairs, runners, bolsters, spacers and hangers, as required.

E. Provide additional steel reinforcement as necessary or as directed, to act as spreaders or separators to maintain proper positioning.

F. Tying and Attachment: Securely tie at all intersections and supports with wire. Prevent dislocation or movement during placement of concrete. Direct twisted ends of wire ties away from exposed concrete surfaces.

G. Separate reinforcing from pipes or conduits with approved non-metallic separators. Do not use wood or steel form stakes or reinforcement used as stakes as support for reinforcement.

H. Accommodate placement of formed openings required by other sections.

I. Obstructions:

1. Where obstructions, block-outs, or penetrations (conduits, raceways, ductwork) prevent continuous placement of reinforcement as indicated, provide additional reinforcing as detailed and as directed by the Structural Engineer to supplement the indicated reinforcement around the obstruction.

2. Place additional trim bars, ties, stirrups, or other elements as detailed and as directed at all opening, sleeves, pipes or other penetrations through structural elements.

J. Welded Wire Reinforcement: Reinforce slabs with 6"x 6"-W1.4 x W1.4 welded wire reinforcement reinforcing, unless otherwise noted on drawings.

1. Provide flat sheets only, no rolls. Straighten, cut to required size, and lay out flat in place.

2. Securely wire-tie reinforcement to other reinforcement at frequent intervals.

3. Extend reinforcement over supporting beams and walls, and to within 1 inch of edge of slabs, construction joints, and expansion joints.

4. Support reinforcement in mid-depth of slab.

5. Lift reinforcement at intervals as slab concrete is placed, ensure proper embedment

3.3 REINFORCING SPACING AND COVERAGE

A. Spacing: Do not space bars closer than four (4) diameters of the largest of two adjacent bars, except at bar laps, which shall be placed such that a minimum of 2 bar diameters is clear between bars.

B. Where reinforcing in members is placed in two layers, the distance between layers shall not be less than four bar diameters of the largest bar and the bars in the upper layers shall be placed directly above those in the bottom layer, unless otherwise detailed or dimensioned.

C. Coverage of bars (including stirrups and columns ties) shall be as follows, unless otherwise shown:

1. Footings and Mat Foundation: 3 inches to any soil face, 2 inches to top.

2. Slabs (on grade): 2 inches to grade face, 1-1/2 inches to top face.

3. Slabs (elevated): 1-1/2 inches top and bottom.

4. Beam & Column: 1-1/2inches to form.

5. Walls: 1-1/2 inches clear to form and 2 inches clear to form at soil face.

3.4 DOWELS, SPLICES, OFFSETS AND BENDS

A. Provide standard reinforcement splices at splices, corners, and intersections by lapping ends, placing bars in contact, and tightly tying with wire at each end. Comply with details shown on structural drawings and requirements of ACI 318.

B. Provide minimum 1-1/2 inch clearance between sets of splices. Stagger splices in horizontal bars so that adjacent splices will be 4 feet apart.

C. Laps of welded wire reinforcement shall be at least two times the spacing of the members in the direction lapped but not less than twelve inches.

D. Splices of reinforcement shall not be made at points of maximum stress. Provide splice lengths as noted on the structural drawings, with sufficient lap to transfer the stress between bars by bond and shear.

E. Spacing:

1. Space bars minimum distance specified and all lapped bars 2 bar diameters (minimum) clear of the next bar.

2. Stagger splices of adjacent bars where possible and where required to maintain bar clearance.

3. Beam or slab top bars shall be spliced mid-span of column support and bottom bars spliced at column supports.

4. Request Architect/Engineer review prior to placement for all splices not shown on the drawings.

F. Reinforcement Couplers: Install at all locations indicated. Install couplers in accordance with manufacturer's recommendations.

3.5 WELDING

A. No reinforcing shall be welded unless specifically indicated. No reinforcing shall be welded without prior approval of the Structural Engineer and the Authority Having Jurisdiction.

B. Only when so approved for use as noted above, all welding shall conform to AWS D1.4, ACI 318 Section 26.6.4, and CBC 1903A.8 and the following;

1. All welding performed by certified welders.

2. All reinforcement requires preheat prior to welding. All preheat and welding shall be continuously inspected by the Testing Agency.

3.6 MISPLACED REINFORCEMENT

A. Notify Architect/Engineer immediately if reinforcing bars are known to be misplaced after concrete has been placed.

B. Perform no correction or cutting without specific direction. Do not bend or kink misplaced bars.

C. Correct misplaced reinforcing only as directed in writing by the Architect/Engineer. Bear all costs of redesign, new, or additional reinforcing required because of misplaced bars at Contractor's expense.

3.7 FIELD QUALITY CONTROL

A. The Testing Agency as specified in the Article QUALITY ASSURANCE, will inspect the work for conformance to contract documents before concrete placement.

1. Inspection: Provide inspection and verification of installed reinforcement. Confirm that the surface of the rebar is free of form release oil or other coatings.

2. Inspect all preheat and welding activities for steel reinforcement when these occur.

3. Exception: Non-structural patios, driveways, and sidewalks do not require special inspection.

3.8 CLEANING

A. Remove excess material and debris associated with this work from the job site.

END OF SECTION

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SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: Provide all labor, materials, equipment and services to complete all concrete work required, including, but not limited to, the following:

1. Foundations, beams, columns, elevated slabs, slabs-on-grade, walls, and retaining walls.

2. Installation of all bolts, inserts, sleeves, connections, etc. in the concrete.

3. Joint devices associated with concrete work.

4. Miscellaneous concrete elements, including, but not limited to: equipment pads, light pole bases, flagpole bases, thrust blocks, and manholes.

5. Concrete curing.

6. Coordination with other sections:
   a. Make all preparations and do all work necessary to receive or adjoin other work. Install all bolts and anchors, including those furnished by other sections, into formwork and provide all required blocking.
   b. Install all accessories embedded in the concrete and provide all holes, blockouts and similar provisions necessary for the work of other sections. Provide all patching or cutting made necessary by failure or delay in complying with this requirement at the Contractor's expense.
   c. Coordinate with other sections for the accurate location of embedded accessories.

B. Related Sections:

1. Pertinent Sections of Division 01 specifying Quality Control and Testing Laboratory services.

2. Pertinent Sections of Division 03 specifying concrete construction.

3. Pertinent Sections of other Divisions specifying work to be embedded in concrete or work penetrating concrete.

4. Pertinent sections of other Divisions specifying floor finishes and sealants applied to concrete substrates.

1.2 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC) Chapter 19A Concrete.

B. American Concrete Institute (ACI) 211.1 “Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete”; ACI 211.2 “Standard Practice for Selecting Proportions for Lightweight Concrete”.

C. ACI 301 “Specifications for Structural Concrete”.

D. ACI 302.1R “Guide for Concrete Floor and Slab Construction”.

E. ACI 304R “Guide for Measuring, Mixing, Transporting, and Placing Concrete”.

F. ACI 305R “Hot Weather Concreting”.

G. ACI 306R “Cold Weather Concreting”.

H. ACI 308 “Standard Practice for Curing Concrete”.

I. ACI 318 “Building Code Requirements for Reinforced Concrete and Commentary”.

1.3 SUBMITTALS

A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer. Submittals that do not meet these requirements will be returned for correction without review. Submit for review prior to fabrication.

B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents.

C. Product Data: Submit manufacturers' data on manufactured products and other concrete related materials such as bond breakers, cure/sealer, admixtures, etc. Demonstrate compliance with specified characteristics. Provide samples of items upon request. Submit material certificates for concrete aggregates and cementitious materials. Certificates shall show compliance to applicable ASTM’s, the CBC, and additional requirements stated herein.

D. Mix Designs: Submit Mix Designs for each structural concrete type required for work per requirements of articles CONCRETE MIXES and QUALITY ASSURANCE. Resubmit revised designs for review if original designs are adjusted or changed for any reason. Non-Structural mixes need not be submitted for review by Structural Engineer.

E. Shop Drawings: Proposed location of construction and cold joints. Proposed location of all slab construction/dowel joints, control joints, and blockouts.

F. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction for concrete accessories.

G. Batch Plant Certificates: Include with delivery of each load of concrete. Provide certificates to the Testing Agency and the Architect/Engineer as separate submittals. Concrete delivered to the site without such certificate shall be

rejected and returned to the plant. Each certificate shall include all information specified in Article SOURCE QUALITY CONTROL below.

H. Engineering Analysis: Prepared by a California-licensed Civil or Structural Engineer, justifying construction-imposed loads on slabs, beams, and walls which exceed those allowed by CBC for the specified use.

1. 2000 lbs maximum allowable construction load without analysis.

2. 10,000 lbs maximum allowable construction load with analysis.

I. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.4 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

B. Concrete construction verification and inspection to conform to CBC 1705A.3.

C. Common Sourcing: Provide each of the following materials from a single source for entire project.

1. Cement.

2. Fly ash.

3. Aggregate.

D. Follow recommendations of ACI 305R when concreting during hot weather. Follow recommendations of ACI 306R when concreting during cold weather.

E. Services by the Independent Testing Agency (includes "Special" Inspections) as specified in this Section and as follows:

1. Perform tests and inspections specified below in articles SOURCE QUALITY CONTROL and FIELD QUALITY CONTROL. Duties and limitations of Independent Testing Agency, test costs and reports to be in conformance with pertinent Sections of Division 01.

F. Contractor shall bear the entire cost of remediation, removal, and/or replacement of concrete determined defective or non-conforming, including Architect/Engineer fees for redesign.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Materials specified by brand name shall be delivered in unbroken packages bearing manufacturer's label and shall be brand specified or an approved equal.

B. Delivery, Handling and Storage of other materials shall conform to the applicable sections of the current editions of the various reference standards listed in this Section.

C. Protect materials from weather or other damage. Sort to prevent inclusion of foreign materials.

D. Specific Requirements:

1. Cement: Protect against dampness, contamination, and warehouse set. Store in weather tight enclosures.

2. Aggregates: Prevent excessive segregation, or contamination with other materials or other sizes of aggregates. Use only one supply source for each aggregate stock pile.

3. Admixtures:
   a. Store to prevent contamination, evaporation, or damage.
   b. Protect liquid admixtures from freezing and extreme temperature ranges.
   c. Agitate emulsions prior to use.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather (Freezing or near-freezing temperatures) per ACI 306R:

1. Heat concrete materials before mixing, as necessary to deposit concrete at a temperature of at least 50°F but not more than 90°F.

2. Do not place concrete during freezing, near-freezing weather, snow, rain or sleet unless protection from moisture and/or cold is provided.

3. Protect from freezing and maintain at a temperature of at least 50°F for not less than seven days after placing. Take special precautions to protect transit-mixed concrete.

4. No salts, chemical protection or admixture are permitted without written approval of Architect/Engineer.

5. Contractor shall maintain an air temperature log for the first 7 days after placement with entry intervals not to exceed 8 hours.

B. Hot Weather per ACI 305R:

1. Cool concrete materials before mixing, or add ice in lieu of mix water as necessary to deposit concrete at a temperature below 85°F.

2. Do not place concrete in hot/windy weather without Architect/ Engineer review of procedures.

3. Provide sunshades and/or wind breakers to protect concrete during finishing and immediate curing operations. Do not place concrete at air temperature exceeding 90°F.

4. Provide modified mix designs, adding retarders to improve initial set times and applying evaporation reducers during hot/windy weather for review by Independent Testing Agency prior to use.

1.7 MOCK-UP

A. Construct and erect mock-up panel for architectural concrete surfaces indicated to receive special treatment or finish, as result of formwork.

1. Panel Size: Sufficient to illustrate full range of treatment.

2. Number of Panels: 2.

3. Locate as indicated on drawings.

B. If requested by Architect / Engineer, cast concrete against mock-up panel. Obtain acceptance of resulting surface finish prior to erecting formwork.

C. Accepted mock-up panel is considered basis of quality for the finished work. Keep mock-up exposed to view for duration of concrete work.

D. Mock-up may remain as part of the Work.

1.8 SCHEDULING AND SEQUENCING

A. Organize the work and employ shop and field crew(s) of sufficient size to minimize inspections by the Testing Agency.

B. Provide schedule and sequence information to Testing Agency in writing upon request. Update information as work progresses.

PART 2 – PRODUCTS

2.1 FORMWORK

A. Comply with requirements of Section 03 10 00.

2.2 REINFORCEMENT

A. Comply with requirements of Section 03 20 00.

2.3 MATERIALS

A. General Requirements: All materials shall be new and best of their class or kind. All materials found defective, unsuitable, or not as specified, will be condemned and promptly removed from the premises.

B. Cementitious Materials:

1. Portland Cement: ASTM C150, Type II, low alkali.

2. Fly Ash (Pozzolan): ASTM C618, Class F.

C. Concrete Aggregates:

1. Coarse and Fine Aggregates: ASTM C33; Stone aggregate and sand. Specific source aggregate and/or sand or shrinkage characteristics as required for class of concrete specified.

2. Lightweight aggregate: ASTM C330 and C332.

3. Source shall remain constant throughout the duration of the job. The exact portions of the fine aggregates and coarse aggregates to be used in the mix shall be determined by the mix design.

4. Aggregates shall be tested for alkali reactivity per CBC section 1903A.5. Where test results exceed allowable limits, additional testing of mitigation procedures shall be provided, as outlined per CBC section 1903A.5.

D. Water: Potable, clean, from domestic source.

E. Admixtures: All admixtures shall be used in strict accordance with the manufacturer's recommendations. Admixtures containing calcium chlorides or other accelerators shall not be used without the approval of the Architect/Engineer and the Owner's Testing Laboratory.

1. Mid-Range Water Reducing Admixtures: ASTM C494 Type A, "MasterPolyHeed" (formerly “PolyHeed”) series by BASF, "WRDA" series by W.R. Grace, or equal.

2. High Range Water-Reducing Admixtures: ASTM C494 Type F, "MasterRheoBuild 1000" (formerly “RheoBuild 1000”) or “MasterGlenium” (formerly “Glenium”) series by BASF or equal.

3. Water Reducing Admixture and Retarder: ASTM C494 Type B or D, "MasterPozzolith" (formerly “Pozzolith”) series or “MasterSet DELVO” (formerly “DELVO”) series by BASF, "Plastiflow-R" by Nox-crete, or equal.

4. Air Entraining Admixtures: ASTM C260, product suit condition by BASF or equal.

5. Viscocity Modifiers: ASTM C494 Type S.

F. Slurry: Same proportion of cement to fine aggregates used in the regular concrete mix (i.e. only coarse aggregate omitted); well mixed with water to produce a thick consistency.

G. High Strength Grout: See section 05 12 00 or 05 11 00 for requirements.

H. Dry Pack: Dry pack (used only for cosmetic concrete repairs) shall consist of:

1. One part cement to 2-1/2 parts fine aggregate (screen out all materials retained on No.4 sieve), mixed with a minimum amount of water, added in small amounts.

2. Mix to consistency such that a ball of the mixture compressed in the hand will retain its shape, showing finger marks, but without showing any surface water.

2.4 ACCESSORIES

A. Bonding Agent: ASTM C881, Type II Grade 2 Class B or C. Do not allow epoxy to set before placing fresh concrete.

1. "MasterEmaco ADH 326" (formerly "Concresive Liquid LPL") by BASF;

2. "Rezi-Weld 1000" by W.R. Meadows.

B. Chemical Hardener: Fluorosilicate solution designed for densification of cured concrete slabs. "MasterKure HD 300 WB" (formerly "Lapidolith") by BASF, "LIQUI-HARD" W.R. Meadows Co, or equal.

C. Moisture-Retaining Cover: ASTM C171, type 1, one of the following;

1. Regular Curing Paper, Type I, reinforced waterproof: Fortifiber Corporation "Orange Label Sisalkraft", "Pabcotite" paper, or equal.

2. Polyethylene Film: ASTM D 2103, 4 mil thick, clear or white color.

3. White-burlap-polyethylene sheet, weighing not less than 10 oz/per linear yd.

D. Liquid Curing Compound: ASTM C 309, Type 1, Class B, clear or translucent, 25% minimum solids, water base acrylic cure/sealer which will not discolor concrete and compatible with bonding of finishes specified in related sections. W.R. Meadows Co. "Vocomp 25" or equal. Maximum VOC content shall comply with local requirements and California Green Building Code.

E. Under Slab Water Vapor Retarder: Vapor retarder sheet to be ASTM E1745 Class A; 15 mil, single ply extruded polyolefin; permeance no greater than 0.01 U.S. Perms per ASTM E154, ASTM E96 procedure B or ASTM F1249.

1. "Stego Wrap Vapor Barrier (15mil)" by Stego Industries LLC.

2. "Vaporguard" by Reef Industries.

3. Approved Equal.

F. Evaporation Reducer: "MasterKure ER 50" (formerly Confilm), by BASF.

G. Permeability Reducer: Use only where specifically referred to.

1. Admixture Type: Xypex Chemical Corporation "XYPEX Admix C-500". Dosage: 2-3% of cement content by weight; 15 lb/cu. yd. max. or BASF "MasterLife 300D" (formerly "Rheomac 300D"). Dosage: 2% of cement content by mass.

2. Surface-Applied Type: Xypex Chemical Corporation "XYPEX Concentrate. Brush application: 1.25-1.50lb/sq. yd., 5 parts powder to 2 parts water. BASF "MasterSeal 500" (formerly "Tegraproof"). Slurry coat: one part water to 2.25-2.5 parts powder by volume.

3. Approved equal.

2.5 JOINT DEVICES AND MATERIALS

A. Waterstops: Resilient type, meeting Corps of Engineers CRD-C 572. Consult manufacturer for appropriate product for specific use. Submit for review. Install per manufacturers recommendation. Provide W. R. Meadows “Seal Tight” PVC waterstop, Sika “Greenstreak” PVC waterstop, or approved equal.

B. Expansion Joint Filler: ASTM D1751, Nonextruding, resilient asphalt impregnated fiberboard or felt, 3/8 inch thick and 4 inches deep; tongue and groove profile.

1. Products: "Servicised Products", W.R. Meadows, Inc., "National Expansion Joint Company", "Celotex Corporation", or equal.

C. Joint Filler: ASTM D944, Compressible asphalt mastic with felt facers, 1/4 inch thick and 4 inches deep.

D. Sealant and Primer: As specified in Section 07 90 00.

E. Slab Joint Sealant: Compatible with floor finishes specified in related sections.

2.6 CONCRETE MIXES

A. General requirements for mix design and submittal of structural class concrete:

1. Provide Contractor submittals to Architect/Engineer not less than 15 days before placing concrete.

2. Contractor shall review mix designs and proposed placing requirements prior to submittal for compatibility to ensure that the concrete as designed can be placed in accordance with the drawings and specifications.

3. Changes or revisions require re-submittal: All variations to approved mix designs, including changing type and/or quantity of admixtures shall be resubmitted to the Architect/Engineer for review prior to use.

4. Mix design(s) for all structural classes of concrete to be prepared by qualified person experienced in mix design. Allow for time necessary to do trial batch testing when required.

5. Preparer to provide backup data and certify in writing that mix design meets:
   a. Requirements of the specifications for concrete durability and quality;
   b. Requirements of the California Building Code and ACI 318 Section 26.4, including break histories, trial batching test results, and/or a mix designed by a California Registered Civil Engineer per ACI 318 Section 26.4.3.1(b) and bearing the Engineer’s seal & signature.

6. Clearly note on mix designs with specified maximum WCR if design permits addition of water on site, or clearly identify in the mix design that no water is to be added on site.

7. Deviations: Clearly indicate proposed deviations, and provide written explanation explaining how the deviating mix design(s) will provide equivalent or better concrete product(s) than those specified.

8. Include adjustments to reviewed mix designs to account for weather conditions and similar factors.

B. Proportioning - General: The following provisions apply to all mix designs:

1. Proportion concrete mixes to produce concrete of required average strength (as defined by ACI 318 Section 19.2.1). Select slump, aggregate sizes, shrinkage, and consistency that will allow thorough compaction without excessive puddling, spading, or vibration, and without permitting the materials to segregate, or allow free water to collect on the surface.

2. Select aggregate size and type to produce dense, uniform concrete with low to moderate shrinkage, free from rock pockets, honeycomb and other irregularities.

3. Mix designs may include water reducing and retarding admixtures to meet or exceed minimum set times (time required to place and finish) and to minimize Water Cement Ratios (WCR). Minimum and maximum criteria presented in this section are guidelines and do not represent a specific mix design.

4. Cement Content: Minimum cement content indicates minimum sacks of cementitious material. Increasing cement content to increase early strengths or to achieve specified WCR while maintaining water content is discouraged in order to minimize effects of shrinkage.
   a. Substitution of fly ash for Portland cement on an equivalent weight basis up to 25% replacement is permitted, except at high early strength concrete. Replacement in excess of 25% is not permitted unless part of a specified mix design that has been submitted for review.
   b. Such substitution requests may be denied by the Engineer.

5. Water Content: Mix designs with a specified maximum Water Cement Ratio (WCR) may be designed with a lower WCR than specified in order to allow addition of water at the site.

6. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301 and this section.
   a. For trial mixtures method, employ independent testing agency acceptable to Architect/Engineer for preparing and reporting proposed mix designs.

7. Placement Options: Mix designs may, at the Contractor's option, be designed for either pump or conventional placement with aggregate size, slumps, etc. to be maintained as specified in this section.

C. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations and this section.

D. Proportioning Structural Light Weight Concrete: Comply with ACI 211.2 recommendations and this section. Maximum cured weight of light weight concrete shall be 120 pounds per cubic feet. General Contractor is responsible for coordinating and providing light weight concrete density to meet the required fire assembly rating of the Construction Documents at the concrete depths provided in the structural drawings. General Contractor to notify the Structural Engineer for review if light weight concrete of the required density for the specified fire assembly rating cannot be sourced.

E. Special mix design requirements for interior concrete floor slabs on grade:

1. Proportion concrete mixes per this specification, ACI 211.1, and the requirements below:

2. Fly Ash Type F, shall be substituted for cement on a 1 lb. per 1 lb. basis, with a minimum replacement of 25% and a maximum of 35%.

3. 200 lbs. of 3/8(-) aggregate shall be added to reduce total sand.

4. Reduce total sand to minimum practical.

5. Admixture dosage shall be per manufacturer's recommendations. Dosage may be increased for workability as long as set times are not excessive for placement and finishing.

F. Special mix design requirements for high volume fly ash concrete:

1. Proportion concrete mixes per this specification, ACI 211.1, and the requirements below:

2. Fly Ash Type F, shall be substituted for cement on a 1 lb. per 1 lb. basis, with a replacement of 50%.

3. Minimum strength at 28 days to be 2500 psi; minimum strength at 56 days to be 3000 psi.

4. Add 200-300 pounds 3/8" aggregate to replace portion of fine aggregate.

5. Admixture dosage shall be per manufacturer's recommendations. Dosage may be increased for workability as long as set times are not excessive for placement and finishing.

6. Concrete shall be wet cured per CONCRETE CURING.

G. Mix Design Minimum Requirements:

Concrete Class	Coarse Aggregate Size (Inches) & Fine Aggregate[3]	Maximum WCR or Maximum Nominal Slump & Tolerance (Inches)[1,2]	Minimum 28-Day Design Strength	Minimum Cement Sacks/per yd[4]
NON-STRUCTURAL				
1) Lean Concrete (use only where specified)	---	---	---	3.0
2) Slab on Grade Exterior (Walks & Patios)	1" x #4	4" ± 1"	2,500	4.5
STRUCTURAL				
3) Interior Slab on Grade[5]	1" x #4	WCR = .45	3,000	6.1
4) Foundation (including stem walls)	1" x #4	WCR = .53	3,000	5.0
5) Formed Cast Slab Above Grade	1" x #4	WCR = .46	4,000	6.0
6) Cast Slab Above Grade on Metal Deck	3/4" x #4	WCR = .53	3,000	5.0
7) Columns, Walls, Retaining Walls & Beams	1" x #4	WCR = .46	4,000	6.0
8) Drilled Pier	3/4" x #4	WCR = .53	3,000	5.0
9) Tilt-Up Concrete Wall Panels	1" x #4	WCR = .53	3,000	5.25
10) Light Weight Concrete	3/4" x #4 Expanded Shale	3" ± 1/2"	3,000	5.5
11) High Volume Fly Ash Concrete[6]	1" x #4	WCR = .45	See footnote 6	6.0

1. The tolerance is the maximum deviation allowable without rejection. The mix design shall be based on the nominal value specified and is without water reducing mixtures. Slump to be measured at the end of the hose.

2. The maximum water cement ratio (WCR) is limited at time of placement as noted. No water is to be added on site such that the specified WCR or maximum slump is exceeded without approval of the testing laboratory and the Architect/Engineer. Workability is to be achieved utilizing an acceptable mid-range to high range water reducing admixture.

3. Gradation of aggregate is per ACI 318 section 26.4.1.2 and ASTM C33.

4. Minimum cement content includes all cementitious materials.

5. See Article 2.6E for additional requirements at slabs on grade.

6. See article 2.6F for additional requirements at high volume fly ash concrete.

2.7 MIXING CONCRETE

A. Batch final proportions in accordance with approved mix designs. All adjustments to approved proportions, for whatever reason, shall be reviewed by the Architect/Engineer prior to use.

B. Batch and mix concrete in accordance with ASTM C94, at an established plant. Site mixed concrete will be rejected.

C. Provide batch and transit equipment adequate for the work. Operate as necessary to provide concrete complying with specified requirements.

D. Place mixed concrete in forms within 1-1/2 hours from the time of introduction of cement and water into mixer or 300 revolutions of the drum whichever comes first. Use of, re-mixing, and/or tempering mixed concrete older than 1 hour will not be permitted.

E. Do not add water at the site to concrete mixes with a maximum specified WCR unless the water content at batch time provides for a WCR less than specified and this provision, including the quantity of water which may be added at the site, is specifically noted on the mix design and certification by the mix preparer. See ASTM C94 for additional requirements.

2.8 SOURCE QUALITY CONTROL

A. Services by independent Testing Agency:

1. Where aggregate alkali reactivity testing (and, when applicable, mitigation testing) per the MATERIALS section is not available, the Testing Agency shall perform this testing to verify materials conformance to CBC section 1903A.5.

2. Batch Plant inspection at automated plants to occur at commencement of concrete work each day (first truck). Batch Plant inspection at non-automated plants and when accuracy is questionable shall be continuous. Additionally, water cement ratio (WCR) is to be verified where a WCR is specified herein. The computed WCR is to be written on the Batch Plant Certificate to be taken to the job site prior to the truck leaving the plant. See requirements of CBC 1705A.3.3.

3. Batch Plant Certificates: Obtain the weighmaster's Batch Plant Certificate at arrival of truck at the site. If no batch plant certificate is provided, recommend to the General Contractor that the truckload of concrete be rejected. So note in daily log, along with the location of the load of concrete in the structure if the load is not rejected. See requirements of CBC 1705A.3.3.
   a. Laboratory's inspector shall obtain for each transit mixer Batch Plant Certificates to verify mix design quantities and condition upon delivery to the site.
   b. Certificates to include: Date, time, ingredient quantities, water added at plant and on job, total mixer revolutions at time of placement, and time of departure.

c. Concrete with specified water cement ratio: Add no water on site unless mix design and batch records each show additional water may be added. See ASTM C94 for additional requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

B. Verify work of other sections is complete and tested as required before proceeding.

3.2 PREPARATION

A. Observation, Inspection and Testing:

1. Architect/Engineer: Notify not less than 2 working days before each concrete placement, for observation and review of reinforcing, forms, and other work prior to placement of concrete.

2. Testing Agency: Notify not less than 24 hours before each placement for inspection and testing.

B. Placement Records: Contractor shall maintain records of time, temperature and date of concrete placement including mix design and location in the structure. Retain records until completion of the contract. Make available for review by Testing Agency and Architect/Engineer.

C. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

D. Verify location, position and inclusion of all embedded and concealed items.

E. Verify installation of vapor retarder under interior slabs on grade, as specified in related section, is complete.

F. Cleaning and Preparation:

1. Remove loose dirt, mud, standing water, and foreign matter from excavations and cavities.

2. Close cleanout and inspection ports securely.

3. Thoroughly clean reinforcement and other embedded items free from loose rust and foreign matter. Maintain reinforcing securely in place. Do not place concrete on hot reinforcing.

4. Dampen form materials and substrates on which concrete is to be placed at least 1 hour in advance of placing concrete; repeat wetting as necessary to keep surfaces damp. Do not saturate. Do not place concrete on saturated material.

a. Thoroughly wet wood forms (except coated plywood), bottom and sides of trenches, adjacent concrete or masonry and reinforcement.
b. Concrete slabs on base rock, dampen rock.
c. Concrete slabs on vapor retarder, do not wet vapor retarder.

5. Verify that metal forms are clean and free of rust before applying release agent.

6. Thoroughly clean metal decking. Do not place concrete on wet deck surface.

7. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

G. Drill holes in existing concrete at locations where new concrete is doweled to existing work. Insert steel dowels and prepare connections as detailed.

H. Do not overcut at existing concrete work to remain. Contractor is responsible for repair/replacement of overcut concrete to the Owner's satisfaction.

3.3 PIPES AND CONDUITS IN CONCRETE

A. Slabs-on-Grade:

1. No pipe or conduit exceeding 1 inch outside diameter shall be embedded within the specified slab thickness except as specifically detailed.

2. Do not stack or abut pipes, maintain 3 inches minimum clearance.

B. Sleeving and Wrapping:

1. Foundations: Sleeve or wrap all individual pipe penetrations, minimum 1-1/2 inches clear to reinforcing all around.
a. Sleeves: PVC. Provide 1 inch minimum clear all around O.D. pipe to I.D sleeve, UNO at ends, fill void space with mastic or plastic bituminous cement.
b. Wrapped Vertical Pipes: Provide 1/8 inch nominal sheet foam with three wraps minimum, UNO.
c. Wrapped Horizontal Pipes: Provide 1/8 inch nominal sheet foam with eight wraps minimum, UNO.
d. Underground Fire Lines 4" and Larger: At sleeves provide 2 inch minimum clear all around O.D. pipe to I.D sleeve. At wrapped pipes, provide 1/8 inch nominal sheet foam with sixteen wraps minimum.

2. Slabs or Curbs: Wrap pipes as described above.

C. Space groups of pipes/conduits at least 3 sleeve diameters apart, do not interrupt specified concrete and reinforcement.

1. Provide block-outs as detailed when grouping of pipes/conduits in foundation or other structural member prevents spacing as described. Notify Architect/Engineer for review of any conditions not conforming to details.

2. Center pipe/conduit penetrations in the depth and/or thickness of foundations.

3. Maximum size of pipe/conduit penetrations shall not exceed the least dimension of concrete divided by 3.

D. Do not embed pipes/conduits in concrete slabs on metal deck.

E. Provide the following at pipes/conduits detailed to be embedded in a concrete beam, wall or column:

1. Place as near as possible to center of member with reinforcing as specified on each side.

2. Where reinforcing is located near or at center of member, place pipe or conduit 1 inch minimum clear from reinforcing and provide #3 at 12 inches on center perpendicular to the pipe/conduit. Reinforcing to extend 12 inches minimum past pipe/conduit each side.

3. Maintain ¾ inch clear minimum from added reinforcing to face of concrete where not exposed to weather and 1-1/2 inches clear where exposed to weather.

4. Space embedded items (groups of pipe/conduit, junction boxes or other elements) minimum 3 inches apart.

5. Provide reinforcing in walls, beams, columns as detailed for groups of pipe/conduit. Provide minimum replacement reinforcement of same size and number for interrupted or displaced reinforcement for the full height, length, width of the wall, beam, and/or column on each side of the "effective opening."

3.4 CONCRETE PLACEMENT

A. Transporting:

1. Provide clean, well-maintained equipment of sufficient quantity and capacity to execute the work and produce concrete of quality specified.

2. Handle and transport concrete from mixer to final deposit location as rapidly as practicable. Prevent separation or loss of ingredients.

B. Perform concrete placement by methods which will not puncture, damage or disturb vapor retarder membrane. Repair all damage to vapor retarder membrane before covering.

C. Placement - General: Placement, once started, shall be carried on as a continuous operation until section of approved size and shape is completed.

Provide construction joints as detailed on the drawings. Engineer's written approval required for all deviations.

1. Deposition:
   a. Deposit concrete to maintain an approximately horizontal plastic surface until the completion of the unit placement.
   b. Deposit as neatly as practicable in final position, minimize re-handling or flow.
   c. Do not drop concrete freely where reinforcing bars, embeds, or obstructions occur that may cause segregation. Provide spouts, elephant trunks, or other means to prevent segregation during placement.

2. Depth: Layered placement in columns and walls shall not exceed ten feet vertical depth.
   a. Place concrete in minimum 32 inch horizontal lifts.
   b. Schedule placement to ensure that concrete will not take initial set before placement of next lift.
   c. No horizontal cold joints are allowed in columns or walls.

3. Progress Cleaning: Remove all concrete spilled on forms or reinforcing steel in portions of structure not immediately concreted. Remove completely before concrete sets.

4. Interruptions: Shut down placement operations and dispose of all remaining mixed concrete and concrete in hoppers or mixers following all interruption in placement longer than 60 minutes.
   a. If such interruption occurs, provide new or relocate existing construction joints as directed by Engineer.
   b. Cut concrete back to the designated line, cleaning forms and reinforcing as herein specified.
   c. Prepare for resumption of placement as for new unit when reason for interruption is resolved.

D. Placement - Elevated Structural Systems: Place as noted for "General" above and as follows:

1. Metal Decking and Structural Steel Beam Systems that are not to be shored: Locate screed lines on primary structural members. Review proposed screed line locations and expected structural deflections with the Architect/Engineer prior to placement of concrete.

2. Place screed lines to match camber of primary girders made of material other than concrete. Locate screeds to provide the minimum specified thickness of concrete at all locations.

3. Compensate for deflection of intermediate structural members and decking by placement of additional concrete.

4. Adjust embedded items to compensate for camber and deflection. Maintain locations within specified tolerances.

E. Consolidation:

1. Consolidate all concrete thoroughly during placement with high-speed mechanical vibrators and other suitable tools. Perform manual spading and tamping to work around reinforcement, embedded fixtures, and into corners of formwork as required to obtain thorough compaction.
   a. Provide vibrators with sufficient amplitude for adequate consolidation.
   b. Use mechanical vibrators at each point of concrete placement.
   c. Keep additional spare vibrators, in addition to those required for use, at the site for standby service in case of equipment failure.

2. Consolidate each layer of concrete as placed.
   a. Insert vibrators vertically at points 18 to 30 inches apart; work into top area of previously placed layer to reconsolidate, slowly withdraw vibrator to surface.
   b. Avoid contact of vibrator heads with formwork surfaces.
   c. Systematically double back and reconsolidate wherever possible. Consolidate as required to provide concrete of maximum density with minimized honeycomb.

F. Unacceptable Materials:

1. Do not place concrete that has started to set or stiffen. Dispose of these materials.

2. Do not add water on site to concrete except as specified in the approved mix design, see PART 2 above.

G. Protection of installed work:

1. Do not introduce any foreign material into any specified drainage, piping or duct systems.

2. Contractor shall bear all costs of work required to repair or clean affected work as a result of failure to comply with this requirement.

3.5 CONCRETE JOINTS

A. Structural Joints (Construction/Cold Joints):

1. Locate joints only where shown, or as approved.

2. Review Required: Joints not indicated on the plans shall be located to meet the minimum requirements below, shall not impair the strength of the structure and shall be submitted to Architect/Engineer for review prior to placement of concrete.
   a. Indicate proposed location(s) of construction/cold/expansion joints on shop drawing submittals for review prior to placing concrete.

3. Clean and roughen all surfaces of previously placed concrete at construction joints by washing and sandblasting to expose aggregate to 1/4 inch amplitude.

4. Slabs-On-Grade: Maximum Length of continuous placement shall not exceed 60 feet without special review by the Architect/Engineer. Alternate or stagger placement sections.

5. Foundations, Beams, Elevated Slabs and Joists: Maximum Length of continuous placement shall not exceed 200 foot increments. Provide "keyed" shut-off locations made up with form boards. Extend reinforcing one lap length or more through shut-off.
   a. All reinforcement shall be continuous through construction/cold joint, lapping to adjacent reinforcing in future placement.
   b. Construction Joints in Elevated Slabs: Review all proposed locations with Architect/Engineer.
   c. Construction Joints in Slabs on Metal Decking: Review all proposed locations with Architect/Engineer. Do not locate closer than 24 inches to faces of girder or beam.

6. Horizontal Construction Joints: Place 2 inch slurry (specified concrete mix less coarse aggregate) at beginning of pour at the bottom of walls unless a prior review of a mock-up section demonstrates that segregation of aggregate will not occur.

B. Expansion/Construction Joints (Dowel Joints and Control Joints):

1. Interior and Exterior Slabs-on-Grade:
   a. Expansion/Construction Joints: Provide dowel joints or control joints at a maximum dimension (in feet) of three times the slab thickness (in inches) in each direction unless noted otherwise (15'-0" maximum). Install joints to match slab level and in straight lines. Locate joints at all reentrant corners including blockouts.
   b. Proportions: Install joints to divide slab into rectangular areas with long dimensions less than 1.5 times short dimension.

2. Exterior Concrete Slabs on Grade (walkways, patios):
   a. Expansion/ construction joints: Provide a 2 inch deep troweled groove or asphalt impregnated joint material embedded 50 percent of the slab depth at 12 feet on center, maximum.
   b. Proportions: Place no section with a length larger than two times width. Additionally, place joints at all inside corners and at all intersections with other work.

3. Elevated Structural Slabs: Locate construction joints as specifically indicated on the drawings. All additional proposed locations shall be reviewed by the Architect/Engineer prior to placement.

C. Joint Types:

1. Dowel Joint: A keyed joint with smooth dowels passing through to allow unrestricted movement due to contraction and expansion. Joints are as specified on the drawings.

2. Control Joint(s): Shrinkage crack control joints may be of the following types when shown on the drawings. Install joints in a straight line between end points with edges finished appropriate to type. Depth shall be 25% of the slab thickness, unless noted otherwise. Fill joints with sealant as shown on the drawings or as required by related sections.
   a. 1/4 inch wide troweled joint.
   b. Keyed joint: Only at locations where concealed by other finishes.
   c. Masonite Strip, 1/8 inch: Only at locations where concealed by other finishes.
   d. Saw Cut, 1/8 inch: Must be performed within eight hours of completion of finishing. Do not make saw cuts if aggregate separates from cement paste during cutting operation. Prevent marring of surface finish. Fill with flexible sealant.

3.6 VAPOR RETARDER

A. Vapor Retarder Installation: Install as specified in PART 2, ASTM E1643, and per manufacturer's recommendations including taping and lapping of seams, sealing of penetrations, and repair of damage. Do not extend vapor retarder below footings.

3.7 FLATWORK

A. General Requirements for All Concrete Formed & Finished Flat:

1. Edge Forms and Screeds: Set accurately to produce indicated design elevations and contours in the finished surface, edge forms sufficiently strong to support screed type proposed.

2. Jointing: Located and detailed as indicated.

3. Consolidation: Concrete in slabs shall be thoroughly consolidated.

B. Flatwork Schedule:

1. Exterior Slabs-On-Grade: Place concrete directly over sub-base as indicated.
   a. Sub-Base: Clean free-draining, crushed base rock, 6 inch minimum thickness, thoroughly compacted.

2. Interior Slabs-On-Grade:
   a. Sub-Base: Clean free-draining, crushed base rock, 6 inch minimum thickness, thoroughly compacted.
   b. Vapor Retarder: Install over sub-base.

3.8 FORMED SURFACES

A. Form all concrete members level and plumb, except as specifically indicated. Comply with tolerances specified in ACI 318 Section 26.11, ACI 301 Section 2, and this specification, except that maximum permissible deviation is 1/4 inch end-to-end for any single member.

B. Cambers: Provide all cambers indicated in the formwork construction. Set screeds to produce specified cambers in the finished concrete.

3.9 CONCRETE FINISHES

A. Flatwork Finishing:

1. All exposed concrete flatwork surfaces shall be non-slip. See Architectural, Civil, and Landscape drawings.

2. Perform with experienced operators.

3. Finish surfaces monolithically. Establish uniform slopes or level grades as indicated. Maintain full design thickness.

4. In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains as indicated on drawings.

5. Flatwork Finish Types:
   a. Wood Float Finish: Surfaces to receive quarry tile, ceramic tile, or cementitious terrazzo with full bed setting system, or wood frame for raised finished floors.
   b. Steel Trowel Finish: Surfaces to receive carpeting, resilient flooring, seamless flooring, thin set terrazzo, thin set tile or similar finishes specified in related sections. Trowel twice, minimum.
   c. Broom Texture Finish: Exterior surfaces as indicated or for which no other finish is indicated. Finish as for steel trowel finish, except immediately following first troweling, (depending on conditions of concrete and nature of finish required) provide uniform surfaces texture using a medium or coarse fiber broom.

B. Other Concrete: Provide as required to achieve appearance indicated on structural and architectural drawings and related sections.

1. Repair surface defects, including tie holes, immediately after removing formwork.

2. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.

3. Exposed Form Finish: Finish concrete to match forms. Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
   a. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
   b. Grout Cleaned Finish: Wet areas to be cleaned and apply grout mixture by brush or spray; scrub immediately to remove excess grout. After drying, rub vigorously with clean burlap, and keep moist for 36 hours.
   c. Cork Floated Finish: Immediately after form removal, apply grout with trowel or firm rubber float; compress grout with low-speed grinder, and apply final texture with cork float.

4. Intermediate joint and score marks and edges: Tool smooth and flush unless otherwise indicated or as directed by the Architect.

5. Use steel tools of standard patterns and as required to achieve details shown or specified. All exposed corners not specified to be chamfered shall have radiused edges.

3.10 TOLERANCES

A. Minimum Flatwork Tolerances: Measure flatness of slabs with in 48 hours after slab installation in accordance with ACI 302.1R and ASTM E1155 and to achieve the following FF and FL tolerances:

1. Exterior surfaces: 1/8 inch minimum per foot where sloped to drain. Level otherwise. FF20 and FL15.

2. Interior surfaces not otherwise shown or required: Level throughout. FF25 and FL20.

3. Interior surfaces required to be sloped for drainage: 1/8 inch in 10 ft.

4. Finish concrete to achieve the following tolerances:
   a. Under Glazed Tile on Setting Bed: FF30 and FL20.
   b. Under Resilient Finishes: FF35 and FL25.
   c. Flooring manufactureer and pertainent section of Division 9.

B. Formed Surface Tolerances:

1. Permanently Exposed Joints and Surfaces: Provide maximum differential height within two feet of, and across construction joints of 1/16 inch.

2. Vertical Elevations: Elevation of surfaces shall be as shown or approved.

3.11 SEPARATE FLOOR TOPPINGS

A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.

B. Place required dividers, edge strips, reinforcing, and other items to be cast in.

C. Apply bonding agent to substrate in accordance with manufacturer's instructions.

D. Apply sand and cement slurry coat on base course, immediately prior to placing toppings.

E. Place concrete floor toppings to required lines and levels. Place topping in checkerboard panels not to exceed 20 feet in either direction.

F. Screed toppings level, maintaining surface tolerances per above.

3.12 CONCRETE CURING

A. Curing, General: Cure in accordance with ACI 308. Maintain concrete water content for proper hydration and minimize temperature variations. Begin curing immediately following finishing.

B. Protection During Curing: Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury. The General Contractor is responsible for the protection of the finished slab from damage.

1. Avoid foot traffic on concrete for minimum of 24-hours after placement.

2. Protect concrete from sun and rain.

3. Maintain concrete temperature at or above 50 degrees F. during the first 7 days after placement. See Article ENVIRONMENTAL REQUIREMENTS.

4. Do not subject concrete to design loads until concrete is completely cured, and until concrete has attained its full specified 28-day compressive strength or until 21 days after placement, whichever is longer.

5. Protect concrete during and after curing from damage during subsequent building construction operations. See Article PROTECTION.

C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

1. Normal concrete: Not less than 7 days.

2. High early strength concrete: Not less than 4 days.

D. Begin curing immediately following finishing.

E. Surfaces Not in Contact with Forms:

1. Start initial curing as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than 3 days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.

2. Begin final curing after initial curing but before surface is dry.
   a. Moisture-retaining cover: Seal in place with waterproof tape or adhesive.
   b. Curing compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

3. In addition, see specific conditions noted below.

F. Slabs on Grade: Cure by one of the following methods:

1. Water Cure (Ponding): Maintain 100 percent coverage of water over floor slab areas, continuously for minimum 7 calendar days.

2. Spraying: Spray water over floor slab areas and maintain wet for 7 days.

3. Moisture-Retaining Film or Paper: Lap strips not less than 6 inches and seal with waterproof tape or adhesive; extend beyond slab or paving perimeters minimum 6 inches and secure at edges; maintain in place for minimum 7 days.

4. Absorptive Moisture-Retaining Covering: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides and extend beyond slab or paving perimeters 6 inches minimum; maintain in place for minimum 7 days.

5. Liquid Membrane-forming Curing Compound: Provide only when subsequent concrete treatments or finish flooring specified in related sections will not be affected by cure/sealer. Apply curing compound in accordance with manufacturer's instructions at the maximum recommended application rate in two coats, with second coat applied at right angles to first.

G. Elevated Slabs: Cure by one of the following methods.

1. Moisture-Retaining Sheet: As specified for Slabs on Grade above.

2. Water Cure: As specified above for minimum 14 days.

3. Apply Membrane Curing Compound as specified above after initial curing period.

H. Concrete on Metal Decking: Moisture-Retaining Sheet method as specified above.

I. Formed Concrete Members: Cure by moist curing with forms in place for full curing period.

1. Protect free-standing elements from temperature extremes.

2. Maintain forms tight for minimum 7 days. Maintain exposed surfaces continuously damp and completely covered by sheet materials thereafter.

3. Maintain all shoring in place. Refer to related sections specifying formwork.

4. Membrane Curing Compound: Apply compound in accordance with manufacturer's instructions in one coat.

J. Foundations: Apply curing compound immediately after floating.

3.13 CONCRETE HARDENER

A. Apply hardener to all floor slabs not receiving other finishes after 30 days minimum curing. Clean slabs of non-compatible cure/sealers or other foreign material(s) and apply in strict accordance with the manufacturer's directions.

3.14 GROUTING AND DRY PACK

A. Set steel plates on concrete or masonry with high strength grout bed, completely fill all voids; thoroughly compact in place. See Section 05 12 00 or 05 11 00.

B. Bolts or inserts dry packed or grouted in place shall cure for minimum 7 days before tensioning.

3.15 FIELD QUALITY CONTROL

A. Testing and Inspections by Independent Testing Agency: Provided verification and inspection of concrete per CBC Table 1705A.3. Provide written reports for to Engineer, Architect, Contractor and Building Official for the following tests and inspections:

B. Testing & Inspection: Provide periodic inspection of reinforcing steel. Provide continuous inspection during placement of structural class concrete, 3000 psi or more. Non-structural class concrete with a design strength of 2500 psi or less to have periodic inspection on a 150 cubic yard basis as required to assure conformance.

1. Provide periodic inspection of bolts in concrete prior to and during placement where so noted on the construction documents.

2. Structural Concrete Cylinder Tests: Perform in accordance with ASTM C31.
   a. Take four standard 6 inch x 12 inch (or five 4 inch x 8 inch) cylinder specimens on the site, of each class of concrete as specified in PART 2, not less than once a day or for each 50 cubic yards or 2000 sq ft or fraction thereof placed each day.
   b. Record the location of each concrete batch in the building in a log and also note on each specimen.
   c. Perform standard compression test of cylinders in accordance with ASTM C39, one at 7 days and two (three for 4x8 cylinders) at 28 days.
   d. Hold fourth (fifth) cylinder untested until specified concrete strengths are attained.

3. Structural Concrete Slump Test and Air Tests: Perform in accordance with ASTM D143 and C231 or C173 at the time of taking test cylinders, and/or at one-hour intervals during concrete placing.

4. Measure and record concrete temperature upon arrival of transit mixers and when taking specimens. Note weather conditions and temperature.

5. Propose adjustments to reviewed mix designs for Architect / Engineer review to account for variations in site or weather conditions, or other factors as appropriate.

6. Water Vapor Transmission Tests: Floors receiving floor finishes specified in related sections will be tested prior to installation of flooring systems. Refer to sections specifying floor finishes for related requirements.

C. Services by Contractor:

1. Rejection of Concrete Materials: Do not use the following without prior written approval of the Architect/Engineer;
   a. Materials without batch plant certificates.
   b. Materials not conforming to the requirements of these specifications.

3.16 ADJUSTING

A. Inspect all concrete surfaces immediately upon formwork removal. Notify Architect/Engineer of identified minor defects. Repair all minor defects as directed.

B. Surface and Finish Defects: Repair as directed by the Architect/Engineer, at no added expense to the Owner. Repairs include all necessary materials; reinforcement grouts, dry pack, admixtures, epoxy and aggregates to perform required repair.

1. Repair minor defective surface defects by use of drypack and surface grinding. Specific written approval of Architect/Engineer is required. Submit proposed patching mixture and methods for approval prior to commencing work.

2. Slabs-on-Grade, Elevated Slabs and on Slabs on Metal Deck: Review for "curled" slab edges and shrinkage cracks prior to installation of other floor finishes. Grind curled edges flush, fill cracks of 1/16 inch and greater with cementitious grout.

3. Grind high spots, fins or protrusions caused by formwork; Fill-in pour joints, voids, rock pockets, tie holes and other void not impairing structural strength. Provide surfaces flush with surrounding concrete.

3.17 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required compressive strength, lines, details, dimensions, tolerances, finishes or specified requirements; as determined by the Architect/Engineer.

B. Repair or replacement of defective concrete will be determined by the Architect/Engineer who may order additional testing and inspection at his option. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

C. Specific Defects:

1. "Low-Strength"; Concrete Not Meeting Specified Compressive Strength after 28 days:
   a. Concrete with less than 25% Fly Ash as cementitious material: Test remaining cylinder(s) at 56 days. If strength requirements are met, concrete strength is acceptable.
   b. Concrete with 25% or more Fly Ash as cementitious material: Test remaining cylinder(s) at 70 days. If strength requirements are met, concrete strength is acceptable.

2. Excessive Shrinkage, Cracking, Crazing or Curling; Defective Finish: Remove and replace if repair to acceptable condition is not feasible.

3. Lines, Details, Dimensions, Tolerances: Remove and replace if repair to acceptable condition is not feasible.

4. Slab sections not meeting specified tolerances for trueness/flatness or lines/levels: Remove and replace unless otherwise directed by the Architect/Engineer. Minimum area for removal: Fifteen square feet area unless directed otherwise by the Architect/Engineer.

5. Defective work affecting the strength of the structure or the appearance: Complete removal and replacement of defective concrete, as directed by the Architect/Engineer.

3.18 CLEANING

A. Maintain site free of debris and rubbish. Remove all materials and apparatus from the premises and streets at completion of work. Remove all drippings; leave the entire work clean and free of debris.

B. Slabs to Receive Floor Finishes Specified in other sections: Remove non-compatible cure/sealers or other foreign material(s) which may affect bonding of subsequent finishes. Leave in condition to receive work of related sections.

3.19 PROTECTION

A. Protect completed work from damage until project is complete and accepted by Owner.

B. Construction Loads: Submit engineering analysis for equipment loads (including all carried loads) specified in article submittals.

C. Keep finished areas free from all equipment traffic for a minimum of 4 additional days following attainment of design strength and completion of curing.

D. Protection of Drainage Systems:

1. Care shall be taken not to introduce any foreign material into any specified drainage, piping or duct system.

2. Cost of work to repair or clean drainage system as a result of failure to comply with this requirement will be back charged to the contractor.

E. Cover traffic areas with plywood sheets or other protective devices; maintain protection in place and in good repair for as long as necessary to protect against damage by subsequent construction operations.

END OF SECTION

SECTION 03 40 00
PRECAST CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The scope of work outlined in this Section includes the following items of work, as detailed in these Contract Specifications, as shown on the Contract Drawings or reasonably implied therefrom and is not limited to the following items:

1. Masonry Accessories, Admixtures, Caulk, Sealants, Pins, Mortar, and Grout

2. Precast Concrete Wall

3. Precast Concrete Seatpad

1.02 RELATED REQUIREMENTS

A. These Contract Specifications are part of the Contract Drawings and shall include all labor, materials, equipment, reasonable incidentals, and services necessary for the execution of the Work installed complete in place.

B. Refer to all other sections, determine the extent and character of related work, and coordinate all work to produce a complete, properly constructed product.

1.03 RELATED SECTIONS

A. Architectural Precast Association (APA).

B. ASTM

C. Section 09 96 33 Graffiti-Resistant Coatings

D. Section 32 13 16 Decorative Concrete

E. Concrete Tile Manufacturers Association Handbook for Concrete Tiles (CTMA)

F. Tile Council of North America Handbook for Ceramic, Glass, and Stone Tile Installation (TCNA)

1.04 SUBMITTALS

A. General: Refer to Section 01 33 00 – Submittals for Shop Drawings, Product Data, and Samples for submittal requirements and procedures.

B. Product Data: Submit product data for manufactured materials and products.

C. Shop Drawing

1. Show in-place location, fabrication details, plans, elevations, anchorages, reinforcement, connection details and methods, dimensions, finishes, relationships to adjacent materials, and erection and placement.

D. Manufacture to offer a minimum of 10 standard colors and 6 standard texture options. If custom color is desired, manufacture to provide square sample at no additional cost.

E. Samples: Nominal size 6 sq. by appropriate thickness, of each type of unit and finished facing shown and specified for approval of quality, color, and texture of surface finish. Submit prior to fabrication.

F. Mix Design(s): Propose concrete mix design for each type and color of concrete mix.

G. Test Reports: Compressive Strength. Supply 12 test results conforming to the required results of 7000 PSI.

H. Graffiti coatings to be applied by manufacturer that are in conformance with Section 09 96 33 – Graffiti-Resistant Coatings.

1.05 MOCKUP PANEL

A. Provide at the Project site an 18” high x 12” wide F.I.B.A.W 3’ length mock-up panel (front, top and one side) for Concrete Precast over a concrete wall.

B. Prepare laid-up panel using the selected Concrete Precast and mortar materials and showing the full range of colors expected in the finished Work, with finished corners at one end, demonstrating cuts and joints, complete with accessories for the Engineer’s evaluation.

C. Repeat mock-up until Engineer’s approval is obtained.

D. Protect approved mock-up, which will be used as a standard for the Project, until their removal is authorized.

1.06 QUALITY ASSURANCE

A. Fabricator’s Qualifications: Firm shall have a minimum of ten (10) years experience in producing units similar to those required for this Project, with sufficient production capacity to produce and deliver required units without causing delay in Work.

1. Fabricating plant shall be a certified plant and member of the Architectural Precast Association (APA). Plant subject to (2) two unannounced inspections per calendar year to confirm compliance with quality control

B. Fabricator shall have a minimum of ten (10) years experience casting electrical components and knockouts into product within allowed tolerances.

C. Installer Qualifications: Experience in performing work of this section, specializing in installation of work similar to that required for this project, employing workers who are

skilled in this area of work, and whose projects have a record of successful in-service performance.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver units to the Project site in such quantities and at such times to ensure continuity of installation.

B. Contractor shall be responsible for all protection, storage, offhaul, cranes, equipment and rentals required for the offhaul, installation and placement of all precast products.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approved Fabricators:

1. Quick Crete Products Corp. P.O. Box 639 Norco, CA 92860. (951)737-6240 (main office), (951) 737-7032 (fax) www.quickcrete.com

2. CDI. 3650 S Broadmont Drive, Tucson, AZ 85713, 520-624-6653

3. Tectura. PO Box 1520 Wausau, WI 54402, 707-507-9610

4. Architectural Facades Unlimited Inc, 600 E Luchessa Ave, Gilroy, CA. 95020

   408-846-5350

5. Outdoor Creations Inc., 2270 Barney Rd. Anderson, CA 96007. 530-365-6106

6. Universal Precast Concrete, PO Box 641296 San Jose, CA 95164, 408-799-888

7. Fabricators not listed as approved shall request approval. Approval request must be sent to the owner 30 days before bid opening. Request must include Contract Drawings, color samples, and an actual product for review by owner. Approved Fabricator must be able to produce all units within a 10-12 week lead-time.

2.02 ACCESSORIES

A. Backer rod

1. Closed Cell Foam compatible with cold applied Laticrete Latasil caulk.

B. Fiber Joint

1. Ceramar by WR Meadows

C. Sealant

1. Latricrete Latasil. Color to match precast concrete units

D. Inserts

1. Stainless Steel, type 304.

E. Mortar

1. Laticrete 254 Platinum

F. Masonry Epoxy

1. Laticrete Latipoxy

G. Graffiti Coatings on all Precast Concrete Walls shall be as specified within Section 09 96 33, Graffiti-Resistant Coatings

H. Grout

1. Sakrete Non-shrink construction grout

a. Non shrink, non-metallic, structural grout, 9000 psi, 28 days meeting ASTM C 1107

b. Color to match adjacent work.

I. Pins

1. 3/8 minimum Galvanized all thread.

J. Shims

1. Galvanized flat bar, 4x4 minimum dimensions, heights as required to level items.

K. Uncoupling Membrane

1. Laticrete Strata Mat

2.03 MATERIALS

A. Precast Concrete Materials:

1. Portland cement: ASTM C 150, Type III (gray), to achieve desired finish colors. Use only one brand, type, and color from the same mill.

2. Aggregates: ASTM C 33, gradation may differ to achieve desired finish characteristics. Select coarse and fine aggregate colors and screen sizes to match approved sample(s). Verify that adequate supply, from one pit or quarry, for each type of aggregate is available for the entire Project. If possible

obtain entire aggregate supply prior to starting Work, or have aggregate supply held in reserve by aggregate supplier.

3. Water: Potable. Clean, clear, and free from deleterious amounts of salts, acids, alkali's, organic materials, oils, detergents, or other matter that may interfere with color, curing, or strength of concrete.

4. Admixtures: Select to be compatible in specified mix.

   a. Air Entraining: ASTM C 260.

   b. Water Reducing: ASTM C 494, Type A, B, C, F. or G.

   c. Coloring Agent: ASTM C 979, compatible with other concrete materials.

B. Formwork:

1. Provide forms with acceptable form facing materials that are non-reactive with concrete or form release agents and will produce required finish surfaces.

2. Construct and maintain forms to produce precast concrete units of shapes, lines, and dimensions indicated, within specified tolerances.

C. Reinforcing Materials:

1. Reinforcing Bars: ASTM A 615, Grade 40

D. Connection Materials:

1. Bolts, washers, nuts to be zinc plated.

2.04 MIXES

A. Design mixes for each type of concrete specified may be prepared by an independent testing agency or by architectural precast manufacturing plant personnel at precast fabricator's option.

B. Proportion mixes by either testing agency trial batch or field test data methods in accordance with ACI 211.1, using materials to be used on the project, to provide normal weight concrete with properties as follows:

1. Compressive Strength: 7,000 PSI when tested in accordance with ASTM C 39.

2. Maximum water cement ratio 0.47 at point of placement.

3. Add air-entrainment admixture to result in air content at point of placement complying with ACI 533 requirements.

2.05 FABRICATION

A. General:

1. Fabricate precast concrete units with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances as specified in ACI 533, unless more stringent requirements are shown or specified.

2. Fabricate units straight, smooth and true to size and shape, with exposed edges and corners precise and square, unless otherwise indicated.

3. Walls must be made without any visible lift points.

B. Reinforcement: Comply with CRSI Manual of Standard Practice and ACI 318 recommendations. Reinforce architectural precast concrete units to resist handling, transportation stresses, and to comply with specified performance criteria.

C. Comply with ACI-533 requirements for measuring, mixing, transporting, and placing concrete.

D. Consolidate concrete using equipment and procedures complying with ACI 533.

E. Discard units that are warped, cracked, broken, spalled, stained, or otherwise defective unless repairs are approved by the Owner and meet specified requirements.

F. Fabrication Tolerances: Fabricate to tolerances listed in ACI-533.

2.06 FINISHES

A. Owner to choose a concrete color from one of MFR standard colors. Texture to be determined from mfr. standard textures. Sealer to be applied to all products.

1. Surface finish free from pockets, sand streaks, honeycomb, with uniform color and texture. Bugholes larger than 1/4 inch in diameter are not acceptable and must be filled.

B. Seam lines to be stoned neatly to minimize appearance. Products with wide or uneven seam lines could be subject to rejection.

2.07 SEALERS

A. All precast concrete walls shall be sealed by the manufacturer with three coats of a water based acrylic sealer, which has graffiti-resistant qualities. Must be non-sacrificial so most graffiti can be cleaned with lacquer thinner and not require resealing.

B. Interior to be sealed with a high solids (min. 50% by weight), low-VOC acrylic-bituminous emulsion polymer sealer designed for use on above and below grade applications on Concrete. Sealer to contain fungicide and mildewcide protection, UV protection and designed for water resistance and vapor permeability. Sealer must comply with Bay Area Air Quality Management District (BAAQMD) VOC limit.

2.08 SOURCE QUALITY CONTROL

A. Inspect and test architectural precast concrete in accordance with ACI 533.

B. Defective Work: Discard units that do not conform to requirements as shown or specified. Replace with units which meet requirements.

2.09 GUARANTEE

A. Fabricator to provide a (5) five-year guarantee against manufacture's defect

B. Fabricator must staff qualified field repair technician(s) and be available to perform any necessary field repairs and detailing in a timely manner. Field repairs for manufacture defects to be included in warranty. Manufacture to provide non-warranty field repairs, detail and refurbishment at reasonable rates.

PART 3 - EXECUTION

3.01 COORDINATION

A. All concrete paving, walls and linear elements to support Precast Concrete shall be straight, parallel, sloped to drain and follow all grades. Concrete work which varies more than ¼ horizontally shall be removed and replaced at the discretion of the Engineer.

B. All work shall be coordinated with concrete paving patterns located immediately adjacent. First installed work (offsite or onsite) shall set precedence for all patterns, spacing, and widths for all Work.

C. Prepare all concrete footings in accordance with Section 32 13 16 – Decorative Concrete.

3.02 EXAMINATION

A. Acceptance of Site Verification of Conditions:

1. General Contractor shall inspect, accept and certify in writing to the Precast Concrete installation subcontractor that site conditions meet specifications for the following items prior to installation of Precast Concrete Work.

a. Verify that concrete base materials, thickness, surface tolerances, slopes, grades, and elevations conform to specified requirements.

b. Verify all concrete edges are straight and true prior to the start of work.

c. Verify that all wall and paving expansion joints are in alignment with all score lines.

d. Verify that concrete surfaces to receive the Precast Concrete material are free of dust, oil, grease, paint, wax, curing compounds, primer,

sealers, form release agents, from cracks over 3/16 in. (5 mm) in width, or any deleterious substances and debris which may prevent or reduce bonding.

e. Inspect all concrete work to receive Precast Concrete for evidence of cracking with the Engineer. Areas of excessive cracking may require full removal and replacement upon the direction of the Engineer and Engineer of Record. Concrete work which shows evidence of minor cracking prior to the placement of Precast Concrete veneer work shall be underlain with an uncoupling membrane for the full panel length of veneer straddling the crack.

f. Do not proceed with installation of Precast Concrete until base conditions are corrected by the General Contractor or designated subcontractor.

3.03 PREPARATION

A. Verify base is dry, certified by General Contractor as meeting material, installation and grade specifications.

B. Verify that base is clean, dry, and ready to accept epoxy, mortar and Precast Concrete.

3.04 MORTAR INSTALLATION

A. Concrete base preparation

1. All concrete work shall have a minimum cure of 28 days.

2. Repair any cracks in veneer substrate in accordance with CTMA Tech Bulletin 'Crack Isolation'

3. Concrete substrate slabs must be free from any foreign substances.

4. Sweep the surface clean or shot blast as required to ensure a clean bonding substrate.

5. Coordinate elevations of subgrade slabs prior to placement.

6. Install uncoupling membranes if required over areas of cracking per mfr specifications and standard details.

B. Layout, cut, and dry fit masonry to level and alignment as required prior to applying mortar.

C. Locate, drill, and install all pins as required per the Contract Drawings.

D. Apply mortar over concrete subbase per mfr specification and detail. Provide all tenting and protection based on weather conditions. Contractor shall comply with Laticrete warranty requirements.

E. Mix and place only that amount of mortar bed that can be covered with Concrete Precast before initial set per the manufacturers specifications. Avoid air entrainment into the mix.

F. Cut back, bevel edge, and discard material that has reached initial set before placing Precast Concrete.

G. Wet Precast Concrete and concrete slab before laying if the initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow paver units and concrete slab to absorb water so they are damp but not wet at the time of laying.

H. Back butter all pavers Precast Concrete as well as concrete slab.

I. Tamp or beat Precast Concrete with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each piece in a single operation before initial set of mortar; do not return to areas already set and disturb pavers for purposes of realigning finished surfaces or adjusting joints. Finish grade of pavers on mortar bed to abut flush to finish grade of pavers on aggregate base. Contractor to remove and replace all pavers which do not match flush to adjacent and replace at no additional cost to the contract.

J. Clean all Precast Concrete immediately of mortar. Hazed Precast Concrete shall be replaced.

K. Spaced joint widths to match that of all adjacent score lines.

L. Install Laticrete Latasil caulk as directed by the manufacturer's specifications. Protect all work to avoid contamination of adjacent work or Precast Concrete Work.

M. Protect all work to cure for a minimum of 7 days.

3.05 DEFECTIVE CONCRETE

A. Color and finish of all precast concrete work shall match. Inconsistent color and finishing shall be considered defective precast concrete.

B. All work shall be plumb, straight and sloped to drain. Walls which are not plumb, straight, and pond water shall be considered defective precast concrete.

C. All jointing and sealants shall be equal, matching, and clean.

D. Defective precast concrete shall be repaired or fully replaced as directed by the Engineer, at no added expense to the Contract.

END OF SECTION

SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: All labor, materials, equipment and operations required to complete structural and miscellaneous metals in shapes and configurations indicated; including:

1. Structural steel columns, beams, bracing, base plates, bolts, joist hangers, and stud bolts welded to structural steel.

2. Miscellaneous structural steel and connections; fabricated connectors and hangers installed by related sections.

3. Anchor bolts and steel inserts embedded in concrete or masonry, installed by related sections.

4. Fabricated steel items embedded in concrete or masonry installed by related sections.

5. Supervision of anchor bolt setting, leveling and elevations to insure required fit of steel work.

6. Shop priming and field touch-up, galvanizing.

7. Bracing, Shoring, Fabrication and Erection.

B. Related Sections:

1. Pertinent sections of Division 01 specifying Quality Control and Testing Agency services.

2. Pertinent Sections of other Divisions specifying concrete reinforcement, formwork, concrete, structural and miscellaneous metal fabrications, steel joists, metal decking, cold-formed metal framing, rough carpentry.

1.2 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 22A Steel.

B. American Institute of Steel Construction (AISC) 303 “Code of Standard Practice for Steel Buildings and Bridges”.

C. AISC 341 “Seismic Provisions for Structural Steel Buildings”.

D. AISC 358 “Prequalified Connection for Special and Intermediate Steel Moment Frames for Seismic Applications”.

E. AISC 360 “Specification for Structural Steel Buildings”.

F. American Welding Society (AWS) D1.1 “Structural Welding Code - Steel”.

G. AWS D1.8 “Structural Welding Code - Seismic Supplement”.

H. Research Council on Structural Connections (RCSC) “Specification for Structural Joints Using High-Strength Bolts”.

I. Underwriters Laboratories (UL) FRD “Fire Resistance Directory”.

1.3 SUBMITTALS

A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer. Submittals that do not meet these requirements will be returned for correction without review.

B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents.

C. Product Data: Submit manufacturer's product data, specifications, location and installation instructions for proprietary materials and reinforcement accessories. Provide samples of these items upon request.

D. Shop drawings: Submit each building as a complete unit. Do not mix components from multiple buildings or units of work in a submittal. Include all of the following;

1. Profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.

2. Fabrication tolerances for all steel.

3. Connections: All, including type and location of shop and field connections.

4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths, type, size, and sequence. Designate demand critical welds.

5. Designation of Seismic Force Resisting System (SFRS) members and connections. Locate and dimension protected zones. Braced frame gusset plates shall be drawn to scale.

6. Cross-reference all shop drawing detail references to contract document detail references.

7. Secure all field measurements as necessary to complete this work prior to submitting shop drawings for review.

8. Provide holes, welded studs, etc. as necessary to secure work of other sections.
9. Provide the following as separate submittals for each building or unit of work:
    a. Bolt and anchor setting plans.
    b. Layout, fabrication and erection drawings.

E. Certifications:

1. Steel Materials: Submit the following for identified materials.
    a. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
    b. Mill Test Reports: Indicate structural strength, destructive test analysis, and non-destructive test analysis.
    c. Contractor's affidavit certifying that all identified steel materials provided are of the grades specified and match the certificates supplied.

2. High-Strength Bolting: Certify all materials provided are the grades specified.

3. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification per AWS D1.1.

F. Samples: Provide samples to the Testing Agency as specified in Article SOURCE QUALITY CONTROL, at no additional costs.

1.4 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies, refer to pertinent sections of Division 01 and CBC Chapter 17A.

B. All tests shall be performed by a recognized testing agency as specified in pertinent sections of Division 01.

C. Certification and Identification of Materials and Uses: Provide Testing Agency with access to fabrication plant to facilitate inspection of steel. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection and all material identification/test information listed below.

1. Test all steel as required by ASTM A6.

2. Provide manufacturer's Mill Test Reports for all materials. Include chemical and physical properties of the material for each heat number manufactured. Tag all fabricated materials with heat number.

3. Provide letter certifying all materials supplied are from heat numbers covered by supplied mill certificates. Include in letter the physical location of each material type and/or heat number in the project (i.e. walls, braced frames etc.).

4. Unidentified Material Tests: Where identification of materials by heat number or mill tests cannot be made, Owner's Testing Agency shall test unidentified materials.

5. Provide all certification, verifications, and other test data required to substantiate specified material properties at no additional cost to the Owner.

D. Testing and Inspection: Tests and Inspections performed by Independent Testing Agency are specified below in Articles SOURCE QUALITY CONTROL and FIELD QUALITY CONTROL. Duties and limitations of Independent Testing Agency, test costs and test reports in conformance with pertinent sections of Division 01.

E. The following standards are the minimum level of quality required. Provide higher quality work as specifically indicated in the Contract Documents.

1. Workmanship and details of structural steel work shall conform to the CBC and AISC 360.

2. The quality of materials and the fabrication of all welded connections shall conform to AWS D1.1 and D1.8.

3. Comply with Section 10 of AISC 303 for architecturally exposed structural steel.

F. The Testing Agency will review all submittals and testing of materials.

G. All re-inspections made necessary by non-conforming work shall be at the Contractor's expense.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to project site in bundles marked with durable tags indicating heat number, mill, member size and length, proposed location in the structure and other information corresponding with markings shown on placement diagrams.

B. Handle and store materials above ground to prevent damage, contamination or accumulation of dirt or rust.

1.6 SCHEDULING AND SEQUENCING

A. Organize the work and employ shop and field crew(s) of sufficient size to minimize inspections by the Testing Agency.

B. Provide schedule and sequence information to Testing Agency in writing upon request. Update information as work progresses.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Steel W Shapes: ASTM A992 Gr. 50 or ASTM A572 Gr. 50.

B. Structural Steel Plates: ASTM A36 or ASTM A572 Gr. 50 or ASTM 529 Gr. 50

C. Structural Steel Channels, Angles: ASTM A36 or ASTM A572 Gr. 50.

D. HSS (Hollow Structural Sections):

1. Round: ASTM A500, Gr. C.

2. Rectangular or Square: ASTM A500, Gr. C.

E. Pipe: ASTM A53, Grade B.

F. Bolts and Washers: See FINISHES section for galvanization, where required.

1. Machine Bolts, Nuts, and Washers: Bearing and shear connections (denoted as “MB”); ASTM A307 Grade A machine bolts with ASTM A563 Grade A nuts and ASTM F844 washers to match.

2. High Strength Bolts, Nuts, and Washers: Bearing and shear connections (denoted as “HSB”); ASTM F3125 Grade A325 or A490 with ASTM A563 Grade C nuts (Grade DH at A490) and ASTM F436 Type 1 washers.
   a. HSB-N: For use in snug tight (ST), pretensioned (PT), and slip critical (SC) joints. Conform to the RCSC Specifications.
   b. HSB-X: For use where specified on the drawings.
   c. Use of ASTM F3125 Grade F1852 (twist off assemblies) is permitted conforming to requirements of RCSC Specifications.
   d. Use of ASTM F959 Load Indicator Washers is permitted conforming to the requirements of RCSC Specifications.
   e. Slip critical (SC) bolt faying surfaces shall be prepared per RCSC as Class A, unless noted to be Class B per the drawings. Galvanized surfaces at SC bolts shall be hand wire brushed.

G. Headed Stud Type Shear Connectors: ASTM A108 and AWS D1.1 Section 7.

H. Deformed Bar Anchors: ASTM A496.

I. Anchor Bolts/Rods:

1. ASTM F1554 Grade 36 or 55 with ASTM A563 Grade A nuts and ASTM F436 Type 1 washers.

2. ASTM F1554 Grade 105 where indicated on plans with ASTM A563 Grade DH nuts and ASTM F436 Type 1 washers.

3. No upset thread allowed.

J. Arc-Welding Electrodes: AWS Standards E70 or equivalent, except no E70T-4 allowed. Additionally, welding electrodes to be used in the welding of seismic force resisting system to conform to AISC 341 and AWS D1.8.

K. Other Welding Materials: AWS D1.1; type required for materials being welded.

2.2 ACCESSORIES

A. High Strength Grout: ASTM C1107, non-shrink, premixed compound consisting of aggregate, cement, and water reducing plasticizing agents.

1. Minimum Compressive Strength at 3 days: 3000 psi.

2. Minimum Compressive Strength at 28 days: 7000 psi, placed in a “fluid” state.

3. Provide only non-metallic grout at exposed work.

4. Meet or exceed properties of BASF "Master Flow 928" mixed to fluid consistency. Other acceptable manufacturers: The Burke Company and W.R. Meadows, Inc.

B. Building Structural Steel Primers: Comply with local VOC limitations of authorities having jurisdiction and the California Green Building Code. Verify compatibility with finish coats specified in other sections. Follow manufacturers printed instructions. Apply one coat unless otherwise directed.

1. Type A: Self-Crosslinking Hydrophobic Acrylic passing 2000 hours ASTM D4585 and 7000 hours ASTM D5894. “Series 115 Uni-Bond DF” by Tnemec (2.0 to 4.0 mils DFT).

2. Type B: Organic Zinc-Rich Urethane passing 50,000 hours ASTM B117 and 15000 hours ASTM G85. “Series 90-97 Tneme-Zinc” by Tnemec (2.5 to 3.5 mils DFT) or “Series 94-H20 Hydro-Zinc” by Tnemec (2.5 to 3.5 mils DFT).

3. Type C: MIO-Zinc Filled Urethane passing 10,000 hours ASTM B117 and 5000 hours ASTM D4585. “Series 394 PerimePrime” by Tnemec (2.5 to 3.5 mils DFT).

C. Galvanizing: ASTM A153 and A123.

D. Touch-Up Primer for Galvanized Surfaces: Type B primer.

2.3 FABRICATION

A. Shop fabricate to greatest extent possible.

B. Continuously seal built up members by continuous welds where exposed to weather.

C. Fabricate connections for bolt, nut, and washer connectors.

D. Protect all materials, before and after fabrication, from rust, corrosion, dirt, grease, and other foreign matter.

E. Fabricate framing members free from twists or bends. Form holes, cut and sheared edges neatly without kinks, burrs, or warped edges.

F. Exposed Steel: Straight, smooth, free of nicks, scars or dents.

G. Gas Cutting: Gas cutting of holes in a member shall not be permitted.

H. Splicing of members: Members requiring splicing due to length requirements

may be spliced using full penetration butt welds when such welds and procedures are inspected and certified by the Testing Agency, in conformance with AWS and AISC standards. The location of splices shall be approved by the Architect/Engineer in writing prior to fabrication.

I. Welding: Welding of structural steel connections shall be performed by qualified welders in accordance with AWS Standards. All weld sizes shall match those shown on the drawings.

1. Preparation: Clean all surfaces free of rust, paint and all foreign matter. Remove paint or scale by brushing, chipping or hammering as required. Chip clean and wire brush burned or flame cut edges before welding. Space and alternate welds, clamping as necessary to prevent warp or misalignment.

2. Sequence Welding: When welds enclose, or partially enclose, the perimeter or portion of the surface of a member, make weld bead in sequence, or staggered. Minimize internal stresses. Weld groups of members occurring in a single line in staggered sequence to minimize distortion of the structural frame.

3. Faulty and Defective Welding: Welds failing to meet AWS standards and the Contract Documents shall be rejected and remade at Contractor expense. All welds showing cracks, slag inclusion, lack of fusion, bad undercut or other defects, ascertained by visual or other means of inspection shall be removed and replaced with conforming work.

4. Minimum Weld Strengths: All welds shall match the minimum weld sizes recommended by AISC. Details of fabrication not specifically shown shall match similar details which are specifically shown. All bevel and groove welds shall be full penetration unless size is noted otherwise.

5. Threaded studs, headed studs, and deformed bar anchors shall be full-fusion welded conforming to ASW D1.1.

J. Camber: Fabricate all beams cambered as indicated on the drawings.

1. Fabricate beams without camber for installation with any "natural" crown up.

2. Exception: Fabricate cantilever beams with "crown" down.

K. Grinding: Grind smooth the following structural steel and connections;

1. Exposed cut ends of structural and fabricated shapes.

2. All welds exposed to view.

3. Mitered and fit-up corners and intersections.

L. Back-Up Bars: Required for all complete penetration welds. See requirements of AISC 358.

M. Bolt Holes: Edge, end distances and spacing shall conform to dimensions shown

on the drawings, and as follows;

1. Round: Size indicated and 1/16 inch maximum oversize, except 1 inch and larger bolts may have 1/8 inch maximum oversize.

2. Slotted: At locations specifically noted on the drawings, provide size indicated and 1/16 inch by 1/4 inch oversize slotted in direction perpendicular to applied loads.

3. Holes in base plates for anchor bolts may be 1/8 inch oversize.

2.4 FINISHES

A. Steel exposed to inclement atmospheric conditions or weather (such as coastal moisture or seasonal rain) shall be sufficiently primed or otherwise protected against corrosion. If condition of steel is suspect due to weathering/corrosion, Contractor shall bear cost of inspection to determine if excessive corrosion is present and if steel member(s) requires repair or replacement. Contractor shall bear cost of repair or replacement.

B. Prepare and finish structural and miscellaneous steel component surfaces as follows, unless a higher standard-of-care is determined necessary per item A:

1. Unpainted, interior, dry exposure surfaces need not be primed.

2. Finished painted, interior, dry exposure surfaces:
   a. Surface Preparation: SSPC-SP2 Hand-Tool and/or SP3 Power-Tool Cleaning. Apply Primer Type A. Field touchup with same primer.
   b. Where jobsite exposure is expected to exceed 6 months, SSPC-SP6 / NACE No. 3 Commercial Blast-Cleaning is required. Apply Primer Type B or C. Field touchup with same primer.

3. Finish painted surfaces with exterior exposure, interior exposure subject to wet conditions or fumes, or surfaces to receive high performance finish coatings (for example epoxy or urethane coatings.
   a. Surface Preparation: SSPC-SP6 / NACE No. 3 Commercial Blast-Cleaning to create a dense, uniform angular surface profile of 2.0 mils minimum. For severe (immersion) exposure, SSPC-SP10 / NACE No. 2 Near-White Blast-Cleaning is required.
   b. Apply Primer Type B. Field touchup with same primer.

4. Surfaces to be fire proofed need not be primed unless required by the fireproofing manufacturer or if jobsite exposure is expected to be inclement per item A. Where unprimed steel is to receive fireproofing, prepare steel surface as required by fireproofing manufacturer. If fireproofed surfaces are to be primed, provide primer as follows:
   a. Surface Preparation: SSPC-SP3 Power-Tool Cleaning.
   b. Apply Primer Type C. Field touchup with same primer.

5. Exterior exposed (unpainted) surfaces and as otherwise indicated to receive galvanizing:
   a. Galvanize per ASTM A123 Class 55 minimum. Passivation agents are not permitted on galvanized metal that is to be painted.

Provide vent holes per ASTM A385 at closed sections (such as HSS). Submit proposed location of vent holes for review by Engineer.

b. Connection hardware shall be hot-dip galvanized per ASTM A153 or F2329. Grade A325 high-strength bolt assemblies may be mechanically galvanized per ASTM B695 class 55 or hot-dip galvanized per ASTM F2329. Mating bolts and nuts shall receive the same zinc-coating process.

c. Repair all uncoated, damaged, or altered galvanized surfaces per ASTM A780.

C. Do not prime the following surfaces unless otherwise indicated:

1. Connections to be field welded.

2. Steel in contact with concrete.

3. Surfaces to receive welded metal decking.

D. Slip critical bolted connection surfaces shall either be unfinished & prepared per the RCSC or primed per item B3 or B4.

E. Do not cover up work with finish materials until inspection is complete and work is approved by the Testing Agency.

2.5 SOURCE QUALITY CONTROL

A. An independent Testing Agency will perform source quality control tests and submit reports, as specified in pertinent sections of Division 01.

B. Steel Materials Testing:

1. No testing is required for materials identified in accordance with CBC Section 2202A.1 (heat number, grade stencil, etc.).

2. Unidentified steel- General: Test all structural shapes. In addition, test to verify Fy and Fu values when engineering requirements exceed Fy = 25 ksi for design.

3. Charpy V-Notch (CVN) testing requirements are per AISC 341. Heavy sections requiring CVN testing are indicated on the documents.

C. Shop Welding Inspection:

1. Testing Agency shall inspect and certify all structural welds.

2. Welder Qualifications: Welding inspector shall verify that all the welders are properly qualified prior to steel fabrication and state the qualifications of each welder in the welding inspection report.

3. Welding Inspection: Continuous inspection required unless otherwise noted below. Comply with requirements of AWS D1.1, AWS D1.8 and AISC 341.

a. Welding Inspector shall check all welds, materials, equipment and

procedures.

b. Welding Inspector shall provide reports certifying the welding is as required and has been done in conformity with the plans, specifications and codes.

c. Welding Inspector shall use radiographic, ultrasonic, magnetic particle, or any other necessary aid to visual inspection to assure adequacy of welds. Ultrasonic Testing (UT) shall be required for all complete joint penetration (CJP) welds of material 5/16 inch thick or greater.

4. Periodic Inspection Acceptable:
   a. Single pass fillet welds not exceeding 5/16 inch.
   b. Welding of studs to beams.

D. Bolts, Nuts and Washers: Provide samples to Testing Agency for required testing, at no additional cost.

E. High Strength Bolted Connections: Provide testing and verification of shop-bolted connections in accordance with RCSC specifications. Test all bolts at each connection.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.2 ERECTION

A. Erect structural steel in compliance with AISC 303.

B. Framing:

1. Erect all structural steel true and plumb.

2. Verify proper final alignment prior to making final connections.

C. Field Connections:

1. Workmanship of field bolted and welded connections shall conform in all respects to methods and tolerances specified for fabrication.

2. Field weld components indicated on shop drawings. Sequence field welds to minimize built-up stress and distortion of the structural frame. Verify sequence with Engineer. Coordinate field welding schedule with Testing Laboratory.

3. Welded Studs: Install in accordance with manufacturer's instructions and structural welding code AWS D1.1 and AWS D1.8.

D. Templates: Provide bolt setting templates for all anchor bolts. Provide instructions for the setting of anchors and bearing plates, verify these items are set correctly as work progresses.

E. Column base plates: Set level to correct elevations, support temporarily on steel wedges, shims, or leveling nuts where shown, until the supported members are plumbed and base plate is grouted.

1. Grout solid the full bearing area under base plates prior to installation of floor and/or roof decks.

2. Comply with manufacturer's instructions for high strength grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

F. Bolting - General:

1. Inspect mating surfaces to insure that bolt head and nut will have full bearing and that metal plies will mate flush between bolts.

2. Install bolts in matching holes. Do not distort metal or enlarge holes by drifting during assembly. Remake mismatched components to achieve tolerances indicated.

3. Holes mismatched in excess of 1/8 inch will be rejected.

4. Holes mismatched less than 1/8 inch may be reamed to the next larger size bolt.

5. Do not enlarge holes by flame cutting or air/arc (“plasma“) cutting.

6. Provide flat washer(s) at over-size holes.

7. Provide washers for all conditions per RCSC Section 6 and under nuts to connected parts less than ¼ inch thick.

8. Provide ASTM F436 beveled washers when the slope of the surfaces of parts in contact with the bolt head or nut is greater than 1:20.

9. Do not install bolts with damaged threads.

10. Threads shall commence outside of the shear plane where noted as HSB-X on drawings..

G. Bolting - Specific:

1. Machine Bolts (MB): Install and tighten to a snug condition (ST) such that laminated surfaces bear fully on one another, using an impact wrench or “full effort” of an installer using a standard spud wrench.

2. High Strength Bolts in Bearing/Shear or Static Tension joints snug tight (ST):
   a. Provide a hardened washer at the head/nut at slotted holes
   b. Install and tighten as per Machine Bolts (MB) snug tight (ST) and other requirements of RCSC specification Section 8.
   c. Use ASTM F436 washer only in snug tight connections with static tension loads.

3. High Strength Bolts in Pretensioned joints (PT):
   a. Provide ASTM F436 washer per requirements of RCSC Section 6.
   b. Install and tighten in accordance with the requirements of RCSC Section 8.
   c. Install bolts in all holes of the joint and compact the joint until the connected plies are in firm contact prior to pretensioning.
   d. The following tightening methods and bolt type are acceptable for PT joints:
      (a) Turn-of-the-nut pretensioning method
      (b) Calibrated wrench pretensioning method
      (c) Twist-off-type tension-control bolts
      (d) Direct-tension-indicator washer pretensioning method.

4. High Strength Bolts in Slip Critical (SC) joints:
   a. Provide tensioning for High Strength Bolts (PT) per above.
   b. Faying surfaces to be prepared per RCSC Section 3 and PART 2.

H. Supports, Shoring and Bracing: Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing. Conform to requirements of all applicable laws and governing safety regulations. Resist imposed loads, including those of stored materials and equipment.

1. Provide all temporary supports, shoring and bracing necessary to achieve work of tolerances indicated.

2. Provide all necessary temporary flooring, planking and scaffolding required for erection of steel, and support of erection machinery.

3. Construction Loading: Do not overload the structure or temporary supports with stored materials, equipment or other loads.

4. Maintain temporary bracing and shoring until work is complete, and longer as required to ensure stability and safety of structure.

I. Do not make final connections until structure is aligned to meet specified tolerances.

3.3 ERECTION TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

3.4 FIELD QUALITY CONTROL

A. The independent Testing Agency will perform field quality control tests, as specified in pertinent sections of Division 01.

B. Field Welding Inspection: Conform to all requirements of section SOURCE QUALITY CONTROL.

C. High Strength Bolting: Provide testing and verification of field-bolted connections in accordance with RCSC Section 9.

1. Inspect mating surfaces.

2. Test all materials prior to use. Use only materials meeting specified requirements.

3. Inspector shall review installation and verify “full effort” with installers for ST joints and shall randomly manually verify “full effort” on 10 percent of installed bolts.

4. Inspector shall verify installation for 100% of SC and PT joints.

5. Review installation procedures for all types of HSB joints and verify installation of “Twist-off” and load-indicator type bolts.

6. If any bolt fails testing, all bolts at the joint shall be loosened and re-tightened. Exception: Galvanized bolts shall be replaced prior to re-testing.

D. Welded Studs: Test headed studs electro-magnetically welded through metal deck to directly to steel members as follows:

1. Install minimum of two trial studs.

2. Testing Agency shall bend studs with a hammer to minimum 30 degrees out of axis.

3. Any failure shall require new studs be welded for another test and welding apparatus adjusted.

3.5 ADJUSTING

A. Touch-up damaged finishes with compatible specified primer.

B. Replace defective or damaged work with conforming work. Replace all defective work at Contractor's expense.

C. Straighten materials by means that will not injure the materials.

D. Replace defective or damaged work which cannot be corrected in the field with new work, or return defective items to the shop for repair.

E. Architect/Engineer shall review all proposals for the repair or replacement of damaged, defective, or missing work.

F. Pay expenses incurred by Owner for Architect/Engineer's costs for (re-)design and obtaining approvals of Authorities Having Jurisdiction (AHJ) necessitated by incomplete, inefficiently scheduled, improperly performed, defective or nonconforming work, as specified in pertinent sections of Division 01.

G. Pay expenses due to re-testing and re-inspection necessitated by incomplete, inefficiently scheduled, improperly performed, defective or nonconforming work, as specified in pertinent sections of Division 01.

3.6 CLEANING AND PROTECTION

A. Clean all surfaces upon completion of erection; leave free of grime and dirt. Remove unused materials, tools, equipment and debris from the premises and leave surfaces broomed clean.

B. Protect work from damage by subsequent operations.

END OF SECTION

SECTION 05 30 00
METAL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: All material, labor, equipment and services necessary for the fabrication, erection, and completion of all metal decking as noted on drawings, including all supports for erection. The work shall include, but not necessarily be limited to the following:

1. Furnish metal decking, supports at structural steel, closures, flashing, weld plates, and necessary accessories, complete and ready to receive concrete or roofing.

2. Install metal decking including cutting, fitting, and welding.

3. All cutting and reinforcing of openings as required, and as laid out by other trades.

B. Related Sections:

1. Pertinent Sections of Division 01 Specifying Quality Control and Testing Agency Services.

2. Pertinent Sections of Division 03 Specifying Concrete Construction.

3. Pertinent Sections of Division 05 Specifying Structural Steel.

1.2 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 19A Concrete, Chapter 22A Steel.

B. American Iron and Steel Institute (AISI) S100 "North American Specification for the Design of Cold-Formed Steel Structural Members".

C. Steel Deck Institute (SDI) “Design Manual for Composite Decks, Form Decks and Roof Decks”.

D. International Code Council (ICC) “Acceptance Criteria (AC) 43 – Steel Deck Roof and Floor Systems”.

E. American Society for Testing and Materials (ASTM):

1. ASTM A653 “Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process”.

2. ASTM A780 “Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings”.
3. ASTM A1003 “Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members”.
4. ASTM A1008 “Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable”.
5. ASTM C1513 “Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections”.

F. American Welding Society (AWS) “D1.3 Structural Welding Code – Sheet Steel”.

1.3 SUBMITTALS

A. Shop drawings shall indicate all details of layout, fabrication and installation, location and dimension of openings, reinforcing and accessories, metal closures and flashing and type, size and location of all welds, and electromagnetically welded studs. Submit shop drawings before the start of fabrication. All details must reference detail callouts on the construction documents. Submittals that do not meet these requirements will be returned for correction without review.

B. Current ICC reports indicating design values.

C. Obtain reviewed structural steel shop drawings and verify all conditions before preparing shop drawings for metal decking; show all members required for support of metal decking on shop drawings for metal decking.

D. The Contractor shall review and approve shop drawings prior to submittal. The Architect's review is of a general nature only and all responsibility for conformance with drawings and specifications and for dimensions shall remain with the Contractor.

1.4 QUALITY ASSURANCE

A. All work under this section shall be fabricated and installed in strict accordance with the incorporated documents. Refer to pertinent sections of Division 05, Structural Steel.

B. Decking shall be installed in the field by an approved steel deck applicator with at least five years demonstrated successful experience in this type work.

C. All installation and welding shall be done by qualified, experienced workers skilled in their trade, in conformance with established standards of good practice and the manufacturer's recommendations. All welders shall be AWS certified.

1.5 DELIVERY, STORAGE AND HANDLING

A. Protection: Steel decking sheets shall be covered and protected from weather during transit and during storage at the job site. Sheets shall not be in contact with the ground and are to have a waterproof covering.

1.6 JOB CONDITIONS

A. Coordination: The Contractor shall secure all field measurements necessary for the completion of this work. The Contractor shall be responsible for all errors of detailing and fabrication and for the correct fitting of all metal decking to each other and to their supports. Provide holes and reinforcement for mechanical and electrical penetrations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Deck shall be of type and by manufacturer as specified on the drawings or approved equal. All equals must meet or exceed ICC approved design values of specified decking.

B. Steel decking and flashing shall be formed from steel sheets conforming to ASTM A653, A1003, or A1008 with a minimum yield strength of 40,000 psi. Before forming, the steel shall receive a protective metal coating of zinc conforming to ASTM A653 G60 wiped coating.

C. Deck Sections

1. Deck units shall be supplied in lengths to span over at least 3 supports where layout permits. All single span units shall have temporary mid-span shoring.

2. All deck units shall be provided with either an interlocking side lap or a lapping type side lap.

3. Venting Devices: Unless noted otherwise, all deck sections to receive cementitious fill shall be vented using individual separating clips of type, style and spacing recommended by deck manufacturer (space no more than 48" o.c. or a two per deck span) or built-in venting-slot formed as an integral part of deck profile. Venting slots are required only in non-cellular deck. Tabs shall be turned up into deck so that they cannot be used for hangers. Provide three rows of slots at 2'-0" on centers in three foot wide deck sections.

4. Flashing and Closure Plates: Provide 16 gauge zinc coated continuous flashing for deck units as detailed, or as required, at ends and sides, at openings and at deck perimeter to contain fill. Flashing shall be detailed and installed to prevent concrete leakage.

5. Reinforcing at openings and penetrations: Provide reinforcing at all openings and penetrations per PART 3.

6. Galvanization Coating Repair: Zinc dust-zinc oxide primer, ASTM A780.

D. Headed welded studs and deformed bar anchors: See section 05 12 00 or 05 11 00.

E. Painted Finish: Where painted finish is specified it shall be Manufacturer's standard; baked on, rust inhibitive, applied to chemically cleaned surface.

F. Welding Electrodes: AWS Standard E60 or equivalent or E70 or equivalent, or as specified by AWS D1.3 and Manufacturer's recommendation.

2.2 FABRICATION

A. All fabrication bevel cuts, etc. shall be done in the shop, and shall be equal to a high standard of workmanship. All deck units shall be shipped to the field in standard widths and in precut lengths so that end joints occur over supporting members.

B. Deck section shall be cut to fit all openings, which are required. Dimensions of openings and holes required for the work of other trades will be provided by respective trades for cutting of deck.

C. Misalignment of deck sections and cuts, short lengths, and poor workmanship shall be cause for rejection. All rejected work shall be replaced at the Contractor's expense.

2.3 SOURCE QUALITY CONTROL

A. An independent testing agency will perform source quality control tests and submit reports as specified in pertinent sections of Division 01.

B. Steel Materials Testing:

1. No Testing Required for Materials as follows:
   a. Materials identified in accordance with CBC 2202A.1 and ASTM A6. (heat number, grade stencil, etc.)
   b. Materials accompanied by certified mill test reports for all members, and Contractor's affidavit confirming that all materials used in the fabrication and shipped to the job are from the grades specified and match the certificates supplied.

2. Unidentified steel: Where identification of materials by heat number or mill reports cannot be made, testing agency shall test unidentified deck.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The steel deck units shall be placed on the supporting framework, aligned, and adjusted to final position before being permanently fastened. Each unit shall be brought to proper bearing on the supporting beams. If the supporting beams are not properly aligned or sufficiently level to permit proper bearing of the steel units, the Contractor shall notify the Architect prior to taking corrective action to insure properly aligned work.

B. Deck units shall be placed in straight alignment for the entire length of run with close registration of the cells of one unit with those of abutting and adjoining

units. Provide a minimum of 2 inch end bearing at abutting deck units. Continuous deck units shall be provided with a minimum of 3” bearing, all butt joints shall be “tight” (no gap).

C. Deck units shall not be placed on supporting members until all structural steel is completely installed, plumbed, and connections are completed.

D. Welding:

1. Steel deck units shall be fastened to the steel framework by the arc welding process. Welds shall be free of sharp points or edges.

2. All welding shall be done by competent experienced welders, thoroughly familiar with the metal to be welded, and certified for welding of light gauge metal.

3. Deck sheets shall be welded to the supporting member and to each other with welds as listed below unless otherwise noted on the drawings.
   a. End and intermediate support perpendicular to deck flutes: 3/4" diameter spot weld at each flute.
   b. Side joints between individual deck units with side interlock joint: 1-1/2" top or side seam weld at 12" on center. Button punch at 36" on center before welding to draw units together.
   c. Side joints between individual deck units where concrete is placed on the metal deck is to be button punched at 36” on center.
   d. Boundary deck units to parallel supports and interior deck units to parallel framing supports 3/4" diameter spot weld or 3/8" x 1-1/4" arc seam weld at 12" on center.

4. Weld all closure angles and plates with 3/4" diameter spot weld or 3/8"x 1-1/4" arc seam welds at 18" apart.

5. Headed welded studs and deformed bar anchors: See section 05 12 00 or 05 11 00.

E. Screw Attachment: When called for on the drawings, painted roof deck is to be attached with galvanized #12 hex head metal screws with neoprene washers at flutes and at 24” on center at side laps and at 12” on center at perimeter side laps. Screws and metal washers shall be painted to match deck color where decking is a painted finish surface.

F. Decking shall be installed in a continuous operation to avoid delays in the construction.

G. Opening reinforcement shall be as detailed on the drawings. Cutting of holes other than those detailed on the drawings shall be done only as specifically approved by the Architect. Holes not shown on structural drawings shall be cut and reinforced in accordance with details on drawings. In general, reinforcing is not required for holes less that 4" in diameter. Holes at column penetrations shall be reinforced as any other hole. See details on drawings for other requirements.

H. Leave slag in place at welds to be covered by concrete. Elsewhere, remove slag to bright metal and touch up all welds and field cut edges with galvanization repair primer.

I. Field Finishing:

1. Permanently exposed galvanized surfaces requiring welding shall be thoroughly cleaned by wire brushing after welding and then touched up with galvanization repair primer.

2. After erection all damaged surfaces shall be primed.

3. Painted deck shall be touched up with primer and matching paint.

3.2 FIELD QUALITY CONTROL

A. Welding Inspection:

1. Testing Agency shall inspect and certify all structural welds. Submit certification to the Architect/Engineer for review and the Building Official for approval.

2. Welder Qualifications: Welding inspector shall verify that all the welders are properly qualified prior to steel fabrication and state the qualifications of each welder in the welding inspection report.

3. Welding Inspection:
   a. Welding Inspector shall check all welds, materials, equipment and procedures.
   b. Welding Inspector shall provide reports certifying the welding is as required and has been done in conformity with the plans, specifications and codes.
   c. Periodic inspection per CBC is acceptable.

3.3 DEFECTIVE WORK

A. All work not in conformance with these specifications and/or generally accepted standards of the trade, will be deemed defective by the Architect and will be rejected. All work that is defective shall be corrected or replaced as directed by the Architect. Corrections redesign, and replacement of defective work shall be at Contractor's expense.

3.4 CLEANING

A. After erection, all surfaces shall be cleaned and left free of all grime and dirt. Decking shall be cleaned with solvents, if necessary to provide a surface, which will readily bond with concrete fill and direct-to-steel fireproofing. Remove unused materials, tools, scaffolding and debris from the premises and leave the area broom clean.

END OF SECTION

SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. All design and other services, material, labor and equipment as necessary for the fabrication, erection and completion of all cold formed metal framing including all bracing and shoring required for erection, miscellaneous metal, and related work.

B. Related Sections:

1. Pertinent Sections of Division 01 Specifying Quality Control and Testing Agency Sections.

2. Pertinent Sections of Division 05 Specifying Structural Steel.

1.2 REFERENCE STANDARDS

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 22A Steel.

B. American Iron and Steel Institute (AISI) S100 “North American Specification for the Design of Cold-Formed Steel Structural Members”.

C. AISI S200 “North American Standard for Cold-Formed Steel Framing – General Provisions”.

D. AISI D100 “Cold-Formed Steel Design Manual.

E. American Welding Society (AWS) D1.3 “Structural Welding Code – Sheet Steel”

F. American Society for Testing and Materials (ASTM):

1. ASTM A307 “Stand Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength”.

2. ASTM A606 “Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance”.

3. ASTM A653 “Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process”.

4. ASTM A780 “Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings”.

5. ASTM A1003 “Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members”.

6. ASTM A1008 “Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable”.

7. ASTM A1011 “Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength”.

8. ASTM C645 “Standard Specification for Nonstructural Steel Framing Members”.

9. ASTM C754 “Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products”.

10. ASTM C955 “Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases”.

11. ASTM C1007 “Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories”.

12. ASTM C1513 “Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections”.

G. The Society for Protective Coatings (SSPC) SSPC-Paint20 “Zinc-Rich Coating (Inorganic or Organic)”.

1.3 SUBMITTALS

A. Shop Drawings

1. Show size and locations of all framing members in conformance to the criteria shown on the drawings.

2. Shop and field assembly details, including cuts and connections. All details must reference detail callouts on the construction documents.

3. Type and location of shop and field welds, screws, bolts, and fastening devices.

4. General Contractor shall review and approve shop drawings prior to submittal.

5. Shop drawing submittals that do not meet these requirements will be returned for correction without review.

B. Manufacturer's Literature:

1. Descriptive data illustrating cold-formed framing system components including framing members, fasteners, and accessories, including ICC-ES reports.

2. Erection instructions containing sequence of operations.

C. Samples: Provide adequate samples of unidentified material to the Owner's Testing Laboratory for testing purposes.

1.4 QUALITY ASSURANCE

A. Erector Qualifications:

1. Minimum of three years successful experience on comparable cold-formed metal framing projects.

2. Welders qualified in accordance AWS D1.3.

B. Cold form carbon and low alloy steel used for structural purposes shall be identified per CBC Section 2202A.1.

C. Welding inspections shall conform to AWS D1.3 and CBC 1705A.2.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Members of the "Steel Stud Manufacturers Association (SSMA)" with products meeting ICC-ES ESR-3064P. Members of the "Certified Steel Stud Association (CSSA)" with products meeting ICC-ES ESR-3016.

2.2 MATERIALS

A. Steel Framing System:

1. All stud and/or joist framing members shall be of the type & size as shown on the plans and reviewed shop drawings.

2. All runner and end tracks, bridging, and non-load bearing studs shall be of the type & size shown on the plans.

3. All studs, joists, and tracks 54 mils or greater in thickness shall be formed from steel that corresponds to the requirements of ASTM A1003 (Grade ST50H or ST50L) with a minimum yield of 50,000 psi.

4. All studs, joists, track, bridging, U-channel, (hat) furring (F) channels, and accessories 43 mils or thinner in thickness shall be formed from steel that corresponds to the requirements of ASTM A1003 (Grade ST33H or ST33L) with a minimum yield of 33,000 psi.

5. All stud and joist components shall be formed from steel having a minimum G-60 galvanized coating (equivalent coatings such as “G60e”

are not acceptable), unless noted otherwise, or shall be primed with paint meeting the performance requirements SSPC-Paint20, where noted.

6. Welding Electrodes: Shall conform to AWS D1.3. E60 or E70. Touch up all welds with zinc-rich paint in compliance with ASTM A780.

7. Primer: SSPC-Paint20.

B. Screws shall be per ASTM C1513.

C. Machine bolts shall be per ASTM A307.

D. Powder Driven Pins (PDP): Hilti X-U, ICC ESR-2269. For use only where specified by the drawings.

E. Accessories: Cold-formed metal framing manufacturer's standard.

2.3 FABRICATION

A. Form members to manufacturer's standard shapes meeting design criteria.

B. Cut right angle connections of framing components to fit squarely against abutting members.

C. Prime un-galvanized steel to 1.5 mil (0.038) minimum dry film thickness.

PART 3 - EXECUTION

3.1 ERECTION

A. Clean surfaces that will be in contact after assembly.

B. Position members plumb, square and true to line.

C. Seat studs squarely in track with stud web and flange abutting track web with maximum 1/8 inch gap.

D. Connect members together by welding and/or fasteners in accordance with the drawings.

E. Do not splice studs. Provide "headers" and "trim studs" at openings as required. Studs shall be securely attached to tracks at all exterior walls except as noted below.

F. Provide for expansion and contraction between floors at solid wall sections of two stories or more by providing a slip joint between stud and track at one end. This connection shall be capable of transmitting lateral loads to the structure.

G. Provide and install bridging, fire blocking, etc. per manufacturer's recommendations, the plans, and code requirements.

H. Perform welding in accordance with AWS D1.3

I. Remove erection bolts and screws used in welded construction.

J. Do not use gas cutting for field correction of fabrication without concurrence of Architect/Engineer.

K. Touch-up field connections and breaks in shop coating with same primer used for shop priming.

3.2 DEFECTIVE WORK AND MATERIALS

A. Work found to be defective, missing or damaged shall be immediately replaced with proper work. Such replaced work and the inspection for same shall be at the expense of the Contractor.

B. Straightening of any materials, if necessary, shall be done by a process and in a manner that will not injure the materials, and which is approved by the Architect. Sharp kinks or bends shall be cause for rejection. Heating will not be allowed.

C. If defects or damaged work cannot be corrected in the field, the material shall be returned to the shop or new parts furnished, as the Architect directs; the Contractor shall replace all work at his own expense.

3.3 CLEANING

A. After erection, all surfaces shall be cleaned and left free of all grime and dirt. Remove unused materials, tools, equipment and debris from the premises and leave broom clean.

END OF SECTION

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SECTION 05 43 00

SLOTTED CHANNEL FRAMING

PART 1 – GENERAL

1.01 SUMMARY

A. Framing shall be a strut type metal framing system (Strut System)

B. Strut System shall be used:

1. To support mechanical and electrical equipment and devices.
2. For structural appliances as applicable.

C. Strut System and components must be supplied from a single approved Manufacturer. UNISTRUT P5500 or Architect approved equal.

1.02 QUALITY ASSURANCE

A. Manufacturer's qualifications:
1. The manufacturer shall have at least 10 years experience in manufacturing Strut Systems.
2. The manufacturer must certify in writing all components supplied have been produced in accordance with an established quality assurance program.

B. Work shall meet the requirements of the following standards:
1. Federal, State and Local codes
2. American Iron and Steel Institute (AISI) Specification for the Design of Cold-Formed Steel Structural Members 2014 Edition.
3. American Society for Testing and Materials (ASTM)
4. Metal Framing Manufacturer's Association (MFMA)

1.03 SUBMITTALS

A. Structural calculations by a Registered Professional or Structural Engineer in the State of the Project's location for approval by the Professional of Record. Calculations may include, but not limited to:
1. Description of design criteria
2. Stress and deflection analysis
3. Selection of framing members, fittings and accessories

B. Assembly drawings necessary to install the Strut System in compliance with the Contract drawings.

C. Pertinent manufacturers published data

1.04 PRODUCT DELIVERY , STORAGE AND HANDLING

A. All material is to be delivered to the work site in original factory packaging to avoid damage to the finish.

B. Upon delivery to the work site, all components shall be protected from the elements by a shelter or other covering.

1.05 WARRANTY

A. Manufacturer shall warrant for 1 year from the shipment date that products will be free from defects in material or manufacture. In the event of any such defect in violation of the warranty. Manufacturer shall have the option to repair or replace any such defective product.

B. Installer shall warrant for 1 year from the date of completion of work that the work will be free of defects in installation. In the event of any such defect in violation of the warranty, Installer shall have the option to repair or replace any such defective product.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Strut System and components shall be UNISTRUT.

2.02 MATERIALS

A. All channel members shall be fabricated conforming to one of the following ASTM specification:
1. Plain Carbon Steel : A 1011 SS Grade 33
2. Pre-Galvanized Carbon Steel: A 653 Grade 33
3. UNISTRUT DEFENDER . A 1046 SS Grade 33
4. Stainless Steel : A 240 (Type 304)
5. Aluminum: B 221 (Type 6063-T6)

B. All fittings shall be fabricated conforming to one of the following ASTM specifications:
1. Carbon Steel: All carbon steel fittings shall be fabricated from steel that meets/exceeds the physical requirements of ASTM A1011 SS Grade 33 and conforms to one of the following ASTM specifications:
   a. A 575
   b. A 576
   c. A 36
   d. A 635
   e. A 1059
   f. A 1046
2. Stainless Steel:
   a. A 240 (Type 304 or Type 316)
   b. A 276 (Type 304 or Type 316)
3. Aluminum:
   a. B 209 (Type 1100F or Type 5052-H32)

C. Any substitutions of product or manufacturer must be approved in writing ten days prior to bid by the Professional of Record.

2.03 FINISHES

A. FACTORY PAINTED
   1. Channel
      a. Rust inhibiting thermoset acrylic enamel paint applied by electro-deposition after cleaning and phosphating and thoroughly baked.
   2. Fittings
      a. Polyester powder coat after cleaning and phosphating and thoroughly baked.
   3. Color shall be FHWA Highway Green, Color Tolerance Chart, PR color No. 4
   4. Hardness = 2H
   5. Performance
      a. Salt Spray per ASTM B117
         1. Scribed: Exceed 400 hours
         2. Unscribed: Exceed 600 hours
      b. Nominal chalking at 1,000 hours per weatherometer G-23 test
      c. No checking at 1.000 hours per weatherometer G-23 test

B. ELECTRO-GALVANIZED per ASTM B 633 Type III SC 1

C. PRE-GALVANIZED per ASTM A653

   1. Zinc coated by hot-dipped process prior to roll forming at the steel mill
   2. Zinc coating thickness shall be G90 (0.75=0.45 oz/sq.ft surface area)

D. HOT-DIPPED GALVANIZED per ASTM A123 or A 153
   1. Zinc coated after all manufacturing operations are complete
   2. Zinc coating thickness shall be G65 (2.6 mils =1.50 oz.ft surface area)

E. UNISTRUT DEFENDER per ASTM A1046 and A1059
   1. Strut coated per A1046 to mass of 0.45 oz./sq.ft. surface area
   2. Fittings coated per A1059 to a thickness of 30 microns and/or A1046 to a mass of 0.45oz./sq/ft. surface area

F. SPECIAL COATING/MATERIAL
   (Describe as applicable)

PART 3- EXECUTION

3.01 EXAMINATION

A. The installer shall inspect the work area prior to installation. If work area conditions are unsatisfactory, installation shall not proceed until satisfactory corrections and completed.

3.02 INSTALLATION

A. Installation shall be accomplished by a fully trained manufacturer authorized installer.

B. Set Strut System components into final position true to line, level and plump, in accordance with approved drawings.

C. Anchor material firmly in place and tighten all connections to their recommended torques.

3.03 CLEANUP

A. Upon completion of this section of work, remove all protective wraps and debris. Repair

any damage due to installation of this section of work.

3.04 PROTECTION

A. During installation, it shall be the responsibility of the installer to protect this work from damage

B. Upon completion of this scope of work, it shall become the responsibility of the general contractor to protect this work from damage during the remainder of construction on the project and until substantial completion.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. All items of miscellaneous metal and related accessories and fasteners, including but not necessarily limited to the following:

1. Steel pipe railing, handrails, guardrails and brackets.
2. Continuous inserts for pipe and conduit supports.
3. Backing and mounting plates for equipment items.
4. Ceiling support system.
5. Metal grating with frames and ledger angles.
6. Anchor bolts.
7. Auxiliary angles brackets.

1.2 RELATED SECTIONS

A. Section 05 12 00: Structural Steel.

B. Section 05 51 00: Prefabricated Stairs.

C. Section 05 51 33: Metal Ladders.

D. Section 05 52 00: Manufactured Handrails and Railings.

E. Section 14 20 00: Elevators.

1.3 REFERENCES

A. Published specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to Work of this Section where cited by abbreviations noted below (latest additions apply).

1. California Code of Regulations, Title 24, latest edition, also known as California Building Code (CBC), with 2001 amendments.
2. American Society for Testing and Materials (ASTM).
3. Federal Specifications (FS).

4. American Institute of Steel Construction's "Specification for Structural Steel Building".

5. American Welding Society's "Structural Welding Code" (AWS D1.1).

6. American Iron and Steel Institute's "Specifications for Design of Light Gauge Cold-Formed Stainless Steel Structural Members".

7. National Association of Architectural Metal Manufacturer's: "Metal Stairs" (NAAMM-MS).

8. Steel Structures Painting Council's "Painting Manual":

   a. Solvent Cleaning (SSPCC-SP 1).

   b. Hand Tool Cleaning (SSPC-SP 2).

   c. Brush-Off Blast Cleaning (SSPC-SP 7).

   d. Hot Phosphate Surface treatment (SSPC-PT 4).

9. American Hot Dip Galvanizers Association, Inc. (AHDGA):

   a. Inspection manual for hot dip galvanized products.

1.4 QUALITY ASSURANCE

A. Welded Qualifications: Welders shall be qualified in accordance with AWS D1.1.

B. Design Criteria:

1. Work shall be designed to support normally imposed loads and conform to AISC requirements.

2. Built-up parts shall not exhibit warp.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Manufacturer's literature describing products including details and dimensions.

C. Shop Drawings:

1. Show a large scale construction of various parts, methods of joining, thickness of metals, profiles of surfaces, reinforcing, anchorage, and structural supports. Include information regarding concealed and exposed joints, welds, and fastenings.

2. Where welded connectors and concrete inserts are required to receive Work, show size and locations required.

D. Samples: Only as requested by the Architect.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle packaged materials in original containers with seals unbroken and labels intact until time of use.

B. Discharge materials carefully and store on clean concrete surface or raised platform in safe, dry area.

1.7 JOB CONDITIONS

A. Scheduling, Sequencing:

1. Ensure timely fabrication of items to be embedded or enclosed by other Work.

2. Furnish information and assistance required for locating embedded items and be responsible for proper locations.

PART 2 - GENERAL

2.1 BASIC MATERIALS AND ACCESSORIES

A. Ferrous Metals:

1. Structural Steel Shapes: ASTM A36, conforming to AISC specifications.

2. Architectural and Miscellaneous Steel Items: ASTM A283.

3. Steel Sheets: ASTM A570, Grade 36.

4. Steel Pipe: ASTM A53.

5. Steel Bars: ASTM A36.

6. Steel Tubing: ASTM A500, Grade B.

7. Steel Plate: ASTM A36.

8. Checker Plate: FS QQ-F461c, flat back carbon steel, pattern 15 or 16.

9. Zinc for Galvanizing: ASTM B06 as specified in ASTM A123.

10. Welding Electrodes: E-70XX.

11. Grout: Embeco "636" or approved equal.

12. Stair Treads: Irving, Reliance, or approved equal with abrasive metal nosing.

13. Grating: Irving, Reliance or approved equal typical one-inch X 3/16-inch beaming bars at 1-3/6-inch centers with 1/4-inch twisted cross bars welded at 4-inch centers, galvanized with bolted anchorage.

B. Fastenings:

1. Typical Unfinished Bolts, Nuts, and Washers: Low carbon steel standard fasteners, externally and internally threaded, ASTM A307 Grade A; malleable washers.

2. Expansion Bolts: FS FF-S-325, Group II, Type 4. Same as Hilti's "Kwik-Bolt II Concrete Anchors"; Wej-It Expansion Products, Inc.'s "Wej-It Concrete Anchors"; or approved equal.

C. Primer: Zinc-chromate type. Same as manufactured by Fuller-O'Brien Corp.'s Ne. 121-00; The Glidden Co.'s No. 4570; Sinclair Paint Co.'s 20; or approved equal.

2.2 SPECIALTY FABRICATED PRODUCTS

A. Preparation:

1. Coordinate with other Work supporting or adjoining miscellaneous metal and verify requirements of cutting out, fitting, and attaching.

2. Verify sizes, designs, and locations of items; do so at site whenever construction progress permits.

B. General Requirements:

1. Fabricate items from materials noted and make true to profiles shown. Obtain the Architect's approval of proposed variations.

2. Miter corners and angles of frames and moldings unless otherwise noted.

3. Perform cutting, shearing, drilling, punching, threading, tapping as required for items or their adjacent Work.

4. Drill or punch holes; do not use cutting torch.

5. Ensure shearing and punching leaves true lines and surfaces.

6. Items to be Galvanized: Fabricate in accordance with recommended practices of ASTM A385 and A386 unless specifically noted otherwise.

7. Fabricate exterior items for assembly and installation on site without field-welding of joint.

8. Ensure metal thickness and assembly details provide ample strength and stiffness.

9. Size sleeves for approximately 1/4-inch clearance all around.

C. Fastening:

1. Provide fasteners and anchor assemblies required for complete fabrication, field assembly, and erection.

2. Conceal fastenings wherever practicable.

3. Size internally threaded diameters to accommodate galvanized threaded bolts where galvanizing is required.

4. Permanent Connections in Ferrous Metal Items: Employ welding wherever practicable; avoid bolts and screws.

D. Welding:

1. Use electric shielded-arc process according to AWS D1.1.

2. Maintain shape and profile of item welded.

3. Prevent heat blisters, run-throughs, and surface distortions.

4. Welds Normally Exposed to View in Finished Work: Make uniform and grind smooth.

5. Exposed Welds: Remove burrs, flux, welding oxide, air spots and discoloration; grind smooth, polish, or otherwise finish to match material welded.

E. Bolted and Screwed Connections:

1. Use bolts for field connections only, and then only as noted. Countersink heads; finish smooth and flush.

   a. Provide washers under heads and nuts bearing on wood.

   b. Draw nuts tight and prevent loosening of permanent connections by nicking threads.

   c. Use beveled washers where bearing is on sloped surfaces.

2. Where necessary to use screws for permanent connections in ferrous metal, use flat head type, countersink, fill screw slots, and finish smooth and flush.

3. Evenly space exposed heads.

F. Steel Stairs: Fabricate in accordance with NAAMM-MS standards from steel sections as noted.

G. Ferrous Metal Pipe Railings:

1. Fabricate in largest sections practicable.

2. Weld shop joints; fit field joints with concealed pins and sleeves.

3. Flush fittings may be used for crosses and tees.

4. Return rails to wall as noted.

5. Close ends with welded cap and ease edges.

H. Handrail Bracket for Pipe Railings: Fabricate according to details on Drawings.

2.3 FINISHES

A. Preparations of Surfaces:

1. Thoroughly clean mill scale, rust, dirt, grease, and other foreign matter from ferrous metal prior to galvanizing, hot phosphate treatment or painting.

2. Where hand cleaning methods are not adequate, clean in accordance with SSPC-SP 1, SSPC-SP 2, or SSPC-SP 7 as required.

3. Completely eliminate burrs, rough spots and pitting from normally exposed ferrous metal items.

B. Galvanizing:

1. Galvanize items after fabrication in largest sections practicable unless otherwise permitted or recommended by ASTM A 384 and A385.

2. Where galvanizing is removed by welding or other assembly procedures, touch up abraded areas with molten zinc or zinc-rich paint.

3. Where ferrous metal item is noted to be galvanized, perform galvanizing in accordance with following standards as applicable to item:

a. Hardware items Including Fasteners: ASTM A153.

b. Items Both under 1/8-inch Thickness and Fabricated from Rolled, Pressed, and Forged Shapes, Plates, Bars, and Strips: ASTM A383.

c. Other Fabricated items: ASTM A123.

C. Finish Schedule: Unless noted otherwise in Materials or Standard Catalog Products Articles.

1. Ferrous Metal, Interior Items:

a. Concealed: Clean, chemically etch, and shop-apply one prime-coat.

b. Exposed: Clean, treat with hot phosphate, chemically etch, and shop-apply one prime-coat.

2. Ferrous Metal, Exterior Items:

a. Concealed: Clean and hot-dip galvanize in accordance with galvanizing standards.

b. Exposed: Clean, then hot-dip galvanize in accordance with galvanizing standards, chemically etch, and shop-apply one prime-coat.

3. Special Ferrous Metal Items as Noted Below: Clean and hot-dip galvanize in accordance with galvanizing standards. Do not prime coat.

a. Miscellaneous metal items such as stairs and railings.

4. Items Noted as Chrome-Plated: Same as US26D finish.

5. Hardware Including Fasteners (Bolts, Nuts, Washers, Etc.):

a. Finish to match items fastened.

b. Where galvanizing is required, hot-dip galvanize according to ASTM A153.

2.4 SOURCE QUALITY CONTROL

A. Tests and Inspections: The Owner will employ testing laboratory to test welds per CBC, Section 2212A.5.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas to receive Work and verify that setting conditions and dimensions are correct to receive items.

B. Do not start installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install Work plumb, true, rigid, and neatly trimmed out.

B. Do not tighten fastener through finish alone without spacer washers.

C. Provide concrete inserts or predrilled expansion bolts in fastening items into concrete.

D. Protect dissimilar metals from contact with each other or with other materials causing corrosion.

E. Fasten Work tightly to prevent rattle or vibration except where expansion-contraction tolerances are required.

F. Use nonshrink grout mixed in accordance with manufacturer's direction for setting frames, plates, sills, bolts and similar items.

G. Set items shown or required to be installed in sleeves with quicksetting anchor cement unless otherwise noted.

H. Protect metal from damage to surface, profile and shape.

3.3 CLEANING

A. Remove protective devices only when items will safe from other construction operations or removal is required to permit related Work.

B. Clean prime-coated items as required for finish painting.

END OF SECTION

SECTION 05 51 00
PREFABRICATED STAIRS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Shop-fabricated stairs for field installation.

B. Connectors as needed.

C. Non-slip surfacing, if not part of the construction.

1.2 REFERENCES

A. California Building Code (CBC)

B. ADAAG - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities.

C. ASTM A36 - Structural Steel.

D. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

E. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

F. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

G. ASTM A780 - Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

H. AWS A2.4 - Standard Welding Symbols.

I. AWS D1.1 - Structural Welding Code - Steel.

J. SSPC - Steel Structures Painting Council.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00, Submittals.

B. Engineering drawings bearing the professional seal of an engineer registered in the State of California, along with the DSA approval stamp.

C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

D. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

1.4 QUALIFICATIONS

A. Welders' Certificates: Submit under provisions of Section 01 33 00, Submittals, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.5 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on Drawings.

PART 2 - PRODUCTS

2.1 MATERIALS - STEEL

A. Steel Sections and Plates: ASTM A36.

B. Steel Shapes: ASTM Grade 50.

C. Steel Tubing:

1. Structural Use: ASTM A500, Grade B or C.

2. Non-Structural Use: ASTM A513, hot-rolled or cold-rolled (mill option).

D. Pipe: ASTM A53, Grade B, Schedule 40.

E. Steel Sheet:

1. Structural Use: ASTM A570 (hot-rolled) or A366 (cold-rolled).

2. Non-Structural Use: ASTM A569 (hot-rolled) or A366 (cold-rolled).

F. Fasteners and Accessories: Provide all necessary anchor bolts, clip angles, hanger rods and other hardware, accessories and incidental materials required for complete installation of stairs and rails.

G. Bolts, Nuts, and Washers: ASTM A307 galvanized to ASTM A153 for galvanized components.

H. Welding Materials: Conform to AWS code and AWS filler metal specifications for material being welded.

I. Shop and Touch Up Primer: SSPC 15, Type 1, red oxide.

J. Touch-Up Primer for Galvanized Surfaces: SSPC 20.

K. Primer: Acrylic Latex rust-inhibitive primer containing less than 1.0 pounds per gallon volatile organic compounds (VOC), certified to be compatible with finish coats specified in Section 09 91 00.

L. Concrete Materials and Reinforcement: Comply with the applicable requirements of Section 03 30 00.

2.2 MATERIALS - CONCRETE

A. 3,000 PSI concrete.

2.3 STANDARD STAIR SYSTEM

A. Manufacturer's standard prefabricated, straight run stair riser and tread system, consisting of hot-rolled steel sheet treads and risers.

1. Risers: Closed riser, minimum 14-gauge hot-rolled mild steel sheet, sloped maximum 1-1/2 inches and conforming to ADAAG nosing requirements.

2. Treads: Manufacturer's standard concrete pan system (field-poured). Tread pans shall be minimum of 14 gauge, or as determined by design calculations. Pan depth 1-1/2 inches. Exposed welds from the bottom side of flight assemblies will not be allowed. All welds shall be from topside of tread pans as recommended by manufacturer. Refer to Section 03 30 00 for concrete design requirements and field finish of treads.

3. Landings: Minimum of 11 gauge hot-rolled mild steel sheets, formed for a minimum 3 inches concrete fill, with 12 gauge channel supports and bracing welded to perimeter frame at 12 inches on center.

4. Fasteners and Supports: Sized by the manufacturer to meet the structural design and drawings. If hanger rod connections are applicable to any of the landing connections, they shall be a minimum of 5/8 inch diameter steel rod, actual size based on stair load.

2.6 FABRICATION, GENERAL

A. Fit and shop assemble in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by continuous welds unless indicated otherwise.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise. Screws or bolts in contact with concrete shall be hot-dip galvanized or stainless steel.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.7 FINISHES

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. To the greatest extent possible, galvanizing shall be performed after all welding and cutting is complete.

C. Galvanize assembled items to minimum 1.25 ounces per square foot zinc coating in accordance with ASTM A123.

D. Repair damaged galvanized surfaces in accordance with ASTM A780 Method A2.

E. Do not prime surfaces in direct contact with concrete or where field welding is required.

F. Prime paint items with one coat of primer, after galvanizing.

H. Finish: Field paint exposed-to-view prime painted items under provisions of Section 09 91 00, Painting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive Work.

B. Beginning of installation means erector accepts existing conditions.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate trades.

3.3 INSTALLATION

A. Align accurately with adjacent structures.

B. Install items plumb and level, accurately fitted, free from distortion or defects.

C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Field weld components indicated on Drawings.

E. Perform field welding in accordance with AWS D1.1.

F. Obtain Architect's approval prior to site cutting or making adjustments not scheduled.

G. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

END OF SECTION

SECTION 05 51 33
METAL LADDERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Metal roof access ladder[s].

1.2 RELATED SECTIONS

A. Section 05 12 00: Structural Metal Framing.

B. Section 05 50 00: Metal Fabrications.

C. Section 06 10 00: Rough Carpentry

1.3 REFERENCES

A. Codes and Regulations:

1. California Building Code, 2016 edition.

2. Welding Certification requirements of permit jurisdiction.

B. Organization and Trade Standards:

1. Applicable or referenced sections of AISC Manual of Steel Contraction, current edition.

2. Applicable or referenced sections of AWS D1.1 Standards, current edition.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Ladder shall be detailed and submitted for approval prior to fabrication showing full dimensions, wall and floor attachments, materials, construction and finish, and shall comply with all safety orders pertinent to the installation. Indicate size and type of fasteners, welds, accessory items, shop finish and method of anchorage.

C. Product Data: Submit for primer paint.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials and finished assemblies in an undamaged condition under provisions of Section 01 87 00.

B. Maintain manufacturer's packaging until ready for installation.

1.6 WARRANTY

A. Provide a 5 year manufacturer's warranty against defects in materials and workmanship.

PART 2 - PRODUCTS

2.1 METAL FABRICATIONS

A. Steel ASTM A36/A36M.

B. Fasteners:

1. Provide stainless steel fasteners for fastening. Select fasteners for type, grade and class required.

2. Masonry Anchorage Devices: Expansion shields, FS FF-S-325.

2.2 FIXED LADDER

A. General: Comply with OSHA and ANSI A14.3. Provide complete with anchors and accessories.

1. Side Rails: Minimum 3/8 inch by 3 inches flat steel bars with eased edges.

2. Rungs: 1 inch minimum round steel bars uniformly spaced, punched through stringers and plug welded. Provide non-slip surface on top of each rung, either by coating rung with aluminum oxide granules set in epoxy adhesive, or by using manufactured rung which is filled with aluminum oxide grout.

3. Angle Supports: Support ladder by steel angles bolted to wall to provide minimum or 7 inches from face of wall to centerline of rungs.

4. Roofover Rail Extension: Extend side rails no less than 3 feet 6 inches above top rung.

5. Security Door: Size as shown, formed 1/8 inch thick bent steel plate. Security panels shall extend on both sides, perpendicular to the door face, to within 2 inches of the wall. Security door shall be furnished complete with continuous piano hinge and heavy duty steel locking hasps.

6. Finish: Hot-dip galvanized.

2.3 FABRICATION PROCEDURES

A. Ladder shall be shop fabricated.

B. Fabricate finish surfaces smooth, unless otherwise specified.

C. Make joints as strong and rigid as adjoining sections. Make exposed joints close fitting and where jointing is least conspicuous. Unless otherwise indicated, full weld joints and seams and dress smooth where exposed.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to Work of this Section, carefully inspect the installed Work of all other trades and verify that all such Work is complete to the point where this installation may properly commence.

B. Verify measurements in field for Work fabricated to fit job conditions.

3.2 INSTALLATION

A. Install straight and true and in accordance with fabricator's instructions and with approved Shop Drawings.

B. Upon completion of installation, re-examine Work and provide additional shims, washers, anchors and corrective Work to insure that installation is firm, tight anchored, in alignment with neat fits, without distortion, unsightly fastenings raw edges or protrusions.

3.3 ADJUSTING AND CLEANING

A. Cleaning Galvanized Surfaces: Clean bolted connections, abraded areas and field welds and apply ASTM A780 galvanizing repair paint.

3.4 PROTECTION

A. Protect finished installation under provisions of Section 01 50 00.

END OF SECTION

SECTION 05 52 00
METAL RAILINGS AND HANDRAILS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The General Conditions of the Contract, including General and Special Provisions and General Requirements apply to the work in this section.

1.02 DESCRIPTION

A. Work included: Furnish all labor, materials, equipment, facilities, transportation and services to complete all metal stair handrails, ramp handrails and related work as shown on the drawings and/or specified herein and as necessary for a complete installation.

1.03 RELATED SECTIONS

A. Section 32 13 14 – Site Concrete

1.04 REFERENCES

A. ASTM A123 - Zinc (Hot-Galvanized) Coatings on Products Fabricated From Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip.

B. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

C. ASTM B117 – Std for Salt Spray Resistance for Powder Coatings

D. ASTM D822 – Std for Weatherability of Powder Coatings.

E. American Welding Society – (AWS)

F. AWS A5.8 – Specification for Filler metals for Brazing and Braze Welding

G. AWS D1.1 – Specification for Structural Welding Code.

H. Society of protective Coatings– (SSPC)
   1. SSPC – SP2 Hand Tool Cleaning
   2. SSPC – SP7 Commercial Blasting

I. ADA Accessibility Guidelines, September 2002.

1.05 SUBMITTALS

A. Submit under provisions for SUBMITTALS.

B. Submit two (2) 2-foot section of each material sample to Design Builder including galvanized section.

C. Submit complete shop drawings of all railings and handrails prior to manufacturing; indicate profiles, edge and joint conditions, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.

D. Submit color swatch on metal of Powder Coat Paint. Color to match existing handrails at Haymarket Theater. Contractor to submit color match sample for approval in field.

1.06 CREDENTIALS

A. Installer: Company who has completed metal railings and handrails fabrication and installation work similar in material and design for a period of at least five (5) years.

1.07 PRODUCT STORAGE

A. Store materials, either plain or fabricated, above ground on platforms, pallets, skids, or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.

1.08 QUALITY ASSURANCE

A. Field Measurement: Make all field measurements as required prior to fabrication and installation. Unless specifically directed otherwise by Design Builder.

B. Coordination: Coordinate with other trades to ensure proper sequencing and fitting of construction.

C. Shop Assembly: Preassemble items in shop to greatest possible extent to minimize splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordination of installation.

PART 2 - PRODUCTS

2.01 METAL RAILING

A. sA-120 standard weight (Schedule 40).

B. Guardrail and handrails shall have a nominal 1½" O.D. as shown on the Drawings.

C. Bolts, Nuts, and Washers: ASTM A325 and A307, galvanized as follows:
   1. For A307 items: Zinc electroplated per ASTM B633.

D. All galvanized metal materials - post fabrication with, Powder Coat Paint finish.

2.02 FINISHING

A. Galvanizing:
   1. Galvanize all metal items so specified or indicated on plans. Use the hot dip process, conforming to ASTM A123. Galvanizing shall be done after fabrication.
   2. Average weight of zinc coating per square foot of actual surface: Not less than 2.0 ounces, with no individual specimen showing less than 1.8 ounces. (One ounce of zinc corresponds to a coating thickness of 0.0017.)

B. Commercial Brush Blast
   1. Brush Blast all steel members and components to ensure inter-coat adhesion to SSPC-SP7.

C. Powder Coating
   1. Powder coat all items so specified or indicated on plans.
   2. Hot dip galvanize and do not water or chromate quench.
   3. Removal all drainage spikes and surface defects.
   4. Powder coat within 12 hours of galvanizing. Do not get surfaces wet. Do not leave outside.
   5. Keep the surface clean. Do not transport uncovered loads. Diesel fumes will contaminate surface.
   6. If surface contamination has occurred or is suspected, clean surface with proprietary solvent/detergent designed for pre-cleaning prior to powder coating.
   7. Use zinc phosphate pretreatment if highest adhesion is required. Surface must be perfectly clean. Zinc phosphate has no detergent action and will not remove oil or soil.
   8. Use iron phosphate if standard performance is required. Iron phosphate has a slight detergent action and will remove small amounts of surface contamination. Best used for pre-galvanized products.
   9. Pre-heat work prior to powder application.
   10. Use “degassing” grade polyester powder only.
   11. Check for correct curing by solvent testing. Adjust pre-heat and line speed to ensure full cure.
   12. Apply thermoset polyester powder coat at 3-5 mils to manufacturer’s specifications ASTM B117 and ASTM D822 technical recommendations.

PART 3 - EXECUTION

3.01 FABRICATION

A. Weld all shop connections. Welds shall be smooth, continuous beads, free to excessive roughness and spatter. Grind surface welds smooth and flush to match and blend with parent metal surfaces.

B. Guardrail and handrail diameters size shall be as indicated on Drawings.

C. Guardrail and handrail heights shall be as indicated on Drawings.

D. The work shall be laid out according to the dimensions on the Drawings. Contractor shall field verify all dimensions prior to fabrication

E. Hot Dip Galvanized

3.02 INSTALLATION

A. Contact the Design Builder before beginning work if discrepancies are noted. Do not proceed until discrepancies are resolved.

B. All posts shall be installed as indicated on Drawings. Set and plumb posts vertically. Rails shall be parallel to the grade. Panels shall be curved or pitched as required.

C. After posts have been set in place and properly supported to hold them inline and on grade, fill the annular space to the depth shown on plan with non-slip grout.

D. Apply Permagel epoxy sealer after grout has hardened. Trowel to fill and seal hole to form a ¼" wash.

E. Exercise care when installing components so as not to damage finished surface.

F. Touch-up finished surfaces, where applicable to match factory applied coating

G. Where set in pre-cast sleeves or core drilled holes, posts to be secured with thin-set epoxy setting mixture or non-shrink grout with color to match adjacent paving as noted on the Drawings.

H. Where attached to existing concrete wall, secure post plates with masonry anchors as required.

I. Minimize field welds as noted above. Where required properly prepare area and use approved materials and method to provide durable, long lasting protection against rust.

J. Final finish of railings shall be uniform and equal.

K. All welding shall conform to requirements of the Committee for Standard Tests for Welds of the American Welding Society. All welding shall be electric arc process. Welds exposed in finish work shall be filled out flush, ground and dressed. Welders for structural shall be certified

L. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete

M. Railings which do not meet ADA code, are not equal, do not have a uniform finish or show poor workmanship shall be repaired or replaced by the contractor prior to acceptance.

3.03 WARRANTY

A. 1 year including against rust.

END OF SECTION

SECTON 05 73 60
DECORATIVE METAL RAILINGS WITH GLASS INFILL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Aluminum pipe and tube railings for use at interior stairs and balconies.
   2. Infill system for pipe and tube railings

1.2 PERFORMANCE REQUIREMENTS

A. All railings shall be supplied to conform to applicable sections of the following codes:
   1. California Building Code (CBC)
   2. ADAAG - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities.

B. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails:
      a. Uniform load of 50 lbf/ ft. applied in any direction.
      b. Concentrated load of 200 lbf applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   2. Top Rails of Guards:
      a. Uniform load of 50 lbf/ ft. applied in any direction.
      b. Concentrated load of 200 lbf applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   3. Infill Area of Guards:
      a. Horizontal concentrated load of 50 lbf applied to 1 sq. ft. at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area. Load on infill area need not be assumed to act concurrently with loads on top rails.

C. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.3 SUBMITTALS

A. Product Data: For the following:
   1. Manufacturer's product lines of mechanically connected railings.
   2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Initial Selection: For products involving selection of color, texture, or design.

D. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

E. Qualification Data: For professional engineer.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 935.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing through one source from a single manufacturer.

B. Mock-up Panel: one section of railing system for verification.
   1. Approximate ¼ to ½ size using full size components.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents unless such deviations are specifically approved by Architect in writing.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Railing Product: Subject to compliance with requirements, provide Interna-Rail VUE for Glass as manufactured and assembled by Hollaender Manufacturing or an approved equivalent.

B. Or approved equal. Substitutions under the provisions of Section 01 25 13, Product Options and Substitutions..

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.3 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

B. Extruded Bars and Tubing: ASTM B 221, Alloy 6063-T5/T52, 6005-T5.

C. Extruded Structural Pipe and Round Tubing: ASTM B 429, Alloy 6061-T6. Provide 1 ½ in IPS, (1.90 in OD) Standard Weight (Schedule 40) pipe for rails, Schedule 80 for posts, unless otherwise indicated

D. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832

E. Plate and Sheet: ASTM B 209, Alloy 6061-T6

F. Die and Hand Forgings: ASTM B 247, Alloy 6061-T6

G. Base Flange Castings: ASTM B 26/B 26M, Alloy Almag 535

H. Structural Fittings and Panel Clips: Alloy 6063-T6.

2.4 STEEL

A. Perforated Sheet: ASTM A1008.

2.5 FASTENERS

A. General: Provide the following:
   1. Aluminum Railings: Type 302 stainless-steel fasteners

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Structural Fasteners for Interconnecting Railing Components:
   1. The top rail shall be connected to the main body of the post with Hollaender 255-8 EXT tees. Tee fittings shall be manufactured from 6063-T6 aluminum alloy and shall be internally connected to the rail by means of 5/16" set screw that engages a lug on the 255-8 tee through the wall of the Sch 80 post. The stainless steel set screw shall have an internal /external, reverse knurl, cup point. This combination shall prevent any loosening of the system due to changes in temperature or vibration. Systems using pop rivets or adhesives will not be accepted.

D. Glass or resin panels to be secured to the post using Hollaender 244-8 two piece glass panel clips. 244-8 clips will be manufactured from 6063-T6 aluminum alloy and secured to the rails using anodized aluminum tubular rivet nuts, size 5/16 – 18 UNC, and stainless steel socket head cap screws. The glass shall be supported at the bottom using Hollaender 244B-8 glass support clips. No holes will be drilled in the glass except at corner or end post conditions.

2.6 FLANGES AND ANCHORS

A. Anchors: Provide concrete adhesive anchors where indicated or necessary.

B. Flanges :
   1. For level railing, provide Hollaender 142-8 internal cast flanges with 4 holes, capped with Hollaender 242-8 anodized aluminum escutcheon plate.
   2. For raked railing on steel stringers, use Hollaender 146I-8 internal spud with integral cover plate.
   3. For side mount, use Hollaender 52E-8 flange.

2.7 GLASS OR RESIN INFILL PANELS FOR RAILINGS

A. Tempered Glass: ASTM C 1048, Fully Tempered, Condition A, Type 1 (Transparent Flat Glass), Quality Q3. Products shall comply with properties indicated for class, thickness, and manufacturing process that have been tested for surface and edge compression according to ASTM C1048 and for impact strength according to 16 CFR 1201for category 2 materials.

B. Glass infill panel to be 3/8 inch thickness, with maximum spacing between posts to be 4 ft.

C. Resin panels to be acrylic, 3/8 in thickness, from Lumicor or other architect approved vendor.

2.8 HANDRAIL FOR ADA APPLICATIONS / STAIRS (AS REQUIRED)

1. Stairways shall have handrails on both sides.
2. Handrail will be attached to the guardrail sections using Hollaender model 87-8 adjustable brackets.
3. Handrail will be installed at a height of 34 – 38 inches above stair tread nosings.
4. Handrail will be anodized aluminum 6063 Sch 40, 1 ½ in IPS nominal (1.90 in. OD) and shall have a continuous surface. Where necessary, lengths of the handrail will be spliced using Hollaender Model 70ES-8 internal locking splices.
5. Handrails shall return to a wall, guard or walking surface. If returning to the guard, Hollaender model 185 post return swivel shall be used to connect the end of the handrail to the guardrail post.

2.9 MISCELLANEOUS MATERIALS

A. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.10 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with nonwelded connections, unless otherwise indicated.

H. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fittings to be of the internal double tang type activated by a reverse knurl cup point set screw. Reverse knurl is required to ensure that screw does not come loose under vibration. Plain cup point screws will not be accepted. Fittings to be fastened to pipe by means of a 5/16 in. tubular rivet nut and socket head cap screw.

I. Form changes in direction as follows:
1. By flush bends or by inserting prefabricated flush-elbow fittings.

J. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

K. Close exposed ends of railing members with prefabricated end fittings.

L. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated. Flanges to be sand cast from aluminum alloy 535 with anodized finish and fastened directly to the post by means of two reverse knurl cup point set screws.

N. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

2.11 FINISHES, GENERAL

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

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

C. 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.

2.12 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Unless indicated otherwise, provide aluminum with the following finish:
   1. Anodized Finish: AA-M10C22A41 (Architectural class, .7 mil thickness or greater)

2.13 STEEL FINISHES

A. Steel Perforated Sheet Metal or Wire Mesh Infill Panel:
   1. Primer/Corrosion Protection – approx 1 mm coating provided by minimum 4 step electrocoat process.
   2. Finish: Powder coat Color: as selected by Architect from manufacturer's full line

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
   1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
   2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
   3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings.

B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches of post.

3.4 ANCHORING RAILING ENDS

A. Anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and connected to railing ends using nonwelded connections.

3.5 ATTACHING HANDRAILS TO WALLS

A. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.

B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets to building construction as indicated, or if not indicated, as follows:
1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. Provide blocking between studs in stud wall construction.

3.6 ADJUSTING AND CLEANING

A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

3.7 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 05 51 33
ARCHITECTURAL METAL COLUMN COVERS

PART 1 - GENERAL

1.1 Section Includes

A. Furnish all labor, materials, equipment and incidentals required to install column covers, in accordance with the contract drawings and details to insure a weather-tight system. Column Cover supplier shall be responsible for the design of the Column Cover System, including, but not limited to, the anchorage details, sealant recommendations, and expansion/contraction provisions for system.

B. Provide formed metal column covers and/or beam wraps as shown on drawings. Contractor to coordinate requirements, quantities and sizes with structural drawings.

1.3 References

A. The manufacturer will be a firm regularly engaged in the fabrication of custom aluminum columns cover systems with a minimum of 5 years experience in the production of systems as specified herein.
B. The name of the manufacturer and/or installer must specifically be listed by the general contractor at the time of submission of the bid.
C. No bidder of the column cover system will be accepted without the prior written approval of the architect based on submission of a mock-up illustrating the significant conditions of the project.
    a. Scope of the mock-up must be closely coordinated with the architect.
    b. Written approval of all bidders fulfilling these requirements shall be so noted by addendum.

1.4 Submittals

A. Submit copies of manufacturer's standard guide specifications, standard detail drawings and installation procedures.
B. Submit certified test reports verifying the performance requirements.
C. Submit shop drawings showing small scale layout and elevations of the total project. Details shall include attachment to the support system, include all information necessary for fabrication and recommendation for installation of column covers. Indicate materials, sizes, thickness, fastenings and profiles. Show details of weatherproofing at edges, termination, penetrations and connections to adjacent materials.
D. Submit product samples as directed by the project architect representative of materials to be furnished.

1.5 Quality Assurance

A. The installer shall be an experienced installation firm acceptable to the panel manufacturer. Written approval of any subcontract installer must be received by the architect prior to the installation of any materials.
B. Any reference to specific manufacturers is not intended to restrict bidding but rather to establish a minimum standard of quality and offer clarification of panel profiles. Manufacturers not listed must obtain the written approval of the architect

a minimum of 7 days prior to the bid. Such request for approval must be in accordance with paragraph 1.3 of this section and the general conditions.

1.7 Project Conditions

A. Field Measurements Verify actual supporting and adjoining construction by field measurements before fabrication, and indicate recorded measurements on final shop drawings. Coordinate construction to ensure that Column Covers fit properly to supporting and adjoining construction and coordinate schedule with construction progress to avoid delaying the work.

B. Established dimensions: where field measurements can not be made without delaying the work, guaranteed dimensions shall be provided to manufacturer to proceed with fabrication of Column Covers corresponding to the established dimensions.

PART 2 - PRODUCTS

2.1 Manufacturer

A. Manufacturers: Subject to compliance with requirements, provide products manufactured by:

1. Alumafab Metal Sales, LLC Burnsville, MN.

2. ATAS International

The Column Covers shall be installed in accordance with the details illustrated on the contract drawings. The vertical and horizontal joints shall be sealed through the use of exposed sealants as indicated. The column covers shall be positively attached to the building structure on the panel edges.

2.2 Panel Assembly

A. The basic panel shall consist of custom fabricated, solid aluminum column covers, in thicknesses, lengths, widths and finish as illustrated on the contract drawings.
   a. Each course to be fabricated in two or more vertical sections (typically halves) with joints as indicated on the drawings but not greater than 3/4". Fold back ends of sheet metal to form a 1" wide return leg on the concealed side.
   b. Vertical joints to be AF1000 open joint with either caulk and backer rod or compression fit .040" channel inserts finished to match column cover.
   c. Bump forming of column cover will not be permitted unless prior written approval of Architect.
   d. Form bent metal corners to the smallest radius possible without causing grain separation or otherwise damaging the work.
   e. Provide straps, plates and brackets as required for support and anchorage of fabricated items.

B. Covers shall be .125" aluminum 3003 alloy H14 temper. Top and bottom rings shall be welded construction. Horizontal and vertical caulking reveals shall be a minimum of ½" wide. Fold back ends of sheet metal to form a 1" wide return leg on the concealed side.

2.3 Finish

A. Exterior surfaces of the metal panels shall be a fluoropolymer coating utilizing 70% KYNAR 500 resins with a total nominal dry film thickness of 1.0 mil. Finish shall be applied in accordance with industry standards.
(For alternate finishes or more detailed specifications, refer to separate guide specification for insertion at this point.)
B. One manufacturer's standard *(custom)* color shall be selected by the architect.
C. All exposed surfaces shall be protected with a strippable coating.
   a. The strippable coating shall be compatible with the exterior finish.
   b. The strippable coating shall be removed by the erector immediately upon installation of the panels.

2.4 Accessories

A. Fasteners
   a. All panels shall be positively attached to the structure through the use of concealed fasteners contained within the side joint of the assembly. Installer to provide stainless steel screws and fasteners for aluminum column covers.
   b. No exposed fasteners will be accepted, unless noted otherwise.
   c. Fastener types and sizes shall be designed to resist negative & positive wind loads.
B. Sealants
   a. All sealants shall be in accordance with the latest ASTM standards and shall comply with the sealant specifications of the contract documents.
C. Subgirts & Clips
   a. Subgirts and clips shall be furnished as part of the scope of this work as noted on the contract drawings and as required to provide a complete Column Cover assembly.

PART 3 - EXECUTION

3.1 Examination

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation.
B. Substructure shall be structurally sound and shall be free of defects detrimental to work and erected in accordance with established building tolerances.

3.2 Installation

A. Comply with panel manufacturer's instruction for installation and erection of preformed metal panels. Install in accordance with approved shop drawings.
B. Anchor component parts securely in place, providing for necessary thermal and structural movement.
C. Examine structure and surfaces for defects that would prevent proper installation of the wall system. Report any discrepancies to the architect and contractor. Do not proceed until the remedial work has been completed..
D. All fasteners shall be installed in accordance with the materials specification above.
E. Covers to be secured to substrate by use of formed aluminum clips utilizing angle, adjustable angle or zee shapes. Number of clips required to be determined by manufacturers standard practice. Quantity to be approved by Architect.

F. Isolate dissimilar materials in accordance with acceptable industry practices and as recommended by panel manufacturer.

3.3 Cleaning

A. Touch-up damaged finishes.
B. Cleaning and maintenance per maintenance instructions.

3.4 Damaged Column Covers

A. Repair or replace any and all Column Covers and trim that have been damaged upon determination of responsibility.

END OF SECTION

SECTION 06 05 60
COUNTERTOPS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Laminated plastic countertops.

B. Stainless steel countertops.

C. Epoxy resin countertops and sinks.

D. Preparation for utilities.

1.1 RELATED SECTIONS

A. Section 06 41 16: Laminate-Clad Wood Casework.

1.3 REFERENCES

A. WI - Woodwork Institute: Manual of Millwork.

B. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

C. ASTM A653 - Steel Sheet, Zinc Coated, (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

D. ASTM A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

E. NEMA LD3.1: High-Pressure Decorative Laminates.

1.4 QUALITY ASSURANCE

A. Manufacture countertops in accordance with quality standards of the Manual of Millwork of the Woodwork Institute.

B. Issue WI Certified Compliance Certificate to Architect prior to delivery of countertops and provide WI Certified Compliance Labels on all countertops.

C. Provide WI Reinspection Service at the job site prior to installation. Provide to Architect a written report showing the results of the reinspection.

D. Upon completion of the installation, provide a WI Certified Compliance Certificate.

1.6 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Include materials, component profiles, fastening methods, assembly methods, joint details, accessory listings, and schedule of finishes. Provide WI Certified Compliance label on first page of each set.

C. Submit Samples of each type of countertop material.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Active member of the Woodwork Institute licensed by WI to provide WI Certified Compliance Certificates and Labels for the products and materials specified in this Section.

B. Substitutions: Under provisions of Section 01 87 00.

2.2 LAMINATED PLASTIC COUNTERTOPS

A. Fabricate in accordance with Section 16 of the Manual of Millwork:

1.	WI Grade:	Premium [Custom].
2.	Core Thickness:	0.75 inch minimum.
3.	Laminate Thickness:	0.050 inch.
4.	Edge Covering:	Square.
5.	Backsplash:	Square butt.
6.	Top of Backsplash:	Square.
7.	Plastic Colors and Pattern:	To be selected by Architect from Nevamar's standard ARP, textured, satin and woodgrain pattern finishes
8.	Laboratory Exposed Shelves And Reagent Shelves:	Acid-resistant laminated plastic "Chemsurf" by WilsonArt, color as selected by Architect from standard patterns, satin finish.

2.3 STAINLESS STEEL COUNTERTOPS

A. Stainless Steel: ASTM A167, Type 304, No. 4 finish, 18 gage thick.

B. Core: Particleboard, minimum 3/4 inch thick at interior and 3/4 inch pressure treated plywood at exterior pass-through countertops.

1. Pressure treat plywood with water-borne preservatives to comply with AWPB LP-2. After treatment, kiln-dry plywood to a maximum moisture content, of 15 percent.

C. Edge: Marine edge, thickness as indicated on Drawings.

D. Backsplash: Integral cove with corners radiused 1-1/2 inch total thickness.

2.4 EPOXY RESIN COUNTERTOPS

A. Epoxy resin tops and splashes as manufactured by Laboratory Tops, Inc., (512) 352-5591, or Trespa (800) 487-3772, or approved equal, shall be fabricated in accordance with the following:

1. Core Thickness: 1 inch (Trespa: 3/4 inch).

2. Edge: Radius 1/4 inch with drip groove.

3. Sink Edge: 1/4 inch deep x 5/16 inch wide continuous rabbet.

4. Backsplash: Square butt.

5. Color: Black.

B. Epoxy resin sinks (drop in type) as manufactured by Laboratory Tops, Inc., (512) 352-5591, or approved equal, shall be fabricated in accordance with the following:

1. Wall Thickness: 1/2 inch.

2. Edge: 1/4 inch thick lipped rim.

3. Color: Black.

4. Type (as noted on plumbing drawings):

a. Standard Student Sink & Utility Sink at Science Classroom: Rim dimensions 29-5/8 inches long x 16-5/8 inches wide x 12 inches inside bowl depth, end drain location.

b. Demo Table, Science Prep Room, & Accessible student Sink: Rim dimensions 29-5/8 inches long x 16-5/8 inches wide x 6 inches over all depth. This sink must be disabled accessible.

2.6 HARDWARE

A. Grommets: Doug Mockett and Company, Inc. SG Series; plastic 3-1/2 inch diameter. Colors and locations as selected by Architect.

B. Countertop Support Brackets: 1/8 inch thick x 18 inch x 24 inch steel legs, 1-1/2 inch forms with six 1/4 inch mounting holes per side, 1,000 lbs minimum load support, 45 degree cut out as manufactured by A & M Hardware, Inc., or approved equal.

C. Piano Hinge for Countertop: Stanley No. 311, or approved equal.

D. Remainder of hardware required shall be as listed in Supplement No. 1 to Sections 14 and 15 of the Manual of Millwork.

2.7 FABRICATION

A. Shop assemble countertops for delivery to site in units easily handled and sized to permit passage through building openings.

B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

C. Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes, and other fixtures and fittings. Verify locations of cutouts from on-site dimensions. Seal contact surfaces of cut edges.

D. Install plastic grommets in the field in countertops as directed by the District's Representative and/or Architect.

2.8 FABRICATION OF STAINLESS STEEL COUNTERTOPS

A. Fabricate stainless steel countertops with one piece top and two piece bottom.

B. Install bottom panels first. Lap stainless steel edge up over front edge of countertop framing. Secure with adhesive and stainless steel screws.

C. Install one piece top second. Secure to plywood substrate with adhesive. Tack weld the top to the bottom along lower front edges as detailed.

D. Scribe top and bottom ends to adjacent material and around window frames.

E. Provide continuous bead of sealant at all edges and ends to provide a watertight installation.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify adequacy of backing and support framing.

B. Examine countertops for defects. Correct all defects prior to installation.

3.2 INSTALLATION

A. Install countertops in accordance with Installation of Architectural Millwork, Section 26 of the Manual of Millwork.

B. Make joints neatly, with uniform appearance.

C. Install Work plumb, level, true, and straight, with no distortions. Install with no variation in flushness of adjoining surfaces.

D. Shim as required, using concealed shims.

E. Scribe and cut to fit adjoining Work.

F. Repair damaged and defective Work to eliminate visual and functional defects; where repair is not possible, replace Work.

G. Sealant: Install sealant as specified in Section 07 92 00, as required to close any small unavoidable gaps between counter and abutting surfaces.

3.3 ADJUSTING AND CLEANING

A. Protect countertops from damage until acceptance.

B. Clean countertops with materials and equipment that will not cause damage to surfaces.

3.4 SCHEDULE

A. Each base cabinets shall receive a countertop.

B. All Science Classroom and Science Prep Room countertops shall be epoxy resin.

C. Ceramics Room Sink & Cabinets shall be stainless steel.

D. All other countertops shall be plastic laminate covered.

E. Stainless steel countertops shall be as detailed on Drawings.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. All lumber framing, rough hardware and blocking as indicated.

1.2 REFERENCES

A. Published Specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to Work in this Section where cited by abbreviations noted below (latest editions apply).

1. California Code of Regulations. Title 24, also known as 2016 California Building Code (CBC), with amendments.

2. APA - American Plywood Association, "Guide to Plywood Grades".

3. PS - United States Product Standard, PS-1 "Construction and Industrial Plywood".

4. UL - Underwriters' Laboratories, Inc., "Fire Hazard Classification, FR-S".

5. WCLIB - West Coast Lumber Inspection Bureau, "Standard Grading Rules No. 17".

6. WWPA - Western Wood Products Association, "Western Lumber Grading Rules".

7. AWPA - American Wood Preservers Association Standards.

8. ASTM - American Society of Testing and Materials.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings of all specially fabricated rough hardware.

C. Certificates of compliance with standards specified.

1.4 DELIVERY, STORAGE AND HANDLING

A. Provide proper facilities for handling and storage of materials to prevent damage to edges, ends, and surfaces.

B. Keep materials dry. Where necessary, stack materials off ground on level flat forms, fully protected from weather.

1.5 JOB CONDITIONS

A. Environmental Requirements: Maintain uniform moisture content of lumber at not more than 19-percent before, during, and after installation.

B. Sequencing, Scheduling: Coordinate details with other Work supporting, adjoining or fastening to rough carpentry Work.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Rough Carpentry

1. Sills on Concrete: Foundation grade Redwood or pressure-treated Douglas Fir.

2. Lumber (Wood Framing): Meet requirements of following minimum grades.

Item	Grade
Studs	D.F. No. 2
Plates	D.F. No. 2
Beams	D.F. No. 1
Joists	D.F. No. 2
Posts	D.F. No. 1
Blocking	D.F. No. 2

3. Plywood: Provide thickness, grade, and panel identification index shown on Drawings.

B. Rough Hardware: All exterior hardware shall be hot-dipped galvanized steel.

1. Nails: Common wire, typical.

2. Powder Driven Fasteners: Hilti Fastening Systems: Impex Tool Corporation; or approved equal. Tempered steel pins with special corrosion-resistant finish. Provide guide washers to accurately control penetration, maximum 3/4-inch. Accomplish fastening by low-velocity piston-driven powder-actuated tool.

3. Expansion Bolts: Illinois Tool Works “Red Head Trubolt”; Hilti; “Kwik-Bolt II” or approved equal. Reverse cone, self-wedging, expansion type, Tightening of nut or increased tension on bolt shank shall act to force wedges outward to create positive increased resistance to withdrawal.

4. Metal Timber Framing Connectors: Simpson Company or approved equal. Fabricate from hot-dipped galvanized steel. Connectors shall be at least 16-gauge material, 1/8-inch plate materials where welded, unless otherwise shown or specified, punched for nailing. Nails and nailing shall conform to the manufacturer's instructions, with a nail provided for each punched hole.

5. Miscellaneous Hardware: Provide all common screws, bolts, fastenings, washers and nuts required to complete rough carpentry Work.

2.2 TREATMENTS

A. Fire-Retardant Treatment: Koppers Co., Inc.'s "Non-Com"; J.H. Baxter and Co. "Baco-Pyresote"; or approved equal.

B. Preservative Treatment: Furnish in accordance with AWPA.

2.3 FABRICATION

A. Preparation:

1. Verify measurements at job site.

2. Verify details and dimensions of equipment and fixtures integral with finish carpentry for proper fit and accurate alignment.

3. Coordinate details with other Work supporting, adjoining, or fastening to casework.

B. Lumber:

1. Air- or kiln-dry to maximum 19-percent moisture content prior to shipment. Stack and air-dry to maximum 15 percent in field prior to installation.

2. Furnish surfaced four sides, S4S, unless otherwise noted.

3. Size shall conform with rules of governing standard. Sizes shown are nominal unless otherwise noted.

C. Wood Treatments:

1. Preservative Treatment:

a. Treat lumber and plywood sheathing exposed to weather.

b. Lumber: Treat in accordance with AWPA C2.

c. Plywood: Treat in accordance with AWPA C9.

d. After treatment and prior to shipping, air- or kiln-dry lumber to maximum 19 percent moisture content. Air-dry in field to maximum 15 percent prior to installation.

2.4 QUALITY CONTROL

A. Lumber shall bear grade-trademark or be accompanied by certificate of compliance of appropriate grading agency.

B. Plywood shall bear APA grade-trademark.

C. Air-dry all framing lumber to a maximum of 15 percent moisture content prior to installing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive rough carpentry Work and verify following:

1. Completion of installation of building components to receive rough carpentry Work.

2. That surfaces are satisfactory to receive Work.

3. That spacing, direction, and details of supports are correct to accommodate installation of blocking, backing, stripping, furring and nailers.

4. That all anchor bolts and holdown bolts are properly installed.

3.2 INSTALLATION

A. Cutting: Perform all cutting, boring, and similar Work required.

B. Studs, Joists, Beams, and Posts: Install all members true to line. No wood shingle shims are permitted. Place joists with crown up; maximum 1/4-inch crown permitted.

C. Nail joints in accordance with applicable requirements of the CBC Table 2304.10.1 unless otherwise shown or specified. Predrill where nails tend to split wood.

D. Bolt holes to be 1/16-inch oversize. Threads shall not bear on wood. Use standard malleable iron washers against wood. Carriage bolts require washers under the nut only.

E. Provide blocking, grounds, nailers, stripping, and backing as shown and as required to secure other Work.

F. Maintain 1/8-inch gap between all plywood panel edges.

G. Do not utilize plywood sheets having a width smaller than 2-feet 0-inches.

H. Plywood flooring shall be field glued with adhesives meeting APA specification AFG-01 applied in accordance with the manufacturers' recommendations. Apply continuous line of glue on joists and in groove of tongue and groove panels.

I. Where wood is cut, sawed, planed, bored or marred after preservative or fire-retardant treatment, apply two heavy brush coats of same material used in treatment.

J. Nail heads shall be driven flush with plywood surface. Overdriven nails (nails which fracture the outer ply layer) shall be replaced one for one.

K. Wood Screws or Lag Screws: Screws shall be screwed and not driven into place. Screw holes shall be predrilled to the same diameter and depth of shank. Holes for threaded portion shall be predrilled less than or equal to the diameter of the root of the thread. Provide standard cut washers under head of lag screws.

L. Sills under bearing, exterior and shear walls shall be bedded on 1/2 inch minimum drypack or grout to obtain continuous bearing.

3.3 CLEANING AND ADJUSTING

A. Remove damaged or otherwise disfigured portions and replace with new prior to the Owner's acceptance.

B. Wash finished Work in strict accordance with product manufacturer's directions and ensure that washed surfaces do not differ from clean unwashed surfaces. Any difference will be considered unsatisfactory Work.

3.4 FIELD QUALITY CONTROL

A. The Owner's Testing Agency shall:

1. Inspect erected timber framing as required to establish conformity of Work with Drawings.

2. Inspect all bolted connections.

3. Inspect all timber connectors for compliance with CBC Paragraph 2304.9.

4. Inspect roof diaphragm nailing for nail size, spacing and penetration at plywood panel edges, and special nailing at collector and drag members.

5. Inspect shear wall nailing for nail size, spacing and penetration at plywood panel edges, and nailing at holdown posts.

END OF SECTION

SECTION 06 20 00
FINISH CARPENTRY

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Finish carpentry items, other than shop prefabricated casework.

B. Hardware and attachment accessories.

1.2 REFERENCES

A. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

B. ASTM E152 - Methods for Fire Tests of Door Assemblies.

C. AWPA - American Wood Preservers Association.

D. NFPA 80 - Fire Door and Windows.

E. CBC – California Building Code.

F. UL - Underwriters' Laboratories, Inc.

G. WI - Woodwork Institute: Manual of Millwork.

1.3 QUALITY ASSURANCE

A. Manufacture millwork and finish carpentry items in accordance with quality standards of the Manual of Millwork of the Woodwork Institute.

B. Issue WI Certified Compliance Certificate to Architect prior to delivery of millwork and provide WI Certified Compliance Labels on all items of millwork.

C. All millwork and the installation of millwork shall be monitored for compliance under the scope of the WI Certified Compliance Program (CCP).

D. Provide WI Reinspection Service at the job site prior to installation. Provide to Architect a written report showing results of the reinspection.

E. Upon completion of the installation, provide a WI Certified Compliance Certificate.

1.4 REGULATORY REQUIREMENTS

A. Conform to CBC and UL requirements for fire ratings.

B. Conform to Flame Spread Classifications of Interior Millwork contained within the Appendix of the WI Manual of Millwork for flame spread ratings.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, finishes, and accessories to a minimum scale of 1-1/2 inch to one foot. Provide WI Certified Compliance label on first page of each set.

C. Submit two samples 6 x 6 inch in size illustrating wood grain and specified finish.

D. Submit two samples 6 inch long of wood trim.

E. CHPS Submittals:

1. Credit EQ2.0D.P4: Provide product data, MSDS, and other official literature from manufacturer clearly identifying that the composite wood products (as specified) is manufactured with no-added formaldehyde based resins or employ ultra-low emitting formaldehyde resins as defined by the ATCM and shall meet the emission requirements established by the ATCM for such products.

2. Credit EQ2.2: Provide product data, MSDS, and other official literature from manufacturer clearly identifying that the composite wood products (used as wall finishes) meet the testing requirements and threshold limits of the State of California Department of Health Services (DHS) *Standard Practice for the Testing of Volatile Organic Compounds*. Such products shall be either identified on the *CHPS Low-Emitting Materials Product List* or by a 3rd party certification program listing low-emitting material products that meet the State testing requirements, as identified on the CHPS website.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and protect products under provisions of Section 01 87 00.

B. Conform to Section 1 of Millwork Manual.

C. Store materials in ventilated, interior locations under constant minimum temperatures of 70 degrees F and maximum relative humidity of 50 to 55 percent.

PART 2 - PRODUCTS

2.1 FABRICATORS

A. Active member of the Woodwork Institute, licensed by WI to provide WI Certified Compliance Certificates and Labels for the products and materials specified in this section (916) 372-9943.

B. Substitutions: Under provisions of Section 01 62 00.

2.2 MATERIALS

A. Materials specified under Millwork Manual Section Numbers refer to lumber grades in Millwork Manual as follows: Section 3, Lumber - Hardwood/Softwoods; Section 4, Plywood - Hardwood/Softwood; Section 6, Exterior Trim; Section 9, Interior Trim.

2.3 INTERIOR TRIM - PAINT GRADE

A. Finger jointed kiln-dried pine is acceptable for all areas except high moisture areas.

B. Trim profiles shall be mill standard shape numbers as indicated.

C. All paint-grade trim shall be pre-painted at mill.

2.4 INTERIOR TRIM - STAIN GRADE

A. Fabricate in accordance with Section 9 of Millwork Manual:

Item	Species	Grade	Intended Finish
Base, Casing & Trim	Red Oak	Custom	Transparent
Tackboard Frames, Chalk Rail & Frame	Red Oak	Custom	Transparent

2.5 MISCELLANEOUS INTERIOR MILLWORK

A. Fabricate in accordance with Section 9 of Millwork Manual:

Item	Species	Grade	Intended Finish
Wainscot	Red Oak	Custom	Transparent

2.6 INTERIOR JAMBS - NON FIRE-RATED

A. Fabricate in accordance with Section 9 of Millwork Manual:

Item	Species	Grade	Intended Finish
Interior door & borrowed light frames stops and trim	Red Oak	Custom	Transparent

2.7 INTERIOR JAMBS - FIRE RATED

A. Frames equivalent to “CanDor” frames manufactured by Algoma Hardwoods, (707) 538-1397. Substitutions under provisions of Section 01 62 00.

B. Fire-retardant medium-density fiberboard units tested for use in door assemblies per ASTM E152 and listed by U.L.

C. Identify fire-rated frames with appropriate label from applicable testing agency.

D. Factory pre-machine frames for hardware specified in Section 08 71 00.

E. Exposed surface veneers to match non fire-rated frames.

2.8 ADHESIVE

A. Adhesives: Type 1 adhesive recommended by WI to accommodate application in accordance with the Appendix to the Millwork Manual.

B. Formulation: Exterior type per AWPA C20, consisting of organic-resin solution, insoluble in water, thermally set in wood by kiln drying.

C. Wall Adhesive: Solvent release, cartridge type, compatible with wall substrate, capable of achieving durable bond.

2.9 WOOD TREATMENT PROCESS

A. Fire Retardant Type: Listed by Underwriters' Laboratories, Inc. (UL); capable of providing a maximum flame spread/smoke development rating of 20/25 in accordance with ASTM E84.

B. The following items are to be treated:

1. 1 x 6 T&G Vee Joint Wainscot.

2. 1 x 6 T&G Vee Joint Ceiling.

3. Medium Density Fiberboard.

4. 3/4 inch Ply Wainscot.

2.10 ACCESSORIES

A. Nails: Size and type to suit application, galvanized finish for interior use, stainless steel for exterior use.

B. Bolts, Nuts, Washers, Blind Fasteners, Lags, and Screws: Size and type to suit application; galvanized finish for interior use, stainless steel for exterior use.

C. Lumber for Shimming and Blocking: Softwood lumber of Douglas Fir species.

D. Primer: Alkyd primer sealer.

E. Wood Filler: Solvent base, tinted to match surface finish color.

2.11 FABRICATION

A. Fabricate work in accordance with WI [Custom] [or] [Premium] grade standards. [as listed].

B. Shop assemble work for delivery to site, permitting passage through building openings.

C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and openings are ready to receive work and field measurements are as instructed by the fabricator.

B. Verify mechanical, electrical, and building items affecting work of this Section are placed and ready to receive this work.

C. Verify adequacy of backing and support framing.

D. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

A. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials or that will be permanently concealed from view.

3.3 INSTALLATION

A. Install work in accordance with WI Manual of Millwork, [Custom] [Premium] quality standard.

B. Install fire rated door frames in accordance with NFPA 80.

3.4 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

3.5 PREPARATION FOR FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand Work smooth.

3.6 FINISHING

A. Site finish under provisions of Section 09 91 00.

3.7 PROTECTION

A. Protect finished installation under provisions of Section 01 87 00.

END OF SECTION

SECTION 06 41 16
LAMINATE-CLAD WOOD CASEWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Special fabricated cabinet units.

B. Preparation for utilities.

C. Cabinet hardware.

D. Glass for cabinet doors.

1.2 RELATED SECTIONS

A. Section 01 74 00: Cleaning and Waste Management.
B. Section 06 05 60: Countertops.
C. Section 06 10 00: Rough Carpentry

1.3 REFERENCES

A. WI - Woodwork Institute: Manual of Millwork.

B. NEMA LD3.1: High-Pressure Decorative Laminates.

1.4 QUALITY ASSURANCE

A. Manufacture casework items in accordance with quality standards of the Manual of Millwork of the Woodwork Institute.

B. Issue WI Certified Compliance Certificate to Architect prior to delivery of millwork and provide WI Certified Compliance Labels on all items of casework.

C. Provide WI Reinspection Service at the job site prior to installation. Provide to Architect a written report showing the results of the reinspection.

D. Upon completion of the installation, provide a WI Certified Compliance Certificate.

1.6 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Include materials, component profiles, fastening methods, assembly methods, joint details, accessory listings, and schedule of finishes. Provide WI Certified Compliance label on first page of each set.

C. Submit Samples of each color/pattern of plastic laminate cabinet facing.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Active member of the Woodwork Institute licensed by WI to provide WI Certified Compliance Certificates and Labels for the products and materials specified in this Section.

B. Substitutions: Under provisions of Section 01 62 00.

2.2 CABINET DESIGN

A. Individual cabinets are indicated on the Drawings by the WI Design Numbering System, Section 15, Supplement No. 3.

B. A WI number followed by an "L" indicated on the Drawings requires that each door or pair of doors and drawers within that WI cabinet be individually lockable.

2.3 CASEWORK - LAMINATED PLASTIC COVERED

A. Fabricate in accordance with Section 15 of the Manual of Millwork:

1.	WI Grade:	Custom.
2.	Type:	Type I.
3.	Construction:	Style A-Frameless.
4.	Joinery:	Doweled Joints.
5.	Cabinet Backs:	Dadoed (Detail 2C and 7C Millwork Manual).
6.	Cabinet Door Type:	Type A. Flush Overlay. Stile and rail (for glass).
7.	Shelves:	1-M-2 particle board, 1 inch thick, MOE of 950, capable of supporting 50 lb/sq ft load with deflection of L/144.
8.	Shelf Edge Bands	0.028 inch high pressure plastic laminate in color to match shelf. All 4 edges of adjustable shelves to receive banding.
9.	Door, Drawer, and Cabinet Drawer Box Edge Bands:	0.028 inch high pressure plastic laminate the same as exposed faces.
10.	Exposed Surfaces (Including Shelves and Interior of Open Front Cabinets):	0.028 inch high pressure plastic laminate, color and pattern as selected by Architect. A maximum of 5 colors and patterns to be selected by Architect from Nevamar's standard ARP textured, satin and woodgrain pattern finish.

11.	Semi-Exposed Surfaces (Behind Doors and Inside Drawers):	Low pressure decorative polyester or melamine laminate ALA-85.
12.	Exposed Laboratory Surfaces (Including Shelves and Interior of Open Front Cabinets):	Acid-resistant laminated plastic "Chemsurf" by WilsonArt, color as selected by Architect from standard patterns, satin finish.
13.	Security and Dust Panels:	Particleboard, 3/4 inch thick at all lockable drawers.
14.	Track for Sliding Glass Doors	Knape & Vogt No. [965.] [1092.]

2.4 GLAZING

A. 1/4 inch thick clear laminated safety glazing with all exposed edges ground smooth.

B. Glass shelves (if indicated) 5/8 inch thick clear laminated safety glazing with all exposed edges ground smooth.

2.5 HARDWARE

A. Finish: Polished chrome or stainless steel.
B. Shelf Standards: Knape and Vogt 255Z (bright zinc plated).

C. Shelf Supports: Knape and Vogt 256Z (bright zinc plated).

D. Shelf Fastener Supports: Knape and Vogt 243Z (bright zinc plated) 2 each shelf.

E. Drawer and Door Pulls: Epco MC-402-3.

F. Cabinet Locks: Corbin 0737/8, Olympus 500/600.

G. Drawer Slides: Accuride 3832A, 100 lbs. minimum.

H. Hinges: Rockford Process Control, No. 851, heavy duty wrap-around, tight pin butts of steel, 2-3/4 inch minimum width with companion magnetic door catch capable of a minimum 10 pound pull capacity. Stanley FW or SLCO equivalents are acceptable.

I. Magnetic Door Catch: Epco 591/592.

J. Sliding Door Track Assemblies: Grant 2023N sheaves and Grant 2011 track.

K. Grommets: Doug Mockett and Company, Inc. SG Series; plastic 3-1/2 inch diameter. Colors and locations as selected by Architect.

L. Hanger Rods: 1-1/16 inch diameter tubing, stainless steel.

M. Seismic Shelf Lip: 1/4 inch thick x 3 inch high acrylic plastic edging of color selected by Architect. Ease all edges of plastic.

N. Remainder of hardware required shall be as listed in Supplement No. 1 to Sections 14 and 15 of the Manual of Millwork.

2.6 FABRICATION

A. Shop assemble casework for delivery to site in units easily handled and sized to permit passage through building openings.

B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

C. Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes, and other fixtures and fittings. Verify locations of cutouts from on-site dimensions. Seal contact surfaces of cut edges.

D. In freestanding base casework with utilities, provide enclosed chase from penetration into casework (includes through floor penetrations) to termination at fixture. Utilities to be entirely concealed by chase. Provide plastic laminate clad face and edged banded removable access panels as necessary for full accessibility to utilities. Access panels to be located at unexposed portion of casework. Chase and access panels shall in no way reduce or infringe on ADA and Title 24 accessibility requirements.

E. Install plastic grommets in the field in plastic laminate casework and Owner-furnished furniture as directed by the Owner's Representative and/or Architect.

F. Install seismic shelf lips on all exposed edges of open laboratory shelving with flathead countersunk wood screws spaced 6 inches on center. Finish exposed screw heads to match color of shelf lip.

G. Install one adjustable shelf for each 12 inches of height for all wall mounted cabinets.

H. Provide stretcher at top face of all door and drawer fronts.

I. Fabricate base and full height cabinets 24 inches deep unless shown otherwise.

J. Fabricate wall mounted upper cabinets 12 inches deep unless shown otherwise.

K. Provide locks as indicated at location shown on Drawings for both doors and drawers.

L. Provide acid-resistant laminated plastic at all exposed surfaces (including shelves and interior of open front cabinets.)

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify adequacy of backing and support framing.

3.2 INSTALLATION

A. Set and secure casework in place rigid, plumb, and level.

B. Install casework in accordance with Installation of Architectural Millwork, Section 26 of the Manual of Millwork.

3.3 ADJUSTING AND CLEANING

A. Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly and correctly.

B. Clean casework, shelves, hardware, fittings and fixtures.

3.4 SCHEDULE

A. All casework shall be plastic laminate covered unless specifically noted otherwise.

END OF SECTION

SECTION 07 13 50
SHEET MEMBRANE WATERPROOFING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this section.

1.2 SUMMARY

A. The work of this section includes, but is not limited to, the following:

1. Below grade waterproofing membrane system.

B. Related Sections: Other specification sections which directly relate to the work of this section include, but are not limited to, the following:

1. Section 31 30 00 - Earthwork
2. Section 03 30 00 - Cast-In-Place Concrete
3. Section 07 26 50 - Vapor Barriers
4. Section 07 62 00 - Flashing and Sheet Metal
5. Section 07 90 00 - Joint Sealers
6. Section 15 40 00 - Plumbing

1.3 REFERENCE STANDARDS

A. Contractor's work shall comply with the following standards as applicable. Manufactured items are to be fabricated to these same standards.

The following standards (and publications) are applicable to the extent referenced in the text. The most recent of these standards is implied, unless otherwise stated.

B. American Society for Testing and Materials (ASTM)

1. 836 - Standard Specification for High Solids, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course
2. 412 - Standard Test Methods for Rubber Properties in Tension
3. 570 - Standard Test Method for Water Absorption of Plastics
4. 882 - Standard Test Methods for Tensile Properties of Thin Plastic Sheeting
5. 903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds

6. 1876 - Standard Test Method for Peel Release of Adhesives (T-Peel)

7. 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection

8. 3767 - Standard Practice for Rubber - Measurements of Dimensions

9. 5385 - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes

10. 96 - Standard Test Methods for Water Vapor Transmission of Materials

11. 154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations. Include certification of data indicating VOC (Volatile Organic Compound) content of all components of waterproofing system.

B. Samples: Submit representative samples of the following for approval:

1. Below grade waterproofing sheet membrane.

2. Pre-applied sheet waterproof membrane.

3. Prefabricated drainage panel.

4. Waterstop

1.5 QUALITY ASSURANCE

A. Manufacturer: Sheet membrane waterproofing system shall be manufactured and marketed by a firm with a minimum of 20 years experience in the production and sales of self-adhesive sheet membrane waterproofing. Manufacturers proposed for use but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past 5 years.

B. Installer: A firm which has at least 3 years experience in work of the type required by this section.

C. Materials: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer.

D. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of special details and flashing.

E. Schedule Coordination: Schedule work such that membranes will not be left exposed to weather for longer than that recommended by the manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.

1. Do not double-stack pallets of membrane on the job site. Provide cover on top and all sides, allowing for adequate ventilation.

2. Protect mastic and adhesive from moisture and potential sources of ignition.

3. Store drainage composite or protection board flat and off the ground. Provide cover on top and all sides.

4. Protect surface conditioner from freezing.

B. Sequence deliveries to avoid delays, but minimize on-site storage.

1.7 PROJECT CONDITIONS

A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.

B. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive sheet membrane waterproofing.

1.8 WARRANTY

A. Sheet Membrane Waterproofing: Provide written 5 year material warranty issued by the membrane manufacturer upon completion of the work.

PART 2 – PRODUCTS

2.1 MATERIALS: Preprufe 250 waterproofing membrane for horizontal use below concrete slabs or vertically against soil retention systems. Intended for cast-in-place concrete. Or approved equal.

PHYSICAL PROPERTIES FOR PREFRUFE 250 MEMBRANE

PROPERTY	TYPICAL VALUE PREPRUFE® 250	TEST METHOD
Color	White	
Thickness	0.030 in. (0.8 mm)	ASTM D3767
Lateral Water Migration Resistance	Pass at 180 ft (55 m) of hydrostatic head pressure	ASTM D5385[1]
Low temperature flexibility	Unaffected at -20°F (-29°C)	ASTM D1970
Resistance to hydrostatic head	180 ft (55 m)	ASTM D5385[2]
Elongation	300%	ASTM D412[3]
Tensile strength, film	4000 psi (27.6 MPa)	ASTM D412
Crack cycling at -9.4°F (-23°C),100 cycles	Unaffected, Pass	ASTM C836
Puncture resistance	135 lbs (600 N)	ASTM E154
Peel adhesion to concrete	4 lbs/in. (700 N/m)	ASTM D903[4]
Lap peel adhesion	4 lbs/in. (700 N/m)	ASTM D1876[5]
Permeance to water vapor transmission	0.01 perms (0.6 ng/(Pa x s x m2))	ASTM E96, method B

Footnotes:

1. Lateral water migration resistance is tested by casting concrete against the membrane with a hole and subjecting the membrane to hydrostatic head pressure with water. The test measures the resistance of lateral water migration between the concrete and the membrane.

2. Hydrostatic head tests of PREPRUFE® membranes are performed by casting concrete against the membrane with a lap. Before the concrete cures, a 0.125 in. (3 mm) spacer is inserted perpendicular to the membrane to create a gap. The cured block is placed in a chamber where

water is introduced to the membrane surface up to the head indicated.
3. Elongation of membrane is run at a rate of 2 in. (50 mm) per minute.
4. Concrete is cast against the protective coating surface of the membrane and allowed to properly dry (seven days minimum). Peel adhesion of the membrane to the concrete is measured at a rate of 2 in. (50 mm) per minute at room temperature.
5. The test is conducted 15 minutes after the lap is formed and run at a rate of 2 in. (50 mm) per minute at 72°F (22°C).

E. Miscellaneous Materials:

1. PREPRUFE® Tape LT – Low temperature tape for covering cut edges, roll ends, penetrations and detailing in cold weather
2. PREPRUFE® Tape HC – High temperature tape for covering cut edges, roll ends, penetrations and detailing at elevated temperatures
3. PREPRUFE® CJ Tape LT — Low temperature joint tape for construction joints and detailing in cold weather
4. PREPRUFE® CJ Tape HC — High temperature joint tape for construction joints and detailing in hot weather
5. BITUTHENE® liquid membrane — For sealing around penetrations, etc.
6. ADCOR® waterstop for joints in concrete walls and floors
7. PREPRUFE® tieback covers — Preformed cover for soil retention wall tieback heads
8. DE NEEF® INJECTO® tube groutable waterstop for non-moving concrete construction joints and penetrations

PART 3 - EXECUTION

3.1 EXAMINATION

A. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

3.2 PREPARATION OF SUBSTRATES

A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be structurally sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods which are acceptable to manufacturer of sheet membrane waterproofing. Do not proceed with work until unsatisfactory conditions are corrected and are acceptable for compliance with manufacturers' warranty requirements. Contractor to adjust work to achieve compliance with manufacturer's requirements.

B. Cast-In-Place Concrete Substrates:

1. Do not proceed with installation until concrete has properly cured and dried (minimum 7 days for normal structural concrete and minimum 14 days for lightweight structural concrete).

2. Fill form tie rod holes with concrete and finish flush with surrounding surface.

3. Repair bugholes over 13 mm (0.5 in.) in length and 6 mm (0.25 in.) deep and finish flush with surrounding surface.

4. Remove scaling to sound, unaffected concrete and repair exposed area.

5. Grind irregular construction joints to suitable flush surface.

C. Wood Substrates: Apply waterproofing membrane over securely fastened sound surface. All joints and fasteners shall be flush to create a smooth surface.

D. Related Materials: Treat joints and install flashing as recommended by waterproofing manufacturer.

3.3 INSTALLATION - BELOW GRADE WATERPROOFING MEMBRANE SYSTEM

A. Refer to manufacturer's literature for recommendations on installation, including but not limited to, the following:

1. Apply surface conditioner at rate recommended by manufacturer. Recoat areas not waterproofed if contaminated by dust. Mask and protect adjoining exposed finish surfaces to protect those surfaces from excessive application of surface conditioner.

2. Delay application of membrane until surface conditioner is completely dry. Dry time will vary with weather conditions.

3. Seal daily terminations with troweled bead of mastic.

4. Apply prefabricated drainage panel, waterstop and related materials in accordance with manufacturer's recommendations.

3.4 INSTALLATION - PRE-APPLIED SHEET WATERPROOFING MEMBRANE

A. Substrates shall be smooth and sound.

B. Strictly comply with installation instructions in manufacturer's published literature, including but not limited to, the following:

1. Apply membrane with the HDPE film facing the prepared soil retention system (wood lagging, sheet piling, gunite, shotcrete, etc.). Remove the release liner and fasten membrane along uncoated edge to Hydroduct drainage composite with large head nails or to plywood with large head nails or staples.

2. Apply succeeding sheets by overlapping the previous sheet 75 mm (3 in.) along the uncoated edge of the membrane. Side laps must be firmly rolled to ensure a tight seal.

3. Overlap the ends of the membrane 75 mm (3 in.). Apply Preprufe Tape centered over the end lap and roll firmly to ensure a tight seal. Remove release liner.

3.6 CLEANING AND PROTECTION

A. Remove any masking materials after installation. Clean any stains on materials which would be exposed in the completed work.

B. Protect completed membrane waterproofing from subsequent construction activities as recommended by manufacturer.

END OF SECTION

SECTION 07 21 13
BOARD INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Board insulation and integral vapor retarder at exterior wall behind gypsum board wall finish.

1.2 RELATED SECTIONS

A. Section 05 40 00: Cold-Formed Metal Framing.

B. Section 07 21 16: Blanket Insulation.

C. Section 07 27 20 Fluid-Applied Air Barriers

1.3 REFERENCES

A. ASTM C208 -Insulating Board (Cellulosic Fiber), Structural and Decorative.

B. ASTM C612 -Mineral Fiber Block and Board Thermal Insulation Board.

C. ASTM D2842 -Water Absorption of Rigid Cellular Plastics.

D. ASTM E84 -Test Method for Surface Burning Characteristics of Building Materials.

E. ASTM E96 -Test Methods for Water Vapor Transmission of Materials.

F. NFPA 255 -Test of Surface Burning Characteristics of Building Materials.

G. UL 723 -Tests for Surface Burning Characteristics of Building Materials.

1.4 SYSTEM DESCRIPTION

A. Materials of This Section: Provide continuity of thermal barrier and vapor retarder at building enclosure.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Manufacturer's Installation Instructions: Indicate special environmental conditions required for installation and installation techniques.

C. Manufacturer's Certification: Certify that products meet or exceed specified requirements.

1.6 COORDINATION

A. Coordinate Work under provisions of Section 01 31 19.

B. Coordinate the Work with Section 07 92 00, Joint Sealers, for air seal materials.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Celotex Product: “Thermax” Commercial Cavity Wall Insulation, or approved equal.

B. Substitutions: Under provisions of Section 01 62 00.

2.2 MATERIALS

A. Polyisocyanurate Insulation: Closed-cell glass fiber reinforced type, conforming to the following:

1. The Inspector of Record shall have access to the required and shall provide assistance for sampling or measuring materials.

2. Board Density: 2 pounds per cubic foot nominal.

3. Board Size: 120 inches x 24 inches.

4. Board Thickness: 1 inch.

5. Facing: Factory-applied skin of aluminum foil on both faces.

6. Thermal Resistance: Aged R-value of 11.

7. Board Edges: Square.

8. Water Absorption: In accordance with ASTM D2842, less than I-1/2 percent by volume maximum.

B. Insulation Fasteners: Mechanical fasteners, capable of securely and rigidly fastening through metal furring and insulation to substrate. Length to suit overall thickness of insulation, furring and required substrate penetration depth.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify site conditions before proceeding with insulation. Verify that substrate, adjacent materials, and insulation boards are dry and ready to receive insulation.

B. Verify substrate surface is flat, free of irregularities, materials or substances that may impede installation.

3.2 INSTALLATION

A. Install in strict accordance with manufacturer's written instructions and recommendations.

END OF SECTION

SECTION 07 21 16
BLANKET INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Batt insulation and vapor barrier in exterior wall and roof construction.

B. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof

C. Batt sound insulation in interior walls and partitions.

1.2 REFERENCES

A. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

B. ASTM C1320 - Installation of Mineral Fiber Batt and Thermal Insulation for Light Frame Construction.

C. CCR – 2016 California Code of Regulations.

D. CBC - California Building Code.

E. Business and Professions Code.

1.3 PERFORMANCE REQUIREMENTS

A. Materials of this Section shall provide continuity of thermal and moisture barrier at building enclosure elements.

B. Materials of this Section shall provide continuity of sound control where indicated or scheduled.

1.4 REGULATORY REQUIREMENTS

A. Installation of insulation may only commence if insulation meets mandatory manufacturer certification to the California Energy Commission required by Title 24, Part 6, Section 118 of the California Code of Regulations (CCR) that insulation complies with Title 20, Chapter 4, Article 3 of the California Quality Standards for Insulating Materials.

B. Insulation materials shall be certified in compliance with Business and Professions Code Section 19165.

C. Insulation manufacturer shall be licensed by the California Department of Consumer Affairs, Bureau of Home Furnishing and Thermal Insulation according to Business and Professions Code, Section 19059.7.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Submit Product Data for each type of insulation specified.

C. Submit manufacturer's certification that materials meet or exceed specified regulatory requirements.

D. CHPS Credit ME4.1: Provide product data and other official certifications/ literature from manufacturer clearly identifying that the product meets the minimum levels of total and post-consumer contents to comply with this CHPS credit.

E. Credit EQ2.2: Provide product data, MSDS, and other official literature from manufacturer clearly identifying that the product and adhesives meet the testing requirements and threshold limits of the State of California Department of Health Services (DHS) *Standard Practice for the Testing of Volatile Organic Compounds*. Such products shall be either identified on the *CHPS Low-Emitting Materials Product List* or by a 3rd party certification program listing low-emitting material products that meet the State testing requirements, as identified on the CHPS website.

PART 2 - PRODUCTS

2.1 MANUFACTURERS - INSULATION MATERIALS

A. Certain Teed Corp.

B. Manville Corp.

C. Owens-Corning Fiberglass Corporation.

2.2 MATERIALS

A. Batt Insulation: ASTM C665 preformed glass fiber batt, Type III, Class A, with reflective membrane faced surface with a flame spread of 25 or less, and a smoke density of less than 50 when tested in accordance with CBC Standard No. 8-1. Category 1 with stapling flanges for attachment of blanket to applicable

construction. Equivalent continuous roll membrane facing may be utilized in lieu of individual faced glass fiber batts. Provide R30 at ceilings and roofs. Provide R-19 unfaced insulation at walls.

B. Batt Sound Insulation: ASTM C665 preformed glass fiber batt, Type I unfaced, with flame spread of 25 or less, and a smoke density of less than 450 when tested in accordance with UL 723-03. Provide R-19.

C. Nails or Staples: Steel wire; electroplated; type and size to suit application.

D. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inches wide.

E. Support Wire: 16 gauge steel wire.

F. Support Rods: 13 gauge, pointed spring steel length as required for stud spacing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation are dry and ready to receive insulation.

B. Do not install until building is fully enclosed to weather.

3.2 INSTALLATION

A. Install insulation in accordance with insulation manufacturer's instructions and ASTM C739, C1149 and C1320. Cut “blow-in” holes only where specifically needed.

B. Install batt insulation in exterior walls, ceiling furring, and roof spaces without gaps or voids. Where wood framed furred ceiling occur, install insulation over the furring strips rather than between the rafters.

C. Install batt sound insulation in interior walls and where indicated or scheduled.

E. Trim insulation neatly to fit spaces.

F. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation. Leave no gaps or voids.

G. Install with factory-applied membrane facing on warm side of building spaces.

H. Lap ends and side flanges of vapor barrier membrane over face of framing members.

I. Extend vapor barrier on to any adjacent construction and tape seal edge of vapor barrier.

J. Seal butt ends, lapped flanges, and tears or cuts in membrane with tape or another layer of membrane.

K. Seal joints in vapor barrier caused by pipes, conduits, electrical boxes, and similar items penetrating vapor barrier.

L. Tape stapling flange over flange of adjacent blanket to flange of metal stud.

M. Friction fit sound insulation between studs as required to completely fill space between the wall finishes.

N. Where wall finish does not occur, use 16 gauge support wire through studs at not more than 16 inches on center vertically at metal studs.

O. Retain unsupported roof insulation to metal or concrete substrate with spindle fasteners at 24 inches on center.

P. Remove all unused insulation and related products and dispose of correctly.

END OF SECTION

SECTION 07 22 16
ROOF AND DECK INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Rigid foam insulation board at roof. Tapered foam insulation board.

B. Mechanical fasteners.

C. Cant strips, saddles, crickets and tapered edge strips.

E. Installation of acoustical insulation in flutes of metal roof deck.

1.2 REFERENCES

A. ASTM C209 - Cellulosic Fiber Insulating Board.

B. ASTM C518 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

C. ASTM C728 - Perlite Thermal Insulation Board.

D. ASTM D312 - Asphalt Used in Roofing.

E. ASTM D1622 - Apparent Density of Rigid Cellular Plastics.

F. ASTM E84 - Surface Burning Characteristics of Building Materials.

G. FM (Factory Mutual Engineering Corp.) - Roof Assembly Classification.

H. FS HH-I-529 - Insulation Board, Thermal (Mineral Aggregate).

I. FS HH-I-1972/Gen - Insulation Board, Thermal, Faced, Polyurethane or Polyisocyanurate.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Provide Shop Drawings of tapered insulation system indicating roof slope configuration and insulation thickness.

C. Product Data: Provide product characteristics, performance criteria and limitations.

1.4 REGULATORY REQUIREMENTS

A. Conform to FM requirements for roof assembly requirements.

B. Windstorm Rating: FM I-60.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and protect products to site under provisions of Section 01 87 00.

B. Store products to protect from environment, clear of ground and moisture.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not install insulation when temperature or weather conditions are detrimental to successful installation.

1.7 SEQUENCING

A. Sequence Work under the provisions of Section 01 11 00.

B. Sequence Work to ensure fireproofing, and firestop, materials are in place before beginning the Work of this Section.

1.8 COORDINATION

A. Coordinate Work under provisions of Section 01 31 19.

B. Coordinate the Work with Section 07 54 20 for installation of roofing materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS - INSULATION MATERIALS

A. Apache Products Co., (800) 241-7444.

B. Atlas Energy Products, (909) 923-7535.

C. Celotex Corporation, (714) 693-3770.

D. GAF Materials Corporation, (800) 445-9330.

E. RMax Industries, (714) 497-1551.

F. Johns Manville Corp., (415) 463-2560.

G. Substitutions: Under provisions of Section 01 62 00.

2.2 INSULATION MATERIALS

A. Rigid Polyisocyanurate Foam Roof Insulation Board: FS HH-I-1972/GEN, closed cell type, conforming to the following:
   1. Board Density: ASTM D1622, 2.0 pounds per cubic foot.

2. Board Size: 48 inch x 48 inch.

3. Board Thickness: 4 inches.

4. Facing: Factory applied skin of fiberglass on both faces.

5. Thermal Resistance: ASTM C518, Aged R-value of 30.

6. Board Edges: Square.

7. Water Absorption: ASTM C209, less than 1 percent by volume maximum.

8. Flame/Smoke Properties: ASTM E84, 25/450.

9. Tapered Insulation Board: Tapered closed cell insulation of same characteristics as stated above for roof insulation. Minimum 2 inch thickness, tapered to ¼ inch per foot slope.

2.3 CANT STRIPS

A. ASTM C728, fire-resistant expanded perlite, preformed to 45 degree angle, 4 inch minimum face dimension.

2.4 TAPERED EDGE STRIPS/SADDLES/CRICKETTS

A. ASTM C728 fire-resistant expanded perlite, configuration as detailed.

2.5 ACCESSORIES

A. Insulation Fasteners: Galvanized steel screws, plastic coated, with plastic washers, length and type to suit insulation thickness and substrate. Approved for application by Factory Mutual.

B. Asphalt Bitumen: ASTM D312, Type III.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify site conditions under provisions of Section 01 31 19.

B. Verify that substrate, adjacent materials, and insulation boards are dry and ready to be installed.

C. Verify substrate surface is flat, free of irregularities.

D. Verify that roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set.

E. Beginning of installation means installer accepts existing surfaces.

3.2 ROOF INSULATION INSTALLATION

A. Lay acoustical insulation [supplied under Section 05 31 23 - Steel Roof Deck] into flutes of acoustical roof deck.

B. Place insulation perpendicular to deck flutes with edges over flute surface for support.

C. Run insulation in straight lines, perpendicular to roof slope with end joints staggered between rows.

D. Lay insulation with edges in moderate contact without forcing.

E. Cut insulation neatly around penetrations through roof.

F. Place tapered insulation to required slope.

G. Trim insulation at roof drains to required slope to form a one inch deep sump area with a diameter of 4 feet.

H. Mechanically fasten insulation to deck with no less than one fastener for every two square feet of board area in compliance with spacing required by FM for a Windstorm Resistance Classification.

3.3 CANTS, SADDLES, CRICKETT AND EDGE STRIP INSTALLATION

A. Nail cants 2 feet on center to treated wood nailer. Fit flush at ends and to vertical surfaces. Apply cant 2 inches back from flange and bevel 8 inches from ends at scuppers.

B. Install crickets and saddles in hot asphalt, to configuration as indicated on Drawings.

C. Install tapered edge strips, 1-1/2 inch thick x 24 inch wide, in hot asphalt, at all roof penetrations and at all intersections of roof with vertical surfaces.

END OF SECTION

SECTION 07 27 00
WEATHER-RESISTIVE BARRIER AND FLASHING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Weather-resistive barriers, self-adhered flashing and other associated accessories.

1.2 RELATED SECTIONS

A. Section 07 92 00: Joint Sealers.

B. Section 09 24 00: Portland Cement Plaster.

C. Section 09 21 16: Gypsum Sheathing.

D. Section 09 96 02: Protective Coatings.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Manufacturer's literature describing each weather barrier and flashing.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:

1. American Society for Testing Materials (ASTM).

2. California Building Code, 2016 Edition, with all applicable amendments.

B. Performance Characteristics:

1. Membrane system shall provide a watertight barrier to prevent passage of water into the building.

2. Membrane shall seal around penetrating fasteners and meet the strictest requirements of ASTM D1970.

C. Single Source Responsibility for Products: Obtain each type of building weather-resistive barrier and flashing from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

D. Submit example of wall waterproofing manufacturer's warranty, as specified herein, prior to beginning Work. Provide executed warranty upon Project closeout.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Section 01 87 00.

B. Deliver and store packaged materials in original containers bearing identification of manufacturer's name, components materials, application details, recommendations for application and use, and test data substantiating that products comply with Contract requirements. Maintain seals unbroken and labels intact until time of use.

C. Keep materials dry by storing off ground under watertight covers.

D. MSDS sheets for all materials, cleaners, and solvents used.

1.6 PROJECT CONDITIONS

A. Comply with requirements of Section 02 41 20.

B. Do not install products until construction has progressed to a point that inclement weather will not damage existing or repaired conditions.

1.7 QUALITY REQUIREMENTS

A. Engage experienced personnel to perform Work of this Section. The Contractor shall have completed installations similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance, for a period of at least five years.

B. Obtain each type of material comprising the wall waterproofing system, from a single manufacturer for the duration of the Project.

C. Provide effective, full-time quality control over all fabrication and installation activities. Full responsibility for quality control shall remain with the Contractor.

D. Perform inspections to ensure strict conformance to the Contract at all phases of construction. Inspect components for proper alignment and placement, attachment, workmanship, and damage. Inspect the Work prior to covering any part of the Work of this Section, or releasing for subsequent Work by other trades.

1.8 WARRANTY

A. Warranty all Work under this Section in a document stating that:

1. If, within two years after the date of Substantial Completion of this Work, any of the Work of this Section is found to be defective or not in accordance with the Contract Documents, the Contractor shall, at its sole cost and expense, correct it promptly after receipt of a written notice from the [Owner][District] to do so, unless the [Owner][District] has previously given the Contractor a written acceptance of such condition.

2. The Contractor shall bear all costs incurred by the [Owner][District], including reasonable attorney's fees, court costs, and expert witness and consultant fees, to enforce Contractor's compliance with the obligations of this warranty.

3. The obligations of this warranty shall run directly to the [Owner][District] and its successors and assigns and may be enforced by the [Owner][District] and its successors and assigns against the Contractor, shall survive the termination of the Contract, and shall not be limited by the conditions other than this Contract.

B. Provide five-year manufacturers' material warranties for the self-adhered membrane liquid membrane for the building underlayment.

1.9 PRECONSTRUCTION CONFERENCE

A. Attend a preconstruction conference to be held with the Owner's Representative, Architect, Inspector of Record, and all other involved trades to discuss and coordinate the Work specified in this Section.

B. Review requirements for sequencing of installation of weather barrier assembly with installation of windows, doors, louvers and flashing to provide a weather-tight barrier assembly.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Flashing: "Vycor V40" manufactured by Grace Construction Products; 0.040 inch thick, self-adhering rubberized-asphalt membrane with integrally bonded polyethylene laminate, minimum 6 inches in width.

B. Fluid Applied, Vapor Permeable Membrane Air Barrier Primer for Wood, Gypsum and Other Surfaces: "Perm-A-Barrier VP" by Grace Construction Products; single component acrylic membrane.

C. Weather-Resistive Barrier for Cement Plaster: "Tyvek StuccoWrap" manufactured by DuPont Building Innovations; non-woven, non-perforated non-absorbing, breathable membrane providing air flow, bulk water and wind driven rain protection.

D. Accessories: Seam Tape, fasteners, sealants, primers and adhesives as recommended by weather barrier and/or flashing manufacturer.

E. Substitutions: Under provisions of Section 01 62 00.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify all site conditions and dimensions by field measurement in consideration of the special conditions associated with repairs to existing construction prior to

development of submittals and to material fabrication, purchase or delivery. Notify the Architect immediately of any inconsistency between the conditions found and those shown in the Drawings.

B. Before starting Work in a given area, examine all surfaces to receive waterproofing membrane for roughness, ridges, contaminants, unsound substrates or other conditions that may impair the installation. Promptly report any such conditions to the Architect. Correct all defective conditions before commencing Work.

3.2 PRIMER INSTALLATION

A. Follow all manufacturers' recommendations, except as modified herein. Ensure that surfaces to receive primer are clean and dry.

B. Coat thoroughly all exterior sheathing surfaces prior to installation of underlayments including overhangs, jambs, heads and sills of openings.

3.3 FLASHING INSTALLATION

A. Follow all manufacturers' recommendations, except as modified herein. Ensure that surfaces to receive membrane are clean and dry.

B. Fully and completely adhere membrane to the primed substrate using a neoprene roller. Wrinkles, open laps, blisters, perforations or "fish mouths" in the membrane are not acceptable. Promptly repair defects in the membrane. Do not allow membrane installation defects to be concealed by Work of other Sections.

C. Ensure all membrane material is continuously supported.

D. Provide continuous membrane flashing at all openings. Flash rough openings, penetrations, and other appurtenances whether shown or not on the Drawings and to provide airtight and watertight assembly.

E. Wrap all rough openings with minimum 12 inches wide membrane strips, with minimum 3inch overlap at splices.

F. Barrier Termination: Minimum 6 inches wide stripping into opening or up against finish product. Extend termination strip up to door or window frame, and seal joint. Lap termination strip onto nailing flange of door or window.

G. Configure membrane flashings to maintain laps to shed water; shingle flashings over onto metal flashings. Provide a minimum 6 inches lap onto face of adjacent sheathing or waterproofing unless detailed otherwise.

3.4 WEATHER BARRIER INSTALLATION

A. Install weather barrier over exterior face of exterior wall substrate in accordance with manufacturer recommendations.

B. Start weather barrier installation at a building corner, leaving 6 to 12 inches of weather barrier extended beyond corner to overlap.

C. Apply wrap with grooved surface pattern in vertical direction.

D. Install weather barrier in a horizontal manner staring at the lower portion of the wall surface. Maintain weather barrier plumb and level.

E. Shingle weather barrier over back edge of weep screed. Seal weather barrier with sealant or tape to weep screed. Ensure weeps are not blocked.

F. Subsequent layers shall overlap lower layers a minimum of 6 inches horizontally in a shingling manner.

G. Window and Door Openings: Extend weather barrier completely over openings.

H. Apply flashing to weather barrier membrane prior to the installation cladding anchors.

I. Seal seams of weather barrier with seam tape at all vertical and horizontal overlapping seams.

J. Tie building weather barrier into all openings, penetrations, and flashings whether shown on the Drawings or not.

K. Minimize exposure of the building underlayment to rain. Promptly install rainscreen and/or siding upon completion of the building underlayment installation.

L. Protect installed weather barrier from damage.

3.5 GENERAL

A. Install materials in accordance with the manufacturers' recommendations, using fasteners, seam tape, and other accessories intended for the purpose.

B. Lap joints to direct water to the exterior.

C. Provide complete coverage to produce a continuous weather tight barrier.

3.6 PATCHING

A. Promptly repair all rips, tears, or holes in the membrane, using precut sheets of membrane that extend 6 inches beyond the damaged area in all directions. Seal any tears or cuts as recommended by weather barrier manufacturer.

B. Extend patch sheets vertically and fit snugly against the lower edge of the membrane above to avoid creating backwater laps in the membrane.

END OF SECTION

SECTION 07 54 20
ADHERED PVC THERMOPLASTIC MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SCOPE

A. This specification uses the Sika Sarnafil thermoplastic (PVC) roofing membrane and its accessories, as the basis of design for the single-ply roofing being sought for this project.

C. Install a new fully adhered 60 mil Single Ply Thermoplastic (PVC) Roofing Membrane manufactured by Sika Sarnafil to the newly installed 1/2" Dens Deck Prime. Install per manufactures standard and detail requirement and the following specification requirements.

D. Provide and Install membrane, flashing and other components to comprise of a complete adhered single ply roof system.

1.2 RELATED WORK

A. The work includes but is not necessarily limited to the installation of:

1. Substrate Preparation
2. Roof Drains
3. Wood Blocking
4. Insulation
5. Separation Layers
6. Roof Membrane
7. Fasteners
8. Adhesive for Flashings
9. Roof Membrane Flashings
10. Walkways
11. Metal Flashings
12. Sealants

1.3 QUALITY ASSURANCE

A. This roofing system shall be applied only by a Roofing Contractor authorized by the Manufacturer prior to bid ("Applicator"). The Roofing Contractor shall have at least five (5) years of experience as an applicator with the submitted manufacturer as certified by the manufacturer.

B. Upon completion of the installation and the delivery to the Manufacturer by the Applicator of a certification that all work has been done in strict accordance with the contract specifications and the Manufacturer's requirements, an inspection

shall be made by a Technical Representative of the Manufacturer to review the installed roof system.

C. There shall be no deviation made from the Project Specification or the approved shop drawings without prior written approval by the Owner, the Owner's Representative and the Manufacturer.

D. All work pertaining to the installation of the membrane and flashings shall only be completed by Applicator personnel trained and authorized by the Manufacturer in those procedures.

E. Membrane to have no formulation changes in the last fifteen (15) years as certified by the manufacturer. No private labeled membrane products will be accepted or reviewed. Manufacturer must directly produce PVC membrane.

1.4 SUBMITTALS

A. All submittals which do not conform to the following requirements will be rejected.

B. SUBMITTALS WITH BID

1. A list of each primary component to be used in the roof system and the manufacturer's current literature for each component.

2. Sample copy of Roofing Manufacturer's warranty.

3. Sample copy of Contractor's warranty.

4. Letter from Roofing Manufacturer confirming that the Contractor is an authorized applicator of the specified roof system.

1.5 CODE REQUIREMENTS

A. The applicator shall submit evidence that the proposed roof system meets the requirements of the local building code and has been tested and approved or listed by the following test organizations. These requirements are minimum standards and no roofing work shall commence without written documentation of the system's compliance, as required in the "Submittals" section of this specification.

B. Factory Mutual Research Corporation (FM) - Norwood, MA

1. Class 1-75 (attachment criteria only)

C. Underwriters Laboratories, Inc. - Northbrook, IL
1. Class A assembly

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All products delivered to the job site shall be in the original unopened containers or wrappings bearing all seals and approvals.

B. Handle all materials to prevent damage. Place all materials on pallets and fully protect from moisture.

C. Membrane rolls shall be stored lying down on pallets and fully protected from the weather with clean canvas tarpaulins. Unvented polyethylene tarpaulins are not accepted due to the accumulation of moisture beneath the tarpaulin in certain weather conditions that may affect the ease of membrane weldability.

D. All adhesives shall be stored at temperatures between 40º F (5º C) and 80º F (27º C).

E. All flammable materials shall be stored in a cool, dry area away from sparks and open flames. Follow precautions outlined on containers or supplied by material manufacturer/supplier.

F. All materials which are determined to be damaged by the Owner's Representative or the manufacturer are to be removed from the job site and replaced at no cost to the Owner.

1.7 JOB CONDITIONS

A. Membrane materials may be installed under certain adverse weather conditions but only after consultation with the Manufacturer, as installation time and system integrity may be affected.

B. Only as much of the new roofing as can be made weathertight each day, including all flashing and detail work, shall be installed. All seams shall be cleaned and heat welded before leaving the job site that day.

C. All work shall be scheduled and executed without exposing the interior building areas to the effects of inclement weather. The existing building and its contents shall be protected against all risks.

D. All surfaces to receive new insulation, membrane or flashings shall be dry. Should surface moisture occur, the Applicator shall provide the necessary equipment to dry the surface prior to application.

E. All new and temporary construction, including equipment and accessories, shall be secured in such a manner as to preclude wind blow-off and subsequent roof or equipment damage.

F. Uninterrupted waterstops shall be installed at the end of each day's work and shall be completely removed before proceeding with the next day's work. Waterstops shall not emit dangerous or unsafe fumes and shall not remain in

contact with the finished roof as the installation progresses. Contaminated membrane shall be replaced at no cost to the Owner.

G. The Applicator is cautioned that certain membranes are incompatible with asphalt, coal tar, heavy oils, roofing cements, creosote and some preservative materials. Such materials shall not remain in contact with the membranes. The Applicator shall consult the manufacturer regarding compatibility, precautions and recommendations.

H. Arrange work sequence to avoid use of newly constructed roofing as a walking surface or for equipment movement and storage. Where such access is absolutely required, the Applicator shall provide all necessary protection and barriers to segregate the work area and to prevent damage to adjacent areas. A substantial protection layer consisting of plywood over Felt or plywood over insulation board shall be provided for all new and existing roof areas that receive rooftop traffic during construction.

I. Prior to and during application, all dirt, debris and dust shall be removed from surfaces either by vacuuming, sweeping, blowing with compressed air and/or similar methods.

J. The Applicator shall follow all safety regulations as required by OSHA and any other applicable authority having jurisdiction.

K. All roofing, insulation, flashings and metal work removed during construction shall be immediately taken off site to a legal dumping area authorized to receive such materials. Hazardous materials, such as materials containing asbestos, are to be removed and disposed of in strict accordance with applicable City, State and Federal requirements.

L. All new roofing waste material (i.e., scrap roof membrane, empty cans of adhesive) shall be immediately removed from the site by the Applicator and properly transported to a legal dumping area authorized to receive such material.

M. The Applicator shall take precautions that storage and/or application of materials and/or equipment does not overload the roof deck or building structure.

N. Installation of the membrane over coal tar pitch or a resaturated roof requires special consideration to protect the membrane from volatile fumes and materials. Consult the manufacturer for precautions prior to bid.

O. Flammable adhesives and deck primers shall not be stored and not be used in the vicinity of open flames, sparks and excessive heat.

P. All rooftop contamination that is anticipated or that is occurring shall be reported to the manufacturer to determine the corrective steps to be taken.

Q. The Applicator shall verify that all roof drain lines are functioning correctly (not clogged or blocked) before starting work. Applicator shall report any such

blockages in writing (letter copy to the manufacturer) to the Owner's Representative for corrective action prior to installation of the roof system.

R. Applicator shall immediately stop work if any unusual or concealed condition is discovered and shall immediately notify Owner of such condition in writing for correction at the Owner's expense (letter copy to the manufacturer).

S. Site cleanup, including both interior and exterior building areas that have been affected by construction, shall be completed to the Owner's satisfaction.

T. All landscaped areas damaged by construction activities shall be repaired at no cost to the Owner.

U. The Applicator shall conduct fastener pullout tests in accordance with the latest revision of the SPRI/ANSI Fastener Pullout Standard to help verify condition of deck/substrate and to confirm expected pullout values.

V. The adhered membrane shall not be installed under the following conditions without consulting the manufacturer's technical department for precautionary steps:

1. The roof assembly permits interior air to pressurize the membrane underside.

2. Any exterior wall has 10% or more of the surface area comprised of opening doors or windows.

3. The wall/deck intersection permits air entry into the wall flashing area.

W. Precautions shall be taken when using adhesives at or near rooftop vents or air intakes. Adhesive odors could enter the building. Coordinate the operation of vents and air intakes in such a manner as to avoid the intake of adhesive odor while ventilating the building. Keep lids on unused cans at all times.

X. Protective wear shall be worn when using solvents or adhesives or as required by job conditions.

1.8 WARRANTIES

A. Manufacturer's Standard Warranty (only products purchased from the membrane manufacturer are covered under Standard Warranty)

1. Upon successful completion of the work to the Roofing Manufacturer's and Owner's satisfaction, and receipt of final payment, the twenty (20) Year Standard Warranty shall be issued. The Standard Warranty shall provide for the roof membrane, all accessories that comprise a roof system, and contractor labor. The Warranty shall be Non-Prorated provide for No Dollar Limit (NDL), and shall not exclude ponding water

and no time limited shall be assigned for any such ponding water during the warranty period.

B. Applicator/Roofing Contractor Warranty

1. The Applicator shall supply the Owner with a separate five-year workmanship warranty. In the event any work related to roofing, flashing, or metal is found to be within the Applicator warranty term, defective or otherwise not in accordance with the Contract Documents, the Applicator shall repair that defect at no cost to the Owner. The Applicator's warranty obligation shall run directly to the Owner, and a copy shall be sent to the manufacturer.

PART 2 - PRODUCTS

2.1 GENERAL

A. Components to be used that are other than those supplied or manufactured by the membrane manufacturer must be submitted for review and acceptance by the manufacturer. The manufacturer's acceptance of any other product is only for a determination of compatibility with membrane products and not for inclusion in the manufacturer's warranty. The specifications, installation instructions, limitations, and/or restrictions of the respective manufacturers must be reviewed by the Owner's Representative for acceptability for the intended use with the manufacturer's products.

2.2 MEMBRANE

A. Sika Sarnafil® G410 fiberglass reinforced membrane with a factory-applied integral lacquer coating to repel dirt and sustain reflectivity.

B. Membrane shall conform to ASTM D4434-96 (or latest revision), "Standard for Polyvinyl Chloride Sheet Roofing". Classification: Type II, Grade I.

1. Sika Sarnafil G410-15, 60 mil, thermoplastic membrane with fiberglass reinforcement.

2. Or Approved Equal.

C. Color of Membrane

1. EnergySmart (white), initial reflectivity of 0.83, initial emissivity 0.90, solar reflective index (SRI) of >104.

D. Typical Physical Properties

Parameters	ASTM Test Method	Minimum ASTM Requirement	Sarnafil Typical Physical Properties
Reinforcing Material	-		Fiberglass
Overall Thickness, min., inches (mm)	D638	0.060	[0.060 inches)]
Tensile Strength, min., psi (MPa)	D638	1500 (10.4)	1600 (11.1)
Elongation at Break, min. (machine x tranverse)	D638	250% / 230%	270% / 250%
Seam strength*, min. (% of tensile strength)	D638	75	80
Retention of Properties After Heat Aging	D3045	-	-
Tensile Strength, min., (% of original)	D638	90	95
Elongation, min., (% of original)	D638	90	90
Tearing Resistance, min., lbf (N)	D1004	10 (45.0)	14 (63.0)
Low Temperature Bend, -40º F (-40º C)	D2136	Pass	Pass
Accelerated Weathering Test (Xenon Arc)	D2565	5,000 Hours	10,000 Hours
Cracking (7x magnification)	-	None	None
Discoloration (by observation)	-	Negligible	Negligible
Crazing (7 x magnification)	-	None	None
Linear Dimensional Change	D1204	0.10 %	0.02%
Weight Change After Immersion in Water	D570	± 3.0%	2.5%
Static Puncture Resistance, 33 lbf (15 kg)	D5602	Pass	Pass
Dynamic Puncture Resistance, 7.3 ft-lbf (10 J)	D5635	Pass	Pass

*Failure occurs through membrane rupture not seam failure.

2.3 COVER BOARD

A. Pre-primed cover board Dens-Deck prime 1/2” thick

2.4 FLASHING MATERIALS

A. Wall/Curb Flashing

1. Flashing Membrane - A fiberglass reinforced membrane adhered to approved substrate using adhesive.

2. Flashing G459 Membrane - An asphalt-resistant, fiberglass reinforced membrane adhered to approved substrate using adhesive.

B. Clad - A PVC-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles. Clad is a 25 gauge, G90 galvanized metal sheet with a 20 mil (1 mm) unsupported membrane laminated on one side.

C. Perimeter Edge Flashing

1. Clad - A PVC-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles. Clad is a 25 gauge, G90 galvanized metal sheet with a 20 mil (1 mm) unsupported membrane laminated on one side.

2. Use Sarna-stop termination bar atop mechanical curbs and other higher upturns.

3. Non-Typical Edge - Project-specific perimeter edge detail reviewed and accepted for one-time use by the manufacturer's Technical Department. Consult Regional Technical Manager prior to job start for review and consideration for acceptance.

D. Miscellaneous Flashing

1. Flash - A prefabricated expansion joint cover made from membrane. Flash is designed for securement to wall or horizontal surfaces to span and accommodate the movement of new and existing expansion gaps from 1 inch to 4½ inches (25 mm to 114 mm) across.

2. Reglet - A heavy-duty, extruded aluminum flashing termination reglet used at walls and large curbs. Reglet is produced from 6063-T5, 0.10 inch - 0.12 inch (2.5 mm - 3.0 mm) thick extruded aluminum. Reglet has a 2¼ inch (57 mm) deep profile, and is provided in 10 foot (3 m) lengths. Use prefabricated Reglet mitered inside and outside corners where walls intersect.

3. Stack - A prefabricated vent pipe flashing made from 0.048 inch (48 mil/1.2 mm) thick G410 membrane.

4. Circle-"G" - Circular 0.048 inch (48 mil/1.2 mm) thick G410 membrane patch welded over T-joints formed by overlapping thick membranes.

5. Corner - Prefabricated outside and inside flashing corners made of 0.060 inch (60 mil/1.5 mm) thick membrane that are heat-welded to membrane or Clad base flashings. Corner is available in 2 outside sizes (5 inch and 8½ inch diameter/127 mm and 215 mm) and 1 inside size.

6. Multi-Purpose Sealant - A sealant used at flashing terminations.

7. Flashing Adhesive - A low solvent-based reactivating-type adhesive used to attach membrane to flashing substrate.

8. Roof Drain - Replace existing box drains using new retrofit basket drains with 4 inch flanges, JM USII RetroDrain or equivalent. Prime flange and strip in with two piles as per manufacturer's recommendations. Maintain positive slope of sheathing and roofing materials to rim of drain.

2.5 ATTACHMENT COMPONENTS

A. Membrane adhesive:

1. 2121 Adhesive - A water-based adhesive used to attach the membrane to horizontal or near-horizontal substrates. Application rates are as follows:

APPLICATION RATES FOR FELTBACK MEMBRANE						
	Adhesive Rates - Gallons/100 Ft² *(Liters/Meter²)*					Approximate Sq. Ft./Pail *(meter²)*
	Substrate		Membrane		Total	
Isocyanurate facer	1.75 *(0.71)*	+	0	=	1.75 *(0.71)*	285 *(26.48)*
Smooth plywood	1.75 *(0.71)*	+	0	=	1.75 *(0.71)*	285 *(26.48)*
Concrete deck	2.00 *(0.81)*	+	0	=	2.00 *(0.81)*	250 *(23.23)*
Cellular concrete	2.00 *(0.81)*	+	0	=	2.00 *(0.81)*	250 *(23.23)*
GP Dens-Deck®	1.75 *(0.71)*	+	0	=	1.75 *(0.71)*	285 *(26.48)*
GP Dens-Deck Prime®	1.50 *(0.61)*	+	0	=	1.50 *(0.61)*	333 *(30.94)*

NOTES:

a) There is a significant increase in drying time due to an increase in humidity and/or a decrease in temperature. Do not install when outdoor or substrate temperatures during drying period are expected to fall below 40º F (5º C).

b) Do not allow 2121 adhesive to skin-over or surface-dry prior to installation of membrane.

c) Use a water-filled, foam-covered lawn roller to consistently and evenly press the membrane into the adhesive layer.

d) Adhesive must be applied as a continuous layer.

e) Use a water-filled, foam-covered lawn roller to consistently and evenly press insulation into adhesive layer.

f) Storage temperatures in excess of 90° F (32° C) may affect shelf life.

g) If exposed to temperatures below 40° F (5° C), restored to a minimum temperature of 60°F (15° C) before use.

h) Job site conditions may affect performance. Adhesive shall not be used if surface and/or ambient temperatures below 40° F (5° C) are expected during application or subsequent curing time.

i) Adhesive shall not be applied to wet or damp surfaces.

B. Plate

1. Used with various Fasteners to attach insulation boards to roof deck. Plate is a 3 inch (75 mm) square or round, 26 gauge stamping of SAE 1010 steel with an AZ 55 Galvalume coating.

C. Fastener-XP

1. A #15, heavy-duty, corrosion-resistant fastener used with Plate to attach insulation or Stop and Bar to attach G410 roof membrane to steel or wood roof decks. Fastener-XP has a shank diameter of approximately 0.21 inch (5.3 mm) and the thread diameter is approximately 0.26 inch (6.6 mm). The driving head has a diameter of approximately 0.435 inch (11 mm) with a #3 Phillips recess for positive engagement.

D. Stop

1. An extruded aluminum, low profile bar used with certain Fasteners to attach to the roof deck or to walls/curbs at terminations, penetrations and at incline changes of the substrate. Stop is a 1 inch (25 mm) wide, flat aluminum bar 1/8 inch (3 mm) thick that has predrilled holes every 6 inches (152 mm) on center.

E. Fastener #12

1. A #12 corrosion resistant fastener used with insulation plates to attach insulation boards to wood or steel decks. #12 fastener has a modified buttress thread, a shank diameter of approximately .168 inch and thread diameter of approximately .214 inch. The driving head has a diameter of approximately .435 inch with a #3 Phillips recess for positive engagement.

2.6 WALKWAY PROTECTION

A. Tread - A polyester reinforced, 0.096 inch (96 mil/2.4 mm), weldable membrane with surface embossment. Used as a protection layer from rooftop traffic. Tread is supplied in rolls of 39.3 inches (1.0 m) wide and 32.8 feet (10 m) long.

2.7 MISCELLANEOUS ACCESSORIES

A. Aluminum Tape - A 2 inch (50 mm) wide pressure-sensitive aluminum tape used as a separation layer between small areas of asphalt contamination and the membrane and as a bond-breaker under the coverstrip at Clad joints.

B. Solvent - A high quality solvent cleaner used for the general cleaning of residual asphalt, scuff marks, etc., from the membrane surface. Solvent is also used daily to clean seam areas prior to hot-air welding in tear off or dirty conditions or if the membrane is not welded the same day it is unrolled. Consult Product Data Sheet for additional information.

PART 3 - EXECUTION

3.1 PRE-CONSTRUCTION CONFERENCE

A. The Applicator, Owner's Representative/Designer and Manufacturer(s) shall attend a pre-construction conference.

B. The meeting shall discuss all aspects of the project including but not limited to:

1. Safety
2. Set up
3. Construction schedule
4. Contract conditions
5. Coordination of the work

3.2 SUBSTRATE CONDITION

A. Applicator shall be responsible for acceptance or provision of proper substrate to receive new roofing materials. General contractor to repair or make modifications to provide adequate substrate in the event of defective preparation.

B. Applicator shall verify that the work done under related sections meets the following conditions:

1. Roof drains and/or scuppers have been reconditioned and/or replaced and installed properly.

2. Roof curbs, nailers, equipment supports, vents and other roof penetrations are properly secured and prepared to receive new roofing materials.

3. All surfaces are smooth and free of dirt, debris and incompatible materials.

4. All roof surfaces shall be free of water, ice and snow.

3.3 SUBSTRATE PREPARATION

A. The roof deck and existing roof construction must be structurally sound to provide support for the new roof system. The Applicator shall load materials on the rooftop in such a manner to eliminate risk of deck overload due to concentrated weight. The Owner's Representative shall ensure that the roof deck is secured to the structural framing according to local building code and in such a manner as to resist all anticipated wind loads in that location.

3.4 SUBSTRATE INSPECTION

A. A dry, clean and smooth substrate shall be prepared to receive the Adhered roof system.

B. The Applicator shall inspect the substrate for defects such as excessive surface roughness, contamination, structural inadequacy, or any other condition that will adversely affect the quality of work.

C. The substrate shall be clean, smooth, dry, free of flaws, sharp edges, loose and foreign material, oil and grease. Roofing shall not start until all defects have been corrected.

D. All roof surfaces shall be free of water, ice and snow.

E. The membrane shall be applied over compatible and accepted substrates only.

3.5 COVER BOARD INSTALLATION - GENERAL CRITERIA

A. Cover board shall be installed according to insulation manufacturer's instructions.

B. Cover board shall be neatly cut to fit around penetrations and projections.

C. Install tapered insulation in accordance with insulation manufacturer's shop drawings (if required).

D. Install tapered insulation around drains creating a drain sump (if required).

E. Do not install more insulation board than can be covered with the membrane by the end of the day or the onset of inclement weather.

F. Use at least 2 layers of insulation when the total insulation thickness exceeds 2½ inches (64 mm). Stagger joints at least 12 inches (0.3 m) between layers.

G. Mechanical Attachment:

1. Insulation/Recovery board shall be mechanically fastened to the deck with approved fasteners and plates at a rate according to the insulation manufacturer's, FM and the PVC manufacturer's recommendations for fastening rates and patterns. The quantity and locations of the fasteners and plates shall also cause the insulation/recovery board to rest unevenly on the roof deck/substrate so that there are no significant avoidable air spaces between the board and the substrate. Each insulation board shall be installed tightly against the adjacent board on all sides.

2. Fasteners are to be installed consistently in accordance with fastener manufacturer's recommendations. Fasteners are to have minimum penetration into structural deck recommended by the fastener manufacturer and PVC membrane manufacturer.

3.6 INSTALLATION OF ROOF MEMBRANE

The surface of the insulation or substrate shall be inspected prior to installation of the roof membrane. The substrate shall be clean, dry, free from debris and smooth with no surface roughness or contamination. Broken, delaminated, wet or damaged insulation boards shall be removed and replaced.

A. 2121 Adhesive:

1. Over the properly installed and prepared substrate, 2121 adhesive shall be poured out of the pail and spread using notched ¼ inch x ¼ inch x ¼ inch (6 mm x 6 mm x 6 mm) rubber squeegees. The 2121 adhesive shall be applied at a rate according to the manufacturer's requirements. Do not allow adhesive to skin-over or surface-dry prior to installation of G410 membrane.

2. The G410 of membrane is unrolled immediately into the wet 2121 adhesive. Adjacent rolls overlap previous rolls by 3 inches (75 mm). This process is repeated throughout the roof area. Immediately after application into adhesive, each roll shall be pressed firmly into place with a water-filled, foam-covered lawn roller by frequent rolling in two directions. Do not allow adhesive to skin-over or surface-dry prior to installation of G410 membrane.

3. Weld G410 coverstrips at all G410 seams that do not have a factory selvage edge.

NOTES:

a) 2121 adhesive shall not be used if temperatures below 40º F (5º C) are expected during application or subsequent drying time.

b) No adhesive shall be applied in seam areas. All membrane shall be applied in the same manner.

3.7 HOT-AIR WELDING OF SEAM OVERLAPS

A. General

1. All seams shall be hot-air welded. Seam overlaps should be 3 inches (75 mm) wide when automatic machine-welding and 4 inches (100 mm) wide when hand-welding, except for certain details.

2. Welding equipment shall be provided by or approved by the manufacturer. All mechanics intending to use the equipment shall have successfully completed a training course provided by a Technical Representative prior to welding.

3. All membrane to be welded shall be clean and dry.

B. Hand-Welding - Hand-welded seams shall be completed in two stages. Hot-air welding equipment shall be allowed to warm up for at least one minute prior to welding.

1. The back edge of the seam shall be welded with a narrow but continuous weld to prevent loss of hot air during the final welding.

2. The nozzle shall be inserted into the seam at a 45 degree angle to the edge of the membrane. Once the proper welding temperature has been reached and the membrane begins to "flow," the hand roller is positioned perpendicular to the nozzle and pressed lightly. For straight seams, the 1½ inch (40 mm) wide nozzle is recommended for use. For corners and compound connections, the ¾ inch (20 mm) wide nozzle shall be used.

C. Machine Welding

1. Machine welded seams are achieved by the use of automatic welding equipment. When using this equipment, the manufacturer's instructions shall be followed and local codes for electric supply, grounding and over current protection observed. Dedicated circuit house power or a dedicated portable generator is recommended. No other equipment shall be operated off the generator.

2. Metal tracks may be used over the deck membrane and under the machine welder to minimize or eliminate wrinkles.

D. Quality Control of Welded Seams

1. The Applicator shall check all welded seams for continuity using a rounded screwdriver. Visible evidence that welding is proceeding correctly is smoke during the welding operation, shiny membrane surfaces, and an uninterrupted flow of dark grey material from the underside of the top membrane. On-site evaluation of welded seams shall be made daily by the Applicator to locations as directed by the Owner's Representative or a manufacturer's representative. One inch (25 mm) wide cross-section samples of welded seams shall be taken at least three times a day. Correct welds display failure from shearing of the membrane prior to separation of the weld. Each test cut shall be patched by the Applicator at no extra cost to the Owner.

3.8 MEMBRANE FLASHINGS

All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the Owner's Representative and the manufacturer. Approval shall only be for specific locations on specific dates. If any water is allowed to enter under the newly completed roofing, the affected area shall be removed and replaced at the Applicator's expense. Flashing shall be adhered to compatible, dry, smooth, and solvent-resistant surfaces. Use caution to ensure adhesive fumes are not drawn into the building.

A. Adhesive for Membrane Flashings

1. Over the properly installed and prepared flashing substrate, adhesive shall be applied according to instructions found on the Product Data Sheet. The adhesive shall be applied in smooth, even coats with no gaps, globs or similar inconsistencies. Only an area which can be completely covered in the same day's operations shall be flashed. The bonded sheet shall be pressed firmly in place with a hand roller.

2. No adhesive shall be applied in seam areas that are to be welded. All panels of membrane shall be applied in the same manner, overlapping the edges of the panels as required by welding techniques.

B. Install Stop/Bar/Cord according to the Detail Drawings with approved fasteners into the structural deck at the base of parapets, walls and curbs. Stop is required by the manufacturer at the base of all tapered edge strips and at transitions, peaks, and valleys according to the manufacturer's details.

C. The manufacturer's requirements and recommendations and the specifications shall be followed. All material submittals shall have been accepted by the manufacturer prior to installation.

D. All flashings shall extend a minimum of 8 inches (0.2 m) above roofing level unless otherwise accepted in writing by the Owner's Representative and the Technical Department.

E. All flashing membranes shall be consistently adhered to substrates. All interior and exterior corners and miters shall be cut and hot-air welded into place. No bitumen shall be in contact with the membrane.

F. All flashing membranes shall be mechanically fastened along the counter-flashed top edge with Stop at 6-8 inches (0.15-0.20 m) on center.

G. Flashings shall be terminated according to the manufacturer's recommended details.

3.9 METAL FLASHINGS

A. Metal details, fabrication practices and installation methods shall conform to the applicable requirements of the following:

1. Factory Mutual Loss Prevention Data Sheet 1-49 (latest issue).

2. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - latest issue.

B. Metal, other than that provided by the manufacturer, is not covered under the warranty.

C. Complete all metal work in conjunction with roofing and flashings so that a watertight condition exists daily.

D. Metal shall be installed to provide adequate resistance to bending to allow for normal thermal expansion and contraction.

E. Metal joints shall be watertight.

F. Metal flashings shall be securely fastened into solid wood blocking. Fasteners shall penetrate the wood nailer a minimum of 1 inch (25 mm).

G. Airtight and continuous metal hook strips are required behind metal fascias. Hook strips are to be fastened 12 inches (0.3 m) on center into the wood nailer or masonry wall.

H. Counter flashings shall overlap base flashings at least 4 inches (100 mm).

I. Hook strips shall extend past wood nailers over wall surfaces by 1½ inch (38 mm) minimum and shall be securely sealed from air entry.

3.10 CLAD METAL BASE FLASHINGS/EDGE METAL

All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the Owner's Representative and the manufacturer. Acceptance shall only be for specific locations on specific dates. If any water is allowed to enter under the newly completed roofing due to incomplete flashings, the affected area shall be removed and replaced at the Applicator's expense.

A. Clad metal flashings shall be formed and installed per the Detail Drawings.

1. All metal flashings shall be fastened into solid wood nailers with two rows of post galvanized flat head annular ring nails, 4 inches (100 mm) on center staggered. Fasteners shall penetrate the nailer a minimum of 1 inch (25 mm).

2. Metal shall be installed to provide adequate resistance to bending and allow for normal thermal expansion and contraction.

B. Adjacent sheets of Clad shall be spaced ¼ inch (6 mm) apart. The joint shall be covered with 2 inch (50 mm) wide aluminum tape. A 4 inch minimum (100 mm) wide strip of flashing membrane shall be hot-air welded over the joint.

3.11 WALKWAY INSTALLATION

A. Tread Walkway

1. Roofing membrane to receive the Tread Walkway shall be clean and dry. Place chalk lines on deck sheet to indicate location of Walkway. Apply a continuous coat of 2170 adhesive to the deck sheet and the back of Walkway in accordance with manufacturer's technical requirements and press Walkway into place with a water-filled, foam-covered lawn roller. Clean the deck membrane in areas to be welded. Hot-air weld the entire perimeter of the Walkway to the membrane deck sheet. Check all welds with a rounded screwdriver. Re-weld any inconsistencies. Important: Check all existing deck membrane seams that are to be covered by Walkway with rounded screwdriver and reweld any inconsistencies before Walkway installation. Do not run Walkway over Bars.

3.12 TEMPORARY CUT-OFF

A. All flashings shall be installed concurrently with the roof membrane in order to maintain a watertight condition as the work progresses. All temporary waterstops shall be constructed to provide a 100% watertight seal. The stagger of the insulation joints shall be made even by installing partial panels of insulation. The new membrane shall be carried into the waterstop. The waterstop shall be sealed to the deck and/or substrate so that water will not be allowed to travel under the new or existing roofing. The edge of the membrane shall be sealed in a continuous heavy application of sealant as described in Section 2.10. When work resumes, the contaminated membrane shall be cut out. All sealant, contaminated membrane, insulation fillers, etc. shall be removed from the work

area and properly disposed of off site. None of these materials shall be used in the new work.

B. If inclement weather occurs while a temporary waterstop is in place, the Applicator shall provide the labor necessary to monitor the situation to maintain a watertight condition.

C. If any water is allowed to enter under the newly-completed roofing, the affected area shall be removed and replaced at the Applicator's expense.

3.13 COMPLETION

A. Prior to demobilization from the site, the work shall be reviewed by the Owner's Representative and the Applicator. All defects noted and non-compliances with the Specifications or the recommendations of the manufacturer shall be itemized in a punch list. These items must be corrected immediately by the Applicator to the satisfaction of the Owner's Representative and the manufacturer prior to demobilization.

B. All Warranties referenced in this Specification shall have been submitted and have been accepted at time of contract award.

END OF SECTION

SECTION 07 62 00
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Ccoping, parapet, and cap flashings.

B. Fascias, gutters, and scuppers.

C. Counterflashings at piping penetrations, vent pipes, and conduits.

D. Counterflashings over bituminous base flashings.

E. Counterflashings at roof mounted equipment, curbs and supports.

F. Counterflashings for roof hatches.

G. Flexible sheet flashing.

H. Manufactured reglets.

I. Sill-pans (sheet metal sub-pans) for windows and storefront units.

1.2 REFERENCES

Contractor's work shall comply with the following standards as applicable. Manufactured items are to be fabricated to these same standards.

The following standards (and publications) are applicable to the extent referenced in the text. The most recent of these standards is implied, unless otherwise stated.

A. ASTM A653 - Steel Sheet, Zinc-Coated, (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. ASTM A755 - Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.

C. ASTM A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

D. ASTM B32 - Solder Metal.

E. ASTM B101 - Standard Specifications for Lead-Coated Copper Sheet and Strip for Building Construction.

F. ASTM D226 - Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

G. ASTM D549 - Rosin in Paper and Paperboard.

H. ASTM D4586 - Asphalt Roof Cement, Asbestos Free.

I. SMACNA - Architectural Sheet Metal Manual.

1.3 SYSTEM DESCRIPTION

A. Work of this Section is to physically protect membrane roofing and base flashings, from damage that would permit water leakage to building interior.

1.4 QUALITY ASSURANCE

A. Applicator: Company specializing in sheet metal flashing Work with five years minimum experience.

B. Perform Work in accordance with SMACNA standard details and requirements.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Submit Shop Drawings of sheet metal items indicating profiles, jointing, terminations, sill pans and installation details. Indicate type and spacing of fasteners.

C. Submittal of specific plates from the SMACNA Architectural Sheet Metal Manual constitutes acceptable documentation of installation details.

D. Submit Product Data for pre-coated galvanized steel and flashing accessories.

E. Submit two 4-inch square Samples illustrating metal finish color for pre-coated steel.

1.6 STORAGE AND HANDLING

A. Store products under provisions of Section 01 66 00, Product Delivery, Storage, and Handling.

B. Stack preformed material to prevent twisting, bending, or abrasion, and to provide ventilation.

C. Prevent contact with materials during storage which may cause discoloration, staining, or damage.

1.7 WARRANTY

A. Provide manufacturer’s 20-year warranty against defective materials and finish.

B. Provide installer’s 2-year warranty coverage for water tightness and integrity of seals.

PART 2 - PRODUCTS

2.1 SHEET MATERIALS

A. Galvanized Steel: ASTM A653, Grade 33, G90 zinc coating in accordance with ASTM A924, 0.0299 inch thick core steel.

2.2 ACCESSORIES

A. Lead-Coated Copper: ASTM B101, Temper H00 and H01, cold-rolled copper sheet, coated both sides with lead weighing not less than 12 pounds per 100 square feet or more than 15 pounds per 100 square feet total weight of copper sheet with lead applied to both sides.

B. Fastener: Galvanized steel or stainless steel with soft neoprene washers at exposed fasteners. [Finish exposed fasteners shall match pre-coated metal.]

C. Underlayment: ASTM D266; No. 30 asphalt-saturated roofing felt.

D. Metal Primer: As specified in Section 09 91 00.

E. Protective Backing Paint: Zinc chromate alkyd.

F. Slip Sheet: ASTM D549, 0.05 psf, rosin-sized building paper.

G. Sealant: As specified in Section 07 92 00.

H. Bedding Compound: Rubber-asphalt type.

I. Plastic Cement: ASTM D4586, Type I.

J. Metal Flashing System: Two piece pre-coated galvanized steel similar to Springlok Flashing System, manufactured by Fry Reglet, type as indicated. Include fabricated end closures and mitered corners.

K. Solder for Lead-Coated Copper: ASTM B32, Grade SN 60 percent tin, 40 percent lead.

L. Solder for Zinc: ASTM B32; 50/50 tin/lead type, with rosin flux.

M. Self-Adhesive Flexible Sheet Flashing: 40-mil-thick composite of polyethylene film and self-adhesive rubberized asphalt with embossed slip-resistant surface; “Ice and Water Shield” by W.R. Grace or approved equal.

N. Manufactured Reglets: Two piece pre-coated galvanized steel, spring-action type similar to “Springlock Flashing System” or approved equal, manufactured by Fry Reglet, type as indicated. Include fabricated end closures and mitered corners. Finish: Manufacturer’s gray epoxy primer; exposed portions shall be field finish painted as specified in Section 09 91 00.

O. Fabricated Galvanized Sill Pans. Shop fabricate sill pans from 24 ga, fully soldered and watertight as per the drawings. Protect underside of pans sitting atop concrete surfaces with continuous layer of self adhered flashing.

2.3 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Fabricate concealed cleats of galvanized steel, ASTM A653, Grade 33, G90 zinc coating, 0.0478 inch thickness, interlockable with sheet.

C. Fabricate exposed cleats and coverplates of same material as sheet, interlockable with sheet.

D. Form pieces in longest practical lengths.

E. Hem exposed edges on underside 1/2 inch. Miter and seam corners.

F. Form material with flat lock seam.

G. Solder and seal metal joints. After soldering, remove flux. Wipe and wash solder joints clean.

H. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

I. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

J. Fabricate flashings to allow toe to extend 4 inches over [bituminous base flashings] [roofing surface]. Return and brake edges.

K. Fabricate vent pipe and roof penetration flashings of non lead-bearing material with clamping ring and storm collar.

2.4 FINISH

A. Shop prepare and prime exposed ferrous metal surfaces.

B. Back-paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

C. Site paint exposed to view metal surfaces under provisions of Section 09 91 00.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets are in place, and nailing strips located.

B. Verify membrane termination and base flashings are in place, sealed, and secure.

C. Contractor to confirm that site conditions and substrates are ready for sheet metal work to commence. If not, make suitable repairs or adjustments to the work. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

A. Field measure site conditions prior to fabricating Work.

B. Install starter and edge strips, and cleats before starting installation.

C. Install surface-mounted reglets true to line and level. Seal top with sealant.

D. Install underlayment with protective slip sheet over parapets, caps, copings, gravel stops and curbs.

3.3 INSTALLATION

A. Conform to details on the Drawings and the recommendations included in the SMACNA Architectural Sheet Metal Manual.

B. Provide for thermal expansion of exposed sheet metal Work. Space movement joints at 10 feet on center maximum with no joints within 2 feet of corners. Attach members with clips to permit movement without damage, or provide slotted or oversize holes with washers.

C. Form expansion joints of intermeshing hooked flanges filled with sealant.

D. Insert flashings into reglets to form tight fit. Secure in place with lead wedges at maximum 12 inches on center. Pack remaining spaces with lead wool. Seal flashings into reglets with sealant.

E. Secure flashings in place using concealed fasteners. Use exposed fasteners only where indicated.

F. Lap, lock, seam and seal all joints. Make lock seam Work flat and true to line, and sweat full of solder, except where installed to permit expansion and contraction. Lap flat lock seams, and lap seams where soldered according to pitch, but in no case less than 3 inches. Make seams in direction of flow.

G. Apply plastic cement compound between metal flashings and felt flashings. Apply bituminous coating between dissimilar metals where occurs.

H. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

I. Roof-Penetration, Vent Pipe Flashing: Turn lead flashing down inside vent piping. Clamp flashing to other pipes penetrating roof except for vent piping. Seal with elastomeric sealant.

J. Solder metal joints watertight for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.

K. Seal metal joints watertight and weathertight throughout.

3.4 FIELD QUALITY CONTROL

A. Conform to SMACNA Architectural Sheet Metal Manual.

B. Field observation will involve surveillance of Work during installation to ascertain compliance with specified requirements.

3.5 CLEANING AND ADJUSTMENT

A. Leave Work clean and free of stains, scrap and debris.

B. Repair and replace damaged Work.

END OF SECTION

SECTION 07 63 00
GUTTERS AND DOWNSPOUTS

1.1 SECTION INCLUDES

A. Galvanized steel gutters and downspouts.

B. Steel pipe downspouts.

C. Precast concrete splash blocks and sheet metal splash pans.

1.2 REFERENCES

Contractor's work shall comply with the following standards as applicable. Manufactured items are to be fabricated to these same standards.

The following standards (and publications) are applicable to the extent referenced in the text. The most recent of these standards is implied, unless otherwise stated.

A. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless.

B. ASTM A653 - Steel Sheet, Zinc Coated, (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. ASTM A755 - Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.

D. ASTM A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

E. SMACNA - Architectural Sheet Metal Manual.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Submit Shop Drawings of metal items indicating profiles, jointing, terminations, and installation details. Indicate type and spacing of fasteners.

C. Submittal of specific plates from the SMACNA Architectural Sheet Metal Manual constitutes acceptable documentation of installation details.

D. Submit Product Data for pre-coated galvanized steel.

1.4 QUALITY ASSURANCE

A. Applicator: Company specializing in sheet metal Work with five years minimum experience.

B. Perform Work in accordance with SMACNA standard details and requirements.

1.5 STORAGE AND HANDLING

A. Store products under provisions of Section 01 60 00.

B. Stack preformed material to prevent twisting, bending, or abrasion and to provide ventilation.

C. Prevent contact with materials during storage which may cause discoloration, staining or damage.

1.6 WARRANTY

A. Provide manufacturer's 20-year warranty against defective materials and finish.

B. Provide installer's 2-year warranty coverage for water tightness and integrity of seals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Galvanized Steel: ASTM A653, Grade 33, G90 zinc-coating in accordance with ASTM A924; thickness as specified.

B. Steel Pipe: ASTM A53, Grade B, Schedule 40 steel pipe, standard weight, Type S, one piece without joints, galvanized according to ASTM A53; 1.8 ounces per square foot.

2.2 COMPONENTS

A. Facia Gutters: 16 gauge or as indicated. Formed to profiles indicated. Include downspout outlet and integral straps as part of the assembly.

B. Steel Pipe Downspouts: Fabricate from Schedule 40 steel pipe, and other steel stock as indicated, all full penetration welded into one assembly, then hot-dip galvanized. (Use these within 8 feet of finished grade only.)

C. Splash Blocks: Pre-cast concrete type, of sizes and profiles indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.

D. Splash Pans: Fabricated from same metal as gutters. Tack down to roofing surface with asphalt cement.

2.3 ACCESSORIES

A. Anchorage Devices: Meet SMACNA requirements.

B. End Caps, Downspout Outlets, Rain Diverters, Straps, Support Brackets, Joint Fasteners. Profiled to suit gutters and downspouts.

C. Protective Backing Paint: Zinc chromate alkyd at all concealed surfaces.

D. Gutter Expansion Joints: Provide at every 50' of length or as recommended by SMACNA. Submit sketches of detail.

2.4 FABRICATION

A. Form gutters and downspouts of profiles and sizes indicated.

B. Field measure site conditions prior to fabricating Work.

C. Fabricate with required connection pieces.

D. Form sections square, true, and accurate in size, in maximum possible lengths and free of distortion or defects detrimental to appearance or performance.

E. Hem exposed edges of metal.

F. Seal metal joints.

G. Fabricate gutter and downspout accessories; seal watertight.

H. Form splash pans to size as detailed with rolled edges.

2.5 SHOP FINISHING

A. Shop prepare and prime exposed ferrous metal surfaces.

B. Back-paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mils.

C. Site paint exposed to view metal surfaces as specified in Section 09 91 00.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive Work. Contractor to correct deficiencies in the surfaces at own expense.

B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

A. Provide concealed solid blocking at all steel pipe downspout brackets.

B. Coordinate layout of downspouts with site conditions and features on the building not shown in the building elevations.

C. Install gutters, downspouts, and accessories in accordance with SMACNA requirements.

D. Coordinate installation of sheet metal gutters with steel pipe downspouts.

E. Join lengths with seams sealed watertight. Flash and seal gutters to downspouts and accessories.

F. Seal metal joints watertight.

G. Set splash blocks under downspouts. Tack down all metal rooftop splash pans to roof surface with asphalt cement.

H. Coordinate downspouts connecting to the storm drain system with other Work.

END OF SECTION

SECTION 07 72 33
ROOF HATCHES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Prefabricated roof hatches with integral support curbs, operable hardware, and counterflashings as indicated.

B. Roof hatch railing system.

1.2 REFERENCES

A. UL - Underwriters' Laboratories: Fire Hazard Classification.

B. FM - Factory Mutual Engineering Corporation: Roof Assembly Classifications.

C. OSHA - Standards of Occupational Safety and Health Administration.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Provide Product Data on unit construction, sizes, configuration, jointing methods, attachment methods, and accessories.

C. Manufacturer and/or fabricator shall submit a certificate of product compliance with OSHA Standards.

1.4 REGULATORY REQUIREMENTS

A. UL - Underwriters' Laboratories: Fire Hazard Classification.

B. FM - Factory Mutual Engineering Corporation: Roof Assembly Classifications.

C. OSHA - Standards of Occupational Safety and Health Administration.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Babcock-Davis Hatchways, Inc., (781) 643-5344.

B. Dur-Red Products, (323) 771-9000.

C. Milcor, Inc., (800) 528-1411.
D. Substitutions: Under provisions of Section 01 62 00.

2.2 ROOF HATCHES

A. Unit: 30 inch x 36 inch size or as noted, single leaf type unless otherwise indicated.

B. Curb: 14 gage galvanized prime painted steel with one inch rigid insulation; integral cap flashing to receive roof flashing system; extended flange for mounting.

C. Cover: 14 gage galvanized prime painted steel with 1 inch glass fiber insulation retained by 22 gage steel inner liner. Continuous gasket to provide weatherproof seal.

D. Hardware: Manufacturer's standard manually operated type with compression spring operators, positive snap latch with turn handles inside and out and padlock hasp inside; automatic hold-open arm with vinyl covered grip handle for easy release; cadmium plated finish.

E. Hinges: Manufacturer's recommended type.

2.3 HEAT/SMOKE VENTS

A. Unit: Sizes shown single leaf type unless otherwise indicated, labeled as being FM Approved. UL Listed.

B. Curb: 14 gage galvanized prime painted steel with 1 inch rigid insulation; integral cap flashing to receive roof flashing system; extended flange for mounting.

C. Cover: 14 gage galvanized prime painted steel with 1 inch glass fiber insulation retained by 22 gage steel interior liner. Continuous gasket to provide weatherproof seal.

D. Hardware: Compression spring operators, heavy duty shock absorbers, and manual pull rings for interior and exterior operation; hold-open arm with vinyl covered grip handle for easy release; cadmium plated finish.

E. Hinges: Manufacturer's recommended type.

2.4 RAILING SYSTEM

A. Nesea Corporation, Model No. RHSR-SS as distributed by David/Randall Associates, (215) 256-7950.

B. Shop Fabrication or Substitutions: Under provisions of Section 01 62 00.

2.5 HATCH AND VENT FABRICATION

A. Fabricate free of visual distortions and defects. Weld corners and joints.

B. Provide for removal of condensation.

C. Provide weathertight assembly.

2.6 FINISH

A. Shop prime paint all exposed metal.

B. Site paint metal surfaces under provisions of Section 09 91 00.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions. Coordinate with installation of roofing system and related flashings. Provide weather tight installation.

B. Permanently bolt railing system to roof hatch curb in accordance with manufacturer's instructions.

C. Apply bituminous paint on metal surfaces of units in contact with cementitious materials and dissimilar metals.

END OF SECTION

SECTION 07 81 00
APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fireproofing, spray - applied.

1.2 REFERENCES

A. ASTM E84 - Surface Burning Characteristics of Building Materials.

B. ASTM E119 - Fire Tests of Building Construction and Materials.

C. ASTM E605 - Thickness and Density of Sprayed Fire-Resistive Materials Applied to Structural Members.

D. ASTM E736 - Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.

E. ASTM E759 - Deflection of Sprayed Fire-Resistive Materials Applied to Structural Members.

F. ASTM E760 - Effect of Impact on Bonding of Sprayed Fire-Resistive Materials Applied to Structural Members.

G. ASTM E761 - Compressive Strength of Sprayed Fire-Resistive Materials Applied to Structural Members.

H. ASTM E859 - Air Erosion of Sprayed Fire-Resistive Materials Applied to Structural Members.

I. ASTM E937 - Corrosion of Steel by Sprayed Fire-Resistive Material Applied to Structural Members.

J. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

K. California Building Code (CBC) - Standard No. 7-6, Thickness and Density Determination For Spray-Applied Fireproofing.

L. UL - Underwriters Laboratories: Fire Hazard Classifications.

M. 40 CFR Part 763, Subpart F(7-1-90 Edition) - Asbestos Hazardous Emergency Response Act, Friable Asbestos-Containing Materials in Schools.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Submit manufacturer's specifications, and include certification from materials manufacturer to show material compliance with Contract Documents. Include certification from manufacturer, signed by an officer of the firm, stating that the proposed material is free of all forms of asbestos, including actionlite, amosite, anthophyllite, chrysotile, crocidolite and tremolite.

C. Test Data: Submit laboratory test results for sprayed fireproofing for the following:

1. Deflection per ASTM E759.

2. Bond Impact per ASTM E760.

3. Compressive Strength per ASTM E761.

4. Bond Strength per ASTM E736.

5. Air Erosion per ASTM E859.

6. Surface Burning Characteristics per ASTM E84.

7. Corrosion Resistance per ASTM E937.

8. Mold Resistance per ASTM G21.

D. Submit laboratory test reports in accordance with ASTM E119, indicating fire resistance as required to satisfy codes. Submit extracts of classified listings of tests performed by Underwriters Laboratories, Inc.

1.4 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five years documented experience.

B. Applicator: Company specializing in applying the Work of this Section with minimum three years documented experience, approved by manufacturer.

C. Provide fireproofing products containing no detectable asbestos as determined according to the method specified in 40 CFR, Part 763, Subpart F, Appendix A, Section 1.

D. Products, execution, and fireproofing thicknesses shall conform to CBC and UL requirements for the required fire-resistance ratings.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable codes for fire resistance ratings.

B. Submit certification of acceptability of fireproofing materials to authority having jurisdiction.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not apply fireproofing when temperature of substrate material and surrounding air is below 40 degrees Fahrenheit.

B. Provide ventilation to allow proper drying of the sprayed fire-proofing during and subsequent to its application.

C. Maintain non-toxic, unpolluted working area. Provide temporary enclosure to prevent spray from contaminating air.

1.7 SEQUENCING AND SCHEDULING

A. Sequence Work in conjunction with placement of ceiling hanger tabs, mechanical component hangers, and other related Sections.

1.8 DELIVERY, STORAGE AND PROTECTION

A. Deliver, store and protect products under provisions of Section 01 87 00.

1.9 WARRANTY

A. Provide warranty that fireproofing will remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering. Reinstall or repair such defects or failures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Construction Products Division, W.R. Grace & Co., “Monokote” Type MK-6, (800) 778-2880.

B. Isolatek International, BlazeShield II, (714) 837-4024.

C. Mandoval Vermiculite Products, Inc., CP-2, (714) 761-1921.

D. Substitutions: Under provisions of Section 01 62 00.

2.2 MATERIALS

A. Fireproofing: Factory mixed, asbestos free, material blended for uniform texture conforming to the following requirements:

1. Bond Strength: ASTM E736, 200 pounds per square foot when set and dry.

2. Bond Impact: ASTM E760, no cracking, flaking, or delamination.

3. Dry Density: ASTM E605, minimum average density of 15 pounds per square foot.

4. Compressive Strength: ASTM E761, Minimum 500 pounds per square foot.

5. Surface Burning Characteristics: In accordance with ASTM E84:

   a. Flame Spread: 0.

   b. Smoke Developed: 0.

6. Air Erosion: Maximum allowable weight loss of the fireproofing material shall be 0.025 grams per square foot when tested in accordance with ASTM E859.

7. Corrosion Resistance: Tested in accordance with ASTM E937 and shall not promote corrosion of steel.

8. Resistance to Mold: Formulated at time of manufacturing with mold inhibitor. Tested in accordance with ASTM G21 and shall show resistance to mold growth when inoculated with aspergillus niger.

2.3 ACCESSORIES

A. Provide accessories to comply with manufacturer's recommendations and to meet fire resistance design requirements.

B. Accessories include, but are not limited to, any required or optional items such as bonding agents, mechanical attachments, application aids such as metal lath, scrim or netting and accelerators.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive Work.

B. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.

C. Verify that ducts, piping, equipment, or other items which would interfere with application of fireproofing are not positioned until fireproofing Work is complete.

D. Verify that voids and cracks in substrate are filled, and projections are removed where fireproofing is exposed to view as a finish material.

E. Verify that all dead loads have been applied to all floor or roof decks.

F. Beginning of installation means installer accepts existing surfaces.

3.2 PREPARATION

A. Clean substrate of dirt, dust, grease, oil, loose material, paints, primers, or other matter which may affect bond of fireproofing.

B. Remove incompatible materials which affect bond by scraping, brushing, scrubbing, or sandblasting.

3.3 PROTECTION

A. Protect workmen and public, as required under the regulations of the Occupational Safety and Health Act (OSHA) and applicable local ordinances and/or code regulations.

B. Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting.

3.4 APPLICATION

A. Equipment and application procedure shall conform to the material manufacturer's application instructions.
application instructions.]

3.5 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 45 29.

B. Random sampling to verify thickness and density of fireproofing will be conducted in accordance with provisions of ASTM E605 or CBC Standard 7-6.

C. Reinspect the installed fireproofing for integrity of fire protection, prior to concealment of Work.

D. Correct unacceptable Work and provide further inspection to verify compliance with requirements.

E. Trade responsible for any damage to fireproofing shall be held responsible for its replacement and/or repair.

3.6 CLEANING

A. Clean Work under provisions of 01700.

B. Remove excess material, overspray, droppings, and debris.

C. Remove fireproofing from materials and surfaces not specifically required to be fireproofed.

END OF SECTION

SECTION 07 84 00
FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Penetrations through fire-resistance-rated floor and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.

B. Penetrations through fire-resistance-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.

C. Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.

D. Sealant joints in fire-resistance-rated construction.

E. Fireproof firestopping and firesafing materials and accessories.

F. Openings between exterior curtainwall and edge of floor slabs.

G. Opening between top tracks of walls and connecting floor or roof assemblies.

H. Openings at each floor level in shafts and stairwells.

1.2 REFERENCES

A. ASTM E814 – Standard Test Method for Fire Tests of Through Penetration Firestop Systems

B. ASTM E1399 – Standard Test Method of Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems

C. ASTM E1966 – Standard Test Method for Fire-Resistive Joint Systems

D. ASTM E2307 – Standard test method of perimeter fire barriers.

E. ASTM C920 - Elastomeric Joint Sealants.

F. ASTM C1193 - Use of Joint Sealants.

G. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

H. ASTM E119 - Method for Fire Tests of Building Construction and Materials.

I. UL - Fire Hazard Classifications.

J. UL 1479 - Fire Tests of Through-Penetration Firestops.

K. 40 CFR Part 763, Subpart F (7-1-90 Edition) - Asbestos Hazardous Emergency Response Act, Friable Asbestos - Containing Materials in Schools.

1.3 DEFINITION

A. Firestopping (Firesafing): A sealing or stuffing material or assembly placed in spaces between building materials to arrest the movement of smoke, heat, gases, or fire through wall or floor openings.

1.4 SYSTEM DESCRIPTION

A. F-Rated Through-Penetration Firestop Systems: F-ratings as required according to UL 1479, but not less than that equaling or exceeding fire resistance rating of assembly penetrated where the following conditions exist:

1. Penetrations larger than 4 inch nominal pipe size or 16 square inches in overall cross-sectional area.

B. T-Rated Through-Penetration Firestop Systems: T-ratings, in addition to F-ratings, as required according to UL 1479, where the following conditions exist:

1. Through-penetrations of fire-rated walls above corridor ceilings which are not part of a fire-resistive assembly.

2. Through-penetrations of fire-rated walls below any ceiling.

3. Penetrations larger than 4 inch nominal pipe size or 16 square inches in overall cross-sectional area.

C. Penetrations not larger than 4 inch nominal pipe size or 16 square inches in overall cross-sectional area shall have the annular space between the penetrating item and the wall/floor assembly filled with a material which will prevent passage of flame and hot gases sufficient to ignite cotton waste when subjected to ASTM E119 under a minimum positive pressure differential of 0.01-inch water column for the time period at least equal to the fire resistance rating of the wall/floor assembly.

D. Surface Burning: ASTM E84 with a flame spread/smoke developed rating of 25/450.

E. Firestop all interruptions and terminations of fire-rated assemblies.

F. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.

G. For floor penetrations with annular spaces exceeding 4 inches or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means.

H. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Submit manufacturer's Shop Drawings for each type of firestop or smoke seal required by the Project. Shop Drawings shall indicate the detailing of all necessary anchorages, reinforcements and fastenings required.

C. Product Data: Provide product characteristics, performance and limitation criteria.

D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

E. Certification: Submit firestopping manufacturer's certification that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.

1.6 QUALITY ASSURANCE

A. Through-penetration firestop systems shall correspond to through-penetration firestop system designations listed in the UL Fire Resistance Directory.

B. Firestopping and smoke seal Work shall be performed by an installer trained or approved by the firestop or smoke seal manufacturer. Equipment used shall be in accordance with firestop or smoke seal manufacturer's written installation instructions.

1.7 REGULATORY REQUIREMENTS

A. Conform to Title 24, Part 2 and UL requirements for fire-resistance ratings and surface-burning characteristics.

B. Firestopping products shall contain no detectable asbestos as determined by 40 CFR, Part 763, Subpart F, Appendix A, Section 1, Polarized Light Microscopy.

1.8 SEQUENCING AND SCHEDULING

A. Coordinate Work with related trades.

B. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed in accordance with manufacturer's instructions and regulatory requirements.

C. Do not cover up installations that will become concealed behind other construction until Owner's Representative and authorities having jurisdiction, if required, have examined each installation.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when temperature of substrate material and ambient air is below 60 degrees F.

B. Maintain this minimum temperature before, during, and for 3 days after installation of materials.

1.10 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in original unopened packages fully identified with manufacturer's name, trade name and UL label.

1. Leave seals unbroken and labels intact until time of use.
2. Remove from job site any rejected or damaged packages found unsuitable for use.

B. Store materials in a dry place, off of the ground or floor, and away from other material subject to sweating or attraction of moisture or dampness.

C. Provide ventilation in areas to receive solvent cured materials.

PART 2 - PRODUCTS

2.1 FIRESTOPPING, GENERAL

A. Provide firestopping components that are compatible with each other, substrates of openings, and items penetrating firestopping.

B. Provide accessories for each firestopping system that are needed to comply with designated fire-resistance-rated systems specified by firestopping manufacturer.

2.2 ACCEPTABLE MANUFACTURERS

A. Hilti Construction Chemicals Inc., (909) 864-2294.

B. Minnesota Mining and Mfg. Co., (213) 726-6321.

C. Tremco, (800) 551-7085.

D. United States Gypsum Co., (800) 964-4874.

E. Bio Fireshield, Inc.

F. Dow-Corning Corp.

G. International Protective Coatings (IPC.)

H. Substitutions: Under provisions of Section 01 62 00.

2.3 FILL MATERIALS

A. General: Firestopping and smoke seal materials shall be asbestos free.

1. The F rating must be a minimum of 1 hour, but not less than the fire resistance rating of the assembly being penetrated, when tested per ASTM E84.

2. Materials being applied in openings between elements of differing fire ratings shall conform to the most restrictive rating.

3. Fire tests shall be conducted with a minimum positive pressure differential of 0.03 inches of water column.

4. Material shall be noncombustible, with flame spread of 25 or less, and smoke development of 50 or less, when tested in accordance with ASTM E84.

B. Firestop or Smoke Seal Mortar: Single-component Portland cement fly ash mortar, requiring no special supports or anchoring devices to pass water hose stream tests.

C. Intumescent:

1. Wrap: Single-component, elastomeric sheet with aluminum foil on one side.

2. Calk: Water-based latex calk per UL1479.

D. Vinyl Compound: Vinyl-based powder product mixed on site with water to produce a paintable compound with flame-spread and smoke-developed rating of 0 per ASTM E84.

E. Silicone Foam: Two-component, silicone based liquid elastomer that, when mixed, expands and cures in place to produce a flexible nonshrinking foam.

F. Firestop or Smoke Seal Sleeve: Prefabricated device used around plastic pipes in fire-rated floors and walls. The sleeve shall be made of a steel collar lined with an intumescent material.

G. Fiber Stuffing: Mineral fiber stuffing with a minimum density of 3.5 lbs/cu ft.

H. Mineral fiber board, mineral fiber matting, and mineral fiber putty-forming and damming materials shall be used to contain the fluid material mixture prior to and during filling of penetrations and voids.

1. Fire tested and functionally approved forming materials may be left in place to become an integral part of the formed penetration seal.

2. Combustible forming and damming materials may be used for containment during installation of materials only, and must be removed from the final completed penetration seal system.

I. Provide primers as required which conform to manufacturer's recommendations for various substrates and conditions.

2.4 JOINT SEALANTS

A. Manufacturer's standard chemically-curing elastomeric sealant that complies with ASTM C920.

B. Provide selections from manufacturer's full range of colors.

C. Single-Component, Neutral Curing Silicone Sealant: Type S; Grade NS; Class 25; exposure-related use NT; and joint substrate related uses M, G, A, and O, as applicable to substrate assembly condition.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that site conditions are suitable for installation of products.

B. Verify openings are ready to receive the Work of this Section.

C. Notify the Contractor in writing, with copy to Architect, of conditions detrimental to the timely completion of the Work.

D. Do not proceed with Work until all unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material.

B. Remove laitance and form release agents from concrete.

C. Remove incompatible materials which may affect bond.

D. Install backing materials to arrest liquid material leakage.

3.3 APPLICATION OF THROUGH-PENETRATION FIRESTOPS

A. Install material at walls or partition openings which contain penetrating sleeves, piping, ductwork, conduit and other items requiring firestopping.

B. Comply with through-penetration firestop manufacturer's installation instructions and Drawings pertaining to products and applications required.

C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce shapes and depths required to achieve fire ratings.

D. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop system.

E. Apply primer and materials in accordance with manufacturer's instructions.

F. Apply firestopping material in sufficient thickness to achieve rating.

G. Install firestops or smoke seals with sufficient pressure to properly fill and seal openings to ensure an effective smoke seal.

H. Install fire-resistant filler in openings where indicated.
   1. Dam bottom of vertical openings and one side of horizontal openings with temporary containment forms or, where required to achieve fire-resistance ratings, provide permanent mineral composition board forms.
   2. On horizontal penetrations, provide partial face containment forms where required for material displacement.

   3. Allow installed fillers to cure, and remove temporary forms; trim ragged edges with sharp knife; inspect and fill voids with additional filler to form uniform thickness of filler.

3.4 APPLICATION OF FIRE-RESISTIVE JOINT SEALANT

A. Comply with ASTM C1193 and manufacturer's installation instructions and Drawings pertaining to products and applications required.

B. Install joint fillers to provide support and at a position required to produce depth to joint widths that allow development of fire-resistance rating required.

C. Install sealant to completely fill recesses provided. Install sealant at same time as joint filler.

D. Tool non-sag sealants after application to form smooth uniform bead to configuration required to produce fire-resistance rating.

E. Spillage: Do not allow sealants to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.

F. Recess exposed edges of gaskets and exposed joint fillers slightly behind adjoining surfaces, unless otherwise shown, so that compressed units will not protrude from joints.

G. Tool or trowel exposed surfaces. Remove excess firestop or smoke seal material promptly as Work progresses and upon completion.

H. Apply firestop or smoke seal material at penetrations of insulated piping after the insulation is installed.

   1. The material used shall have been tested for compatibility and rating in conjunction with the use of the insulation material being used.

2. Calcium silicate, or other pipe insulation, may be substituted for fiberglass pipe insulation through the sleeve, if the insulation is part of an assembly which meets the requirements specified for firestopping or smoke sealing.

I. Firestopping or smoke sealing materials for filling voids in floors having openings of 4 inches or greater, shall be installed to support the same load as the floor system, unless the area is protected by a permanent barrier preventing loading or traffic on the firestopped or smoke sealed area.

3.5 FIELD QUALITY CONTROL

A. Do not cover up installations that will become concealed behind other construction until Owner's Representative and authorities having jurisdiction, if required, have examined each installation.

B. Where deficiencies are found, repair or replace firestopping to required condition.

3.6 CLEANING

A. Clean Work under provisions of Section 01 70 00.

B. Clean adjacent surfaces of firestopping materials.

3.7 CURING AND PROTECTION OF FINISHED WORK

A. Cure firestopping and smoke seal materials in compliance with manufacturer's instructions and recommendations.

B. Installer shall advise Contractor of procedures required for protection of firestopping and smoke seals during remaining construction period.

C. Protect finished Work under provisions of Section 01 87 00.

D. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 92 00
JOINT SEALERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Preparing sealant substrate surfaces.

B. Sealant and backing.

1.2 SUMMARY OF SEALANT LOCATIONS

A. Joints in Horizontal Surfaces:

1. Expansion and isolation joints in cast-in-place concrete slabs.
2. Control and expansion joints in ceramic and quarry tile.
3. Control and expansion joints in soffits, ceilings and overhead surfaces.
4. Joints on underside of precast beams and planks.
5. Perimeter joints in exterior openings.
6. Joints between ceiling surfaces and frames for doors and windows.
7. Joints in flashing and sheet metal.
8. Perimeter joints of toilet fixtures.
9. Acoustical isolation joints between head and sill of walls and floor and ceiling surfaces.
10. Joints between countertops and wall surfaces.
11. Joints between thresholds and floors.
12. Joints between dissimilar materials and those listed above.
13. Other joints as indicated.

B. Joints in Vertical Surfaces:

1. Joints in precast concrete.
2. Control and expansion joints in ceramic and quarry tile.

3. Perimeter joints in exterior openings.

4. Joints in flashing and sheet metal.

5. Perimeter joints of toilet fixtures.

6. Acoustical isolation joints of walls.

7. Joints between cabinets and walls.

8. Joints between wall surfaces and door and window frames.

9. Joints between dissimilar materials and those listed above.

10. Other joints as indicated.

1.3 REFERENCES

A. ASTM C834 - Latex Sealing Compounds.

B. ASTM C919 - Practices for Use of Sealants in Acoustical Applications.

C. ASTM C920 - Elastomeric Joint Sealants.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants.

E. ASTM D217 - Cone Penetration of Lubricating Grease.

F. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.

G. FS TT-S-001657 - Sealing Compound, Single Component, Butyl Rubber Based, solvent Release Type.

H. SWRI - (Sealant, Waterproofing and Restoration Institute) - Sealant and Caulking Guide Specification.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Submit Product Data indicating sealant chemical characteristics, performance criteria, limitations, and color availability.

C. Submit two 4-inch long Samples illustrating colors selected.

D. CHPS Submittals:

1. Credit EQ2.0D.P1: Provide product data, MSDS, and other official literature from manufacturer clearly identifying that the product meets the testing

requirements and threshold limits of the State of California Department of Health Services (DHS) *Standard Practice for the Testing of Volatile Organic Compounds*. Such products shall be either identified on the *CHPS Low-Emitting Materials Product List* or by a 3rd party certification program listing low-emitting material products that meet the State testing requirements, as identified on the CHPS website.

1.5 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five years documented experience.

B. Applicator: Company specializing in applying the Work of this Section with minimum three years documented experience, approved by sealant manufacturer.

C. Conform to Sealant, Waterproofing, and Restoration Institute (SWRI) requirements for materials and installation.

D. Perform Work in accordance with ASTM C1193.

E. Perform acoustical sealant application work to provide maximum STC values in accordance with ASTM C919.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not install solvent curing sealants in enclosed building spaces.

B. Do not install sealant when temperature is less than 40 degrees F.

C. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.7 WARRANTY

A. Provide sealant manufacturer's 5-year warranty against defects in materials.

B. Include coverage for installed sealants and accessories which fail to achieve air and water seal and exhibit loss of adhesion or cohesion or do not cure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers and products are listed for each sealant type.

B. Substitutions: Under provisions of Section 01 62 00.

2.2 SEALANTS

A. Type A - Acrylic Latex: One-part, non-sag, mildew resistant acrylic emulsion compound complying with ASTM C834, Type S, Grade NS, formulated to be paintable.

1. Tremco Inc., Acrylic Latex Caulk.

2. Bostik Construction Products Division, “Chem-Calk 600”.

3. Pecora Corporation, “AC-20”.

B. Type B - Butyl Sealant: One-part, non-sag solvent-release-curing sealant complying with FS TT-S-001657 for Type 1 and formulated with a minimum of 75 percent solids.

1. Tremco Inc., Tremco “Bitul Sealant”.

2. Bostik Construction Products Division, “Chem-Calk 300”.

3. Pecora Corporation, “BC-158”.

C. Type C - Silicone Sealant: One-part nonacid-curing silicone sealant complying with ASTM C920, Type S, Grade NS, Class 25.

1. Dow Corning Corp., “Dow Corning 790”.

2. General Electric Co., “Silpruf”.

3. Tremco, Inc., “Spectrum 1”.

4. Pecora Corp., “864” or “890”.

D. Type D - Neutral-Curing Silicone Sealant: One part medium modulus neutral-curing silicone sealant complying with ASTM C920, Type S, Grade NS, Class 25.

1. Dow Corning Corp., “Dow Corning 795”.

2. General Electric Co., “Ultraglaze 4000”.

3. Tremco, Inc., “Spectrum 3”.

4. Pecora Corp., “895”.

E. Type E - One-Part Mildew-Resistant Silicone Sealant: Complying with ASTM C920, Type S, Grade NS, Class 25.

1. Dow Corning Corp., “Dow Corning 786”.

2. General Electric Co., “Sanitary 1700”.

3. Rhone-Poulene Inc., “Rhodorsil 6 B White”.

4. Tremco, Inc., “Proglaze White”.

5. Pecora Corp., “863” or “898” White.

F. Type F - Multi-Part Pourable Sealant: Complying with ASTM C920, Type M, Grade P, Class 25. Shore A hardness +40.

1. Tremco, Inc., “HPL”.

2. Mameco International, Inc., “Vulkem 255”.

3. Pecora Corp., “Dynatred” or “Urexpan NR-200”.

4. Sika Corporation, “Sikaflex 2C NS/SL”.

5. W.R. Meadows, “Pourthane”.

G. Type G - Acoustical Sealant: Nondrying, nonhardening permanently flexible conforming to ASTM D217.

1. Pecora Corp., “BA-98 Acoustical Sealant”.

2. Tremco, Inc., “Tremco Acoustical Sealant”.

3. United States Gypsum Co., “Sheetrock Acoustical Sealant”.

H. Sound and Fire Protective Rated Moldable Putty Pads as wall opening protective materials when code required in fire-rated walls.

1. Tremco, Inc., TREMstop “MP Putty Pads”.

2. 3M Inc., “3M Fire Barrier Moldable Putty Pads MPP+.”

3. Hilti Co., “CFS-P PA Fire Putty Pad”.

2.3 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: ASTM D1056; round, closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure-sensitive tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that joint openings are ready to receive Work and field measurements are as shown on Drawings and recommended by the manufacturer.

B. Beginning of installation means installer accepts existing substrate.

3.2 PREPARATION

A. Clean and prime joints in accordance with manufacturer's instructions. Prime if recommended by manufacturer.

B. Remove loose materials and foreign matter which might impair adhesion of sealant.

C. Verify that joint backing and release tapes are compatible with sealant.

D. Perform preparation in accordance with ASTM C1193.

E. Protect elements surrounding the Work of this Section from damage or disfiguration.

3.3 INSTALLATION

A. Install sealant in accordance with manufacturer's instructions.

B. Measure joint dimensions and size materials to achieve required width/depth ratios.

C. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width.

D. Install bond breaker where joint backing is not used.

E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

G. Tool joints concave unless otherwise detailed.

3.4 CLEANING AND REPAIRING

A. Clean work under provisions of Section 01 70 00.
B. Clean adjacent soiled surfaces.

C. Repair or replace defaced or disfigured finishes caused by Work of this Section.

3.5 PROTECTION OF FINISHED WORK

A. Protect sealants until cured.

3.6 SCHEDULE

	Type	Location	Color
A.	Type A - Acrylic Latex Cure	All interior joints not otherwise scheduled	To match adjacent surfaces
	Type B - Butyl	Under thresholds	Black
	Type C - One-Part Nonacid Curing Silicone	Exterior door, entrance & window frames. Exterior & Interior vertical joints in concrete; metal flashing	Color to be selected by Architect
	Type D - Neutral-Curing Silicone	Joints within skylight framing system, aluminum entrance system, glass and glazing	Color to be selected by Architect
	Type E - Mildew-Resistant Silicone	Interior joints in ceramic tile and at plumbing fixtures	Translucent
	Type F - Multi-part Pourable Urethane	Exterior & interior joints in horizontal surfaces of concrete; between metal & concrete masonry and mortar	Color to be selected by Architect
	Type G - Acoustical Sealant	In sound rated walls between stud track/runner and adjacent construction. Between outlet boxes and gypsum board.	White
	Type H - Sound and Fire Protective Rated Moldable Putty Pads	At fire-rated wall openings when code required, such as electric boxes. In sound rated walls at electric boxes.	Red

END OF SECTION

SECTION 08 11 13
STANDARD STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Non-rated and fire rated rolled steel frames and doors and panels, where indicated.

B. Interior and exterior light frames.

C. Louvers where integral with the doors.

1.2 REFERENCES

A. ANSI A250.8 - Recommended Specification for Standard Steel Doors and Frames.

B. ASTM A653 - Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. ASTM A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

D. NFPA 80 - Fire Doors and Windows.

E. SDI-105 - Recommended Erection Instructions for Steel Frames.

F. DHI - Door and Hardware Institute.

G. CBC - California Building Code.

H. UL 9 - Fire Tests of Window Assemblies.

I. UL 10C - Fire Tests of Door Assemblies.

1.3 QUALITY ASSURANCE

A. Conform to requirements of ANSI A250.8.

B. Fire rated frame and [door] [panel] construction to conform to UL 9 and UL 10C.

C. Installed frame and door assembly to conform to NFPA 80 for fire rating class indicated on Drawings.

D. Installed exterior frame [and door] assembly to be weathertight

1.4 REGULATORY REQUIREMENTS

A. Conform to CBC for fire rated frames and doors.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Indicate frame configuration, anchor types and spacings, location of cutouts for hardware, reinforcement, and finish. Where doors are included, indicate door elevations, internal reinforcement, closure method, and cut-outs for glazing and louvers, as well as provisions for electric hookups where required.

C. Submit Sample of exterior frame and mullion intersection.

1.6 DELIVERY, STORAGE AND PROTECTION

A. Deliver, store, protect, and handle products under provisions of Section 01 87 00.

B. Store products on site under cover.

C. Support products on nominal 4 inch wood spacers to prevent rust and damage.

D. Protect doors and frames with resilient packaging.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Amweld Building Products, Inc.

B. Ceco Door Products.

C. Steelcraft.

D. Substitutions: Under provisions of Section 01 62 00.

2.2 DOORS, PANELS, AND FRAMES

A. Steel: Commercial quality cold rolled steel conforming to ASTM A653 galvanized to A60 or G60 coating class or Type B, A40 (ZF120) according to ASTM A924 with minimized spangle, mill phosphatized.

B. Exterior Doors: ANSI A250.8, Grade III, extra heavy-duty, Model 2, continuous welded seam, minimum 0.053 inch thick faces.

C. Interior Doors: ANSI A250.8, Grade II heavy duty, Model 1, minimum 0.042 inch thick faces.

D. Exterior Frames: 0.067 inch thick material, core thickness.

E. Interior Frames: 0.053 inch thick material, core thickness.

F. Panels: Same materials and construction as specified for doors.

2.3 DOOR CORE

A. Exterior Core: Polystyrene insulation.

B. Interior Door Core: Impregnated cardboard honeycomb.

2.4 ACCESSORIES

A. Louvers: Roll formed steel, prime coated, inverted 'V' blade, sightproof, with countersink, tamperproof fasteners.

B. Rubber Silencers: Resilient rubber as specified in Section 08 71 00.

C. Glazing Stops: Rolled steel channel shape, mitered corners; prepared for countersink style tamperproof screws at door installations, square butt at light frames.

2.5 FRAME ANCHORS

A. Masonry Anchors: Adjustable T-strap, 0.053 inch thick steel, corrugated, 2 inch x 10 inch size. Fire rated frames to have UL listed perforated strap anchor permanently anchored to frame.

B. Metal Stud Anchor: Z type anchor, welded to frame, 0.053 inch thick steel, UL listed as required for fire rating.

C. Wood Stud Anchor: U shaped anchor, welded to frame, 1 inch wide, 0.053 inch thick steel, with 2 pre-punched holes in nailing flange. UL listed as required for fire rating.

D. Existing Wall Anchor: 0.053 inch thick pipe spacer with 2 inch x 0.053 inch thick steel plate sized to accommodate a 3/8 diameter countersunk flathead expansion anchor. UL listed as required for fire rating.

E. Floor Clip: Adjustable 2 piece angle anchor, full width of frame, 0.067 inch thick steel.

2.6 PROTECTIVE COATINGS

A. Bituminous Coating: Fibered asphalt emulsion.

B. Primer: Zinc-chromate type.

2.7 FABRICATION

A. When shipping limitations so dictate, frames for large openings shall be fabricated in sections designed for splicing.

B. All spliced joints shall occur on the interior side of exterior frames.

C. Fabricate frames as fully welded units.

D. All face, rabbet and soffit joints between abutting members shall be continuously welded and finished smooth when exposed to exterior.

E. Corner joints shall have all contact edges closed tight, with faces mitered and continuously welded.

F. Frames with multiple openings shall have mullion members fabricated with no visible seams or joints. All face, rabbet and soffit joints between abutted members shall be continuously welded and finished smooth when exposed to exterior.

G. Provide 3/8 inch back bend return on frames where gypsum board wall material occurs whether on one or both sides.

H. Fabricate frames and doors with hardware reinforcement plates filet welded in place. Reinforcement gages to be in accordance with ANSI A250.8, Table IV. Provide 0.167 inch thick full width hinge reinforcing. Provide spacers for all thru-bolted hardware.

I. Dust cover boxes or mortar guards of 0.016 inch thick steel shall be provided at all hardware mortises on frames.

J. Reinforce frames wider than 48 inches with roll formed, 0.093 inch thick steel channels fitted tightly and welded into frame head, flush with top.

K. Prepare frame for silencers except for frames which receive weather stripping. Provide three single rubber silencers for single doors on strike side, and two single silencers on frame head at double doors without mullions.

L. Clean and treat with three-stage iron phosphate process. Provide baked-on prime coat of EPA-compliant grey rust-inhibitive enamel.

M. Provide steel spreader temporarily attached to feet of both jambs as a brace during shipping and handling. Spreader shall not be used for installation purposes.

N. Attach fire rating label to each fire-rated frame and door unit.

O. Close top edge of exterior door flush with inverted steel channel closure. Seal joints watertight.

2.8 MANUFACTURING TOLERANCE

A. Manufacturing tolerance shall be maintained within the following limits:

Frame width	±1/16 inch -1/32 inch
Frame height	±3/64 inch
Frame face	±1/32 inch
Frame stop	±1/32 inch
Frame rabbet	±1/64 inch
Frame depth	±1/32 inch
Frame throat	±1/16 inch
Door width and height	±3/64 inch
Door thickness	±1/16 inch
Hardware location	±1/32 inch
Door flatness	±1/16 inch

2.9 FINISH

A. Primer: Air-dried or baked-on.

B. Finish: Site paint as specified in Section 09 91 00.

C. Where installing against masonry, coat inside of frame profile with bituminous coating with a thickness of 1/16 inch. Coating may be factory or site applied. Do not apply coating to fire-rated frames.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install frames in accordance with SDI-105.

B. Install doors in accordance with DHI.

C. Install fire doors and frames in accordance with NFPA 80.

D. Installation of exterior frames and doors shall be weathertight and waterproof.

E. Coordinate with wall construction and details for anchor placement. Provide anchors as follows:

1. Frames up to 7 feet 6 inches in height - 4 anchors each jamb.

2. Frames 7 feet 6 inches to 8 feet in height; 5 anchors each jamb, plus an additional anchor for each 2 feet or fraction thereof over 8 feet.

3. Frames for double doors; minimum of 2 anchors in head approximately 12 inches from each jamb.

4. Borrowed lite frames; 2 anchors each jamb plus 1 anchor for each 18 inches or fraction thereof over 3 feet. Minimum of 2 anchors in head and sill approximately 12 inches from each jamb plus 1 anchor for each 30 inches of length or fraction thereof.

5. Floor anchors; 1 anchor each jamb for interior doors. Where wall construction will not allow placement of floor anchor, provide one additional jamb anchor as close to floor as possible. At exterior doors set frames 2 inches into blocked out recess and grout flush with floor.

6. Existing wall anchors shall be welded to provide non-removable condition. Welded bolt head to be ground, dressed and finished smooth.

F. Coordinate with installation of low-voltage wiring.

G. Frames installed in masonry walls shall be fully grouted.

H. Exposed field welds shall be finished smooth and touched up.

I. Primed or painted surfaces which are scratched or marred shall be touched up.

J. Hardware shall be applied in accordance with hardware manufacturer's templates and instructions.

K. Coordinate installation of glass and glazing.

L. Install door louvers.

M. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

3.2 INSTALLATION TOLERANCES

A. Edge clearance for swinging doors shall not exceed the following:

Between door and frame at head and jamb	1/8 inch

Between edge of pair of doors	1/8 inch
At door sill with threshold. (From bottom of door to top of threshold)	3/8 inch
At door sill with no threshold	3/4 inch
At door bottom and nominal floor covering per NFPA 80	5/8 inch

B. Frame installation tolerance shall not exceed the following:

Squareness	±1/16 inch
Alignment	±1/16 inch
Plumbness	±1/16 inch
Diagonal Distortion	±1/32 inch

END OF SECTION

SECTION 08 14 16
WOOD DOORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wood doors, fire-rated and non-rated.

B. Glass lite frames.

C. Door louvers.

1.2 REFERENCES

A. WDMA I.S.1 - Industry Standard For Wood Flush Doors (Includes Standards I.S.1.1 through I.S.1.7).

B. NFPA 80 - Fire Doors and Windows.

C. CBC - California Building Code.

D. UL 10C - Fire Tests of Door Assemblies.

E. WI - Woodwork Institute: Manual of Millwork.

1.3 QUALITY ASSURANCE

A. Conform to requirements of WI Manual of Millwork, Section 12 and 13, Premium Grade except where otherwise indicated.

B. Issue a WI Certified Compliance Certificate prior to delivery of doors certifying that doors meet all requirements of WI Grade specified.

C. After completion issue a WI Certified Compliance Certificate for Installation.

1.4 REGULATORY REQUIREMENTS

A. Conform to CBC for fire-rated doors.

B. Fire Door Construction: Conform to UL 10C.

C. Installed Doors: Conform to NFPA 80 for fire-rated class indicated on Drawings.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings shall bear the WI Certified Compliance Label on the first page of each set. Indicate door elevations, stile and rail reinforcement, internal blocking for hardware attachment, and cutouts for glazing and louvers.

C. Submit two Samples 12 inches x 12 inches in size illustrating each species and finish specified.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Protect products under provisions of Section 01 87 00.

B. Package, deliver, and store doors in accordance with WI requirements as set forth in Technical Bulletin 419-R.

1.7 WARRANTY

A. Provide manufacturer's standard lifetime warranty under provisions of Section 01 70 00 for solid core doors.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS, FLUSH FACED DOORS and FRAMES

A. Eggers Industries, Inc.

B. Marshfield Door Systems, Inc.

C. Algoma Hardwoods, Inc.

D. Frames: Anemostat or equal.

E. Substitutions: Under provisions of Section 01 62 00.

2.2 DOOR and FRAME CONSTRUCTION

A. Solid Non-rated Core: Solid wood block, framed block glued, or solid particleboard.

B. Solid, Special Function Core: Labeled fire performance type.

C. Construction: 5-ply, with face veneer applied vertically over wood veneer cross banding.

D. Flush Interior Door Veneer: Birch for paint grade and clear finish; plain sliced with book matched grain, for transparent clear or stain finish. Satin sheen. Color as selected by Architect.

E. Rated Wood Frames: Manufacturer’s standard 20 minute labeled frames, species to match door, U.O.N. installed in accordance with manufacturer’s

installation instructions. Fire rated frames shall be machined for hardware at factory.

2.3 GLASS LITE FRAMES

A. 20 Ga. Cold rolled steel

2.4 ADHESIVES

A. Exterior and Interior Doors: WI Type I.

2.5 FABRICATION

A. Fabricate non-rated wood doors to requirements of WI Manual of Millwork, Section 12 and 13, in the WI Grade specified.

B. Fabricate fire rated doors per manufacturer's standard construction, and labeling agency requirements.

C. Premachine doors for finish hardware.

D. For fire rated doors with mineral cores, provide solid wood blocks for hardware reinforcement at lock edge, mid-height push bar, and at top of door for closer.

E. For fire-rated doors with mineral cores, provide solid wood blocking for thru-bolted hardware.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install doors in accordance with WI Manual of Millwork Sections 12 and 13 and WI Technical Bulletin 420-R.

B. Conform to WI requirements for fit tolerances.

C. Coordinate installation of glass and glazing.

D. Install door louvers.

E. Adjust doors for smooth and balanced movements.

F. Install fire doors in accordance with NFPA 80.

3.2 INSTALLATION TOLERANCES

A. Edge clearance for swinging doors shall not exceed the following:

1. Between door and frame at head and jamb 1/8 inch

2. Between edge of pair of doors 1/8 inch

3. At door sill with threshold 3/8 inch

4. At door bottom and surface of nominal floor covering per NFPA 80 and at doors requiring an undercut as indicated on Drawings. 5/8 inch

B. Frame installation tolerance shall not exceed the following:

1. Squareness ±1/16 inch

2. Alignment ±1/16 inch

3. Plumbness ±1/16 inch

4. Diagonal Distortion ±1/32 inch

END OF SECTION

SECTION 08 33 23
OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Steel overhead coiling doors.

1.2 REFERENCES

A. ASTM A480 - Flat Rolled Stainless Heat Resisting Steel Plate, Sheet, and Strip.

B. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron, Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. ASTM A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

D. UL - Underwriters' Laboratories, Inc.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Provide Data and Shop Drawings: Submit literature and specifications. Provide pertinent dimensioning, general construction, component connections and details, anchorage methods, hardware location, and installation details.

C. Submit manufacturer's installation instructions.

D. Submit manufacturer's operation and maintenance data.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - OVERHEAD COILING DOORS

A. The Cookson Company, (800) 698-9023.

B. Overhead Door Corp., (415) 934-1200.

C. Pacific Rolling Door Co., (800) 773-7269.\

D. Substitutions: Under provisions of Section 01 62 00.

2.2 ACCEPTABLE MANUFACTURERS - OVERHEAD COILING COUNTER DOORS

A. Connors Overhead Door Co., Inc., (510) 526-1211.

B. The Cookson Co., (800) 698-9023.

C. Overhead Door Corp., (415) 934-1200.

D. Substitutions: Under provisions of Section 01 62 00.

2.3 STEEL OVERHEAD COILING DOORS NON-RATED

A. Insulated Curtain: Minimum 0.0269 inch thick flat slats of steel with back panels, ASTM A653, commercial steel, Type A, G60 ; galvanized coating in accordance with ASTM A924; 2-7/8 inches wide x required length; ends of alternate slats fitted with endlocks to act as wearing surface in guides and to prevent lateral movement; bottom fitted with aluminum extrusion to provide reinforcement and positive contact with floor in closed position. Slats to be filled with foamed-in-place polyurethane insulation.

B. Curtain Guides: Formed steel channels and angles for required sizes and configurations.

C. Roller Shaft (Counterbalance): Steel pipe and helical steel spring system capable of producing sufficient torque to assure easy operation of curtain from any position; adjustable spring tension.

D. Hood: 0.020 inch thick galvanized steel; internally reinforced to maintain rigidity and form.

E. Weatherstripping: Water- and rot-proof, resilient type; located along jamb edges, bottom of curtain, and within housing.

F. Hardware: As specified in Section 08 71 00.

G. Electric Operator: Activated by smoke detection or fire alarm system, UL Approved in accordance with UL 325; side mounted 480 volt, three phase 60 Hz supply to one hp electric motor; adjustable friction clutch, double shoe brake system actuated by independent full line voltage solenoid controlled by motor starter; fully enclosed positive gear driven limit switch; fully enclosed magnetic cross line reversing starter. Cookson “Soft-Close” governor or approved equal, to maintain closing speed between 6 inches and 9 inches per second.

1. Control Station: Standard three button (open-close-stop) control for each operator; recessed mounted with stainless steel locking lever.

2. Safety Device: Cookson “Featheredge” or approved equal. Located at bottom of doors; electromechanical type; wired to reverse door upon striking

2.6 FINISH

A. Overhead Coiling Steel Doors: Galvanized steel factory primed for finish painting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install overhead coiling doors, and coiling counter doors in accordance with manufacturer's instructions and approved Shop Drawings. Coordinate installation with electric service.

B. Fit, align, and adjust door assembly level and plumb; provide smooth operation.

END OF SECTION

SECTION 08 36 00
VERTICAL PANEL DOORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Glazed aluminum sectional overhead door
   1. Full view aluminum door.
   2. Electric door operator and controls
   3. Operating hardware tracks and support

1.2 REFERENCES

A. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures.

B. ANSI / DASMA 102; American National Standard specifications for sectional overhead type doors.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Provide Data and Shop Drawings: Submit literature and specifications. Provide pertinent dimensioning, general construction, component connections and details, anchorage methods, hardware location, and installation details.

C. Submit manufacturer's installation instructions.

D. Submit manufacturer's operation and maintenance data.

E. Nameplate data and ratings for motors.

1.4 WIND PERFORMANCE REQUIREMENTS

A. Design doors to withstand positive and negative wind loads as calculated in accordance with applicable building code and detailed in structural documents.
   1. Design Wind Load: +14, -14 lb/sf
   2. Safety Factor: 1.5 times design wind load.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Clopay Corporation- Aluminum Sectional Overhead Doors
   1. Model: #904

B. Substitutions:
   1. Cookson
   2. Cornell

2.1 ALUMINUM SECTIONAL OVERHEAD DOORS, MODEL #904

A. Door Assembly: Stile and rail assembles with 6063-T5 aluminum.
   1. Panel Thickness: 2 1/8 inches
   2. Finish: Clear Coat

B. Windows:
   1. Fully View Aluminum Sections
   2. ½" Low E Insulated tempered glazing

C. Weather stripping:
   1. Provide complete perimeter seals.
   2. Provide reverse angle seal at jamb and head with U-shaped bottom seal.

D. Tracks:
   1. Vertical tracks minimum 0.061 inch galvanized steel tapered and mounted for wedge type closing.
   2. Track Width: 2 inches.
   3. Provide full vertical lift track.

E. Spring Counterbalance:
   1. Torsion spring counterbalance mechanism sized to weight of the door, with a helically wound, oil tempered torsion spring mounted on a steel shaft; cable drum of die cast aluminum with high strength galvanized aircraft cable with minimum 7 to 1 safety factor.
   2. Spring: 10,000 cycles.

F. Locking:
   1. Inside spring loaded slide bolt lock on end stile that engages slot in track.
   2. Provide 2 inside slide locks.

G. Shaft:
   1. Provide 1" extended solid shaft for moto operation.

2.3 HOIST-TYPE DOOR OPERATORS

A. Industrial-Duty Operator: LiftMaster Industrial-Duty Hoist Operators, continuous-duty, high-starting torque motor with overload protection and an emergency chain hoist with electric interlock.

1. Model: LiftMaster BH.

B. Electric Operator: Industrial-duty assembly, cULus listed and cULus labeled, with electric motor and factory-prewired motor controls, manually operated chain hoist, 3-button open/close/stop control station, conduit-encased wiring from control circuit to motor, positive locking mechanical system acting as a holding brake, and accessories required for proper operation; door speed of approximately 8 to 9 inches per second.

(a) Drive Reduction: Heavy-duty 5L V-belt primary reduction and chain/sprocket secondary and third stage reduction; all reduction sprockets and pulleys shall be drilled and pinned to steel shafts plated for resistance to corrosion; operator shall be equipped with permanently lubricated ball bearings on output shaft, adjustable friction clutch and output and door driven sprockets.

(b) Brake: Electric solenoid-actuated brake capable of stopping and holding a door at any position.

(c) Limit Switches: Fully adjustable, linear-driven limit mechanism synchronizing operator with door; low-friction nylon limit nuts fitted on threaded steel shaft that rotates on oil-tight self-lubricating bronze bushings; motor shall be removable without affecting limit switch settings.

(d) Electric Motor: High-starting torque, continuous-duty, industrial-type protected against overload by current sensing and thermal overload devices. For three-phase applications, incoming voltage field-selectable between 208V, 230V and 460V, 60 Hz by properly positioning connector.

Motor Specification:

a.) 208/230/460V 60 Hz, 3-phase, 1/2 HP.

(e). Motor Control and Enclosure: LiftMaster Logic 5.0 motor control shall be UL- approved microprocessor solid-state type and shall include the capability to select one of 7 wiring types; additional features shall include a maintenance alert diagnostic system, programmable Timer- to-Close with timer defeat input, mid-stop programming capabilities and a maximum run timer to provide motor overrun protection; motor control shall be housed in a NEMA 1 enclosure integral to the operator and shall conform to

ANSI/NEMA ICS 6.

(1) Radio Receiver: LiftMaster Logic 5.0 on-board, 3-channel receiver with standard external antenna; equipped to accept Security+ 2.0 Rolling Code Technology remote controls and trinary DIP switch remote controls, with memory up to (30) 3-button remote controls (or 90 single-button remote controls) plus 30 wireless keypads, or an unlimited number of trinary DIP switch remote controls. Tri-band frequency (310/315/390 MHz) sends multiple radio signals to bypass radio interference.

(2) Internet Connectivity: MyQ Technology.

a 902 to 928 MHz.

b 50-channel FHSS (Frequency Hopping Spread Spectrum).

c LiftMaster 828LM Internet Gateway enables monitoring and control of door operators and lighting controls via Internet-enabled smartphone, tablet or computer.

d Provides two-way communication between commercial door operator and MyQ Accessories to enable remote open, close and monitoring of commercial door.

f. 3-Button Control Station: 3-button station providing open/close/stop functionality shall be NEMA Type 1 with maintenance alert indicator to signal intervals for routine door and operator maintenance.

g. Door Drive: Full #50 roller chain; operator shall be equipped with an electrically interlocked, floor level disconnect and chain hoist for manual operation.

C. Primary Entrapment Protection Devices:
NEMA 4 Monitored Photo Sensors: LiftMaster Monitored Photo Eyes, non-contact, photo beam reversing photo sensor system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install overhead doors and track in accordance with manufacturer's instructions and approved Shop Drawings. Coordinate installation with electric service.

B. Fit, align, and adjust door assembly level and plumb; provide smooth operation.

END OF SECTION

SECTION 08 41 00
ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Aluminum doors, frames and glazed lights.

B. Anchors, brackets, and attachments.

C. Perimeter sealant.

D. Sill-pans under storefront units.

1.2 REFERENCES

Contractor's work shall comply with the following standards as applicable. Manufactured items are to be fabricated to these same standards.

The following standards (and publications) are applicable to the extent referenced in the text. The most recent of these standards is implied, unless otherwise stated.

A. ASTM A36 - Structural Steel.

B. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

C. ASTM E283 - Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors.

D. ASTM D2000 - Classification System for Rubber Products.

E. ASTM D2287 - Nonrigid Vinyl Chloride Polymer and Copolymer molding and Extrusion Compounds.

F. AAMA 701.2 - Voluntary Specification for Pile Weatherstripping.

G. AAMA SFM-1 - Aluminum Storefront and Entrance Manual.

H. NAAMM - Metal Finishes Manual.

I. CBC - California Building Code.

1.3 PERFORMANCE

A. System to provide for expansion and contraction within system components caused

by a cycling temperature range of 120 F degrees without causing detrimental effects to system or components.

B. Design and size members to withstand dead loads and live loads caused by pressure and suction of wind as calculated in accordance with CBC.

C. Limit mullion deflection to 1/200, or flexure limit of glass with full recovery of glazing materials, whichever is less.

D. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior.

E. Limit air infiltration through assembly to 0.06 cu ft/min/sq ft as measured in accordance with ASTM E283.

F. System to accommodate, without damage to system or components, or deterioration of perimeter seal: Movement within system; movement between system and perimeter framing components; dynamic loading and release of loads; and deflection of structural support framing.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00, Submittals.

B. Shop Drawings: Include system and component dimensions; components within assembly; framed opening requirements and tolerances; anchorage and fasteners; glass and infills; sub sill-pans under storefront units, door hardware requirements; and affected related Work.

C. Product Data: Manufacturer’s brochures and manufacturer's installation instructions.

E. For storefronts over 10’ in height, submit drawing and stamped structural calculations to verify structural capabilities and obtain DSA approval.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with AMA SFM-1.

1.7 PRE-INSTALLATION CONFERENCE

A. Convene a preinstallation conference approximately two (2) weeks before scheduled commencement of storefront system installation and associated work.

B. Require attendance of installer of each component of associated work, installers of substrate construction to receive window system, and other work in and around window installation which must precede or follow installation work (including cement plaster, fiber cement siding, and finish carpentry work if any), Architect, Owner, window system manufacturer's representative, and other representatives directly concerned with performance of the Work, including (where applicable) the IOR, Owner's insurers, testing agencies and governing authorities.

C. Objectives of conference to include:

1. Review foreseeable methods and procedures related to window installation work, including set up and mobilization areas for stored material and work area.

2. Tour representative areas of the Work, inspect and discuss condition of substrate, curbs, rough openings and other preparatory work performed by others.

3. Review window system requirements (drawings, specifications and other contract documents).

4. Review required submittals both completed and yet to be completed.

5. Review and finalize construction schedule related to the window installation work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.

6. Review required inspection, testing, certifying and material usage accounting procedures.

7. Record discussion of conference including decisions and agreements (or disagreements) reached. Furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference. The Owner's Representative will designate one of the conference participants to record the proceedings and promptly distribute them to the participants for record.

8. Review notification procedures for inclement weather or non-working days.

D. The intent of the conference is to resolve issues affecting the installation and performance of the window installation work. Do not proceed with the installation work until such issues are resolved the satisfaction of the Owner and Engineer of Record. This shall not be construed as interference with the progress of Work on the part of the Owner or Engineer of Record.

1.8 WARRANTY

A. The window manufacturer shall furnish a written warranty against defects in workmanship and materials for a period of ten (10) years from the date of Substantial Completion. Warranty shall stipulate that service to windows shall be performed on job site and not at a point of manufacture. Warranty shall cover all portions and components of the system, including the laminated glass.

B. Manufacturer shall designate the factory certified installer as responsible to be on call for a period of five (5) years following the date of Project Closeout. During such time, all calls shall be responded to within eight (8) hours of notification by the District. On call shall include any repairs required for the system and caulking, as well as training and assistance to District staff as needed.

C. Following the five-year period and for the remainder of the ten- year warranty period, the manufacturer shall be on call to correct all defects in manufacture. If such corrections involve need for the designated factory-certified installer, then installer shall be included as well.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle system components under provisions of Section 01 66 00 Product Delivery, Storage, and Handling.

B. Provide strippable coating to protect prefinished aluminum surfaces.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Arcadia, (213) 269-7300.

B. EFCO Corporation, (800) 221-4169.

C. Kawneer Company, Inc., (714) 523-4850.

D. Or approved equal. Substitutions under the provisions of Section 01 25 13, Product Options and Substitutions.

2.2 MATERIALS

A. Extruded Aluminum: ASTM B221; Alloy G.S. 10A-T5.

B. Brackets and Reinforcements: High strength aluminum.

C. Fasteners: Stainless steel, aluminum.

D. Compression Weatherstripping: Replaceable gaskets of molded neoprene complying with ASTM D2000, or molded PVC complying with ASTM D 2287.

E. Sliding Weatherstripping: Replaceable wool, polypropylene or nylon woven pile; nylon fabric or aluminum strip backing; complying with AAMA 701.2.

2.3 FABRICATED COMPONENTS

A. Frames: 2 inch x 4 inch profile, flush glazing stops.

B. Wide Stile Doors: 2 inches thick, 5 inch wide top and mid-rail, 5 inch wide vertical stiles, 10 inch wide bottom rail (nominal dimensions); beveled glazing strips. All stiles and rails welded.

C. Reinforced Mullion: Extruded aluminum cladding with internal reinforcement of steel shaped structural section as required by manufacturer.

E. Provide sill-pans per drawings under glazed units on curbs, as specified in Section 07 62 00, Flashing and Sheet Metal.

2.4 GLASS AND GLAZING MATERIALS

A. Glass and Glazing Materials: As specified in Section 08 80 00 and as indicated on Drawings.

2.5 HARDWARE

A. Door Hardware: As specified in Section 08 71 00, Door Hardware.

2.6 FABRICATION

A. Fabricate doors and frames allowing for minimum clearances and shim spacing around perimeter of assembly, yet enabling installation.

B. Rigidly fit and secure joints and corners with internal reinforcement. Weld top and bottom rails of doors to reinforcement clips. Make joints and connections flush, hairline, and weatherproof.

C. Develop drainage holes with moisture pattern to exterior.

D. Prepare components to receive anchor devices. Fabricate anchorage items.

E. Arrange fasteners, attachments, and jointing to ensure concealment from view.

F. Prepare components with internal reinforcement for door hardware and door operator hinge hardware.

G. Reinforce framing members for imposed loads.

2.7 FINISHES

A. Anodized Finish: NAAMM AA-M12-C22, Class I clear anodic coating.

B. Apply bituminous paint to separate dissimilar metals and metal surfaces in contact with cementitious or dissimilar materials.

2.8 SEALANT MATERIALS

A. Sealant and Backing Materials: As specified in Section 07 92 00, Joint Sealers.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify wall openings and adjoining materials are ready to receive Work of this Section.

B. Confirm that site conditions and substrates are ready for work covered under this section to commence. If not, Contractor is to make suitable repairs or adjustments to the work.

B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

A. Install doors, frames, glazing and hardware in accordance with manufacturer's instructions and AAMA SFM-1.

B. Use anchorage devices to securely attach frame assembly to structure.

C. Attach to structure to permit adjustment to accommodate construction tolerances and other irregularities.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent Work.

E. Install sill flashings.

F. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

G. Install sealant and backing materials as specified in Section 07 90 00.

H. Install hardware using templates provided. Refer to Section 08 71 00 for installation requirements.

I. Install glass in accordance with Section 08 80 00, using exterior dry method of glazing.

J. Adjust operating hardware.

K. Extra stock: Hardware (all labeled), weather stripping, glazing accessories as verified by Owner.

3.3 TOLERANCES

A. Variation from Plane: 0.03 inches per foot maximum or 0.25 inches per 30 feet, whichever is less.

B. Misalignment of Two Adjoining Members Abutting in Plane: 0.015 inches maximum.

3.4 CLEANING

A. Remove protective material from prefinished aluminum surfaces.

B. Wash down exposed surfaces using a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

C. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

END OF SECTION

SECTION 08 51 13
ALUMINUM WINDOWS

Edit all items in brackets, eliminating the brackets as you proceed. Follow all instructions appearing in boxes. Do product research or obtain guidance from project manager regarding unclear directives in these instructions. Eliminate boxes and any other options, if not employed.

All red text, items in boxes, and brackets should vanish when the section is fully edited.

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Extruded aluminum windows with fixed and sash.

B. Sub-sill pans under windows as per the drawings.

1.2 REFERENCES

Contractor's work shall comply with the following standards as applicable. Manufactured items are to be fabricated to these same standards.

The following standards (and publications) are applicable to the extent referenced in the text. The most recent of these standards is implied, unless otherwise stated.

A. AAMA 101 - Voluntary Specifications for Aluminum Prime Windows and Sliding Glass Door.

B. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

C. ASTM E283 - Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors.

D. ASTM E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

E. ASTM E331 - Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

F. ASTM E547 - Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.

G. CCR - California Code of Regulations, Title 24, Part 6, Section 116.

H. CEC - California Energy Commission.

I. FS L-S-125 - Screening, Insect, Nonmetallic.

J. NFRC - National Fenestration Rating Council.

K. NAAMM - National Association of Architectural Metal Manufacturers.

L. SIGMA - Sealed Insulating Glass Manufacturers Association.

1.3 PERFORMANCE REQUIREMENTS

A. Comply with air infiltration, water penetration and structural performance requirements indicated in AAMA 101 for the type, grade and performance class of window units required.

B. Test each type and size of required window unit through a recognized testing laboratory or agency, in accordance with ASTM E330 for structural performance, with ASTM E283 for air infiltration and with both ASTM E331 and ASTM E547 for water penetration.

C. Thermal Performance: Overall U-value of 1.10 as rated in accordance with the National Fenestration Rating councils' (NFRC) Interim U-value Rating Procedure or in accordance with default table method approved by the California Energy Commission (CEC).

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Include wall opening and component dimensions; wall opening tolerances required; anchorage and fasteners; sub-sill pans; affected related Work; installation requirements, and details of existing openings (if applicable).

C. Submit manufacturer's installation instructions.

D. Submit Product Data for each window type specified.

E. Submit two 12 inch square Samples illustrating window frame sections, corner section, mullion section, screen and frame.

F. Submit two Samples of operating hardware.

G. Submit manufacturer's certification and certified test results showing that window units meet or exceed specified requirements.

1.5 PRE-IINSTALLATION CONFERENCE

A. Prior to the beginning of the window installations, a conference is to be held at the site, attended by the Owner or the Owner's designated representative, the Contractor, subcontractor responsible for the installation, (including foremen), a representative of the window manufacturer, and other party(ies) as the Owner may arrange for. The purpose of this conference shall be to review the specifications, details, application requirements, onsite inspection and/or testing requirements, and other pertinent aspects of the work. The Contractor shall

make all arrangements and provide all facilities, for the meeting. All parties shall be notified in writing of date, time, and place at least 2 weeks before the proposed meeting.

B. The specifications, building elevations, with all window and flashing details shall be reviewed at the pre-installation conference. Any discrepancies between the contract documents and the manufacturer's specifications shall be discussed and resolved.

1.6 QUALITY ASSURANCE

A. Label to be permanently affixed to frame listing certified U-value, certifying organization and rating procedure.

B. Label to be temporarily affixed to frame certifying that air infiltration requirements of CCR, Title 24, Part 6, Section 116 have been met.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and protect window units under provisions of Section 01 87 00.

B. Provide wrapping or strippable coating to protect prefinished aluminum surfaces.

1.8 WARRANTY

1. Manufacturer shall give written warranty to District stating that manufacturer will replace all aluminum windows that are found to be defective within 10 years of date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Fixed Windows: F-HC40 type, grade, and performance class (minimum).

1. EFCO Corporation, 2600 Series, (800) 221-4169.

2. Wausau Metals, 2250 Series, (715) 845-2161.

3. Kawneer Company, Inc., 7225 Series, (877) 505-3785.

B. Substitutions: Under provisions of Section 01 62 00.

2.2 MATERIALS

A. Extruded Aluminum: ASTM B221, 6063 alloy, T5 or T6 temper.

2.3 FABRICATED COMPONENTS

A. Frames: Nominal 2 inches wide x 2 inches deep profile, of non-thermally broken, flush glass stops of snap-on type with capped sill ends.

B. Fasteners: Stainless steel.

2.4 GLASS AND GLAZING MATERIALS

A. Glass and Glazing Materials: As indicated on Drawings.

2.5 SEALANT MATERIALS

A. Sealant and Backing Material: As specified in Section 07 92 00.

2.6 FABRICATION

A. Fabricate windows allowing for minimum installation clearances and shim spacing around perimeter of assembly, yet enabling installation.

B. Rigidly fit joints and corners. Accurately fit and secure corners tight. Make corner joints flush, hairline, and weatherproof. Seal corner joints with sealant.

C. Develop drainage holes with moisture pattern to exterior.

D. Prepare components to receive anchor devices. Fabricate anchorage items.

E. Prepare components with internal reinforcement for operating hardware.

F. Provide internal reinforcement in mullions to maintain rigidity.

G. Factory glaze window units in accordance with manufacturer's instructions.

2.7 ACCESSORIES

A. Provide fully soldered galvanized sheet metal sill pans under all windows and openings as per Section 07 62 00.

2.8 FINISHES

A. Polyurethane Powder Coat; color to be selected by architect.

B. Apply one coat of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials.

PART 3 - EXECUTION

3.1 INSPECTION

A. Confirm that all site conditions and substrates are ready for the work covered under this section is ready to commence. If not, Contractor to make suitable repairs or adjustments to the work.

B. Beginning installation means acceptance of existing conditions.

3.2 INSTALLATION

A. Install window frames, glass and glazing and hardware in accordance with manufacturer's instructions.

B. Use anchorage devices to securely attach frame to structure.

C. Align window frame plumb and level, free of warp or twist. Maintain dimensional tolerances, aligning with adjacent Work.

D. Pack fibrous insulation in shim spaces at perimeter to maintain continuity of thermal barrier.

E. Install sealant and backing materials as specified in Section 07 92 00.

F. Adjust operable hardware for smooth operation and tight fit of sash.

3.3 CLEANING

A. Remove protective material from prefinished aluminum surfaces.

B. Wash down exposed surfaces using a solution of mild detergent in warm water. Rinse with clean water, and wipe dry with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

C. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Hardware for doors.

B. Thresholds.

C. Gasketing.

D. Keying and key cabinet.

1.2 REFERENCES

A. ADAAG - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities.

B. BHMA - Builders' Hardware Manufacturers Association.

C. CCR - California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.

D. DHI - Door and Hardware Institute.

E. NFPA 80 - Fire Doors and Windows.

F. CBC - California Building Code.

G. UL - Underwriters Laboratories.

1.3 COORDINATION

A. Coordinate work of this Section with other directly affected Sections involving manufacturer of any internal reinforcement for door hardware.

1.4 QUALITY ASSURANCE

A. Manufacturers: Companies specializing in manufacturing door hardware with minimum five years experience. Obtain each kind of hardware from only one manufacturer.

B. Hardware Supplier: Company specializing in supplying commercial door hardware with five years documented experience.

C. Hardware Installer: Company specializing in the installation of commercial door hardware with five years documented specialized experience in educational facilities.

D. Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the Work of this Section.

1.5 REGULATORY REQUIREMENTS

A. Conform to CBC for requirements applicable to fire-rated doors and frames.

B. Fire-Rated Openings: Comply with NFPA Standard No. 80. Provide only hardware tested and listed by UL for the type and size of each door required, which complies with the requirements of the door and frame labels.

1. Where panic exit devices are required on fire-rated doors, provide supplementary marking on door UL label indicating "Fire Door to be Equipped with Fire Exit Hardware", and provide UL Label on exit device indicating "Fire Exit Hardware".

C. Conform to CCR, Title 24, Part 2, and ADAAG for accessibility requirements.

D. Exit Doors: Openable at all times from the inside without the use of a key or any special knowledge or effort.

1.6 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Submit hardware schedule at earliest possible date along with essential Product Data where acceptance of hardware schedule must precede fabrication of other Work.

C. Organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following:

1. Type, style, function, size and finish of each hardware item.

2. Name and manufacturer of each item.

3. Fastenings and other pertinent information.

4. Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.

5. Explanation of all abbreviations, symbols, codes, etc., contained in schedule.

6. Mounting locations for hardware.

7. Door and frame sizes and materials.

D. Provide Product Data on specified hardware.

E. Keying Schedule: Submit separate detailed keying schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

F. Furnish hardware templates to each fabricator of doors, frames, and other Work to be factory-prepared for the installation of hardware.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 01 70 00.

B. Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site and to other Sections under provisions of Section 01 87 00.

B. Store and protect products under provisions of Section 01 87 00.

C. Package hardware items individually; label and identify package with door opening code to match hardware schedule.

D. Ship permanent keys and cores directly from lock manufacturer to Owner.

1.9 WARRANTY

A. Provide ten year warranty for closers, five year warranty for all other hardware under provisions of Section 01 70 00.

1.10 MAINTENANCE MATERIALS

A. Provide special wrenches and tools applicable to each different or special hardware component.

B. Provide maintenance tools and accessories supplied by hardware component manufacturer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

	Item	Manufacturer	Acceptable Substitute
A.	Hinges	Ives (IVE)	Hager, Stanley, McKinney
B.	Continuous Hinges	Select Products (SEL)	Roton, Markar
C.	Locks	Schlage (SCH)	District Standard – NO Substitutions

D.	Deadbolts	Schlage (SCH)	District Standard – NO Substitutions
E.	Push/Pulls	Ives (IVE)	Trimco, BBW, Quality
F.	Exit Devices	Von Duprin (VON)	District Standard – NO Substitutions
G.	Surface Closers	LCN (LCN)	District Standard – NO Substitution
H.	Electric Strikes	Von Duprin (VON)	Folger Adam
I.	Flush Bolts	Ives (IVE)	Trimco, BBW, Quality
J.	Coordinators	Ives (IVE)	Trimco, BBW, Quality
K.	Silencers	Ives (IVE)	Trimco, BBW, Quality
L.	Protection Plates	Ives (IVE)	Trimco, BBW, Quality
M.	Stops & Holders	Ives (IVE)	Trimco, BBW, Quality
N.	Thresholds	National Guard (NGP)	Pemko, Zero
O.	Seals & Bottoms	National Guard (NGP)	Pemko, Zero
P.	Key Cabinets	Telkee	Lund, Key Systems

2.2 MATERIALS

A. Locksets and Latchsets: Schlage "ND" Series with “Sparta” (SPA) levers and interchangeable core. Fastened with through-bolts and threaded chassis hubs.

1. Chassis: Cylindrical design, corrosion-resistant plated cold-rolled steel.

2. Locking Spindle: One piece stainless steel interlocking design.

3. Latch Retractors: Forged steel. Balance of inner parts; corrosion-resistant plated steel, or stainless steel.

4. Lever Trim: Accessible design, independent operation, spring-cage supported, minimum 2 inches clearance from lever mid-point to door face.

5. Locks shall be of such construction that when locked, the door may be opened from within by using lever and without the use of a key or special knowledge.

6. Rosettes: Minimum 3-7/16 inches diameter for coverage of ANSI/DHI A115.18, 1994 door preparation, through-bolt lugs on both spring cages to fully engage this pattern.

7. Springs: Full compression type.

8. Strikes: 16 gage curved steel, bronze or brass with 1 inch deep box construction, lips of sufficient length to clear trim and protect clothing.

B. Hinges: Out swinging exterior doors shall have non-removable pin (NRP). All hinge open widths shall be minimum, but of sufficient size to permit door to swing 180 degrees. Furnish exterior door hinges with stainless steel pins and ball bearings.

1. Furnish 3 hinges per leaf to 7 feet 5 inches high, Add one for each additional 2 feet of height.

2. Exterior hinges with prime finish shall have Stanley K base.

3. Provide extra heavy weight hinges on doors over 3 feet 4 inches wide.

C. Panic Hardware: Furnish sex bolts for all devices. Lever handle trim shall match locksets. All touch bar type devices shall have deadlocking latch bolt, and be non-handed. Device push bar must release with 15 pounds maximum pressure at fire rated doors. When the latched door is subjected to a horizontal force of 250 pounds applied against the latching edge adjacent to the latch in the direction in which the door opens a force of 50 pounds or less shall actuate the release bar. Device shall bear UL label for fire and/or panic as may be required.

D. Surface Door Closers: All door closers shall be of one manufacturer to provide for proper installation and servicing after installation. All closers shall be inspected after installation by a representative to ensure proper adjustment and operation. Closers shall carry a manufacturers ten year warranty against manufacturing defects and workmanship.

1. Door closer cylinders shall be of high strength cast iron construction to provide low wear operating capabilities of internal parts throughout the life of the installation.

2. Provide 1 size adjustable 1 through 6 unless otherwise specified at exterior and interior doors.

3. Flush transom offset brackets shall be used where parallel arm closers are listed for doors with fixed panels above doors.

4. All closers shall utilize a temperature stable fluid capable of withstanding temperature ranges of 120 degrees F. to -30 degrees F. without requiring seasonal adjustment of closer speed to properly close the door. Closers for fire-rated doors shall be provided with a temperature stabilizing fluid that complies with standards NFPA 80-13.

5. Drop bracket are required at narrow head rails.

6. Maximum effort to operated doors shall not exceed 5 pounds, such pull or push effort being applied at right angles to hinged doors. Compensating

devices or automatic door operators may be utilized to meet the above standards. When fire doors are required, the maximum effort to operate the door may be increased but shall not to exceed 15 pounds when specifically approved by fire marshal. All closers shall be adjusted to operate with the minimum amount of opening force and still close and latch the door. Door shall take at least 5 seconds to move from an open position of 70 degrees to a point of 9 to 12 degrees from the latch jamb. Reference CBC Sections 1133B.2.1, 1133B.2.5, 1133B2.5.1 & 1003.3.1.8.

7. Provide sex-bolted or through-bolted mounting for all door closers.

E. Protection Plates: Fabricate either kick, armor, or mop plates with four beveled edges, height called for in Hardware Schedule by width of door less 2 inches. Furnish with machine or wood screws of bronze or stainless steel to match other hardware.

F. Seals: Solid neoprene to be MIL Spec. R6855-CL III, Grade 40. Sponge neoprene to be MIL Spec. R6130, Type II, Group C. UL label shall be applied on all fire-rated doors.

G. Silencers: Furnish silencers for interior hollow metal frames, 3 for single doors, 4 for pairs of doors. Omit where sound or light seals occurs, and omit at fire-rated door and frame assemblies.

2.3 DOOR STOPS

A. Provide either floor-mounted or wall-mounted stops, whichever will best suit the condition.

B. Provide overhead door stops where conditions do not permit installation of wall or floor stops. Overhead door stops shall be made of stainless steel and non-plastic mechanisms and finished metal end caps. Overhead door stops used in applications with door closers shall be provided with proper templating and brackets so no conflict will occur.

2.4 KEYING

A. Master key and grand master key all locks and cylinders as directed by the District representative. Provide temporary cores during the construction phase and remove at the time District takes occupancy.

B. All permanent I.C. Cores and keys are to be furnished by the Contractor and shipped directly from the factory to the School District Maintenance Office. All keying and keyways must be approved in writing by the District representative. The Contractor shall be responsible for installing the permanent I.C. Cores after the District receives and inventories them.

C. Although the Hardware Schedule, at the end of this Section, may not indicate “Primus” I.C. cores, the “Primus” cores shall be furnished throughout the Project.

D. All standard cores shall be furnished with “Primus” keys.

E. Supply 2 “Primus” change keys per lock or cylinder.

F. Supply “Primus” keys in the following quantities:

1. 6 master keys.
2. 1 grand master key.
3. 10 construction keys.
4. 4 control keys and 6 extra cylinder cores.

2.5 KEY CABINETS

A. Key Cabinet: Sheet steel construction, .047 inch thick, piano hinged door with lock keyed to building system; manufactured by Lund Equipment Company, Bath, Ohio; or approved equal from Key Control System, Bechtelsvill, Pennsylvania; and Telkee, Inc., Glen Riddle, Pennsylvania. Model number as shown in Hardware Schedule.

B. Cabinet Size: Size for project keys plus 10 percent growth.

C. Horizontal metal strips for keyhook labeling with plastic strip cover over paper labels.

D. Provide book index.

E. Finish: Baked enamel finish, color as selected by Architect.

2.6 FINISHES

A. Generally to be satin or dull chrome US26D (626 on brass or bronze base metal and 652 on steel base metal) unless otherwise noted.

B. Push, pull and kick plates shall be dull stainless steel US32D (630).

C. Door closers shall be powder-coated (689) to match other hardware, unless otherwise noted.

D. Aluminum items to be finished clear anodized (628), except thresholds which can be furnished as standard mill finish.

2.7 FASTENERS

A. Screws for strikes, face plates and similar items shall be flathead, countersunk type; provide machine screws for metal and standard wood screws for wood.

B. Screws for butt hinges shall be flathead, countersunk, full-thread type.

C. Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.

D. Provide expansion anchors for attaching hardware items to concrete or masonry.

E. All exposed fasteners shall have a Phillips head.

F. Finish of exposed screws to match surface finish of hardware or other adjacent Work.

2.8 OTHER MATERIAL

A. All other materials not specifically described, but required for a complete and proper finish hardware installation shall be selected by Architect as required at no additional cost.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that doors and frames are ready to receive Work and dimensions are as instructed by the manufacturer.

B. Verify that power supply is available to power operated devices.

C. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and requirements of DHI.

B. Use the templates provided by hardware item manufacturer.

C. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protection with finishing Work specified in Division 9. Do not install surface-mounted items until finishes have been completed on the substrate.

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

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

F. Set thresholds for exterior doors in full bed of butyl-rubber sealant.

G. If swing of door is changed during construction, make necessary changes in hardware at no additional cost.

3.3 ADJUST AND CLEAN

A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

B. Clean adjacent surfaces soiled by hardware installation.

C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the Work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

D. Instruct Owner's personnel in proper adjustment and maintenance of hardware finishes, during the final adjustment of hardware.

E. Continued Maintenance Service: Approximately six months after the completion of the Project, the Contractor, accompanied by the Architectural Hardware Consultant, shall return to the Project and re-adjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.4 HARDWARE LOCATIONS

A. Hinges:

1. Bottom Hinges: 10 inches from door bottom to bottom of hinge.

2. Top Hinge: 5 inches from door top to top of hinges.

3. Center Hinge: Center between top and bottom hinge.

4. Extra Hinge: 6 inches from bottom of top hinge to top of extra hinge.

B. Lock: 38 inches from bottom of door to center of lever or knob.

C. Push Bar: 44 inches from bottom of door to center of bar.

D. Push Plate: 44 inches from bottom of door to center of plate.

E. Pull Plate: 42 inches from bottom of door to center of pull.

F. Panic Device: 39-13/16 inches from bottom of door to center of pad.

G. Deadlock Strike: 44 inches from floor, centered.

H. Floor Stops: Not more than 4 inches from any adjacent wall surface. Not permitted in path of travel.

I. Conform to CCR, Title 24, Part 2, and ADAAG for positioning requirements for accessibility.

3.5 FIELD QUALITY CONTROL

A. Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and its installation have been furnished and installed in accordance with manufacturer's instructions and as specified herein.

3.6 HARDWARE SCHEDULE

A. The last column in the Hardware Sets is the 3-letter abbreviation for the manufacturer as shown in Paragraph 2.1 of this Section.

B. The items listed in the following Hardware Schedule shall conform to the requirements of the foregoing Specification.

C. The Door Schedule on the Drawings indicates which Hardware Set is used with each door.

D. Hardware Schedule Notes:

1. Refer to Part 2 of this Section for quantity of hinges required per leaf.

2. This Hardware Schedule lists bolts for metal doors; provide type as required for application.

3. Closers shall not be installed in hallways, corridors, lobbies or on the exterior of the building if at all possible.

4. Provide door stops or door stops and holders as follows to best suit the condition.

   a. Interior Door Stops: Ives FS13/R14 (Floor Type) or WS407CCV (Wall Type).

   b. Exterior Door Stops: Ives FS442 (Floor Type) or WS33 (Wall Type).

   c. Interior Door Stop and Holders: Ives FS40 (Floor Type) or WS40 (Wall Type).

   d. Exterior Door Stop and Holders: Ives FS43 (Floor Type) or WS45 (Wall Type).

   e. At conditions where doors swing back to back or there is not a place to install a floor or wall type stop or stop holder, provide Glynn-Johnson

overhead types. Provide 100 Series at new doors. Hold-opens not permitted at fire-rated doors.

5. Provide gasketing at all fire rated doors complying with UL10C.

6. Provide Ives Silencers SR64 at all metal frames without weather-stripping or gasketing.

01	**Exterior Door**			
3	Each	IVE	112HD	Continuous Hinge
1	Each	VON	CD-PA-AX-98-NL-OP-110MD	Panic Hardware
1	Each	SCH	20-057	Rim Cylinder
1	Each	SCH	26-091 XQ11-948	Mortise Cylinder
1	Each	IVE	VR910 NL	Door Pull
1	Each	LCN	4040XP EDA	Surface Closer
1	Each	IVE	8400 10" X 2" LDW B-CS	Kick Plate
1	Each	IVE	FS18L	Floor Stop
1	Each	ZER	188SBK PSA	Gasketing
1	Each	ZER	39A	Door Sweep
1	Each	ZER	Per Detail	Threshold

02	Exterior Door			
1	Each	IVE	112HD	Continuos Hinge
1	Each	VON	CD-PA-AX-35A-NL-OP-388	Panic Hardware
1	Each	SCH	20-057	Rim Cylinder
1	Each	SCH	26-091 XQ11-948	Mortise Cylinder
1	Each	IVE	8190HD 12" O	90 Degree Offset Pull
1	Each	LCN	4040XP EDA	Surface Closer
1	Each	LCN	4040XP-18PA	PA Mounting Plate
1	Each	IVE	FS18L	Floor Stop
1	Each	ZER	39A	Door Sweep
1	Each	ZER	Per Detail	Threshold
			Weatherstrip by Door / Frame Manufacturer	

03				
4	Each	IVE	5BB1HW 5 X 4.5 NRP	Hinge
1	Each	SCH	ND96PD RHO	Vandal Storeroom Lock
1	Each	IVE	LG13	Lock Guard
1	Each	LCN	4040XP EDA	Surface Closer
1	Each	IVE	FS18L	Floor Stop
1	Each	ZER	188SBK PSA	Gasketing
1	Each	ZER	39A	Door Sweep
1	Each	ZER	Per Detail	Threshold

04				
3	Each	IVE	5BB1 4.5 X 4.5 NRP	Hinge
1	Each	SCH	ND95PD RHO XN12-035	Vandal Storeroom Lock
1	Each	IVE	LG13	Lock Guard
1	Each	LCN	4040XP EDA	Surface Closer
1	Each	IVE	FS18L	Floor Stop
1	Each	ZER	188SBK PSA	Gasketing
1	Each	ZER	39A	Door Sweep
1	Each	ZER	Per Detail	Threshold

05				
4	Each	IVE	5BB1 4.5 X 4.5 NRP	Hinge
1	Each	SCH	ND96PD RHO	Vandal Storeroom Lock
1	Each	IVE	LG13	Lock Guard
1	Each	LCN	4040XP EDA	Surface Closer
1	Each	IVE	FS18L	Floor Stop
1	Each	ZER	188SBK PSA	Gasketing
1	Each	ZER	39A	Door Sweep
1	Each	ZER	Per Detail	Threshold

06	Exterior Door			
2	Each	IVE	112HD	Continuous Hinge
1	Each	VON	KR4954 STAB	Removable Mullion
1	Each	VON	CD-PA-AX-35A-EO	Panic Hardware
1	Each	VON	CD-PA-AX-35A-NL-OP-388	Panic Hardware
1	Each	SCH	20-057	Rim Cylinder
1	Each	SCH	26-091	Mortise Cylinder
2	Each	SCH	26-091 XQ11-948	Mortise Cylinder
2	Each	IVE	8190HD 12" O	90 Degree Offset Pull
2	Each	LCN	4040XP EDA	Surface Closer
2	Each	LCN	4040XP-18PA	PA Mounting Plate
2	Each	IVE	FS18L	Floor Stop
2	Each	ZER	39A	Door Sweep
1	Each	ZER	Per Detail	Threshold
			Weatherstrip by Door / Frame Manufacturer	

07	Exterior Door			
2	Each	IVE	112HD	Continuous Hinge
1	Each	VON	KR4954 STAB	Removable Mullion
1	Each	VON	CD-PA-AX-98-EO	Panic Hardware
1	Each	VON	CD-PA-AX-98-NL-OP-110MD	Panic Hardware
1	Each	SCH	20-057	Rim Cylinder
1	Each	SCH	26-091	Mortise Cylinder
2	Each	SCH	26-091 XQ11-948	Mortise Cylinder
1	Each	IVE	VR910 DT	Door Pull
1	Each	IVE	VR910 NL	Door Pull
1	Each	GLY	100S	Overhead Stop
2	Each	LCN	4040XP EDA	Surface Closer
1	Each	IVE	FS18L	Floor Stop
2	Each	ZER	39A	Door Sweep
1	Each	ZER	Per Detail	Threshold

08	Exterior Door			
4	Each	IVE	5BB1 4.5 X 4.5 NRP	Hinge
1	Each	VON	PA-AX-35A-L-BE-06	Panic Hardware
1	Each	LCN	4040XP EDA	Surface Closer
1	Each	LCN	4040XP-18PA	PA Mounting Plate
1	Each	IVE	WS406/407CVX	Wall Stop
			Weatherstrip by Door / Frame Manufacturer	

09				
1	Each	BOM	7012	Spring Pivot
1	Each	IVE	WS406/407CVX	Wall Stop
3	Each	IVE	SR64	Silencer

10	Interior Door			
3	Each	IVE	5BB1 4.5 X 4.5 NRP	Hinge
1	Each	VON	PA-AX-35A-L-BE-06	Panic Hardware
1	Each	LCN	4040XP EDA	Surface Closer
1	Each	IVE	8400 10" X 2" LDW B-CS	Kick Plate
1	Each	IVE	WS406/407CVX	Wall Stop
3	Each	Ives	SR64	Silencer

11	Interior Office Door			
3	Each	5BB1 4.5 X 4.5 NRP	5BB1 4.5 X 4.5 NRP	Hinge
1	Each	ND91PD RHO	ND91PD RHO	Office Lock
1	Each	8400 10" X 2" LDW B-CS	8400 10" X 2" LDW B-CS	Kick Plate
1	Each	WS406/407CVX	WS406/407CVX	Wall Stop

12	Interior Door			
3	Each	Ives	5BB1 4.5 X 4.5 NRP	Hinge
1	Each	SCH	ND96PD RHO	Storeroom Lock
1	Each	LCN	4040XP	Surface Closer
1	Each	Ives	8400 10" X 2" LDW B-CS	Kick Plate
1	Each	Ives	WS406/407CVX	Wall Stop
1	Each	Ives	SR64	Silencer

13	Interior Door			
3	Each	Ives	5BB1 4.5 X 4.5 NRP	Hinge
1	Each	SCH	ND10S RHO	Passage Set
1	Each	Ives	WS406/407CVX	Wall Stop

14				
3	Each	IVE	5BB1 4.5 X 4.5 NRP	Hinge
1	Each	SCH	B663P	Classroom Deadbolt
1	Each	IVE	8200 8" X 16"	Push Plate
1	Each	IVE	8302 10" 6" X 16"	Pull Plate
1	Each	LCN	4040XP	Surface Closer
1	Each	IVE	8400 10" X 2" LDW B-CS	Kick Plate
1	Each	ZER	488SBK PSA	Gasketing

15				
3	Each	IVE	5BB1 4.5 X 4.5 NRP	Hinge
1	Each	SCH	ND96PD RHO	Storeroom Lock
1	Each	LCN	4040XP EDA	Surface Closer
1	Each	IVE	8400 10" X 2" LDW B-CS	Kick Plate
3	Each	IVE	WS406/407CVX	Wall Stop

16	Single Occupancy Restroom Door			
3	Each	IVE	5BB1 4.5 X 4.5 NRP	Hinge
1	Each	SCH	ND40S RHO	Privacy Lock
1	Each	IVE	WS406/407CVX	Wall Stop
1	Each	ZER	488SBK PSA	Gasketing

17	Classroom Door			
3	Each	IVE	5BB1 4.5 X 4.5 NRP	Hinge
1	Each	SCH	ND94PD RHO	Classroom Lock
1	Each	LCN	4040XP	Surface Closer
1	Each	IVE	8400 10" X 2" LDW B-CS	Kickplate
1	Each	IVE	WS406/407CVX	Wall Stop
3	Each		SR64	Silencer

18	Faculty Restroom			
3	Each	IVE	5BB1 4.5 X 4.5 NRP	Hinge
1	Each	SCH	ND85PD RHO	Faculty Restroom with Individual Cylinder
1	Each	LCN	4040XP	Surface Closer
1	Each	IVE	WS406/407CVX	Wall Stop
1	Each	ZER	488SBK PSA	Gasketing

19	Interior Door			
3	Each	IVE	5BB1 4.5 X 4.5 NRP	Hinge
1	Each	SCH	ND94PD RHO	Classroom Lock
1	Each	LCN	4040XP EDA	Surface Closer
1	Each	IVE	8400 10" X 2" LDW B-CS	Kick Plate
1	Each	IVE	WS406/407CVX	Wall Stop
3	Each	IVE	SR64	Silencer

20				
3	Each	IVE	5BB1HW 5 X 4.5 NRP	Hinge
1	Each	SCH	ND94PD RHO	Classroom Lock
1	Each	LCN	4040XP	Surface Closer
1	Each	IVE	8400 10" X 2" LDW B-CS	Kick Plate
1	Each	IVE	WS406/407CVX	Wall Stop
3	Each	IVE	SR64	Silencer

21	**Interior Door**			
3	Each	IVE	5BB1HW 5 X 4.5 NRP	Hinge
1	Each	SCH	ND96PD RHO	Storeroom Lock
1	Each	LCN	4040XP EDA	Surface Closer
1	Each	IVE	8400 10" X 2" LDW B-CS	Kick Plate
1	Each	IVE	WS406/407CVX	Wall Stop
3	Each	IVE	SR64	Silencer

22	**Interior Door**			
3	Each	IVE	5BB1 4.5 X 4.5 NRP	Hinge
1	Each	SCH	ND96PD RHO	Storeroom Lock
1	Each	GLY	100S	Overhead Stop
1	Each	LCN	4040XP EDA	Surface closer
1	Each	IVE	8400 10" X 2" LDW B-CS	Kick Plate
1	Each	IVE	SR64	Silencer

23	Interior Door			
3	Each	IVE	5BB1 4.5 X 4.5 NRP	Hinge
1	Each	SCH	ND94PD RHO	Classroom Lock
1	Each	GLY	100S	Overhead Stop
1	Each	LCN	4040XP EDA	Surface Closer
1	Each	IVE	8400 10" X 2" LDW B-CS	Kick Plate
1	Each	ZER	488SBK PSA	Gasketing

24	Interior Door			
3	Each	IVE	5BB1 4.5 X 4.5 NRP	Hinge
1	Each	SCH	ND94PD RHO	Classroom Lock
1	Each	GLY	90S	Overhead Stop
1	Each	LCN	4040XP	Surface Closer
1	Each	IVE	8400 10" X 2" LDW B-CS	Kick Plate
3	Each		SR64	Silencer

25	Interior Door			
6	Each	Ives	5BB1 4.5 X 4.5 NRP	Hinge
1	Set	IVE	FB41P	Automatic Flush Bolt
1	Each	IVE	DP1	Dust Proof Strike
1	Each	IVE	ND96PD RHO	Storeroom Lock
1	Each	SCH	LG13	Lock Guard
1	Each	IVE	COR X FL	Coordinator
2	Each	IVE	MB	Mounting Bracker
2	Each	IVE	4040XP SCUSH	Surface Closer
2	Each	LCN	SR64	Silencer

26	Interior Door			
6	Each	IVES	5BB1 4.5 X 4.5 NRP	Hinge
1	Each	IVE	FB61P	Const. Latching Bolt
1	Each	IVE	DP1	Dust Proof Strike
1	Each	SCH	ND96PD RHO	Storeroom Lock
1	Each	IVE	LG13	Lock Guard
2	Each	LCN	4040XP SCUSH	Surface Closer
2	Each	IVE	SR64	Silencer

27				
2	Each	IVE	112HD	Continuous Hinge
1	Each	VON	KR4954 STAB	Removable Mullion
1	Each	VON	CD-PA-AX-35A-EO	Panic Hardware
1	Each	VON	CD-PA-AX-35A-NL-OP-388	Panic Hardware
1	Each	SCH	20-057	Rim Cylinder
1	Each	SCH	26-091	Mortise Cylinder
2	Each	SCH	26-091 XQ11-948	Mortise Cylinder
2	Each	IVE	8190HD 12" O	90 Degree Offset Pull
2	Each	GLY	100S	Overhead Stop
2	Each	LCN	4040XP EDA	Surface Closer
2	Each	LCN	4040XP-18PA	PA Mounting Plate
1		IVE	WS406/407CVX	Wall Stop

28	**Roll-up Door**			
			Hardware by Roll Up Door Manufacturer	

29	**Sliding Door**			
			Hardware by Sliding Door Manufacturer	

30	**Folding Door**			
			Hardware by Folding Door Manufacturer	

END OF SECTION

SECTION 08 75 16
WINDOW ACTUATORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Motorized window actuator manual and control system for windows.

B. Hardware and accessories.

C. Related Sections:

1. Division 08 for windows and doors.

1.2 SUBMITTALS

A. Submit under provisions of Section 01 33 00, Submittals.

B. Product Data: For each window actuator and controls type required. Include anufacturer's standard details, fabrication methods, and mounting and installation recommendations for each component of the window operating system required, and the following:

1. Installation instructions
2. Parts included

C. Maintenance Data: include in the maintenance manual.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced electrical installer who is an authorized representative for both installation and maintenance of units required for this Project.

B. UL Standard: Provide actuators and controls that comply with UL 325. Coordinate work of this Section with other directly affected Sections involving manufacturer of any internal reinforcement for door hardware.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 01 70 00.

B. Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site and to other Sections under provisions of Section 01 87 00.

B. Store and protect products under provisions of Section 01 87 00.

C. Package hardware items individually; label and identify package with door opening code to match hardware schedule.

1.6 WARRANTY

A. Provide five year warranty for all other hardware under provisions of Section 01 70 00.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Motorized Window Actuators and Controls Basis of Design WindowMaster Industries. www.windowmaster.com

2.2 WINDOW ACTUATOR REQUIREMENTS

A. Capacity: Provide window actuators recommended by manufacturer for window dimensions, weight, glass thickness, opening direction and movement; for long-term maintenance-free operation.

1. 24vdc Motorized Window Actuators by WindowMaster Control Systems WMX 804-1, WMX 804-2and WMX 804-3 series. Actuators will be delivered in WindowMaster's standard color, unless otherwise specified.

2. Power Supplies by MotorController WCC 310/320 UL.

3. BACnet field bus communication cards, product name WCA 3FM.

4. Keypads for manual override, product name WSK 100 1161.

5. 1.9 Meter 3-Core Cable, unless otherwise specified

6. All brackets and mounting parts for specific actuators, which will be WAB 804 and WAB 801.

7. Springs: Full compression type.

2.3 MOTORIZED WINDOW ACTUATORS

A. Motorized Window Actuators: shall be WMX 804-1, WMX 804-2 and WMX 804-3 series actuatorsby WindowMaster Control Systems Inc, and shall be mounted with manufacturer's brackets.

1. At least one motorized actuator is required per operable window. The number of actuators will be based on the window size, weight, glass thickness and window movement.

2. 24V DC window actuators shall be used. Motors and all low voltage system components shall be Underwriter Laboratory (UL) recognized or listed.

3. Electrical installer shall provide voltage drop calculation for wire runs to actuators to insure adequate power for synchronized operation of motors in each room.

4. Electrical installer to supply wiring (sized correctly for voltage drop), conduit, connectors, j boxes, electrical enclosures and required fuses.

B. Technical Specifications:

1. Voltage Supply: 24V DC (max. 10% ripple)

2. Open Circuit Voltage: max. 36 VDC

3. Actuator Max Stroke: 250 mm

4. Traction Force: 200 N

5. Locking Force: 3000 N

6. Power: Max 24W

7. Current consumption: 1 Amp per actuator

2.4 MOTORLINK ACTUATORS

A. Programmable 24 V DC window actuators with MotorLink technology must be used throughout the project. The MotorLink actuator range must be suitable for surface and/or for concealed installation in comfort ventilation applications. The actuator must have a reverse function to prolong the life of the weather seal and must be programmable for modification of tractive force and pressure for closing forces (subject to factors such as hinges, window type, application etc.).

B. The MotorLink actuators must be used in conjunction with an intelligent MotorLink MotorControl panel for programmed to benefit from:

1. Actuator Position feedback. The actuator must provide two-way communication with the control panel to enable feedback to the control software on the exact position, for precision of opening (mm x mm) and control, as well as a security indicator for open windows.

2. Three speed operation. The actuator must provide two-way communication with the control panel to enable it to operate at a very slow speed when in the automatic mode, which can reduce any potential impact or disturbance to the occupants. It can also enable the motors to operate at a faster speed when activated by the manual keypads, for example, in order to provide an immediate visual response to the user, and at full speed in the event of an alarm signal for rain, snow or/and wind situations.

3. Pressure Safety Function. The MotorLink actuator must have the ability to monitor for entrapment on specified windows by communication via the microprocessors installed within the actuator and by monitoring in real-time the amount of electrical current being drawn and the precise position of the window to an accuracy of less than a millimetre. The MotorLink actuator will detect if an object becomes trapped in the leading edge of the window and prevent it from closing by monitoring the amount of current being drawn and then reversing the actuator to release the obstruction. The sensitivity of the pressure safety must be adjustable, as the pressure safety function is a factor of the closing force of the actuator combined with the size and weight of the window, as well as the configuration of the window, its hinges and the rigidity of the profile itself. Therefore, the overall performance and sensitivity of the system is dependent upon all these factors combined and needs to be monitored and adjusted as the required forces can change during the life of the building.

4. Fault indication. The actuator must provide two-way communication with the control panel to enable feedback to the control software on the window status and an early indication of any errors with the actuator operation or the wiring.

5. Synchronization function. The MotorLink actuators must run fully synchronized – without an external synchronization module. Up to four actuators can work together on one window with a tolerance of less than 0.08 inches (2 mm). The actuators communicate with each other directly and adjust their speed so that they are always operating fully synchronized.

PART 3 - EXECUTION

3.1 PREPARATION

A. Templates and Diagrams: Completed diagrams, and other data to fabricators and installers of related work as necessary for coordinating window actuator and controls installation.Verify that doors and frames are ready to receive Work and dimensions are as instructed by the manufacturer.

3.2 INSTALLATION

A. General: Install complete manual and motorized window operating system according to manufacturer's written installation manuals, including controls, control wiring units and cables.

B. Location: refer to drawings for location and installation manuals. Install hardware in accordance with manufacturer's instructions and requirements of DHI.

3.3 ADJUSTING, CLEANING, AND MAINTENANCE

A. Adjust and check each operating acuator and each window, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

B. Clean adjacent surfaces soiled by installation.

C. Final Adjustment: Wherever installation is made more than one month prior to acceptance or occupancy of a space or area, return to the Work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function. Adjust control devices to compensate for final operation of heating and ventilating equipment.

D. Instruct Owner's personnel in proper adjustment and maintenance of actuators.

E. Follow instructions from manufacturer's installation manual.

END OF SECTION

SECTION 08 80 00
GLAZING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Glass and glazing for hollow metal work, windows, glazed walls, and doors.

1.2 SECTION EXCLUDES

A. Factory glazing of aluminum windows.

1.3 REFERENCES

A. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.

B. ASTM C920 - Elastomeric Joint Sealants.

C. ASTM C1036 - Flat Glass.

D. ASTM C1048 - Heat-Treated Flat Glass.

E. ASTM C1172 - Specification for Laminated Architectural Flat Glass.

F. GANA - Glazing Manual and Sealant Manual.

G. UL - Underwriters' Laboratories, Inc., Building Materials Directory.

1.4 QUALITY ASSURANCE

A. Conform to Glass Association of North America (GANA) Glazing Manual and Sealant Manual for glazing installation methods.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements for glass. Provide data on glazing sealant. Identify colors available.

C. Submit two 12-inch-square Samples, illustrating each glass coloration.
D. Submit 12-inch long bead of glazing sealant in color selected.
E. Submit sealed glass unit manufacturer's certificate indicating units meet or exceed specified requirements.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Deliver, store and protect products under provisions of Section 01 87 00.

1.7 WARRANTY

A. Provide manufacturer's warranty against defects in material, including loss of hermetic seal insulating units, for a period of 5 years after date of Substantial Completion.

B. Include coverage for delamination of laminated glass and replacement of same.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Laminated Glass:

1. Ford Glass Division.
2. Guardian Industries Corp.
3. PPG Industries, Inc.
4. HGP and Affiliates Inc.
5. AFG Industries, Inc.
6. Spectrum Glass Products, Inc.
7. Oldcastle Glass.
8. Viracon, Inc.

B. Fire-Resistive Glazing: Fire Lite.

1. SAFTI, a Division of O'Keefe's, Inc.
2. Nippon Electric Glass, Co., UL No. R13849(N).
3. Technical Glass Products, UL No. R13377(N).

C. Fire-Resistive Safety Glazing: Fire Lite Plus.

1. Nippon Electric Glass, Co., UL No. R13849(N).
2. Technical Glass Products, UL No. R13377(N).

D. Tempered Glass:

1. Guardian Industries Corp.

2. Ford Glass Division.

3. LOF Glass, Inc.

4. PPG Industries, Inc.

5. HGP and Affiliates Inc.

6. AFG Industries, Inc.
7. Spectrum Glass Products, Inc.

8. Oldcastle Glass.

9. Viracon, Inc.

E. Substitutions: Under provisions of Section 01 62 00.

2.2 GLASS MATERIALS, GENERAL

A. Primary Glass Standard: Comply with ASTM C1036 requirements, including reference to type, class, quality, and, if applicable, form, finish, mesh and pattern.

B. Laminated Glass Standard: Comply with ASTM C1172 requirements including reference to type, class, quality and if applicable, form, finish and pattern.

C. Tempered Glass Standard: Comply with ASTM C1048 requirements, including those indicated by reference to kind, condition, type, quality, class, and, if applicable, form, finish, and pattern.

D. Visual Light Transmission and Heat Gain: Conform to requirements indicated.

E. Sizes: Fabricate glass to sizes required for glazing openings, with edge clearances and tolerances complying with recommendations of glass manufacturer and GANA.

F. Provide thicknesses indicated or, if not indicated, as recommended by glass manufacturer for application indicated.

2.3 PRIMARY GLASS PRODUCTS

A. Clear Float Glass: ASTM C1036, Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select). Low E coating on No. 2 surface of exterior glass.

2.4 FIRE-RESISTIVE GLAZING

A. Clear Glass: 7/8 inch thick; complying with ANSI Z97.1 and listed by UL.

2.5 TEMPERED GLASS PRODUCTS

A. Manufacturing Process: Horizontal (roller hearth) process with roll wave distortion parallel with bottom edge of glass as installed.

B. Clear Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type 1 (transparent glass, flat) Class 1 (clear), Quality q3 (glazing select); conforming to ANSI Z97.1.

2.6 LAMINATED GLASS PRODUCTS

A. Laminated Glass: Two panes of float glass of equal thickness, ASTM C1172, kind LHS (heat-strengthened), laminated with 0.060 inch thick plastic interlayer; conforming to ANSI Z97.1. Unit shall have the following characteristics:

1. Overall Laminated Glass Thickness: Approximately 5/16 inch.

2. Visual Light Transmission (VLT): The VLT of the entire laminated assembly shall be equal to or better than 75%.

3. Solar Heat Gain Coefficient: The SHGC of the entire laminated assembly shall equal to or less than 0.60.

B. Clear Laminated Glass:

1. Glass: Class 1 clear for both panes. Low E coating number 2 surface.

2. Glass Thickness (Each Pane): 1/8/ inch.

3. Color of Plastic Interlayer: Clear.

C. Plastic Interlayer: Polyvinyl Butyral as manufactured by:

1. “Saflex”; Monsanto Co.

2. “Butacite”; E.S. DuPont DeNemours & Co., Inc.

2.7 GLAZING SEALANTS AND PREFORMED GLAZING TABS

A. General: Comply with ASTM C920, and sealant and glass manufacturers’ recommendations for suitability and compatibility.

B. One-Part Butyl Glazing Sealant:

1. “Chem-Calk 300”; Bostik Construction Products Div.

2. “Norseal Butyl”; Norton Performance Products.

3. “BC 158”; Pecora Corp.

4. “757 Butyl Sealant”; Protective Treatments, Inc.

C. One-Part Acid-Curing Silicone Glazing Sealant: Type S; Grade NS; Class 25:
   1. “Chem-Calk 1200”; Bostik Construction Products Div.
   2. “Dow Corning 999”; Dow Corning Corp.
   3. “SCS 1200”; General Electric Corp.
   4. “863”; Pecora Corp.
   5. “Rhodorsil 3B”; Rhone-Poulenc Inc.
   6. “Omniglaze”; Sonneborn Building Products Div.; Rexnord Chemical Products Inc.
   7. “Proglaze”; Tremco.

D. Preformed Butyl-Polyisobutylene Glazing Tape With Spacer Rod:
   1. “Chem-Tape 60”; Bostik Construction Products Div.
   2. “Shim-Seal”; Pecora Corp.
   3. “PTTI 303 Shim Tape”; Protective Treatments, Inc.
   4. “Pre-shimmed Tremco 440 Tape”; Tremco Inc.

2.8 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene; EPDM or silicone blocks, 80-90 Shore A durometer hardness.

B. Spacer Shims: Neoprene; EPDM or silicone blocks, Shore A durometer hardness; self-adhesive one face.

C. Glazing Gasket: Resilient polyvinylchloride extruded shape to suit glazing channel retaining slot with prefabricated molded corners. Color to be selected by Architect from manufacturer’s full range of colors.

D. Glazing Clips: Manufacturer's standard type.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify surfaces of glazing channels or recesses are clean, free of obstructions, and ready for Work of this Section.
B. Beginning of installation means acceptance of substrate.

3.2 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses.

C. Prime surfaces scheduled to receive sealant.

3.3 EXTERIOR DRY METHOD (PREFORMED GLAZING AT ALUMINUM STOREFRONT SYSTEM)

A. Cut glazing tape to length; install on glass pane. Seal corners by butting tape and dabbing with butyl sealant.

B. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.

C. Rest glass on setting blocks and push against fixed stop with sufficient pressure to attain full contact at perimeter of pane.

D. Install removable stops without displacement of glazing gasket. Exert pressure for full continuous contact.

E. Trim protruding tape edge.

3.4 EXTERIOR COMBINATION METHOD (TAPE AND SEALANT AT STEEL FRAMES)

A. Cut glazing tape to length and set against permanent stops, 3/16 inch below sightline. Seal corners by butting tape and dabbing with butyl sealant.

B. Apply heel bed of butyl sealant along intersection of removable stop with frame ensuring full seal between glass and frame.

C. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.

D. Rest glass on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane.

E. Install removable stops with spacer strips inserted between glass, and applied stops at 24 inch intervals, 1/4 inch below sightline.

F. Fill gap between pane and removable stop with silicone sealant to depth equal to bite of frame on pane, but not more than 3/8 inch below sightline.

G. Apply cap bead of silicone sealant along exterior void, to uniform line, flush with sightline. Tool or wipe sealant surface with solvent for smooth appearance.

3.5 INTERIOR - DRY METHOD (TAPE AND TAPE)

A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.

B. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.

C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.

D. Place glazing tape on free perimeter of glazing in same manner described above.

E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

F. Knife trim protruding tape.

3.6 CLEANING

A. After installation, mark pane with an "X" by using plastic tape or removable paste.

B. Remove glazing materials from finish surfaces.

C. Remove labels after Work is completed.

END OF SECTION

SECTION 08 91 00
METAL LOUVERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Louvers and frames.

B. Blank out sheeting.

C. Bird and Insect Screening.

1.2 REFERENCES

A. AMCA 500 - (Air Movement Council Association) Test Method for Louvers, Dampers, and Shutters.

B. ASTM B221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.

C. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot- Dip Process.

D. ASTM A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot- Dip Process.

1.3 SYSTEM PERFORMANCE

A. Fabricate louver to permit 50 percent free area.

1.4 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacture of AMCA certified louvers with five years experience.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Indicate layout, elevations, dimensions, and tolerances; head, jamb, and sill details; blade configuration; screening; and frames.

C. Provide Product Data on preassembled louvers describing design characteristics, maximum recommended air velocity, free area, materials, and finishes.

D. Submit manufacturer's installation instructions.

E. Submit two 6-inch square Samples illustrating finish and color of exterior and interior prefinish

1.6 COORDINATION

A. Coordinate Work of this Section with installation of flashings and mechanical ductwork.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Airline Products Co.

B. The C/S Group.

C. The Airolite Co. (as a standard of quality).

D. Industrial Louvers, Inc.

E. Substitutions: Under provisions of Section 01 62 00.

2.2 MATERIALS

A. Aluminum: ASTM B221, 6063 alloy, T5 or T52 temper; extruded shape.

B. Steel Sheet: ASTM A653, Commercial Steel, Type A, galvanized to G90 zinc coating in accordance with ASTM A924.

C. Fasteners and Anchors: Stainless steel type.

D. Flashings: Of same material as louver frame.

2.3 FABRICATION

A. Louver Size: 4 inches deep, face measurements as indicated.

B. Louver Blade: Sloped at 45 degree; minimum material thickness of 16 gage.

C. Louver Frame: Channel shape, mechanically fastened corner joints, material thickness of 16 gage.

D. Mullions: Concealed aluminum, profiled to suit louver frame.

2.4 ACCESSORIES

A. Insect Screen: 18 x 16 size aluminum or steel mesh, set in aluminum or steel frame, same material as louver frame.

B. Bird Screen: Interwoven wire mesh of steel or aluminum, 0.063 inch diameter wire, 1/2 inch open weave, square design

C. Primer: Zinc chromate, alkyd type.

D. Flashings: Of same material as louver frame.

2.5 FINISHES

A. Aluminum Surfaces: AA-M12C22A42 clear anodized.

B. Steel Surfaces: Shop coat of primer for site painting under provisions of Section 09 91 00.

C. At Mechanical Roof Screen & Vertical Exterior fins at North Facade (Steel Surfaces) Factory “Kynar 500” or “Hylar 5000” fluorocarbon 3-coat coating system, color as selected by Architect

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that conditions are ready to receive Work and opening dimensions are as indicated on Drawings.

B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Install louvers level and plumb.

C. Secure louvers in opening framing with concealed fasteners.

D. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

E. Install bird screening to exterior of louver under metal protection grille at all exhaust louvers.

F. Install insect screens to intake louvers and.

3.3 CLEANING

A. Clean surfaces and components.

END OF SECTION

SECTION 09 21 16
GYPSUM SHEATHING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Glass-mat gypsum sheathing board.

1.2 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Provide manufacturers' data describing products and installations.

1.3 QUALITY ASSURANCE

A. Comply with the latest edition of ASTM C11.

B. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL “Fire Resistance Directory”.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the project site with manufacturers' labels intact and legible under provisions of Section 01 87 00.

B. Keep materials dry by storing inside building and fully protect from weather.

C. Stack gypsum sheathing neatly and flat, with care to avoid damage to edges, ends and surfaces.

1.5 PROJECT CONDITIONS

A. Environmental Requirements: Establish and maintain application and finishing environment in accordance with ASTM C840.

1. Do not leave exposed to weather for more than 180 days.

B. Provide adequate ventilation to eliminate excessive moisture within building during this Work.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. G-P Gypsum Corporation.

B. Substitutions: Under provisions of Section 01 62 00.

2.2 MATERIALS

A. Glass-Mat Gypsum Sheathing Board: ASTM C1177/C1177M

1. Product: Subject to compliance with requirements, provide “Dens-Glass Gold” by G-P Gypsum Corporation.

2. Type and Thickness: Regular, 1/2 inch thick.

3. Size: As required for vertical installation.

2.3 ACCESSORY MATERIALS

A. Fasteners: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. For steel framing less than 0.0329 inch thick, attach sheathing with steel drill screws complying with ASTM C1002.

2. For steel framing from 0.033 to 0.112 inch thick, attach sheathing with drill screws complying with ASTM C954.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with GA-253 and manufacturer’s written instructions.

B. Cut boards at penetrations, edges, and other obstructions of Work; fit tightly against abutting construction, unless otherwise indicated.

1. Install boards with a 3/8-inch setback where non-loadbearing construction abuts structural elements.

2. Install boards with a 1/4-inch setback where they abut masonry or similar materials that might retain moisture, to prevent wicking.

C. Coordinate sheathing installation with the flashing and joint-sealant installation so these materials are installed in sequence and manner that prevents exterior moisture from passing through completed exterior wall assembly.

D. Apply fasteners so screw heads bear tightly against face of sheathing boards but do not cut into facing.

E. Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.

F. Vertical Installation: Install board vertical edges centered over flanges of steel studs. Abut ends and edges of each board with those of adjacent boards. Screw-attach boards at perimeter and within field of board of each steel stud.

1. Space fasteners approximately 8 inches on center and set back a minimum of 3/8 inch from edges and ends of boards.

END OF SECTION

SECTION 09 21 17
DRYWALL SHAFT SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Special framing and gypsum board required for fire-rated shaft conditions. Drywall shaft systems include special-purpose assemblies of gypsum board and metal components designed for erection entirely from room side of shaft and chases. Types of drywall shaft systems include the following:

1. Service shaft enclosures (for piping, ductwork, air plenums, electrical, elevator, and similar services) and chases.

1.2 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Submit manufacturer's product specifications and installation instructions for each gypsum drywall component, including other data as may be required to show compliance with these Specifications.

1.3 QUALITY ASSURANCE

A. Allowable Tolerances: On faces of Work exposed in occupied spaces, including stairwells (if any), limit offsets between planes of board faces to 1/8 inch, and limit variations from plumb and location (including warp and bow) to 1/4 inch in 8 feet-0 inches.

B. System Design Loading: Provide drywall shaft systems designed and tested by manufacturer to withstand the following lateral loadings (air pressures), applied continuously and cyclically, for maximum heights of partitions required, within the following deflection limits.

1. Lateral Loading: As indicated but not less than 10 pounds per square foot.

2. Deflection Limit: As indicated but not less than 1/240 of partition height.

C. Sound Transmission Class: Provide drywall shaft systems designed and tested by manufacturer to achieve a minimum STC rating (when tested in accordance with ASTM E 90) as noted on the drawings and a minimum of 49 where not specifically called out on the drawings.

D. Fire Ratings: Fire rated gypsum board assemblies shall satisfy minimum fire ratings as noted and shall conform to methods approved by applicable building codes.
1. Underwriters Laboratory.

2. Gypsum Association (GA) File Numbers in GA-600 Fire Resistance Design Manual.

3. Or other listing approved by applicable authorities.

1.4 DELIVERY, STORAGE AND HANDLING

A. Comply with requirements of Section 01 87 00.

B. Deliver drywall shaft system components and materials in sealed containers and bundles, fully identified with manufacturer's name, brand, type and grade.

C. Store inside in a dry, well ventilated space, protected from the weather, under cover and off the ground.

D. Protect ends, edges, and faces of gypsum board from damage. Protect steel studs and accessories from bending.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. National Gypsum Company, Gold Bond Building Products.

B. United States Gypsum.

C. Pabco Division; Fiberboard Corporation.

D. Domtar Gypsum.

E. Substitutions: Under provisions of Section 01 62 00.

2.2 BASIC SYSTEM MATERIALS

A. General: Except as otherwise indicated or required by governing regulations, provide the manufacturer's standard materials specified in published product literature for the system and application required.

B. Metal Framing and Furring: Hot-dip galvanized steel, ASTM A446, G 90 coating; except comply with ASTM C645 for 25 gauge members, minimum base steel thickness 0.0179 inch, provide electro-galvanized or hot-dip galvanized coating.

C. Gypsum Shaftwall Coreboards: Manufacturer's special gypsum coreboard of thickness and type indicated and as required to comply with system performance requirements. ASTM C442, Type X, with water repellant paper on front, base, and long edges (bonded).

D. Exposed Gypsum Board: ASTM C36, Type X where required for fire-resistance rating, 5/8 inch thick.

1. Long Edge Profile: Square, tapered, or bended taper.

E. Drywall Trim Accessories:

1. Provide manufacturer's standard trim accessories of types indicated for drywall work, formed of galvanized steel, with either knurled and perforated or expanded flanges for nailing or stapling, and beaded for concealment of flanges in joint compound.

2. Provide corner beads, L-type edge trim-beads, U-type edge trim-beads, special L-kerf-type edge trim-beads, and one-piece control joint beads, angle (ASTM C1047), screws (ASTM C954 or C1002).

F. Joint Treatment Materials: ASTM C475; type recommended by the manufacturer for the application indicated, except as otherwise indicated.

1. Joint Tape: Perforated type, paper.

2. Joint Compound: Premixed vinyl-type for interior use.

2. Grade: 2 separate grades; one specifically for bedding tapes and filling depressions, and one for topping and sanding.

3. Joint Compound: On interior Work provide chemical-hardening type for bedding and filling, premixed vinyl-type or vinyl-type powder for topping.

G. Miscellaneous Materials: Provide auxiliary materials for gypsum drywall Work of the type and grade recommended by the manufacturer of the system.

1. Laminating Adhesive: Special adhesive or joint compound specifically recommended for laminating gypsum boards.

2. Concealed Acoustical Sealant: Mastic type; non-shrinking, nondrying, nonmigrating and nonstaining.

3. Exposed Acoustical Sealant: Latex, acrylic, or acrylic-latex type; permanently elastic and paintable.

4. Sound Attenuation Blankets: ASTM C665, Type I; semi-rigid mineral fiber blanket without membrane, Class 25 flame-spread, thicknesses as indicated.

2.3 BASIC SYSTEM DESCRIPTION

A. General Requirements: The following descriptions indicate type of manufacturer's standard systems required; the descriptions are not intended to be comprehensive but to identify a discrete type of system.

1. Provide a complete system, complying with requirements indicated.

2. Modify and supplement manufacturer's standard system to comply with performance requirements, including those of governing regulations.

3. Provide the depth, profile, gauge, and anchorage system of metal support members recommended by manufacturer for heights and system design loading criteria indicated.

4. Provide runners, stiffeners, braces, and similar framing members required to form a complete system.

B. Cavity Shaftwall Systems: Provide shaftwall assemblies consisting of:

1. Gypsum shaftwall coreboards inserted between J-shaped metal floor and ceiling tracks.

2. Specially-shaped studs engaged in tracks and fitted between shaftwall boards

3. Gypsum boards on finished side or sides applied to studs in number of layers, thicknesses and arrangement indicated.

4. Shaftwall Board Size: 1 inch thick, 2 feet wide, 7 feet through 14 feet long.

5. Stud Shape: I, C-H or double E.

6. Stud Thickness: 16 ga or as indicated in structural drawings.

7. Stud Depth: As indicated.

8. Room-Side Finish: Depends on rated assembly specified or detailed.

9. Shaft-Side Finish: Leave exposed, refer to rated assembly specified or detailed.

10. Cavity Insulation: Provide sound attenuation blankets in cavity formed by studs between shaftwall board and room-side finish, refer to rated assembly specified or detailed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect areas and surfaces scheduled to receive gypsum board and verify that:

1. Support systems are in proper alignment, straight and true.

2. Required blocking, bracing and backing members of support systems are installed.

B. Do not start installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF DRYWALL SHAFT SYSTEMS

A. Preparations and Coordination:

1. Pre-Installation Conference: Prior to the start of shaft system installation, meet at the Project Site with the installers of related Work including Work requiring openings, chases, frames, access panels, support and similar integrated requirements (including interference and conflicts, and coordinate layout and sequencing requirements for proper integration of the Work.

2. Weather Exposure: Do not proceed with the installation of gypsum board until building is sufficiently enclosed and ambient conditions are adequately controlled to prevent moisture and weather deterioration of the Work.

B. Installation of Basic System Components:

1. General: Comply with the manufacturer's installation instructions.

2. Comply with recognized industry standards ASTM C754 and ASTM C840 for the installation of both light gage metal framing and gypsum board, to the extent not specified by manufacturer's instructions.

3. Anchor and fasten materials and components to comply with ratings and performance requirements, and to comply with governing regulations.

4. Do not bridge building expansion joints with drywall shaft system, frame both sides of joints with furring and other support as indicated.

5. Install supplementary framing, blocking and bracing to support fixtures, equipment, services, heavy trim, furnishings and similar Work which cannot be adequately supported directly on gypsum drywall shaft system, which is nonload bearing.

6. Support elevator hoistway door frames independently of drywall shaft framing system, or reinforce system in accordance with system manufacturer's instructions.

7. Where handrails are indicated for direct attachment to drywall shaft system, provide not less than 16 gauge sheet metal backing plate, accurate positioned and secured behind not less than one 5/8 inch thick course of gypsum board in the system.

8. Coordinate drywall shaft system Work with sprayed-on fireproofing of the structure, so that both remain complete and undamaged. Patch or replace sprayed-on fireproofing removed or damaged during the installation of the shaft system.

9. Prevent transfer of structural loading to shaft wall system, both horizontally and vertically.

   a. Provide deflection track type joints to attain lateral support and avoid axial loading.

b. Comply with details shown and with manufacturer's instructions.

10. Seal perimeter of each section of drywall shaft Work where it abuts other Work.

    a. Install a second bead of acoustical sealant in a location and manner which will prevent dislocation by air pressure differential between shaft and external spaces.

    b. Seal joints and penetrations in the Work; comply with manufacturer's instructions.

11. Provide water-resistant sealant (in lieu of acoustical type) where room-side of system is indicated as base for tile Work. Wall board to be water resistant gypsum backing board.

12. In elevator shafts, where drywall shaft-face system cannot be positioned within 2 inches of structural beams, floor edges and similar projections into the shaft, provide 5/8 inch gypsum board cants to cover the tops of the projections.

    a. Slope cant panels not more than 15 degrees from vertical.

    b. Set base-edge of panels in drywall adhesive and secure top edges to shaft walls at 24 inches on center with screws.

C. Special Application Requirements:

1. Tile Finish: Where room-side of drywall shaft Work is indicated to receive thin-set tile wall finish, substitute cementitious backer units as the exposed board of the system; refer to Section 09 30 00.

2. Work to Receive Drywall Finish:

    a. Provide exposed boards with tapered edges and recessed fastener heads, ready for drywall finishing where room-side of drywall shaft Work is indicated to receive drywall finish, including spaces indicated for paint or wall coverings.

    b. For unfinished Work, provide edge profile of exposed boards at installer's option, except comply with requirements for fire-resistance and STC ratings.

D. Installation of Drywall Trim Accessories:

1. General: Install metal trim accessories where room-side of drywall shaft system is indicated to receive drywall finish (tape and joint compound treatment) including spaces indicated for paint or wall coverings.

a. Nail or staple the flanges of accessories in accordance with manufacturers instructions, and fasten integrally with gypsum board where possible.

b. Apply trim wherever edge of gypsum board would otherwise be exposed or semi-exposed, including terminations of the Work, openings in the Work, external corners, expansion and control joints and similar edges, both exposed and abutting other Work.

c. Miter-cut corners of exposed trim accessories, and spline-reinforce from behind to eliminate offsets and misalignments.

d. Install L-type trim where board edges abut other Work without space or reveal.

e. Install control-joint trim (beaded type) where indicated.

3.3 INSTALLATION OF DRYWALL FINISHING

A. General: Apply treatment at gypsum board joints (both directions) flanges of trim accessories, penetrations, fasteners heads, surface defects and elsewhere as required to prepare Work for decoration. Prefill open joints and rounded or beveled edges, using type of compound recommended by manufacturer.

B. Except as otherwise indicated, comply with provisions of levels of finishing as specified in Section 09 21 16.

3.4 CLEANING AND PROTECTION

A. Comply with requirements of Section 01710.

B. Remedy any fastener popping or ridging.

C. Promptly remove any residual joint compound from adjacent surfaces.

D. Provide final protection and maintain conditions, in a manner suitable to Installer, that ensures gypsum board assemblies remain without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 09 22 16
METAL STUD FRAMING SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Formed metal stud framing.

B. Framing accessories.

C. Extruded aluminum partition closures.

1.2 REFERENCES

A. ASTM A653 - Steel Sheet, Zinc- Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. ASTM A924 - General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

C. ASTM C645 - Non-Load (Axial) Bearing Steel Studs, Runners (Track) and Rigid Furring Channels for Screw Application of Gypsum Board.

D. ASTM C754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wallboard, Backing Board, or Water-Resistant Backing Board.

E. ASTM C1002 - Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases.

F. NFPA 80 - Fire Doors and Windows.

G. GA600 - Fire Resistance Design Manual.

H. MSMA - Metal Stud Manufacturers Association.

I. SSPC - Steel Structures Painting Council.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Submit Shop Drawings of any prefabricated Work indicating component details, stud layout, framed openings, anchorage to structure, type and location of fasteners, and accessories or items required of other related work.

C. Product Data: Manufacturer's descriptive literature for all products specified.

D. Samples: Mullion mate series 30- three 12 inch samples of each type of mullion mate partition closure and finish.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with ASTM C754.

B. Maintain one copy of each document on site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Gold Bond Building Products.

B. Domtar Gypsum.

C. National Gypsum Company.

D. Gordon Interior Specialties.

E. Substitutions: Under provisions of Section 01 62 00.

2.2 STUD FRAMING MATERIALS

A. Studs: ASTM A653, Grade 33, galvanized to G60 coating class in compliance with ASTM A924, non-load bearing rolled steel, channel shaped, punched for utility access, as follows:

1. Depth: 1-5/8, 2-1/2, 3-5/8,4, or 6 inches is indicated in drawings.

2. Thickness: 0.0179 inch unless otherwise indicated.

B. Runners: Of same material, finish and thickness as studs, unpunched.

C. Ceiling Runners: Of same material, finish and thickness as studs.

D. Deflection and Firestop Track: Top runner designed to allow for deflection of structure applied to interior partition fabricated of same material, finish and thickness as studs and of the following configuration:

1. Top runner with slotted flanges, 2-1/2 inch deep with slots 1 inch on center.

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

a. “SLP-TRK”, Sliptrack Systems, Inc.

b. “The System”, Metal-Lite, Inc.

c. Substitutions: Under provisions of Section 01 62 00.

E. Furring and Bracing Members: Of same material and finish as studs, thickness to suit purpose.

F. Extruded Aluminum Partition Closure: Mullion Mate series 30, for use at Interior curtain wall locations as noted on drawings, or equal.

1. Preassembled, spring loaded, extruded aluminum partition closures.
2. Materials: Aluminum extrusions: 6063-T5 temper, tensile strength 31 KSI (ASTM B 221, ASTM B 221 M).
3. End Caps to match depth of system required.
4. Finish: Clear anodized to match curtain wall.

G. Fasteners: ASTM C1002, self-drilling, self-tapping screws.

H. Metal Backing: 0.0538 inch thick galvanized steel.

I. Anchorage Devices: Powder actuated.

J. Primer: SSPC 20.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that conditions are ready to receive work.

B. Verify field measurements are as shown on Drawings.

C. Verify that rough-in utilities are in proper location.

D. Beginning of installation means installer accepts existing conditions.

3.2 ERECTION

A. Install components in accordance with ASTM C754 requirements and manufacturer's instructions.

B. Align and secure top and bottom runners at 24 inches on center.

C. Fit runners under and above openings; secure intermediate studs at spacing of wall studs.

Check span capabilities of stud with intended sheathing material to determine spacing.

D. Install studs vertically at 16 inches on center, unless otherwise indicated on drawings.

E. Connect studs to tracks using fastener method.

F. Stud splicing not permissible.

G. Construct corners using minimum three studs.

H. Double studs of 0.0329 inch thickness to form box jambs and headers at wall openings, door and window jambs, and each side of other openings.

I. Frame door and window openings with details indicated and with GA-600 and NFPA 80.

J. Install framing below sills of openings to match framing above head of opening.

K. Coordinate erection of studs with requirements of door and window frame supports and attachments.

L. Brace stud framing system and make rigid.

M. Construct toilet and plumbing chase walls of 0.0329 inch thick studs braced horizontally at 24 inches on center vertically with 2-1/2 inch wide cross studs.

N. Erect minimum 0.0329 inch thick studs behind all cementitious backing board and ceramic tile installations.

O. Align stud web openings and point stud flanges in the same directions.

P. Secure stud ends to bottom tracks on both faces.

Q. Coordinate installation of bucks, anchors, and backing with electrical and mechanical work to be placed in or behind stud framing.

R. Backing: Secure steel backing to studs. Install backing for support of toilet partitions, wall cabinets, toilet accessories, hardware, and all other wall mounted items.

S. Extend partition framing full height to structural support or substrates above suspended ceilings, except where partitions are indicated to terminate at ceiling.

T. For sound and fire resistance rated partitions extend framing to underside of floor/roof or other continuous solid surface to obtain rating.

U. Continue partition framing over door and window openings and frame around ducts penetrating partitions above ceiling.

V. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide deflection track top runner to attain lateral support and avoid axial loading.

W. Coordinate placement of insulation in multiple stud spaces made inaccessible after stud framing erection.

X. Maintain clearance under structural building members at fire-resistance rated assemblies. Provide firestop track top runner.

3.3 ERECTION TOLERANCES

A. Maximum variation from true position: 1/2 inch.

B. Maximum variation of any member from plane: 1/8 inch in 10 feet.

C. Maximum variation from plumb: 1/8 inch in 10 feet.

END OF SECTION

SECTION 09 24 00
PORTLAND CEMENT PLASTER

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Metal furring and lathing.

B. Portland cement plaster system.

C. Machine applied surface finish.

1.2 REFERENCES

A. Contractor's work shall comply with the following standards as applicable. Manufactured items are to be fabricated to these same standards.

B. The following standards (and publications) are applicable to the extent referenced in the text. The most recent of these standards is implied, unless otherwise stated.

C. ASTM C150 - Portland Cement.

D. ASTM C206 - Finishing Hydrated Lime.

E. ASTM C207 - Hydrated Lime for Masonry Purposes.

F. ASTM C847 - Standard Specifications for Metal Lath.

G. ASTM C897 - Aggregate for Job-Mixed Portland Cement-Based Plasters.

H. ASTM C926 - Application of Portland Cement-Based Plaster.

I. ASTM C932 - Surface-Applied Bonding Agents for Exterior Plaster.

J. ASTM C954 - Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 inches to 0.112 inches in thickness.

K. ASTM C1002 - Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases.

L. ASTM C1063 - Installation of Lathing and Furring for Portland Cement Based Plaster.

M. NAAMM Standard ML/SFA 920 - Guide Specifications for Metal Lathing and Furring.

N. TSIB (Technical Services & Information Bureau) – 2012 Plaster Assembly Manual.

O. CCR - California Code of Regulations, Title 24, Part 2, Chapter 25.

P. ICC-ES: ICC—Evaluation Services Reports.

Q. CBC – California Building Code, Chapter 25.

1.3 QUALITY ASSURANCE

A. Applicator: Company specializing in cement plaster work with five years documented experience.

B. At the completion of lathing and prior to the application of scratch coat of plaster, contact the Northern California Plastering Institute, Inc., and arrange for inspection of lathing and accessories installation. Provide to Architect a written report of the results of the inspection.

C. Lath and related accessories shall provide proper, secure base and reinforcement for plaster systems. Plaster base coats shall provide suitable base for finish coat.

1.4 REGULATORY REQUIREMENTS

A. Conform to CBC, Chapter 7, for fire rated assemblies as indicated on Drawings.

B. Conform to CCR, Title 24, Part 2, Chapter 25A for materials and their installation.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00, Submittals.

B. Provide Product Data on plaster materials, characteristics and limitations of products specified.

C. Submit Samples of texture for plaster finish, building paper, flashing membrane, lath, accessories, trim, and fasteners.

1.6 DELIVERY, STORAGE AND HANDLING

A. Comply with requirements of Section 01 87 00.

B. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use.

C. Keep plaster and other cementitious materials dry until ready for use. Keep materials off ground, under watertight covers, and away from damp surfaces.

D. Protect metal products from rusting.

E. Remove from site any damaged or deteriorated materials.

F. Stack preformed material to prevent twisting, bending, abrasion, staining, or corrosion and to provide ventilation.

G. Prevent contact with materials during storage which may cause damage, discoloration, staining, or drainage.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not apply plaster when substrate or ambient air temperature is less than 40 degrees Fahrenheit nor more than 77 degrees Fahrenheit.

B. Maintain minimum ambient temperature of 40 degrees Fahrenheit during and after installation of plaster.

C. Protect plaster from uneven and excessive evaporation during dry weather and from strong blasts of dry air.

D. Do not subject newly applied plaster to hot, dry winds.

E. Do not install exterior plaster when prevailing temperature is less than 40 degrees Fahrenheit.

F. When ambient air temperature exceeds 77 degrees Fahrenheit, follow procedures for maintaining moisture content in new plaster.

G. Provide protection against accelerated dehydration caused by wind. Protect cement plaster from uneven and excessive evaporation during hot and/or windy weather.

H. Fine spray plaster twice daily for up to 48 hours minimum.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Lathing Materials:

1. Western Metal Lath Division.
2. Amico-West.
3. CEMCO.

B. Accessories:

1. Fry Reglet Corp.
2. Keene Metal Products Division.
3. M.M. Systems Corporation.

4. CEMCO.

5. Amico-West.

6. Superior Metal Trim.

7. Stockton Wire Products.

8. Western.

C. Or approved equal. Substitutions under the provisions of Section 01 25 13, Product Options and Substitutions.

2.2 PLASTER BASE COAT MATERIALS

A. Cement: ASTM C150, Normal - Type I, Portland or ASTM C91, masonry.\

B. Lime: ASTM C206, Type S for use with Portland cement or ASTM C207, Type S, for use with masonry cement.

C. Aggregate: In accordance with ASTM C897 and PCA Plaster (Stucco) Manual.

D. Water: Clean, fresh, potable and free of mineral or organic matter which can affect plaster.

E. Plaster Mix Reinforcement: Glass fibers, 1/2 inch nominal length, alkali resistant.

F. Bonding Agent: ASTM C932; type recommended for bonding plaster to concrete, concrete masonry surfaces and existing plaster surfaces. Larsen Products Corp. “Weld-Crete”. Substitutions under provisions of Section 01 62 00.

G. Sand: ASTM C144.

2.3 PLASTER FINISH COAT MATERIALS

A. Cement: As specified for plaster base coat, grey color.

B. Lime: As specified for plaster base coat.

C. Water: Clean, fresh, potable and free of mineral or organic matter which can affect plaster.

D. Finish: Site paint under provisions of Section 09 91 00.

2.4 FURRING AND LATHING

A. Metal Lath for Vertical Surfaces: ASTM C847, 3.4 lb/sq. yd. expanded metal, galvanized, self-furring type with continuous groove.

B. Wire Lath for Vertical Patchwork: 1-1/2 x 17 gage woven galvanized wire.

C. Underlayment: Two layers of WRB Type D building paper conforming to CBC Standard No. 14-1.

2.5 ACCESSORIES

A. Corner Mesh: Formed steel, minimum .0179 inch thick; expanded flanges shaped to permit complete embedding in plaster; minimum 2 inches wide; galvanized finish.

B. Corner Reinforcement: Equivalent to Western Metal, .0179 inch “Stucco-Lok” or 18 gage Stockton “Corneraid” for straight corners. Stockton “Bullnose Regular” for rounded corners, galvanized finish.

C. Strip Mesh: Metal lath, 3.4 lb/sq. yd. expanded metal, galvanized, 6 inch wide x 18 inch long.

D. Vent Screed: Equivalent to Superior SRS, minimum .0179 inch thick; depth governed by plaster thickness, minimum 4 inch width, double "V" profile with perforated expanse between "V's" of longest possible lengths; galvanized finish.

E. Casing Bead: Formed steel; minimum .0239 inch thick; thickness governed by plaster thickness; maximum possible lengths; expanded metal flanges, with square edges; galvanized finish.

F. Curved Casing Bead: Square-edged style fabricated from aluminum, preformed into curve or radius indicated.

G. Weep Screed: Equivalent to Superior SWS, minimum .0179 inch thick; depth governed by plaster thickness, minimum 3-1/2 inch high flange, "V" shaped, of longest possible lengths; galvanized finish.

H. Drip Screed: Equivalent to Superior No. 5 or No. 10 drip mould as indicated on drawings, minimum .0179 inch thick; depth governed by plaster thickness, minimum 3-1/2 inch high flange, of longest possible lengths; galvanized finish.

I. Window/Door Drip Screed: Equivalent to Superior SWD, minimum .0179 inch thick; depth governed by plaster thickness, minimum 3-1/2 inch high flange, of longest possible lengths; galvanized finish.

J. Control and Expansion Joints: Equivalent to Western XJ 15-3, depth to conform to plaster thickness, maximum practical lengths, galvanized finish.

K. Interior Corner Joints: Equivalent to Western No. 30, depth to conform to plaster thickness, maximum practical lengths, galvanized finish.

L. Anchorages: Nails, staples, or other approved metal supports, of type and size to suit application, galvanized to rigidly secure lath and associated metal accessories in place.

M. Screws: ASTM C954 or ASTM C1002, self drilling.

N. Penetration Flashing: Type 1, Grade A conforming to CBC Standard 14-1, 9 inch wide x length required.

O. Polyethylene Sheet: Clear, 6 mil thick, with self-adhesive tape.

P. Wire: ASTM A641, Class 1 coating (galvanized), soft temper.

Q. Powder Activated Fastener: 0.145 inch diameter SDM flat head nail with washer as manufactured by Hilti, Inc., ICBO Report No. 2388.

2.8 CEMENT PLASTER MIXES

A. Mix and proportion cement plaster in accordance with ASTM C926 and the Plaster Asembly Manual, by TSIB.

B. Base Coat and Brown Coat: One part cement, minimum 3-1/2 and maximum 4 parts aggregate, and 0-3/4 parts hydrated lime, and alkali resistant glass fibers at a rate of 1 lb. per sack of cement.

C. Job Mixed Finish Coat: One part cement, three parts aggregate, and one part lime.

D. Mix only as much plaster as can be used in 1 hour.

E. Mix materials dry, to uniform color and consistency, before adding water.

F. Protect mixtures from frost, contamination, and evaporation.

G. Do not retemper mixes after initial set has occurred.

2.6 CEMENT PLASTER FINISHES

A. Unless noted otherwise, all interior plaster surfaces shall be smooth finish.

B. Medium Sand finish and Smooth Trowel finish- see exterior elevations for locations and extent.

C. Plaster surface finishes must be capable of receiving roller-applied paint (medium texture) without leaving pinholes or voids.

PART 3 - EXECUTION

3.1 INSPECTION

A. Confirm that site conditions and substrates are ready for work covered under this section to commence. If not, Contractor to make suitable repairs or adjustments to the work.

B. Grounds and Blocking: Verify items within walls for other Sections of Work have been installed.

C. Mechanical and Electrical: Verify services within walls have been tested and approved.

D. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION - LATHING MATERIALS

A. Install metal lathing in accordance with ML/SFA 920, ASTM C1063 and as specified herein.

B. On vertical surfaces apply two plies of WRB underlayment over substrate; weatherlap horizontal edges 4 inches, vertical edges 6 inches. Fasten in place.

C. Install penetration flashing around all openings and penetrations in exterior walls, soffits and ceilings in compliance with CCR, Title 24, Part 2, Section 1402A, including sealant and in conformance with recommendations contained in Plaster and Lathing Systems Manual and ML/SFA 920.

D. Apply self-furring reinforcement with self-furring ribs perpendicular to supports for horizontal surfaces.

E. Apply metal lath taut, with long dimension perpendicular to supports for vertical surfaces.

C. Lap ends minimum 1 inch. Secure end laps with tie wire where they occur between supports.

D. Lap sides of expanded metal lath minimum 1-1/2 inches. Nest outside ribs of rib lath together.

E. Fur out metal lath from vertical supports or backing not less than 1/4 inch. Furring of metal lath on vertical supports having a bearing surface width of 1-5/8 inches or less is not required.

F. Attach metal lath to vertical metal supports with tie wires or No. 8 self drilling screws with 3/8 inch diameter wafer head capable of penetrating metal supports by not less than 1/4 inch. Maximum spacing 6 inches on center.

G. Attach metal lath to horizontal metal supports with tie wires or No. 8 self drilling screws with 3/8 inch diameter wafer head fitted with 1 inch O.D. x 1/4 inch I.D. x 16 gage galvanized cut washers capable of penetrating metal supports by not less than 1/4 inch.

H. Attach metal lath to wood supports using 1-1/2 inch No. 11 galvanized nails with 7/16 inch diameter heads at maximum 6 inches on center. In addition, at horizontal wood supports, secure lath to each support with 1/2 inch wide, 1-1/2 inch long No. 9 W & M gage ring shank, hook staple placed around a 10d common nail laid flat under the surface of the lath at 27 inches on center and not more than 3 inches from the edge of each sheet. Such staples may be placed over the ribs of 3/8 rib lath or over the back wire of other approved lath at 27 inches on center omitting the 10d nails.

I. Continuously reinforce internal angles with corner mesh, except where corner joint No. 30 is shown. Fasten at perimeter edges only.

J. Place beaded external angle with mesh at corners. Fasten at outer edges only.

K. Place strip mesh diagonally at corners of lathed openings. Secure rigidly in place.

L. Place 4 inch wide strips of metal lath centered over junctions of dissimilar backing materials. Secure rigidly in place.

M. Place window/door drip screed at head of all windows and door openings in exterior walls.

N. Place weep screed at base of all vertical plaster applications at foundation line not less than 4 inches above earth or 2 inches above paved surfaces. WRB underlayment and lath shall cover and terminate on the attachment flange of the screed.

O. Place drip screed at base of all vertical plaster applications which do not terminate at framed wall openings or at foundation line.

P. Place vent screed in soffit areas as indicated.

Q. Place casing beads at all terminations of plaster finish not otherwise indicated to have screeds installed and at all intersections with dissimilar materials. Butt and align ends. Secure rigidly in place.

R. Install accessories to lines and levels.

3.3 INSTALLATION - SUSPENDED METAL CEILING FRAMING

A. Install in accordance with ASTM C1063.

B. Coordinate location of hangers with other Work.

C. Install ceiling framing independent of walls and columns.

D. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum of 24 inches past end of openings.

3.4 CONTROL AND EXPANSION JOINTS

A. Locate interior control and expansion joints as indicated on the Drawings, but not to exceed 20 feet on center, horizontally or vertically.

B. Locate exterior control and expansion joints as indicated on Drawings.

C. Establish control and expansion joints with specified joint device.

D. Install expansion joint in such a way as to assist with air seal continuity.

E. Coordinate joint placement with other related Work.

3.5 PLASTERING

A. Apply plaster in accordance with ASTM C926 and the Plaster Assembly Manual.

B. Three Coat Application: At metal lathed surfaces, apply scratch coat to a nominal thickness of 3/8 inch, brown coat to a nominal thickness of 3/8 inch, and finish coat to a nominal thickness of 1/8 inch.

C. Two Coat Application: Apply bonding agent to substrate. Wet surface if required. At concrete, masonry, and existing plaster surfaces, apply 3/8 inch thick leveling coat and then 1/8 inch finish coat.

D. No flat horizontal surfaces in restrooms. Restrooms are designed to be hosed down daily. Plaster at base of windows, tops of stub walls and other flat surfaces shall be gently sloped so as not to allow any standing water.

E. Coved corners and beveled edges in restrooms: All inside corners and intersections of walls and ceilings shall receive a 1/2 inch cove. All beveled edges around windows, doors, and other projections shall receive a 1/2 inch beveled edge.

F. Moist cure scratch and brown coats. Do not apply brown coat sooner than 48 hours following scratch coat.

G. After curing, dampen base coat prior to applying finish coat. Do not apply finish coat sooner than 7 days following brown coat.

H. Apply finish plaster in two coats evenly and uniformly. Machine or trowel or finish spray as indicated. Apply as recommended based on finish texture selected. Apply first coat to provide texture pattern; second coat to obtain uniformity in color and texture.

I. Moist cure finish coat for minimum period of 48 hours only when strong dry wind conditions exist.

3.6 FINISH COAT TEXTURE

A. Medium Sand Float as defined by photographs and application procedures in the Plaster Assembly Manual, recent edition, and as indicated.

B. Smooth Trowel Finish, where indicated on drawings.

3.7 TOLERANCES

A. Maximum Variation from True Flatness: 1/8 inch in 10 feet.

3.8 CLEANING

A. Remove protective maskings.

B. Remove any overspray from surrounding materials.

C. Clean adjacent affected surfaces.

3.9 PLASTER APPLICATION SCHEDULE

A. Exterior Vertical Surface of Framed Walls: Three coat plaster over metal lath and underlayment.

D. Exterior Horizontal Framed Surfaces: Three coat plaster over metal lath.

END OF SECTION

SECTION 09 28 13
CEMENTITIOUS BACKING BOARD

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Membrane under backing board.

B. Cementitious backing board.

C. Preparation of surface to receive special coatings.

1.2 REFERENCES

A. ANSI/TCA A108.11 - Interior Installation of Cementitious Backer Units.

B. ANSI/TCA A118.4 - Latex-Portland Cement Mortar.

C. ANSI/TCA A118.9 - Test Methods and Specifications for Cementitious Backer Units.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data for materials specified.

C. Samples of backing board and membrane.

1.4 MOCK-UP

A. Provide mock-up of finish substrate in accordance with Section 09 67 01.

1.5 QUALITY ASSURANCE

A. Conform to ANSI/TCA A108.11 and A118.9 for backing board.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in the manufacture of products specified in this Section with minimum five years documented experience.

B. Installer: Company specializing in applying the Work of this Section with minimum five years documented experience.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain 50 degrees Fahrenheit during installation.

PART 2 - PRODUCTS

2.1 BACKING BOARD MATERIALS

A. Backing Board: ANSI/TCA A118.9; high density, cementitious, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners; manufacturer shall be licensed by TCA. Material containing “Styrofoam” additive or a rippled or pinholed surface will be rejected.

2.2 MORTAR MATERIALS

A. Portland Cement Mortar Materials: ANSI/TCA A118.1.

B. Latex-Portland Cement Mortar: ANSI/TCA A118.4 and the following:

1. Acrylic resin latex additive.

2. Dry mortar mix supplied by latex manufacturer.

2.3 ACCESSORIES

1. Membrane: ASTM D226; No. 15 asphalt saturated roof felt. Provide on stud face for full height of wall.

2. RedGard Waterproofing and crack prevention membrane or approved equal. Provide over surface of cementitious backer board. Overlap 6 inches to adjacent gypsum wallboard where applicable.

2.4 JOINT FILLER MIX

A. Mix and proportion pre-mix setting bed and grout materials in accordance with manufacturer's instructions and referenced standards.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive Work.

B. Beginning of installation means installer accepts condition of existing surfaces.

3.2 PREPARATION

A. Protect surrounding work from damage or disfiguration.

B. Vacuum clean existing surfaces and damp clean.

3.3 INSTALLATION

A. Install vapor barrier over substrate; weatherlap horizontal edges 4 inches, lap vertical edges 6 inches, and tape all joints as recommended by manufacturer.

B. Coordinate installation of backing board with application of finish surfaces. Install with the rough side exposed.

C. Install backing board in accordance with manufacturer's instructions and ANSI/TCA A108.11. Tape joints and corners. Chamfer all exposed corners to create a 1/2 inch radius.

D. Smooth finish with skim coat of dry-set mortar to conceal all joints, fasteners, and imperfections in the board surface, to a feather edge, to make the entire surface "paint ready".

E. Obtain acceptance of special coatings applicator prior to final completion.

3.4 CLEANING

A. Clean Work under provisions of 01 70 00.

END OF SECTION

SECTION 09 29 00
GYPSUM BOARD

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Gypsum board.

B. Taped and sanded joint treatment.

C. Surface primer.

D. Texture finish.

E. Level 5 finish, if indicated.

F. Resilient furring channels.

G. Metal channel ceiling framing.

1.2 REFERENCES

A. ASTM C11 - Standard Terminology Relating to Gypsum and Related Building Materials and Systems.

B. ASTM C1396 - Gypsum Wallboard.

C. ASTM C475 - Joint Treatment Materials for Gypsum Wallboard Construction.

D. ASTM C514 - Nails for the Application of Gypsum Wallboard.

E. ASTM C557 - Adhesives for Fastening Gypsum Wallboard to Wood Framing.

F. ASTM C630 - Water Resistant Gypsum Backing Board.

G. ASTM C641 - Zinc-Coated (Galvanized) Carbon Steel Wire.

H. ASTM C645 - Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.

I. ASTM C754 - Installation of Steel Framing Members to Receive Screw Attached Gypsum Wallboard, Backing Board, or Water Resistant Backing Board.

J. ASTM C840 - Application and Finishing of Gypsum Board.

K. ASTM C919 - Use of Sealants in Acoustical Applications.

L. ASTM C1002 - Steel Drill Screws for the Application of Gypsum Board.

M. ASTM D226 - Asphalt-Saturated Felt Used in Roofing and Waterproofing.

N. ASTM E90 - Method for Laboratory Measurement of Airborne Sound transmission Loss of Building Partitions.

O. GA 201 - Using Gypsum Board for Walls and Ceilings.

P. GA 214 - Levels of Gypsum Board Finish.

Q. GA 216 - Application and Finishing of Gypsum Board.

R. GA 600 - Fire Resistance Design Manual.

S. CBC - California Building Code.

T. UL - Underwriters Laboratories.

1.3 QUALITY ASSURANCE

A. Applicator: Company specializing in gypsum board systems, with five years documented experience.

1.4 REGULATORY REQUIREMENTS

A. Conform to CBC, Chapter 7, and UL and GA requirements for fire-rated assemblies.

1.5 ACOUSTICAL PERFORMANCE

A. Acoustical attenuation for interior partitions, where indicated, shall be STC rating in accordance with ASTM E90.

1.6 DEFINITIONS

A. Refer to ASTM C11 for definitions of terms related to gypsum board assemblies.

1.7 FIELD SAMPLES

A. Provide field samples under provisions of Section 01 33 00.

B. On wall and ceiling surface duplicate specified texture finish on at least 100 square feet of surface area.

C. Provide complete finish including surface primer.

D. Simulate finished lighting conditions for review of field sample.

E. After surface texture is accepted, the accepted surface will remain as part of the Work and will be used to evaluate subsequent applications of finish texture.

1.8 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Provide Product Data for all items specified.

C. Submit 12 inch square Samples of each texture finish specified.

D. CHPS Submittals:

1. Credit EQ2.0D.P1/ EQ2.2: Provide product data, MSDS, and other official literature from manufacturer clearly identifying that the product and its adhesives and sealants, meet the testing requirements and threshold limits of the State of California Department of Health Services (DHS) *Standard Practice for the Testing of Volatile Organic Compounds*. Such products shall be either identified on the *CHPS Low-Emitting Materials Product List* or by a 3rd party certification program listing low-emitting material products that meet the State testing requirements, as identified on the CHPS website.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Georgia Pacific Corp.

B. National Gypsum Company.

C. United States Gypsum Co..

D. Substitutions: Under provisions of Section 01 62 00.

2.2 FRAMING MATERIALS

A. Metal Furring: ASTM C645, hat-shaped, 7/8 inch deep, .0329 inch thick.

B. Resilient Furring Channel: Manufacturer's standard product designed to reduce sound transmission, complying with ASTM C645 for material, finish and widths of face and fastening flange; 1/2 inch deep x .0179 inch thick asymmetric - shaped channel with face connected to single flange by slotted leg (web).

C. Furring Channel: ASTM C754, 1-1/2 inch x .475 pounds per foot.

D. Fasteners: ASTM C1002.

E. Hanger Wire: ASTM A641, Class 1 coating (galvanized) soft temper, 9 gauge.

F. Tie Wire: ASTM A641, Class 1 coating (galvanized) soft temper, 16 and 18 gauge.

G. Adhesive: ASTM C557.

2.3 GYPSUM BOARD MATERIALS

A. Standard Gypsum Board: ASTM C36; 5/8 inch thick unless otherwise indicated, maximum permissible length; ends square cut, tapered and beveled edges.

B. Fire Rated Gypsum Board: ASTM C36; fire resistive type, UL rated; 5/8 inch thick unless otherwise indicated, maximum permissible length; ends square cut, tapered and beveled edges.

C. Moisture-Resistant Gypsum Board: ASTM C630; 5/8 inch thick unless otherwise indicated, maximum permissible length; ends square cut, tapered and beveled edges.

2.4 ACCESSORIES

A. Acoustical Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.

1. “Sheetrock Acoustical Sealant”, manufactured by United States Gypsum Company.

2. “BA-98 Acoustical Sealant”, manufactured by Pecora Corporation.

3. “Tremco Acoustical Sealant”, manufactured by Tremco, Inc.

B. Fire-Rated Sealant: As specified in Section 07 84 00.

C. Corner Beads: Metal, hot dip galvanized.

D. Edge Trim: GA 201 and GA 216; Type LC bead, unless otherwise indicated.

E. Control Joints: Roll-formed zinc, USG No. 093, or approved equal.

F. Spot Grout: ASTM C475, setting-type joint compound.

G. Joint Materials: ASTM C475; reinforcing tape, joint compound, adhesive, water, and fasteners. Use tapes and compound recommended by gypsum board manufacturer for the use intended. Use ready mixed, drying type compounds. Use taping compound for embedding tape and first coat over fasteners and flanges of corner beads and trim. Use topping compound for fill and finish coats.

H. Primer: Flat latex basecoat paint equivalent to “First Coat” manufactured by United States Gypsum Company.

I. Membrane: ASTM D226; No. 15 asphalt saturated roofing felt.

J. Adhesive for Application Over Hard Surfaces: Mastic glue as recommended by the gypsum board manufacturer for the specific substrate.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that site conditions are ready to receive Work.

B. Beginning of installation means acceptance of substrate.

3.2 WALL FURRING INSTALLATION

A. Erect wall furring for direct attachment to [masonry] [and] [concrete] walls.

B. Erect metal furring vertically at 16 inches on center. Secure in place on alternate channel flanges at maximum 24 inches on center.

3.3 ACOUSTICAL ACCESSORIES INSTALLATION

A. Space resilient furring channels horizontally at maximum 16 inches on center, not more than 2 inches from floor and ceiling lines.

B. Locate nested joints over framing members.

C. Install acoustical sealant within partitions in accordance with manufacturer's instructions and ASTM C919. Seal perimeter, joints, openings and penetrations on each face of partition.

3.4 CEILING FRAMING INSTALLATION

A. Install in accordance with ASTM C754 and CBC, Chapter 25.

B. Coordinate locations of hangers with other Work.

C. Install ceiling framing independent of walls and columns.

D. Space 9 gauge hanger wires at 3 feet on center along 1-1/2 inch furring channels and within 6 inches of end of furring channel.

E. Install 1-1/2 inch furring channels at 4 feet on center and within 6 inches of parallel walls. Provide 1 inch clearance between end of channels and abutting walls.

F. Position furring channels for proper ceiling height, level, and secure with hanger wire saddle-tied along channel.

G. At channel splices, interlock flanges, overlap ends 12 inches and secure each end with double-strand of 16 gauge tie wire.

H. Erect metal furring at right angles to 1-1/2 inch furring channels. Space metal furring 16 inches on center.

I. Install metal furring within 6 inches of parallel walls. Provide 1 inch clearance between end of furring and abutting wall.

J. Secure metal furring to furring channel with clips or saddle tie with double strand of 18 gauge tie wire.

K. At splices of metal furring nest furring at least 8 inches and securely wire-tie each end with double strand of 16 gauge tie-wire.

L. Reinforce openings in ceiling suspension system which interrupt main furring channels or metal furring with lateral channel bracing. Extend bracing minimum 24 inches past each end of openings.

3.5 GYPSUM BOARD INSTALLATION

A. Install gypsum board in accordance with ASTM C840 and manufacturer's instructions.

B. Erect single layer standard gypsum board in most economical direction, with ends and edges occurring over firm bearing except those ends and edges which are perpendicular to framing.

C. Erect single layer fire rated gypsum board vertically, with edges and ends occurring over firm bearing except those ends and edges which are perpendicular to framing members. Comply with required UL, CBC, or GA fire rated assembly.

D. Erect double layer gypsum board with standard gypsum board for first layer placed in most economical direction with second layer placed parallel to face layer with adhesive and supplementary fasteners. Off-set joints of second layer from joints of first layer by at least 12 inches.

E. Erect double layer fire-rated gypsum board in accordance with required UL, CBC, or GA fire rated assembly.

F. Use screws when fastening gypsum board to metal furring.

G. Use screws when fastening gypsum board to wood furring or framing except where nails are required for UL or CBC fire-rated assembly.

H. Install firestop sealant at wall penetrations and terminations in accordance with required UL, CBC, or GA fire-rated assembly in accordance with Section 07 84 00.

I. Treat cut edges and holes in moisture-resistant gypsum board with sealant.

J. Place control joints where partitions or ceilings of dissimilar construction meet; at junctions of "L", "U" and "T" shaped ceiling areas; and on the interior side opposite building expansion or separation joints (maximum 30 feet in any direction), and as indicated on the Drawings.

K. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.

L. Spot grout metal door frames. Apply spot grout at each jamb anchor clip just before inserting board into frame.

3.6 JOINT TREATMENT

A. Tape, fill, and sand joints, edges, and corners in accordance with GA-214.

B. Feather successive coats a minimum of 2 inches onto adjoining surfaces for each coat.

C. Where fire-resistance rating is required, detail of joint treatment shall meet fire-rating requirement.

D. Level 1 Treatment:

1. All joints and angles shall have tape embedded in joint compound.

2. Surface shall be free of excess joint compound.

3. Tool marks and ridges are acceptable.

4. Use for plenum areas above ceiling, in areas that are generally concealed and other areas not normally open to view.

E. Level 2 Treatment:

1. All joints and angles shall have tape embedded in joint compound and one separate coat of joint compound shall be applied over all fastener heads and accessories.

2. Surface shall be free of excess joint compound.

3. Tool marks and ridges are acceptable.

4. Use where surface is substrate to ceramic tile, acoustic tile, or tackable wallboard system.

F. Level 3 Treatment:

1. Not used.

G. Level 4 Treatment:

1. All joints and angles shall have tape embedded in joint compound with three separate coats of topping compound applied over all joints, angles, fasteners, and accessories.

2. All compound shall be smooth and free of tool marks and ridges.

3. Sand lightly between coats, taking care not to roughen face paper.

4. Use for all surfaces that are scheduled to receive a textured and painted finish, except areas with a surface applied wallcovering.

H. Level 5 Treatment:

1. All joints and angles shall have tape embedded in joint compound with three separate coats of topping compound applied over all joints, fasteners, and accessories.

2. Apply a thin skim coat of topping compound over entire surface.

3. All compounds shall be smooth and free of tool marks and ridges.

4. Sand lightly between coats.

5. Use as scheduled below.

3.7 FINISHING

A. Roller apply surface primer to all gypsum board surfaces scheduled to receive a painted and textured finish prior to application of paint or texture finish.

B. Spray apply textured finish to all surfaces scheduled to receive a paint finish except surfaces of food service and preparation areas.

C. Trowel-apply patch-to-match textures to match existing.

D. Remove any overspray of texture finish from door frames, windows, and other adjoining construction.

3.8 TOLERANCES

A. Maximum Variation from True Flatness: 1/8 inch in 10 feet in any direction.

3.9 SCHEDULE

Room Type	Wallboard System	Finish Type	Notes
Typical Surfaces (Classrooms, corridors, office/work areas)	5/8", Type X	Level 5	Accent surfaces only, such as Soffits.

Wet Areas (all restrooms, Areas with floor sinks and mop sinks- science labs, break-out rooms)	5/8", Type MR	Level 5	Coordinate finish with final surface treatment
Shaft Walls	Shaft wall system to suit	Finish outside per above, if exposed	
High Abuse Areas (Tool Storage, Kiln room, Breakout Rooms)	5/8" High-Impact Fire-Shield 2000	Finish per above.	See drawings for required locations
Fire-Rated Underlayment	5/8" Type X	Tape joints only	Use only in conjunction with a finish surface overlay system

END OF SECTION

SECTION 09 30 13
CERAMIC TILE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Glazed ceramic tile.

B. Unglazed ceramic tile.

C. Cementitious backing board.

D. Grout.

E. Accessories.

1.2 REFERENCES

A. ANSI/TCA A108.5 - Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.

B. ANSI/TCA A108.11 - Interior Installation of Cementitious Backer Units.

C. ANSI/TCA A118.1 - Dry-Set Portland Cement Mortar.

D. ANSI/TCA A118.4 - Latex-Portland Cement Mortar.

E. ANSI/TCA A118.6 - Ceramic Tile Grouts.

F. ANSI/TCA A118.9 - Test Methods and Specifications for Cementitious Backer Units.

G. ANSI/TCA A137.1 - Specifications for Ceramic Tile.

H. ASTM C1028 – Static Coefficient of Friction of Ceramic Tile.

I. ASTM D226 - Asphalt-Saturated Felt Used in Roofing and Waterproofing.

J. ASTM D2047 – Static Coefficient of Friction Test.

K. TCA (Tile Council of America) - Handbook for Ceramic Tile Installation.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00, Submittals.

B. Submit Product Data for all materials specified.

C. Samples: Mount tile and apply grout on two 24 inch x 24 inch plywood panels, representative of pattern, color variations, and grout joint size variations.

D. Submit manufacturer's installation instructions, maintenance data, and recommended cleaning and stain removal methods and cleaning materials.

E. CHPS Submittals:

1. Credit EQ2.0D.P1: Provide product data, MSDS, and other official literature from manufacturer clearly identifying that the adhesives and sealants meet the testing requirements and threshold limits of the State of California Department of Health Services (DHS) *Standard Practice for the Testing of Volatile Organic Compounds*. Such products shall be either identified on the *CHPS Low-Emitting Materials Product List* or by a 3rd party certification program listing low-emitting material products that meet the State testing requirements, as identified on the CHPS website.

1.4 QUALITY ASSURANCE

A. Conform to ANSI/TCA A137.1 for tile material.

B. Conform to ANSI/TCA Standards and TCA Handbook for tile installation.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in the manufacture of products specified in this Section with minimum five years documented experience.

B. Installer: Company specializing in applying the Work of this Section with minimum five years documented experience.

C. Installer for thin porcelain tile panels to have a minimum of three documented years installation experience with this specific product.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Maintain 50 degrees Fahrenheit during installation of mortar materials.

1.7 EXTRA STOCK

A. Provide extra quantity of full size tile and trim shape units to District under provisions of Section 01 70 00.

B. Provide quantity equal to 2 percent of units installed of each shape and color.

PART 2 - PRODUCTS

2.1 MANUFACTURERS - TILES

A. Dal-Tile Corp., “Natural Hues” Series.

B. Dal-Tile Corp. Mosaic, Colorbody Porcelain

C. Substitutions under the provisions of Section 01 25 13, Product Options and Substitutions.

2.2 TILE MATERIAL

A. Ceramic Wall Tile: Clay Eco-Body

1. Moisture Absorption: Over 3.0 percent.

2. Pattern: To be selected by Architect from manufacturer’s full range of patterns.

3. Size: 6 inches x 12 inches

4. Tile Thickness: 5/16.

5. Surface Finish: Matt Glazed.

6. Grout Joint Recommendation: 1/4" approximate.

7. Color(s): To be selected by Architect from manufacturer’s full range of colors.

8. Eco-Body: 17% Post consumer recycled glass, 17% post industrial.

B. Ceramic Floor Tile: Mosaic Colorbody Porcelain/Keystones.

1. Pattern: To be selected by Architect from manufacturer’s full range of patterns.

2. Size: 3 inches x 3 inches.

3. Thickness: 1/4".

4. Grout Joint Recommendations: 1/8” approximate.

5. Surface Finish: Non-Slip with Coefficient of friction of 0.60 or greater, when tested in acceptance with ASTM C1028 or ASTM D2047.

2.3 MANUFACTURERS - MORTAR AND GROUT

A. As recommended by the manufacturer for the application indicated.

2.4 MORTAR MATERIALS

A. Portland Cement Mortar Materials: ANSI/TCA A118.1.

B. Latex-Portland Cement Mortar: ANSI/TCA A118.4.

1. Acrylic resin latex additive.

2. Dry mortar mix supplied by latex manufacturer.

2.5 GROUT MATERIALS

A. Portland Cement Grout Materials: ANSI/TCA A118.6, commercial type.

B. Latex-Portland Cement Grout: ANSI/TCA A118.6 of color selected and the following:

1. Acrylic resin latex additive.

2. Dry mortar mix supplied by latex manufacturer.

2.6 ACCESSORIES

A. Membrane: ASTM D226; No. 15 asphalt saturated roofing felt.

B. Backing Board: ANSI/TCA A118.9; high density, cementitious, glass fiber reinforced, 1/2 inch thick minimum; 2 inch wide coated glass fiber tape for joints and corners; manufacturer shall be licensed by TCA.

C. Sealant: Type specified in Section 07 90 00.

2.7 MORTAR MIX AND GROUT MIX

A. Mix and proportion pre-mix setting bed and grout materials in accordance with manufacturer's instructions and referenced standards.

2.8 SEALER

A. Tile and Grout Sealer: “Aqua Mix Penetrating Sealer” manufactured by Aqua Mix, Inc., (562) 946-6877, or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive Work.

B. Beginning of installation means installer accepts condition of existing surfaces.

3.2 PREPARATION

A. Protect surrounding Work from damage or disfiguration.

B. Vacuum clean existing surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

3.3 INSTALLATION - GENERAL

A. Install mortar, tile, and grout in accordance with ANSI/TCA 108.5 and applicable tile installation standards of the TCNA Handbook.

B. Install membrane over substrate; weatherlap horizontal edges 4 inches, lap vertical edges 6 inches.

C. Lay tile to pattern indicated. If not indicated, request from Architect. Do not interrupt tile pattern around openings.

D. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align wall, base, and floor joints.

E. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar or excess grout.

F. Form internal angles square and external angles bullnosed.

G. Sound tile after setting. Replace hollow sounding units.

H. Keep control joints free of mortar or grout. Apply sealant to joints.

I. Allow tile to set for a minimum of 48 hours prior to grouting.

J. Grout tile joints.

K. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.4 INSTALLATION - THINSET METHOD

A. Install mortar, tile, and grout in accordance with ANSI/TCA 108.5 and applicable tile installation standards of the TCA Handbook. Shower areas in accordance with TCA B415-09

B. Install backing board in accordance with manufacturer's instructions and ANSI/TCA A108.11. Tape joints and corners; cover with skim coat of dry-set mortar to a feather edge.

3.5 INSTALLATION - MORTAR BED METHOD

A. Install mortar, tile, and grout in accordance with ANSI/TCA 108.5 and applicable tile installation standards of the TCNA Handbook. Shower areas in accordance with TCA B414-09

3.7 CLEANING

B. Clean Work under provisions of 01 70 00.

C. Clean tile surfaces.

3.8 SEALING

D. Install sealer on all surfaces in accordance with manufacturer's instructions.

END OF SECTION

SECTION 09 51 00
SUSPENDED ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical panels.

C. Perimeter trim.

1.2 REFERENCES

A. ASTM A513 - Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.

B. ASTM C635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

C. ASTM C636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.

D. ASTM C641 - Zinc-Coated (Galvanized) Carbon Steel Wire.

E. ASTM E580 - Application of Ceiling Suspension Systems from Acoustic Tile and Lay-in Panels in Areas Requiring Seismic Restraint.

F. ASTM E1264 - Classification of Acoustical Ceiling Products.

G. CCR - California Code of Regulations, Title 24, Part 2, Chapter 25A.

H. DSA - Division of the State Architect.

I. CBC - California Building Code.

J. UL - Underwriters' Laboratories Building Material Directory.

1.3 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacture of ceiling suspension system and ceiling panels with five years minimum experience.

B. Installer: Company with five years minimum documented experience, approved by manufacturer.

1.4 REGULATORY REQUIREMENTS

A. Conform to CCR Title 24, Part 2, for suspension system requirements.

B. Suspension system shall be acceptable to DSA and have current product acceptance number issued by DSA.

C. Conform to applicable UL and CBC combustibility requirements for materials.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Provide Product Data on metal grid system components and acoustic units.

C. Provide product acceptance approval verification issued by DSA for metal grid system.

D. Submit two 6-inch squares Samples illustrating material and finish of acoustic units.

E. Submit two 12-inch long Samples of suspension system main runner, cross runner, and edge trim.

F. CHPS Submittals:

1. Credit EQ2.2: Provide product data, MSDS, and other official literature from manufacturer clearly identifying that the product meets the testing requirements and threshold limits of the State of California Department of Health Services (DHS) *Standard Practice for the Testing of Volatile Organic Compounds*. Such products shall be either identified on the *CHPS Low-Emitting Materials Product List* or by a 3rd party certification program listing low-emitting material products that meet the State testing requirements, as identified on the CHPS website.

2. Credit ME4.1: Provide product data, MSDS, and other official literature from manufacturer clearly identifying that the product meets the minimum levels of total and post-consumer recycled contents, as prescribed in Table 4A of CHPS criteria.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Maintain uniform temperature of minimum 60 degrees Farenheit, and humidity of 20 to 40 percent prior to, during, and after installation.

1.7 SEQUENCING/SCHEDULING

A. Do not install acoustical ceilings until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead Work is completed, tested, and approved.

B. Schedule installation of acoustic units after interior wet Work is dry.

1.8 EXTRA STOCK

A. Provide extra quantity of acoustic units to Owner under provisions of Section 01 70 00.

B. Provide quantity equal to 2 percent of units installed.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - SUSPENSION SYSTEM

A. Armstrong Ceiling Systems. DSA Product Acceptance No. PA-041.

B. Chicago Metallic Corporation. DSA Product Acceptance No. PA-026.

C. USG Interior Systems, (DONN). DSA Product Acceptance No. PA-030.

D. Substitutions: Under provisions of Section 01 62 00.

2.2 SUSPENSION SYSTEM MATERIALS

A. Grid: ASTM C635, heavy duty, non-fire-rated, exposed “T” with 15/16 inch exposed flange; components die-cut and interlocking. 2 feet x 4 feet for acoustic panels and 2 feet x 2 feet for metallic panels.

B. Accessories: Stabilizer bars, clips, splices, and edge moldings required for suspended grid system.

C. Grid Materials: Commercial quality cold-rolled steel with galvanized coating.

D. Grid Finish: Off-White color, baked enamel.

E. Support Channels and Hangers: Galvanized steel; size and type to suit application, to rigidly secure acoustic ceiling system including integral mechanical and electrical components, as detailed on Drawings.

F. Compression Strut: ASTM A513, telescoping design as detailed on Drawings, galvanized 3/4 inch diameter 14 gage rigid steel tubing with crimped end attached to roof framing and secured to 1/2 inch diameter 14 age rigid steel tubing with crimped end to main runners or equivalent pre-manufactured compression post supplied by ceiling grid manufacturer.

G. Hanger Wire: ASTM C641, Class 1 coating (galvanized), soft temper, No. 12 gage.

2.3 ACCEPTABLE MANUFACTURERS - ACOUSTIC UNITS

A. Armstrong Ceiling Systems.

B. BPB Celotex.

C. Chicago Metallic Corporation

D. USG Interiors, Inc.

E. Substitutions: Under provisions of Section 01 62 00.

2.4 ACOUSTIC UNIT MATERIALS

A. Acoustic Panels: ASTM E1264, conforming to the following:

1. Equivalent to Eclipse Clima Plus panel, manufactured by USG Corporation or approved equal.

a. Size: 24 x 48 inches.
b. Thickness: 3/4 inches.

c. Composition: Nodulated mineral fiber.

d. Light Reflectance: 0.80 percent.

e. NRC Range: .55 to .65.

f. CAC Range: 33 to 39.

g. Edge: Reveal.

h. Surface Color: White.

i. Flame Spread : (0-25) Class A, UL 25 or under.

j. Smoke Density: Not to exceed 450 when tested in accordance with UL Standard 723-03.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that existing conditions are ready to receive Work.

B. Verify that layout of hangers will not interfere with other Work.\

C. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION - GRID SYSTEM

A. Install system in accordance with ASTM C636 and ASTM E580 as supplemented in this Section and with notes on the Drawings entitled Metal Suspension Systems for Lay In Panel Ceilings.

B. Install after major above ceiling Work is complete. Coordinate the location of hangers with other Work.

C. Hang system independent of columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members. Provide cross-struts at four-foot centers for acoustic panels and at two-foot centers for metal panels.

D. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest effected hangers and related carrying channels to span the extra distance.

E. Compression struts shall be installed at each main runner not exceeding 12 feet on center in both directions and not more than 8 inches from end of main runner. Insert main 3/4 inch tube over 1/2 inch tube with a minimum 6 inch lap. Secure crimped end of main 3/4 inch tube to structural framing with metal screws and 1/2 inch tube to main runner with metal screws. Secure tube sections together with 2 set screws. Install prefabricated compression post according to manufacturer's recommendations.

F. Locate grid system on room axis according to reflected ceiling plan. Trim edge panels precisely to fit using table saw. Reject cut pieces which are deformed or damaged during cutting.

G. Do not eccentrically load system, or produce rotation of runners.

H. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions.

3.3 INSTALLATION - ACOUSTIC UNITS

A. Field reveal cut edge of perimeter tiles to match factory reveal edge. Paint cut surface if necessary to match surface of tile.

B. Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Lay directional patterned units one way in room. Fit border neatly against abutting surfaces.

D. Install acoustic units level, in uniform plane, and free from twist, warp and dents.

3.4 TOLERANCES

A. Maintain tolerances in accordance with Section 01 44 00.

B. Variation from Flat and Level Surface: 1/8 inch in 10 feet.

C. Variation from Plumb of Grid Members Caused by Eccentric Loads: Two degrees maximum.

END OF SECTION

SECTION 09 54 23
LINEAR METAL CEILINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Section includes strip, linear metal pans and suspension systems for ceilings.

1.2 REFERENCES

A. ASTM A513 - Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.

B. ASTM C635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

C. ASTM C636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.

D. ASTM C641 - Zinc-Coated (Galvanized) Carbon Steel Wire.

E. ASTM E580 - Application of Ceiling Suspension Systems from Acoustic Tile and Lay-in Panels in Areas Requiring Seismic Restraint.

F. ASTM E1264 - Classification of Acoustical Ceiling Products.

G. CCR - California Code of Regulations, Title 24, Part 2, Chapter 25A.

H. DSA - Division of the State Architect.

I. CBC - California Building Code.

J. UL - Underwriters' Laboratories Building Material Directory.

1.3 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacture of ceiling suspension system and ceiling panels with five years minimum experience.

B. Installer: Company with five years minimum documented experience, approved by manufacturer.

1.4 REGULATORY REQUIREMENTS

A. Conform to CCR Title 24, Part 2, for suspension system requirements.

B. Suspension system shall be acceptable to DSA and have current product acceptance number issued by DSA.

C. Conform to applicable UL and CBC combustibility requirements for materials.

1.5 COORDINATION

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

1.6 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Provide Product Data on metal grid system components and acoustic units.

C. Provide product acceptance approval verification issued by DSA for metal grid system.

1.7 SEQUENCING/SCHEDULING

A. Do not install acoustical ceilings until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead Work is completed, tested, and approved.

B. Schedule installation of acoustic units after interior wet Work is dry.

1.8 EXTRA STOCK

A. Provide extra quantity of acoustic units to Owner under provisions of Section 01 70 00.

B. Provide quantity equal to 2 percent of units installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Exterior linear metal ceilings shall withstand exterior exposure and the effects of gravity loads and the following loads and stresses without showing permanent deformation of ceiling system components including pans and suspension system; noise or metal fatigue caused by vibration, deflection, and displacement of ceiling pans; or permanent damage to fasteners and anchors. Wind Load: 30 lb/SF. Seismic Criteria: Provide linear metal ceilings designed and

installed to withstand the effects of earthquake motions according to: Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580 / E 580M.

2.2 ACCEPTABLE MANUFACTURERS - SUSPENSION SYSTEM

A. USG Paraline II or approved equal.

2.3 LINEAR METAL CEILING PANS

A. Acoustical Metal Pan Standard: Provide manufacturer's standard linear metal pans of configuration indicated that comply with ASTM E 1264 classifications as designated by types, acoustical ratings, and light reflectances unless otherwise indicated.

B. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated to snap on and be securely retained on carriers without separate fasteners, and finished to comply with requirements indicated.

C. Pan Splices: Construction same as pans, in lengths 8 to 12 inches (200 to 300 mm); with manufacturer's standard finish.

D. End Caps: Metal matching pans; fabricated to fit and conceal exposed ends of pans.

E. Filler Strips: Metal matching pans; fabricated to uninterruptedly close voids between pans.

Moldings and Trim: Provide manufacturer's standard moldings and trim for exposed members, and as indicated or required, for edges and penetrations of ceiling, around fixtures, at changes in ceiling height, and for other conditions; of same metal and finish as linear metal ceiling pans.

F. Sound-Absorbent Fabric Layer: (Interior only.) Provide fabric layer, sized to fit concealed surface of pan, and consisting of black, nonwoven, nonflammable, sound-absorbent material with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing per ASTM E 84.

2.4 SUSPENSION SYSTEM MATERIALS

A. Metal Suspension Systems Standard: Provide ceiling manufacturer's standard metal suspension systems of types and finishes indicated that comply with applicable ASTM C 635/C 635M requirements.

B. Suspension Systems: Provide systems complete with carriers, splice sections, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips,

load-resisting struts, fixture adapters, and other suspension components required to support ceiling units and other ceiling-supported construction.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, Direct Hung, unless otherwise indicated. Zinc coated for exterior application.

D. Wire Hangers, Braces, and Ties: Provide wire complying with the following requirements:

1 Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2 Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
3 Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
4 Size: Select wire diameter so its stress at 3 times the hanger design load indicated in ASTM C 635/C 635M, Table 1, Direct Hung is less than yield stress of wire, but provide not less than 0.135-inch- diameter wire.

E. Main Carriers: Steel, not less than 0.0209-inch (0.53-mm) nominal thickness, cold-rolled sheet, with factory-applied protective coating, complying with ASTM C 635/C 635M.

F. Carrier Splices: Same metal, profile, and finish as for carriers.

G. Stabilizer Channels, Tees, and Bars: Manufacturer's standard components for stabilizing main carriers at regular intervals and at light fixtures, air-distribution equipment, access doors, and other equipment; spaced as standard with manufacturer for use indicated; and factory finished with matte-black baked finish.

H. Accessories: Stabilizer bars, clips, splices, and edge moldings required for suspended grid system.

I. Grid Materials: Commercial quality cold-rolled steel with galvanized coating.

J. Support Channels and Hangers: Galvanized steel; size and type to suit application, to rigidly secure acoustic ceiling system including integral mechanical and electrical components, as detailed on Drawings.

K. Compression Strut: ASTM A513, telescoping design as detailed on Drawings, galvanized 3/4 inch diameter 14 gage rigid steel tubing with crimped end attached to roof framing and secured to 1/2 inch diameter 14 age rigid steel tubing with crimped end to main runners or equivalent pre-manufactured compression post supplied by ceiling grid manufacturer.

L. Exterior Bracing: Cold-rolled steel channels and angles, hot-dip galvanized to comply with ASTM A 653/A 653M, G60 (Z180) coating designation; size and profile as required to withstand wind load.

M. Hold-Down Clips: Manufacturer's standard hold-down clips spaced as standard with manufacturer.

N. Edge Moldings and Trim: Provide exposed members as indicated or required to comply with seismic requirements of authorities having jurisdiction, to conceal edges of penetrations through ceiling, to conceal ends of pans and carriers, for fixture trim and adapters, for fasciae at changes in ceiling height, and for other conditions; of metal and finish matching linear metal pans unless otherwise indicated.

2.5 ACCESSORIES

A. Access Panels: For access at locations indicated, provide door hinge assembly, retainer clip, and retainer bar, assembled with ceiling panels and carrier sections into access panels of required size, permitting upward or downward opening.

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. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that existing conditions are ready to receive Work.

B. Verify that layout of hangers will not interfere with other Work.\

C. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION - GRID SYSTEM

A. Install system in accordance with ASTM C636 and ASTM E580 as supplemented in this Section and with notes on the Drawings entitled Metal Suspension Systems for Lay In Panel Ceilings.

B. Install after major above ceiling Work is complete. Coordinate the location of hangers with other Work.

C. Hang system independent of columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members. Provide cross-struts at four-foot centers for acoustic panels and at two-foot centers for metal panels.

D. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest effected hangers and related carrying channels to span the extra distance.

E. Compression struts shall be installed at each main runner not exceeding 12 feet on center in both directions and not more than 8 inches from end of main runner. Insert main 3/4 inch tube over 1/2 inch tube with a minimum 6 inch lap. Secure crimped end of main 3/4 inch tube to structural framing with metal screws and 1/2 inch tube to main runner with metal screws. Secure tube sections together with 2 set screws. Install prefabricated compression post according to manufacturer's recommendations.

F. Locate grid system on room axis according to reflected ceiling plan. Trim edge panels precisely to fit using table saw. Reject cut pieces which are deformed or damaged during cutting.

G. Do not eccentrically load system, or produce rotation of runners.

H. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions.

3.3 INSTALLATION

A. Comply with ASTM C 636/C 636M and seismic requirement indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns.

C. Install edge moldings and trim of type indicated at perimeter of linear metal ceiling area and where necessary to conceal edges and ends of linear metal pans.

D. Install suspension system carriers so they are aligned and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Cut linear metal pans for accurate fit at borders and at interruptions and penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.

F. Install linear metal pans in coordination with suspension system and exposed moldings and trim.

G. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions unless otherwise indicated.

H. Fit adjoining units to form flush, tight joints. Scribe and cut units for accurate fit at borders and around construction penetrating ceiling.

I. Install pans with butt joints using internal pan splices Staggered a minimum of 12 inches.

J. Install sound-absorbent pads at right angle to perforated metal pans so pads do not hang unsupported.

K. Install hold-down clips where indicated.

3.4 TOLERANCES

A. Maintain tolerances in accordance with Section 01 44 00.

B. Variation from Flat and Level Surface: 1/8 inch in 10 feet.

C. Variation from Plumb of Grid Members Caused by Eccentric Loads: Two degrees maximum.

END OF SECTION

SECTION 09 65 16
RESILIENT FLOORING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Linoleum sheet flooring.

B. Resilient stair treads.

C. Resilient top-set base.

D. Calcium chloride, relative humidity and alkalinity concrete moisture testing.

1.2 REFERENCES

A. ADAAG - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities.

B. CCR - California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.

C. ASTM D2047 - Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.

D. ASTM E648 - Test Method for Critical Radiant Flux of Floor-Covering Systems using a Radiant Energy Source.

E. ASTM E662 - Test Method for Specific Optical Density of Smoke Generated by Solid Materials.

F. ASTM F710 - Practice for Preparing Concrete Floors and other Monolithic Floors to Receive Resilient Flooring.

G. ASTM F970 - Standard Test Method for Static Load Limit.

H. ASTM F1869 - Test method for moisture content.

I. FS RR-T-650 - Treads, Metallic and Non-metallic, Non-skid.

J. ASTM F1861 - Wall Base: Rubber and Vinyl Plastic.

K. NFPA 258 - Recommended Practice for Determining Smoke Generation of Solid Materials.

L. ASTM F1869 – Standard test Method for Moisture Vapor Emission Rate of Concrete

M. ASTM F2170 – Standard test Method for Determining Relative Humidity in Concrete

1.3 REGULATORY REQUIREMENTS

A. Resilient flooring shall comply with the following fire performance characteristics as determined by testing products per ASTM test method indicated below:

1. Critical Radiant Flux: 0.45 watts per sq cm or more per ASTM E648.

2. Smoke Density: Less than 450 per ASTM E662.

B. Products supplied for tile installation shall comply with local regulations controlling use of volatile organic compounds (VOC).

C. Resilient flooring products shall have a minimum coefficient of friction when tested according to ASTM D2047 of 0.60 for flat floors and 0.80 for ramped surfaces.

D. Conform to CCR, Title 24, Part 2, and ADAAG for access for the handicapped.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Submit substitutions under provisions of Section 01 62 00.

C. Submit two 3-inch square Samples illustrating color and pattern for each floor material specified.

D. Submit two 2-inch long Samples of base and stair material for each material specified.

E. Submit two copies of concrete test results and locations map with manufacturer's acceptance of concrete slab as substrate.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit cleaning and maintenance data under provisions of Section 01 70 00.

B. Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Concrete subfloor shall be allowed to cure for a minimum of 90 days to achieve acceptable dryness.

B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

C. Maintain ambient temperature required by adhesive manufacturer three days prior to, during, and 24 hours after installation of materials.

D. Subfloor Moisture Conditions: Moisture emission rate of both new and existing floors of no more than 3 lb/1000 sq. ft./24 hours when tested by ASTM F1869 with subfloor temperature not less than 65 degrees Fahrenheit in the presence of the Inspector of Record.

E. Subfloor Alkalinity Conditions: A pH range of between 5 to 9 when subfloor is wetted with potable water and pHdrion paper is applied.

1.7 WARRANTY FOR MOISTURE, VAPOR, AND/OR ALKALINITY MITIGATION

A. System shall carry a minimum 10-year warranty for both labor and finish materials if subsequent flooring material failure is due to slab substrate generated emission and/or alkalinity. No exclusions for moisture vapor emission changes that occur at a later date from that of control system testing are allowed.

B. System shall be compatible with all floor finished and adhesives.

C. Systems shall deeply penetrate and seal the substrate and provide a smooth surface suitable to accept new floor finish material.

D. System shall be three-component consisting of a penetrating sealer, a primer and a polymerized topcoat and shall be approved by the applicator of the finish floor surface.

1.8 EXTRA MATERIALS

A. Provide 100 square feet of flooring and 100 lineal feet of base and stair materials of each material specified under provisions of Section 01 70 00.

1.9 CALCIUM CHLORIDE TEST

A. Perform test in presence of Inspector of Record.

B. The concrete surface shall be clean and void of all oils, adhesives, patching compounds and any other substances which will inhibit the natural transmission of moisture from the surface. Have the test area scarified by shotblasting.

C. Room temperature must be ecological-valid, that is, similar to the environment in which the floor covering will be installed and occupied by people. Do not conduct the test when the slab surface temperature is less than 65 degrees Fahrenheit for (3) days prior to, and during the test procedure. Never conduct the test when concrete is within 5 degrees of dewpoint.

D. Prior to exposure, the Petrie dish containing anhydrous calcium shall be weighed on a gram weight scale. The exact weight, date, and time shall be recorded.

E. Expose crystal dish according to manufacturer's instruction. After 60 to 72 hours exposure time, again record the date and time. Weigh the dish again. A formula for Pounds computation is enclosed with manufacturer's instructions.

F. Compute pounds and report the test results to the Architect, Contractor and Owner. Post-weigh within 1 hour after exposure.

G. A minimum of three test kits for the first 1,000 square feet surface area is required. Add one more test unit for each additional 1,000 square feet surface area.

H. Maximum Moisture Content: 3 pounds.

PART 2 - PRODUCTS

2.1 ACCEPTABLE FLOOR SLAB PREPARATION/MITIGATION FIRMS

A. Creteseal.

B. Floor Seal Technology.

C. Sinak Corporation.

2.2 LINOLEUM SHEET FLOORING

A. Manufacturers: Marmoleum® Composition Sheet (MCS) linoleum sheet.

B. Linoleum Sheet Flooring: ASTM F2034, sheet linoleum material consisting of linseed oil, wood flour and rosin binders meeting the following characteristics:

1. Thickness: 2.5 millimeters.

2. Width: Approximately 6 feet 6 inches.

3. Length: Approximately 98 feet.

4. Static Load Limit: ASTM F970, 450 psi.

5. Backing: Jute.

6. Pattern and Color: Extending throughout material. To be selected by Architect from manufacturer's entire range.

C. Integral Coved Base: Self-coved of same material as flooring, 6 inches high with continuous rubber cap trim, and fillet support strip.

2.3 RESILIENT STAIR TREADS

A. Manufacturers: BurkeMercer, Flexco Company, Johnsonite, Roppe Corporation, or approved equal.

B. Resilient Stair Treads: FS RR-T-650, Type 2 raised diamond pattern equivalent to "Natural Illusions" as manufactured by BurkeMercer Flooring Products; Composition A Rubber; 1/4 inch thick, full width and depth of stair tread in one piece; return down

nosing edge of tread 1-1/2 inch with tapered thickness. Two-inch visual warning strip of contrasting color and texture on top and bottom tread.

C. Stair Risers and Stringers: Paint per Specification Section 09 91 00.

2.4 RESILIENT TOP-SET BASE

A. Manufacturers: Armstrong World Industries, BurkeMercer, Roppe Corporation, or approved equal.

B. Resilient Top-Set Base: ASTM F1861, [rubber] [vinyl]; Style B coved; 4 inches high; 0.125 inch thick.

2.5 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.

C. Edge Strips: Vinyl type, color as selected by Architect.

D. Sealer and Wax: Types recommended by flooring manufacturer.

E. Welding Rods for Linoleum Flooring: Color matched welding rod.

F. Concrete Testing Equipment: American Moisture Test, Inc. (866) 670-9700
1. ASTM F1869 Water vapor emission
2. ASTM F710 Digital alkalinity-pH testing
3. ASTM F2170 In-concrete relative humidity

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that concrete slabs comply with ASTM F710.

B. Verify concrete floors exhibit acceptable moisture emission rate; exhibit negative alkalinity, carbonization, or dusting.

C. Perform concrete moisture testing at a rate of three tests for areas up to 1,000 square feet and one test for each 1,000 square feet thereafter in accordance with the following test methods:
1. ASTM F1869 water vapor emission: shall not exceed 3.0 lbs.
2. ASTM F2170 in-concrete relative humidity: shall not exceed 75%
3. ASTM F710 digital alkalinity-pH testing: shall not exceed 9.0pH

E. Verify that surfaces are smooth and flat and are ready to receive Work.

C. Perform calcium chloride test.

F. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

A. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.

B. Apply, trowel, and float filler to leave a smooth, flat, hard surface.

C. Prohibit traffic from area until filler is cured.

D. Vacuum clean substrate.

E. Apply primer to concrete slab surfaces if recommended by flooring manufacturer.

3.3 INSTALLATION - TILE AND SHEET MATERIAL

A. Install in accordance with manufacturers' instructions.

B. Mix tile from container to ensure shade variations are consistent.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Set flooring in place; press with heavy roller to attain full adhesion.

E. Install tile to square grid pattern with all joints aligned and to pattern indicated on drawings.

F. Pattern grain parallel for all units and parallel to width of room. Allow minimum 1/2 full size tile width at room or area perimeter.

G. Lay flooring with seams parallel to length of room to produce minimum number of seams. Provide minimum of 1/3 full roll width. Double cut sheet and continuously heat weld seams.

H. Terminate flooring and provide rubber edge strip at centerline of door openings where adjacent floor finish is dissimilar.

I. Install edge strips at unprotected or exposed edges, and where flooring terminates.

J. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

K. Install flooring in pan type floor access covers. Maintain floor pattern.

L. Install flooring under movable partitions and under cabinetry without interrupting floor pattern.

M. Install feature strips, edge strips, and floor markings where indicated. Fit joints tightly.

N. Allow for 25 percent accent color pattern unless noted otherwise.

O. Heat weld all seams of sheet flooring.

3.4 INSTALLATION - BASE MATERIAL

A. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.

B. Miter internal corners.

C. Field wrap external corners with longest practical lengths. "V" cut back surface to 2/3 its thickness.

D. Install base on solid backing. Bond tight to wall and floor surfaces.

E. Scribe and fit to door frames and other interruptions.

F. Install base at casework where occurs in rooms scheduled for rubber base.

G. Install integral coved base in flash-coved method. Install cap trim at top of base where edge of flooring is exposed. Install radiused backing fillet at wall and floor juncture. Heat weld all seams.

3.5 INSTALLATION - STAIR COVERING MATERIALS

A. Install stair treads, one piece for full width and depth of tread.

B. Adhere over entire surface. Fit accurately and securely.

3.6 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

3.7 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean, seal, and wax floor and base surfaces in accordance with manufacturer's instructions.

C. At the very minimum, four layers of wax shall be applied, sufficient to fully seal the floor surface to a smooth lustrous finish and to completely fill all joints and any voids or cracks between tiles.

D. The finished floor, completely waxed, shall be reviewed by the Owner and deemed satisfactory. If, in the opinion of the Owner, additional coats are required, the Contractor shall apply these at no expense to the Owner.

END OF SECTION

SECTION 09 72 16
WALL COVERINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.

B. Prime painting.

C. Tackablel wall covering.

D. Whiteboard wall covering.

E. Adhesives and accessories.

1.2 REFERENCES

A. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

B. CFFA-W-101-B - Chemical Fabrics and Film Association Quality Standard for Vinyl Coated Fabric Wall Covering.

C. FS CCC-W-408 A and B - Wall Covering, Vinyl Coated.

D. UL - Underwriters Laboratories, Inc.

1.3 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing commercial wall coverings with five years documented experience.

B. Applicator: Company specializing in installing commercial wall coverings with five years documented experience.

1.4 REGULATORY REQUIREMENTS

A. Conform to flame/smoke developed ratings of no more than 25/50 when tested according to ASTM E84 by UL.

B. Each roll of material used shall have UL labels affixed thereto verifying tests.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Submit two 12-inch square samples of wall coverings illustrating color, finish, and texture.

C. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

D. Submit test reports verifying flame/smoke ratings.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and protect products under provisions of Section 01 87 00.

B. Inspect roll materials on site to verify acceptance.

C. Protect packaged adhesive from temperature cycling.

D. Do not store roll goods on end.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Provide continuous ventilation and heating facilities to maintain substrate surface and ambient temperatures above 60 degrees Fahrenheit, unless required otherwise by manufacturer's instructions.

B. Do not apply adhesive when substrate surface temperature or ambient temperature is below 60 degrees Fahrenheit or relative humidity is above 40 percent.

C. Maintain these conditions 72 hours before, during, and after installation of wall covering.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Muraspec, North America: ‘Genon’ or ‘Guard’ brand.

B. MDC: ‘Bolta’ brand.

C. Maharam Wallcoverings.

D. Koroseal Wallcoverings

E. Substitutions: Under provisions of Section 01 62 00.

2.2 MATERIALS

A. Tackable Wall Covering: Vinyl fabric roll stock, conforming to FS CCC-W-408 A and B and CFFA W-101-B for Type II wallcovering and the following:

1. Total Weight: 20.0 oz/lin yd.

2. Roll Width: 54 inches

3. Color: As selected by Architect.

4. Pattern: As selected by Architect.

5. Fire Rating, ASTM E84: Class A.

   a. Flame Spread: 15.

   b. Smoke Developed: 20.

6. Stain Resistance: ASTM D-1308, Method B: 24 hour exposure followed by washing with soap and water.

a. Ethanol	Pencil	Tea	10 percent Hydrochloric Acid	
b. Vinegar	Mayonnaise	Milk	10 percent Sodium Hydroxide	
c. Detergent	Bleach	Coca-Cola	Oleic Acid	
d. Lemon Juice	Crayon	Pot Wine	10 percent Ammonia	
e. Coffee	Ketchup	Hydrogen Peroxide		

B. Markerboard Wall Covering: Walltalkers projectable Mag-Rite 48 by Koroseal (magnetized and projectable whiteboard) wall covering to conform to :

7. Description: scrim backed, ferrous sheet bonded with white pigmented vinyl capped with matte, projectable, dry erase film.

8. Roll Width: 48 inches

9. Color: Matte White.

10. Pattern Match: Straight match, reverse hang.

11. Fire Rating, ASTM E84: Class A.

12. Attachment: Heavy duty clear or clay based premixed vinyl adhesive.

2.3 ACCESSORIES

A. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate. Mildew-resistant, non-staining, and strippable.

B. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.

C. Substrate Primer and Sealer: As recommended by adhesive and wall covering manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that substrate surfaces are ready to receive Work, and conform to requirements of the wall covering manufacturer.

B. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet nor vary at a rate greater than 1/16 inch/foot.

C. Beginning of installation means acceptance of substrate.

3.2 PREPARATION

A. Fill cracks and smooth irregularities with filler; sand smooth.

B. Sand glossy surfaces. Shellac stains or marks which may bleed.

C. Remove electrical and telephone wall plates, covers and wall mounted fixtures.

D. Vacuum clean surfaces free of loose particles.

E. Prime and seal substrate in accordance with manufacturer's recommendations. Apply surface sealer to gypsum drywall which will permit subsequent removal of wallcovering without damage to paper facing.

3.3 INSTALLATION

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.

B. Apply adhesive to fabric surface immediately prior to application of wall covering.

C. Use wall covering in roll number sequence.

D. Register or reverse pattern of wall covering to insure color uniformity.

E. Razor trim edges on flat work table. Do not razor cut on gypsum board surfaces.

F. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface. Butt edges tight.

G. Horizontal seams are not acceptable.

H. Do not seam within 6 inches of internal or external corners.

I. Install wall covering before installation of bases, cabinets, hardware, or items attached to or spaced slightly from wall surface. Do not install wall covering more than 1/4 inch below top of resilient base.

J. Cover spaces above and below windows, above doors, in sequence from roll.

K. Where wall covering tucks into door frame reveals, or metal wallboard or plaster stops, apply covering with contact adhesive within 6 inches of wall covering termination. Ensure full contact bond.

L. Remove excess wet adhesive from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.4 CLEANING

A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.

B. Replace wall plates and accessories removed prior to Work of this Section.

3.5 PROTECTION

A. Protect finished installation under provisions of Section 01 87 00.

END OF SECTION

SECTION 09 84 00
SURFACE-APPLIED ACOUSTICAL PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cement/wood fiber beveled edge panels.

1.2 REFERENCES

A. ASTM C423: Standard Test Method for Sound Absorption and Sound Coefficients by the Reverberation Room Method.

B. ASTM E-84: Standard Test Method for Surface Burning Characteristics of Building Materials.

C. ASTM E-1264: Standard Classification for Acoustical Ceiling Products.

1.3 PERFORMANCE REQUIREMENTS

A. Meet the requirements of ASTM E-84 for flame spread of 25 or less.

B. Meet the requirements of ASTM C423 for NRC value noted for panel type.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Submit Shop Drawings indicating panel layout, locations of furring strips and insulation.

C. Submit Product Data for panels and unit supports.

D. Submit Samples for selection by Architect. Submit color samples for selection by Architect.

E. Submit four 12-inch square Samples illustrating panel composition, edge banding, support method, and finish color and texture.

F. Submit test reports under provisions of Section 01 44 00.

G. Submit test report indicating flame spread and sound absorption.

H. Submit manufacturer's certification that products meet or exceed specified requirements.

I. Submit manufacturer's installation instructions.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit maintenance data under provisions of Section 01 70 00.

B. Include cleaning and replacement of damaged fabrics.

C. Include cleaning and stain removal methods and recommended cleaning materials, polishes, and waxes.

1.6 QUALITY ASSURANCE

A. Install in accordance with manufacturer's instructions.

B. Maintain one copy of document on site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in the manufacture of products specified in this Section with minimum five years documented experience.

B. Installer: Company specializing in applying the Work of this Section with minimum five years documented experience and approved by manufacturer.

1.8 MOCK-UP

A. Provide mock-up of panels under provisions of Section 01 44 00.

B. When accepted, mock-up will demonstrate minimum standard for the Work. Approved mock-up may remain as part of the Work.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and protect products under provisions of Section 01 87 00.

B. Accept packaged panel assemblies on-site. Verify damage.

C. Protect all material from weather by storing indoors in properly ventilated area.

1.10 WARRANTY

A. Provide five-year warranty under provisions of Section 01 70 00.

B. Warranty: Include coverage for panel deterioration and support failure.

1.11 EXTRA MATERIALS

A. Submit maintenance materials under provisions of Section 01 70 00.

B. Provide three extra panels of each panel type, size, and color.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. As specified in 2.2.

B. Substitutions: Under provisions of Section 01 62 00.

2.2 MANUFACTURED UNITS

A. Acoustical Panel: Cement/wood fiber beveled edge panels. Tectum, Inc. long edges beveled, square ends;

1. Depth: 1 inches.

2. Size: as indicated on drawings.

3. Color: Manufacturer's standard white. Field paint to achieve design shown on drawings.

4. Surface Pattern: None.

5. Mounting Style: (C-40) – Screwed to 1-½" furring strips with 2-½" batt insulation over 2x furring strips at 24" on center.

6. NRC rating: .85 minimum.

2.3 ACCESSORIES

A. As required by manufacturers for each style.

2.4 FACTORY FINISHING

A. Apply factory finishes in strict accordance with the ASTM requirements as tested.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that substrate is ready to receive Work.

B. Verify field measurements are as shown on approved Shop Drawings.

C. Verify that required electrical and other utilities are in place, in proper locations, and ready for use.

D. Verify that all painting and other surface treatment has been satisfactorily completed prior to beginning installation.

E. Verify that all supporting material is in proper locations as shown on approved Shop Drawings.

F. Beginning of installation means installer accepts existing substrate conditions.

3.2 PREPARATION

A. Clean surfaces to be covered.

B. Protect elements surrounding the Work of this Section from damage or disfiguration.

3.3 INSTALLATION

A. Install in accordance with manufacturer's recommendations and instructions.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Coordinate with installation of finish electrical Work and any other Work that impacts the panel installation.

3.5 TOLERANCES

A. Maximum Variation From Level: 1/8 inch in 4 feet.

B. Maximum Offset From True Alignment: 1/4 inch.

3.6 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Section 01 45 29.

3.7 CLEANING

A. Clean Work under provisions of Section 01 70 00.

B. Clean panel surfaces.

3.8 PROTECTION

A. Protect finished installation under provisions of Section 01 87 00.

B. Provide poly-wrap or other protective means.

C. Do not permit traffic in contact with surfaces or protect as necessary.

END OF SECTION

SECTION 09 91 00
PAINTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.

B. Products and application.

C. Surface finish schedule.

1.2 REFERENCES

A. ASTM D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.

B. ASTM D2016 - Test Method for Moisture Content of Wood.

1.3 SYSTEM DESCRIPTION

A. Preparation of all surfaces to receive final finish.

B. Painting and finishing Work of this Section using coating systems of materials including primers, sealers, fillers, and other applied materials whether used as prime, intermediate, or finish coats.

C. Surface preparation, priming, and finish coats specified in this Section are in addition to shop-priming and surface treatment specified under other Sections.

D. Painting and finishing all exterior and interior surfaces of materials including structural, mechanical, and electrical Work on site, in building spaces, and above or on the roof.

E. Paint exposed surfaces except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces.

1.4 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this Section.

1.5 QUALITY ASSURANCE

A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products with five years experience.

B. Applicator: Company specializing in commercial painting and finishing with five years documented experience.

C. Regulatory Requirements: Comply with applicable codes and regulations of governmental agencies having jurisdiction including those having jurisdiction over airborne emissions and industrial waste disposal. Where those requirements conflict with this specification, comply with the more stringent provisions. Comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA).

D. Coats: The number of coats specified is the minimum number acceptable. If full coverage is not obtained with the specified number of coats, apply such additional coats as are necessary to produce the required finish.

E. Employ coats and undercoats for all types of finishes in strict accordance with the recommendations of the paint manufacturer.

F. Provide primers and undercoat paint produced by the same manufacturer as the finish coat.

1.6 SUBMITTALS

A. Submit under provisions of Section 01 33 00, Submittals.

B. Provide manufacturer's technical information and instructions for application of each material proposed for use by catalog number.

C. List each material by catalog number and cross-reference specific coating with specified finish system.

D. Provide manufacturer's certification that products proposed meet or exceed specified materials.

E. Submit two 8-1/2 inch x 11 inch samples of each paint color and texture applied to cardboard. Resubmit samples until acceptable color, sheen and texture is obtained.

F. On same species and quality of wood to be installed, submit two 4 x 8 inch Samples showing system to be used.

G. Provide product data, MSDS, and other official literature from manufacturer identifying that the INTERIOR APPLIED products meet the testing requirements and threshold limits of the State of California Department of Health Services (DHS) *Standard Practice for the Testing of Volatile Organic Compounds*. Such products shall be identified by a 3rd party certification program listing low-emitting material products. Contractor to clearly highlight, circle and call out on the product literature, identifying how the product complies.

1.7 FIELD SAMPLES

A. Provide field samples under provisions of Section 01 33 00, Submittals.

B. On wall surfaces and other exterior and interior components, duplicate specified finishes on at least 100 square feet of surface area.

C. Provide full-coat finishes until required coverage, sheen, color and texture are obtained.

D. Simulate finished lighting conditions for review of field samples.

E. After finishes are accepted, the accepted surface may remain as part of the Work and will be used to evaluate subsequent coating systems applications of a similar nature.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver the products to site and store and protect under provisions of Section 01 66 00, Product Delivery, Storage, and Handling.

B. Deliver products to site in sealed and labeled containers; inspect to verify acceptance.

C. Container labeling to include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation, and instructions for mixing and reducing. Paint containers not displaying product identification will not be acceptable.

D. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in well ventilated area, unless required otherwise by manufacturer's instructions.

E. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees F for 24 hours before, during, and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is above 50 percent, unless required otherwise by manufacturer's instructions.

C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

D. Minimum Application Temperature for Varnish and Urethane Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 feet candles measured mid-height at substrate surface.

1.10 EXTRA STOCK

A. Provide a ten gallon container of each finish paint color to Owner for touchup.

B. Label each container with color, texture, and room locations in addition to the manufacturer's label.

1.11 QUALITY ASSURANCE

A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products with five years experience.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Unless specifically identified otherwise, product designations are those of the Kelly-Moore Paint Company and shall serve as the standard for kind, quality, and function.

B. Subject to compliance with requirements, other manufacturers offering equivalent products are:

1. Benjamin Moore Paints.

2. Frazee Paint (McCloskey, Ameron).

3. ICI Paint Stores.

4. Dunn-Edwards Corporation.

5. Pittsburgh Paints.

6. Sherwin Williams.

7. Spectra-Tone Paint Corp.

8. Tnemec Company, Inc.

9. Vista Paint Corporation.

C. Substitutions: Under provisions of Section 01 25 13, Product Options and Substitutions.

2.2 MATERIALS

A. Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating.

B. Good flow and brushing properties; capable of drying or curing free of streaks or sags.

C. Accessory Materials: Linseed oil, shella, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

D. INTERIOR APPLIED Paint shall be low-emitting and must meet the testing requirements and threshold limits of the State of California Department of Health Services (DHS) *Standard Practice for the Testing of Volatile Organic Compounds*. Such products shall be identified by a 3rd party certification program listing low-emitting material.

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2.3 FINISHES

A. Refer to schedule at end of Section for surface finish schedule.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.

B. Examine surfaces to be finished prior to commencement of Work. Report any condition that may potentially affect proper application.

C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Plaster and Gypsum Wallboard: 12 percent.

2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.

3. Interior Located Wood: 15 percent, measured in accordance with ASTM D2016.

4. Exterior Located Wood: 15 percent, measured in accordance with ASTM D2016.

D. Beginning of installation means acceptance of existing surfaces.

3.2 SURFACE PREPARATION

A. Remove electrical plates, hardware, light fixture trim, and fittings prior to preparing surfaces or finishing.

B. Correct minor defects and clean surfaces which affect Work of this Section.

C. Shellac and seal marks which may bleed through surface finishes.

D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

E. Aluminum Surfaces: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

F. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

G. Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

H. Gypsum Board: Repair all voids, nicks, cracks and dents with patching materials and finish flush with adjacent surface. Latex fill minor defects. Spot prime defects after repair.

I. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Pretreat with phosphoric acid etch or vinyl wash. Apply coat of etching primer the same day as pretreatment is applied.

J. Concrete and Unit Masonry: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

K. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

L. Uncoated Steel and Iron: Remove grease, scale, dirt, and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.

M. Shop Primed Steel: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

N. Interior Wood: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.

O. Exterior Wood: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied.

P. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

Q. Wood Doors: Seal top and bottom edges with 2 coats of spar varnish sealer.

R. Wood Fiber Acoustic Wall Panels: Clean surfaces, remove dirt and grease, prepare to manufacturers recommended installation instructions. Paint prior to installation, paint all edges.

3.3 PROTECTION OF ADJACENT WORK

A. Protect elements surrounding the Work of this Section from damage or disfiguration.

B. Repair damage to other surfaces caused by Work of this Section.

C. Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.

D. Remove empty paint containers from site.

3.4 WORK NOT TO BE PAINTED

A. Painting is not required on surfaces in concealed and inaccessible areas such as furred spaces, foundation spaces, utility tunnels, pipe spaces and duct shafts.

B. Do not paint metal surfaces such as stainless steel, chromium plate, brass, bronze, and similar finished metal surfaces.

C. Do not paint anodized aluminum or other surfaces which are specified to be factory pre-finished.

D. Do not paint sandblasted or architecturally finished concrete surfaces.

E. Do not paint over Underwriters Laboratories, Factory Mutual or other code-required labels or identifications.

3.5 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Do not apply finishes to surfaces that are not dry.

C. Apply each coat to uniform finish.

D. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

E. Sand lightly between coats to achieve required finish.

F. Allow applied coat to dry before next coat is applied.

G. The number of coats specified is the minimum that shall be applied. Apply additional coats when undercoats, stains or other conditions show through final paint coat, until paint film is of uniform finish, color and appearance.

H. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

I. Prime back surfaces of interior and exterior woodwork with primer paint.

J. Prime back surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

K. Paint mill finished door seals to match door or frame.

L. Paint primed steel glazing stops in doors to match door or frame.

M. Cloudiness, spotting, lap marks, brush marks, runs, sags, spikes and other surface imperfections will not be acceptable.

N. Where spray application is used, apply each coat of the required thickness. Do not double back to build up film thickness of two coats in one pass.

O. Where roller application is used, roll and redistribute paint to an even and fine texture. Leave no evidence of roller laps, irregularity of texture, skid marks, or other surface imperfections.

P. For painting of exterior patchwork, paint to the nearest surface break.

3.6 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Paint shop primed equipment. Do not paint shop prefinished items.

B. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

C. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are prefinished.

D. Replace identification markings on mechanical or electrical equipment when painted accidentally.

E. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

F. Replace electrical plates, hardware, light fixture trim, and fittings removed prior to finishing.

G. Paint grilles, registers, and diffusers which do not match color of adjacent surface.

H. Paint all mechanical and electrical equipment, vents, fans, and the like occurring on roof.

I. Do not paint moving parts of operating units; mechanical or electrical parts such as valve operators; linkages; sensing devices; and motor shafts.

J. Do not paint over labels or equipment identification markings.

K. Do not paint mechanical room specialties such as compressors, boilers, pumps, control panels, etc.

L. Do not paint switch plates, light fixtures, and fixture lenses.

3.7 CLEANING

A. As Work proceeds, promptly remove paint where spilled, splashed, or spattered.

B. During progress of Work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris.

C. Collect cotton waste, cloths, and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.8 PROTECTION OF COMPLETED WORK

A. Protect finished installation.

B. Erect barriers and post warning signs. Maintain in place until coatings are fully dry.

C. Confirm that no dust generating activities will occur following application of coatings.

3.9 PATCHING

A. After completion of painting in any one room or area, repair surfaces damaged by other trades.

B. Touch-up or re-finish as required to produce intended appearance.

3.10 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 45 00, Quality Control.

B. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary.

C. The Owner will engage the services of an independent testing agency to sample paint material being used.

D. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.

E. The testing agency will perform appropriate quantitive materials analysis and other characteristic testing of materials as required by the Owner.

F. If test results show materials being used and their installation do not comply with specified requirements or manufacturer's recommendations, the Contractor may be directed to stop painting, remove noncomplying paint, pay for testing and repaint surfaces to acceptable condition.

3.11 COLOR SCHEDULE

A. Paint and finish colors shall be custom color, mixed and formulated to meet color as specified by Architect.

B. Interior Colors: 10 interior paint colors to be selected and located by Architect.

C. Exterior Colors: 4 exterior paint colors to be selected and located by Architect.

D. Access doors, registers, exposed piping, electrical conduit and mechanical/electrical panels if not stainless steel; generally the same color as adjacent walls.

E. Exterior and interior steel doors, frames and trim; as selected by architect.

F. Doors: as selected by architect..

G. Interior and Exterior Steel Fabrications, if not Stainless Steel: Match adjacent walls.

3.12 SCHEDULE - EXTERIOR SURFACES

A. The following Kelly Moore paint systems or Architect approved equal shall be used:

1. Wood-Painted (Flat Acrylic) - Exterior Trim and Exposed Wood Framing

1st coat:	KM 255 AcryShield wood Primer
2nd coat:	KM 1200 Premium professional 100% Acrylic Flat
3rd coat:	KM 1200 Premium professional 100% Acrylic Flat

2. Wood-Painted (Semi-Gloss Acrylic)

1st coat:	KM 255 AcryShield wood Primer
2nd coat:	KM 1215 Premium Professional 100% Acrylic S/G
3rd coat:	KM 1215 Premium Professional 100% Acrylic S/G

3. Wood-Painted (Gloss Alkyd)

1st coat:	KM 265 Water-Alkyd Professional Primer
2nd coat:	KM 1980 Professional Waterborne Urethane Modified Alkyd Gloss
3rd coat:	KM 1980 Professional Waterborne Urethane Modified Alkyd Gloss

4. Wood - Semi-Transparent

1st coat:	Storm System 2

5. Concrete (Flat Acrylic) - Exposed concrete indicated on drawings to be painted

1st coat:	KM 255 AcryShield Masonry Primer
2nd coat:	KM 1200 Premium Professional 100% Acrylic Flat
3rd coat:	KM 1200 Premium Professional 100% Acrylic Flat

6. Concrete Masonry Units (Flat Acrylic)

Fill coat:	KM 521 Color Shield Prime and Fill
1st coat:	KM 1200 Premium professional 100% Acrylic Flat
2nd coat:	KM 1200 Premium professional 100% Acrylic Flat

7. Cement Plaster (Flat Elastomeric)

1st coat:	KM 98 Multi-Seal
2nd coat:	KM 1128 Kel-Seal
3rd coat:	KM 1128 Kel-Seal

8. Steel-Primed or Unprimed (Flat Acrylic)

1st coat:	Rust-Oleum CV740 Primer
2nd coat:	KM 1200 Premium professional 100% Acrylic Flat
3rd coat:	KM 1200 Premium professional 100% Acrylic Flat

9. Steel-Primed or Unprimed (Semi-Gloss Acrylic)

1st coat:	Rust-Oleum CV740 Primer
2nd coat:	KM 1215 Premium Professional 100% Acrylic S/G

3rd coat:	KM 1215 Premium Professional 100% Acrylic S/G

10. Steel-Primed or Unprimed (Gloss-Alkyd)

1st coat:	KM 265 Water-Alkyd Professional Primer
2nd coat:	KM 1980 Professional Waterborne Urethane Modified Alkyd Gloss
3rd coat:	KM 1980 Professional Waterborne Urethane Modified Alkyd Gloss

11. Steel-Galvanized (Flat Acrylic)

1st coat:	Krud Kutter Metal and Etch
2nd coat:	KM 5725 DTM Primer
3rd coat:	KM 1200 Premium Professional 100% Acrylic Flat
4th coat	KM 1200 Premium Professional 100% Acrylic Flat

12. Steel-Galvanized (Semi-Gloss - Acrylic)

Prep:	Krud Kutter Metal and Etch
1st coat:	KM 5725 DTM Primer
2nd coat:	KM 1215 Premium Professional 100% Acrylic S/G
3rd coat	KM 1215 Premium Professional 100% Acrylic S/G

13. Steel-Galvanized (Gloss - Alkyd)

Prep:	Krud Kutter Metal and Etch
1st coat:	KM 5725 DTM Primer
2nd coat:	KM 1980 Professional Waterborne Urethane Modified Alkyd Gloss
3rd coat	KM 1980 Professional Waterborne Urethane Modified Alkyd Gloss

14. Pavement Marking –Refer to Section 32 12 16 & Section 32 13 13 KM 1272 Zone Marking

3.13 SCHEDULE - INTERIOR SURFACES

A. The following Dunn-Edwards paint systems or Architect approved equal shall be used:

1. Wood-Painted (Semi-Gloss Alkyd) - Wood Trim

1st coat:	KM 265 Water-Alkyd Professional Primer
2nd coat:	KM 1930 Professional Waterborne Urethane Modified Alkyd S/G
3rd coat:	KM 1980 KM Professional Waterborne Urethane Modified Alkyd S/G

2. Wood-Painted (Gloss Alkyd)

1st coat:	KM 265 Water-Alkyd Professional Primer
2nd coat:	KM 1980 Professional Waterborne Urethane Modified Alkyd Gloss
3rd coat:	KM 1980 Professional Waterborne Urethane Modified Alkyd Gloss

4. Wood - Transparent (Stain - Semi-Gloss Varnish)

1st coat:	Old Masters Master Armor
Filler coat (Open grain wood only):	Old Masters Wood Filler
2nd coat:	Old Masters Master Armor
3rd coat:	Old Masters Master Armor

5. Wood - Transparent (Stain-Semi-Gloss Lacquer)

1st coat:	Old Masters Wiping Stain
2nd coat:	Old Masters Master Armor
3rd coat:	Old Masters Master Armor
4th coat:	Old Masters Master Armor

6. Concrete (Flat-Latex)

1st coat:	KM 247 AcryShield Masonry Primer
2nd coat:	KM 1005 Premium Professional Flat
3rd coat:	KM 1005 Premium Professional Flat

7. Concrete (Semi Gloss Latex)

1st coat:	KM 247 AcryShield Masonry Primer
2nd coat:	KM 1050 Premium Professional S/G
3rd coat:	KM 1050 Premium Professional S/G

8. Concrete Floors - Sealed (Low Sheen Epoxy Acrylic)

1st coat:	AllFlor 530XX
2nd coat:	AllFlor 530XX

12. Steel - Primed or Unprimed (Flat-Latex) - Exposed Duct Work

1st coat:	KM 5725 DTM Primer/Finish
2nd coat:	KM 5725 DTM Primer/Finish
3rd coat:	KM 5725 DTM Primer/Finish

13. Steel - Primed or Unprimed (Semi-Gloss-Alkyd) - Steel Doors/Frames

1st coat:	KM 265 Water-Alkyd Professional Primer
2nd coat:	KM 1930 Professional Waterborne Urethane Modified Alkyd S/G
3rd coat:	KM 1930 Professional Waterborne Urethane Modified Alkyd S/G

14. Steel - Primed or Unprimed (Gloss-Alkyd)

1st coat:	KM 265 Water-Alkyd Professional Primer
2nd coat:	KM 1980 Professional Waterborne Urethane Modified Alkyd Gloss
3rd coat:	KM 1980 Professional Waterborne Urethane Modified Alkyd Gloss

15. Steel - Galvanized (Flat-Latex) - Exposed Duct Work

1st coat:	KM 5725 DTM Primer/Finish
2nd coat:	KM 5725 DTM Primer/Finish
3rd coat:	KM 5725 DTM Primer/Finish

16. Steel - Galvanized (Semi-Gloss - Alkyd) - Steel Handrails

1st coat:	KM 5725 DTM Primer
2nd coat:	KM 1930 Professional Waterborne Urethane Modified Alkyd S/G
3rd coat:	KM 1930 Professional Waterborne Urethane Modified Alkyd S/G

17. Steel - Galvanized (Gloss - Alkyd)

1st coat:	KM 5725 DTM Primer
2nd coat:	KM 1980 Professional Waterborne Urethane Modified Alkyd Gloss
3rd coat:	KM 1980 Professional Waterborne Urethane Modified Alkyd Gloss

18. Gypsum Board (Flat - Latex)

1st coat:	KM 971 AcryPlex PVA/Sealer
2nd coat:	KM 1005 Premium Professional Flat
3rd coat:	KM 1005 Premium Professional Flat

19. Gypsum Board (Eggshell-Acrylic) - Gypsum Board Walls and Ceilings

1st coat:	KM 971 AcryPlex PVA/Sealer
2nd coat:	KM 1010 Premium Professional Eggshell
3rd coat:	KM 1010 Premium Professional Eggshell

20. Gypsum Board (Semi-Gloss -Acrylic) - Kitchen areas; all Interior Wood Trim

1st coat:	KM 971 AcryPlex PVA/Sealer
2nd coat:	KM 1685 Dura-Poxy S/G
3rd coat:	KM 1685 Dura-Poxy S/G

21. Gypsum Board (Gloss -Acrylic)

1st coat:	KM 971 AcryPlex PVA/Sealer
2nd coat:	KM 1680 Dura-Poxy Gloss
3rd coat:	KM 1680 Dura-Poxy Gloss

22. Gypsum Board (Gloss -Epoxy)

1st coat:	KM Tru-Glaze 4030 Epoxy Primer
2nd coat:	KM Tru-Glaze 4428 WB Epoxy Gloss
3rd coat:	KM Tru-Glaze 4428 WB Epoxy Gloss

END OF SECTION

SECTION 09 96 46
INTUMESCENT PAINTING

This Section is based on FlameOff "Fire Barrier Paint", Paint Coatings as a level of standard for use on One-hour and Two-hour applications as a level of standard applications.

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Surface preparation and application of One-hour and Two-hour coatings that are IBC/NFPA Code Compliant to vertical surfaces and non-traffic surfaces of the following:

1. Steel.

1.2 REFERENCES

A. ASTM E84 - Surface Burning Characteristics of Building Materials.

B. ASTM E119 - Fire Tests of Building Construction and Materials.

C. ASTM D2240, Standard Test Method for Rubber Property - Durometer Hardness.

D. ASTM D2794, Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

E. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

F. ASTM D4060, Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abrader. ASTM E595, Standard Test Method for Total Mass Loss and Collected Volatile Condensable Materials from Out-gassing in a vacuum Environment.

G.

H. ASTM E736, Standard Test method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.

I.

J. ASTM E759, Standard Test method for Effect of Deflection on Sprayed Fire-Resistive Materials Applied to Structural Members.

K.

L. ASTM E761, Standard Test method for Compressive Strength of Sprayed Fire-Resistive Materials Applied to Structural Members.

M. California Building Code (CBC) - Standards

N. UL - Underwriters Laboratories: Fire Hazard Classifications.

O. UL 1715, ASTM E-84 Fire ratings

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Submit manufacturer's specifications, and include certification from materials manufacturer to show material compliance with Contract Documents. Include certification from manufacturer, signed by an officer of the firm, stating that the proposed material is free of all forms of asbestos, including actionlite, amosite, anthophyllite, chrysotile, crocidolite and tremolite.

C. Test Data: Submit laboratory test results for sprayed fireproofing for the following:

1. Deflection per ASTM E119.

2. Surface Burning Characteristics per ASTM E84.

3. Corrosion Resistance per ASTM E937.

4. Mold Resistance per ASTM G21.

D. Submit laboratory test reports in accordance with ASTM E119, indicating fire resistance as required to satisfy codes. Submit extracts of classified listings of tests performed by Underwriters Laboratories, Inc.

1.4 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five years documented experience.

B. Applicator: Company specializing in applying the Work of this Section with minimum three years documented experience, approved by manufacturer.

C. Products, execution, and fire retardant thicknesses shall conform to CBC and UL requirements for the required fire-resistance ratings.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable codes for fire resistance ratings.

B. Submit certification of acceptability of fireproofing materials to authority having jurisdiction.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not apply fireproofing when temperature of substrate material and surrounding air is below 40 degrees Fahrenheit.

B. Provide ventilation to allow proper drying of the intumescent paint during and subsequent to its application.

C. Maintain non-toxic, unpolluted working area. Provide temporary enclosure to prevent spray from contaminating air.

1.7 SYSTEM DESCRIPTION

A. Columns, Beams, and Brace Frames (including gussets): 1 Hours in accordance with the following:

a. ULI No. x 636

b. ITS/WH Design No.'s: AD/CA 90-02, AD/CA 120-02, AD/CA 120-03, AD/CA 120-04, AD/CA 180-01 and AD/CA 180-02.

1.8 SEQUENCING AND SCHEDULING

A. Sequence Work in conjunction with placement of ceiling hanger tabs, mechanical component hangers, and other related Sections.

1.9 DELIVERY, STORAGE AND PROTECTION

A. Deliver, store and protect products under provisions of Section 01 87 00.

1.10 WARRANTY

A. Provide warranty that fireproofing will remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering. Reinstall or repair such defects or failures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. FlameOff; “Fire Barrier Paint”, (888) 816-7468.

D. Substitutions: Under provisions of Section 01 62 00.

2.2 MATERIALS

A. Fire Barrier Paint: Factory mixed, asbestos free, decorative thin film intumescent coating that consists of a vinyl acetate resin. Material can be top coated to provide the desired color match requirements. Fire Barrier Paint to meet the following requirements:

a. Flame Spread: 0.

b. Smoke Developed: 0.

1. Air Erosion: Maximum allowable weight loss of the fireproofing material shall be 0.025 grams per square foot when tested in accordance with ASTM E859.

2. Resistance to Mold: Formulated at time of manufacturing with mold inhibitor. Tested in accordance with ASTM G21 and shall show resistance to mold growth when inoculated with aspergillus niger.

2.3 ACCESSORIES

A. Provide accessories to comply with manufacturer's recommendations and to meet fire resistance design requirements.

B. Accessories include, but are not limited to, any required or optional items such as bonding agents, mechanical attachments, application aids such as metal lath, scrim or netting and accelerators.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive Work.

B. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.

C. Beginning of installation means installer accepts existing surfaces.

3.2 PREPARATION

A. Clean substrate of dirt, dust, grease, oil, loose material, paints, primers, or other matter which may affect bond of fireproofing.

B. Remove incompatible materials which affect bond by scraping, brushing, scrubbing, or sandblasting.

3.3 PROTECTION

A. Protect workmen and public, as required under the regulations of the Occupational Safety and Health Act (OSHA) and applicable local ordinances and/or code regulations.

B. Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting.

3.4 APPLICATION

A. Equipment and application procedure shall conform to the material manufacturer's application instructions.

3.5 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 45 29.

B. Random sampling to verify thickness and density of fireproofing will be conducted in accordance with provisions of ASTM E605 or CBC Standard 7-6.

C. Reinspect the installed fireproofing for integrity of fire protection, prior to concealment of Work.

D. Correct unacceptable Work and provide further inspection to verify compliance with requirements.

E. Trade responsible for any damage to fireproofing shall be held responsible for its replacement and/or repair.

3.6 CLEANING

A. Clean Work under provisions of 01700.

B. Remove excess material, overspray, droppings, and debris.

C. Remove fireproofing from materials and surfaces not specifically required to be fireproofed.

END OF SECTION

SECTION 09 97 23
CONCRETE SEALER

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. High-performance sealer for interior concrete slabs.

1.2 SYSTEM DESCRIPTION

A. Liquid-applied, proprietary penetrating treatment for concrete slab surfaces. System shall protect sealed areas against unsightly oil, chemical and grease stains, in addition to damage caused by moisture intrusion. Clear, water-repellant, non-membrane-forming.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Submit manufacturer's technical bulletins for each product.

C. Provide protection plan for surrounding areas and for surfaces not to be coated.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer Qualifications: Company with a minimum of 15 years experience in manufacturing of specified products and systems.

2. Applicator Qualifications: Company with a minimum of 2 years experience in application of specified products and systems on projects of similar size and scope, which is acceptable to product manufacturer.

B. Field Sample:

1. Install field sample, as directed by Architect.

a. Provide mock-up of at least 100 square feet. To allow for evaluation of slip resistance and appearance.

b. Apply material in accordance with manufacturer's suggested application procedures.

2. Do not alter, move, or destroy field sample until Work is completed and approved by Architect.

3. Obtain Architect's written approval of field sample before start of material application, including approval of aesthetics, color, texture, and appearance.

1.5 DELIVERY, STORAGE AND HANDLING

A. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

1.6 PROJECT CONDITIONS

A. Environmental Requirements:

1. Minimum application temperature shall be 40 degrees Fahrenheit and rising.

2. Do not apply in rain or when rain is expected within 24 hours. Do not apply above 90 degrees Fahrenheit or below 40 degrees Fahrenheit or when temperatures are expected to fall below 40 degrees Fahrenheit within 24 hours.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. BASF Building Systems, telephone (800) 433-9517; "Hydrozo Enviroseal Surface Guard."

B. Tamms Industries, Inc., telephone (800) 862-2667; "Chemstop WB."

C. Substitutions: Under provisions of Section 01 62 00.

2.2 MATERIALS

A. Water-based, VOC-compliant, silane liquid.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that substrate, adjacent materials, are clean and dry and ready for installation.

3.2 SURFACE PREPARATION

A. Ensure substrates are sound and free of dust, dirt, laitance, paints, oils, grease, curing compounds, or any other contaminants.

B. Verify that no residue from curing compounds or membrane forming sealers is present on or within surface to be treated.

1. Test of penetrability by applying droplets of potable water and observing absorption. If water is not absorbed within 30 minutes, contamination is present and must be removed. Contact sealer manufacturer's technical service for recommendations.

C. Verify that substrate has properly cured. If efflorescence is present, mechanically remove it before proceeding. For extreme cases where this is not adequate, contact sealer manufacturer's technical service.

1. Concrete shall have minimum compressive strength of 3,000 pounds per square foot and be cured for minimum of 28 days or to 80 percent of design strength.

3.3 APPLICATION

A. Apply line stripping prior to application of sealer.

B. Complete all surface repairs, and/or joint filling procedures prior to application of sealer. Allow appropriate cure time for repair materials and joint fillers.

C. Apply with spray equipment, (low pressure), manual or drum type, to match approved field sample mock-up.

D. Coverage rate will vary based on porosity of concrete; minimum 200 square feet per gallon, maximum 100 square feet per gallon. Use mock-up to determine coverage rate.

E. Allow minimum twenty four hours drying time before exposing slab to liquids.

3.4 CLEAN UP

A. Clean tools and equipment with warm water as soon as possible after using.

B. Remove spills and remove sealer from surfaces not required to receive sealer.

END OF SECTION

SECTION 10 11 00
VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Markerboards - unlined.

B. Horizontal sliding panel assembly.

C. Glass markerboards.

D. Display rails.

1.2 REFERENCES

A. ANSI A208.1 - Mat Formed Wood Particleboard.

B. ASTM B221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.

C. ASTM A424 - Steel Sheets for Porcelain Enameling.

D. ASTM C208 - Insulation Board (Cellulose Fiber).

E. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

F. CFFA-W-101-A - Chemical Fabrics and Film Association Quality Standard for Vinyl Coated Fabric Wallcovering.

G. FS CCC-W-408 A and B - Wall Covering, Vinyl-Coated.

H. Porcelain Enamel Institute - Performance Specifications for Porcelain Enamel Chalkboards.

I. UL - Underwriters Laboratories, Inc.

1.3 REGULATORY REQUIREMENTS

A. Conform to UL flame/fuel/smoke rating of 25/0/25 for vinyl fabric covered tackboards when tested in accordance with ASTM E84.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Indicate wall elevations, dimensions, joint locations.

C. Provide complete Product Data on all items specified.

D. Submit two 12-inch square Samples illustrating materials and finish, color, and texture of markerboard and glass markerboard.

E. Horizontal Sliding Panel System: Submit 18 x 24 inch Sample illustrating materials and construction.

1.5 MAINTENANCE DATA

A. Submit under provisions of Section 01 70 00.

B. Include maintenance information on regular cleaning and stain removal.

1.6 WARRANTY

A. Provide one year warranty under provisions of Section 01 70 00.

B. Include one-year warranty against discoloration of surfaces due to cleaning, crazing or cracking and staining.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Claridge Products and Equipment, Inc.

B. Chatfield Clarke Co., Inc.

C. Polyvision Corporation.

D. Substitutions: Under provisions of Section 01 62 00.

2.2 MATERIALS

A. Steel Sheet: ASTM A424, Type I, commercial quality.

B. Aluminum Extrusions: ASTM B221, 6063 alloy, T5 temper.

C. Cork: Fine grain natural cork, homogeneous composition.

D. Particleboard: ANSI A208.1; wood shavings set with waterproof resin binder, sanded faces.

E. Fiberboard: Industrial insulation board, ironed and prime coated, ASTM C208, 3/8 inch thick, 4 foot wide x required length.

F. Foil Backing: Aluminum foil sheet.

G. Honeycomb: Honeycell/Honeycomb.

H. Adhesives: Type recommended by manufacturer to suit applicable to substrate.

2.3 ACCESSORIES

A. Map Rail Accessories: Formed aluminum display hooks, map roller brackets, and flag holder. Sliding type to fit map rail. One pair of display hooks and map roller brackets for every two feet of map rail. One flag holder per map rail.

B. Temporary Protective Cover: Sheet polyethylene, 8 mil thick.

C. Blocking Pads: Manufacturers standard padding designed to prevent deflection.

D. Metal Mounting Clips: Steel angle clips, 2 inches long x 16 gage thick.

2.4 FABRICATION - MARKERBOARDS

A. Outer Face Sheet: Steel, 24 gage thick. Equivalent to Claridge LCS.

B. Core: Particleboard, 3/8 inch thick.

C. Backing Surface: Aluminum foil, 0.005 inch thick.

D. Units in 8 foot increments shall be one piece construction, no joints.

2.5 FRAME AND TRIM

A. Frame: Extruded aluminum, equivalent to Claridge Series 1; concealed fasteners; map rail with 1/4 inch thick cork insert above markerboard surfaces.

B. Chalktray: Extruded aluminum, equivalent to Claridge No. 271A profile; one piece, full length of markerboard; concealed fasteners.

2.6 HORIZONTAL SLIDING PANEL ASSEMBLY

A. 4 x 6 Single Sided Panel; Markerboard:

1. Surface: Porcelain markerboard, unlined or lined as indicated.

2. Core: 7/8 inch thick honeycomb.

3. Subframe: Polyvision SF-78, 2 inch x 7/8 inch aluminum tube, 4 sides.

4. Moisture Barrier: .012 inch thick aluminum sheet.

B. 4 x 6 Single Sided Panel; Glass Markerboard:

1. Surface: ¼” low-iron ultra-clear glass.

E. Frame, Hardware, and Accessories

1. Trim: Polyvision C-12 extruded aluminum with punched and wrapped safety corner.

2. Top Track: Polyvision extruded aluminum guide, dual rail.

3. Bottom Track: Polyvision, extruded aluminum track, dual rail.

4. Filler Strip: Polyvision BT- extruded aluminum series.

5. Rollers: Polyvision HB Series, Model MAL-33 bottom rollers.

6. Sheaves: Polyvision 1607 adjustable brass ball bearing sheaves. Two wheels per sheave and two sheaves per panel.

7. Pulls: IVES chrome retractable edge pulls, two per panel, fully recessed.

8. Locks: Polyvision JK-39 locking mechanism, one per panel.

9. Chalkrail: Polyvision CRA-4D modified as indicated with rounded corner.

10. Maprail: Polyvision MR-3 with vinyl backed cork and end caps.

11. Maprail Accessories: Formed aluminum display hooks, map roller brackets and flag holder. Sliding type to fit map rail. One pair of display hooks and map roller brackets for every two feet of map rail.

F. Standard markerboard configuration as indicated in the schedule at the end of this section and on drawings.

2.7 DISPLAY RAILS

A. Claridge Model No. 151 display rail with cork insert. Lengths as required.

B. Claridge metal display hooks, one for each 12 inches length of display rail.

2.8 FINISHES

A. Porcelain Enamel: Glass fibered enamel, baked to vitreous surfaces; Porcelain Enamel Institute Type A; white color.

C. Aluminum Frame and Accessories: Clear satin anodized.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that surfaces and internal wall blocking are ready to receive work, and dimensions are as [indicated on Shop Drawings.] [instructed by the manufacturer.]

B. Beginning of installation means acceptance of substrate construction.

3.2 INSTALLATION

A. Install markerboards in accordance with manufacturer's instructions and as indicated on Drawings.

B. Install blocking pads behind markerboards at 16 inches on center.

C. Install metal clips at 16 inches on center at sides and bottom of boards.

D. Secure units level and plumb.

F. Butt markerboard panels tight with concealed spline to hairline joint.

F. Carefully cut holes in markerboards for thermostats, TVs, wall switches, electrical outlets or boxes, where occur.

3.3 CLEANING

A. Clean all surfaces in accordance with manufacturer's instructions.\

B. Cover all surfaces with protective cover, taped to frame.

C. Remove temporary protective cover at date of Substantial Completion.

3.4 HORIZONTAL SLIDING PANEL ASSEMBLY CONFIGURATION SCHEDULE

A. Abbreviations: MB - Markerboard, GB – Clear Glass Markerboard. (F) – Fixed Panel (S) – Sliding panel.

B. System Configuration (to be used at all locations where markerboard is identified on drawings, all classrooms, science labs, and ceramics room):

Location	**Panel Size** **W x H** (Overall Size)	**Fixed/ Sliding**	**Panel Type**
Wall Surface	4 x 6 ea. (16 x 6) overall	F	MB
Inner Rail	4 x 6	S	MB
Outer Rail	4 x 6	S	GB

END OF SECTION

SECTION 10 14 00
SIGNAGE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Door and wall signage.

B. Exterior metal signs.

C. Cast letters and numbers.

D. Traffic Signs.

E. Cast metal plaques.

1.2 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Submit dimensioned elevations of each sign configuration.

1. Show sign sections indicating materials, thicknesses and attachment methods.

2. Show anchors and reinforcement.

3. Provide complete signage schedule indicating all signs and locations, key to room numbers and elevations. Provide space for Architect to indicate sign type and location.

C. Product Data:

1. Manufacturer's current published specifications.

2. Manufacturer's installation instructions.

D. Samples:

1. Provide two Samples of each sign type required in the profiles and sizes indicated on the Drawings. Signs approved with correct color and type may be used in the final installation at the request of the Contractor.

2. Provide Samples of all proposed fasteners and accessories.
3. Three copies of manufacturer's color chart indicating all available standard colors for selection by the Architect.

E. Closeout: Manufacturer's warranty.

1.3 PROJECT CONDITIONS

A. Environmental Requirements: Install signs only when interior air and substrates have reached equilibrium moisture and temperature approximating that of normal occupied conditions.

B. Do not install adhesive tape mounted signs when ambient temperature is below 70 degrees Fahrenheit. Maintain this temperature during and after installation of signs.

1.4 REGULATORY REQUIREMENTS

A. Conform to C.C.R., Title 24, Part 2, Chapter 11, ADA Accessibility Guidelines (ADAAG), and American Disability Act (ADA) for accessibility requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver signs safely packed to prevent damage during shipment and prior to installation.

B. Keep signs in protective wrapping until ready for installation.

C. Handle carefully to prevent damage. Replace damaged parts at no cost to the Owner.

D. Comply with the additional requirements specified in Section 01 87 00.

1.6 SCHEDULING

A. Do not install signs until walls and/or doors have received final finish.

1.7 WARRANTY

A. Procedures: In accordance with Section 01 78 36.

B. Furnish manufacturer's written warranty agreeing to replace signs which fade or discolor under normal environmental exposure.

C. Warranty Period: 5 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Subject to compliance with requirements specified herein.
B. Substitutions: Under provisions of Section 01 62 00.

2.2 DOOR AND WALL SIGNAGE

A. Cast Acrylic Sheet: ASI Modulux, Mohawk Sign Systems Inc., or approved equal.

1. Monolithic tactile plaque sign with fully integrated graphics composed of high-impact polyester acrylate resins, pressure molded into a single polymerized component, using manufacturer's co-molding process.

    a. Depth: 0.25 inch thickness.

    b. Panel Appearance: Specify from manufacturer's standard, high contrast semi-matte color chart.

    c. Surface Texture: Matte non-glare.

    d. Letter Styles and Sizes and Layout Position: Specify from manufacturer's standard letter styles and color chart.

    e. Text Schedule: Verify correct capitalization.

    f. Sign Size: As indicated on the Drawings.

    g. Sign Shape: As indicated on the Drawings. Square or rectangular shapes shall have radiused corners.

    h. Installation: Provide countersunk mounting holes for mechanical fasteners.

    i. Sign Copy: Shall be integrally molded with sign body per manufacturer's standard bonding process.

    j. Application: Rated for exterior and interior applications.

    k. Background Appearance: Solid color from manufacturer's standard color charts.

    l. Braille: Integral domed-shaped California Grade 2 Braille dots, each distinct and separate.

2. Flame Resistance: Application of a lighted match shall not produce melting, flashing, flaring or distortion. Signs shall not ignite at a temperature less than 800º F.

3. Vandal resistant surface which can be cleaned using industrial cleansers, including acetone.

B. Fasteners: All screws, bolts and fasteners to be tamper resistant stainless steel. All fasteners to be to be provided with solid anchorage to studs, blocking or concrete; do not use toggle bolts.

C. Colors: High contrast semi-matte integral colors for graphics. All integral resins are U.V stabilized resins utilizing automotive grade pigments.

D. Location of signs as shown on Drawings.

2.3 EXTERIOR METAL SIGNAGE

A. Galvanized steel plate, 0.0538 inch thick, mechanically mounted.

B. Porcelain copy, 1 inch high, colors as selected by Architect. Text and size shall be all uppercase as indicated on Drawings.

C. Location of signs as shown on Drawings.

D. Shop Fabricated Signs: All joints, returns and the like shall be properly joined together and welded edges shall be ground smooth to proper aluminum finish.

E. Shapes shall be saw-cut smooth and straight and shall be deburred prior to final finishing and assembly. Square or rectangular shapes shall have radiused corners.

F. Vandal resistant surface which can be cleaned using industrial cleansers, including acetone.

G. Fasteners: All screws, bolts and fasteners to be tamper resistant stainless steel. All fasteners shall be to be provided with solid anchorage to studs, blocking or concrete; do not use toggle bolts.

H. Colors: High contrast non-glare or semi-matte integral colors for graphics. All integral resins are UV stabilized resins utilizing automotive grade pigments.

2.4 CAST LETTERS AND NUMBERS

A. Manufacturer: ARK Ramos, Metal Arts Inc., ASI Modulux, or approved equal.

B. Standard cast letters, No. 530 “Optima”, color to be selected by Architect.

C. Verify location as shown on Exterior Elevations. Verify all text with Owner prior to ordering signage.

D. Size of Letters: 36 inches high x 2 inches deep.

E. Text: As shown on the drawings.

2.5 TRAFFIC SIGNS

A. Manufacturer: Hawkins Sign Co, Inc. (510) 525-8500; Traffic Control Service Inc., (800) 884-8274; or approved equal.

B. Types of Signs: Sheet metal with porcelain enamel finish.

1. Accessible Parking Stall Signs: Complying with Title 24, Part 2, Section 7102(e) at automobile stalls and Section 1129B.5 at van stalls. At van stalls, provide separate 12 inch wide x 4 inch high sign below main sign. Text on signs shall comply with ADAAG Article 4.6.4.

2. Tow-Away Signs: Complying with Title 24, Part 2, Section 7102(e).

C. Sign Posts: 2-inch outside diameter standard weight galvanized steel pipe, set in concrete footing.

D. Mount signs on sign posts with bottom of sign 7 feet 2 inches above grade, unless indicated otherwise.

2.6 CAST METAL PLAQUES

A. Manufacturer: ARK Ramos, Metal Arts Inc., ASI Modulux, or approved equal.

B. Construction: Cast aluminum, alloy C443.2, bronze with raised graphics and single line bevel edge. Provide clear protective coating and satin highlighting finish at raised surfaces. Letter and border styles and painted background color to be selected by Architect from manufacturer's standard styles and colors.

C. Size: 21 inches high x 16 inches wide.

D. Text: prior to fabrication, verify content and spelling of text with District representative.

E. Mounting: Provide hardware and blocking for wall mounting in location indicated.

2.8 FABRICATION

A. General Requirements:

1. Shop-fabricate signs to requirements indicated for materials, thicknesses, designs, shapes, sizes and details of construction.

2. Sign panel surfaces shall be smooth, even and fabricated to remain flat under installed conditions. Ease all edges and corners of signs.
3. Provide lettering and graphics precisely formed, uniformly opaque to comply with relevant regulations and requirements indicated for size, style, spacing, content, position and colors.

B. Tactile Graphics and Text:

1. Conform to C.B.C. Title 24, Chapter 11, Section 11B-Division 7. 11B-703.2.5, Table 11B-703.3.1, 11b-703.3.1 11B-703.3.2.

2. California Grade 2 Braille must accompany raised text characters. Provide tactile copy and Grade 2 Braille raised 1/32 inch minimum from plaque using manufacturer's co-molding process:

a. Letters and numbers shall be raised 1/32 inch (0.794 mm) and shall be sans-serif uppercase characters accompanied by California Grade 2 Braille symbols.

b. Braille Symbols: Rounded or domed California Braille dots, each distinct and separate. Dots shall be 1/10 inch (2.54 mm) on centers in each cell with 2/10 inch (5.08 mm) space between cells. Dots shall be raised a minimum of 1/32 inch (0.794 mm) from a plaque surface.

c. Proportions: Characters shall be selected from fonts where the width of the uppercase letter "O" is 60 percent minimum and 110 percent maximum of the height of the uppercase letter "I".

d. Character Height: Characters and numbers on signs shall be 5/8-inch minimum and 2 inches maximum high and as shown on the Drawings.

e. Contrast of Characters and Symbols: Characters and symbols shall be light characters with dark background with a contrast of 70 percent minimum.

3. Raised Characters and Pictorial Symbol Signs:

a. Letter Type: Letters and numbers on signs shall be raised 1/32 inch (0.794 mm) minimum and shall be sans-serif uppercase characters accompanied by California Grade 2 Braille.

b. The stroke thickness of the uppercase letter “I” shall be 15 percent maximum of the height of the character. Reference to CBC 11B Division 7, 11B-703.2.6.

c. Symbol Size: Raised characters or symbols shall be a minimum of 5/8-inch (15.9 mm) and as shown on the Drawings.

d. Pictorial Symbol Signs (Pictograms): Pictorial symbol signs (pictograms) shall be accompanied by the equivalent verbal description placed directly below the pictogram as shown on the Drawings.

e. Contrast between letters and/or characters and background color must be 70 percent minimum.

C. Silkscreening: All silkscreened graphics shall be produced with ABS paint compatible with the substrate, using mesh of 390 or finer to produce clean, sharp edges. All media are to be opaque, with full even coverage, and free from dust bubbles, blemishes and other foreign matter. Characters and symbols shall contrast 70 percent minimum with their background. Characters shall be light colors with dark background.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces to receive units are true and plumb. Correct inadequate surfaces before installation of signs.

B. Verify that moisture and temperature levels of substrate and environment have been stabilized and are acceptable prior to proceeding with the Work.

C. Take field measurements prior to shop fabrication where necessary in order to ensure proper fitting of Work.

D. Do not begin Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install units in locations and at mounting heights indicated on Drawings.

1. Keep perimeter lines straight, plumb, and level.

2. Install within 1/4 inch tolerance vertically and horizontally of intended location and in accordance with manufacturer's recommendations.

3. Install product at heights to conform to C.C.R., Title 24, Part 2 and ADA Accessibility Guidelines (ADAAG).

B. Installation on Walls: Attach securely through finish wall to rigid backing.

C. Installation Method: Install with vandal - resistant fasteners.

3.3 CLEANING, PROTECTION AND REPAIR

A. Repair scratches and other damage which might have occurred during installation. Replace components where repairs were made but are still visible to the unaided eye from a distance of 5 feet.

B. Clean installed products in accordance with manufacturer's instructions prior to District's acceptance.

END OF SECTION

SECTION 10 21 13
PHENOLIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Solid phenolic toilet partitions and sight screens, floor mounted, headrail braced.

B. Additional cross-bracing as required.

C. Hardware: Coordinate with items installed under Section 10 28 00, Toilet and Bath Accessories.

D. Attachments, screws and bolts.

1.2 REFERENCES

A. California Building Code (CBC).

B. ADAAG - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities.

C. CCR - California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.

D. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

E. ASTM E84 - Test Method of Surface Burning Characteristics of Building Materials.

F. NEMA LD-3 - High Pressure Decorative Laminates.

G. NFPA 286-Standard Methods for Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00, Submittals.

B. Submit Product Data for components, hardware, and accessories.

C. Submit three Samples 4 inch x 4 inch in size, cut from actual panel construction, illustrating panel pattern.

D. Submit manufacturer's installation instructions.

1.4 REGULATORY REQUIREMENTS

A. Conform to CBC Chapter 11B and CCR, Title 24, Part 2, and ADAAG for accessibility requirements.

B. Class B rating toonform to flame spread and smoke developed ratings of 20/95 for panel materials when tested in accordance with ASTM E84.

1.5 COORDINATION

A. Coordinate Work with support framing and anchors.

B. Coordinate Work with placement of plumbing fixtures and floor drains.

C. Coordinate Work with placement of electrical fixtures and equipment.

D. Coordinate Work with toilet accessories.

1.6 WARRANTY

A. Provide 10 year limited warranty under provisions of Section 01 78 36, Warranties.

B. Warranty shall provide for coverage of solid phenolic panels, doors and stiles against breakage, corrosion and delamination.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Bobrick Washroom Equipment Inc.

B. Young Industries

C. Columbia Industries

D. Or approved equal. Substitutions under the provisions of Section 01 25 13, Product Options and Substitutions.

2.2 MATERIALS

A. Solid Phenolic Panel: NEMA LD-3 solid phenolic core with melamine laminate veneer material.

B. Stainless Steel: ASTM A167, Type 304.

2.3 ACCESSORIES

A. Pilaster Shoe: ASTM A167, Type 304 stainless steel, with adjustable screw jack.

B. Headrail: 1 inch x 1-5/8 inch anodized extruded aluminum; with anti-grip configuration; and stainless steel wall brackets.

C. Attachments, Screws, and Bolts: Stainless steel with Torx pin head.

D. Through-Bolts and Nuts: Stainless steel with Torx pin head.

2.4 HARDWARE

A. Hinges: Full-height continuous hinges of 16 gage stainless steel. Spring-loaded and self-closing.

B. Latch and Keeper, Standard Doors: 16 gage stainless steel combination slide latch and bumper.

C. Latch and Keeper, Accessible Stall Doors: U-shaped handle with concealed latch.

D. Door Stop: Vinyl coated 11 gauge steel door stop.

E. Coat Hook: 12 gage stainless steel clothes hook. See Section 10 28 00, Toilet and Bath Accessories.

F. Door Pull: Stainless steel door pull both sides at accessible stall.

G. All hardware shall be concealed inside compartments with the exception of out-swing doors.

H. Panel Brackets: Full length continuous "U" channel brackets of 16 gage stainless steel.

2.5 FABRICATION

A. Doors and Panels:

1. Door Thickness: 3/4 inch.
2. Panel Thickness: 1/2 inch.
3. Door Width: 24 inches.
4. Door Width for Accessible Use: 32 inch front entry, 34 inch side entry.
5. Height: 58 inches.

B. Pilasters: 3/4 inch thick, constructed same as doors, of sizes required to suit cubicle width and spacing.

C. Furnish units with cutouts and drilled holes to receive partition mounted hardware, accessories, and grab bars as indicated.

D. Concealed hardware fasteners shall have a metal-to-metal connection that shall withstand a direct pull of 1,500 lbs per screw.

2.6 FINISHES

A. Phenolic Panels: Color from manufacturer's standard color selections.

B. Stainless Steel Surfaces: No. 4 finish.

C. Aluminum: Clear anodized.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that openings are ready to receive Work.

B. Verify field measurements are as shown on Shop Drawings.

C. Verify correct location of built-in framing, anchorage, bracing, electrical and plumbing fixtures.

D. Beginning of installation means installer accepts existing conditions.

3.2 ERECTION

A. Erect in accordance with manufacturer's instructions.

B. Install partition components secure, plumb and level.

C. Attach panel brackets securely to walls and floors using appropriate anchor devices.

D. Set all floor anchors and pilaster shoes firmly in mastic.

E. Attach panels and pilasters to brackets with through bolts and nuts. Locate headrail joints at pilaster center line.

F. Provide 1/2 inch space between wall surface and panels or pilasters.

G. Provide for adjustment of floor variations with screw jack through steel saddles integral with pilaster. Conceal floor fastenings with pilaster shoes.

H. Equip each toilet stall door with hinge, door latch, pull, and clothes hook.

I. Equip each accessible toilet stall door with two pulls, one each side of door, and clothes hook. Mount coat hook at 48 inches maximum height or as required by ADA for accessible stalls.

J. Install door strike keeper on each pilaster in alignment with door latch.

K. Equip each toilet stall door with coat hook and bumper.

3.3 ERECTION TOLERANCES

A. Maximum Variation From Plumb or Level: 1/8 inch.

B. Maximum Misplacement From Intended Position: 1/8 inch.

3.4 ADJUSTING

A. Adjust Work under provisions of Section 01 70 00.

B. Adjust and align door hardware to uniform clearance at vertical edges of doors. Clearance space not to exceed 3/16 inch.

C. Adjust door hinges so that free movement is attained and will locate in-swinging doors in partial open position when unlatched. Return out-swinging doors to closed position.

3.5 CLEANING

A. Clean Work under provisions of Section 01 77 00, Contract Closeout and Final Cleaning.

B. Remove protective coverings.

C. Clean surfaces and hardware.

3.6 PROTECTION OF FINISHED WORK

A. Protect finished installation.

B. Field touch-up of finished surfaces will not be permitted.

C. Replace damaged or scratched materials with new materials.

END OF SECTION

SECTION 10 26 00
WALL AND DOOR PROTECTION
(STAINLESS STEEL WALL COVERINGS)

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section includes labor, materials and other services necessary to complete stainless steel wall coverings.

B. Hardware and attachment accessories.

1.2 REFERENCES

A. ASTM A480 Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

1.3 QUALITY ASSURANCE

A. Manufacture millwork and finish carpentry items in accordance with quality standards of the Manual of Millwork of the Woodwork Institute.

B. Issue WI Certified Compliance Certificate to Architect prior to delivery of millwork and provide WI Certified Compliance Labels on all items of millwork.

C. All millwork and the installation of millwork shall be monitored for compliance under the scope of the WI Certified Compliance Program (CCP).

D. Provide WI Reinspection Service at the job site prior to installation. Provide to Architect a written report showing results of the reinspection.

E. Upon completion of the installation, provide a WI Certified Compliance Certificate.

1.4 SYSTEM DESCRIPTION

A. Performance Requirements: Provide antimicrobial wall covering which has been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage or failure

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Submit shop drawings to indicate materials, details, and accessories in accordance with Section 01330

C. Submit two samples 6 x 6 inch in size of material as well as e samples each of accessory pieces.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and protect products under provisions of Section 01 87 00.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Store materials in ventilated, interior locations under constant minimum temperatures of 70 degrees F and maximum relative humidity of 50 to 55 percent.

PART 2 - PRODUCTS

2.1 FABRICATORS

A. Manufacturer: Protek Systems, Inc.:
1250 Wallace Dr. Unit B, Delray Beach, FL 33444
Tel: 800-598-2153, Fax: 561.395.4771

B. Substitutions: Under provisions of Section 01 62 00.

2.2 MATERIALS

A. WPS-12 Stainless Steel Wall Covering by Protek Systems, Inc.
1. Material: Type 304 #4 satin stainless steel sheet. Consult factory for recommended gauge.
2. Standard Sheet Sizes: 4ft x 8ft or 4ft x 10ft
3. 1/2" offset construction
4. Finish: #4 satin

B. Or Equal.

2.3 ACCESSORIES

A. WPS-12-ICG-50 Inside Corner

1. Material: Type 304 #4 satin stainless steel. Consult factory for recommended gauge.
2. Standard sizes: 4ft, 8ft, or 10ft
3. 1/2" offset construction
4. Finish: #4 satin

B. WPS-12-EB-1 Edge Bar / Top Cap

1. Material: Type 304 brushed stainless steel.
2. Standard sizes: 12ft
3. Profile: 1” x 1/8”
4. Brushed finish

D. Mounting Method: Adhesive OR mechanical fasteners

1. ADH-50 Construction Adhesive
2. Mechanical fasteners: Specify drilling requirements when ordering. Fasteners by others.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and openings are ready to receive work and field measurements are as instructed by the fabricator.

B. Verify mechanical, electrical, and building items affecting work of this Section are placed and ready to receive this work.

C. Verify adequacy of backing and support framing.

D. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

A. Walls should be smooth and level. High points must be removed and low points filled with filler intended for the substrate and environmental conditions.

B. Surfaces must be permanently dry and free from all substances that may contribute to adhesive bond failure

C. Drywall substrates should be paint ready.

D. Check the room using a 6’ (2 m) level to ensure all walls are flat, paying particular attention to the corners, window reveals, and door entrances. These need to be inspected to ensure they are free of any debris or irregularities, which could prevent the panels laying flat to the substrate after the adhesive has been applied and the panel installed.

3.3 INSTALLATION

A. Panels should be stored flat and be pre-conditioned a minimum of 24 hours in ambient temperatures similar to the prevailing operational conditions

B. If fitting to door frames, these must be in place prior to installation of panels.

C. All pipes, fixing bolts, etc. extending through the panels should have a minimum 1/8” (3mm) expansion gap and be sealed with caulking.

D. Hot pipes and steam pipes should be insulated and a 1/8” to 1/4” (3-6mm) expansion gap should be created when installing panels around these pipes, then sealed with caulking.

3.4 FINISHING

A. Site finish under provisions of Section 09 91 00.

3.5 PROTECTION

A. Protect finished installation under provisions of Section 01 87 00.

END OF SECTION

SECTION 10 28 00
TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Toilet and washroom accessories.

B. Mirror units.

C. Concealed anchor devices and backing plate reinforcements furnished to other Sections.

D. Attachment hardware.

1.2 REFERENCES

A. ADAAG - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities.

B. CCR - California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.

C. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strips.

D. ASTM A366 - Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.

E. ASTM A386 - Zinc Coating (Hot-Dip) on Assembled Steel Products.

F. ASTM B456 - Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

G. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.

H. ASTM A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Provide Product Data on accessories, describing size, finish, details of function, attachment methods.

C. Submit manufacturer's installation instructions.

1.4 KEYING

A. Supply two keys for each accessory to Owner.

B. Master key all accessories.

1.5 REGULATORY REQUIREMENTS

A. Conform to CCR, Title 24, Part 2, and ADAAG for access for the handicapped.

1.6 COORDINATION

A. Coordinate the Work of this Section under provisions of Section 01 31 19.

B. Coordinate the Work of this Section with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Bobrick Washroom Equipment, Inc.

B. American Specialties, Inc. (ASI).

C. Bradley Corporation.

D. Substitutions: Under provisions of Section 01 62 00.

2.2 MATERIALS

A. Sheet Steel: ASTM A366.

B. Stainless Steel Sheet: ASTM A167, Type 304.

C. Tubing: ASTM A269, stainless steel, Type 304.

D. Adhesive: Two-component epoxy type waterproof.

E. Fasteners, Screws, and Bolts: Hot-dip galvanized, tamperproof.

F. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.3 FABRICATION

A. Weld and grind smooth joints of fabricated components.

B. Form exposed surfaces from single sheet of stock, free of joints.

C. Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

D. Back-paint components where contact is made with building finishes to prevent electrolysis.

E. Shop-assemble components and package complete with anchors and fittings.

F. Provide steel anchor plates, adapters, and anchor components for installation.

G. Hot-dip galvanize all ferrous metal and fastening devices.

2.4 FACTORY FINISHING

A. Galvanizing: ASTM A123 to 1.25 ounces per square yard.

B. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

C. Stainless Steel: No. 4 satin finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that site conditions are ready to receive Work and dimensions are as instructed by the manufacturer.

B. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

A. Deliver inserts and rough-in frames to site at appropriate time for building-in.

B. Provide templates and rough-in measurements as required.

C. Verify exact location of accessories for installation.

3.3 INSTALLATION

A. Install fixtures, accessories and items in accordance with manufacturers' instructions.

B. Install plumb and level, securely and rigidly anchored to substrate.
C. Verify that no equipment in accessible toilet stalls protrudes past the face of the wall by more than 3 inches.

3.4 SCHEDULE

A. Model numbers refer to Bobrick products, as a standard of quality and performance.

Model No.	Description	Power	Remark
B-7120	Surface Mounted Hand Dryer - ADA		
B-29744	Semi-recessed Automatic Universal Roll Paper Towel Dispenser	-	-
B-1659	Glass Mirror, reference Drawings for sizes	-	-
B-295	Stainless steel shelf	-	-
B-221	Toilet seat cover dispenser	-	-
B-239 x 34	Custodian's mop and broom rack w/shelf	-	-
B-2888, B-3888	Toilet tissue dispenser, non-accessible stalls	-	-
B-3888 B-4388	Toilet tissue dispenser, accessible stalls	-	-
B-2112	Soap dispenser	-	-
B-233	Stainless steel clothes hook	-	-
B-3706 25	Recessed sanitary napkin dispenser - ADA	-	-
B-4388	Recessed toilet tissue dispenser	-	-
B-254	Sanitary napkin disposal	-	-
B-6806-99	1-1/2" diameter x 36" long grab bar refer to Drawings for anchorage	-	-
B-6806-99	1-1/2" diameter x 48" long grab bar refer to Drawings for anchorage		

END OF SECTION

SECTION 10 44 00
FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fire extinguishers.

B. Non-rated and fire-rated cabinets.

C. Accessories.

1.2 REFERENCES

A. ASTM E814 - Fire Tests of Through-Penetration Fire Stops.

B. NFPA 10 - Portable Fire Extinguishers.

C. WARNOCK - HERSEY - Fire Test and Certification.

1.3 QUALITY ASSURANCE

A. Conform to Title 19, CCR requirements for fire extinguishers.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Include physical dimensions, operational features, color and finish, mounting and anchorage details, rough-in measurements, location, and details.

C. Submit manufacturer's installation instructions.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit manufacturer's operation and maintenance data under provisions of Section 01 70 00.

B. Include test, refill or recharge schedules, procedures, and re-certification requirements.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not install extinguishers when ambient temperatures may cause freezing.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. J. L. Industries.

B. Larsen's Mfg. Co.

C. Potter-Roemer, Inc.

D. Watrous, Inc.

E. Substitutions: Under provisions of Section 01 62 00.

2.2 EXTINGUISHERS

A. Dry Chemical Type: Equivalent to J.L. Industries “Cosmic” Model 5E, UL 2A:10B:C with valid certification tag attached.

2.3 CABINETS

A. Fully-Recessed Non-Rated Cabinets: Equivalent to J.L. Industries “Ambassador” Model No. 1815 with full glazed doors, clear acrylic glazing.

B. Semi-Recessed Non-Rated Cabinets: Equivalent to J.L. Industries “Ambassador” Model No. 1812 with full glazed doors, clear acrylic glazing.

C. Surface-Mounted Non-Rated Cabinets: Equivalent to J.L. Industries “Ambassador” Model No. 8113 with full glazed doors, clear acrylic glazing.

D. Fire-Rated Cabinets: Equivalent to J.L. Industries “Amassador” Model No., 1815FX with full glazed doors, clear wire glass. Cabinet shall be fabricated according to ASTM E814 and shall be listed and labeled by Warnock-Hersey for one and two hour fire-rated wall systems.

2.4 FABRICATION

A. Form body of cabinet with tight inside corners and seams.

B. Fabricate body of fire-rated cabinet of double-wall construction filled with a 5/8 inch thick layer of protective fire barrier insulation.

C. Predrill holes for anchorage.

D. Form perimeter trim by welding, filling, and grinding smooth.

E. Hinge doors for 180 degree opening with continuous piano hinge. Provide nylon catch.

F. Glaze doors with resilient channel gasket glazing.

2.5 ACCESSORIES

A. Steel Cable Theft Device: Model STI 6200 as manufactured by STI Inc.

2.6 FINISHES

A. Extinguisher: Red enamel.

B. Cabinet, Trim and Door: Electrostatic white powder coat finish.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that rough openings for cabinet are correctly sized and located.

B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

A. Install cabinets plumb and level in wall openings.

B. Secure rigidly in place in accordance with manufacturer's instructions.

C. Install fire-rated cabinets in strict conformance with manufacturer's instructions and listing requirements of Warnock-Hersey.

D. Attach steel cable theft device to each extinguisher. Locate inside cabinet.

3.3 SCHEDULE

A. Provide fire-rated cabinets at all recessed locations in 1 or 2 hour fire-rated walls. See Drawings for locations and wall ratings. Provide recessed non-rated cabinets at all other non-rated wall locations.

B. Provide J.L. Industries “Cosmic” Model 5E at all locations unless noted otherwise.

C. Provide J.L. Industries “Cosmic” Model 5X at Kitchen where indicated, within 30 feet 0 inches of stove in the path of travel.

END OF SECTION

SECTION 10 51 13
METAL LOCKERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fully riveted heavy duty knocked down locker units with hinged doors.

B. End, top, and filler panels.

C. Hooks, latches, and hardware.

D. Attachment hardware.

1.2 REFERENCES

A. ASTM A1008 Cold Rolled Steel.

1.3 SYSTEM DESCRIPTION

A. Lockers: Recessed multiple tier lockers, on concrete base, with padlock hasps.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Include locker types, sizes, configurations, layout of groups of lockers, accessories, and numbering plan.

C. Submit manufacturer's installation instructions.

D. Provide two 3-inch x 6-inch Samples of each color selected. Finish shall be on actual base material.

1.5 PROTECTION

A. Store and protect lockers in manufacturer’s unopened packaging until ready for installation.

B. Protect locker finishes and adjacent surfaces from damage during installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Penco Products: Vanguard Welded Lockers with Classic III Recessed door pull.

B. Republic Storage Systems, Co.

C. Substitutions: Under provisions of Section 01 62 00.

2.2 MATERIALS

A. Steel: ASTM A1008, prime grade mild cold-rolled sheet steel free from surface imperfection, capable of taking a high-grade enamel finish.

1. Sides, bottoms, tops and shelves: 16 gauge steel.

2. Doors: 14 gauge steel with 3/4 inch x 1-1/2 inch high diamond-shaped perforations for ventilation.

3. Door Frames: 16 gauge steel.

4. Backs: 18 gauge steel; solid unless otherwise indicated on the Drawings.

5. Hinges: 16 gauge continuous type hinge.

6. Fillers: 16 gauge steel.

7. Trim: 20 gauge steel.

8. End Panels and Bottom Panel: 16 gauge steel.

9. Hooks: Zinc plated formed steel, gall ends.

10. Bolts and Nuts: Zinc plated truss fin head bolts and hex nuts, for attachment of locker groups to each other.

2.3 ACCESSORIES

A. Provide each locker with 1 shelf, two double-prong wall hooks, and aluminum number plate attached with aluminum rivets.

2.4 FABRICATION

A. Size: 12” wide x 12” deep x 84” high (overall).

B. Locker body construction: Steel specially formed for added strength and rigidity and to ensure tight joints at fastening points.

C. Two- and three-tier locker: Intermediate channel-shaped horizontal frame members attached to side frames with mortise and tenon construction, securely welded.

D. Doors: Multi-point type latch. One piece sheet steel with full channel formation of adequate depth to fully conceal lock bar on lock side; channel formation on hinge side, right angle formations across top and bottom, with holes for attaching number plates.

E. Continuous piano hinge welded to door and riveted to frame for full height of door.

F. Door handles and latching: Provide integral recessed door pull multi-point latch with lifting trigger for padlock. Locking device supplied by Owner.

G. Provide 1-inch thick box end panels at all exposed row ends, filler panels, and metal tops to close off all openings.

1. End panels: Match locker width, depth and configuration with attachment by means of concealed fasteners; finish to match lockers.

2. Top panels: Provide continuous flat top cover over the full length of lockers; finish to match lockers; install with concealed fasteners.

3. Trim Strip: Top and Side Trim Strips at all locker banks.

H. Provide ventilation openings at door and sides between locker frames. Match locker depth, height and finish. Install with concealed fasteners.

I. Hole spacing in locker body construction: Not exceeding 9 inches.

J. Shelf: Locate shelf approximately 9 inches below top of locker

K. Accessible lockers: Conform to ADA and CBC (California Building Code) requirements for height of latching device, shelf, locker bottom and hooks,

L. Fabricate lockers square, rigid, without warp, with metal faces flat and free of distortion; finish edges smooth without burrs.

2.5 FINISHES

A. Finish: Enamel powder coat paint finish electrostatically applied, 2 to 2.2 mils. Finishes containing volatile organic compounds and subject to out-gassing are not acceptable. Locker exterior and interior shall be painted the same color.

B. Paint locker doors and bodies in one color throughout.

C. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 PREPARATION

1. Verify that all bases are properly sized and located; do not begin installation until substrates and bases have been properly prepared.

3.2 INSTALLATION

1. Install lockers and accessories at locations shown on Drawings.

2. Install lockers secure, plumb, square and in line. Set on concrete base as noted in the Drawings.

3. Anchor lockers with appropriate anchor devices to suit materials encountered. Bolt adjoining locker units together to provide rigid installation.

4. Install end panels, filler panels and tops using concealed fasteners. Provide flush hairline joints against adjacent surfaces to completely close off openings.

3.3 ADJUSTING AND CLEANING

1. Install lockers secure, plumb, square, and in line. Set on existing base as noted in the Drawings.

2. Adjust doors and latches to operate without binding. Verify that latches are operating satisfactorily.

3. Touch-up with factory-supplied paint and repair or replace damaged products before substantial completion.

END OF SECTION

SECTION 10 71 13
EXTERIOR SUN CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: Provide design and engineering, labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, erection, and installation for exterior sun control devices as required for the complete performance of the work, and as shown on the Drawings and as herein specified.

B. Section Includes: The work specified in this Section includes, but shall not be limited to, horizontal, fixed, extruded aluminum exterior sun control assemblies.

1.2 REFERENCES

A. General: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.

B. American Architectural Manufacturers Association (AAMA):
1. AAMA 611, "Voluntary Specifications for Anodized Architectural Aluminum (Revised)."
2. AAMA 2605, "Voluntary Specification, Performance Requirements, and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels."

C. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE):
1. ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings" (co-sponsored by IESNA).

D. American Welding Society (AWS):
1. AWS D1.2, "Structural Welding Code - Aluminum" (copyrighted by AWS, ANSI approved).

E. ASTM (ASTM):
1. ASTM B 26/B 26M, "Standard Specification for Aluminum-Alloy Sand Castings."
2. ASTM B 209/B 209M, "Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate."
3. ASTM B 221/B 221M, "Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes."
4. ASTM D 1187, "Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal."

F. National Association of Architectural Metal Manufacturers (NAAMM):
1. NAAMM MFM, "Metal Finishes Manual."

G. SSPC: The Society for Protective Coatings (SSPC):
   1. SSPC Paint 12, "Paint Specification No. 12 Cold-Applied Asphalt Mastic (Extra Thick Film)."

H. South Coast Air Quality Management District (SCAQMD):
   1. SCAQMD Rule #1168, “Adhesive and Sealant Applications,” including most recent amendments.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide exterior sun control assemblies capable of withstanding the effects of loads and stresses from dead loads, live loads, snow loads, wind loads, and normal thermal movement without evidencing permanent deformation of assembly or components including blades, frames, and supports; noise or metal fatigue caused by blade rattle or flutter; or permanent damage to fasteners and anchors.
   1. Dead Load: As required by applicable building code.
   2. Live Load: As required by applicable building code.
   3. Snow Load: As required by applicable building code.
   4. Wind Load: As required by applicable building code.
   5. Thermal Movements: Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures in engineering, fabricating, and installing exterior metal fabrications to prevent buckling, opening of joints, overstressing of components and connections, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.
      a. Temperature Change (Range): 120 °F or 67 °C ambient, 180 °F or 100 °C material surfaces.

1.4 SUBMITTALS

A. General: See Section 01 33 00 - Submittals.

B. Product Data: Submit product data showing material proposed. Submit sufficient information to determine compliance with the Drawings and Specifications. Product data shall include, but shall not be limited to, manufacturer’s technical and descriptive data on exterior sun control components and assemblies.

C. Shop Drawings: Submit shop drawings for each product and accessory required. Include information not fully detailed in manufacturer’s standard product data, including, but not limited to, plans; elevations; and sections and details showing profiles, angles, and spacing of blades, frames and supports. Show unit dimensions related to supporting and adjoining structures and construction. Indicate anchorage details and locations.
   1. Submit shop drawings which have been signed and sealed by a professional engineer licensed to practice in the State in which the Project is located.

D. Samples:
   1. Submit samples for initial color selection. Submit samples of each specified finish. Submit samples in form of manufacturer’s color charts showing full range of colors and finishes available. Where finishes involve normal color variations, include samples showing the full, range of variations expected.

2. Submit samples for verification purposes. Submit 2 inch (51 mm) by 3 inch (76 mm) minimum size sample of selected color coating. Additional samples may be required to show design, fabrication techniques, and workmanship.

E. Quality Control Submittals:
1. Design Data: For installed products indicated to comply with certain design loadings, include structural analysis data signed and sealed by the professional engineer who was responsible for their preparation. Only the loading on the structure at the connections will be reviewed.
2. Qualification Data: Submit qualification data for firms and persons specified in Quality Assurance Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names of architects and owners, and other information specified.

F. LEED Submittals: Submittals that are required to comply with requirements for LEED certification include, but shall not be limited to, the following:
1. Recycled Content Materials: Provide product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
2. Regional Materials: Provide product data for regional materials indicating location and distance from the Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Distance shall be within 500 miles (805 Km) of the Project Site. Include statement indicating cost for each regional material and, if applicable, the fraction by weight that is considered regional.
3. Low-Emitting Materials: Submit certification by the manufacturer confirming that products (i.e., adhesives, sealants, paints, coatings, etc.) meet or exceed the volatile organic compound (VOC) limits set by specific agencies or other requirements as outlined in the LEED Green Building Rating System. VOC limits shall be clearly stated in the submittal.
4. Daylighting 75 Percent of Spaces: Submit certification by the manufacturer confirming that products provide the building occupants a connection between indoor spaces and the outdoors through the introduction of daylight and views into the regularly occupied areas of the building.
5. Optimize Energy Performance: Submit certification by the manufacturer confirming that products contribute to increasing levels of energy performance above the baseline in the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.

G. Maintenance Data: Submit maintenance data for exterior sun control devices to include in operation and maintenance manuals specified in Division 01 - General Requirements.

1.5 QUALITY ASSURANCE

A. Qualifications:
1. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of exterior sun control devices of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of 10 years.

2. Installer Qualifications: Installer shall be a firm that shall have a minimum of five years of successful installation experience with projects utilizing exterior sun control devices similar in type and scope to that required for this Project.
3. Engineer Qualifications: The engineer shall be a professional engineer legally authorized to practice in the jurisdiction where the Project is located and experienced in providing engineering services of the kind indicated that have resulted in the installation of products similar to this Project in material, design, and extent, and that have a record of successful in-service performance.
4. Welder Qualifications: Qualify welding processes and welding operators in accordance with AWS standard qualification procedures. Operators shall carry proof of qualification on their persons.

B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.

C. Welding Standards: Comply with applicable provisions of AWS D1.2.

D. Pre-Installation Conference: Conduct pre-installation conference in accordance with Section 01 31 19 - Project Meetings. Prior to commencing the installation, meet at the Project site to review the material selections, installation procedures, and coordination with other trades. Pre-installation conference shall include, but shall not be limited to, the Contractor, the Installer, and any trade that requires coordination with the work. Date and time of the pre-installation conference shall be acceptable to the Owner and the Architect.

E. Coordination: Coordinate installation of exterior sun control devices with provision of exterior wall system, window framing system, curtain wall system, etc., to ensure proper structural support is provided, attachment of exterior sun control devices is compatible with substrate, and weathertightness of exterior envelope is maintained.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier'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.

1.7 PROJECT CONDITIONS

A. Field Measurements: Take field measurements prior to fabrication of the work and preparation of shop drawings, to ensure proper fitting of the work. Show recorded measurements on final shop drawings. Notify the Owner and the Architect, in writing, of any dimensions found which are not within specified dimensions and tolerances in the Contract Documents, prior to proceeding with the fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the work.
1. Established Dimensions: Where field measurements can not be made without delaying the work, guarantee dimensions and proceed with fabricating of exterior sun

control assemblies without field measurements. Coordinate construction to ensure that exterior sun control assemblies correspond to established dimensions.

1.8 WARRANTY

A. General: See Section 01 77 00 - Closeout Procedures.

B. Special Warranty: The Contractor shall warrant the work of this Section to be in accordance with the Contract Documents and free from faults and defects in materials and workmanship for a period of five years. This special warranty shall extend the one year period of limitations contained in the General Conditions. The special warranty shall be countersigned by the manufacturer and the Installer.

C. Special PVDF Finish Warranty: Submit a written warranty, signed by manufacturer, covering failure of the factory-applied exterior finish within the specified warranty period and agreeing to repair finish or replace work that shows evidence of finish deterioration. Deterioration of finish includes, but shall not be limited to, color fade, chalking, cracking, peeling, and loss of film integrity.
   1. Warranty Period: Warranty period shall be 10 years from date of Substantial Completion.

D. Additional Owner Rights: The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Vertical Sunshades, VS Series as manufactured by DAMS Incorporated. D. Architectural Metal Solutions Incorporated; 5919 W. 118th Street, Alsip, IL 60803; Phone: 708-224-4300; Fax: 708-388-9392; Website: www.damsinc.com Items specified are to establish a standard of quality for design, function, materials, and appearance. No substitutions will be accepted.

B. Substitutions under the provisions of Section 01 25 13, Product Options and Substitutions.

2.2 MATERIALS

A. Aluminum:
   1. Aluminum Extrusions: ASTM B 221/B 221M, Alloy 6063-TB or T2.
   2. Aluminum Sheet: ASTM B 209/B 209M, Alloy 3003 or Alloy 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
   3. Aluminum Castings: ASTM B 26/B 26M, Alloy 319.

B. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit instillation conditions.
2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.

C. Anchors and Inserts: Type, size, and material required for loading and installation indicated. Use non-ferrous metal or hot dip galvanized anchors and inserts for exterior installations and elsewhere as needed for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187 and SSPC Paint 12. Use to separate dissimilar, corrosive metals, or metal from concrete.

2.3 HORIZONTAL, FIXED, EXTRUDED ALUMINUM EXTERIOR SUN CONTROLS

A. General: Provide horizontal, fixed, extruded aluminum exterior sun control assemblies complying with the following:
1. Infill: Airfoil.
2. Outrigger: As detailed.
3. Fascia: None.

B. Basis of Design: Vertical Sunshades, VS Series as manufactured by DAMS Incorporated. D. Architectural Metal Solutions Incorporated. No substitutions will be accepted.

2.4 FABRICATION

A. Assemble exterior sun control assemblies in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitation. Clearly mark units for reassembly and coordinated installation.

B. Exterior sun control assemblies shall be assembled in accordance with manufacturer recommendations.

C. Maintain equal blade spacing, including, but not limited to, separation between blades and frames to produce a uniform appearance.

D. Include supports, anchorage, and accessories required for complete assembly.

2.5 FINISHES

A. Comply with NAAMM MFM for architectural metal products for recommendations for applying and designating finishes. Finish exterior sun control devices after assembly if welded.
1. Aluminum Finishes: Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.

    a. Class I Clear Anodized Finish: AA-M12-C22-A41 (Mechanical Finish: as fabricated, non-specular; Chemical Finish: etched, medium matte; Anodic Coating: Class I Architectural, clear film thicker than 0.7 mil [0.018 mm]) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Architect, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
   1. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to the Project Site.

3.3 INSTALLATION

A. Install exterior sun control devices in accordance with reviewed product data, final shop drawings, and engineering calculations.

B. Locate and place exterior sun control assemblies level, plumb, and at indicated alignment with adjacent work.

C. Use concealed anchorage.

D. Form closely fitted joints with exposed connections accurately located and secured.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be finished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Protect galvanized and non-ferrous metal surfaces from corrosion or galvanic action by applying a heavy coating or bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

3.4 CLEANING

A. Periodically clean exposed surfaces of exterior sun control devices that are not protected by temporary covering to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

B. Before final inspection, clean exposed surfaces with water and a mild soap not harmful to finishes.

C. Clean-up and touch-up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

3.5 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to the Installer, that shall ensure that the exterior sun control devices shall be without damage at time of Substantial Completion.
   1. Use temporary protective coverings where needed and approved by the manufacturer. Remove protective covering at the time of Substantial Completion.

END OF SECTION

SECTION 10 82 13
ROOF SCREENS

1.1 SECTION INCLUDES

A. Stand-alone roof equipment screens and supporting steel framework. Screens shall be designed to attach to the roof structure and not the equipment being screened.

B. Roof screen accessories.

1.2 RELATED SECTIONS

A. Section 051200 - Structural Steel: Metal Framing.

B. Section 053113 - Steel Floor Deck.

C. Section 055000 - Metal Fabrications: Frames and supports.

D. Section 099100 - Paints and Coatings: Field applied paint finish.

E. Division 23 - Roof Top HVAC Equipment.

1.3 REFERENCES

A. ASTM A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

B. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

D. ASTM A 1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

E. ASTM A 1057 - Standard Specification for Steel, Structural Tubing, Cold Formed, Welded, Carbon, Zinc-Coated (Galvanized) by the Hot-Dip Process.

F. ASTM D 4811 - Standard Specification for Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing.

G. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

H. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive

Examination.

I. AWS D1.1 - Structural Welding Code - Steel.

J. AWS D1.6 - Structural Welding Code - Stainless Steel.

1.4 COORDINATION

A. Coordinate Work with other operations and installation of roofing materials to avoid damage to installed insulation and membrane materials.

1.5 ACTION SUBMITTALS

A. Submit under provisions of Section 013300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Layout and erection drawings showing typical cross sections and dimensioned locations of all frames and base supports. Include erection drawings, elevations, and details where applicable. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, shape, and patterns.

1.6 INFORMATIONAL SUBMITTALS

A. Design Calculations: 3 copies of structural design calculations for structural components and components resisting wind loads with seal and signature of professional engineer licensed in the State of California.

B. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

D. Warranties: 3 signed copies.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with a minimum five years documented

experience in producing pre-manufactured metal-framed equipment screens.

B. Design Qualifications: Provide structural design calculations stamped by a professional engineer licensed in the state in which this project is located.

C. Welders: AWS certified within previous 12 months.

D. Pre-Installation Meeting:
   1. Convene at job site, at least seven calendar days prior to scheduled beginning of construction activities of this section, to review requirements of this section.
   2. Require attendance by representatives of the installing subcontractor (who will represent the system manufacturer), the mechanical subcontractors and other entities affected by construction activities of this section.
   3. Notify Architect four calendar days in advance of scheduled meeting date.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the project site clearly marked for proper identification.

B. Receive, handle and store materials in conformance with the manufacturers printed instructions.

C. Store products under cover, in manufacturer's unopened packaging until ready for installation.

D. Protect materials from exposure to moisture.

E. Store materials in a dry, warm, ventilated weathertight location.

F. Protect metal fabrications from damage by exposure to weather.

G. Handling: Use a forklift or crane to move material. Do not lift the bundles by the metal bands.
   1. Fork Lift: Spread the forks as far as possible to balance the load. Drive slowly when moving long bundles over uneven surfaces to avoid tipping the load
   2. Crane: Position the canvas sling straps so that the space between the straps is at least 1/3 the length of the bundle. Use sling straps with looped ends running one end of the strap through the loop at the other end to cinch the bundle when lifted. When setting the load on the roof, put wood blocks under it to protect the roof and allow space to remove the sling straps.
   3. Roof Placement: Spread the bundles and crates out as much as possible to avoid overloading the roof structure. Place the material directly over major supports such as beams or trusses.
   4. Position bundles of tubing parallel to the slope of the roof and block prior to opening to prevent the tubing from rolling down the roof slope when

unbundled.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Field Measurements: Verify roof screen dimensions and conditions of the installation by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating equipment enclosure without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.10 WARRANTY

A. Framing System: Provide manufacturer's standard written limited warranty stating that the complete framing system shall be warranted against structural failure due to cracking, buckling, bending, tearing or corrosion arising under normal use and environmental conditions for the coverage period applicable.

   1. Products installed on projects located 2 miles or greater from salt or brackish bodies of water shall be warranted for twenty (20) years

   2. Products installed on projects located greater than 1 mile but less than 2 miles from salt or brackish bodies of water will be warranted for five (5) years, except for aluminum, stainless steel or copper Products which will be warranted for twenty (20) years.

   3. Products installed on projects located 1 mile or less from salt or brackish bodies of water will be warranted for three (3) years, except for aluminum, stainless steel or copper Products which will be warranted for twenty (20) years

B. Panel Finish:
   1. Provide written warranty stating that the paint finish applied on all equipment enclosure panels will be warranted against chipping, peeling, cracking, fading, or blistering for the coverage period of twenty (20) years.
   2. Provide warranty signed by the panel manufacturer and paint finish applicator (if separate from manufacturer).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Design Loads: Comply with Building Code for site location and building height.
   1. Design to resist ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
   2. Design all materials, assembly and attachments to resist snow, wind, suction and uplift loading at any point without damage or permanent set.

B. Structural Design: Prepare structural design calculations for screen framing and attachment to structure including reactions at base supports for verification of roof structure by Architect.

C. All welds to be performed by an AWS certified welder. Valid certification to be provided.

2.2 MANUFACTURERS

A. Acceptable Manufacturer: RoofScreen Mfg., which is located at: 347 Coral St.; Santa Cruz, CA 95060; Toll Free Tel: 866-766-3727; Tel: 831-421-9230; Fax: 866-253-0738; Email: request info (info@roofscreen.com); Web: www.roofscreen.com.

   1. Product description is based on Aluminum L20 Slatted louver assembly mounted on vertical tree by Roof Screen MFG, Inc.

   2. Or Equal.

B. Requests for substitutions will be considered in accordance with provisions of Section 01 25 00, Substitutions Procedures.

2.3 MATERIALS

A. Square Base Supports: Weldments fabricated from cold rolled steel conforming to ASTM A 1008, fabricated with pre-punched holes in base plate for fastening to roof structure. After fabrication, apply minimum 2 to 4 mil baked on powder coat primer.
   1. Height 5 inches (127 mm).

B. Square Base Support Extensions: Fabricated from same material and finish as base supports.
   1. Height 4 inches (101 mm).

C. Square Base Cap: Weldments fabricated from AISI Type 304 stainless steel with mill finish, and fabricated to overlap base support and flashing boot a minimum of 2 inches (51 mm). Provide moment resisting adjustable connection to attach framing to base cap.

D. Square Galvanized Roof Flashing: Fabricated from galvanized sheet steel, 24 gauge, conforming to ASTM A 653/A 653M. Provide with galvanized sheet steel,

24 gauge (ASTM A 653/A 653M) base flange that extends a minimum of 4 inches (102 mm) onto the roof surface on all four sides. Riser shall be tapered to allow easy fit over Square Base Supports with minimal gap at top of flashing. Solder all seams for water tightness.

E. Square PVC Roof Flashing: Fabricated from 60 mil, white, single ply PVC sheet conforming to ASTM D 4434. Provide with base flange that extends a minimum of 5 inches (127 mm) onto the roof surface on all four sides. Riser shall be tapered to allow easy fit over Square Base Supports with minimal gap at top of flashing. Hot weld all seams for water tightness.

F. Framing: Carbon steel structural tubing in manufacturer's standard sizes, conforming to ASTM A 500 with manufacturer's standard galvanized coating conforming to ASTM A 1057. Provide with wall thickness as determined by structural calculations.

G. Connector Fittings: Fabricated from AISI Type 304 stainless steel with mill finish.

H. Steel Hat Channel: Steel sheet conforming to ASTM A 653, Class SS, with a G90 hot-dip galvanized coating.

I. Hardware: Bolts, nuts and washers: 18-8 stainless steel.

J. Self-Drilling Screws: Carbon steel with factory applied protective coating conforming to ASTM B 117 salt spray testing.

K. Welding Materials: AWS D1.1; type required for materials being welded.

L. Panel:
1. Profile:
   a. L-20 Slatted Louver assembly.

2. Base Metal:
   a. Minimum 24 gauge Galvalume steel sheet, AZ50, conforming to ASTM A 792 for painted and unpainted panels.
3. Finish:
   a. Kynar finish.
   b. Color as selected by Architect from manufacturer's standard color range, 20 colors minimum.
4. Panel Fasteners: No. 14 self-tapping sheet metal screw. Color coat heads to match panel color.
5. Panel Trim: Same material and finish as panel. Configuration as shown on Drawings

2.4 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

E. Fabricate system components so that portions of screen can be dismantled for repairs to equipment being screened and for future roof replacement.

F. Trim and Closures: Fabricated from 24 gauge metal and finished with the manufacturer's standard coating system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine area where work will be installed to verify the installation can be performed in accordance with the Drawings and structural calculation requirements without interference from other equipment or trades.

B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Do not begin installation until conditions have been properly prepared.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects.

C. Provide for erection loads, and for sufficient temporary bracing to maintain indicated alignment until completion of erection and installation of permanent attachments.

D. Anchor fabrications to structure as indicated.

E. Separate dissimilar metals and use gasketed fasteners, isolation shim, or isolation tape to eliminate possibility of corrosive or electrolytic action between metals.

F. Exercise care when installing components so as not to damage finish surfaces. Touch up as required to repair damaged finishes.

G. Install flashing boots at base supports as required to provide a watertight connection. Install as recommended by the roof membrane manufacturer.

H. Remove all protective masking from material immediately after installation.

3.4 CLEANING AND PROTECTION

A. Remove all protective masking from framing and trim material immediately after installation. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. Maintain in a clean condition during construction.

B. Protect installed products until completion of project.
   1. Ensure that finishes and structure of installed systems are not damaged by subsequent construction activities.
   2. If minor damage to finishes occurs, repair damage in accordance with manufacturer's recommendations; provide replacement components if repaired finishes are unacceptable to Architect.

C. Prior to Substantial Completion: Remove dust or other foreign matter from component surfaces; clean finishes in accordance with manufacturer's instructions.

D. Replace metal wall panels and framing members that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 11 00 00
MISCELLANEOUS EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. TV monitor supports.

B. Gate fire padlocks.

C. Access ladder.

D. Ceramics glazing table.

1.2 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Submit Product Data and manufacturer's installation instructions for each item.

1.3 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 01 70 00.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. TV/Monitor Supports:

1. Wall Mounted TV Bracket: Bretford locking yoke-mount Model TVWW3035WW-BK with wall plate TVMPEX-BK for 16 inch studs, OSHPD-approved for 175 pounds. Equivalent products by Lucasey or Peerless are acceptable if they meet all requirements. Provide VCR attachments.

B. Gate Fire Padlocks: Padlocks as manufactured by The Knox Company, 5/16 inch diameter x 2-5/8 inch long steel shackle or 7/16 inch diameter x 1-7/8 inch long steel shackle at all entry gates as shown on Drawings. Select lock type appropriate for each installation.

C. Access Ladder: O'Keefe's, Inc., Model 503, or approved equal; tubular rail, high parapet access ladder, serrated aluminum grab bars, rungs, and platform.

D. Ceramics Glazing Table: Alpine Kiln glazing table with bins, Model ALGFT8SH. Dimensions- 46.5" x 22.5" x 37", 10 half bins (8"x14"x10". Constructed of MIG welded steel frame, aluminum bins, and stainless steel top.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that all concealed supports are accurately installed in positions to receive Work and opening dimensions are as indicated on approved Shop Drawings.

B. Verify that all finishes are complete and ready to receive Work.

C. Beginning of installation means acceptance of supports and substrate.

3.2 INSTALLATION

A. Install equipment in accordance with manufacturer's printed instructions and as indicated on the Drawings.

B. Furnish all necessary hardware, anchors, inserts, connections, and embedded items necessary for proper installation. Coordinate with Work of other Sections.

3.3 GUARANTEES AND WARRANTIES

A. Contractor shall guarantee all miscellaneous equipment, in writing, against defects in workmanship and material for a minimum of one year after final acceptance. During this time, all equipment must be kept in proper operating condition at no additional labor or material cost to Owner.

B. Warranty service must be rendered within 4 hours and all problems resolved within 24 hours of notification by Owner.

C. The manufacturer shall maintain a replacement parts department and provide test equipment when needed. A complete parts department shall be located in a geographical proximity consistent with rendering service within the stated twenty-four hour period. An ample stock of individual components and equivalent unit replacements shall be carried for as long a period as demand warrants. This period shall extend beyond the normal life expectancy of the equipment, with ten years being minimum period. Shipping costs associated with providing required equipment not available in local stock shall be the responsibility of the Contractor.

D. Actions which may void warranty shall be identified and submitted for Owner's approval prior to award of Contract.

END OF SECTION

SECTION 11 53 13
LABORATORY FUME HOODS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fume hoods, work tops, and understructures, including all filler panels, knee space panels and scribes as shown on Drawings.

1. Furnishing and delivering all service outlets, accessory fittings, electrical receptacles and switches, as listed in these Specifications, equipment schedules or as shown on Drawings. Plumbing fixtures mounted on the fume hood superstructures shall be preplumbed. Electrical fixtures shall be prewired. The fume hood superstructure shall be listed to UL Standards for Safety by Underwriters Laboratories Inc. (UL). Final plumbing and electrical connections are the responsibility of those subcontractors fulfilling requirements of Divisions 15 and 16.

1.2 REFERENCES

A. ASHRAE Standard 100.1995 - Method of Testing Performance of Laboratory Fume Hoods.

B. NSF STD#49 - Photometric Method of Testing.

C. NIH03-112C - National Institute of Health Specification.

D. UL - Underwriters Laboratories.

E. ASTM D552 - Bending Test.

F. NFPA-45 - National Fire Protection Association.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Submit manufacturer's data and installation instructions for each type of fume hood. Provide data indicating compliance with ASHRAE Standard 110.1995.

C. Samples: Samples if called for will be reviewed for color, texture, and pattern only. Submit the following:

1. Hood interior lining, 6 by 6 inches.

2. Hood enclosure, 6 by 6 inches, of color selected.

3. Operation sign(s).

D. Shop Drawings: Submit for fume hoods, shoring plans, elevation, ends, cross-sections, service run spaces, location and type of service fittings:

1. Coordinate with other Work involved.

2. Provide roughing-in drawings for mechanical and electrical services when required.

3. Provide face opening, air volume, and static pressure drop data.

1.4 PERFORMANCE REQUIREMENTS

A. Fume hoods shall be of complete airfoil design to insure maximum operating efficiency. Foil sections at the front fascias of the hood shall minimize eddying of air currents at the hood face and the rear baffle system shall minimize turbulence in the upper portion of the hood interior.

B. Standard Fume Hood Types:

1. Variable Air Volume: The fume hoods shall be of the variable air volume type in which the exhaust air volume varies proportionally to the hood opening when used with a hood face velocity controller system (provided by others). The air bypass shall be restricted per the VAV Manufacturer's recommendation.

C. Containment:

1. Purpose: The purpose of this Specification is to prequalify the performance of the bidder's laboratory fume hood before Award of Contract. At his option, the District or its representative may require the same tests to be performed and the same performance be achieved before acceptance of the hood after Award of Contract. The [Owner] [District] or its representative shall witness the tests. Failure to meet the performance specified shall be cause for rejection of the hood.

2. Test Method: The hood shall be tested per the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) Standard 110-1995 and by the Auxiliary Air Capture Test (Auxiliary Air hoods only).

3. Location of Tests and Test Facility: All tests referenced herein shall be performed in the bidder's fume hood test facility. The test facility shall meet the following requirements:
   a. The test facility shall have sufficient area so that a minimum of 5 feet of clear space is available in front of and on both sides of the hood for viewing tests.

   b. The facility's ventilation system shall have adequate heating and air conditioning so that room air temperatures can be maintained within the desired ranges.

c. Room air currents in the test area shall be less than 20 feet per minute.

d. The hood exhaust system shall be properly calibrated so that the desired exhaust air volumes can be easily attained.

4. Instrumentation, Equipment and Test Personnel: Qualified personnel to perform the tests shall be supplied by the manufacturer. Instrumentation and equipment required shall be supplied by the manufacturer. Required instrumentation shall include but not be limited to the following items:

a. Thermal anemometer capable of measuring air velocities from 10 to 600 feet per minute.

b. Three dozen one-half minute smoke candles.

c. Four ounces of titanium tetrachloride.

d. Supply of cotton throat swabs.

e. ITI Leakmeter 120 calibrated to indicate concentration of sulfur hexafluoride or equivalent.\

f. Flowmeter – 150 ml/minute capacity.

g. Flowmeter – 15 L/minute capacity.

h. Four gas sampling bags – 8 liter capacity.

i. Two vacuum pumps – 1 CFM capacity.

j. Two flow regulating valves.

k. Two size 3 tanks of sulfur hexafluoride with a two-stage regulator or other tracer gas suitable for detector to be used.

l. Three-way gas valve.

m. Mannequin, 5 feet 7 inches in height, or reasonable human proportions with arms hanging at its side.

n. ASHRAE 110-1995 tracer gas ejector.

5. ASHRAE Standard 110-1995 Test: Hood shall be tested with a face velocity of 100 feet per minute full open vertically and at 100 FPM right, left and center 100% open horizontally. If horizontal openings are present, additional sash configurations and face velocities may be specified. The hood shall have a performance rating of 4.0 AM 0.01 or better wherein:

a. 4.0 = tracer gas release in liters/minute.

b. AM = as manufactured.

c. 0.01 = level control of tracer gas in parts per million (ppm).

1.5 QUALITY ASSURANCE

A. The laboratory fume hood manufacturer shall provide fume hood work tops and casework, all manufactured or shipped from the same geographic location to assure proper staging, shipment and single source responsibility.

B. All fume hoods and related equipment shall be the products of one manufacturer.

1.6 WARRANTY

A. The manufacturer shall warrant for a period of one year, starting date of Substantial Completion, that all products shall be free from defects in material and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Labconco, Kansas KCity, MO & Fort Scott, KS. 800.821.5525. www.labconco.com

B. Kewaunee Scientific Corporation, 2700 West Front Street, Statesville, North Carolina.

C. Advanced Lab Concepts/Mott Manufacturing Sigma Systems fume hoods.

D. Substitutions: Under provisions of Section 01 62 00.

2.2 PRODUCT

A. Labconco Protector Pass-Through Laboratory Hood, Benchtop style, 5’ nominal width, with (2) gas and electrical outlets, remote blower, & T8 fluorescent lighting. This hood has glazed sashes on the front and rear.

B. Or equal to the below:

2.2 MATERIALS AND CONSTRUCTION

A. Fume Hood Interior Walls: Double wall ends, not more than 4 inches wide, shall be provided to maximize interior working area. The area between the double wall ends shall be closed to house the remote control valves. The front vertical facia section shall have a full 135 degree 1 inch radius at the front leading edge to provide a streamlined section and insure smooth even flow of air into the hood. The vertical fascias shall contain the required service controls, electrical switches and receptacles. The hood interior end panels and sash track shall be flush with the facia to prevent eddy currents and back flow of air.

B. Fume Hood Airfoil: A streamlined airfoil shall be integral at the bottom of the hood opening on bench and distillation hoods. This foil shall provide a nominal 1 inch open space between the foil and the top front edge of the work surface to direct an air stream across the work surface to prevent back flow of air. The airfoil shall extend back under the sash, so that the sash does not close the 1 inch opening. The foil shall be removable to allow large equipment into the hood. The foil shall be of 12-gauge steel to resist denting and flexing. Walk-in hoods shall have a stop located at the bottom of the sash track that will ensure a nominal 1 inch opening between the bottom of the sash and the floor.

C. Fume Hood Top Panel: The top front panel of the hood shall have an integral vision panel. It shall be located directly above the sash opening and in such a manner that it allows viewing into the top portion of the hood without the operator having to stoop or place their face inside the hood.

D. Fume Hood Baffles: The upper and lower horizontal slots shall be provided with adjustable baffles that allow the slots to be opened or closed.

E. Fume Hood Duct Collar: A 12 inch diameter polyethylene bell-mouthed duct collar shall be located in the top of the hood plenum chamber. Coated common steel duct collars are not acceptable.

F. Fume Hood Lighting: A two-tube T-12 (T-87) fluorescent light fixture (bulbs not included) of the size given below shall be provided at the top of the hood to give maximum light in the hood working area. The light fixtures shall be isolated from the hood interior by a 1/4 inch thick tempered glass panel sealed from the hood cavity. Fixture shall be UL labeled.

G. Fume Hood Sash: A vertical rising sash of 1/4 inch laminated safety float glass shall be provided. The sash shall have a neutral colored polyvinyl chloride horizontal member at the top and a full length metal handle at the bottom. The sash shall be counterbalanced with a single weight to prevent tilting and binding during operation. The sash track shall be a neutral colored polyvinyl chloride set flush with the interior liner panels to minimize turbulence. Bench hoods shall have one sash in a single slotted sash track. Walk-in hoods shall have two sashes in a double slotted sash track.

H. Fume Hood Plumbing Services: Plumbing services shall consist of remote control valves as selected located within the end panels, controlled by extension rods projecting through the control panels of the hood, with color coded plastic handles. Interior fitting for gases and water shall be nylon panel flanges and angle serrated hose connectors, color coded. Interior fittings for distilled water shall consist of a bronze tin lined, white color-coded, panel flange and angle serrated hose connector. Interior fittings for steam shall consist of a cast bronze flange and angle serrated hose connector with a chemical resistant metallic bronze finish. Water goosenecks shall be cast bronze with a chemical resistant metallic bronze finish. All plumbing fittings shall be factory installed and piped between the valve and the outlet. Inlet piping shall have a single-point connection for each valve provided and carried to a point 1 inch above the fume hood roof or 1 inch above the worktop rear corner

depending on the rough-in locations shown in the drawings. Points of final service connection by other trades shall be at the stub provided by the fume hood manufacturer.

I. Fume Hood Electrical Services: The hood superstructure shall be pre-wired and contain a UL label certifying acceptable wire gauge, connections, fixtures and wire color coding. Wiring electrical services shall consist of two duplex receptacles and a light switch. The duplex receptacles shall be 20 Amp., 125 Volt AC, and 3-wire polarized grounded with ground fault interruption. The receptacles shall be of specification grade, side wired only, to insure a positive connection. The light switch shall be 20 Amp., 125 volt AC, and 3-wire polarized grounded. Wiring shall terminate in one 6 inch x 6 inch x 4 inch service junction box located on the fume hood roof. Final wiring and circuit dedication shall be by others.

J. Hood Worksurfaces: Hood worksurface shall be 1-1/4 inch thick molded epoxy resin made in the form of a watertight pan, not less than 3/8 inch deep to contain spillage with a 6 inch wide safety ledge across the front edge. Top shall be manufactured at the same manufacturing location as the fume hood to assure proper cutout alignment and coordinated shipping. A cup drain flush with the recessed worksurface shall be provided. The worksurface and cup drain shall be available in either black or grey.

K. Access Openings: The interior end liner panels shall be furnished with an opening that provides access to the service piping and valves to facilitate installation and maintenance. The openings shall be covered with a removable panel with rounded corners. Panels that require tools to remove are not acceptable. The panel shall provide an overlapping seal on all edges.

L. Fume Hood Finish: After the component parts have been completely welded together and before finishing, they shall be given a pre-paint treatment to provide excellent adhesion of the finish system to the steel and to aid in the prevention of corrosion. Physical and chemical cleaning of the steel shall be accomplished by washing with an alkaline cleaner, followed by a spray treatment with a complex metallic phosphate solution to provide a uniform fine grained crystalline phosphate surface that shall provide both an excellent bond for the finish and enhance the protection provided by the finish against humidity and corrosive chemicals.

1. After the phosphate treatment, the steel shall be dried and all steel surfaces shall be coated with a chemical and corrosion-resistant, environmentally friendly, electrostatically applied powder coat finish. All components shall be individually painted, insuring that no area be vulnerable to corrosion due to lack of paint coverage. The coating shall then be cured by baking at elevated temperatures to provide maximum properties of corrosion and wear resistance.
2. The completed finish system in standard colors shall meet the performance test requirements specified.

M. Performance Test Results (Chemical Spot Tests):

1. Testing Procedure: Chemical spot tests for non-volatile chemicals shall be made by applying 5 drops of each reagent to the surface to be tested and covering with a 1-1/4 inch diameter watch glass, convex side down to confine the reagent. Spot tests of volatile chemicals shall be tested by placing a cotton ball saturated with reagent on the surface to be tested and covering with an inverted 2-ounce wide mouth bottle to retard evaporation. All spot tests shall be conducted in such a manner that the test surface is kept wet throughout the entire test period, and at a temperature of 77 degrees ±3 degrees Fahrenheit. For both methods, leave the reagents on the panel for a period of one hour. At the end of the test period, the reagents shall be flushed from the surface with water, and the surface scrubbed with a soft bristle brush under running water, rinsed and dried. Volatile solvent test areas shall be cleaned with a cotton swab soaked in the solvent used on the test area. Immediately prior to evaluation, 16 to 24 hours after the reagents are removed, the test surface shall be scrubbed with a damp paper towel and dried with paper towels.

2. Test Evaluation: Evaluation shall be based on the following rating system. After testing, panel shall show no more than three (3) Level 3 conditions.

   a. Level 0 - No detectable change.

   b. Level 1 - Slight change in color or gloss.

   c. Level 2 - Slight surface etching or severe staining.

   d. Level 3 - Pitting, cratering, swelling, or erosion of coating. Obvious and significant deterioration.

3. Test Reagents:

Test No.	Chemical Reagent	Test Method
1.	Acetate, Amyl	Cotton ball & bottle
2.	Acetate, Ethyl	Cotton ball & bottle
3.	Acetic Acid, 98%	Watch glass
4.	Acetone	Cotton ball & bottle
5.	Acid Dichromate, 5%	Watch glass
6.	Alcohol, Butyl	Cotton ball & bottle
7.	Alcohol, Ethyl	Cotton ball & bottle
8.	Alcohol, Methyl	Cotton ball & bottle
9.	Ammonium Hydroxide, 28%	Watch glass
10.	Benzene	Cotton ball & bottle
11.	Carbon Tetrachloride	Cotton ball & bottle
12.	Chloroform	Cotton ball & bottle
13.	Chromic Acid, 60%	Watch glass
14.	Cresol	Cotton ball & bottle
15.	Dichlor Acetic Acid	Cotton ball & bottle
16.	Dimethylformanide	Cotton ball & bottle
17.	Dioxane	Cotton ball & bottle
18.	Ethyl Ether	Cotton ball & bottle

19.	Formaldehyde, 37%	Cotton ball & bottle
20.	Formic Acid, 90%	Watch glass
21.	Furfural	Cotton ball & bottle
22.	Gasoline	Cotton ball & bottle
23.	Hydrochloric Acid, 37%	Watch glass
24.	Hydrofluoric Acid, 48%	Watch glass
25.	Hydrogen Peroxide, 3%	Watch glass
26.	Iodine, Tincture of	Watch glass
27.	Methyl Ethyl Ketone	Cotton ball & bottle
28.	Methylene Cloride	Cotton ball & bottle
29.	Mono Chlorobenzene	Cotton ball & bottle
30.	Naphthalene	Cotton ball & bottle
31.	Nitric Acid, 20%	Watch glass
32.	Nitric Acid, 30%	Watch glass
33.	Nitric Acid, 70%	Watch glass
34.	Phenol, 90%	Cotton ball & bottle
35.	Phosphoric Acid, 85%	Watch glass
36.	Silver Nitrate, Saturated	Watch glass
37.	Sodium Hydroxide, 10%	Watch glass
38.	Sodium Hydroxide, 20%	Watch glass
39.	Sodium Hydroxide, 40%	Watch glass
40.	Sodium Hydroxide, Flake	Watch glass
41.	Sodium Sulfide, Saturated	Watch glass
42.	Sulfuric Acid, 33%	Watch glass
43.	Sulfuric Acid, 77%	Watch glass
44.	Sulfuric Acid, 96%	Watch glass
45.	Sulfuric Acid, 77% and Nitric Acid, 70%, equal parts	Watch glass
46.	Toluene	Cotton ball & bottle
47.	Trichloroethylene	Cotton ball & bottle
48.	Xylene	Cotton ball & bottle
49.	Zinc Chloride, Saturated	Watch glass

* Where concentrations are indicated, percentages are by weight.

N. Performance Test Results (Heat Resistance): Hot water (190 degrees Fahrenheit – 205 degrees Fahrenheit) shall be allowed to trickle (with a steady stream at a rate not less than 6 ounces per minute) on the finished surface, which shall be set at an angle of 45 degrees from horizontal, for a period of five minutes. After cooling and wiping dry, the finish shall show no visible effect from the hot water treatment.

O. Performance Test Results (Impact Resistance): A one-pound ball (approximately 2 inch diameter) shall be dropped from a distance of 12 inches onto the finished surface of steel panel supported underneath by a solid surface. There shall be no evidence of cracks or checks in the finish due to impact upon close eye-ball examination.

P. Performance Test Results (Bending Test): An 18 gauge steel strip, finished as specified, when bent 180 degrees over a 1/2 inch diameter mandrel, shall show no peeling or flaking off of the finish.

Q. Ninety or more squares of the test sample shall remain coated after the scratch adhesion test. Two sets of eleven parallel lines 1/16 inch apart shall be cut with a razor blade to intersect at right angle thus forming a grid of 100 squares. The cuts shall be made just deep enough to go through the coating, but not into the substrate. They shall then be brushed lightly with a soft brush. Examine under 100 foot-candles of illumination. This test is based on ASTM D2197-68, "Standard Method of Test for Adhesion of Organic Coatings".

R. Performance Test Results (Hardness): The test sample shall have a hardness of 4-H using the pencil hardness test. Pencils, regardless of their brand are valued in this way: 8-H is the hardest, and next in order of diminishing hardness are 7-H, 6-H, 5-H, 4-H, 3-H, 2-H, F, HB, B (soft), 2-B, 3-B, 4-B, 5-B (which is the softest). The pencils shall be sharpened on emery paper to a wide sharp edge. Pencils of increasing hardness shall be pushed across the paint film in a chisel-like manner until one is found that will cut or scratch the film. The pencil used before that one-that is the hardest pencil that will not rupture the film-is then used to express or designate the hardness.

S. Fume Hood Dimensions: Double wall end panel thickness shall not exceed 4 inches. Interior clear working height shall be not less than 41-3/4 inches at any location in the interior of the hood on bench hoods and 76 inches on walk-in and distillation hoods. Interior depth from the back of the sash to the front of the rear baffle shall not be less than 25-1/4 inches. The sash opening shall be not less than 28 inches in height above the worksurface on bench hoods and 60 inches on walk-in and distillation hoods.

T. Fume Hood Liners:

1. KMER Epoxy Resin Lining: KMER epoxy resin liner shall be the manufacturing standard for liners in this specification. To assure proper punching and coordination with remaining pieces of assembled fume hood superstructure, this liner material shall be manufactured at the same geographic location and the fume hood superstructure. Interior liner panels shall be 1/4 inch thick epoxy resin sheets of a neutral color. Interior liner panels shall be fastened using stainless steel screws with plastic covered heads. Flame spread of material as measured by ASTM E84 shall be 6.2 or less. Fiberglass reinforced plastics or polyesters shall not be acceptable substitute liner materials for epoxy resin.

2. KEMGLASS Reinforced Polyester Lining: Interior liner panels shall be 1/4 inch thick fiberglass reinforced polyester sheet. Interior liner panels shall be fastened using stainless steel screws with plastic covered heads.

3. Reinforced Phenolic Resin Lining: Interior liner panels shall be 1/4 inch thick made from a compression molded cellulose fiber reinforced phenolic resin core with integrally cured white melamine surfaces. Interior liner panels shall be fastened using stainless steel screws with plastic covered heads.

4. Stainless Steel Lining: Interior liner panels shall be 16 gauge Type 304 stainless steel with a No. 4 finish. Interior liner panels shall be fastened using stainless steel screws.

U. Liner Tests - Chemical Spot Tests - 24 Hours:

1. Chemical spot test shall be made by applying 10 drops of each reagent to the surface to be tested. Each reagent (except those marked **) shall be covered with a 1-1/2 inch diameter watch glass, convex side down to confine the reagent. Spot tests of volatile solvents marked ** shall be tested as follows: A 1 inch or larger ball of cotton shall be saturated with the solvent and placed on the surfaces to be tested. The cotton ball shall then be covered by an inverted 2-ounce, wide mouth bottle to retard evaporation. All spot tests shall be conducted in such a manner that the test surface is kept wet throughout the entire 24-hour test period and at a temperature of 77 degrees Fahrenheit ± 3 degrees Fahrenheit.

2. At the end of the test period, the reagents shall be flushed from the surfaces with water and the surface scrubbed with a soft bristle brush under running water, rinsed, and dried. Volatile solvent test areas shall be cleaned with a cotton swab soaked in the solvent used on the test area. Spots where dyes have dried shall be cleaned with a cotton swab soaked in alcohol to remove the surface dye. The test panel shall then be evaluated immediately after drying.

3. Ratings/Legend

1 - KMER (Kewaunee Modified Epoxy Resin)
2 - Glass Reinforced Polyester
3 - Stainless Steel 304
4 - Stainless Steel 316
5 - Reinforced Phenolic Resin

A = No effect or slight change in gloss
B = Slight change in gloss or color
C = Slight etching or severe staining
D = Swelling, pitting, or severe etching

RESULTS:	1	2	3	4	5
1. Acetic Acid 98%	A	B	B	B	A
2. Acetone **	A	D	A	A	A
3. Acid Dichromate	A	A	A	A	A
4. Ammonium Hydroxide ** 28%	A	A	B	B	A
5. Amyl Acetate **	A	A	A	A	A
6. Benzene **	A	A	A	A	A
7. Butyl Alcohol **	A	A	A	A	A
8. Carbon Tetrachloride **	A	A	A	A	A
9. Chloroform **	A	D	A	A	A
10. Chromic Acid 60%	B	B	C	C	A
11. Cresol	A	A	A	A	A
12. Dichloroacetic Acid	A	D	B	A	A
13. Dimethylformamide	A	A	A	A	A

14.	Dioxane **	A	A	A	A	A
15.	Ethyl Acetate **	A	A	A	A	A
16.	Ethyl Ether **	A	A	A	A	A
17.	Ethyl Alcohol **	A	A	A	A	A
18.	Formaldehyde	A	A	A	A	A
19.	Formic Acid 90%	A	A	A	A	A
20.	Furfural **	B	B	A	A	C
21.	Gasoline **	A	A	A	A	A
22.	Hydrochloric Acid 37%	A	A	B	B	A
23.	Hydrofluoric Acid 48%	B	D	D	D	A
24.	Hydrogen Peroxide 30%	A	A	A	A	A
25.	Methyl Ethyl Ketone **	A	A	A	A	A
26.	Methyl Alcohol **	A	A	A	A	A
27.	Methylene Chloride **	A	D	A	A	A
28.	Monochlorobenzene **	A	A	A	A	A
29.	Naphthalene **	A	A	A	A	A
30.	Nitric Acid 20%	B	A	B	A	A
31.	Nitric Acid 30%	B	A	B	A	A
32.	Nitric Acid 70%	B	D	B	A	A
33.	Phenol ** 85%	A	C	A	A	A
34.	Phosphoric Acid 85%	A	A	B	A	A
35.	Silver Nitrate	B	C	A	A	C
36.	Sodium Hydroxide 40%	A	D	A	A	A
37.	Sodium Hydroxide 20%	A	D	A	A	A
38.	Sodium Hydroxide 10%	A	D	A	A	A
39.	Sodium Hydroxide Flake	A	B	A	A	A
40.	Sodium Sulfide	A	B	A	A	A
41.	Sulfuric Acid 77%	A	A	C	A	A
42.	Sulfuric Acid 96%	C	D	C	A	C
43.	Sulfuric Acid 33%	A	A	C	A	A
44.	Tincture of Iodine	A	C	B	B	A
45.	Toluene **	A	A	A	A	A
46.	Trichlorethylene **	A	A	A	A	A
47.	Xylene **	A	A	A	A	A
48.	Zinc Chloride	A	A	B	A	A
49.	Nitric 70%/Sulfuric Acid 77%*	B	B	B	A	A

* Equal parts of Nitric Acid 70% and Sulfuric Acid 77%.
** Indicates these solvents tested with cotton and jar method

W. Fume Hood Base Cabinets:

1. Standard Steel:

a. Unless otherwise indicated base units under hoods shall be fabricated of cold rolled prime grade roller leveled furniture steel. Gauges of steel used in construction shall be 18 gauge except as follows.

b. Corner gussets for leveling bolts and apron corner braces, 12 gauge.

c. Hinge reinforcements, 14 gauge.

d. Top and intermediate front horizontal rails, apron rails and reinforcement gussets, 16 gauge.

e. Door assemblies and adjustable shelves, 20 gauge.

f. Performance of the painted surfaces shall match that of the fume hood outer panels.

X. Accessories:

1. Filters and Housings: Where called for, a filter housing shall be provided above the hoods. The housing shall contain an absolute filter (99.97% efficient for 0.3 micron particles) and a furnace type prefilter. The housing shall form a rigid, self-supporting assembly and have a gasketed front cover to allow replacement of the filters without disturbing the ductwork. The filter housing shall be fabricated of cold rolled steel with a chemical resistant finish.

2. Alarms: Audible alarm must sound when both sashes are open at the same time. Alarm may be one of the following.

   a. Low Face Velocity Alarm: Fume hoods shall be provided with an electronic alarm system to detect low hood face velocities. The alarm system shall sense the actual face velocity of the hood regardless of sash position. The system shall have air velocity sensing thermistor located in the monitor on the face of the hood. The monitor shall have a green light activated when the face velocity is above the set point and a red light and audible alarm which are activated when the face velocity is below the set point. The audible alarm can be acknowledged and silences with mute switch on panel. When the mute is activated, it automatically resets itself when face velocity again rises above calibrated set point. The set point is to be factory set and calibrated at approximately 70 feet per minute. Field calibration is possible with adjustment of recessed zero potentiometer on front of unit.

   b. Low Static Pressure Alarm: Fume hoods shall be provided with an alarm system to detect low hood face velocities. The alarm system shall sense the static pressure in the exhaust duct above the hood using a differential pressure switch. The switch shall incorporate a gauge and switch set point indicators for continuous indication of hood static pressure and alarm settings. The switch shall be diaphragm operated with switching accomplished by photocell controlled relays. The alarm shall have both high and low set points which can be set from the front of the unit. The alarm shall have both visible (red light) and audible (buzzer) signals to alert the fume hood operator of an unsafe condition. The buzzer shall have a momentary contact silencing

switch to allow the buzzer to be silenced. The red light shall remain on as long as the alarm condition exists.

c. Digital Face Velocity Alarm System: Fume hoods shall be provided with an alarm system to detect low and high hood face velocities. The alarm system shall indicate the actual face velocity of the hood regardless of sash position. The system shall have an air velocity sensor mounted on the interior side liner of the hood where it is easily accessible for cleaning. The velocity monitor shall have a digital display of the air velocity through the hood face in feet per minute. The alarm signals shall activate any time the face velocity falls below the low velocity alarm set point or rises above the high velocity alarm set point. There shall be both visual and audible alarm signals. The audible alarm shall have a mute. Low and high alarm contacts shall be provided for remote monitoring.

PART 3 - EXECUTION

3.1 SITE EXAMINATION

A. The District and/or its representative shall certify building condition conducive to the installation of a finished goods product, including all critical dimensions.

3.2 INSTALLATION

A. Preparation: Prior to beginning installation of fume hood, check and verify that no irregularities exist that would affect quality of execution of Work specified.

B. Coordination: Coordinate the Work of this Section with the schedule and other requirements of other Work being performed in the area at the same time both with regard to mechanical and electrical connections to and in the fume hoods and the general construction Work.

C. Performance: Install fume hoods, plumb, level, rigid, securely anchored to building and adjacent furniture in proper location, in accordance with manufacturer's instructions and the approved Shop Drawings. Provide filler panels between top of hood and ceiling. Securely attach access panels but provide for easy removal and secure reattachment. Do not install any damaged units.

D. Adjust and Clean:

1. After installations are complete, adjust all moving parts for smooth operation.

2. Remove all packing materials and debris resulting from this Work, and turn over the fume hoods to the Owner clean and polished both inside and out.

3. Repair or remove and replace defective work, as directed by DIstirct and/or its representative upon completion of installation.

E. Protection:

1. Provide reasonable protective measures to prevent casework and equipment from being exposed to other construction activity.

2. Advise owner and/or his representative of procedures and precautions for protection of material, installed laboratory casework and fixtures from damage by work of other trades.

F. Certification:

1. Fume Hood Manufacturer shall field test a random sample of 20% of the installed units using ANSI/ASHRAE 110-1995 to a control level of Al 0.01 ppm or better.

2. Project substantial completion shall be withheld until all required fume hood certification letters, tests, and reports have been submitted to and approved by the Architect.

END OF SECTION

SECTION 12 20 00
WINDOW SHADES AND BLINDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Manual sunscreen roller shades.

B. Shroud and fascia assemblies.

C. Operating hardware.

D. Related Work:

a. Section 05 22 16 - Metal Stud Framing System: Metal backing for mounting roller shades and accessories

b. Section 06 10 00 - Rough Carpentry: Wood blocking and grounds for mounting roller shades and accessories

c. Section 09260 - Gypsum Board Assemblies: Coordination with gypsum board assemblies for installation of shade pockets, closures and related accessories

1.2 REFERENCES

A. ASTM E84 - Flame Spread.

B. FS CCC-C-521E - Fire Retardency.

C. NFPA 701 - Large Scale/Small Scale Requirements.

D. ASTM G-21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

1.3 SYSTEM DESCRIPTION

A. Fabric window shades.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00. Coordinate with window submittals.

B. Submit Shop Drawings indicating opening sizes, tolerances required, installation of blind at window opening, method of attachment, clearances, and operation.

C. Submit Product Data indicating physical and dimensional characteristics such as light filtration capabilities and operating features.

1. Preparation instructions and recommendations.
2. CHPS Low-Emitting Materials Product List or by a 3rd party certification program listing low-emitting material products that meet the State testing requirements, as identified on the CHPS website.
3. Styles, material descriptions, dimensions of individual components, profiles, features, finishes, light filtration capabilities and operating instructions.
4. Storage and handling requirements and recommendations.
5. Mounting details and installation methods.

D. Submit two 6 inch long Samples illustrating material weave and fabric color and louver blind material color.

E. Submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with ten years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and protect products to site under provisions of Section 01 87 00.

B. Deliver products wrapped and crated in a manner to prevent damage to components or marring of surfaces.

C. Store in a clean, dry area, laid flat and blocked off ground to prevent sagging, twisting, or warping.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.8 WARRANTY

A. Roller Shade Hardware, Chain: Manufacturer's standard non-depreciating twenty-five year limited warranty.

B. Shadecloth: Manufacturer's standard non-depreciating twenty-five year limited warranty.

C. Roller Shade Motors and Motor Control Systems: Manufacturer's standard non-depreciating five-year warranty.

D. Roller Shade Installation: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. MechoShade Systems, Inc.

B. Substitutions: Under provisions of Section 01 62 00.

2.2 MATERIALS

A. Roller Shades: Based on MechoShade manually-operated units as a standard of quality.

1. Shade: “Thermoveil” 2100 Group sunscreen, open basket-weave, meeting the requirements of FS CCC-C-521E for fire retardency and ASTM E 84-90 for flame spread 17, smoke density index 118.

2. Openness Factor:

   a. North-facing window: 5%
   b. South-facing window: 3%
   c. West-facing window: 3%
   d. East-facing window:3%
   e. Verify all Openness Factors with Architect.

3. Operator: One-piece, chain operated clutch molded and a linear disc-brake opposed to a flat steel backing plate and concealed variable adjustment system, adjustable from 100% friction (static) to 15% friction (dynamic).

4. Fascia Concealer: Snap-on extruded aluminum, clear anodized.

5. Accessories: As required for mounting directly to window frame assembly.

6. Cord: Chain (ball type).

7. Factory Finishing: Manufacturer’s standard color shade. Clear anodized aluminum accessories.

2.3 MOUNTING

A. Mounting Types:

1. Inside Mounting: Shade or blind mounts through top of head assembly to inside of window opening. Shade shall be sized with current clearance not to come in contact with sides of window opening, and shall be wide enough to block the maximum amount of light.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive the Work.

B. Do not commence fabrication until field measurements are confirmed.

C. Ensure head rail supports are correctly placed.

D. Beginning of installation means installer accepts existing surfaces.

3.2 INSTALLATION

A. Install shades in accordance with manufacturer's instructions.

B. Secure in place with concealed fasteners.

C. Verify that wands and other operators are easily reachable for easy operation at floor level.

3.3 TOLERANCES

A. Maximum Variation of Gap at Window Opening Perimeter: 1/8 inch.

B. Maximum Offset From Level: 1/16 inch.

3.4 ADJUSTING

A. Adjust Work under provisions of Section 01 70 00.

B. Adjust for smooth operation.

3.5 CLEANING

A. Clean Work under provisions of 01700.

END OF SECTION

SECTION 12 48 13
ENTRANCE MATS AND FRAMES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Rubber tile surface mats and frames.

1.2 REFERENCES

A. ASTM D2047 – Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Manufacturer's product literature for products specified in this Section.

C. Shop Drawings: Indicate locations and dimension of recessed areas to receive products specified in this Section.

D. Verification Samples: For color or finish selected, two sets of Samples indicating match to selected color or finish.

E. Quality Assurance Submittals:

1. Test Reports: Certified reports from independent testing laboratory supporting compliance of products to specified flammability requirements.

2. Manufacturer's Instructions:

a. Printed installation instructions for each specified product.

b. Manufacturer's Safety Data Sheets (M.S.D.S.) for each adhesive.

F. Closeout Submittals: Manufacturer's recommendations for cleaning and maintaining products specified in this Section.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: Minimum five (5) years documented experience producing products specified in this Section.

2. Installer: Minimum five (5) years documented experience installing products specified in this Section, and approval by product manufacturer.

B. All products provided shall be from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection:

1. Store products of this Section in manufacturer's unopened packaging until installation.

2. Maintain dry, heated storage area for products of this Section until installation of products.

3. Do not store outside.

1.6 PROJECT/SITE CONDITIONS

A. Field measurements: Obtain field measurements of recessed areas to receive products of this Section prior to order placement; include information on squareness and levelness of recess.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Pawling Corporation.

B. Substitutions: Under provisions of Section 01 62 00.

2.2 RUBBER TILE SURFACE MATS AND FRAMES

A. Modular Rubber Tile Mats: Pawling Corporation "Dura Tile" LT-20, Model ADH-501

1. Material: 100 percent recycled rubber with chenille finish and fiberglass backing.

2. Size: 12 inch square or 20 inch square, 1/2 inch minimum thickness.

3. Static Coefficient of Friction per ASTM D2047: 0.67 dry, 0.89 wet.

4. Color: to be selected by Architect from Manufacturers standard colors.

B. Frame: Pawling Corporation Model BSF-225, aluminum surface frame, clear anodized (201-R1) #403, with factory-applied abrasive strip in color to be selected by Architect. Frame shall comply with CBC Title 24, Section 1133B.7.4 for changes in level at door thresholds.

2.3 SURFACE MATS AND FRAMES

A. Mat System: Surface mounted, Construction Specialties “Pedimat”; Balco, Inc., “Floor Mat”; Reese Enterprises “Perfec Mat” Rubber Hinge Mat; or approved equal.

1. Provide extruded aluminum tread section completed with frame and all related accessories.

2. Provide carpet tread inserts.

3. Provide support cushions at bottom of each tread rail.

4. Apply protective coating to surfaces in contact with concrete.

PART 3 - GENERAL

3.1 PREPARATION

A. Surface Preparation: Remove debris from surfaces to receive frames; sweep surfaces clean.

3.2 INSTALLATION

A. Install specified products in accordance with Shop Drawings and manufacturer’s printed installation instructions.

B. Apply mats with adhesives as recommended by manufacturer.

C. Install frame around each mat, using anchors recommended by manufacturer. Corner joints of frame shall be mitered to hairline joints or provide prefabricated corner units without joints.

END OF SECTION

SECTION 12 93 00
SITE FURNISHINGS AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. The General Conditions and all other Contract Documents for this project are complementary and applicable to this Section of the Specifications.

B. Work Included: Furnish all labor, materials, equipment and services necessary to provide and construct, repair, or install the site elements, complete in place, as shown and specified, including, but not limited to:

1. Bench ‘A’
2. Bench ‘B’
3. Bike Rack
4. Bollards fixed and removable
5. Chair
6. Pot ‘A’
7. Picnic Table
8. ADA Picnic Table
9. Square Table
10. Trash/ Recycling/ Compost Receptacles
11. Metal header

C. Related Work:

1. Section 32 31 19 Decorative Metal Fences and Gates
2. Section 32 13 16 Decorative Concrete

1.02 SUBMITTALS

A. Submit shop drawings where noted to the District’s Representative for approval before installing any manufactured items. Plans shall include dimensions, color, finish, structural design (custom items), and connection details.

B. Submit catalog cuts, samples and manufacturers literature of all manufactured items in this section to the Owners Representative for approval before installation.

1. Provide color samples, brushouts, or charts for all items. Final colors to be selected by the Owner’s Representative and a sample submitted for approval.

PART 2 - PRODUCTS

2.01 MANUFACTURED ITEMS

A. Bench 'A': per plans

B. Bench 'B': per plans

C. Bike Rack: per plans

D. Bollards fixed and removable: per plans

E. Chair: per plans

F. Pot 'A': per plans

G. Picnic Table: per plans

H. ADA Picnic Table: per plans

I. Square Table: per plans

J. Trash/ Recycling/ Compost: per plans

K. Metal header: per plans

2.02 MISCELLANEOUS MATERIALS

A. All other materials for site elements shall be as specified on the plans and these specifications.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Examination: Verify that conditions are satisfactory for installation of each item of site elements. If unsatisfactory conditions exist, do not begin installation until such conditions have been corrected.

B. Bike Racks, Bollards, and Trash/ Recycling/ Compost Receptacles

1. Install directly onto concrete. Use manufacturer's recommended adhesive.

3.02 GUARANTEE

A. At completion of project, Contractor shall provide District's Representative with written guarantee from each manufacturer identifying the nature of warranty for each product component.

B. Contractor shall provide the District's Representative with two (2) bound maintenance manuals identifying each piece of equipment on manufacturer's recommended maintenance program including, but not limited to, daily, weekly, and monthly check lists.

C. Contractor to provide the District's Representative with minimum of two (2) gallons each type and color of paint used on apparatus with recommended surface preparation and application guidelines.

END OF SECTION

SECTION 14 24 23
HYDRAULIC ELEVATORS - PASSENGER

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Two operating elevator systems, two hydraulic cylinders above ground.

B. Three-Stop automatic operation. Firefighter's operation.

C. Motor and pump, controllers, hoistway accessories, equipment and fittings.

1.2 RELATED SECTIONS

A. Section 03 30 00 Cast in Place Concrete

B. Section 05 50 00 Metal Fabrications

C. Section 07 13 50 Sheet Membrane Waterproofing

D. Section 09 21 17 Drywall Shaft Systems

E. Section 09 22 16 Metal Stud Framing

F. Section 09 29 00 Gypsum Board

G. Section 09 65 16 Resilient Floor

1.3 RELATED WORK NOT INCLUDED IN THIS SECTION

A. Elevator hoist beam to be provided at top of elevator shaft. Beam must be able to accommodate proper loads and clearances for elevator installation and operation.

B. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.

C. Elevator hoistways shall have barricades, as required by governing authority and as included in General Conditions.

D. Hoistway recesses exceeding 2-in. will not be acceptable.

E. Setbacks to be beveled or covered by 75 degree bevel.

F. Provide rail bracket supports at pit, each floor and roof. For guide rail bracket supports, provide divider beams between hoistway at each floor and roof.

G. Pit floor shall be level and free of debris. Reinforce dry pit to sustain normal vertical forces from rails and buffers.

H. Legal access consisting of self-closing and locking access doors, ladders, machine rooms, controller areas, pits and hoistways.

I. Block-outs, pockets and chases in walls and floors for entrances, signals, fixtures, cables, hydraulic casings and conduit.

J. Machine room to be enclosed and protected.

K. Machine Room temperature must be maintained between 50º and 90º F

L. Access to the machinery space and machine room must be in accordance with the governing authority or code.

M. Install and furnish finished flooring in elevator cab.

N. Finished floors and entrance walls are not to be constructed until after sills and door frames are in place.

O. Contractor shall fill and grout around entrances, as required.

P. Elevator sill supports shall be provided at each opening.

Q. Provide supports, patching and recesses to accommodate hall button boxes, signal fixtures, etc..

R. Locate telephone and convenience outlet on control panel.

1.4 REFERENCES

A. ADAAG - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities.

B. CCR - California Code of Regulations, Title 24, Part 2.

C. ASME A17.1 - Safety Code for Elevators and Escalators.

D. ASTM A366 - Steel Sheet, Carbon, Cold-Rolled Commercial Quality.

E. ASTM A139 - Electric-Fusion (Arc)-Welded Steel Pipe (Sizes 4 inches and Over).

F. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

G. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

H. AWS D1.1 - Structural Welding Code, Steel.

I. IEEE C2 - National Electrical Safety Code.

J. NFPA 80 - Fire Doors and Windows.

K. UL 10B - Fire Tests of Door Assemblies.

L. APA - American Plywood Association.

M. ASTM A36 - Structural Steel.

N. NEMA LD-3 - High Pressure Decorative Laminates.

O. FS TT-P-641 - Primer Coating, Zinc Dust/Zinc Oxide (for Galvanized Surfaces).

P. FS TT-P-645 - Primer, Paint, Zinc Chromate, Alkyd Type.

Q. CBC - California Building Code.

1.5 SYSTEM DESCRIPTION

A. Characteristics of Elevator as follows:

1. Elevator Model: Otis HydroFit 4500 with Machine Room
2. Rated Net Capacity: 4500 pounds
3. Travel Distance (nominal): 14 feet 0 inches
4. Travel Speed: 100 feet/minute
5. No. of Stops: 2
6. No. of Openings: 1 Front
7. Nominal Hoistway Size: 7 feet 9 inches wide x 9 feet 7 inches deep
8. Clear Car Inside: 5 feet 5 & 9/16 inches wide x 7 feet 10 & 15/16 inches deep
9. Car and Hoistway Door Opening Size: 4 feet 0 inches x 7 feet 0 inches
10. Cab Height: 7 feet 9 inches
11. Door Type: Single leaf
12. Door Operation: Front opening; single speed
13. Machine Room Size (minimum): 5 feet 9 inches wide x seven feet four inches deep

14. Pit Depth: 4 feet.

15. Power Characteristics: 480 volts, 3 Phase, 60 Hz.

16. Seismic Requirements: Zone 4

17. Fixture and Button Style: Vandal Resistant Signal Fixtures.

D. Program doors to open automatically when car arrives at floor.

E. Include door protective and reopening devices consisting of movable, retractable safety edges, noiseless in operation photo-electric light rays which operate within invisible infrared light range. Provide as specified.

F. Program door operating sequence to minimize car and hall door open and close times. Provide independently adjustable door open times.

G. Program controls to minimize delays and the return of car to service, should doors be prevented from closing for a predetermined time.

H. If doors are prevented from closing for approximately ten seconds because of an activated obstruction safety device, automatically disconnect door control device, allow doors to close more slowly, and recycle until obstruction is cleared.

I. Render "Door Close" signal inoperative when car is standing at dispatching terminal with doors open unless that elevator is operating on independent service.

J. Special Operational Features:

1. Independent operation; with key operated fire fighter's operation.

2. Interconnect with fire alarm system.

3. Seismic Design: In accordance with CCR, Title 24, Part 2 and the CBC.

4. Emergency Signal System:

a. Mount an electrical alarm bell, not less than 6 inches in diameter, operable from inside the car, in a weatherproof enclosure on the outside of the building near the main entrance.

b. Mount graphic sign adjacent to bell with 2 inch high letters stating "Elevator Emergency, Call Police."

c. Provide emergency power source connection for alarm signal device capable of providing for operation of the bell for one hour.

d. Provide a sign, having lettering not less than 3/16 inch high, in passenger elevators adjacent to the car emergency alarm giving instructions as to the use of the device for summoning assistance.

1.6 FIREFIGHTER'S OPERATION

A. Provide automatic firefighter's operation in accordance with ASME A17.1 initiated by building fire and smoke alarm devices.

B. Locate three-position keyed switch, with pilot light, illuminated when this operation is in effect, marked “MANUAL/AUTOMATIC/RESET” with key removable in “OFF”, marked “FIREFIGHTER'S OPERATION – ELEVATOR”, at street level of building in designated location.

C. Do not permit sensing devices to restore normal service.

D. Furnish two position keyed switch with key removable in “OFF” position only, marked “FIREFIGHTER'S OPERATION” in each car, located in or adjacent to operating panel marked “ON” and “OFF/CANCEL” calls.

1.7 SYSTEM POWER REQUIREMENTS

A. Elevator Motor and Pump Unit Power: Refer to Section 26 00 00.

B. Protect elevator equipment against damage or malfunction due to change, to or from, normal power supply and emergency power supply.

C. Lighting Power: Refer to Section 26 00 00.

1.8 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing elevator equipment with ten years minimum documented experience.

B. Installer: Employees and supervisor on payroll of elevator equipment manufacturer.

C. Conform to ASME A17.1 and IEEE C2 and as supplemented in this Section.

D. Door and Frame Assemblies: NFPA 80 and UL 10B.

E. Perform welding in accordance with AWS D1.1.

1.9 REGULATORY REQUIREMENTS

A. Conform to CCR, Title 24, Part 2, and ADAAG for accessibility requirements.

B. Conform to CCR, Title 24, Part 2 and 7 for manufacture and installation of elevator system.

C. ASME/ANSI A17.1 Safety Code for Elevators and Escalators, latest edition or as required by the local building code.

D. Do not install elevator until detailed plans, specifications, and engineering calculations have been accepted and signed by the Architect or Structural Engineer in general charge of design and signed by a California registered Architect or

Professional Engineer who has been delegated responsibility covering the work shown on a particular plan or specification, and approved by the Division of the State Architect.

1.10 TESTS

A. Provide inspection and testing of each elevator system under provisions of Section 01 44 00.

B. Obtain required permits to perform tests.

C. Perform tests required by regulatory agencies.

D. Perform load testing in compliance with Title 24, Part 7, Section 3071.

E. Schedule tests with authority having jurisdiction and require Architect and/or Engineer, Owner, and Contractor presence.

1.11 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Indicate the following minimum information on Shop Drawings:

1. Plans, elevations, sections and details of assembly, erection, anchorage and equipment locations.

2. Motor and hydraulic pump, valves, controller, motor generator, selector, governor, and other component locations.

3. Car, guide rails, buffers, and other components in hoistway.

4. Rail bracket spacing and maximum loads on guide rails.

5. Reactions at points of support.

6. Weights of principal components.

7. Location of circuit breaker, switchboard panel or disconnect switch, light switch, and feeder extension points in machine room.

8. Locations in hoistway and machine room of traveling cables and connections for car light and telephone.

9. Location and size of trap doors and access doors.

10. Expected heat dissipation of elevator equipment in machine room.

11. Seismic design data certified by a California Registered Professional Engineer.

12. Elevator control functions and operational description.

C. Provide Product Data on the following items:

1. Signal and operating fixtures, operating panels, indicators.

2. Cab design and components.

3. Door and frame details.

4. Electronic equipment to control and monitor elevator control functions.

D. Submit two samples 12 x 12 inch in size illustrating floor material, cab interior, cab ceiling, cab door, hoistway entrance door and frame finishes.

1.12 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 01 70 00.

B. Include description of elevator system's method of operation and control including motor and pump unit, door operation

C. , signals, firefighter's service, and special or non-standard features provided.

D. Provide parts catalogs with complete list of equipment replacement parts with equipment description and identifying numbers.

E. Provide legible schematic of hydraulic piping and wiring diagrams covering electrical equipment installed, including changes made in final Work, with symbols listed corresponding to identity or markings on both machine room and hoistway apparatus.

F. Provide one copy of master electric and hydraulic schematic, behind plastic or glass glazing, in metal frame, mounted on machine room wall.

G. Provide one copy of lubrication chart, behind plastic or glass glazing, in metal frame, mounted on machine room wall.

1.13 PREINSTALLATION CONFERENCE

A. Convene a preinstallation conference one week prior to commencing Work of this Section, under provisions of Section 01 31 19.

B. Require attendance of persons directly involved with the Work of this Section.

C. Review schedule of installation, installation procedures and conditions, and coordination with related Work.

1.14 WARRANTY

A. Provide one year manufacturer's warranty under provisions of Section 01 70 00.

B. Warranty: Include coverage of elevator system controller, operating equipment and devices.

1.15 MAINTENANCE SERVICE

A. Furnish complete service and maintenance of elevator system and components for a period of twelve months after final acceptance.

B. Examine periodically; clean, adjust, and lubricate all equipment.

C. Maintain hydraulic fluid levels. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original equipment.

D. Perform maintenance work without removing car from service during peak traffic periods.

E. Provide emergency call back service during working hours for this maintenance period.

F. Maintain locally, near the location of the elevator(s), an adequate stock of parts for replacement or emergency purposes, and have qualified installation personnel available to ensure the fulfillment of this maintenance service without unreasonable loss of time.

G. Perform maintenance work using competent personnel, under the supervision of the elevator manufacturer.

H. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

1.16 DELIVERY, STORAGE AND HANDLING

A. Protect products under provisions of Division 1 General Requirements.

B. Manufacturing will deliver elevator materials, components and equipment and the contractor is responsible to provide secure and safe storage on job site.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. ThyssenKrupp Elevator.

B. KONE Inc.

C. Otis/United Technologies.

D. Substitutions: Under provisions of Section 01 62 00.

2.2 MATERIALS

A. Rolled Steel Sections, Shapes, Rods: ASTM A36.

B. Casing: ASTM A139, Grade A steel.

C. Sheet Steel: ASTM A366; Class 1, with matte finish.

D. Stainless Steel: ASTM A167; Type 304; No. 4 finish.

E. Aluminum: ASTM B221, extruded 6063 alloy with T6 temper; anodized finish.

F. Plywood: APA rated sheathing, span rating 32/16, Exposure 1, sanded.

G. Plastic Laminate: NEMA LD-3; high pressure type, 0105 inch thick; color/pattern selected by Architect.

H. Primer for Galvanized Surfaces: FS TT-P-641.

I. Primer for Plain Steel Surfaces: FS TT-P-645.

J. Primer for Wood Surfaces: Alkyd primer sealer.

K. Finish Paint (for Metal Surfaces): Two coats of factory-applied alkyd enamel, semi-gloss, color to be selected by Architect.

L. Finish Paint (for Wood Surfaces): Alkyd enamel, semi-gloss, color to be selected by Architect.

M. Finish (Transparent) Stain (for Wood Surfaces): Semi-gloss lacquer.

2.3 EQUIPMENT

A. Elevator: Equivalent to ThyssenKrupp “Endura” Model, Twinpost Above-Ground.

B. Motors, Pumps, Valves, Regulators, Fluid Tank, Hydraulic Fluid, Controller, Controls, Buttons, Wiring and Devices, Indicators: UL approved.

C. Spring Buffers, Attachment brackets and Anchors: Purpose-designed, sized according to code with safety factors.

D. Pump Housing: Sheet steel, acoustically insulated, removable.

2.4 ELECTRICAL COMPONENTS

A. Fittings: Steel compression type for electrical metallic tubing. Fittings with set screws are acceptable only when a separate grounding conductor is also installed across the joint.

B. Spare Conductors: Include 10 percent extra conductors and two pairs of shielded audio cables in traveling cables.

C. Do not use armored flexible metal conduit as grounding conductor.

D. Include wiring and connections to elevator devices remote from hoistway and between elevator machine rooms.

2.5 LUBRICATION

A. Grease Fittings: For lubricating bearings requiring periodic lubrication.

B. Grease Cups: Automatic feed compression type.

C. Lubrication Points: Visible and easily accessible.

2.6 CAR FABRICATION

A. Frame: Rigid rolled steel sections, braced; mounted on resilient isolators.

B. Enclosure: Sheet steel panels attached to steel frame; sheet plywood inner liner.

2.7 CAB FABRICATION

A. Cab Design: Equivalent to ThyssenKrupp Corporation TKS Cab.

B. Floor, Walls and Ceiling: 3/4 inch plywood, fire-retardant treated surfaces and edges. Attach with flush mechanical fasteners.

C. Walls: Walls shall be constructed of 5WL rigidized stainless steel. Cab type TKS, reinforced cold-rolled steel.

D. Canopy: Cold-rolled steel with hinged exit.

E. Ceiling: Downlight type, metal pans with suspended halogen downlights and dimmer switch. Number of downlights shall be dependent on platform size with a minimum of six.

F. Cab Fronts, Return, Transom, Soffit and Strike: Provide panels faced with brushed stainless steel 16 gage metal of rolled profiles, welded corner design, smooth invisible joints.

G. Doors: Horizontal sliding car doors reinforced with steel for panel rigidity. Insulated sandwich panel construction, flush design, rolled profiles, rigid construction Hang doors on sheave type hangers with polyurethane tires that roll on a polished steel track and are guided at the bottom by non-metallic sliding guides.

1. Door Finish: Stainless steel panels: No. 4 brushed finish.

2. Cab Sills: Extruded nickel silver, mill finish.

H. Handrail: Provide 1.5" diameter cylindrical metal on side and rear walls on front opening cars and side walls only on front and rear opening cars. Handrails shall have a stainless steel, no. 4 brushed finish.

I. Ventilation: Manufacturer's standard exhaust fan, mounted on the car top.

J. Resilient Floor: Rubber Floor. Color to be selected by Architect

K. Control Panel and Face Plate: Stainless steel with No. 4 finish, with illuminating call buttons.

L. Indicator Panel: Above control panel with illuminating position indicators.

M. Pad Hooks: Stainless steel type.

N. Wall Mats: One set canvas-covered, padded with sponge fill material, sewn with piping edges; brass grommets spaced to match pad hook spacing, covering side and rear walls.

O. License Frame and Glass: Attached with tamper-proof screws.

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

2.8 HOISTWAY ENTRANCES

A. Hoistway Doors: Stainless steel; 16 gage metal, of insulated sandwich panel construction, flush design, rolled profiles, rigid construction.

1. Manufacturer's standard entrance design consisting of hangers, doors, hanger supports, hanger covers, fascia plates, sight guards, and necessary hardware.
2. Main landing door & frame finish: Stainless steel panels, no. 4 brushed finish.
3. Typical door & frame finish: Stainless steel panels with no. 4 brushed finish.

B. Hoistway Door Frames: Stainless steel; 16 gage metal, of rolled profiles, welded corner design, smooth invisible joints.

C. Door and Frame Construction: UL rated, with applicable fire rating; insulated sandwich panel construction, 1-1/4 inch thick.

D. Weatherstrip hoistway door and frames to minimize audible noise caused by car movement imposed air pressure differential between hoistway and landing floors.

E. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway horizontal sliding door.

1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
2. Hangers: Provide an adjustable device beneath the track to limit the up-thrust of the doors during operation.
3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.

F. Hoistway Sills: Extruded metal, with groove(s) in top surface. Provide mill finish on nickel silver.

2.9 FINISHES

A. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime two coats.

B. Machine Room Components: Clean and degrease; one coat primer; and, one coat enamel.

C. Galvanized Surfaces: Clean with neutralizing solvent; prime one coat.

D. Wood Surfaces Not Exposed to Public View: One coat primer and one coat enamel.

E. Baked Enamel on Steel: Clean and degrease metal surface; apply one coat of zinc-oxide primer sprayed and baked; two coats of semi-gloss enamel sprayed and baked; color as selected by Architect.

F. Stainless Steel: Brushed No. 4 finish. (5WL rigidized stainless steel at Cab Walls).

2.10 CAR OPERATING PANEL

A. Provide one flush-mounted operating panel per car; with front return panels containing illuminated call buttons corresponding to floors served, emergency stop switch, alarm button and “DOOR OPEN / DOOR CLOSE” buttons; key-operated light switch.

B. Locate top operating button at 48 inches above floor.

C. Locate illuminated alarm buttons in bottom row at minimum 35 inched above floor.

D. Position emergency stop switch and alarm button where they are unlikely to be accidentally actuated and not more than 48 inches above car floor.

E. Engrave main panel with capacity and elevator number in ¼ inch letters. All signage required by local codes shall be engraved as directed by District representative.

F. Provide Fire Emergency key switch, engraved instructions and call cancel button with audible/visual signals located above the floor buttons.

G. Car Position Indicators: provide 2 inch digital type car position indicators with direction arrows integral in each operating panel mounted flush with face panel.

H. Include matching service cabinet with concealed hinged door and lock as integral part of car operating panel mounted with flush hairline joints containing:

1. Independent service switch.
2. Inspection switch.
3. Fan or blower switch.
4. Light switch.
5. Necessary additional operating switches.

I. Locate a 110 V, 15 A receptacle below service cabinet.

2.11 HALL CONTROLS

A. Hall Buttons: Vandal resistant buttons with integral illumination, minimum 1 inch diameter, mechanical, stainless steel raised 1/8 inch from surrounding surface with square shoulders; internally illuminated with white light over the entire surface of the button, one for originating “UP” and one for originating “DOWN” calls; one button only at terminating landings; marked with arrows, and Contracted (Grade 2) Braille indications. Operation of car or hall call shall cause corresponding button to extinguish.

B. Hall Lanterns: Illuminating white “UP” and green “DOWN” arrows. Hall lantern shall be a minimum 2-1/2 inches high by 2-1/2 inches wide.

C. Audible Chimes: Electronic adjustable audible chime shall be provided at each landing and located adjacent to the entrance; bell type gong not acceptable.

D. Provide floor passing signal of the adjustable electronic audible chime type.

E. Key and Lock Switches: Toggle type or key operated as specified. The contractor shall provide six (6) Fireman's Recall keys, one (1) inspection key and twelve (12) cab service cabinet door keys.

F. Faceplates: Provide of material and finish as specified: 1/8 inch minimum thickness with sharp edges relieved or beveled.

G. Fastening: Provide with flush tamper-proof security screws of material and finish matching faceplates.

H. Cabinets: Provide with pull, concealed hinges and doors mounted flush with hairline joints to adjacent surface.

I. Arrangement: Arrangement of fixtures based on specified and ThyssenKrupp Vandal-Resistant as basis of design. Rearrangement subject to District approval. All fixtures shall be vandal resistant type.

J. Engravings: Of size indicated; color backfill with epoxy paint in contrasting colors as selected.

K. Lamps: Miniature LED 'cluster' type.

L. Tactile Markings: Provide raised Contracted (Grade 2) Braille and alpha characters, numerals or symbols to the left of operating buttons and devices used by the public. Indications shall be separate plates of same size and shape as buttons flush mounted with hairline joints and concealed mechanical fasteners. Raised characters shall be white on a black background with Braille designation directly below the character.

2.12 DOOR OPERATION

A. Door Operation: Provide a direct current motor driven heavy duty operator designed to operate the car and hoistway doors simultaneously. Door movements shall be electrically cushioned at both limits of travel and the door operating mechanism shall be arranged for manual operation in event of power failure. Doors shall automatically open when the car arrives at the landing and automatically close after an adjustable time interval or when the car is dispatched to another landing. Closed-loop, microprocessor controlled motor-driven linear door operator, with adjustable torque limits, also acceptable. AC controlled units with oil checks or other deviations are not acceptable.

1. No Un-Necessary Door Operation: The car door shall open only if the car is stopping for a car or hall call, answering a car or hall call at the present position or selected as a dispatch car.

2. Door Open Time Saver: If a car is stopping in response to a car call assignment only (no coincident hall call), the current door hold open time is changed to a shorter field programmable time when the electronic door protection device is activated.

3. Double Door Operation: When a car stops at a landing with concurrent up and down hall calls, no car calls, and no other hall call assignments, the car door opens to answer the hall call in the direction of the car's current travel. If an onward car call is not registered before the door closes to within 6 inches of fully closed, the travel will reverse and the door will reopen to answer the other call.

4. Nudging Operation: The doors shall remain open as long as the electronic detector senses the presence of a passenger or object in the door opening. If door closing is prevented for a field programmable time, a buzzer will sound. When the obstruction is removed, the door will begin to close at reduced speed. If the infra-

red door protection system detects a person or object while closing on nudging, the doors will stop and resume closing only after the obstruction has been removed.

5. Limited Door Reversal: If the doors are closing and the infra-red beam(s) is interrupted, the doors will reverse and reopen partially. After the obstruction is cleared, the doors will begin to close.

6. Door Open Watchdog: If the doors are opening, but do not fully open after a field adjustable time, the doors will recycle closed then attempt to open six times to try and correct the fault.

7. Door Close Watchdog: If the doors are closing, but do not fully close after a field adjustable time, the doors will recycle open then attempt to close six times to try and correct the fault.

8. Door Close Assist: When the doors have failed to fully close and are in the recycle mode, the door drive motor shall have increased torque applied to possibly overcome mechanical resistance or differential air pressure and allow the door to close.

B. Door Protection Devices: Provide a door protection system using 150 or more microprocessor controlled infra-red light beams. The beams shall project across the car opening detecting the presence of a passenger or object. If door movement is obstructed, the doors shall immediately reopen.

1. Device capable of detecting a 2 inch diameter rod introduced at any position within the door movement and between the height of 2 inches and 63 inches above the sill level.

2. Door reopening device to remain effective for a minimum period of 20 seconds after obstruction removed

2.13 CONTROL SYSTEMS

A. Controller: The elevator control system shall be microprocessor based and software oriented. Control of the elevator shall be automatic in operation by means of push buttons in the car numbered to correspond to floors served, for registering car stops, and by "up-down" push buttons at each intermediate landing and "call" push buttons at terminal landings.

B. Automatic Light and Fan shut down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.

2.14 EMERGENCY SIGNS

A. Except at the main entrance level, install a pictorial sign of standardized design adjacent to each elevator call station which will indicate that, in case of fire, the elevator will not operate and that exit stairways should be used as indicated.

2.15 SEISMIC CRITERIA

A. Design and assemble elevator equipment and components to withstand earthquake forces in accordance with CCR, Title 24, Part 2.

2.16 DESIGN FOR DISABLED

A. Conform to CCR, Title 24, Part 2, and ADAAG for access for the disabled.

B. Locate uppermost button in elevator cab control panel and center-line of telephone handset, not more than 48 inches above floor level.

C. Include 1-1/4 inch diameter x 1/4 inch thick stainless steel handrails on three sides of car, with ends returned.

D. Sound audible soft-tone signal in car when car is stopping or stopped at a floor. Sound audible signal when as cab passes each floor. The audible signal shall be no less than 20 decibels with a frequency no higher than 1,500 Hz.

E. Where hall indicators with chimes are provided, sound chimes once for up stops and twice for down stops.

F. In each cab provide 1 inch raised characters and standard raised symbols immediately to the left of the control buttons with Contracted (Grade 2) Braille immediately below the characters or symbols.

G. At each floor landing provide 2 inch floor numerals raised 0.03 inch on and adjacent to hall call buttons.

H. Provide "hands free" telephone to a pre-programmed 24-hour emergency telephone number.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that hoistway, pit, and machine room are ready for work of this Section.

B. Verify shaft and openings are of correct size and within tolerances.

C. Verify location and size of machine foundation and position of machine foundation bolts.

D. Confirm electrical power is available and of correct characteristics.

E. Report defects or deficiencies in writing.

F. Beginning of installation means acceptance of conditions.

3.2 EXCAVATION AND BACKFILLING

A. Excavate for shaft pit and hydraulic lines between shaft pit and remote machine room in accordance with Section 31 23 33. Remove subsoil from site. Maintain shaft alignment of one inch from plumb. Fill over excavated shaft depth with sand.

B. Maintain shaft excavation free of water.

C. Backfilling: Refer to Section 31 23 33.

3.3 INSTALLATION

A. Install in accordance with ASME A17.1.

B. Install hoistway and machine room components. Connect equipment to building utilities. Install piping between hoistway plunger and pump unit.

C. Provide conduit, boxes, wiring, and accessories within machine room, hoistway, and signal outlets.

D. Arrange equipment in machine room so functioning equipment and other equipment can be removed for repairs or replaced without dismantling or removing other equipment components. Arrange equipment for clear passage to access door. Accommodate equipment in space indicated.

E. Install guide rails using threaded bolts with metal shims and lockwashers under nuts. Compensate for expansion and contraction movement of guide rails.

F. Accurately machine and align guide rails. Form smooth joints with machined splice plates.

G. Bolt or weld brackets directly to structural hoistway framing.

H. Bolt brackets to (inserts placed in concrete formwork) or (self drilling expansion shell anchors) that will perform to four times the rated pull-out load.

I. Field Welds: Chip and clean away oxidation and residue; wire brush weld; prime two coats.

J. Coordinate installation of hoistway wall construction.

K. Install hoistway door sills, frames and headers in hoistway walls. Grout sills in place. Set entrances in vertical alignment with car openings and aligned with plumb hoistway lines.

L. Fill hoistway door frames solid with non-staining, non-shrink grout.

M. Adjust equipment for smooth and quiet operation.

3.4 TOLERANCES

A. Guide Rail Alignment: Plumb and parallel to each other in accordance with ASME A17.1.

B. Cab Movement on Aligned Guide Rails: Smooth movement, with no perceptible lateral or oscillating movement or vibration.

3.5 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 44 00.

B. Perform and meet tests required by ASME A17.1 and by CCR, Title 24, Part 2.

C. Supply instruments and execute specific tests.

D. Furnish test and approval certificates issued by jurisdictional authorities.

E. Provide two weeks written notice of date and time of tests.

3.6 CLEANING

A. Remove protective coverings from finished surfaces.

B. Clean surfaces and components ready for inspection.

3.7 ADJUSTING

A. Adjust for smooth acceleration and deceleration of car provide passenger comfort.

B. Adjust doors to open only at the landing where the car is stopping or at rest. The opening sequence shall begin only when the car is at rest. The car shall be at rest before the hoistway door is fully open.

C. Adjust automatic floor leveling feature at each floor to achieve 1/4 inch from flush.

3.8 PROTECTION

A. Protect finished installation under provisions of Section 01 87 00.

B. provide suitable protective coverings, barriers, devices, signs, or other such methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout remainder of construction period.

3.9 DEMONSTRATION

A. Instruct Owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions.

B. Make a final check of each elevator operation, with Owner's personnel present, immediately before date of substantial completion. Determine that control systems and operating devices are functioning properly.

END OF SECTION

SECTION 21 00 00
FIRE SUPPRESSION BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work included in 21 00 00, Fire Suppression Basic Requirements applies to Division 21, Fire Suppression work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of fire protection systems for proposed project.

B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:

1. Provide: To furnish and install, complete and ready for intended use.

2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.

3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete Item of work furnished.

4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent," substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted Item.

5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.2 RELATED SECTIONS

A. Content of Section applies to Division 21, Fire Suppression Contract Documents.

B. Related Work:

1. Additional conditions apply to this Division including, but not limited to:

a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.

b. Drawings

c. Addenda

d. Owner/Architect Agreement

e. Owner/Contractor Agreement

f. Codes, Standards, Public Ordinances and Permits

1.3 REFERENCES AND STANDARDS

A. References and Standards per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, individual Division 21, Fire Suppression Sections and those listed in this Section.

B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:

1. State of California:

a. CBC - California Building Code

b. CEC - California Electrical Code

c. CEC T24 - California Energy Code Title 24

d. CFC - California Fire Code

e. CMC - California Mechanical Code

f. CPC - California Plumbing Code

g. CSFM - California State Fire Marshal

h. DSA - Division of State Architect Regulations and Requirements

C. Reference standards and guidelines include but are not limited to the latest adopted editions from:

1. ABA - Architectural Barriers Act

2. ADA - Americans with Disabilities Act

3. AHRI - Air-Conditioning Heating & Refrigeration Institute
4. ANSI - American National Standards Institute
5. ASCE - American Society of Civil Engineers
6. ASCE-7 Minimum Design Loads for Buildings and Other Structures
7. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers
8. ASHRAE Guideline 0, the Commissioning Process
9. ASME - American Society of Mechanical Engineers
10. ASPE - American Society of Plumbing Engineers
11. ASSE - American Society of Sanitary Engineering
12. ASTM - ASTM International
13. AWWA - American Water Works Association
14. Oakland Unified School District Material and Technical Standards
15. CALGreen - California Green Building Standards Code (CCR. Title 24, Part 11)
16. CFR - Code of Federal Regulations
17. CHPS - Collaborative for High Performance Schools
18. EPA - Environmental Protection Agency
19. ETL - Electrical Testing Laboratories
20. FCC - Federal Communications Commission
21. FM - FM Global
22. FM Global - FM Global Approval Guide
23. IAPMO - International Association of Plumbing and Mechanical Official
24. ICC - International Code Council
25. IEC - International Electrotechnical Commission
26. ICC-ESR - International Code Council Evaluation Service Reports
27. HI - Hydraulic Institute Standards
28. ISO - International Organization for Standardization

29. MSS - Manufacturers Standardization Society

30. NEC - National Electric Code

31. NEMA - National Electrical Manufacturers Association

32. NFPA - National Fire Protection Association:

    a. NFPA 13 - Standard for the Installation of Sprinkler Systems

    b. NFPA 24 - Standard for Installation of Private Fire Service Mains and Their Appurtenances

    c. NFPA 25 - Standard for Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems

    d. NFPA 70 - National Electrical Code

    e. NFPA 72 - National Fire Alarm and Signaling Code

33. NRCA - National Roofing Contractors Association

34. NSF - National Sanitation Foundation

35. OSHA - Occupational Safety and Health Administration

36. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.

37. TIMA - Thermal Insulation Manufacturers Association

38. UL - Underwriters Laboratories Inc.

D. See Division 21, Fire Suppression individual Sections for additional references.

1.4 SUBMITTALS

A. See Division 01, General Requirements for Submittal Procedures as well as specific individual Division 21, Fire Suppression sections.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.

D. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. Copy Architect on all transmissions/submissions.

E. Submit shop drawings, calculations and product data sheets as one complete stand-alone package to AHJ, Owner's insurance underwriter and Engineer.

F. Product Data: Provide Manufacturer's descriptive literature for products specified in Division 21, Fire Suppression Sections.

G. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.

1. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed Item. Highlight connections by/to other trades.

2. Include technical data, installation instructions and dimensioned drawings for products, equipment and devices installed, furnished or provided. Reference Division 21, Fire Suppression specification Sections for specific Item required in product data submittal outside of these requirements.

3. Provide pump curves, operation characteristics, capacities, ambient noise criteria, etc. for equipment.

4. For vibration isolation of equipment, list make and model selected with operating load and deflection. Indicate frame type where required. Submit manufacturer's product data.

5. See Division 21, Fire Suppression Sections for additional submittal requirements outside of these requirements.

H. Maximum of two reviews provided of complete submittal package. Arrange for additional reviews and/or early review of long-lead Item; Bear costs of additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.

I. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer's comments. Identify Engineer's comments and provide an individual response to each of the Engineer's comments. Cloud changes in the submittals and further identify changes which are in response to Engineer's comments.

J. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-10 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.

K. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 21, Fire Suppression coordination documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical and Division 28, Electronic Safety and Security submittals.

L. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.

M. Substitutions and Variation from Basis of Design:

1. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.

2. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.

N. Shop Drawings:

1. Provide coordinated Shop Drawings which include physical characteristics of all systems, equipment and piping layout, pipe layout, hanger layout, sway brace layout, seismic restraints, sway brace calculations, drains, location of drain discharge, risers, valves, details, water test information, physical device layout plans, and control wiring diagrams. Reference individual Division 21, Fire Suppression Sections for additional requirements for shop drawings outside of these requirements.

2. Provide Shop Drawings which indicate information required by NFPA 13. Include room names and fire sprinkler occupancy hazard classifications.

3. Provide Shop Drawings illustrating information for Hydraulic Information Sign for each hydraulic remote area calculated.

4. Utilizing the Reflected Ceiling backgrounds, provide Shop Drawings illustrating locations of fire sprinklers and piping.

5. Utilizing the Structural backgrounds, provide Shop Drawings illustrating locations and types of hangers and sway braces.

6. Provide Shop Drawings illustrating each type of hanger, including fasteners to structure.

7. Provide Shop Drawings illustrating each type of branchline restraint and sway brace, including length of sway brace member, sway brace fittings, minimum and maximum angles from vertical of sway brace member, method of attachment to structure, size, length and embedment of attachment to structure and size and type of structural member to which sway brace will be attached. Number each type of restraint and sway brace. Indicate on Drawings locations of each type of numbered restraint and sway brace.

8. Provide details for any hanger, attachment, or sway brace to be attached to any I-joist, structural insulated panels (SIPs), cross laminated timber, and similar engineered structural products according to the specifications of the engineered product manufacturer.

9. Provide Shop Drawings illustrating information for Sprinkler System General Information Sign.

10. Shop Drawings to include a cross-sectional view that shows the sprinkler heads and piping in relation to the building's architectural and structural information. View to be chosen based on a location that will display the most information.

11. When required, provide Coordination Drawings.

12. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.

13. Provide details of hanger, sway bracing and branch line restraint attachments to structure and to piping. Include details on the size and load capacities of fasteners. Provide verification of the structural capacity to withstand seismic load.

14. Provide sway bracing calculations on drawings showing horizontal seismic design load and requirements, with indication of zone of influence for each bracing location.

15. Provide a schedule of sway bracing type, size, and design criteria, including length, angle from vertical, and load capacities.

16. Clearly indicate the elevation of the highest sprinkler in relation to the elevation of the flow test pressure gauge monitor hydrant.

17. Provide details of flexible sprinkler hose fitting per manufacturer's schedule of equivalent feet used in hydraulic calculations, showing device length, maximum number of 90-degree bends and expected radius of bends.

18. Provide a schedule of signage to be installed at each flexible sprinkler hose fitting.

19. On the drawings, provide a list of number, model, temperature, sprinkler Identification number, manufacturer, orifice, deflector type, thermal sensitivity and pressure rating, quantity of each type to be contained in the spare sprinkler cabinet and the issue date or revision date of the list."

20. Spare sprinkler head cabinet size indicating the number of spare sprinkler head to be contained therein.

O. Samples: Provide samples when requested by individual Sections.

P. Resubmission Requirements:

1. Make any corrections or change in submittals when required. Provide submittals as specified. The Engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Clearly indicate changes on Drawings and cloud changes in the submittals.

2. Resubmit for review until review indicates no exceptions taken or make "corrections as noted".

Q. Operation and Maintenance Manuals/Owner's Instructions:

1. Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or Item requiring servicing. Include valve charts. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.

   a. Include copies of certificates of code authority acceptance, code-required acceptance tests; test reports and certificates.

   b. Include Warranty per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Sections.

   c. Catalog description of each Item of equipment actually installed on job.

   d. Instructions for operation and maintenance of fire suppression systems composed of operating instructions, maintenance instructions and manufacturer's literature as follows:

      1) Testing and Maintenance Schedule Chart: Provide an 8-1/2- by 11-inch typewritten list of each item of installed equipment requiring testing inspection , lubrication or service, describing and scheduling performance of maintenance.

      2) Manufacturer's Literature: Provide copies of manufacturer's instructions for operation and maintenance of fire suppression equipment, including replacement parts list with name and address of nearest distributor. Mark each copy with equipment identification label as listed in equipment schedule, i.e. F-5 etc.

   e. Include product certificates of warranties and guarantees.

   f. Include Record Drawings,

   g. Include copy of water supply flow test used as basis for hydraulic calculations.

   h. Include hydraulic calculations and sway brace calculations.

   i. Include Contractor’s Material and Test Certificates for Aboveground Piping/Underground Piping.

   j. Include a copy of NFPA 25.

k. Include a copy of valve charts and whether normally open or normally closed.

l. Include a copy of drain, auxiliary, and low point drains charts.

m. Include a copy of the list to be included in the spare sprinkler head box.

n. Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.

o. Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, and quantities relevant to each piece of equipment: i.e. belts, motors, lubricants, and filters.

p. Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub-assemblies.

q. Include copy of startup and test reports specific to each piece of equipment.

r. Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.

2. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 21 00 00, Fire Suppression Basic Requirements, Article titled "Demonstration".

3. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

R. Record Drawings:

1. Maintain at site at least one set of Drawings for recording “As-constructed” conditions. Indicate on Drawings changes to original documents by referencing revision document, and include buried elements, location of cleanouts, and location of concealed mechanical Item. Include items changed by field orders, supplemental instructions, and constructed conditions.

2. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.

3. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD disk and drawings upon substantial completion.

4. Invert elevations and dimensioned locations for water services and drainage piping below grade extending to 5-feet outside building line.

5. Record Drawings to include site information or reference site information for complete understanding of the fire protection system between the building and the point of connection to the water supply and location of flow test pressure hydrants.

6. See Division 21, Fire Suppression individual Sections for additional items to include in Record Drawings.

S. Calculations: Submit hydraulic and sway brace and the like calculations.

1. Hydraulic Calculations:

a. Include friction losses between the hydraulically most remote design area and the hydrant flow test pressure hydrant.

b. Hydraulic calculations to be performed on a nationally recognized fire sprinkler hydraulic calculation computer program, with cover sheets in the format required by the latest edition of NFPA 13. Hydraulic calculations performed “by hand” or not on a nationally recognized fire sprinkler hydraulic calculations computer program will be returned without review by engineer.

c. Provide one or more hydraulic calculations for each hydraulically most remote area.

d. Where it is not obvious which area is most hydraulically remote, perform and submit for review additional hydraulic calculations proving the hydraulically most remote area.

e. For grid systems, either provide “peaked” hydraulic calculations, or provide two additional sets of hydraulic calculations for each hydraulically most remote area.

f. Include pressure losses between the highest sprinkler and the elevation of the pressure gauge monitor hydrant of the flow test.

g. Include friction loss for flexible branch line connectors per manufacturer's schedule of equivalent feet for device length, maximum number of bends and expected radius of bends.

h. When flexible sprinkler hose fittings are added to an existing system, provide hydraulic calculations verifying the design flow rate will be achieved."

i. For Future Tenant Improvement Spaces: Include in hydraulic calculations friction loss allowances for future installation of flexible sprinkler head connectors so that flexible connectors may be installed in the future without revisions to the overhead system.

2. Sway Brace Calculations:

a. Sway brace calculations utilizing a proprietary computer calculation program only used for the sway brace components supported by that manufacturer. For example, only “manufacturer X” sway brace components, and not those of another manufacturer, may be calculated on a "manufacturer X” sway brace computer calculation program.

b. Provide seismic calculations for any sway brace to be attached to any I-joist, structural insulated panels (SIPs), cross laminated timber, and similar engineered structural products according to the specifications of the I-joist manufacturer.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

C. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.

D. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

E. Provide products that are UL listed.

F. Piping Insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

1.6 WARRANTY

A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.

B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

A. Prior to construction, prepare and submit coordinated layout drawings (composite drawings), to coordinate installation and location of ductwork, grilles, diffusers, piping, fire sprinklers, fire alarm, plumbing, cable trays, lights, and electrical services. Composite Drawings show services on single sheet. Key Drawings to structural column identification system. Prior to completion of Drawings, coordinate proposed installation with architectural and structural requirements, and other trades (including plumbing, HVAC, electrical, fire alarm ceiling suspension and tile systems, etc.), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling and finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence. Unless otherwise required by Division 00, Procurement and Contracting Requirements and/or Division 01, General Requirements, Division 23, HVAC to combine information furnished by other trades onto master coordination documents.

B. Prepare Drawings as follows:

1. Coordination models/drawings may be created using Revit 3D modeled elements or a 3D CAD software. The modeled elements to be graphically represented within the model as a specific system, object or assembly in terms of size, shape, location, quantity, and orientation with detailing, fabrication, assembly, and installation information. Non-graphic information may also be attached to the model elements. Model elements must have the ability to be spatially coordinated with other modeled elements using either Revit, Autodesk Navisworks or Autodesk A360.

2. Provide drawings in CAD Format. CAD format release equal to design documents. Drawings to be same sheet size and scale as Contract Drawings and indicate location, size and elevation above finished floor of equipment and distribution systems.

3. Review and revise, as necessary, section cuts in Contract Drawings after verification of field conditions.

4. Indicate fire protection system piping including fittings, hangers, access panels, valves, and bottom of pipe elevations above finished floor.

5. Indicate inverts and provision for piping that must be graded to have right-of-way over more flexible Item. Drawings also to indicate proposed ceiling grid and lighting layout as shown on electrical drawings, architectural reflected ceiling drawings and HVAC equipment, ductwork and piping. Drawings to indicate proposed and identified structural members to which hangers and sway braces will be attached as shown on structural drawings.

6. Incorporate Addenda Item and change orders.

7. Provide additional coordination as requested by other trades.

C. Advise Architect in event conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.

D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

1.8 COLLABORATIVE FOR HIGH PERFORMANCE SCHOOLS

A. Project seeks CHPS certification.

B. Obtain list of credits sought by project. Be familiar with requirements for credits. See Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for requirements.

C. Provide materials and services as outlined in appropriate CHPS Reference Guide.

D. Provide documentation as outlined in appropriate CHPS Reference Guide.

E. Coordinate start-up, testing, training, and installation with Commissioning Agent as required to meet commissioning requirements.

F. Provide adequate schedule for construction activities such as building flush out.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer, including but not limited to sprinkler heads, pipe, fittings, hangers and bracing materials.

2.2 STANDARDS OF MATERIALS AND WORKMANSHIP

A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL, ETL, FM, ICC-ES, and CSFM approved for their intended fire protection function or have adequate approval or be acceptable by State, County, and City authorities.

B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

C. Hazardous Materials:

1. Comply with local, State of California, and Federal regulations relating to hazardous materials.

2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.

3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

2.3 ACCESS PANELS

A. See Division 01, General Requirements and Division 08, Openings for products and installation requirements.

B. Confirm Access Panel requirements in Division 01, General Requirements, Division 08, Openings and individual Division 21, Fire Suppression Sections. In absence of specific requirements, comply with the following:

1. Provide flush mounting access panels for service of systems and individual components requiring maintenance or inspection. Where access panels are located in fire-rated assemblies of building, rate access panels accordingly.

a. Ceiling access panels to be minimum of 24-inch by 24-inch required and approved size.

b. Wall access panels to be minimum of 12-inch by 12-inch required and approved size.

c. Provide screwdriver operated catch.

d. Manufacturers and Models:

1) Drywall: Karp KDW.

2) Plaster: Karp DSC-214PL.

3) Masonry: Karp DSC-214M.

4) 2 hour rated: Karp KPF-350FR.

5) Manufacturers: Karp, Milcor, Elmdor, Acudor or approved equivalent.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.

B. Install equipment requiring access (i.e. drains, control operators, valves, motors, engines, pumps, controllers, air compressors, gauges, fill cups, tanks, cleanouts and the like) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.

C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.

D. Earthwork:

1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with the following:

a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with the provisions specified. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.

b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.

c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Firestopping:

1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection.

2. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections and coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM International E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Pipe Installation:

1. Provide installation of piping systems coordinated to account for expansion and contraction of piping materials and building as well as anticipated settlement or shrinkage of building. Install work to prevent damage to piping, equipment, and building and its contents. Provide piping offsets, loops, expansion joints, sleeves, anchors or other means to control pipe movement and minimize forces on piping. Verify anticipated settlement and/or shrinkage of building with Project Structural Engineer. Verify construction phasing, type of building construction products and rating coordinating installation of piping systems.

2. Include provisions for servicing and removal of equipment without dismantling piping.

G. Plenums: Provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Architect/Engineer of discrepancy.

3.2 SEISMIC CONTROL

A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 21, Fire Suppression Sections.

B. Provide fire suppression equipment and piping, both hanging and base mounted, with mounting connection points of sufficient strength to resist lateral seismic forces equal to lateral seismic forces as determined by building code and NFPA 13 calculations, whichever is more demanding.

C. See Structural Drawings for seismic design criteria for sway bracing and seismic restraint.

D. Earthquake resistant designs for Fire Protection (Division 21) equipment and distribution, i.e. fire sprinkler systems, fire standpipe systems, fire pumps, fire pump controllers, fire tanks, clean agent fire suppression systems, etc. to conform to regulations of jurisdiction having authority.

E. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.

F. Provide stamped Shop Drawings from licensed Engineer of seismic bracing and seismic movement assemblies for piping, equipment, tanks, pumps controllers and the like. Submit shop drawings along with equipment submittals.

G. Provide stamped Shop Drawings from licensed Engineer of seismic flexible joints for piping and crossing building expansion or seismic joints. Submit Shop Drawings along with seismic bracing details.

H. Provide details of flexible drops for sprinklers in conformance with Building Code and ASCE 7 requirements of ceilings. Coordinate with Architectural and Structural Drawings and Specifications.

I. Piping: Per NFPA 13, ASCE-7 and local requirements.

J. Equipment:

1. Per "Seismic Restraints Manual Guidelines for Mechanical Systems" latest edition published by SMACNA, ASCE 7 and local requirements.

2. Provide means to prohibit excessive motion of fire protection equipment during an earthquake.

3.3 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.

B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:

1. Underground piping installation prior to backfilling.

2. Prior to covering walls.

3. Prior to ceiling cover/installation.

4. When main systems, or portions of, are being tested and ready for inspection by AHJ.

5. When mains or branchlines are to be permanently concealed by construction or insulation systems.

6. When fire suppression systems, or portions of, are being tested and ready for inspection by AHJ.

C. Bear responsibility and cost to make piping accessible, to expose concealed lines, or to demonstrate acceptability of the system. If Contractor fails to notify Architect at times prescribed above, costs incurred by removal of such work are the responsibility of the Contractor.

D. Final Punch: Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CUTTING AND PATCHING

A. Confirm Cutting and Patching requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections and the following:

1. Cutting and patching performed under Division 21, Fire Suppression includes, but is not limited to:

   a. Cutting and patching of plaster or partitions.

   b. Cutting and patching of finished ceilings.

2. Perform cutting and patching by skilled craftsmen in trade of work to be performed. Fill holes which are cut oversized for completed work. Match refinished areas with existing adjacent finish in a manner acceptable to Architect.

3. When masonry to concrete construction must be penetrated, provide a steel pipe sleeve in opening and grout in place in a neat manner. Leave grout surface to match existing finish. Provide escutcheons. If sleeves are not provided, core drill penetrations.

4. Locate concealed utilities to eliminate possible service interruption or damage.

5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

6. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).

7. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.

8. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.

9. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, landscaping, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.

10. Repair mutilation of building around pipes, equipment, hangers, and braces.

3.5 EQUIPMENT SELECTION AND SERVICEABILITY

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing at no additional cost to Owner.

3.6 DELIVERY, STORAGE AND HANDLING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections and the following:

1. Handle materials delivered to project site with care to avoid damage and deterioration. Store materials in original containers which identify manufacturer, name, brand and model numbers on site inside building or protected from weather, sun, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt and/or dust as a result of improper storage to be replaced before installation.

2. Protect equipment and pipe to avoid damage. Close pipe openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.

3. Protect bright finished shafts, bearing housings and similar Item until in service.

3.7 DEMONSTRATION

A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.

B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Owner's Authorized Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.

C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

D. Prior to acceptance of work and during time designated by Architect, provide necessary qualified personnel to operate system for a period of eight hours.

E. Instruct the Owner in the operation of the sprinkler system, including main valve position (open or closed) recognition, system drainage, system testing, dry pipe valve reset and the relation to the fire alarm system.

F. Upon completion of work and adjustment of equipment, test systems to demonstrate to Owner's Authorized Representative and Architect that equipment is furnished and installed or connected under provisions of these Specifications.

3.8 CLEANING

A. Confirm Cleaning requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.

B. Upon completion of installation, except for sprinklers, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

C. Sprinklers may not be cleaned except for vacuuming in a manner in which no part of the sprinkler is touched by the vacuuming equipment. Replace sprinklers which bear traces of foreign substances with sprinklers of same model, temperature, K-factor, orifice, finish, style, orientation, and the like.

3.9 INSTALLATION

A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.

B. Install equipment in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.

C. Start-up equipment, in accordance with manufacturer's start-up instructions, in the presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment. Provide pump impellers to obtain Basis of Design design capacities.

D. Provide miscellaneous supports/metals required for installation of equipment and piping.

3.10 PAINTING

A. Confirm requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections and the following:

1. Ferrous Metal: After completion of fire protection work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.

2. After acceptance by Authority Having Jurisdiction (AHJ), in a mechanical room, on roof or other exposed areas, machinery and equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.

3. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.

4. Piping: Clean, primer coat and paint exposed piping on roof or at other exterior locations with two coats paint suitable for metallic surfaces and exterior exposures. Color selected by Architect.

5. Covers: Covers such as vault covers and the like will be furnished with finishes which resist corrosion and rust.

3.11 ACCESS PANELS

A. Confirm Access Panel requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections and the following:

1. Coordinate locations/sizes of access panels with Architect prior to work. Label access panels with engraved nameplates indicating function of panel.

3.12 ACCEPTANCE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Sections in Division 21, Fire Suppression and the following:

1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:

a. Testing reports including Contractor's Material and Test Certificate for Underground Piping, Contractor's Material and Test Certificate for Aboveground Piping, Contractor's Material and Test Certificate for Private Fire Service Mains, Fire pump acceptance test data report, and the like.

b. Cleaning

c. Operation and Maintenance Manuals

d. Training of Operating Personnel

e. Record Drawings

f. Warranty and Guaranty Certificates

g. Start-up/Test Document and Commissioning Reports

h. Letter of Conformance

3.13 FIELD QUALITY CONTROL

A. Confirm Field Quality Control requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.

B. Upon completion of installation of equipment, sprinklers, hose valves and piping and after units are water pressurized, test system to demonstrate capability and compliance with requirements. When possible, correct malfunctioning Item at site, then retest to demonstrate compliance; otherwise remove and replace with new Item and proceed with retesting.

C. Inspect each installed Item for damage to finish. If feasible, restore and match finish to original, except fire sprinklers, at site; otherwise, remove Item and replace with new Item. Feasibility and match to be judged by Architect. Remove cracked or dented Item and replace with new Item.

D. Fire sprinklers may not be reused, or cleaned, except for dusting. Replace damaged, field painted, oversprayed, overcoated or field coated sprinklers with new sprinklers of same manufacturer, model, finish, K-factor and performance characteristics. Where identical replacement sprinklers are not available, provide sprinklers of similar finish, style, K-factor and performance characteristics.

3.14 LETTER OF CONFORMANCE

A. Provide Letter of Conformance and copies of manufacturers' warranties and extended warranties with a statement that fire suppression items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

3.15 ELECTRICAL INTERLOCKS

A. Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, utilize fire protection equipment wiring diagrams to coordinate with electrical systems so that proper wiring of equipment involved is affected.

3.16 CONNECTIONS TO EXISTING

A. Prior to connection of piping to existing piping or utilities, field verify existing conditions and exact sizes and locations of existing piping. Provide additional offsets, transitions, joints, cut-ins, and replace portions of existing as required to facilitate connections of new.

END OF SECTION

SECTION 21 0500
COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Buried Ductile Iron Pipe and Fittings
2. Buried Stainless Steel Pipe
3. Joint Restraints
4. Aboveground Black Steel Pipe and Fittings
5. Wall and Floor Penetrations and Sleeves
6. Switches, Valve Supervisory
7. Switches, Water Detector
8. Hangers and Supports
9. Struts and Strut Clamps
10. Sway Braces and Restraints
11. Anchors and Attachments
12. Pipe Stands
13. Gauges
14. Bells
15. Fire Department Connection
16. Valves
17. Pipe, Valve, and Fire Protection Equipment Identification
18. Signs
19. Drains

1.2 RELATED SECTIONS

A. Contents of Division 21, Fire Suppression and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Division 22, Plumbing

2. Division 23, Heating, Ventilating and Air Conditioning

3. Division 26, Electrical

4. Division 28, Electronic Safety and Security

5. Division 31, Earthwork

6. Section 21 00 00, Fire Suppression Basic Requirements

7. Section 21 13 00, Fire Suppression Sprinkler Systems

8. Section 21 13 19, Fire Suppression Preaction Sprinkler Systems

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

B. Meet requirements of ASCE 7, Minimum Design Loads for Buildings and Other Structures, by American Society of Civil Engineers, latest adopted edition.

1.4 SUBMITTALS

A. Submittals as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Material and Equipment: Listed for its intended fire protection use in current UL Fire Protection Equipment Directory, or UL Online Certifications Directory for Fire Protection, International Code Council Evaluation Service Reports, California State Fire Marshal's Building Materials Listing Program, or FM Global Approval Guide. All material and equipment to be new and from a current manufacturer.

2. Provide per AHJ requirements.

3. References to product Specifications for materials are listed according to accepted ANSI, ASTM, ASME, AWWA and other base standards. Materials to meet latest approved versions of these standards.

4. Fire Suppression Screw-Thread Connections: Comply with local fire department/fire marshal regulations for sizes, threading and arrangement of connections for fire department equipment to fire department connections.

5. Manufacturers: Unless an item is marked "No substitutions", submit substitution request for materials of other than named manufacturers.

6. Noise and Vibration:

   a. Install vibration isolators and measures required to prevent noise and vibration from being transmitted to occupied areas. Select equipment to operate within noise coefficient (NC) design level for particular type of installation in relation to its location.

   b. After installation, make proper adjustments to reduce noise and vibration to acceptable levels as defined by Architect.

   c. In acoustically sensitive areas, design system in a manner that minimizes the number of wall penetrations.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.7 FLOW TEST

A. If flow test information provided below has been conducted less than 12 months prior to working plan submittal, utilize for design of NFPA 13 fire sprinkler and NFPA 14 standpipe systems.

B. If flow test information provided below has been conducted greater than 12 months prior to working plan submittal, the information provided is advisory only and not to be used for design. Provide materials and labor for a new water supply test on the closest nearby fire hydrants per NFPA 13 and NFPA 291. Utilize new flow test results for design of NFPA 13 fire sprinkler and NFPA 14 standpipe systems.

C. Flow Test:

1. Flow: 750 GPM at a residual pressure of 104 PSI.

2. Static Pressure: 111 PSI.

3. Location: Hydrant 01316

4. Elevation: See plans.

5. Date: 08/28/20.

6. Information Provided By: MMWD.

1.8 SYSTEM IMPAIRMENT

A. When returning a water-based fire protection system to service after impairment or control valve closure, verify the system is in working order by performing a main drain test per NFPA 25.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Buried Ductile Iron Pipe and Fittings:

1. United States Pipe & Foundry Company
2. Tyler Union
3. Or approved equivalent.

B. Buried Stainless Steel Pipe:

1. In Building Riser:
   a. Ames
   b. Or approved equivalent.

C. Joint Restraints:

1. Tyler Pipe Company
2. EBAA Iron, Incorporated
3. United States Pipe and Foundry Company
4. Or approved equivalent.

D. Aboveground Black Steel Pipe and Fittings:

1. Pipe:
   a. Bull Moose Tube
   b. Wheatland Tube Company
   c. Or approved equivalent
2. Fittings, Mechanical and Grooved Couplings:
   a. Victaulic
   b. Or approved equivalent.

3. Fittings, Threaded:
    a. Smith-Cooper International
    b. Or approved equivalent.
4. Fittings, Rubber Gasketed:
    a. Victaulic
    b. Or approved equivalent.
5. Fittings, Welded:
    a. Smith-Cooper International
    b. Or approved equivalent.
6. Fittings, Flanged:
    a. Victaulic; Groove/Flange Adapter.
    b. Or approved equivalent.

E. Wall and Floor Penetrations and Sleeves:
1. Allied Rubber and Gasket Company, Incorporated, dba ARGCO
2. Fire Protection Products Incorporated (FPPI)
3. Or approved equivalent.

F. Switches, Valve Supervisory:
1. Ball Valve Supervisory Switch:
    a. Potter Electric Signal Company; Model RBVS.
    b. Or approved equivalent.

G. Switches, Water Detector:
1. Water Flow Switches:
    a. Wet Sprinkler Systems:
        1) Potter Electric Signal Company; Model VSR.
        2) Or approved equivalent.

H. Hangers and Supports:

1. Cooper B-Line Tolco:

a. Ring Hangers: Figure 200.

b. U-Bolts: Model B3188.

c. Straps:

1) Figure 22.

2) Figure 22L2.

3) Figure 23.

4) Figure 24.

5) Figure 28.

6) Figure 29.

7) Model B3184.

d. Riser Clamps: Model B3373.

e. Pipe Clamps: Model B3140, Figure 4B.

2. ITW Buildex Sammys

3. Erico International

4. Or approved equivalent.

I. Struts and Strut Clamps:

1. Struts:

a. Cooper B-Line Tolco

b. Or approved equivalent.

2. Strut Clamps:

a. Cooper B-Line Tolco; Model B2400.

b. Or approved equivalent.

J. Sway Braces and Restraints:

1. Cooper B-Line Tolco:

a. Fig. 75

b. Fig. 4A

c. Fig. 4L

d. Fig. 4LA

e. Fig. 800

f. Fig. 825

g. Fig. 825A

h. Fig. 828

i. Fig. 906

j. Fig. 910

k. Fig. 975

l. Fig. 980

m. Fig. 1000

n. Fig. 1001

o. Fig. 2002

2. Or approved equivalent.

K. Anchors and Attachments:

1. Concrete:

a. Cast-In Place Anchors for Hangers:

1) Cooper B-Line Tolco; Models 109, 109AF, B2500 with N2500 nut, or B3014 with B3014N nut.

2) Or approved equivalent.

b. Cast-In Place Anchors for Braces:

1) Cooper B-Line Tolco; Models B2500 with N2500 nut, or B3014 with B3014N nut.

2) Or approved equivalent.

c. Attachments as specified or described by structural. If not specified or described by structural, then as follows:

1) Hilti; Model Kwikbolt TZ

2) HDI-P TZ Flush Anchor

3) Or approved equivalent.

2. Steel:

a. Cooper B-Line Tolco:

1) Model B3037

2) Model B3033

3) Model B3034

4) Fig. 65

5) Fig. 66

6) Fig. 67

7) Fig. 68

8) Fig. 69

9) Model B3042T

10) Fig. 22L2

11) Fig. 23

12) Fig. 24

13) Fig. 28

14) Fig. 78

b. ITW Buildex Sammys

c. Or approved equivalent.

L. Pipe Stands:

1. Cooper B-Line Tolco; Fig B3092 with Fig. B3088ST.

2. Or approved equivalent.

M. Gauges:

1. Reliable Automatic Sprinkler Company

2. Or approved equivalent.

N. Bells:

1. Interior/Exterior Alarm Bells:

a. Potter; Model PB, 8-inch.

b. Or approved equivalent.

O. Fire Department Connection:

1. Potter-Roemer

2. Or approved equivalent.

P. Valves:

1. NRS Gate:

a. 175 PSI:

1) Nibco M/F-609 with Nibco NIP1A for yard use.

2) Nibco M/F-609 with Nibco NIP2A for wall use.

3) Or approved equivalent.

b. 200 PSI:

1) Mueller A-2361 with Mueller A-2080x indicator post for yard use.

2) Mueller A-2361 with Mueller A-20813 wall type indicator post for wall use.

3) Or approved equivalent.

c. 250 PSI:

1) Victaulic; Model 772, with Model 774 indicator post for yard use.

2) Victaulic; Model 772, with Model 773 wall type indicator post for wall use.

3) Or approved equivalent.

2. Swing Check:

   a. Reliable; Model G.

   b. Or approved equivalent.

3. Butterfly Valves:

   a. Reliable; Model REL-BFG-300-I.

   b. Or approved equivalent.

4. Pressure Relief:

   a. AGF

   b. Or approved equivalent.

5. Automatic Ball Drip Drain Valve:

   a. Reliable Automatic Sprinkler Company

   b. Or approved equivalent.

6. Three-Way Gauge Valve:

   a. AGF Manufacturing Inc.; Model 7600, 1/4-inch 3-Way Globe Valve.

   b. Or approved equivalent.

7. Automatic Air Release Valve:

   a. Potter Electric Signal Company

   b. Or approved equivalent.

8. Ball Valve:

   a. Reliable; Model R0035A

   b. Or approved equivalent.

Q. Pipe, Valve, and Fire Protection Equipment Identification:

1. Fire Protection Products, Incorporated (FPPI)

2. Or approved equivalent.

R. Signs:

1. Fire Protection Products, Inc. (FPPI)

2. Or approved equivalent.

S. Drains:

1. Reference Aboveground Black Steel Pipe and Fittings.

2. AGF

3. Or approved equivalent.

2.2 BURIED DUCTILE IRON PIPE AND FITTINGS

A. Pipe:

1. Thickness: Class 52 ductile iron, AWWA C151.

2. Pressure: 150 psi or 10.34 bar.

3. Cement mortar lined per AWWA C104, field encased with 8 mil polyethylene bag per AWWA C105. Coat all bolts, restraining rods, and the like with bitumastic prior to encasement in the polyethylene bag.

B. Fittings: AWWA C110, 350 psi or 24.13 bar. Cement mortar lined per AWWA C104, field encased with 8 mil polyethylene bag per AWWA C105. Coat all bolts, restraining rods, and the like with bitumastic prior to encasement in the polyethylene bag.

C. Fittings restrained with thrust blocks or restraining rods per NFPA 24.

D. Underground Valves: Factory coated with powdered epoxy or equivalent corrosion resistant coating. Bolts coated with bitumastic in the field. Encase the entire valve in 8-mil polyethylene bag in accordance with AWWA C-105.

E. Flexible Underground Expansion Joints:

1. AWWA C153, AWWA C116, AWWA C105.

2. Expansion joint designed and cast as an integral part of a ball and socket type flexible joint.

3. Internal and external epoxy lined.

4. Sealing Gasket: EPDM.

5. Polyethylene sleeve.

2.3 BURIED STAINLESS STEEL PIPE

A. Single extended 90 degree fitting of fabricated stainless steel tubing, maximum working pressure 200 PSI. Grooved-end connection on building outlet side and CISPI coupler on underground inlet side.

2.4 JOINT RESTRAINTS

A. Mechanical joint wedge action for ductile iron pipe.

B. Gland: Ductile Iron.

C. Wedges: Ductile iron.

D. Full restraint pressure rating of pipe with minimum safety factor of 2:1.

2.5 ABOVEGROUND BLACK STEEL PIPE AND FITTINGS

A. Wet Pipe Systems:

1. Pipe Size 1-inch: ASTM A53, ASTM A135, or ASTM A795; minimum of schedule 40.

2. Pipe Size 1-1/4-inch to 2-inch Diameter and Smaller: ASTM A53, ASTM A135, or ASTM A795; minimum of Schedule 10 when installed with grooved fittings; minimum of schedule 40 when installed with threaded fittings.

3. Pipe Size 2-1/2-inch Diameter and Larger: ASTM A53, ASTM A135, or ASTM A795; minimum of Schedule 10.

4. Exposed pipe 8-feet or less above finished floor: A minimum of Schedule 40.

B. Joints:

1. Threaded, flanged or bevel welded.

2. Piping installed in plenums or shafts to have welded joints.

C. Fittings:

1. Threaded:

a. Malleable Iron: Class 150 and Class 300, ANSI B16.3.

b. Cast Iron: Class 125 and 250, ANSI B16.3.

2. Flanged:

a. Cast iron; Class 125 and 250, ASME B16.1.

b. Raised ground face, bolt holes spot faced.

3. Welded:

a. Carbon Steel: Long radius, standard weight or extra strong.

b. Factory Wrought Steel Buttweld Fittings: ASME B16.9.

c. Buttwelding Ends for Pipe, Valves, Flanges and Fittings: ASME B16.25.

d. Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures: ASTM A234.

e. Steel Pipe Flanges and Flanged Fittings: ASME B16.5.

f. Forged Steel Fittings, Socket Welded and Threaded: ASME B16.11.

4. Mechanical Fittings and Grooved Couplings:

a. Couplings: UL 213, AWWA C606, ASTM A536 ductile iron or ASTM A47 malleable iron, with enamel finish and grooves or shoulders designed to accept grooved couplings. Synthetic-rubber gasket with central-cavity, pressure-responsive design and ASTM A183 carbon-steel bolts and nuts.

b. FM Global approved.

D. Anti-Microbial Coating: Factory-applied coating to inhibit corrosion from microbiological organisms.

2.6 WALL AND FLOOR PENETRATIONS AND SLEEVES

A. Below Grade and High Water Table Areas: Waterproof elastomeric compound.

2.7 SWITCHES, VALVE SUPERVISORY

A. Provide to mount on applicable, compatible valve (OS&Y gate, or PIV), with SPDT switches to match requirements of fire alarm system. Provide with cover tamper switch where required by AHJ.

2.8 SWITCHES, WATER DETECTOR

A. Provide with cover tamper switch where required by AHJ.

B. Water Flow Switches:

1. Vane-type; SPDT switches; electronic retard, adjustable time delay (0 to 75 seconds).

2. Wet Sprinkler Systems, NFPA 13: 450 PSI, 18-feet per second, 4-10 gpm.

C. Pressure Operated Alarm Switches: Pressure actuated with SPDT electrical switches and adjustable time delay (0 to 75 seconds).

2.9 HANGERS AND SUPPORTS

A. General: Select size of hangers and supports to exactly fit pipe size for bare piping.

B. Hangers: Ferrous.

C. Hanger Rods: Zinc electroplated carbon steel.

D. Finishes: Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

E. Materials:

1. Use carbon steel pipe hangers and supports, metal trapeze pipe hangers and attachments for general service applications.

2. Use stainless steel hangers, rods and attachments for corrosive environment applications. Examples of corrosive environment applications include, but are not limited to: swimming pools and spas, pool and spa equipment rooms and adjacent areas, chemical rooms, kidney dialysis areas, marine and beach environments, commercial laundries and the like.

F. Anti-Scratch Padding: Use padded hangers for piping subject to scratching.

2.10 STRUTS AND STRUT CLAMPS

A. Electro-galvanized steel.

B. Designed for supporting pipe runs from strut supports.

C. Strut clamps UL listed for fire protection.

D. Stainless steel for corrosive environment applications. Examples of corrosive environment applications include, but are not limited to: swimming pools and spas, pool and spa equipment rooms and adjacent areas, chemical rooms, kidney dialysis areas, marine and beach environments, commercial laundries and the like.

2.11 SWAY BRACES AND RESTRAINTS

A. Sway Bracing: From a single manufacturer and compatible with sway brace calculation program.

B. Stainless steel for corrosive environment applications. Examples of corrosive environment applications include, but are not limited to: swimming pools and spas, pool and spa equipment rooms and adjacent areas, chemical rooms, kidney dialysis areas, marine and beach environments, commercial laundries, and the like.

2.12 ANCHORS AND ATTACHMENTS

A. General: Anchor supports to masonry, concrete and block walls per anchoring system manufacturer's recommendations, or as modified by project Structural Engineer.

B. Materials:

1. Ferrous.

2. Stainless steel for corrosive environment applications. Examples of corrosive environment applications include, but are not limited to: swimming pools and spas, pool and spa equipment rooms and adjacent areas, chemical rooms, kidney dialysis areas, marine and beach environments, commercial laundries, and the like.

C. Cast in Place Anchors for Hangers: Verify listing is for hangers, braces, or both.

D. Attachments in Concrete:

1. Suitable for hanging and bracing fire protection systems in concrete which is subject to cracking in a seismic event.

2. Seismic Design Areas C, D, E and F:

a. Compatible with International Code Council Evaluation Service Acceptance Criteria AC-193 and AC308 for expansion, screw and adhesive anchors. Meet requirements of ACI 355.2, Qualification of Post-Installed Mechanical Anchors in Concrete and Commentary.

b. All models of Hilti HDI and ITW Red Head Multi-Set II anchors are not approved for attaching fire protection systems in Seismic Design Areas C, D, E and F. No Exceptions.

E. ITW Buildex Sammys with FM Approval only are not allowed in certain seismic zones. Verify with FM that FM Approval is effective in project's seismic zone.

2.13 PIPE STANDS

A. Adjustable Pipe Saddle Support with Yoke:

1. Designed to support horizontal pipe from floor stanchion.

2. U-bolt and hex nuts to hold pipe securely to saddle or pipe clamp type.

3. ANSI/MSS SP-69; SP-58. Type 37.

4. Steel pipe with steel saddle.

B. Base Stand:

1. Steel pipe welded to steel base plate.

2. Meet requirements of 12X anchor diameter hole spacing for seismic applications.

2.14 GAUGES

A. Pressure Gauges: 3.5-inch, dial type, bronze bourdon tube or spring type, stainless steel case. 0 to 300 PSI.

2.15 BELLS

A. Exterior Alarm Bells: Minimum weatherproof backbox, typical 90 dBA at 10-feet.

2.16 FIRE DEPARTMENT CONNECTION

A. General:

1. Thread to match fire department hardware; automatic drip connected to drain; threaded dust cap and chain of same material and finish as body.

2. Provide with individual clappers.

B. Type: Free-Standing Type

C. Finish: Chrome.

D. Inlet Size: 2-1/2-inch.

E. Number of Inlets: Two.

F. Outlet Size: 4-inch.

G. Size of Pipe between Fire Department Connection and Sprinkler System: 4-inch.

H. Drain: 3/4-inch automatic ball drip, to outside.

I. Sign: Auto Sprinkler Fire Department Connection

2.17 VALVES

A. OS&Y Gate:

1. 2-1/2-inches and Larger: Iron body.

2. 2-inches and Smaller: Bronze body.

B. NRS Gate:

1. Iron body. Non-rising stem with indicator post.

2. Underground Butterfly Valves: Telescopic barrel type.

C. Swing Check: Iron body, rubber and bronze faced checks.

D. Wafer Check: Iron body, rubber seat, spring actuated.

E. Butterfly Valves: Ductile iron body with factory-installed tamper switches. Use lug body next to pumps.

F. Pressure Relief: Bronze body, stainless steel spring.

G. Automatic Ball Drip Drain Valve: Bronze, spring-type.

H. Three-Way Gauge Valve: Brass; rated to 300 psi.

I. Automatic Air-Release Valve for Wet Systems:

1. Rated to 175 psi.

2. Automatic float-type with shutoff mounted in a water retention pan.

3. Ball valve switch with cover tamper.

J. Ball Valves: Brass body, brass stem; forged brass ball disc.

2.18 PIPE, VALVE, AND FIRE PROTECTION EQUIPMENT IDENTIFICATION

A. Engraved plastic laminate or corrosion resistant metal sign or plastic equipment marker.

B. Corrosion-resistant chain or permanent adhesive.

2.19 SIGNS

A. Engraved plastic laminate or corrosion resistant metal sign or plastic equipment marker.

B. Corrosion-resistant chain or permanent adhesive.

2.20 DRAINS

A. Reference Aboveground Black Steel Pipe and Fittings.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install in conformance with UL Listing, FM Approval or ICC-ES requirements and restrictions.

3.2 BURIED DUCTILE IRON PIPE AND FITTINGS

A. Pipe Sleeves:

1. Lay out work in advance of pouring concrete and furnish and set sleeves necessary to complete work.

2. Floor Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Extend sleeve 1-inch above finished floor. Caulk pipes passing through floor with nonshrinking firestopping, smokestopping and water stopping grout or approved equivalent caulking compound. Caulk/seal piping passing through fire rated building assembly with UL rated assemblies.

3. Wall Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Provide sleeve flush with finished face of wall. Caulk pipes passing through walls with nonshrinking caulking compound. Caulk/seal piping passing through fire-rated building assemblies with UL Listed or FM approved fire-rated firestopping compound. Provide fire-rated assemblies per local AHJ requirements.

4. Coordinate with trades for locations of pipe sleeves in reinforced concrete and steel beams. Penetrations must be indicated on structural shop drawings. See Drawings and Specifications for specific sleeve location limitations.

B. Buried Pipe:

1. Hydraulically calculated pipe to be of sufficient size as to deliver the required flow while not exceeding a flow velocity of 15-feet per second or as required in accordance with the water department requirements, whichever is less.

2. Excavation and Backfill:

a. General: Perform necessary excavation and backfill required for installation of mechanical work. Repair piping or other work damaged by Contractor's operations.

b. Water: Keep excavations free of standing water. Re-excavate and fill back excavations damaged or softened by water or frost to original level with sand, crushed rock or other approved material at no expense to Owner.

c. Tests: During progress of work for compacted fill, Owner reserves right to request compaction tests made under direction of a testing laboratory.

d. Trench Excavation: Excavate trenches to necessary depth and width, removing rocks, unstable soil (i.e. muck, peat and the like), roots and stumps. Excavation material is classified as "base fill" and "native." Base fill excavation material consisting of placed crushed rock may be used as backfill above "Pipe Zone." Remove and dispose off site native excavation material at no expense to Owner. Adequate width of trench for proper installation of piping or conduit.

e. Support Foundations:

1) Foundations: Excavate trenches located in unstable ground areas below elevation required for installation of piping to a depth which is determined by Architect as appropriate for conditions encountered. Place and compact approved foundation material in excavation up to "Bedding Zone." Dewatering, placement, compaction and disposal of excavated materials to conform to requirements contained in other Sections of Specifications or Drawings.

2) Over-Excavations: Where trench excavation exceeds required depths, provide, place and compact suitable bedding material to proper grade or elevation at no additional cost to Owner.

3) Foundation Material: Where native material has been removed, place and compact necessary foundation material to form a base for replacement of required thickness of bedding material.

4) Bedding Material: Full bed site piping on sand, pea gravel or 3/4-inch minus crushed rock. Place a minimum 4-inch deep layer of sand or crushed rock on leveled trench bottom for this purpose. Remove bedding to necessary depth for piping bells and couplings to maintain contact of pipe on bedding for its entire length. Provide additional bedding in excessively wet, unstable, or solid rock trench bottom conditions as required to provide a firm foundation.

f. Backfilling:

1) Following installation and successful completion of required tests, backfill piping in lifts.

(a) In "Pipe Zone," place backfill material and compact in lifts not to exceed 6-inches in depth to a height of 12-inches above top of pipe. Place backfill material to obtain contact with entire periphery of pipe, without disturbing or displacing pipe.

(b) Place and compact backfill above "Pipe Zone" in layers not to exceed 12-inches in depth.

2) Backfill Material:

(a) Backfill Material in "Pipe Zone": 3/4-inch minus crushed rock, sand or pea gravel.

(b) Crushed rock, fill sand or other backfill material approved elsewhere in Specifications may be used above "Pipe Zone."

g. Compaction of Trench Backfill:

1) Where compaction of trench backfill material is required, use one of following methods or combination thereof:

(a) Mechanical tamper,

(b) Vibratory compacter, or

(c) Other approved methods appropriate to conditions encountered.

2) Architect to have right to change methods and limits to better accommodate field conditions. Compaction sufficient to attain 95 percent of maximum density at optimum moisture content unless noted otherwise on Drawings or elsewhere in Specifications. Water "puddling" or "washing" is prohibited.

C. Keep pipe openings closed by means of plugs or caps to prevent entrance of foreign matter. Protect piping and fittings against dirty water, chemicals, and mechanical damage both before and after installation. Restore to original condition or replace damaged pipe and fittings prior to final acceptance of work.

3.3 BURIED STAINLESS STEEL PIPE

A. Underground Steel Piping Corrosion Protection: Factory wrap uninsulated underground stainless steel piping systems with protective coating composed of a coal-tar saturated wrapping tape over a 20 mil thick coal-tar epoxy coating, equivalent to "Republic X-Tru-Coat." Wrap joints spirally with a minimum overlap of 1/2 tape width. Extend wrap not less than 3-inches above grade. Provide cathodic protection to meet requirements of governing authorities and servicing utility.

B. Buried Pipe:

1. Excavation and Backfill:

a. General: Perform necessary excavation and backfill required for installation of mechanical work. Repair piping or other work damaged by Contractor's operations.

b. Water: Keep excavations free of standing water. Re-excavate and fill back excavations damaged or softened by water or frost to original level with sand, crushed rock or other approved material at no expense to Owner.

c. Tests: During progress of work for compacted fill, Owner reserves right to request compaction tests made under direction of a testing laboratory.

d. Trench Excavation: Excavate trenches to necessary depth and width, removing rocks, unstable soil (i.e. muck, peat and the like), roots and stumps. Excavation material is classified as "base fill" and "native." Base fill excavation material consisting of placed crushed rock may be used as backfill above "Pipe Zone." Remove and dispose off site native excavation material at no expense to Owner. Adequate width of trench for proper installation of piping or conduit.

e. Support Foundations:

1) Foundations: Excavate trenches located in unstable ground areas below elevation required for installation of piping to a depth which is determined by Architect as appropriate for conditions encountered. Place and compact approved foundation material in excavation up to "Bedding Zone." Dewatering, placement, compaction and disposal of excavated materials to conform to requirements contained in other Sections of Specifications or Drawings.

2) Over-Excavations: Where trench excavation exceeds required depths, provide, place and compact suitable bedding material to proper grade or elevation at no additional cost to Owner.

3) Foundation Material: Where native material has been removed, place and compact necessary foundation material to form a base for replacement of required thickness of bedding material.

4) Bedding Material: Full bed site piping on sand, pea gravel or 3/4-inch minus crushed rock. Place a minimum 4-inch deep layer of sand or crushed rock on leveled trench bottom for this purpose. Remove bedding to necessary depth for piping bells and couplings to maintain contact of pipe on bedding for its entire length. Provide additional bedding in excessively wet, unstable, or solid rock trench bottom conditions as required to provide a firm foundation.

f. Backfilling:

1) Following installation and successful completion of required tests, backfill piping in lifts.

(a) In "Pipe Zone," place backfill material and compact in lifts not to exceed 6-inches in depth to a height of 12-inches above top of pipe. Place backfill material to obtain contact with entire periphery of pipe, without disturbing or displacing pipe.

(b) Place and compact backfill above "Pipe Zone" in layers not to exceed 12-inches in depth.

2) Backfill Material:

(a) Backfill Material in "Pipe Zone": 3/4-inch minus crushed rock, sand or pea gravel.

(b) Crushed rock, fill sand or other backfill material approved elsewhere in Specifications may be used above "Pipe Zone."

g. Compaction of Trench Backfill:

1) Where compaction of trench backfill material is required, use one of following methods or combination thereof:

(a) Mechanical tamper,

(b) Vibratory compacter, or

(c) Other approved methods appropriate to conditions encountered.

2) Architect to have right to change methods and limits to better accommodate field conditions. Compaction sufficient to attain 95 percent of maximum density at optimum moisture content unless noted otherwise on Drawings or elsewhere in Specifications. Water "puddling" or "washing" is prohibited.

C. Keep pipe openings closed by means of plugs or caps to prevent entrance of foreign matter. Protect piping and fittings against dirty water, chemicals, and mechanical damage both before and after installation. Restore to original condition or replace damaged pipe and fittings prior to final acceptance of work.

3.4 JOINT RESTRAINTS

A. Install per manufacturer's instructions and recommendations.

B. Reference 3.01, General Installation Requirements.

3.5 ABOVEGROUND BLACK STEEL PIPE AND FITTINGS

A. Piping Routing:

1. Route piping, except as otherwise indicated, vertically and horizontally (sloped to drain). Avoid diagonal runs wherever possible. Orient horizontal routes parallel with walls and beam lines.

2. Install piping as shown or described by diagrams, details and notations on Drawings or, if not indicated, install piping to provide the shortest route which does not obstruct usable space or block access for servicing the building and its equipment.

3. Install piping in concealed spaces above finished ceilings. Prior to design and installation. obtain pre-approval by Architect for exposed piping.

4. In open-to-structure areas which are open to public view, route exposed piping to minimize visual impact. Obtain Architect's and Engineer's approval of exposed piping installation.

5. Coordinate installation with other trades. Route piping as required to avoid building structure, equipment, plumbing piping, HVAC piping, ductwork, lighting fixtures, electrical conduits and bus ducts and similar work. Final location of lighting will have priority over final sprinkler locations. Provide drains to trapped sections of system which result from such routing. Other trades take precedence for installation space.

6. Support piping adjacent to walls, overhead construction, columns and other structural and permanent enclosure elements of the building. Limit clearance to 2-inches wherever furring is indicated for concealment of piping. Allow for insulation thickness. Locate insulated piping to provide minimum 1-inch clearance outside insulation.

7. Wherever possible in finished and occupied spaces, conceal piping from view by locating within column or beam enclosures, hollow wall construction, or above suspended ceilings. Do not encase horizontal routes in solid partitions, except where approved.

8. General Electrical Equipment Clearances: Do not route piping through electrical rooms, transformer vaults, elevator equipment rooms and other electrical or electronic equipment spaces and enclosures. Do not route piping above electric power or lighting panel, switchgear, low voltage panel, or similar electric device.

9. Rooms Protected by Alternative Systems: Route water filled and dry system piping around rooms protected by pre-action systems, clean agent systems, gaseous suppression systems and other alternative fire suppression systems.

10. Install pipe runs to minimize obstruction to other work.

11. Pitch all dry and pre-action system piping 1/4-inch per 10-feet for mains and 1/2-inch per 10-feet for branch lines, including pipe passing through both warm and cold areas.

B. Couplings:

1. Install where indicated on Drawings and on each side of pieces of equipment to permit easy removal of equipment.

2. Deburr cut edges.

C. Pipe Penetrations: Wire pipe cutout coupon at point of pipe penetration.

D. Pipe and Pipe Fittings:

1. Expansion and Flexibility: Install work with due regard for expansion and contraction to prevent damage to the piping, equipment, building and its contents. Provide piping offsets, loops, approved type expansion joints, sway bracing, wire restraints, vertical restraints, flexible couplings or other means to control pipe movement and to minimize pipe forces.

2. Coordinate support of pipe 4-inches and larger with Structural Engineer.

3. Provide clearances around piping per NFPA 13.

4. Install dry and pre-action welded pipe with welds facing vertically up, or where this is not possible, as close as possible to vertical between 46 degrees and 234 degrees. Intent is to minimize corrosion caused by moisture in the bottom of pipes.

3.6 WALL AND FLOOR PENETRATIONS AND SLEEVES

A. Escutcheons: Install on exposed pipes passing through walls or floors.

1. Pipe Sleeves: Lay out work in advance of pouring concrete and furnish and set sleeves necessary to complete work.

2. Floor Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Extend sleeve 1-inch above finished floor. Caulk pipes passing through floor with nonshrinking fire and water resistant grout or approved equivalent caulking compound. Caulk/seal piping passing through fire rated building assembly with UL rated assemblies. Provide fire-rated assemblies per local AHJ requirements.

3. Wall Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Provide sleeve flush with finished face of wall. Caulk pipes passing through walls with non-shrinking caulking compound. Caulk/seal piping passing through fire-rated building assemblies with UL Listed or FM Approved fire-rated firestopping compound. Provide fire-rated assemblies per local AHJ requirements.

4. Beam Sleeves:

   a. Coordinate with trades for locations of pipe sleeves in reinforced concrete and steel beams. Penetrations must be indicated on structural shop drawings. See Drawings and Specifications for specific sleeve location limitations. Pipe sleeve locations must be indicated on reinforced concrete and steel beam shop drawings. Field cutting of beams not allowed without written approval of structural engineer. No extra costs allowed for failure to coordinate beam penetrations prior to reinforced concrete and steel beam shop drawing submittal.

5. Penetrations in Fire-Rated Wall/Floor Assemblies:

   a. Reference Division 07, Thermal and Moisture Protection.

   b. Coordinate with Drawings location of fire rated walls, ceilings and floors. When these assemblies are penetrated, seal around piping and equipment with approved firestopping material.

   c. Provide proper sizing when providing sleeves or core-drilled holes to accommodate the penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet the requirements of ASTM E814 and NFPA.

   d. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814.

3.7 SWITCHES, VALVE SUPERVISORY

A. Coordinate with Division 28, Electronic Safety and Security.

3.8 SWITCHES, WATER DETECTOR

A. Wire pipe cutout coupon at point of connection of switch to pipe.

B. Flow switches: Connect to system side of valves and drain connections.

C. Coordinate with Division 28, Electronic Safety and Security.

3.9 HANGERS AND SUPPORTS

A. Installation of pipe hangers, inserts and supports to conform to NFPA 13. Provide adjustable hangers, inserts, brackets, clamps, supplementary steel and other accessory materials required for proper support of pipe lines and equipment. Provide supplementary materials for proper support and attachment of hangers.

3.10 STRUTS AND STRUT CLAMPS

A. Install per manufacturer's listed orientation.

3.11 SWAY BRACES AND RESTRAINTS

A. Locate per orientation and spacing as required by sway brace calculations.

B. Attach sway bracing directly to pipe or equipment being braced.

C. Do not attach sway bracing to bottom of truss members.

3.12 ANCHORS AND ATTACHMENTS

A. In post-tension construction, determine location of post-tension cables and install anchors to avoid contact or interference with post-tension cables. Coordinate with Structural.

B. Do not use powder-driven attachments.

C. Building Attachments and Inserts: Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves and flanges, for sizes NPS 2-1/2 and larger. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

D. Hanger and Support Attachments:

1. Concrete:

a. Before Pouring: Prior to installation, coordinate locations of cast in place concrete inserts with other trades. Install in accordance with manufacturer's instructions.

b. After Pouring:

1) Where supports in slabs are required after concrete has been poured, provide drilled-in threaded inserts (mechanical-expansion anchors), installed in accordance with manufacturer's recommendations.

2) Install mechanical-expansion anchors after concrete is completely cured and in accordance with manufacturer's installation instructions.

3) Where anchors are to be installed in post-tension construction, determine and avoid locations of post-tension cables prior to drilling.

2. Metal Floor Deck: Support hangers per UL Listing or FM Approval for selected concrete insert before pouring of concrete topping, or from beam clamps fastened to structural steel.

3. Steel Joists: Support hangers from beam clamps fastened to bar joists or to auxiliary steel between bar joists as required.

4. C-Clamp Hangers: Do not attach to one side of double-angle bottom members.

5. Locate and install hangers, supports and attachments connecting to I-joists, structural insulated panels (SIPs), cross laminated timber and similar engineered structural products according to the structural product manufacturer specifications.

E. Make available to the Architect information required to verify the anchorage, sway bracing and restraint of fire protection systems.

3.13 PIPE STANDS

A. Secure to floor.

B. Install to maintain pipe level and plumb.

C. Securely attach to supported pipe by u-bolt.

3.14 GAUGES

A. Install gauges conveniently and accessibly located with reference to finished building for repairs, removal and service.

B. Install with dial positioned for maximum visibility.

3.15 HORN/STROBES

A. Locate exterior alarm bells at 8-feet above finished grade. Coordinate with Architect.

B. Coordinate with Divisions 26, Electrical and Division 28, Electronic Safety and Security.

3.16 FIRE DEPARTMENT CONNECTION

A. Locate with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.

B. Provide method of draining FDC piping. Drain to sanitary sewer by indirect connection, or to exterior where damage, including damage to landscaping and staining of concrete, will not occur.

C. Locate away from building egress paths. Coordinate location with Fire Marshal.

3.17 VALVES

A. General:

1. Provide post indicator on buried control valves.

2. Inspect valves for leaks. Adjust or replace packing to stop leaks. Replace valve if leak persists.

B. Installation:

1. Install valves where required for proper operation, testing and drainage. Locate valves so as to be accessible and so that separate support can be provided when necessary. Install conveniently and accessibly located with reference to finished building for repairs, removal and service.

2. Swing Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to centerline of pipe. Install for proper direction of flow.

3. Wafer Check Valves: Install between two flanges in horizontal or vertical position, position for proper direction of flow.

C. Pressure Relief Valves: Provide piping to permanent drain.

3.18 PIPE, VALVE, AND FIRE PROTECTION EQUIPMENT IDENTIFICATION

A. Install engraved plastic laminate or corrosion resistant metal sign or plastic equipment marker, secured with corrosion-resistant chain or permanent adhesive on or near each Item of fire suppression equipment and each operational device, as specified in this specification if not otherwise specified for each Item or device.

B. Provide signs for the following general categories of equipment and operational devices: Valves, drains, pumps, standpipes, tanks and similar equipment.

C. Each new piece of equipment to bear a permanently attached identification plate, listing manufacturer's name, capacities, sizes and characteristics.

D. Piping to bear the manufacturer's name, schedule of thickness, size and ASTM identification number

E. Provide valve tag on every valve, control device, main drain, auxiliary drain, and drum drip in each system. Exclude check valves and valves within factory fabricated equipment units. List each tagged valve in valve schedule for each piping system.

F. List each tagged item and its location in valve schedule; identify on fire suppression drawings.

G. Install framed, glass or rigid transparent plastic covered, mounted valve schedule and valve location drawing in main riser or fire pump room.

H. Provide identification sign on ceiling tile below valve location.

I. Provide permanent identification sign at pressure regulating valves stating required setting of pressure regulator.

J. Adjusting: Relocate fire suppression identification device which has become visually blocked.

K. Cleaning: Clean face of identification devices and glass frames of valve charts.

3.19 SIGNS

A. General Information Signs: Provide a general information sign used to determine system design basis and information relevant to the inspection, testing and maintenance requirements required by NFPA 25, Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems. Such general information is to be provided with a permanently marked weatherproof metal or rigid plastic sign, secured with corrosion-resistant wire, chain, or other acceptable means. Such signs are to be placed at each system control rise loop and auxiliary system control valve. The sign is to include the following information:

1. Name and Location of the Facility Protected

2. Presence of High-Piled and/or Rack Storage

3. Maximum Height of Storage Planned

4. Flow Test Data

5. Location of Auxiliary Drains and Low Point Drains

6. Original Results of Main Drain Flow Test

7. Name of Installing Contractor or Designer

8. Indication of presence and location of other auxiliary systems.

B. Dry Signs: At system riser supplying dry systems, provide the following information: volume in gallons contained in each system.

3.20 DRAINS

A. Locate drain connections within 7-feet of floor. Provide piping capable of being fully drained.

B. Provide a drain vent at top of vertical drains. Coordinate with Division 22, Plumbing.

C. Coordinate location of auxiliary drains with Architect. Architect to approve location before drain is installed.

D. Protect drains from tampering and accidental operation.

E. Protect drain discharge at the exterior with a turned-down 45 degree elbow.

END OF SECTION

SECTION 21 1300
FIRE SUPPRESSION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Sprinklers
2. Flexible Sprinkler Hose Fitting Assembly - For fire sprinklers in suspended ceilings which are supplied by a wet pipe system.
3. Riser Manifold
4. Inspector's Test Connection
5. Wet System Air Vent
6. Spare Sprinkler Cabinet
7. Sprinkler Guards

B. Scope:

1. Wet-Pipe Sprinkler System.
2. Private fire service main running from 5-feet outside the building to the inlet connection inside the building. Provide required valves and appurtenances.

C. Coordinate location and type of tamper, flow and pressure switches and fire alarm system.

D. Provide electrical connections and wiring as required for a complete and operable system. Includes but is not limited to bells and nitrogen generators.

1.2 RELATED SECTIONS

A. Contents of Division 21, Fire Suppression and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Division 22, Plumbing
2. Division 23, Heating, Ventilating and Air-Conditioning
3. Division 26, Electrical
4. Division 28, Electronic Safety and Security

5. Section 21 00 00, Fire Suppression Basic Requirements

6. Section 21 05 00, Common Work Results for Fire Suppression

7. Section 21 13 19, Fire Suppression Preaction Sprinkler Systems

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Details of sway bracing.

2. Details of interval and end of branch line restraints.

3. Details of flexible sprinkler hose fitting assembly, including number and radius of bends, corresponding to equivalent feet used in hydraulic calculations. Provide details of sign to be installed at each flexible sprinkler hose fitting assembly.

4. Trapeze hanger details and calculations, including size, length and material. Additionally, provide size, weight and number of pipes to be carried on the trapeze.

5. On submittal and As-Built drawings, provide text of sprinkler list to be installed in the spare sprinkler cabinet.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.7 SYSTEM DESCRIPTION

A. Provide coverage for entire building. Field verify field conditions prior to submittal of bid. Adjust bid to provide protection features in accordance with applicable codes and interpretations by AHJ. Provide design and installation based on more stringent requirements if this specification and AHJ requirements differ from Code.

B. Design Parameters:

1. Building Areas: Offices, Standard Classrooms.

a. Occupancy Classification: Light.

2. Building Areas: Storage Rooms.

a. Occupancy Classification: Ordinary Group 1.

3. Building Areas: Science Classrooms.

a. Occupancy Classification: Ordinary Group 2.

4. Design parameters above are NFPA 13 minimums. Provide increased design densities, design areas and hose allowances to meet requirements of AHJ.

C. Sprinkler system design to include a 10 percent pressure and flow cushion between system demand point and available water supplies.

D. Extend hydraulic calculations from hydraulically most remote design area back to location of pressure hydrant of flow test or effective point of water supply where characteristics of water supply are known.

1.8 EXTRA STOCK

A. Provide extra sprinklers per code.

B. Provide suitable wrenches for each sprinkler type and metal storage cabinet in riser room.

1.9 CONTROL VALVES

A. Sprinkler system control valves to be OS&Y or butterfly valves located inside building in a room with outside door.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Sprinklers:

1. Finished Areas:

a. Reliable

b. Or approved equivalent.

2. Nonfinished Areas:

a. Reliable

b. Or approved equivalent.

B. Flexible Sprinkler Hose Fitting Assembly:

1. Reliable

2. Or approved equivalent.

C. Riser Manifold:

1. Reliable; Model CR.

2. Or approved equivalent.

D. Inspector's Test Connection:

1. Combination Test and Drain:

a. AGF; Model 1011, with pressure relief valve.

b. Or approved equivalent.

E. Wet System Air Vent:

1. Potter Electric Signal Company; Model PAV

2. Or approved equivalent.

F. Spare Sprinkler Cabinet:

1. Reliable

2. Or approved equivalent.

G. Sprinkler Guards:

1. Reliable

2. Or approved equivalent.

2.2 SPRINKLERS

A. Finished Areas: See drawings.

B. Nonfinished Areas: See drawings.

C. Pendent sprinklers supplied by dry or preaction piping: Dry pendent type.

2.3 FLEXIBLE SPRINKLER HOSE FITTING ASSEMBLY

A. Fully welded non-mechanical fittings, stainless steel, braided, leak-tested with minimum 1-inch true-bore internal corrugated hose diameter. 175 psi.

B. Ceiling Bracket: Galvanized steel, direct attachment type, with integrated snap-on clip ends and removable flexible hose attachment with set screw. FM1637, UL 2443.

C. Affix permanent sign, label or decal at each flexible sprinkler hose fitting assembly anchoring component limiting the relocation of the sprinkler.

2.4 RISER MANIFOLD

A. Water-flow alarm, gauge, integral pressure relief valve connected to drain, pressure gauge with 3-way gauge control valve and drain valve, integral pressure relief valve connected to drain, sight glass, smooth bore orifice union of same size as smallest orifice sprinkler installed. Provide cover tamper switch when required by AHJ.

2.5 INSPECTOR'S TEST CONNECTION

A. Combination Test and Drain: Bronze body, brass stem, impregnated Teflon seat, chrome coated brass ball, steel handle with positive stops, tamper resistant test orifice, integral tamper resistant sight glasses, tapped and plugged port for system access, steel identification plate. Provide with pressure relief valve and drainage piping with bronze body and stainless steel spring.

2.6 WET SYSTEM AIR VENT

A. Brass, UL 2573 with ball valve supervisory switch.

2.7 SPARE SPRINKLER CABINET

A. NFPA 13 Systems: Sized to accommodate a minimum of two spare sprinklers of each Sprinkler Identification Number (SIN), manufacturer, model, orifice, deflector type, temperature and thermal sensitivity, or a minimum of six sprinklers for facilities having under 300 sprinklers, or a minimum of 12 sprinklers for facilities having 300 to 1000 sprinklers, or a minimum of 24 sprinklers for facilities having over 1000 sprinklers, whichever is more.

B. Welded steel with hinged steel cover.

C. Red enamel or polyester coated finish inside and out.

2.8 SPRINKLER GUARDS

A. Metal.

B. Listed for use with sprinkler model to which it is attached.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install per manufacturer's requirements and recommendations.

3.2 SPRINKLERS

A. Center sprinklers in center or quarter points of suspended ceiling tile.

B. Align sprinklers with architectural column lines, lighting, diffusers and other ceiling features. In unfinished ceilings, route piping to minimize visual impact. Sprinklers and piping not so aligned are to be removed and replaced at no additional cost to Owner.

C. Comply with sprinkler layouts as shown in Construction Documents to meet architectural constraints. These may be more conservative than code maximums. Notify architect if layout does not meet Code requirements.

D. Install dry sprinklers in a manner which does not trap water.

3.3 FLEXIBLE SPRINKLER HOSE FITTING ASSEMBLY

A. Install flexible sprinkler hose fitting assemblies where pendent sprinkler heads are located in acoustic ceiling tiles.

B. Install with no more bends than are included in equivalent footage used in hydraulic calculations.

C. Maintain manufacturer's recommended bending radius as included in equivalent footage used in hydraulic calculations.

D. Affix permanent sign, label or decal at each flexible sprinkler hose fitting assembly anchoring component limiting the relocation of the sprinkler.

3.4 RISER MANIFOLD

A. Install so valves and gauges are conveniently and accessibly located with reference to finished building for repairs, removal and service.

B. Provide connection to drain.

C. Pipe pressure relief valve to drain.

D. Install with supervised control valve(s) and check valve.

3.5 INSPECTOR'S TEST CONNECTION

A. Locate where full flow discharge or pressure relief valve discharge will not do damage, including damage to landscaping and will not cause dangerous conditions to walking surfaces or discoloration to building surfaces.

B. Locate within 5-feet of finished floor.

3.6 WET SYSTEM AIR VENT

A. Locate at a point in the system that will vent the most air.

B. Connect at top of pipe.

C. Locate so as not to interfere with sprinkler spray pattern.

D. Locate where it can be easily accessed for inspection and cleaning.

E. Pipe output of air vent to drain with an indirect connector or to exterior where it will not cause damage.

3.7 SPARE SPRINKLER CABINET

A. Attach to wall at the main sprinkler system riser.

B. Locate so cover is easy to open and readily accessible.

C. Locate in an area with a temperature between 40 and 100 degrees Fahrenheit (4 and 38 degrees Celsius).

D. Locate sprinkler wrenches inside cabinet.

E. Inside the cabinet, provide a list of sprinklers installed in the property, including sprinkler identification number, manufacturer, model, orifice, deflector type, thermal sensitivity and pressure rating, quantity of each type to be contained in the cabinet and issue or revision date of the list.

3.8 SPRINKLER GUARDS

A. Install per manufacturer's instructions and recommendations.

END OF SECTION

SECTION 22 00 50
BASIC PLUMBING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Electric motors.
2. Motor starters.
3. Strainers.
4. Valve boxes.
5. Gauges.
6. Thermometers.
7. Access Doors.
8. Expansion loops.
9. Flexible joints.
10. Insulation.

1.2 RELATED REQUIREMENTS

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

B. This Section is a part of each Division 22 Section.

1.3 ADDITIONAL REQUIREMENTS

A. Furnish and install any incidental work not shown or specified which is necessary to provide a complete and workable system.

B. Make all temporary connections required to maintain services during the course of this Contract without additional cost to the Owner. Notify the Owner seven days in advance before disturbing any service.

C. Plumbing work done under this contract shall not adversely affect the operation of the existing plumbing systems.

1.4 REFERENCES AND STANDARDS

A. Where material or equipment is specified to conform to referenced standards, it shall be assumed that the most recent edition of the standard in effect at the time of bid shall be used.

1. CSA – Canadian Standards Association International.

2. ANSI - American National Standards Institute.

3. ASTM - American Society for Testing and Materials.

4. CCR - California Code of Regulations.

   a. Title 8 - Division of Industrial Safety, Subchapter 7; General Industry Safety Orders, Articles 31 through 36.

5. NCPWB - National Certified Pipe Welding Bureau.

6. CEC - California Electrical Code.

7. NEMA - National Electrical Manufacturers' Association.

8. NFPA - National Fire Protection Association.

9. OSHA - Occupational Safety and Health Act.

10. UL - Underwriters' Laboratories, Inc.

B. Requirements of Regulatory Agencies:

1. The publications listed below form part of this specification; comply with provisions of these publications except as otherwise shown or specified.

   a. California Building Code, 2019.

   b. California Electrical Code, 2019.

   c. California Energy Code, 2019.

   d. California Fire Code, 2019.

   e. California Green Building Standards Code, 2019.

   f. California Mechanical Code, 2019.

   g. California Plumbing Code, 2019.

   h. California Code of Regulations, Title 24.

   i. California Health and Safety Code.

j. CAL-OSHA.

k. California State Fire Marshal, Title 19 CCR.

l. National Fire Protection Association.

m. Occupational Safety and Health Administration.

n. Other applicable state laws.

2. Nothing in Drawings or specifications shall be construed to permit work not conforming to these codes, or to requirements of authorities having jurisdiction. It is not the intent of Drawings or specifications to repeat requirements of codes except where necessary for clarity.

1.5 DRAWINGS

A. Examine Contract Documents prior to bidding of work and report discrepancies in writing to Architect.

B. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The Plumbing Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.

1. Architectural and Structural Drawings shall be considered part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over Plumbing Drawings.

2. Because of the small scale of Plumbing Drawings, not all offsets, fittings, and accessories required are shown. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in the locations shown. Obtain the Architects approval prior to relocation of equipment and materials.

3. Relocate equipment and materials installed without prior approval of the Architect. Remove and relocate equipment and materials at Contactors' expense upon Architects' direction.

4. Minor changes in locations of equipment, piping, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work, or work directly connected to same are installed and providing no additional material is required.

C. Execute work mentioned in Specifications and not shown on Drawings, or vice versa, the same as if specifically mentioned or shown in both.

1.6 FEES AND PERMITS

A. Obtain and pay for all permits and service required in installation of this work; arrange for required inspections and secure approvals from authorities having jurisdiction. Comply with requirements of Division 01.

B. Arrange for utility connections and pay charges incurred, including excess service charges.

1. Bear the cost of construction related to utility services, from point of connection to utility services shown on Contract Documents. This includes piping, excavation, backfill, meters, boxes, check valves, backflow prevention devices, general service valves, concrete work, and the like, whether or not Work is performed by Contractor, local water/sanitation district, public utility, other governmental agencies or agencies' assigns.

C. Prior to the start of construction, contact local gas company representative and coordinate location of gas meter and piping. In addition, coordinate time required for installation, in order to avoid delay to the Project.

D. Obtain permits to operate compressed air tanks required to be furnished under this Work. Pay costs, and perform tests required to obtain permits. Post permits under glass in a conspicuous place on or near tanks, or as required by authorities having jurisdiction.

E. Coordination:

1. General:

a. Coordinate plumbing Work with trades covered in other Specifications Sections to provide a complete, operable and sanitary installation of the highest quality workmanship.

2. Electrical Coordination:

a. Refer to the Electrical Drawings and Specifications, Division 26, for service voltage and power feed wiring for equipment specified under this section. Contractor has full responsibility for the following items of work:

1) Review the Electrical Drawings and Division 26 Specifications to verify that electrical services provided are adequate and compatible with equipment requirements.

2) If additional electrical services are required above that indicated on Electrical Drawings and in Division 26, such as more control interlock conductors, larger feeder, or separate 120 volt control power source, include cost to furnish and install additional electrical services as part of the bid.

3) Prior to proceeding with installation of additional electrical work, submit detailed drawings indicating exact scope of additional electrical work.

3. Mechanical Coordination:

a. Arrange for pipe spaces, chases, slots and openings in building structure during progress of construction, to accommodate mechanical system installation.

b. Coordinate installation of supporting devices. Set sleeves in poured-in-place concrete and other structural components during progress of construction.

c. Coordinate requirements for access panels and doors for mechanical items requiring access where concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section “Access Doors and Frames.”

d. Coordinate with other trades equipment locations, pipe, duct and conduit runs, electrical outlets and fixtures, air inlets and outlets, and structural and architectural features. Provide information on location of piping and seismic bracing to other trades as required for a completely coordinated project.

1.7 SUBMITTALS - GENERAL

A. Refer to Division 01 Submittals Section(s) for additional requirements.

B. Submittal packages may be submitted via email as PDF electronic files, or as printed packages. PDFs shall be legible at actual size (100 percent). Provide seven copies of printed submittal packages.

C. Provide submittal of materials proposed for use as part of this Project. Product names in Specifications and on Drawings are used as standards of quality. Furnish standard items on specified equipment at no extra cost to the Contract regardless of disposition of submittal data. Other materials or methods shall not be used unless approved in writing by Architect. Architect's review will be required even though "or equal" or synonymous terms are used.

1. Partial or incomplete submittals will not be considered.

2. Quantities are Contractor's responsibility and will not be reviewed.

3. Provide materials of the same brand or manufacturer for each class of equipment or material.

4. Identify each item by manufacturer, brand, trade name, number, size, rating, or other data necessary to properly identify and review materials and equipment. Words "as specified" are not sufficient identification.

5. Identify each submittal item by reference to items' Specification Section number and paragraph, by Drawing and detail number, and by unit tag number.

6. Organize submittals in same sequence as in Specification Sections.

7. Show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping entrance, access requirements for installation and maintenance, physical size, mechanical characteristics, foundation and support details, and weight.

    a. Submit Shop Drawings, performance curves, and other pertinent data, showing size and capacity of proposed materials.

    b. Specifically indicate, by drawn detail or note, that equipment complies with each specifically stated requirement of Contract Documents.

    c. Drawings shall be drawn to scale and dimensioned (except schematic diagrams). Drawings may be prepared by vendor but must be submitted as instruments of Contractor, thoroughly checked and signed by Contractor before submission to Architect for review.

    d. Catalog cuts and published material may be included with supplemental scaled drawings.

D. Review of submittals will be only for general conformance with design concept and general compliance with information given in Contract Documents. Review will not include quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with work of other trades, or construction safety precautions, which are sole responsibility of Contractor. Review of a component of an assembly does not indicate acceptance of an assembly. Deviations from Contract Documents not clearly identified by Contractor are Contractor's responsibility and will not be reviewed by Architect.

E. Within reasonable time after award of contract and in ample time to avoid delay of construction, submit to Architect Shop Drawings or submittals on all items of equipment and materials provided. Provide submittal in at least seven copies and in complete package.

1. Shop Drawings and submittals shall include Specification Section, Paragraph number, and Drawing unit symbol or detail number for reference. Organize submittals into booklets for each Specification section and submit in loose-leaf binders with index. Deviations from the Contract Documents shall be prominently displayed in the front of the submittal package and referenced to the applicable Contract requirement.

F. Furnish to the Project Inspector complete installation instructions on material and equipment before starting installation.

1.8 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing systems materials and products.

B. Shop Drawings.

C. Sustainable Design Submittals:

1. Product Data: For adhesives and sealants, documentation of compliance including printed statement of VOC content and chemical components.

2. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.

D. Pipe, pipe or plumbing fittings, fixtures, solder and flux installed in a system providing water for human consumption shall comply with lead free requirements of the California Health and Safety Code Section 116875. Provide submittal information for products third-party certified by an approved laboratory as complying with California Health and Safety Code Section 116875.

E. Delegated-Design Submittals: For seismic supports, anchorages, restraints, and vibration isolators indicated to comply with performance requirements and design criteria.

1. Calculations performed for use in selection of seismic supports, anchorages, and restraints shall utilize criteria indicated in Structural Contract Documents.

2. Include design calculations and details for selecting vibration isolators and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the California registered structural engineer responsible for their preparation.

3. Supports, anchorages and restraints for piping, ductwork, and equipment shall be an OSHPD pre-approved system such as TOLCO, ISAT, Mason, or equal. Pipes, ducts and equipment shall be seismically restrained in accordance with requirements of current edition of California Building Code. System shall have current OPM number and shall meet additional requirements of authority having jurisdiction. Provide supporting documentation required by the reviewing authority and the Architect and Engineer. Provide layout drawings showing piping, ductwork and restraint locations.

a. Bracing of Piping and Equipment: Specifically state how bracing attachment to structure is accomplished. Provide shop drawings indicating seismic restraints, including details of anchorage to building. In-line equipment must be braced independently of piping, and in conformance with applicable building codes. Provide calculations to show that pre-approval numbers have been correctly

applied in accordance with general information notes of pre-approval documentation. Gas pipe bracing shall be designed in accordance with California Building Code Section 1615A.1.22 and ASCE 7-10 Section 13.6. Coefficient I_p = 1.5 shall be used for gas piping bracing calculations.

b. In lieu of the above or for non-standard installations not covered in the above pre-approved systems, Contractor shall provide layout drawings showing piping, ductwork, and restraint locations, and detail supports, attachments and restraints, and furnish supporting calculations and legible details sealed by a California registered structural engineer, in accordance with 2019 California Building Code

4. Additional Requirements: In addition to the above, conform to all state and local requirements.

1.9 INFORMATIONAL SUBMITTALS

A. Provide layouts for plumbing systems, for inclusion in coordinated layout specified in Section 23 80 00. Comply with requirements for layouts specified in Section 23 80 00.

1.10 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Refer to Division 01 for complete instructions.

2. Furnish three complete sets of Operation and Maintenance Manual bound in hardboard binder, and one compact disc containing complete Operation and Maintenance Manual in searchable PDF format. Provide Table of Contents. Provide index tabs for each piece of equipment in binder and disc. Begin compiling data upon approval of submittals.

a. Sets shall incorporate the following:

1) Product Data.

2) Shop Drawings.

3) Record Drawings.

4) Service telephone number, address and contact person for each category of equipment or system.

5) Complete operating and maintenance instructions for each item of plumbing equipment and systems.

6) Copies of guarantees/warrantees for each item of equipment and systems.

7) Test data and system balancing reports.

8) Typewritten maintenance instructions for each item of equipment listing lubricants to be used, frequency of lubrication, inspections required, adjustment, etc.

9) Manufacturers' bulletins with parts numbers, instructions, etc., for each item of equipment.

10) Control diagrams and literature.

11) A complete list or schedule of all scheduled valves giving the number of the valve, location and the rooms or area controlled by the valve. Identify each valve with a permanently attached metal tag stamped with number to match schedule. Post list in frame under plastic on wall in mechanical room or where directed by Architect.

12) Check test and start reports for each piece of plumbing equipment provided as part of the Work.

13) Commissioning and Preliminary Operation Tests required as part of the Work.

b. Post service telephone numbers and/or addresses in an appropriate place as designated by the Architect.

B. Record Drawings:

1. Refer to Division 01, Record Documents, for requirements governing Work specified herein.

2. Upon completion of the work, deliver to Architect the following:

a. Originals of drawings showing the Work exactly as installed.

b. One complete set of reproducible drawings showing the Work exactly as installed.

c. One compact disc with complete set of drawings in PDF format showing the Work exactly as installed.

d. Provide Contractor's signature, verifying accuracy of record drawings.

e. Obtain the signature of the Project Inspector for all record drawings.

1.11 SUBSTITUTIONS

A. Refer to Division 01 for complete instructions. Requirements given below are in addition to or are intended to amplify Division 01 requirements. In the case of conflict between requirements given herein and those of Division 01, Division 01 requirements shall apply.

B. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project. Refer to Division 01 for complete instructions.

C. Substitutions will be interpreted to be all manufacturers other than those specifically listed in the Contract Documents by brand name, model or catalog number.

D. Only one request for substitution will be considered for each item of equipment or material.

E. Substitution requests shall include the following:

1. Reason for substitution request.

2. Complete submittal information as described herein; see “Submittals.”

3. Coordinated scale layout drawings depicting position of substituted equipment in relation to other work, with required clearances for operation, maintenance and replacement.

4. List optional features required for substituted equipment to meet functional requirements of the system as indicated in Contract Documents.

5. Explanation of impact on connected utilities.

6. Explanation of impact on structural supports.

F. Installation of reviewed substitution is the Contractors’ responsibility. Any mechanical, electrical, structural, or other changes required for installation of reviewed substituted equipment or material must be made by the Contractor without additional cost to the Owner. Review by the Architect of the substituted equipment or material, including dimensioned Drawings will not waive these requirements.

G. Contractor may be required to compensate the Architect for costs related to substituted equipment or material.

1.12 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Contractor's Qualifications: Firm with at least 5 years of successful installation experience on projects with plumbing systems work similar to that required for this Project.

C. California Health and Safety Code Compliance: For products covered under the scope of HSC 116875 for potable water service. Products for potable water service shall be third-party certified by an approved laboratory as complying with California Health and Safety Code Section 116875.

D. Comply with applicable portions of California Plumbing Code pertaining to selection and installation of plumbing materials and products.

E. All materials and products shall be new and shall match existing.

1.13 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment and piping delivered to Project site from weather, humidity and temperature variations, dirt, dust and other contaminants.

1.14 FIELD CONDITIONS

A. Contractor shall visit Project site and examine existing conditions in order to become familiar with Project scope. Verify dimensions shown on Drawings at Project site. Bring discrepancies to the attention of Architect. Failure to examine Project site shall not constitute basis for claims for additional work because of lack of knowledge or location of hidden conditions that affect Project scope.

B. Information on Drawings relative to existing conditions is approximate. Deviations from Drawings necessary during progress of construction to conform to actual conditions shall be approved by the Architect and shall be made without additional cost to the Owner. The Contractor shall be held responsible for damage caused to existing services. Promptly notify the Architect if services are found which are not shown on Drawings.

1.15 WARRANTY

A. Refer to Division 01 for warranty requirements, including effective date of warranty. Refer to specific items of equipment specified herein for warranty duration if different from that specified in Division 01.

B. Repair or replace defective work, material, or part that appears within the warranty period, including damage caused by leaks.

C. On failure to comply with the above warranty within a reasonable length of time after notification is given, the Architect/Owner shall have the repairs made at the Contractor's expense.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials or equipment of the same type shall be of the same brand wherever possible. All materials shall be new and in first class condition.

B. All sizes, capacities, and efficiency ratings shown are minimum, except that gas capacity is maximum available.

C. Refer to Sections 22 10 00 and 23 80 00 for specific system piping materials.

2.2 MATERIALS AND PRODUCTS

A. No material installed as part of this Work shall contain asbestos.

B. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2.3 ELECTRIC MOTORS

A. General Motor Requirements: Comply with NEMA MG 1 unless otherwise indicated. Comply with IEEE 841 for severe-duty motors.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. U.S. Motors.

b. Century Electric.

c. General Electric.

d. Lincoln.

e. Gould.

B. Motor Characteristics: Designed for continuous duty at ambient temperature of 40 deg. C and at altitude of 3300 feet above sea level. Capacity and torque shall be sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

1. Motors exceeding the nameplate amperage shall be promptly replaced at no cost to the Owner. Horsepower shown is minimum and shall be increased as necessary to comply with above requirements. Furnish motors with splash-proof or weatherproof housings, where required or recommended by the manufacturer. Match the nameplate voltage rating with the electrical service supplied. Check Electrical Drawings. Provide a transformer for each motor not wound specifically for system voltage.

C. Polyphase Motors: NEMA MG 1, Design B, medium induction motor, premium efficiency as defined in NEMA MG 1. Select motors with service factor of 1.15. Provide motor with random-wound, squirrel cage rotor, and permanently lubricated or regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading. Temperature rise shall match insulation rating. Provide Class F insulation.

1. Multispeed motors shall have separate windings for each speed.

D. Polyphase Motors with Additional Requirements:

1. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

2. Motors Used with Variable Frequency Controllers:

a. Separately Connected Motors: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

b. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.

c. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.

d. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

e. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

f. Each motor shall be provided with a shaft grounding device for stray current protection.

3. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

E. Single-Phase Motors:

1. Select motors with service factor of 1.15.

2. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

   a. Permanent-split capacitor.

   b. Split phase.

   c. Capacitor start, inductor run.

   d. Capacitor start, capacitor run.

3. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

4. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

5. Motors 1/20 HP and Smaller: Shaded-pole type.

F. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.4 MOTOR STARTERS

A. Square D, Allen Bradley, or equal, in NEMA Type 1 enclosure, unless otherwise specified or required. Minimum starter size shall be Size 1. Provide NEMA 3R enclosure where exposed to outdoors.

B. Provide magnetic motor starters for equipment provided under the Mechanical Work. Starters shall be non-combination type. Provide part winding or reduced voltage start motors where shown or as hereinafter specified. Minimum size starter shall be Size 1.

1. All starters shall have the following:

   a. Cover mounted hand-off-automatic switch. Starters installed exposed in occupied spaces shall have key operated HOA switch.

   b. Ambient compensated thermal overload.

   c. Fused control transformer (for 120 or 24 volt service).

   d. Pilot lights, integral with the starters. Starters located outdoors shall be in NEMA IIIR enclosures.

2. Where three phase motors are provided for two-speed operation, provide two speed motor starters.

3. Starters for single-phase motors shall have thermal overloads. NEMA I enclosure for starters located indoors, NEMA IIIR enclosure for starters located outdoors.

4. Provide OSHA label indicating the device starts automatically.

2.5 STRAINERS FOR POTABLE WATER SYSTEMS

A. Strainers: Full line size, conforming to lead-free requirements of California Health and safety Code Section 116875. "Y" pattern, 125 psi SWP minimum, with 304 stainless steel screens. Install all strainers with a blow-off hose valve with hose adapter. Strainer shall have gasketed cover with straight thread.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. 3 inches and smaller: bronze or brass body, threaded ends, with 20 mesh screen. Watts LF777SI, Wilkins SXL.

b. 4 inches and larger: Cast iron body, flanged ends, 1/16 inch or 1/8 inch screen as normally supplied for each size. Watts 77F-DI-125, Mueller 758.

2.6 STRAINERS FOR NON-POTABLE WATER SYSTEMS

A. Charles M. Bailey #100A, Armstrong, Muessco, or equal, Fig. 11 "Y" pattern, 125 psi WP minimum, with monel screens with 20 square mesh for 2 inches and smaller and 3/64 inch perforations for 2-1/2 inches and larger. Install all strainers with a blow-off hose valve with hose adapter. Strainer shall have gasketed cover with straight thread.

2.7 VALVE BOXES

A. General:

1. Where several valves or other equipment are grouped together, provide larger boxes of rectangular “vault” type adequately sized for condition and similar in construction to those specified above.

2. Provide valve box extensions as required to set bottom of valve box tight up to top of piping in which valve is installed.

3. Provide a tee handle wrench for each size, Alhambra Foundry Co. #A-3008, or equal.

B. Valve Boxes in Traffic Areas: Provide Christy No. G5 traffic valve box, Brooks, or equal, 10-3/8 inches inside diameter with extensions to suit conditions, with cast iron or steel locking cover. Provide Owner with set of special wrenches or tools as required for operation of valves.

C. Valve Boxes in Non-Traffic Areas: Provide Christy No. F22, Brooks, or equal, 8 inches inside diameter by 30 inches long, with cast iron or steel locking cover. Provide Owner with set of special wrenches or tools as required for operation of valves. Cut bottom of plastic body for operation of valves.

D. Valve Box (Rectangular Vault Type): Precast concrete or cast iron with cast iron or steel locking type covers lettered to suit service – Brooks No. 3-TL, Christy No. B3, Fraser No. 3, Alhambra A-3004 or A-3005, Alhambra E-2202, or E-2702, or equal, with extension to suit conditions.

2.8 GAUGES

A. Marsh "Series J", U.S. Gage, Danton 800, or equal, with bronze bushed movement and front recalibration. Dials shall be white with black numerals, 3-1/2 inch dial face. Normal reading shall be at mid-scale. Provide a needle valve on each gauge connection. Supply a gauge piped with branch isolation valves across the inlet and outlet of each pump and where shown on the Drawings.

B. Provide Pete's Plug II, Sisco P/T, or equal, test plug with Nordel core {and gasketed cap}, on inlet and outlet of each coil, boiler, condenser, chiller and heat exchanger and where shown on Drawings.

2.9 THERMOMETERS

A. Marsh, Taylor, Palmer, or equal, 5 inch diameter bimetal dial, adjustable from face, with adjustable positioner, located to be easily read from normal personnel approach. Normal reading shall be at mid-scale.

1. Provide extension for insulation.

2. Provide thermometers with steel bulb chambers and brass separable sockets.

B. Provide Pete's Plug II, Sisco P/T, or equal, test plug with Nordel core, on inlet and outlet of each coil, boiler, and heat exchanger and provide two digital electronic test thermometers for each range of fluid temperature and where shown on Drawings.

2.10 ACCESS DOORS

A. Where floors, walls, or ceilings must be penetrated for access to mechanical equipment, provide access doors, 14 inch by 14 inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 20 inch by 30 inch minimum usable opening. Locate access doors/panels for non-obstructed and easy reach.

1. All access doors less than 7'-0" above floors and exposed to public access shall have keyed locks.

B. Access doors shall match those supplied in Division 08 in all respects, except as noted herein.

C. Provide stainless steel access doors for use in toilet rooms, shower rooms, kitchens and other damp areas. Provide steel access doors with prime coat of baked-on paint for all other areas.

D. Do not locate access doors in highly visible public areas such as lobbies, waiting areas, and primary entrance areas. Coordinate with the Architect when access is required in these areas.

E. Where specific information or details relating to access panels different from the above is shown or given on the Drawings or other Divisions of work, then that information shall supersede this specification.

F. Manufacturers: Subject to compliance with requirements, available manufacturers offering products which may be incorporated into the Work include Milcor, Karp, Nystrom, or Cesco, equal to the following:

1. Milcor

a. Style K (plaster).

b. Style DW (gypsum board).

c. Style M (Masonry).

d. Style "Fire Rated" where required.

2.11 EXPANSION LOOPS

A. Manufactured assembly consisting of inlet and outlet elbow fittings, two sections of flexible metal hose and braid, and 180-degree return bend or center section of flexible hose. Flexible hose shall consist of corrugated metal inner hose and braided outer sheath. Provide assembly selected for 4 inches of movement.

B. Provide CSA certified expansion loops listed for 4 inches of movement for use in natural or propane gas piping systems.

C. Where used in potable water systems, provide expansion loops of certified lead-free construction.

D. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Metraflex Inc., Metraloop series.

2. Unisource Manufacturing, Inc., V series.

2.12 FLEXIBLE JOINTS

A. Where indicated on Drawings, provide Metraflex Metrasphere, Style R, Mason Industries, or equal, Spherical Expansion Joints. Provide control units at each expansion joint, arranged to limit both expansion and compression.

B. Flexible joints at entry points to building shall be Barco Ductile iron, Advanced Thermal Systems, or equal, threaded style with stainless ball and mineral filled seal.

2.13 PIPE GUIDES

A. Where flexible connections are indicated on Drawings, provide Metraflex style IV, B-Line, or equal, pipe guides in locations recommended by manufacturer. Maximum spacing from flexible connection to first pipe guide is 4 pipe diameters, and maximum spacing from second pipe guide is 14 pipe diameters.

2.14 EQUIPMENT IDENTIFICATION

A. Identify each piece of equipment with a permanently attached engraved bakelite plate, 1/2 inch high white letters on black background.

2.15 PIPE IDENTIFICATION

A. Identify each piping system and indicate the direction of flow by means of Seton, Inc., Marking Services Inc., Reef Industries, Inc., or equal, pre-tensioned, coiled semi-rigid plastic pipe labels formed to circumference of pipe, requiring no fasteners or adhesive for attachment to pipe.

B. The legends and flow arrows shall conform to ASME A13.1.

2.16 INSULATION WORK

A. General:

1. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2. Adhesives and sealants shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

3. The term "piping" used herein includes pipe, valves, strainers and fittings.

4. Apply insulating cement to fittings, valves and strainers and trowel smooth to the thickness of adjacent covering. Cover with jacket to match piping. Extend covering on valves up to the bonnet. Leave strainer cleanout plugs accessible.

5. Provide pre-formed PVC valve and fitting covers.

6. Provide Calcium Silicate rigid insulation and sheet metal sleeve, 18 inch minimum length at each pipe hanger. Seal ends of insulation to make vapor tight with jacket.

7. Test insulation, jackets and lap-seal adhesives as a composite product and confirm flame spread of not more than 25 and a smoke developed

rating of not more than 50 when tested in accordance with UL723 or ASTM E84.

8. Clean thoroughly, test and have approved, all piping and equipment before installing insulation and/or covering.

9. Repair all damage to existing pipe and equipment insulation whether or not caused during the work of this contract, to match existing adjacent insulation for thickness and finish, but conforming to flame spread and smoke ratings specified above.

B. Insulation of Piping:

1. Insulate domestic hot and tempered water with minimum 3-1/2 pounds per cubic foot density fiberglass with ASJ-SSL jacket. Insulation thickness shall be the following:

   a. Pipe 3/4 inches and smaller: 1 inch thick.

   b. Pipe 1 inch through 1-1/2 inches: 1-1/2 inches thick.

   c. Pipe 2 inches and larger: 2 inches thick.

2. Insulate domestic hot water piping under slab on grade and cold water piping exposed to the weather with 3/4 inch thick Therma-Cel, Armaflex, or equal; seal water tight per manufacturer's directions.

3. Insulate roof drain and overflow drain bodies, horizontal sections of rainwater leader piping and overflow piping, and condensate drains within the building envelope with 1 inch thick fiberglass, minimum 3-1/2 pound per cubic foot density, with ASJ-SSL jacket.

4. Insulate domestic cold water piping outside of insulation envelope in outside walls, vented attic spaces, and unheated spaces, including equipment rooms and below raised floor with 1 inch thick molded fiberglass, minimum 3-1/2 pound per cubic foot density, with ASJ-SSL jacket.

5. Exposed insulated piping within the building shall have a Zeston 2000 25/50, Proto Lo-Smoke, or equal, PVC jacket and fitting cover installed over the insulation, applied per manufacturer's instructions. Insulation shall be vapor tight before applying PVC jacket and fitting covers. Verify suitability with manufacturer of insulation. Insulation with pre-applied polymer jacket may be substituted at Contractor’s option.

6. Insulate condensate drain piping in freezer with 3/4 inch thick Therma-Cel, Armaflex, or equal. Seal water tight per manufacturer's directions. Install heat tape prior to insulation of piping, in accordance with manufacturer's directions.

7. Where insulated piping is exposed to the weather apply aluminum jacket secured with 1/2 inch stainless-steel bands on 12 inch centers. Insulation shall be vapor tight before applying metal jacket, and aluminum fitting covers. Install jacketing with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Cover fittings with glass cloth, two coats of Foster Sealfas 30-36, and factory-fabricated aluminum fitting covers, of same material, finish, and thickness as jacket. Insulation shall be vapor tight before applying metal jacket and fitting covers.

   a. Fitting covers:

      1) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.

      2) Tee covers.

      3) Flange and union covers.

      4) End caps.

      5) Beveled collars.

      6) Valve covers.

      7) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

   b. Jacket thickness:

      1) Pipes 10 inches diameter and smaller: Minimum .016 inch thick jacket with smooth finish.

      2) Pipes 12 inches diameter and larger: Minimum .020 inch thick jacket with smooth finish.

PART 3 - EXECUTION

3.1 EXISTING MATERIALS

A. Remove existing equipment, piping, wiring, construction, etc., which interferes with Work of this Contract. Promptly return to service upon completion of work in the area. Replace items damaged by Contractor with new material to match existing.

B. Removed materials which will not be re-installed and which are not claimed by Owner shall become property of Contractor and shall be removed from Project site. Consult Owner before removing any material from Project site. Carefully remove materials claimed by Owner to prevent damage and deliver to Owner-designated storage location.

C. Existing piping and wiring not reused and are concealed in building construction may be abandoned in place and all ends shall be capped or plugged. Remove unused piping and wiring exposed in Equipment Rooms or occupied spaces. Material shall be removed from Project premises. Disconnect power, water, gas, pump or any other active energy source from piping or electrical service prior to abandoning in place.

D. Existing piping, ductwork, and equipment modified or altered as part of this Work shall comply with the most recent applicable code requirements.

3.2 FRAMING, CUTTING AND PATCHING

A. Special framing, recesses, chases and backing for Work of this Section, unless otherwise specified, are covered under other Specification Sections.

B. Contractor is responsible for placement of pipe sleeves, hangers, inserts, supports, and location of openings for the Work.

C. Cutting, patching, and repairing of existing construction to permit installation of equipment, and materials is the responsibility of Contractor. Repair or replace damage to existing work with skilled mechanics for each trade.

D. Cut existing concrete construction with a concrete saw. Do not utilize pneumatic devices.

E. Core openings through existing construction for passage of new piping and conduits. Cut holes of minimum diameter to suit size of pipe and associated insulation installed. Coordinate with building structure, and obtain Structural Engineer's approval prior to coring through existing construction.

3.3 PLUMBING DEMOLITION

A. Refer to Division 01 Sections “Cutting and Patching” and “Selective Demolition” for general demolition requirements and procedures.

B. Disconnect, dismantle and remove mechanical systems, equipment, and components indicated to be removed. Coordinate with all other trades.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping to remain with same or compatible piping material. Refrigerant system must be evacuated per EPA requirements.

3. Equipment to Be Removed: Drain down and cap remaining services and remove equipment.

4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.4 ELECTRICAL REQUIREMENTS

A. Provide adequate working space around electrical equipment in compliance with the California Electrical Code. Coordinate the Mechanical Work with the Electrical Work to comply.

B. Furnish necessary control diagrams and instructions for the controls. Before permitting operation of any equipment which is furnished, installed, or modified under this Section, review all associated electrical work, including overload protection devices, and assume complete responsibility for the correctness of the electrical connections and protective devices. Motors and control equipment shall conform to the Standards of the National Electrical Manufacturers' Association. All equipment and connections exposed to the weather shall be NEMA IIIR with factory-wired strip heaters in each starter enclosure and temperature control panel where required to inhibit condensation.

C. All line voltage and low voltage wiring and conduit associated with the Temperature Control System are included in this Section. Wiring and conduit shall comply with Division 26.

3.5 PIPING SYSTEM REQUIREMENTS

A. Drawing plans, schematic and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

3.6 PRIMING AND PAINTING

A. Perform priming and painting on the equipment and materials as specified herein.

B. See Division 09 Painting Section(s) for detailed requirements.

C. Priming and Painting:

1. Exposed ferrous metals, including piping, which are not galvanized or factory-finished shall be primed and painted.

   a. Black Steel Piping:

      1) Primer: One coat gray Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, comparable products by Rust-Oleum, Kelly Moore, or equal.

      2) Topcoat: Two coats gray Sherwin-Williams Pro Industrial Waterbased Alkyd Urethane Enamel, comparable products by Rust-Oleum, Kelly Moore, or equal.

2. Metal surfaces of items to be jacketed or insulated except piping shall be given two coats of primer unless furnished with equivalent factory finish. Items to be primed shall be properly cleaned by effective means free of rust, dirt, scale, grease and other deleterious matter and then primed with the best available grade of zinc rich primer. After erection or installation, all primed surfaces shall be properly cleaned of any foreign or deleterious matter that might impair proper bonding of subsequent paint coatings. Any abrasion or other damage to the shop or field prime coat shall be properly repaired and touched up with the same material used for the original priming.

3. Where equipment is provided with nameplate data, the nameplate shall be masked off prior to painting. When painting is completed, remove masking material.

3.7 EXCAVATING

A. Perform all excavating required for work of this Section. Provide the services of a pipe/cable locating service prior to excavating activities to determine location of existing utilities.

B. Unless shown otherwise, provide a minimum of 2'-6" cover above top of pipe to finished grade for all service piping, unless otherwise noted. Trim trench bottom by hand or provide a 4 inch deep minimum bed of sand to provide a uniform grade and firm support throughout entire length of pipe. For all PVC pipe and for PE gas pipe, bed the pipe in 4 inch sand bed. Pipe bedding materials should be clean crushed rock, gravel or sand of which 100 percent will pass a 1 inch sieve. For pipes that are larger than 10 inches in diameter, at least 95 percent should pass a 3/4 inch sieve, and for pipes 10 inches in diameter or smaller, 100 percent should pass a 1/2 inch sieve. All other materials should have a minimum sand equivalent of 50. Only a small proportion of the native soils will meet these requirements without extensive processing; therefore, importation of pipe bedding materials should be anticipated. Pipe bedding materials shall be compacted in lifts not exceeding 6 inches in compacted thickness. Each lift shall be compacted to not less than 90 percent relative compaction at or above the optimum moisture content, in accordance with ASTM Specification D2940, except that bedding materials graded such that 100 percent of the material will pass a No. 200 sieve shall be compacted in 6 inch lifts using a single pass of a flat-plate, vibratory compactor or vibratory drum. Pipe bedding materials should extend at least to the spring line.

C. Maintain all warning signs, barricades, flares, and red lanterns as required.

D. For all trenches 5 feet or more in depth, submit copy of permit detailed drawings showing shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of such trenches. Obtain a permit from the Division of Industrial Safety prior to beginning excavations. A copy of the permit shall be available at the site at all times.

3.8 BACKFILLING

A. Backfill shall comply with applicable provisions of Division 31 of these Specifications.

B. Except under existing or proposed paved areas, walks, roads, or similar surfaces, backfill for other types of pipe shall be made using suitable excavated material or other approved material. Place backfill in 8 inch layers, measured before compaction, and compact with impact hammer to at least 90 percent relative compaction per ASTM D2940.

1. Backfill plastic pipe and insulated pipe with sand for a minimum distance of 12 inches above the top of the pipe. Compact using mechanical tamping equipment.

C. Entire backfill for excavations under existing or proposed pavements, walks, roads, or similar surfaces, under new slabs on grade, shall be made with clean sand compacted with mechanical tamping equipment vibrator to at least 90 percent relative compaction per ASTM D2940. Remove excess earth. Increase the minimum compaction within the uppermost two feet of backfill to 95 percent.

D. Replace or repair to its original condition all sod, concrete, asphalt paving, or other materials disturbed by the trenching operation. Repair within the guarantee period as required.

3.9 PIPING SYSTEMS INSTALLATION

A. At time of final connection, and prior to opening valve to allow pressurization of water and gas piping from existing systems, on site or off site, perform a pressure test to indicate static pressure of existing systems. If pressure on water piping is greater than 80 psi, or gas pressure is not as indicated on Contract Documents, inform Architect immediately. Do not allow piping systems to be pressurized without written consent of the Architect.

B. General:

1. All piping shall be concealed unless shown or otherwise directed. Allow sufficient space for ceiling panel removal.

2. Installation of piping shall be made with appropriate fittings. Bending of piping will not be accepted.

3. Install piping to permit application of insulation and to allow valve servicing.

4. Where piping or conduit is left exposed within a room, the same shall be run true to plumb, horizontal, or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.

5. Horizontal runs of pipes and/or electrical conduit suspended from ceilings shall provide for a maximum headroom clearance. The clearance shall not be less than 6'-6" without written approval from the Architect.

6. Close ends of pipe immediately after installation. Leave closure in place until removal is necessary for completion of installation.

7. Each piping system shall be thoroughly flushed and proved clean before connection to equipment.

8. Pipe the discharge of each relief valve, air vent, backflow preventer, and similar device to floor sink or drain.

9. Install exposed polished or enameled connections with special care showing no tool marks or threads at fittings.

10. Install horizontal valves with valve stem above horizontal.

11. Use reducing fittings; bushings shall not be allowed. Use eccentric reducing fittings wherever necessary to provide free drainage of lines and passage of air.

12. Verify final equipment locations for roughing-in.

13. Service Markers: Mark the location of each plugged or capped pipe with a 4 inch round by 30 inch long concrete marker, set flush with finish grade. Provide 2-1/2 inch diameter engraved brass plate as part of monument marker.

14. Furnish and install anchors or thrust blocks on PVC water lines in the ground, at all changes in direction of piping, and at all connections or branches from mains 1-1/2 inch and larger. Form anchors or thrust blocks by pouring concrete between pipe and trench wall. Thrust blocks shall be of adequate size and so placed as to take thrusts created by maximum internal water pressure. Sizing and placement shall be per manufacturer's recommendations, CPC, and IAPMO installation standards. Anchor piping to building construction.

15. Sanitary Sewer and Storm Drain: Grade piping inside building uniformly 1/4 inch per foot if possible but not less than 1/8 inch per foot. Run piping as straight as possible. Make piping connections between building piping and outside service pipe with cast iron reducers or increasers. Slope sewers uniformly between given elevations where invert elevations are shown.

16. Where piping is installed in walls within one inch of the face of stud, provide a 16 gauge sheet metal shield plate on the face of the stud. The shield plate shall extend a minimum of 1-1/2 inches beyond the outside diameter of the pipe.

C. Expansion Loops:

1. Install expansion loops where piping crosses building expansion or seismic joints, between buildings, between buildings and canopies, and as indicated on Drawings.

2. Install expansion loops of sizes matching sizes of connected piping.

3. Install grooved-joint expansion joints to grooved-end steel piping.

4. Materials of construction and end fitting type shall be consistent with pipe material and type of gas or liquid conveyed by the piping system in which expansion loop is installed.

D. Sleeves:

1. Install Adjus-to-Crete, Pipeline Seal and Insulator, or equal, pipe sleeves of sufficient size to allow for free motion of pipe, 24 gauge galvanized steel. The space between pipe and sleeves through floor slabs on ground, through outside walls above or below grade, through roof, and other locations as directed shall be caulked with oakum and mastic and made watertight. The space between pipe and sleeve and between sleeve and slab or wall shall be sealed watertight.

2. At Contractor's option, Link-Seal, Metraflex Metraseal, or equal, casing seals may be used in lieu of caulking. Wrap pipes through slabs on grade with 1 inch thick fiberglass insulation to completely isolate the pipe from the concrete.

E. Floor, Wall, and Ceiling Plates:

1. Fit all pipes with or without insulation passing through walls, floors, or ceilings, and all hanger rods penetrating finished ceilings with chrome-plated or stainless escutcheon plates.

F. Firestopping:

1. Pack the annular space between the pipe sleeves and the pipe through all floors and walls with UL listed fire stop, and sealed at the ends. All pipe penetrations shall be UL listed, Hilti, 3M Pro-Set, or equal.

   a. Install fire caulking behind mechanical services installed within fire rated walls, to maintain continuous rating of wall construction.

2. Provide SpecSeal Systems UL fire rated sleeve/coupling penetrators for each pipe penetration or fixture opening passing through floors, walls, partitions or floor/ceiling assemblies. All Penetrators shall comply with UL Fire Resistance Directory (Latest Edition), and in accordance with Chapter 7, CBC requirements.

3. Sleeve penetrators shall have a built in anchor ring for waterproofing and anchoring into concrete pours or use the special fit cored hole penetrator for cored holes.

4. Copper and steel piping shall have SpecSeal plugs on both sides of the penetrator to reduce noise and to provide waterproofing.

5. All above Systems to be installed in strict accordance with manufacturer's instructions.

6. Alternate firestopping systems are acceptable if approved equal. However, any deviation from the above specification requires the Contractor to be responsible for determining the suitability of the proposed products and their intended use, and the Contractor shall assume all risks and liabilities whatsoever in connection therewith.

G. Flashing:

1. Flashing for penetrations of metal or membrane roof for mechanical items such as flues and pipes shall be coordinated with the roofing manufacturer and roofing installer for the specific roofing type. The work of this section shall include furnishing, layout, sizing, and coordination of penetrations required for the mechanical work.

a. Furnish and install flashing and counterflashing in strict conformance with the requirements of the roofing manufacturer. Submit shop drawing details for review prior to installation.

b. Furnish and install counterflashing above each flashing required. Provide Stoneman, or equal, vandalproof top and flashing combination. Provide vandalproof top for each plumbing vent through roof. Elmdor/Stoneman Model 1540, 1550, 1570, or equal.

2. For all other types of roofing system, furnish and install around each pipe, where it passes through roof, a flashing and counterflashing. All flashing shall be made of four pound seamless sheet lead with 6 inch minimum skirt and steel reinforced boot. Counterflashing shall be cast iron. For vents, provide vandalproof top and flashing combination. Elmdor/Stoneman Model 1100-4, 1100-5, 1100-7, or equal.

H. Hangers and Supports:

1. General: Support equipment and piping so that it is firmly held in place by approved iron hangers and supports and special hangers. Hanger and support components shall support weight of equipment and pipe, fluid, and pipe insulation based on spacing between supports with minimum factor of safety of five based on ultimate strength of material used. Do not exceed manufacturer's load rating. Pipe attachments or hangers, of same size as pipe or tubing on which used, or nearest available. Rigidly fasten hose faucets, fixture stops, compressed air outlets, and similar items to the building construction. The Architect shall approve hanger material before installation. Do not support piping with plumbers' tape, wire rope, wood, or other makeshift devices. Where building structural members do not match piping support spacing, provide “bridging” support members firmly attached to building structural members in a fashion approved by the structural engineer.

a. Materials, design, and type numbers per Manufacturers' Standardization Society (MSS), Standard Practice (SP)-58.

1) Provide copper-plated or felt-lined hangers for use on copper tubing.

2. Hanger components shall be provided by one manufacturer: B-Line, Grinnell, Unistrut, Badger, or equal.

3. Riser clamps: B-line model B3373, or equal.

4. Pipe Hanger and Support Placement and Spacing:

a. Vertical piping support spacing: Provide riser clamps for piping, above each floor, in contact with the floor. Provide support at joints, branches, and horizontal offsets. Provide additional support for vertical piping, spaced at or within the following maximum limits:

Pipe Diameter	Steel Threaded or Welded (Note 3)	Steel Gas	Copper Brazed or Soldered (Note 3)	CPVC & PVC (Note 2)
1/2 - 1”	12 ft.	6 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
1-1/4 - 2”	12 ft.	Each Floor, Not to Exceed 10 ft.	Each Floor, Not to Exceed 10 ft..	Base and Each Floor (Note 1)
2-1/2 - 3”	12 ft.	Each Floor, Not to Exceed 10 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
Over 4”	12 ft.	Each Floor, Not to Exceed 10 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)

1) Note 1: Provide mid-story guides.

2) Note 2: For PVC piping, provide for expansion every 30 feet per IAPMO installation standard. For CPVC piping, provide for expansion per IAPMO installation standard.

3) Note 3: Spacing of hangers and supports for piping assembled with mechanical joints shall be in accordance with standards acceptable to authorities having jurisdiction.

b. Vertical cast iron piping support spacing: Base and each floor not to exceed 15 feet.

c. Horizontal piping, hanger and support spacing: Locate hangers and supports at each change of direction, within one foot of elbow, and spaced at or within following maximum limits:

Pipe Diameter	Steel Threaded or Welded (Note 2)	Steel Gas	Copper Brazed or Soldered (Notes 2, 3)	CPVC & PVC (Note 1)
1/2 - 1"	6 ft.	6 ft.	5 ft.	3 ft.
1-1/4 - 2"	7 ft.	10 ft.	6 ft.	4 ft.
2-1/2 - 3"	10 ft.	10 ft.	10 ft.	4 ft.
Over 4"	10 ft.	10 ft.	10 ft.	4 ft.

1) Note 1: For PVC piping, provide for expansion every 30 feet per IAPMO installation standard. For CPVC piping, provide for expansion per IAPMO installation standard.

2) Note 2: Spacing of hangers and supports for piping assembled with mechanical joints shall be in accordance with standards acceptable to authorities having jurisdiction.

3) Note 3: Includes all refrigerant piping, including vapor and hot gas pipes.

d. Horizontal cast iron piping support spacing:

1) Support piping at every other joint for piping length of less than 4 feet.

2) For piping longer than 4 feet, provide support on each side of the coupling, within 18 inches of each joint.

3) Hanger shall not be installed on the coupling.

4) Provide support at each horizontal branch connection.

5) Provide sway brace at 40 foot maximum spacing for suspended pipe with no-hub joints, except where a lesser spacing is required by the seismic design criteria used in delegated design for seismic systems. Refer to Article, Submittals.

6) Provide a brace on each side of a change in direction of 90 degrees or more.

5. Suspended Piping:

a. Individually suspended piping: B-Line B3690 J-Hanger or B3100 Clevis, complete with threaded rod, or equal. All hangers on supply and return piping handling heating hot water or steam shall have a swing connector at point of support.

Pipe Size	Rod Size Diameter
2" and Smaller	3/8"
2-1/2" to 3-1/2"	1/2"
4" to 5"	5/8"
6"	3/4"

b. Provide 3/8 inch rod for support of PVC and CPVC and provide continuous support.

c. Trapeze Suspension: B-Line 1-5/8 inch width channel in accordance with manufacturer's published load ratings. No deflection to exceed 1/180 of a span.

d. Trapeze Supporting Rods: Shall have a safety factor of five; securely anchor to building structure.

e. Pipe Clamps and Straps: B-Line B2000, B2400; isolate copper pipe with two thicknesses of 2 inches wide 10-mil polyvinyl tape. Where used for seismic support systems, provide B-Line B2400 series pipe straps.

f. Concrete Inserts: B-line B22-I continuous insert or B2500 spot insert. Do not use actuated fasteners for support of overhead piping unless approved by Architect.

g. Steel Connectors: Beam clamps with retainers.

6. Support to Structure:

a. Wood Structure: Provide and install wood blocking as required to suit structure. Provide lag screws or through bolts with length to suit requirements, and with size (diameter) to match the size of hanger rods required.

1) Do not install Lag screws in tension without written review and acceptance by Structural Engineer.

Side Beam Angle Clip	B-Line B3062 MSS Type 34
Side Beam Angle Clip	B-Line B3060
Ceiling Flange	B-Line B3199

2) Blocking for support of piping shall be not less than 2 inch thick for piping up to 2 inch size. Provide 3 inch blocking for piping up through 5 inch size, and 4 inch blocking for larger

piping. Provide support for blocking in accordance with Structural Engineers requirements.

3) Where lag screws are used, length of screw shall be 1/2 inch less than the wood blocking. Pre-drill starter holes for each lag screw.

b. Steel Structure: Provide and install additional steel bracing as required to suit structure. Provide through bolts with length to suit requirements of the structural components. Burning or welding on any structural member may only be done if approved by the Architect.

7. Rubber Neoprene Pipe Isolators:

a. Pipe isolators shall comprise an internal rubber or neoprene material that isolates pipe from hanger and structure. Install at all piping located in acoustical walls. Refer to Architectural Drawings for location of acoustical walls.

b. Isolation material shall be either a rubber or neoprene material that prevents contact between the pipe and the structure. The rubber shall have between a 45 to 55 durometer rating and a minimum thickness of 1/2 inch.

c. Acceptable Suppliers:

1) Vertical runs: Acousto-Plumb or equal.

2) Horizontal runs: B-Line, Vibraclamp; Acousto-Plumb or equal.

8. Provide support for piping through roof, arranged to anchor piping solidly in place at the roof penetration.

9. Provide rigid insulation and a 12 inch long, 18 gauge galvanized sheet iron shield between the covering and the hanger whenever hangers are installed on the outside of the pipe covering.

10. Insulate copper tubing from ferrous materials and hangers with two thicknesses of 3 inch wide, 10 mil polyvinyl tape wrapped around pipe.

11. Provide a support or hanger close to each change of direction of pipe either horizontal or vertical and as near as possible to concentrated loads.

12. Suspend rods from concrete inserts with removable nuts where suspended from concrete decks. Power actuated inserts will not be allowed.

3.10 UNION AND FLANGE INSTALLATION

A. Install Watts, Epco, Nibco, or equal, dielectric unions or flanges at points of connection between copper or brass piping or material and steel or cast iron pipe or material except in drain, waste, vent, or rainwater piping. Bushings or couplings shall not be used. Dielectric unions installed in potable water systems shall conform to the lead-free requirements of the California Health and Safety Code Section 116875.

B. Install unions in piping NPS 2” and smaller, and flanges in piping NPS 2-1/2” and larger whether shown or not at each connection to all equipment and tanks, and at all connections to all automatic valves, such as temperature control valves. Unions installed in potable water systems shall conform to the lead-free requirements of the California Health and Safety Code Section 116875.

C. Locate the unions for easy removal of the equipment, tank, or valve.

3.11 ACCESS DOOR INSTALLATION

A. Furnish and install access doors wherever required whether shown or not for easy maintenance of mechanical systems; for example, at concealed valves, strainers, traps, cleanouts, dampers, motors, controls, operating equipment, etc. Access doors shall provide for complete removal and replacement of equipment.

3.12 CONCRETE WORK

A. Concrete work required for work of this Section shall be included under another section of the Specification, unless otherwise noted, including poured-in-place concrete work for installing precast manholes, catch basins, etc., and shall include reinforced concrete bases for pumps, tanks, compressors, fan units, boilers, unless the work is specifically indicated on the Drawings to be furnished under this Section.

B. Thrust blocks, underground anchors, and pads for cleanouts, valve access boxes and washer boxes are included under this Section of the Specification. Concrete shall be 3000 psi test minimum. Refer to Division 03 for concrete types.

3.13 PIPE PROTECTION

A. Wrap bare galvanized and black steel pipe buried in the ground and to 6" above grade, including piping in conduit, with one of the following, or equal:

1. Polyethylene Coating: Pressure sensitive polyethylene coating, "X-Tru-Coat" as manufactured by Pipe Line Service Corporation or "Green Line" wrap as manufactured by Roystron Products, or equal.

a. Field Joints and Fittings: Protecto Wrap #1170 tape as manufactured by Pipe Line Service Corporation, or Primer #200

tape by Roystron Products, or equal. Installation shall be as per manufacturer's recommendation and instructions.

2. Tape Wrap: Pressure-sensitive polyvinyl chloride tape, "Transtex #V-l0 or V-20", "Scotchwrap 50", Slipknot l00, PASCO Specialty & Mfg., Inc., or equal, with continuous identification. Tape shall be a minimum of 20 mils thick for fittings and irregular surfaces, two wraps, 50 percent overlap, 40 mils total thickness. Tape shall be laminated with a suitable adhesive; widths as recommended by the manufacturer for the pipe size. Wrap straight lengths of piping with an approved wrapping machine.

B. Field Joints: Valves and Fittings: double wrap polyvinyl chloride tape as above. Provide at least two thicknesses of tape over the joint and extend a minimum of 4 inches over adjacent pipe covering. Build up with primer to match adjacent covering thickness. Width of tape of fittings shall not exceed 3 inches. Tape shall adhere tightly to all surfaces of the fittings without air pockets.

C. Testing: Test completed wrap of piping, including all epoxy painted piping with Tinker and Rasor Co. test machine (San Gabriel, CA - 818-287-5259), Pipeline Inspection Company (Houston, TX - 713-681-5837), or equal.

D. Cleaning: Clean all piping thoroughly before wrapping.

1. Inspection: Damaged or defective wraps shall be repaired as directed. No wrapped pipe shall be covered until approved by Architect.

E. Sleeve copper piping/tubing installed below slab with “Polywrap-C” polyethylene sleeve, as manufactured by Northtown Pipe Protection Products, or equal. Sleeve shall be a minimum of 6 mils thick, colored blue for domestic water piping and orange for other piping. Install sleeve per manufacturer’s recommendations and instructions.

F. Sleeve copper piping/tubing installed outside building below grade with “Polywrap-C” polyethylene sleeve, as manufactured by Northtown Pipe Protection Products, or equal. Sleeve shall be a minimum of 6 mils thick, colored blue for domestic water piping. Install sleeve per manufacturer’s recommendations and instructions.

G. Sleeve cast iron and ductile iron pipe below grade and below slab with “Polywrap” polyethylene sleeve, as manufactured by Northtown Pipe Protection Products, or equal. Sleeve shall be a minimum of 8 mils thick, colored natural. Install sleeve per manufacturer’s recommendations and instructions.

H. Covering: No rocks or sharp edges shall be backfilled against the wrap or sleeve. When backfilling with other than sand, protect wrap with an outer wrapping of Kraft paper; leave in place during backfill.

3.14 PIPE IDENTIFICATION

A. Provide temporary identification of each pipe installed, at the time of installation. Temporary identification shall be removed and replaced with permanent identification as part of the work.

B. Apply the legend and flow arrow at all valve locations; at all points where the piping enters or leaves a wall, partition, cluster of piping or similar obstruction, at each change of direction and at approximately 20'-0" intervals on pipe runs. Variations or changes in locations and spacing may be made with the approval of the Architect. There shall be at least one marking in each room. Markings shall be located for maximum visibility from expected personnel approach.

1. Apply legend and flow arrow at approximately 10’-0” intervals in science classrooms and science prep rooms.

C. Wherever two or more pipes run parallel, the markings shall be supplied in the same relative location on each.

D. Each valve on non-potable water piping shall be labeled with a metal tag stamped "DANGER -- NON-POTABLE WATER" in 1/4 inch high letters.

E. Apply markings after painting and cleaning of piping and insulation is completed.

3.15 EXPANSION ANCHORS IN HARDENED CONCRETE

A. Refer to Structural Drawings.

B. Qualification Tests: The specific anchor shall have a current ICC-ES report and evaluated in cracked concrete in accordance with Acceptance Criteria AC193. If the specific anchor satisfies cyclic testing requirements per Acceptance Criteria AC01, Section 5.6, the full allowable shear and tension loads listed in the current ICC-ES report and manufacturer’s recommendations for the specific anchor may be used. Otherwise, the design shear and tension loads shall not be more than 80% of the listed allowable shear and tension loads for the specific anchor.

C. Installation: The anchors must be installed in accordance with the requirements given in ICC Research Committee Recommendations for the specific anchor.

D. Testing: Fifty percent of the anchors shall be load-tested on each job to twice the allowable capacity in tension, except that if the design load is less than 75 pounds; only one anchor in ten need be tested. If any anchor fails, all anchors must be tested. The load test shall be performed in the presence of a special inspector.

E. The load may be applied by any method that will effectively measure the tension in the anchor, such as direct pull with a hydraulic jack, a torque wrench calibrated using the specific anchor or calibrated spring-loading devices. Anchors in which the torque is used to expand the anchor without applying tension to the bolt may not be verified with a torque wrench.

3.16 PIPING SYSTEM PRESSURE TESTING

A. General:

1. Perform operational tests under simulated or actual service conditions, including one test of complete plumbing installation with fixtures and other appliances connected.

2. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.

B. Piping Systems: Test piping systems in accordance with the following requirements and applicable codes:

1. Authority having jurisdiction shall witness tests of piping systems.

2. Notify Architect at least seven days in advance of testing.

3. All piping shall be tested at completion of roughing-in, or at other times as directed by Architect.

4. Furnish necessary materials, test pumps, gases, instruments and labor required for testing.

5. Isolate from system equipment that may be damaged by test pressure.

6. Make connections to existing systems with flanged connection. During testing of new work, provide a slip-in plate to restrict test pressure to new systems. Remove plate and make final connection to existing system at completion of testing.

a. Authority having jurisdiction shall witness final connection to system.

C. Test Schedule: No loss in pressure or visible leaks shall show after four hours at the pressures indicated.

D. Testing of Sanitary Sewer, Drain, Vent, and Storm Drain may be done in segments in order to limit pressure to within manufacturer's recommendations. Test to 10 feet above highest point in the system.

System Tested	Test Pressure PSI	Test With
Sanitary Sewer, Drain, Vent	10 Ft. Hd.	Water
Storm Drain, Condensate Drains	10 Ft. Hd.	Water
Domestic Water	125	Water
Natural Gas (PE)	60	Air & Non-corrosive Leak Test Fluid
Natural Gas (Steel)	100	Air & Non-corrosive Leak Test Fluid
Compressed Air	200 lb.	Air & Non-corrosive Leak Test Fluid
Deionized Water	50	Water

1. Flush deionized water lines with deionized water after test and approval.

2. Non-corrosive leak test fluid shall be suitable for use with piping material specified, and with the type of gas conveyed by the piping system.

3.17 TRACER WIRES

A. Provide tracer wire for non-metallic gas and water pipe in ground outside of buildings. Use AWG #12 tracer wire with low density high molecular weight polyethylene insulation, and lay continuously on pipe so that it is not broken or stressed by backfilling operations. Secure wire to the piping with tape at 18 inch intervals. Solder all joints. Tracer wire insulation shall be colored yellow for gas piping, blue for water piping.

B. Terminals: Precast concrete box and cast iron locking traffic cover, Brooks 3TL, or equal; cover marked with name of service; 6 inches of loose gravel below box. Plastic terminal board with brass bolts; identify line direction with plastic tags. Test for continuity between terminals, after backfilling, in presence of Inspector.

C. Alternate: Use electronically detectable plastic tape with metallic core, Terra Tape D, manufactured by Reef Industries, Inc., Seton, Inc., Marking Services, Inc., or equal; tape 2 inches wide, continuously imprinted "CAUTION WATER (GAS, etc.) LINE BELOW". Install, with printed side up, directly over pipe, 18 inches below finish grade. Backfill material shall be as specified for the particular condition where pipe is installed, but avoid use of crushed rock or of earth with particles larger than l/2 inch within the top 12 inches of backfill. Take precautions to insure that tape is not damaged or misplaced during backfill operations. Terminal boxes not required.

3.18 OPERATION OF SYSTEMS

A. Do not operate any plumbing equipment for any purpose, temporary or permanent, until all of the following has been completed:

1. Complete all requirements listed under “Check, Test and Start Requirements.”

2. Piping has been properly cleaned. Piping systems shall be flushed and treated prior to operation.

3. Filters, strainers etc. are in place.

4. Bearings have been lubricated, and alignment of rotating equipment has been checked.

5. Equipment has been run under observation, and is operating in a satisfactory manner.

B. Provide test and balance agency with one set of Contract Drawings, Specifications, Addenda, Change orders issued, applicable shop drawings and submittals and temperature control drawings.

3.19 CHECK, TEST AND START REQUIREMENTS

A. An authorized representative of the equipment manufacturer shall perform check, test and start of each piece of plumbing equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the check test and start of the equipment.

1. As part of the submittal process, provide a copy of each manufacturer’s printed startup form to be used.

2. Some items of specified equipment may require that check, test and start of equipment must be performed by the manufacturer, using manufacturer’s employees. See specific equipment Articles in these Specifications for this requirement.

3. Provide all personnel, test instruments, and equipment to properly perform the check, test and start work.

4. When work has been completed, provide copies of reports for review, prior to final observation of work.

B. Provide copies of the completed check, test and start report of each item of equipment, bound with the Operation and Maintenance Manual.

C. Upon completion of the work, provide a schedule of planned maintenance for each piece of equipment. Indicate frequency of service, recommended spare parts (including filters and lubricants), and methods for adjustment and alignment of all equipment components. Provide a copy of the schedule with each operating and maintenance manual. Provide a copy of certification from the Owner's representative indicating that they have been properly instructed in maintenance requirements for the equipment installed.

3.20 PRELIMINARY OPERATIONAL REQUIREMENTS AND TESTS

A. Prior to observation to determine final acceptance, put all mechanical systems into service and check that work required for that purpose has been done, including but not limited to the following condensed check list. Provide indexed report to tabulating the results of all work.

1. All equipment has been started, checked, lubricated and adjusted in accordance with the manufacturer's recommendations.

2. Correct rotation of motors and ratings of overload heaters are verified.

3. Specified filters are installed and spare filters have been turned over to Owner.

4. All manufacturers' certificates of start-up specified have been delivered to the Owner.

5. All equipment has been cleaned, and damaged painted finishes touched up.

6. Missing or damaged parts have been replaced.

7. Flushing and chemical treatment of piping systems has been completed and water treatment equipment, where specified, is in operation.

8. Equipment labels, pipe marker labels, ceiling markers and valve tags are installed.

9. Valve tag schedules, corrected control diagrams, sequence of operation lists and start-stop instructions have been posted.

10. Preliminary test and balance work is complete, and reports have been forwarded for review.

11. Automatic control set points are as designated and performance of controls checks out to agree with the sequence of operation.

12. Operation and Maintenance Manuals have been delivered and instructions to the operating personnel have been made.

B. Prior to the observation to determine final acceptance, operate all mechanical systems as required to demonstrate that the installation and performance of these systems conform to the requirements of these specifications.

1. Operate and test all mechanical equipment and systems for a period of at least five consecutive 8 hour days to demonstrate the satisfactory overall operation of the project as a complete unit.

2. Commence tests after preliminary balancing and adjustments to equipment have been checked. Immediately before starting tests, install air filters and lubricate all running equipment. Notify the Architect at least seven calendar days in advance of starting the above tests.

3. During the test period, make final adjustments and balancing of equipment, systems controls, and circuits so that all are placed in first class operating condition.

4. Where Utility District rebates are applicable, demonstrate that the systems meet the rebate program requirements.

C. Review of Contractor's Tests:

1. All tests made by the Contractor or manufacturers' representatives are subject to observation and review by the Owner. Provide timely notice prior to start of each test, in order to allow for observation of testing. Upon the completion of all tests, provide a letter to confirm that all testing has been successful.

D. Test Logs:

1. Maintain test logs listing the tests on all mechanical systems showing dates, items tested, inspectors' names, remarks on success or failure of the tests.

E. Preliminary Operation:

1. The Owner reserves the right to operate portions of the plumbing system on a preliminary basis without voiding the guarantee.

3.21 CERTIFICATES OF INSTALLATION

A. Contractor shall complete applicable “Certificates of Installation” forms contained in the California Building Energy Efficiency Standards and submit to the authorities having jurisdiction for approval and issuance of final occupancy permit, as described in the California Energy Code.

3.22 DEMONSTRATION AND TRAINING

A. An authorized representative of the equipment manufacturer shall train Owner-designated personnel in maintenance and adjustment of equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the Owner training for the equipment installed.

1. As part of the submittal process, provide a training agenda outlining major topics and time allowed for each topic.

2. Some items of specified equipment require that training must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.

3. Contractor shall provide three copies of certification by Contractor that training has been completed, signed by Owner's representative, for inclusion in Operation and Maintenance Manual. Certificates shall include:

   a. Listing of Owner-designated personnel completing training, by name and title.

   b. Name and title of training instructor.

   c. Date(s) of training.

   d. List of topics covered in training sessions.

4. Refer to specific equipment Articles for minimum training period duration for each piece of equipment.

END OF SECTION

SECTION 22 10 00
PLUMBING PIPING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Valves.
3. Domestic water piping specialties.
4. Gas piping specialties.
5. Drain and waste piping specialties.
6. Heat tracing.

1.2 RELATED REQUIREMENTS

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

B. Section 22 00 50 Basic Plumbing Materials and Methods.

1.3 ACTION SUBMITTALS

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing piping systems materials and products.

1.4 INFORMATIONAL SUBMITTALS

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Provide welding certificate for all gas pipe welders.

C. Gas Pipe Installer Qualifications: Provide evidence of current qualifications for individuals performing work requiring qualifications.

1.5 CLOSEOUT SUBMITTALS

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Maintenance Data: Submit maintenance data and parts lists for plumbing piping systems materials and products. Include this data in Operation and Maintenance Manual.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish to Owner, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.

1.7 QUALITY ASSURANCE

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Gas Pipe Installer Qualifications: Individuals performing tasks requiring qualifications under Federal and State regulations shall be qualified by the gas utility supplying Project site. The qualifications shall be current at the time of performing the Work.

C. NFPA/ANSI Compliance: Fabricate and install natural gas systems in accordance with latest edition of NFPA 54/ANSI Z223.1 "National Fuel Gas Code."

D. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

E. Fabricate and install natural gas systems in accordance with California Plumbing Code.

F. Utility Compliance: Fabricate and install natural gas systems in accordance with local gas utility company requirements.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Provide materials and products complying with California Plumbing Code. Where more than one type of material or product is indicated, selection from materials or products specified is Contractor's option.

B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Plastic piping components shall be marked with "NSF-pw."

2.2 PIPE AND FITTINGS ATTACHED TO AND BELOW BUILDINGS INCLUDING 5 FEET FROM BUILDINGS

A. Piping and fittings attached to covered walkways and corridors shall comply with the requirements of this article.

B. Drain and Waste Pipe Above Grade: Cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A888 and Cast Iron Soil Pipe Institute Standard (CISPI) 301 and so marked. Pipe and fittings shall be as manufactured by AB&I, Charlotte, Tyler Pipe, or equal. Pipe and fittings shall be the products of a single manufacturer. At Contractor's option, vertical piping above floor from lavatories, sinks, and drinking fountains may be Schedule 40 galvanized steel pipe with black cast iron drainage fittings, or DWV weld pipe and fittings.

1. Joints above grade: No-Hub pipe conforming to ASTM A888 and CISPI 301. Couplings conforming to ASTM 1277 and CISPI 310, with stainless steel bands. Provide products by ANACO-Husky, Tyler, Ideal or equal. Provide sway brace at 20'-0" maximum spacing for suspended pipe with No-Hub joints. Provide a brace on each side of a change in direction of 90 degrees or more. Brace riser joints at each floor and at 15 foot maximum intervals (also see Specification Section 22 00 50).

a. Joints located over critical areas including food preparation, food storage, food serving, and eating areas shall be ANACO-Husky SD 4000, Clamp-All 125, or equal, meeting the requirements of FM 1680, SD Class I and ASTM C1540.

C. Drain and Waste Pipe Below Grade: Cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A888 and CISPI 301 and so marked. Pipe and fittings shall be as manufactured by AB&I, Charlotte, Tyler Pipe, or equal. Pipe and fittings shall be the products of a single manufacturer. At Contractor's option, hub and spigot cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A-74 and so marked, may be used.

1. Joints below grade: ANACO-Husky SD 4000, Clamp-All 125, or equal couplings and No-Hub fittings, meeting the requirements of FM 1680, SD Class I and ASTM C1540.

2. Joints below grade (hub and spigot option): Neoprene gaskets conforming to ASTM C564, as manufactured by Ty-Seal, Dual-Tite, or equal.

D. Vent Pipe:

1. 3 inch and larger: Cast iron soil pipe and fittings conforming to ASTM A888 and Cast Iron Soil Pipe Institute Standard 301 and so marked. Joints in cast iron vent pipe shall be the same as specified for cast iron waste pipe above grade.

2. 2-1/2 inch and smaller: Schedule 40 galvanized steel pipe with black cast iron drainage fittings, or DWV copper pipe and fittings.

3. Vent pipe buried in ground and to 6 inches above ground: Cast iron soil pipe and fittings conforming to ASTM A888 and Cast Iron Soil Pipe Institute Standard 301 and so marked. Joints in cast iron vent pipe shall be the same as specified for cast iron waste pipe below ground.

E. Water Pipe (Tempered Water, Tempered Water Return, Hot Water, Hot Water Return and Cold Water): ASTM B88, Type L copper tubing, hard-temper, with wrought copper fittings. Provide full solder cup for all fittings. Capped or plugged outlets shall be Schedule 40 screwed brass. Water piping below slab: ASTM B88, Type K copper tubing, hard temper, with wrought copper fittings. At Contractor's option, pipe runs below slab having no branches may be ASTM B88, Type K annealed copper tubing without joints. See Section 22 00 50 for pipe protection requirements for below slab copper piping.

F. Temperature and Pressure Relief Valve Piping: ASTM B88, Type L copper tubing, hard-temper, with wrought copper fittings. Provide full solder cup for all fittings. Capped or plugged outlets shall be Schedule 40 screwed brass.

G. Gas Pipe: Schedule 40 black steel conforming to ASTM A53, with malleable iron threaded fittings above grade for piping 2 inch and smaller; welded piping below grade and for above grade piping larger than 2 inches, with Class 150 welding fittings.

1. Appliance Flexible Connectors for Indoor Equipment Without External Spring Isolation:

a. Contractor may choose one of the following:

1) Direct gas pipe connection.

2) Appliance flexible connector:

a) Comply with ANSI Z21.24.

b) Polymer or hot-dipped PVC coated corrugated 304 stainless steel.

c) Operating-Pressure Rating: 0.5 psig.

d) End Fittings: Zinc-coated steel.

e) Maximum Length: 30 inches.

f) Manufacturers: Dormont, Series 30C, 31, 40C, 41, and 51, Brasscraft model ProCoat, or equal.

b. Provide with end connections compatible with equipment and piping system.

c. Equipment located in spaces normally accessible to building occupants, other than maintenance personnel, shall utilize direct gas pipe connection.

d. Provide anti-microbial PVC coating for use with appliances located in kitchen areas.

2. Flexible Gas Connector for Outdoor Equipment Without External Spring Isolation:

a. Contractor may choose one of the following:

1) Direct gas pipe connection.

2) Corrugated stainless steel hose with 304 stainless steel braid covering, CSA certified. Metraflex model GASCT, Unisource Manufacturing series 400, or equal. Provide with end connections compatible with equipment and piping system.

3. Flexible Gas Connector for Equipment with External Spring Isolation, Indoors and Outdoors:

a. Where Drawings indicate installation of mechanical equipment on spring isolation rails spring mounted curbs, or spring hangers, provide metal flexible connectors, Metraflex Metraloop, or equal by Unisource Mfg. Co., or Flexicraft Industries, CSA certified for 4 inches of movement in all directions.

4. Flexible Gas Connection System for Movable Gas-Fired Cooking Equipment:

a. System shall include flexible PVC coated braided stainless steel hose, quick disconnect fitting, full port CSA certified ball valve, 2 swivel elbows, coiled steel restraining cable and mounting hardware. Assembly shall be certified per ANSI Z21.69/CSA 6.16, “Connectors for Movable Gas Appliances.” Size as required for appliance connection, 48” minimum hose length. Install per manufacturer’s instructions. Connectors shall be Dormont Safety System, T&S Safe-T-Link, or equal.

H. Condensate Drain Piping:

1. Inside buildings provide ASTM B88, Type L copper tubing and fittings. Provide Wye fittings with capped cleanout plug for tubing up to 1 inch size. Provide wrought or cast DWV fittings for sizes 1-1/4 inch and larger.

2. Outside buildings provide ASTM B88, Type L copper pipe and fittings, cast iron drain pipe and fittings or Schedule 40 galvanized steel pipe and cast iron drain or vent fittings.

3. Connect condensate drains to mechanical equipment per equipment manufacturer's recommendations; provide P-trap where required. Slope piping to drain, with 1 inch in 10 foot minimum pitch. Provide di-electric couplings or unions at connections to dissimilar materials.

4. Where Drawings indicate installation of mechanical equipment on spring isolation rails spring mounted curbs, or spring hangers, provide threaded metal connector at mechanical equipment, Metraflex Model SST, or equal by Unisource Mfg. Co., or Flexicraft Industries. Arrange flexible connection to ensure drainage of condensate, and support flexible connection at each end of connector, to ensure proper alignment.

5. Where condensate drain P-traps are required, install trap using Wye fitting on inlet and outlet of trap. Provide cap on top of each Wye, made removable for cleaning and inspection. Drill 1/8 inch diameter hole in cap at outlet of the trap to allow venting of the system. Minimum depth of trap should be 4 inches, or as recommended by the manufacturer in printed literature.

6. Provide cleanout tees or “Y” at each change in direction.

I. Condensing-Type Equipment Condensate Drain Pipe: CPVC pipe and fittings conforming to ASTM D-2846.

1. Provide CPVC condensate drain pipe for condensing water heaters, furnaces, and where shown on Drawings.

2. Provide continuous support for horizontal piping, B-line, Grinnell, or equal PVC coated channel systems, series B11 through B72 with matching pipe clamps as appropriate, or equal.

3. Piping and fittings shall be as manufactured by Spears Manufacturing, Charlotte Pipe and foundry Co., or equal.

2.3 SITE PIPING AND FITTINGS TO 5 FEET FROM BUILDINGS

A. Buried Drain, Waste, and Vent Piping:

1. Install piping from street connection to the property line in accordance with local requirements.

2. 4 inches and larger: PVC, ASTM D3034 - SDR 35; use matching Ring Tite fittings.

3. 3 inches and smaller: Cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A888 and Cast Iron Soil Pipe Institute Standard 301 and so marked. Pipe and fittings shall be as manufactured by AB&I, Charlotte, Tyler pipe, or equal. Provide ANACO-Husky SD 4000, Clamp-All 125, or equal couplings and No-Hub fittings, meeting the requirements of FM 1680, SD Class I and ASTM C1540. Pipe and fittings shall be the product of a single manufacturer.

B. Water Service Piping:

1. Sizes 2 inches and larger (not under building): Gasket style PVC conforming to ASTM D2241-SDR21, Class 200 with gasket type fittings or ductile iron mechanical joint couplings. Gasket fittings shall be one piece injection molded PVC fittings, equal to Flo-Seal water main fittings for PVC pressure pipe, 200 psi, ASTM D-3139.

2. Sizes less than 2 inches: Type K copper tubing, hard temper, with wrought copper fittings. See Section 22 00 50 for pipe protection requirements for below grade copper piping.

3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. J.M. Eagle.

   b. P.W. Pipe.

   c. Ipex Series Pipe.

C. Water Service Piping Above Grade:

1. Sizes 2 inches and larger: Class 150 flanged ductile cast iron water pipe conforming to AWWA/ANSI C150/A21.50 and manufactured in accordance with AWWA/ANSI C151/A21.51. Fittings shall conform to AWWA/AWWA C110/A21.10, Class 250 pattern. Pipe and fittings shall have factory applied cement-mortar lining in accordance with AWWA/ANSI C104/A21.4. Flanges shall conform to ASME/ANSI B16.1.

2. Piping 1-1/2 inches and smaller: Type L copper tubing, hard temper, with brazed wrought copper fittings.

D. Gas Piping Underground: Performance Pipe, “DriscoPlex” 6500 PE 2708 (yellow), Polypipe, Inc., “Polypipe”, or equal, polyethylene gas distribution pipe, ASTM D2513, ASTM D3261, and ASTM D2683 fittings with fusion welded joints. Provide piping labeled for natural gas in accordance with CPC.

1. Electrically isolate underground ferrous gas piping from the rest of the gas system with listed or approved isolation fittings installed a minimum of six inches above grade.

2. Provide Central Plastics Corp., Perfection, or equal, anodeless, single seal riser for transition from below grade polyethylene to schedule 40 steel piping above grade. Minimum horizontal length shall be 30 inches. Minimum vertical length shall be 30 inches, or greater as required. Provide fusion connection to polyethylene pipe below grade, and screwed connection to steel pipe above grade.

E. Gas Piping Aboveground to 30 inches Belowground: Schedule 40 black steel with beveled ends for welding, with Class 150 welding fittings. Mitering to form elbows or tees will not be permitted; where branch tee connections of welded piping are required, Bonney "Weldolet" Allied Pipe Fittings, or equal fittings may be used if the branch is one-half of the diameter of the main or less.

2.4 FIRE PROTECTION PIPING

A. Refer to specification Section 21 10 00 “Fire Protection.”

2.5 PIPE JOINING MATERIALS

A. Refer to piping Articles in this Section for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated

a. Full-Face Type: For flat-face, Class 125, cast iron and cast bronze flanges.

b. Narrow-Face Type: For raised-face, Class 250, cast iron and steel flanges.

2. AWWA C111, rubber, flat face, 1/8-inch (3.2mm) thick, unless otherwise indicated; and full-face or ring type, unless other indicated.

3. Flange Bolts and Nuts: AWWA C111, carbon steel, unless otherwise indicated.

4. Plastic, Pipe-Flange Gasket, Bolts and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, 100 percent lead free alloys. Include water-flushable flux according to ASTM B813.

D. Brazing Filler Metals: AWS A5.8, BCup-5 Series, copper-phosphorus unless otherwise indicated. Sil-Fos 15, or equal.

E. Welding Filler Metals: Comply with ASME B31.1 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

F. Solvent Cements for Joining CPVC Piping: ASTM F 493.

1. CPVC solvent cement shall have VOC content of 490 g/L or less.

2. Adhesive primer shall have VOC content of 550 g/L or less.

3. Solvent cement and adhesive primer shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

G. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

1. PVC solvent cement shall have VOC content of 510 g/L or less.

2. Adhesive primer shall have VOC content of 550 g/L or less.

3. Solvent cement and adhesive primer shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

2.6 VALVES AND FITTINGS FOR POTABLE WATER SYSTEMS

A. General:

1. Provide valves and fittings conforming to lead-free requirements of California Health and Safety Code Section 116875.

a. Provide valves listed to NSF/ANSI 61-G or NSF/ANSI 372 for valve materials for potable-water service.

1) Exception: Main distribution gate valves above 1-1/2 inches located underground outside building are not required to conform lead-free requirements of California Health and Safety Code Section 116875.

B. Gate Valves:

1. General: Furnish valves in copper lines with adapters to suit valve/line requirements.

2. 1-1/2 inches and smaller: Minimum 200 psi CWP, bronze body, threaded bonnet, rising or non-rising stem, solid wedge, threaded or solder ends, conforming to MSS SP-80. Milwaukee UP148, UP149, Nibco T-113-LF, S-113-LF, or equal.

3. 2 inches through 3 inches: Minimum 200 psi CWP, bronze body, threaded bonnet, non-rising stem, solid wedge, threaded or solder ends, conforming to MSS SP-80. Nibco T-113-LF, S-113-LF, or equal.

4. Main distribution gate valves underground outside building above 1-1/2 inches:

a. Underground valves 2 inches thru 12 inches: 250 psi, iron body, Non-rising stem, bolted bonnet, resilient wedge valves, conforming to AWWA C509, equipped with operating nuts, Mueller Series 2360, Nibco F-619-RW-SON, or equal.

1) Underground valves 3 inches and smaller may be furnished with operating nuts or hand-wheels, and with Ring-Tite joint ends.

2) Furnish and deliver to Owner one wrench of each size required for operating underground valves.

C. Ball Valves:

1. 2 inches and smaller: 600 psi CWP, cast bronze or brass body, full port, two piece, threaded ends, and reinforced PTFE seal, conforming to MSS SP-110. Nibco T-685-80-LF, Milwaukee UPBA400, Apollo 77C-LF10, Kitz 868, or equal.

2. 2-1/2 inches: Apollo 77C-LF10, or equal.

D. Swing Check Valves:

1. Minimum 200 psi CWP, bronze or brass body, suitable for regrinding, threaded ends, conforming to MSS SP-80. Milwaukee UP509, Nibco T-413LF, Kitz 822T, or equal.

E. Butterfly Valves:

1. General: Tight closing, full lug type, with resilient seat suitable for minimum working pressure of 200 psig, conforming to MSS SP-67. Bi-direction dead end service with downstream flange removed.

2. Provide valves with the following:

a. Seats: suitable for 40 degrees F for cold water service and 250 degrees F for hot water service. Seats shall cover inside surface of body and extend over body ends.

b. Bodies: ductile iron or cast iron.

c. Discs: Bronze or stainless steel.

d. Stems or Shafts: Stainless steel. Install valves with stems horizontal.

e. Control Handles: Suitable for locking in any position or with 10 degree or 15 degree notched throttling plates to hold valve in selected position. Provide extended necks to compensate for insulation thickness. Provide gear operator for valves 5 inches and larger.

3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. 2 through 12 inches: Watts Regulator Co., model DBF-03.

F. Silent Check Valves (for use on pump discharge):

1. General: Provide spring loaded check valves at pump discharge of all pumps.

a. 2 inches and smaller: Minimum 300 psi CWP, bronze body, Apollo 61LF, Milwaukee UP548-T, or equal.

b. 2-1/2 inches and larger: Class 250, cast iron body, suitable for regrinding, Mueller 103MAP, or equal.

G. Calibrated Balancing Valves:

1. General: Calibrated orifice ball type rated for 400 psig maximum operating pressure and 250 degrees F. maximum operating pressure.

a. Body: Brass.

b. Ball: 304 Stainless Steel.

c. Seat: Glass and Carbon filled TFE.

d. End Connections: Threaded.

e. Pressure Gage connections: Integral capped readout valves with internal check valves and drain port, for use with portable pressure differential meter.

f. Handle Style: Dial, with memory stops to retain set position.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. 1 inch and smaller: Bell & Gossett model CB, “LF” series.

2.7 VALVES AND FITTINGS FOR NON-POTABLE WATER, COMPRESSED AIR, AND GAS SYSTEMS

A. Gate Valves:

1. 2-1/2 inches and smaller: Class150, bronze body, union bonnet, rising stem, solid wedge, threaded or solder ends, conforming to MSS SP-80. Hammond IB641, IB648, Nibco T-134, S-134, Milwaukee 1151, 1169, or equal.

2. 3 inches and larger: Class 125, iron body, bronze mounted, bolted bonnet, non-rising stem, solid wedge, flanged ends, conforming to MSS SP-70. Hammond IR-1138, Nibco F619, Milwaukee F2882A, Stockham G-612, or equal.

3. Underground valves 2 inches thru 12 inches: 250 psi, iron body, Non-rising stem, bolted bonnet, resilient wedge valves, conforming to AWWA C509, equipped with operating nuts, Mueller Series 2360, Nibco F-619-RW-SON, or equal.

   a. Underground valves 3 inches and smaller may be furnished with operating nuts or hand-wheels, and with Ring-Tite joint ends.

   b. Furnish and deliver to Owner one wrench of each size required for operating underground valves.

B. Ball Valves:

1. 2 inches and smaller: 600 psi CWP, 150 psi SWP, cast bronze body, full port, two piece, threaded ends, and reinforced PTFE seal, conforming to MSS SP-110. Nibco T585-70, Milwaukee BA-400, Stockham T-285, or equal.

2. 2-1/2 inches and larger: Class 150, carbon steel body, full port, two piece, stainless steel vented ball, flanged ends, and reinforced PTFE seal, conforming to MSS SP-72. Nibco F-515-CS-F-66-FS, Milwaukee F20-CS-15-F-02-GO-VB, or equal.

3. Compressed Air Services: 600 psi CWP, 150 psi SWP, bronze body, full port, three piece, threaded ends, and reinforced PTFE seal, conforming to MSS SP-110. Nibco Model T-595-Y, Milwaukee BA-300, or equal.

C. Swing Check Valves: Class 125 or 150, bronze body, suitable for regrinding, threaded ends, conforming to MSS SP-80. Stockham B-321, Milwaukee 509, Nibco T-433, or equal.

D. Butterfly Valves:

1. General: Tight closing, full lug type, with resilient seat suitable for minimum working pressure of 200 psig, conforming to MSS SP-67. Bi-direction dead end service with downstream flange removed.

2. Provide valves with the following:

   a. Seats: Suitable for 40 degrees F for cold water service and 250 degrees F for hot water service. Seats shall cover inside surface of body and extend over body ends.

   b. Bodies: Ductile iron or cast iron.

   c. Discs: Bronze or stainless steel.

   d. Stems or Shafts: Stainless steel.

   e. Control Handles: Suitable for locking in any position or with 10 degree or 15 degree notched throttling plates to hold valve in

selected position. Provide extended necks to compensate for insulation thickness. Provide gear operator for valves 5 inches and larger.

3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. 2 through 12 inches: Milwaukee Valve, CL series, Nibco, Inc., Model LD2000-3, or equal.

E. Silent Check Valves (for use on pump discharge):

1. General: Provide spring loaded check valves at pump discharge of all pumps.

2. 2 inches and smaller: 250 psi CWP, bronze body, Nibco Model T-480, Milwaukee 548-T, or equal.

3. 2-1/2 inches and larger: Class 250, cast iron body, wafer style, suitable for regrinding. Nibco Model F960, Milwaukee 1400, Mueller 103MAP, or equal.

F. Calibrated Balance Valves (Symbol CBV): Provide globe style valves for precision regulation and control rated 175 psi for sizes 2-1/2 inches through 12 inches and rated 240 psi for bronze sizes 2 inches and below. Each valve shall have two metering/test ports with internal check valves and protective caps. All valves must be equipped with visual position readout and concealed memory stops for repeatable regulation and control.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Bell & Gossett Circuit Setter Plus.

   b. Armstrong CBV.

   c. Flow Design Inc. Accusetter.

   d. Tour & Andersson.

   e. Circuit Sensor with butterfly valve above 3 inches.

   f. Illinois Series 5000 through 2 inches.

G. Building Gas Shut-Off Valves:

1. 2 inches and smaller: Provide 175 psi SWP ball valve, CSA listed, full port, lockwing type, with AGA painted grey finish. Jomar 175-LWN, or equal.

2. Above 2 inches: Provide ReSun D-126, Key Port, or equal, lubricated plug cock, CSA listed, rectangular port, full pipe area, 125 psi SWP, flanged ends. Provide T-Handle socket wrench and adapter fittings as required for operation of valves. Provide one package of spare lubricant sticks, sizes as required for valve sizes. Lubricant shall be the product recommended by valve manufacturer for use with type of gas conveyed by the piping system.

3. Provide valves same size as upstream piping. Make any reduction in size of gas piping downstream of shutoff valves.

H. Gas Shut-off Valve Above Grade:

1. 2 inches and smaller: Provide Milwaukee BB2-100, Jomar T-100NE, or equal, ball valve, CSA listed, full port.

2. Above 2 inches: Provide ReSun D-126, Key Port, or equal, CSA listed, rectangular port, full pipe area, 125 psi SWP, flanged ends. Provide T-Handle socket wrench and adapter fittings as required for operation of valves. Provide one package of spare lubricant sticks, sizes as required for valve sizes. Lubricant shall be the product recommended by valve manufacturer for use with type of gas conveyed by the piping system.

3. Provide valves same size as upstream piping. Make any reduction in size of gas piping downstream of shutoff valves.

I. For Gas Service Below Grade:

1. Lubricated plug cocks: ReSun Model D-126, Key Port, or equal, lubricated plug cock, CSA listed, rectangular port, full pipe area, 125 psi SWP, flanged ends. Provide extended lubrication stem, arranged to allow for lubrication of the valve from grade. The extension must be constructed to allow for lubrication of the valve and for operation of the valve from grade. Provide T-Handle socket wrench and adapter fittings as required for operation of valves. Provide one package of spare lubricant sticks, sizes as required for valve sizes. Lubricant shall be the product recommended by valve manufacturer for use with type of gas conveyed by the piping system.

   a. Provide flanged ends on valves installed below grade. Connect to polyethylene piping with flanges and stainless steel bolts.

   b. Anchor each valve flange to valve box with welded angle iron, or provide vertical stiff leg, minimum 18 inches into earth.

   c. Provide Central Double O Seal Transition Fittings, or equal, flanged style for connection between valve and piping system.

   d. Wrap valve, flanges and exposed pipe with PASCO Specialty & Mfg., Inc., or equal tape wrap, installed in accordance with requirements listed under “Pipe Protection”.

2. Molded polyethylene body ball valves: Nordstrom Valves - Polyvalve II for sizes 1-1/4 inches to 2 inches, and Polyvalve for sizes 2 inches and larger, or equal. Valves 1 inch and smaller shall be listed lubricated plug cocks, with transition fittings..

a. Provide stub ends to match SDR of the piping, arranged for butt fusion welding. Provide valve body material to suit the adjacent piping system.

b. Provide wrench to suit the valve operator.

J. Seismic Gas Shut-Off Valves: Certified by State of California and compliant with ASCE 25. Provide standard or high pressure model as required to match site gas pressure. Provide unit arrangement per Drawings schedule and details.

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

a. Little Firefighter Corporation, models NAGV, VAGV, and AGV.

b. Seismic Safety Products, LLC, Northridge series.

K. Quick Coupling Valves:

1. Provide quick coupling valves, heavy duty brass construction with yellow thermoplastic rubber cover, stainless steel internal valve spring, one piece body.

2.8 DOMESTIC WATER PIPING SPECIALTIES

A. Hose Bibbs:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:

a. Acorn Engineering Co.

b. Woodford Manufacturing Co.

2. Hose Station: Leonard THS-25-VB-CW, Symmons, or equal.

B. Wall Hydrants:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:

a. Acorn Engineering Co.

b. Woodford Manufacturing Co.

c. Mifab, Inc.

C. Water Hammer Arrestors:

1. Provide water hammer arrestors conforming to lead-free requirements of California Health and Safety Code Section 116875, with nesting type bellows contained within a casing having sufficient displacement volume to dissipate the calculated kinetic energy generated in the piping system. Water hammer arrestors shall be sized for type and number of fixtures served. Provide all stainless steel shell construction with stainless steel bellows and threaded connection to water system.

2. Water hammer arrestors shall be certified under P.D.I. Standard WH201 and by ASSE Standard 1010.

3. Select units in accordance with the requirements of Plumbing and Drainage Institute Standard P.D.I. WH201. Install above ceilings or behind wall access door at each plumbing fixture, or where plumbing fixtures are installed in groups, at each group of fixtures.

4. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Josam Company, series 75000.

b. Smith (Jay R.) Mfg. Co., Hydrotrol 5005-5050.

c. Mifab, series WHB.

D. Water Filters:

1. Provide Cuno Incorporated, Aqua Pure model AP510, or equal, point of use water filters, conforming to lead-free requirements of California Health and Safety Code Section 116875, in locations indicated on Drawings.

a. Provide model AP517 filter cartridge at each location, with 5 micron rating and 2,000 gallon rating, to remove sediment, rust, scale and chlorine taste and odor from incoming water. 2 gallon per minute capacity.

b. Provide one spare cartridge for each unit provided.

E. Potable Water Pressure-Regulating Valve:

1. Provide pressure-regulating valves, single-seated, direct-operated type, bronze body, integral strainer, complying with requirements of ASSE Standard 1003, and the lead-free requirements of California Health and Safety Code Section 116875. Size for maximum flow rate and inlet and outlet pressure indicated on Drawings.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Cla-Val Company.

   b. Watts Regulator Company.

F. Thermostatic Water Temperature Control Valve:

1. Provide thermostatic water temperature control valve conforming to lead free requirements of California Health and Safety Code Section 116875, with size as noted on Drawings, complete with union angle strainer checkstops. Valves shall be thermostatic type, with a maximum temperature setting as follows:

2. Provide surface recessed semi-recessed mounted, white enameled or stainless steel cabinet with locking door for control valves. Including:

   a. Control valve cabinet and valve shall be provided as a package, and include thermostatic water mixing valve, thermometer, safety checkstops, volume control valve and internal piping.

3. Where indicated on drawings, provide a temperature alarm system, utilizing a micro-processor based controller and solid state temperature controller. Provide audible and visual indication of high and low temperature set points. Provide required hardware and wiring for a complete operating system.

   a. Provide isolation transformer for control of the alarm system.

   b. Provide solenoid valve and shock absorber, installed and wired to the alarm module.

4. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Leonard Valve Company.

   b. Lawler Manufacturing Co., Inc.

   c. Powers.

G. Relief Valves:

1. Provide relief valves as indicated, of size and capacity as selected by Contractor for proper relieving capacity, in accordance with ASME Boiler and Pressure Vessel Code.

2. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI A21.22 listing requirements for

temperature discharge capacity. Provide temperature relief at 210 degrees F, and pressure relief at 150 psi.

3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Watts Regulator Company.

   b. Cash (A.W.) Valve Manufacturing Corporation.

   c. Zurn Industries, Inc.; Wilkins-Regulator Division.

H. Trap Primers:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:

   a. MiFab, Inc.

   b. Precision Plumbing Products.

   c. Sioux Chief Manufacturing Company.

2.9 GAS PIPING SPECIALTIES

A. Gas Pressure Regulating Valves:

1. Provide single-stage, spring-loaded, corrosion-resistant gas pressure regulators, with die-cast aluminum or cast iron body, complying with ANSI Z21.80. Unit shall be with atmospheric vent, internal relief overpressure protection, threaded ends for 2 inches and smaller, flanged ends for 2-1/2 inches and larger. For inlet and outlet gas pressures, specific gravity, and volume flow refer to Drawings schedule.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

Size	Manufacturer/Model
1/2 inch	Elster (American, Singer) model 1213B Itron (Actaris, Slumberger, Sprague) model B42R.
3/4 thru 1-1/4inches	Elster (American, Singer) model 1813C Sensus (Ivensys, Equimeter, Rockwell) model 143-80-12 Itron (Actaris, Slumberger, Sprague) models B42R, B57R, B58R
1-1/2 thru 2 inches	Elster (American, Singer) models 1813, 1813B Sensus (Ivensys, Equimeter, Rockwell) model 243 Itron (Actaris, Slumberger, Sprague) models B43SR, B34R, B38R

B. Gas and Air Outlets:

2.10 DRAIN AND WASTE PIPING SPECIALTIES

A. Cleanouts:

1. General: Install cleanouts of same diameter as pipe (4 inch maximum) in all horizontal soil and waste lines where indicated and at all points of change in direction. Cleanouts shall be located not less than 18 inches from building construction so as to provide sufficient space for rodding. No horizontal run over 50 feet inside buildings or 100 feet outside buildings shall be without cleanout, whether shown on Drawings or not. Provide two-way cleanouts where indicated on drawings, and where required for satisfactory use.

   a. Provide cleanouts in waste drop from each sink and urinal.

   b. Provide one wrench for each size and type of cleanout used. Turn over to Owner at completion of the project, and obtain receipt. Place receipt in Operation and Maintenance Manuals.

2. Cleanouts in floor and in concrete sidewalks: Ducco Cast Iron with nickel bronze top, clamping collar and ABS plastic plug: Zurn ZN-1400-KC, or equal, with square or round top to suit floor construction.

3. Cleanouts in composition floors: Zurn ZN-1400-X-DX, or equal (nickel bronze top).

4. Cleanouts in concealed, aboveground cast-iron soil or waste lines: Zurn Z-1440A, or equal, with ABS plastic plug.

5. Cleanouts in walls: Zurn Z-1441 or Z-1443, or equal, with stainless steel cover. Provide long sweep elbow or combination wye at connection to riser and install with surface of cleanout within ½ inch of front face of finished wall.

    a. Where space does not permit the above installation, provide Zurn Z-1446, or equal, with stainless steel access cover, and vandal resistant screw.

    b. Install face of cleanout plug within 1/2 inch of front face of finished wall.

6. Cleanouts exterior to building in landscaped areas: Zurn Z-1449-BP, or equal, cleanout ferrule with tapered bronze plug. Where located at grade, provide 18 by 18 by 6 inch concrete pad; Trowel concrete smooth and edge; set flush with finished grade.

7. Cleanouts in drive areas: Zurn -1400-HD-KC, or equal, with heavy-duty top and ABS plastic plug.

B. Floor Drains:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:

    a. J.R. Smith.

    b. MIFAB.

    c. Watts.

    d. Zurn.

C. Floor Sinks:

1. Floor Sinks: Provide anchoring flange (seepage pan) at all floor sinks, and provide flashing clamp in locations where floor membrane is used. Provide cast iron "P" trap and trap primer connection at P-Trap.

2. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:

    a. J.R. Smith.

    b. MIFAB.

    c. Watts.

    d. Zurn.

D. Hopper Drains:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:

a. Zurn.

b. J.R. Smith.

2.11 HEAT TRACING

A. Domestic Hot Water: Provide U.L. listed, 115 degrees F nominal temperature operation heat cable, in locations indicated on drawings. Provide all components required for complete system, including cable, power connections, end seals, splices, tees and accessories. Manufacturer shall be Raychem HWAT-R2, Thermon, or equal, 208 volt single phase.

B. Label all heat traced piping every 10 feet with "ELECTRIC TRACED" label.

C. Freezer Boxes: Where condensate drain piping is provided in freezer boxes, provide insulation and Raychem XL-Trace, Thermon or equal, selected to suit manufacturers' recommendations for the ambient temperature expected. Install in accordance with manufacturers recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which plumbing piping systems are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to Contractor.

B. Make all arrangements for the utilities required. Pay all costs involved in obtaining the services including gas service and meter, water meter, pressure reducing valve, access boxes, street work. Connect to site utilities. Verify the location of all services. No extra cost will be allowed if services are not as shown.

C. Determine sanitary sewer and storm drain location and elevation at all points of connection before installing any piping. Notify Architect immediately if indicated grades cannot be maintained.

D. At time of final connection, and prior to opening valve to allow pressurization of water and gas piping from existing systems, on site or off site, perform a pressure test to indicate static pressure of existing systems. If pressure on water piping is greater than 80 psi, or gas pressure is not as indicated on Contract Documents, inform Architect immediately. Do not allow piping systems to be pressurized without written consent of the Architect.

3.2 INSTALLATION OF WATER PIPING

A. Run all water piping generally level, free of traps or unnecessary bends, arranged to conform to the building requirements, and to suit clearance for other mechanical work such as ducts, flues, conduits, and other work. No piping shall be installed so as to cause unusual noise from the flow of water therein under normal conditions.

B. Provide manufactured water hammer arrestors, sized and installed in accordance with Plumbing and Drainage Institute Standard PDI WH201.

1. Locate water hammer arrestors at every plumbing fixture, or, where fixtures are located in groups, at every group of fixtures, and as indicated on Drawings.

2. Install water hammer arresters above accessible ceilings, or install access doors for service.

C. In freezing locations arrange water piping to drain as shown.

D. Install piping on room side of building insulation.

E. Check final location of rubber rings within couplings on PVC water piping with gauge or as recommended by manufacturer. Make connection to valves with cast iron adapters connected to water pipe with cast iron couplings. Furnish and install anchors or thrust blocks.

F. For all faucets, hose bibbs, or other water outlets delivering industrial hot and/or cold water, provide a sign, permanently mounted, indicating "CAUTION: NON-POTABLE WATER, DO NOT DRINK". Each sign shall be permanently engraved with black uppercase letters on a yellow background. Letters shall be minimum 1-1/4 inch high.

3.3 INSTALLATION OF SANITARY AND STORM DRAINAGE SYSTEMS

A. Make joints in PVC sewer pipe with PVC-type couplings and rubber rings.

B. Check final location of rubber rings within the couplings with gauge or as recommended by the manufacturer. Make joints between PVC pipe and cast iron pipe or fittings using cast iron adapter fittings, installed as recommended by the manufacturer.

1. Ring-Tite cast iron pipe fittings may be used in lieu of standard fittings. Make connection to valves with cast iron adapters connected to the pipe with PVC couplings.

C. Sewer Piping: Run all horizontal sanitary drain piping inside of building on a uniform grade of not less than 1/4 inch per foot unless otherwise noted or later approved. Unless otherwise noted on the plans, piping shall have invert elevations as shown and slope uniformly between given elevations.

D. Storm Drain Piping: Run all horizontal storm drain piping inside of building on a uniform grade of not less than 1/4 inch per foot. Unless otherwise noted on the plans, piping shall have invert elevations as shown and slope uniformly between given elevations.

E. Run all drainage piping as straight as possible and provide easy bends with long turns; make all offsets at an angle of 45 degrees or less.

F. Grade all vent piping so as to free itself quickly of any water condensation.

G. Where possible, join groups of vent risers together with one enlarged outlet through roof. Maintain minimum of 10 foot horizontal or 3 foot vertical clearance from air intakes.

H. Install drip pan under storm drain piping, sanitary drain piping, and vent piping that must be run over kitchen areas.

I. Hubless Cast Iron Joints: Comply with coupling manufacturer's installation instructions.

3.4 INSTALLATION OF NATURAL GAS PIPING

A. Install natural gas piping in accordance with Division 22 Basic Plumbing Materials and Methods sections.

B. Use sealants on metal gas piping threads that are chemically resistant to natural gas. Use sealants sparingly, and apply to only male threads of metal joints.

C. Remove cutting and threading burrs before assembling piping.

D. Do not install defective piping or fittings. Do not use pipe with threads that are chipped, stripped, or damaged.

E. Plug each gas outlet, including valves, with threaded plug or cap immediately after installation and retain until continuing piping or equipment connections are completed.

F. Ground gas piping electrically and continuously within project, and bond tightly to grounding connection.

G. Install drip-legs in gas piping where indicated and where required by code or regulation.

1. Install "Tee" fitting with bottom outlet plugged or capped at bottom of pipe risers.

2. Where gas supply is connected to equipment with flexible connectors, install drip-leg in piping on downstream side of flexible connector, and install shut off valve on piping on upstream side of flexible connector.

H. Install piping with 1/64 inch per foot (1/8 percent) downward slope in direction of flow.

I. Install piping parallel to other piping.

J. Paint all gas piping installed in exposed exterior locations. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods, article, Painting.

K. Provide shutoff valve downstream of meter.

L. Provide exterior shutoff valve at each building. Provide sign affixed to wall at valve location reading: “Gas Shut-Off.” Size and location of the sign shall be as required by the Authority Having Jurisdiction. Where gas piping enters a building in more than one location, exterior shutoff valves shall have a permanently attached metal tag identifying the area served by that valve, in addition to sign on wall.

M. Provide watertight Schedule 40 PVC conduit to protect gas piping installed below covered walk, covered driveways, and where noted on Drawings. Extend sleeve at least 12 inches beyond any area where it is required to be installed, and terminate with valve box extended to grade, and marked “GAS”.

N. Maintain minimum of 12 inch clearance between gas piping and steam piping above 200 degrees F.

3.5 PIPE JOINTS AND CONNECTIONS

A. General:

1. Cutting: Cut pipe and tubing square, remove rough edges or burrs. Bevel plain ends of steel pipe.

2. Remove scale, slag, dirt and debris from inside and outside of pipe before assembly.

3. Boss or saddle type fittings or mechanically extracted tube joints will not be allowed.

B. Threaded Pipe: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply thread compound to external pipe threads: Rectorseal No. 5, Permatex No. 1, or equal.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

C. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

D. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.

2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

3. PVC Piping: Join according to ASTM D 2855.

E. Copper Pipe and Tubing (Except pneumatic control piping): All joints shall be brazed according to ASME Section IX, Welding and Brazing Qualifications, except domestic water piping 1-1/4 inches and smaller when not buried in the ground or concrete and type DWV plumbing piping may be soldered.

1. Soldered joints: Apply water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828.

F. Cast Iron Soil Pipe:

1. No-Hub fittings shall be made with a torque wrench.

2. Hub joints shall be with Ty-Seal couplings.

3. Wrought iron, steel, or copper pipe shall have a ring or part of a coupling screwed on to form a spigot end if caulked into a joint.

4. Connect cast iron sewer piping to outside service pipe with cast iron or vitrified LOP reducers or increasers as required. Caulking of smaller pipe into the larger without a reducer or increaser will not be permitted.

G. Welded Pipe:

1. Make up with oxyacetylene or electric arc process.

2. All line welds shall be of the single "V" butt type. Welds for flanges shall be of the fillet type.

3. Where the branch is two pipe sizes smaller than the main or smaller, Bonney Weldolets, Threadolets, Nibco, or equal, may be used in lieu of welding tees.

H. PVC Sewer and Drainage Pipe (outside building as allowed only): Four inches and larger shall be bell and spigot, assembled in accordance with manufacturer's recommendations. Joint shall be tested in accordance with ASTM D3212. Solvent weld joints below 4 inches in size, schedule 40 PVC with matching fittings, assembled per manufacturer's instructions.

I. Polyethylene and Polypropylene Pipe: Assemble with fusion joints in strict accordance with manufacturer's instructions.

J. Flexible Connections:

1. Furnish and install Thermo Tech., Inc. F/J/R, Metraflex, or equal, flexible couplings with limiter bolts on piping connections to all equipment mounted on anti-vibration bases, on each connection to each base mounted pump and where shown. Couplings shall be suitable for pressure and type of service.

2. Anchor piping securely on the system side of each flexible connection.

3.6 INSTALLATION OF VALVES

A. Install valves as indicated on Drawings and in the following locations:

1. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.

2. Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere indicated or required to completely drain potable water system.

3. Provide gate or globe valves on inlet and outlet of each water heater or pump.

B. General:

1. Valves shall be full line size unless indicated otherwise on Drawings.

2. Install horizontal valves with valve stem above horizontal, except butterfly valves.

3. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

4. Locate valves for easy access and provide separate support where necessary.

5. Install valves in position to allow full stem movement.

6. Install exposed polished or enameled connections with special care showing no tool marks or exposed threads.

7. Butterfly valves conforming to the paragraph “Butterfly Valves” may be used in lieu of gate or globe valves for locations above grade.

8. Ball valves conforming to the paragraph “Ball Valves” may be used in lieu of gate valves for locations above grade for services 2-1/2 inches and smaller.

9. Valves 2-1/2 inches and smaller (except ball valves) in nonferrous water piping systems may be solder joint type with bronze body and trim.

10. Rigidly fasten hose bibbs, hydrants, fixture stops, compressed air outlets, and similar items to the building construction.

C. Gate Valves:

1. Furnish valves in copper lines with adapters to suit valve / line requirements.

2. Underground gate valves:

a. Underground valves 3 inches and smaller may be furnished with operating nuts or hand-wheels, and with Ring-Tite joint ends.

b. Furnish and deliver to Owner one wrench of each size required for operating underground valves.

D. Swing Check Valves: Install in horizontal position with hinge pin level.

E. Butterfly Valves: Install with stems horizontal.

F. Silent Check Valves: Install in horizontal or vertical position between flanges.

G. Calibrated Balancing Valves: Install calibrated balancing valves per manufacturers’ recommendations, including requirements for straight pipe lengths at valve inlet and outlet.

H. Gas Shut-Off Valves:

1. Provide line size ball valve in gas line to each appliance.

2. Provide line size ball valve in gas line, to be used as emergency shut-off for science classrooms. Install valve in locking box where indicated on the drawings.

3. Provide line size electric solenoid gas valve in gas line to kitchen equipment (if not supplied with appliance) under Type 1 hood. Interlock with hood fire alarm system.

I. Valve Adjustment: Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.7 INSTALLATION OF CLEANOUTS

A. Cleanouts: Install in piping as indicated, as required by California Plumbing Code, at each change in direction of piping greater than 45 degrees. Install at maximum intervals of 50 feet for piping 4 inches and smaller and 100 feet for larger piping inside buildings, and at base of each conductor.

B. Flashing Flanges: Install flashing flange and clamping device with each cleanout passing through water resistant membrane.

3.8 INSTALLATION OF FLOOR DRAINS AND FLOOR SINKS

A. Install drains in accordance with manufacturer's written instructions and in locations indicated. Install floor drains with lip of drain slightly below finished floor to ensure drainage. Install floor sinks flush with finished floor. Coordinate with other trades to ensure that floor slopes to drain. Provide flashing flange and clamping device with each drain passing through water resistant membrane.

B. Install vented P-trap below each drain. Where trap primers are indicated, install trap primer connection in the P-trap.

3.9 INSTALLATION OF HOPPER DRAINS

A. Install hopper drain in wall, in sheet metal box, with access door.

1. Size access door and box to suit the size required for hopper drain and trap primer, and solder all seams of box. Seal all penetrations to box with non-hardening waterproof sealant. Provide locking door in occupied spaces.

B. Grind top and sides of funnel, if required, to suit wall thickness.

3.10 TRAP PRIMER INSTALLATION

A. Install as indicated in manufacturers printed literature, with 1/2 inch, Type L, hard copper piping to trap primer connection on floor drains and floor sinks where indicated on Drawings. At Contractor’s option, Type K annealed copper tubing without joints may be used be used below slab only. See Section 22 00 50 for pipe protection requirements for below slab copper piping/tubing.

B. Install trap primer piping with 1/4 inch per foot slope, to insure that the line will drain fully to the floor drain or floor sink.

1. Provide ball valve to the inlet at each trap primer location.

C. Install trap primer and distribution unit exactly as called for in manufacturers printed installation instructions. Connect to domestic water piping from the top of the water line, in order to prevent foreign material from entering directly into primer assembly.

D. Mount trap primer in wall, in sheet metal box, with Karp or equal access door. Size access door and box to suit valve operation, and solder all seams of box. Seal all penetrations to box with non-hardening waterproof sealant. Provide locking door where installed in occupied spaces.

E. Where one trap primer will be used for more than one trap, provide a distribution unit with feeder piping for a maximum of four traps sized for equal pressure drop to each trap.

3.11 INSTALLATION OF GAS PRESSURE REGULATING VALVES

A. Install as indicated; comply with utility requirements. In locations where regulators are installed in confined spaces, pipe atmospheric vent to outdoors, full size of outlet. Install gas shutoff valve upstream and downstream of each pressure-regulating valve.

3.12 GAS PIPING EQUIPMENT CONNECTIONS

A. Connect gas piping to each gas-fired equipment item, with union, drip leg and shutoff gas cock full size of supply line shown. Reduce only at connection to equipment. Comply with equipment manufacturer's instructions.

1. Route gas vent and gas relief to outside.

2. Gas shutoff valve shall be placed as close as possible to equipment in a location where it can be serviced. Distance from equipment to valve shall not exceed 6 feet.

3.13 EQUIPMENT CONNECTIONS

A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated.

B. Mechanical Equipment Connections: Connect hot and cold water piping system and gas piping system to mechanical equipment as indicated, and provide with shutoff valve and union for each connection.

3.14 HEAT TRACING INSTALLATION

A. Provide heat cable on all domestic hot water piping.

B. Manufacturer's installation recommendation shall be considered as part of this specification.

C. Field testing of insulation resistance and continuity of the units shall be carried out with a 500 volt meter and recorded by the contractor. Testing shall be done when received on the job site, after installation on the pipe, and after the heat insulation has been installed. Insulation resistance shall be consistently not less than 50 megohms with no decline in reading.

D. Where source of supply does not coincide with location of thermostat, cable shall be run along the pipe under the insulation to the thermostat.

E. All junction boxes shall be located above grade level. Covers shall be kept on boxes at all times when not working therein. Where allowable, a hole shall be provided in bottom of junction boxes to permit moisture to escape.

F. All terminations shall be protected from the water and from physical damage.

G. Any field alterations or deviations shall proceed only after authority via signed change order has been issued by Architect. All changes shall be accurately recorded by the Contractor and shall be turned over to the Engineer upon completion of that phase of the work.

H. All lines shall be insulated within 24 hours upon cable installation and acceptance.

I. Junction boxes, thermostats, transformers and the like shall not be attached to the insulation, but shall be mounted on brackets fabricated of galvanized angle, channel or other material of sufficient strength to support equipment mounted on them. Brackets shall not be mounted on pipe, but rather on separate supports.

J. Heating cables to be laid out along sections of piping to be heat traced to ensure uniform distribution of heat. It is recommended that the cable first be "roughed-in" using tape or rubber bands which are to be removed after permanent bending. The cable shall not be pulled taut, but allowed reasonable waving along axis of pipe.

K. Cable sheaths shall not cross or touch one another nor shall cables be installed directly on top of pipe.

L. Heating cable shall be strapped to two-inch and larger pipe using one-half inch wide stainless steel banding at intervals not exceeding one foot per CEC. Stainless steel tie wire #18 AWG, or larger, shall be used to hold the cable to irregular surfaces such as valves. Tie wire and strapping shall be snug but not so tight as to indent cable sheath. On small diameter and low temperature pipe, nylon ties or glass tape may be used.

M. Extra cable to be provided at areas of increased heat loss such as valves and flanges to allow dismantling and removal of equipment.

N. Thermostat bulb to be located as far away from heating cable as possible. Thermostat capillary and control wire shall have mechanical protection between the equipment rack and the pipelines.

O. Apply "ELECTRICALLY HEATED" signs to the outside of the thermal insulation.

3.15 DOMESTIC WATER SYSTEM STERILIZATION

A. Clean and disinfect new or altered hot and cold water piping connected to domestic water systems using methods prescribed by the Health Authority. If the Health Authority does not prescribe methods, clean and disinfect new or altered hot and cold water piping using methods given in the California Plumbing Code.

1. A water treatment company that has a current state EPA license to apply disinfectant chlorine in potable water shall perform the procedure.

3.16 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect. At completion, carefully clean and adjust equipment, fixtures, and trim that are installed as part of this work. Remove labels from stainless steel sinks, except 316 stainless steel sink labels should be retained to confirm that the correct material has been provided. Leave systems and equipment in satisfactory operating condition.

3.17 OPERATIONAL TESTS

A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

3.18 TESTING AND BALANCING

A. See Section 23 05 93 of Specifications for testing and balancing requirements.

3.19 CLEANING UP

A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Water supplies and stops.
2. Plumbing fixture hangers and supports.
3. Refrigerator ice maker outlet boxes.
4. Dishwasher air gap fittings.
5. Solids interceptors.
6. Washing machine hose/supply boxes.
7. Plumbing fixtures and trim.
8. Flush valves.

1.2 RELATED REQUIREMENTS

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

B. Section 22 00 50 Basic Plumbing Materials and Methods.

1.3 ACTION SUBMITTALS

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Product Data: Submit manufacturer's specifications for plumbing fixtures and trim, including catalog cut of each fixture type and trim item furnished.

1.4 INFORMATIONAL SUBMITTALS

A. Refer to Section 22 00 50, Basic Plumbing Materials and Methods.

1.5 CLOSEOUT SUBMITTALS

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Maintenance Data: Submit maintenance data and parts lists for each fixture type and trim item, including instructions for care of finishes. Include this data in Operation and Maintenance Manual.

1.6 QUALITY ASSURANCE

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Plumbing Fixture Standards: Comply with applicable portions of the following codes and requirements for all work in this Section:

1. California Building Code – CBC

2. California Plumbing Code – CPC

3. California Health and Safety Code

4. American National Standards Institute - ANSI

5. Federal Standards - F.S.

6. National Sanitary Foundation – NSF International

C. ANSI Standards: Comply with ANSI/NSF 61, “Drinking Water System Components – Health Effects.”

D. PDI Compliance: Comply with standards established by Plumbing and Drainage Institute pertaining to plumbing fixture supports.

E. UL Labels: Provide water coolers that have been listed and labeled by Underwriters' Laboratories.

F. ARI Labels: Provide water coolers that are rated and certified in accordance with applicable Air-Conditioning and Refrigeration Institute Standards.

G. Americans with Disabilities Act (ADA).

H. California Green Building Standards Code Requirements:

1. Tank-type water closets shall be certified to the performance criteria of the U.S. EPA WaterSense Specification for Tank-Type Toilets.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

A. General: Provide factory fabricated fixtures of type, style and material indicated. For each type fixture, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed and constructed, or as recommended by the manufacturer, and as required for a complete, installation. Where more than one type is dedicated, selection is Contractor's option; but, all fixtures of same type must be furnished by single manufacturer.

1. Take special care with the roughing-in and finished plumbing where batteries of fixtures occur.

2. Take location and mounting heights for roughing-in from Architectural Drawings.

3. Follow schedule on Plumbing Drawings for roughing-in connections. Set roughing-in for all fixtures exactly as per measurements furnished by the manufacturers of the fixtures used.

4. Roughing-in for lavatories and sinks shall be brought in through the wall under the centerline of the drain from the fixture wherever possible and as close to the fixture as possible.

2.2 MATERIALS

A. Provide materials that have been selected for their surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, foundry sand holes, stains, discoloration, or other surface imperfections on finished units are not acceptable.

B. Where fittings, trim and accessories are exposed or semi-exposed, provide, chromium plated 17 gauge seamless brass and match faucets and fittings. Provide 17 gauge seamless copper or brass where not exposed.

C. Handles on all faucets and stops shall be all metal chromium plated.

D. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.

2.3 PLUMBING FITTINGS, TRIM AND ACCESSORIES

A. Water Outlets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves, or dispensing devices, of type and size indicated, and as required to operate as indicated.

1. Include manual shutoff valves and connecting stem pipes to permit outlet servicing without shut-down of water supply piping systems.

B. P-Traps: Include IAPMO approved removable P-traps where drains are indicated for direct connection to drainage system. P-Traps shall be less trap screw cleanout, and incorporate a chrome plated cast brass body, brass connection nuts, 17 gauge seamless brass wall return and chrome plated wall escutcheon to match trap finish.

C. Carriers: Provide cast iron supports for fixtures of graphitic gray iron, ductile iron, or malleable iron as indicated. Where the carrier for wall mounted water closets are installed more than 6 inches behind the finished wall, provide water closet support for wide pipe chase.

D. Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.

E. Escutcheons: Where fixture supplies and drains penetrate walls in exposed location, provide chrome-plated cast brass escutcheons with setscrews.

F. Aerators: Provide aerators of types approved by Health Departments having jurisdiction. Delete aerators where not allowed by CPC for health care occupancies.

G. Comply with additional fixture requirements contained in Fixture Schedule shown on the drawings.

2.4 MANUFACTURERS

A. In accordance with California Plumbing Code, provide indelibly marked or embossed manufacturers name or logo, arranged so as to be visible after installation.

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

1. Vitrified China Plumbing Fixtures:

   a. American Standard, U.S. Plumbing Products.

   b. Eljer Plumbingware Div., Wallace-Murray Corp.

   c. Kohler Co.

   d. VitrA.

2. Plumbing Trim:

   a. McGuire Manufacturing Co., Inc.

   b. Delta Commercial.

   c. Chicago Faucet Co.

d. T&S Brass and Bronze Works, Inc.

3. Flush Valves:

a. Sloan Valve Co.

b. Zurn Industries, Hydromechanics Div.

c. Toto USA, Inc.

4. Faucets:

a. Chicago Faucet Co.

b. Symmons Scott.

c. T&S Brass and Bronze Works, Inc.

d. Delta Commercial.

5. Fixture Seats:

a. Church Seat Co.

b. Bemis Mfg. Co.

c. Beneke Corp.

6. Water Coolers and Drinking Fountains:

a. Haws Corporation.

b. Halsey Taylor Mfg. Co.

c. Elkay Mfg. Co.

d. Acorn Aqua.

7. Service Sinks:

a. American Standard.

b. Kohler Co.

c. Williams Serviceptor.

d. Florestone.

e. Acorn.

8. Stainless Steel Sinks:

a. Elkay Mfg. Co.

b. Just Mfg. Co.

c. Haws Corporation.

9. Fixture Carriers:

a. Josam Mfg. Co.

b. J. R. Smith.

c. Tyler Pipe; Wade Div.

d. Zurn Industries; Hydromechanics Div.

e. Mifab, Inc.

2.5 FLUSH VALVE REQUIREMENTS

A. Metering flush valves where required and specified shall be non-hold open type with exposed parts chrome plated. Conform to all codes and manufacturers' recommendations. All diaphragms are to have multiple filtered bypass and be chloramine resistant synthetic rubber with internal components suitable for l80 degree hot water to l50 pounds pressure, plastic or leather diaphragm not acceptable.

B. Electronic flush valves where required and specified shall be non-hold open type with exposed parts chrome plated. Conform to all codes and manufacturers' recommendations. All diaphragms are to have multiple filtered by pass and be chloramine and resistant synthetic rubber with rubber and internal components suitable for 180 degree hot water to 150 pounds pressure, plastic or leather diaphragm not acceptable. All flush valve solenoids and sensors shall be UL listed.

2.6 FIXTURE CONNECTIONS

A. Make connection between fixtures and flanges on soil pipe absolutely gastight and watertight with neoprene type gaskets (wall hung fixtures) or bowl wax (floor outlet fixtures). Rubber gaskets or putty will not be permitted.

B. Provide fixtures not having integral traps with P-traps of chromium-plated 17 gauge cast brass, with 17 gauge seamless brass wall return, connected to concealed waste in wall and sanitary fittings. Provide IAPMO approval for trap, and provide less trap screw cleanout.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Dearborn Brass, Commercial series with brass nuts.

b. Delta Commercial.

c. McGuire Manufacturing Co., Inc.

C. Connections from stacks or horizontal wastes to wall or floor finish for wastes from lavatories, urinals, sinks, and drinking fountains and connection between floor drains and traps shall be IPS 85 percent red brass pipe.

D. Unions on waste pipes on fixture side of traps may be slip or flange joints with soft rubber or lead gaskets. Traps shall rough in full size to waste and vent connection, using deep escutcheon plate to cover wall penetration. Compression adaptor extensions or sweat adaptors are not acceptable.

2.7 WATER SUPPLIES AND STOPS

A. Provide 85 percent IPS threaded red brass nipple, conforming to the lead-free requirements of California Health and Safety Code Section 116875, securely anchored to building construction, for each connection to stops, hose bibbs, etc. Each fixture, except hose bibbs, shall have stop valves installed on water supply lines.

B. Provide water supplies to fixtures with compression shut-off stops with threaded inlets and lock shield-loose key handles. Provide combination fixtures with compression stop and threaded inlet on each water supply fitting. Provide lock shield-loose key handle for each stop.

C. Provide 1/2 inch riser tubes with reducing coupling for fixtures, unless otherwise noted.

D. Provide cast brass escutcheon.

E. Furnish shut-off valves on hose bibbs where directly connected to mains with no intervening valves.

F. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. McGuire Manufacturing Company, Inc., model LFH2167LK.

2. T & S Brass and Bronze Works, Inc., model B-1305.

2.8 PLUMBING FIXTURE HANGERS AND SUPPORTS

A. Residential type fixture supports are not acceptable.

B. Install wall mounted water closets with combination support and waste fittings, with feet of support securely anchored to floor.

C. Install floor mounted water closets with J.R. Smith, Zurn, or equal government pattern cast iron closet flanges with brass bolts, nuts, washers, and porcelain caps secured with Spackle.

D. Install the following fixtures on concealed support with feet of support securely anchored to floor. Anchor top of support to wall construction in an approved manner.

1. Wall hung lavatories.

2. Wall mounted urinals.

3. Drinking fountains.

4. Electric water coolers.

2.9 PLUMBING FIXTURES

A. Install all plumbing fixtures at height indicated on Architectural Drawings. Where mounting height is not indicated, install at height required by Code.

B. Special Requirements For Accessible Fixtures:

1. Operating handle or valve for accessible water closets, urinals, lavatories, and sinks shall operate with less than 5 pounds force. Metering faucets shall be adjusted to operate between 10 and 15 seconds.

2. Insulate exposed waste piping and domestic water supplies below accessible fixtures with CBC access code compliant molded “closed-cell” vinyl covers. Covers shall be installed using vandal resistant fasteners and must be removable. Covers shall meet flame spread rating not to exceed 25 and smoke density not to exceed 50 when tested in accordance with ASTM E-84, and shall comply with the requirements of California Code of Regulations, Title 24. Plumberex – Handy Shield, Johns Manville – Zeston 2000, or equal.

C. Refrigerator Ice Maker Outlet Boxes:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:

Guy Gray.

Water-Tite.

D. Dishwasher Air Gap Fittings:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:

a. Zurn Industries, LLC.

b. Dearborn Brass.

E. Solids Interceptors:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:

J.R. Smith Mfg. Co.

F. Washing Machine Hose/Supply Boxes:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:

Acorn Engineering Co.

PART 3 - EXECUTION

3.1 PRODUCT HANDLING AND PROTECTION

A. Deliver packaged materials in their original, unopened wrapping with labels intact. Protect materials from water, the elements and other damage during delivery, storage and handling.

3.2 PREPARATORY PROVISIONS

A. The Contractor is responsible for the examination and acceptance of all conditions affecting the proper construction and/or installation of the Work of this Section. Do not proceed until all unsatisfactory conditions have been corrected. Commencing work will be construed as acceptance of all conditions by the Contractor as satisfactory for the construction and/or installation of the Work.

3.3 INSPECTION AND PREPARATION

A. Examine roughing-in work of domestic water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping, and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Install plumbing fixtures of types indicated where shown and at indicated heights; in accordance with fixture manufacturer's written instructions, roughing-in drawings. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of the National Standard Plumbing Code pertaining to installation of plumbing fixtures.

C. Fasten plumbing fixtures securely to supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies to blocking behind or within wall construction so as to be rigid, and not subject to pull or push movement.

D. Install CBC accessible fixtures in accordance with Chapter 4 California Plumbing Code, and Chapters 11A and 11B California Building Code.

E. Refer to Division 26 for wiring for electronic flush valves.

3.4 FAUCET INSTALLATION

A. Provide 85 percent IPS red brass pipe, conforming to lead-free requirements of California Health and Safety Code Section 116875, securely anchored to building construction, for each connection to faucets, stops, hose bibbs, etc. Each fixture, except hose bibbs, shall have a stop valve installed on water supply lines to permit repairs without shutting off water mains.

B. Adjust metering faucets to run for 10 to 15 seconds.

3.5 CLEAN AND PROTECT

A. Clean plumbing fixtures of dirt and debris upon completion of installation.

B. Protect installed fixtures from damage during the remainder of the construction period.

C. Grout voids between all fixtures and adjacent surfaces with white Dow Silicone Sealant, arranged to shed water.

3.6 FIELD QUALITY CONTROL

A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

3.7 EXTRA STOCK

A. General: Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt. Furnish one device for every ten units.

END OF SECTION

SECTION 22 50 00
PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. SECTION INCLUDES

1. Commercial electric water heaters.
2. Instantaneous electric water heaters.
3. Expansion tanks.
4. In-line domestic hot water recirculation pumps.

1.2 RELATED REQUIREMENTS

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

B. Section 22 00 50 Basic Plumbing Materials and Methods.

1.3 ACTION SUBMITTALS

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Product Data: Submit manufacturer's plumbing equipment specifications, installation and start-up instructions, capacity and ratings, with selection points clearly indicated.

1.4 INFORMATIONAL SUBMITTALS

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

1.5 CLOSEOUT SUBMITTALS

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Maintenance Data: Submit maintenance data and parts lists for each item of plumbing equipment. Include "trouble-shooting" maintenance guides. Include this data in Operation and Maintenance Manual.

1.6 QUALITY ASSURANCE

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Trade names or catalog numbers stated herein indicates grade or quality of materials desired.

C. Dimensions, sizes, and capacities shown are minimum and shall not be changed without permission of Architect.

D. UL and NEMA Compliance: Provide electric motors and electrical components required as part of plumbing equipment, which have been listed and labeled by Underwriters Laboratories and comply with NEMA standards.

E. CEC Compliance: Comply with California Electrical Code (Title 24, Part 3) as applicable to installation and electrical connections of ancillary electrical components of plumbing equipment.

F. ASME Relief Valve Stamps: Provide water heaters with safety relief valves bearing ASME valve markings.

G. ASME Code Symbol Stamps: For the following equipment, comply with ASME Boiler and Pressure Vessel Code for construction, and stamp with ASME Code symbol:

1. Water Heaters 200 MBH and greater.

H. California Energy Commission Compliance: Provide written confirmation of listing of all water heaters in the "Appliance Efficiency Database."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver packaged materials in their original, unopened wrapping with labels intact. Protect materials from water, the elements and other damage during delivery, storage and handling.

PART 2 - PRODUCTS

2.1 MATERIALS

A. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

B. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2.2 COMMERCIAL ELECTRIC WATER HEATERS

A. General: Provide commercial electric water heaters of size, capacity, and electrical characteristics indicated on Drawings. Comply with ASHRAE 90.1 for energy efficiency. Provide UL listing. Relief valve dip tube shall extend to within 3 inches of tank.

B. Heater: Working pressure of 150 psi, magnesium anode rod; glass lining on internal surfaces exposed to water.

C. Heating Elements: Heavy-duty, medium watt density, with incoloy sheath or zinc plated copper, thermostat stepped through magnetic contactor.

D. Safety Controls: Double-pole, manual-reset, high-limit, probe type electric water low water cutoff; both factory wired.

E. Jacket: Equip with full size control compartments with front panel opening. Insulate tank with vermin resistant polyurethane or glass fiber insulation. Provide outer steel jacket with bonderized undercoat and baked enamel finish.

F. Warranty: Furnish three-year minimum warranty on tank leakage.

G. Provide the following accessories:

1. Brass drain valve.

2. 3/4 inch temperature and pressure relief valve.

3. Thermometer.

H. Provide equal flow manifold for piping entering and leaving the water heaters. Manifold shall be provided as a standard option for the heaters proposed.

I. Controls: Adjustable immersion thermostat or surface mounted therm-o-disc; power circuit fusing.

J. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Bradford White Corporation.

2. Lochinvar Corporation.

3. PVI Industries, LLC.

4. Rheem Manufacturing Company.

5. Smith, A.O. Water Products Co.; a division of A.O. Smith Corporation.

2.3 INSTANTANEOUS ELECTRIC WATER HEATERS

A. General: Wall mounted, microprocessor-controlled, electric heating style.

B. Standard: UL 499 for electric, tankless, (domestic-water heater) heating appliance.

C. Construction: Copper piping or tubing complying with NSF 61 and NSF 372 barrier materials for potable water, without storage capacity.

1. Connections: ASME B1.20.1 pipe thread.

2. Pressure Rating: 150 psig.

3. Heating Element: Resistance heating system.

4. Temperature Control: Flow-control fitting. Thermostat.

5. Safety Control: High-temperature-limit cutoff device or system

6. Jacket: Aluminum or steel with enameled finish or plastic.

D. Support: Bracket for wall mounting.

E. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Chronomite Laboratories, Inc.

2. Eemax, Inc.

2.4 GAS FIRED WATER HEATERSGeneral: All units shall comply with the emissions requirements of the Air Quality Management District (AQMD) in which they are to be installed.

B. Atmospheric Gas Fired Water Heaters:

1. General: Provide commercial atmospheric gas-fired water heater of size, capacity, and electrical characteristics indicated on Drawings. Comply with ASHRAE 90.1 for energy efficiency. Provide UL or CSA International listing.

2. Heater: Working pressure of 150 psi, rigidly supported magnesium anode rod, glass lining on internal surfaces exposed to water. Provide gas pressure regulator, adjusted for operation on natural gas, with pressure rating to suit heater listing. Provide hand-hole cleanout through tank and jacket.

3. Jacket: Insulate tank with rigid polyurethane foam or fiberglass insulation. Provide heavy-gauge steel jacket and baked enamel finish.

4. Warranty: Furnish three year minimum limited warranty on tank.

5. Accessories: Provide brass drain valve and 3/4 inch temperature and pressure relief valve. Provide thermometer, installed in the top 1/3 of the tank or at hot water discharge at the tank.

6. Controls: Adjustable immersion thermostat with safety shutoff.

7. Vent: Furnish and install "Metalbestos", Selkirk, or equal, Type B vent, UL listed. Furnish complete with roof support, flashing, Briedert Type L, Metalbestos, or equal stainless stack cap, and all supports and accessories required for a complete installation.

8. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Bradford White Corporation.

   b. Lochinvar Corporation.

   c. PVI Industries, LLC.

   d. Rheem Manufacturing Company.

   e. Smith, A.O. Water Products Co.; a division of A.O. Smith Corporation.

2.5 EXPANSION TANKS

A. Provide thermal expansion tanks of size and number as indicated on Drawings, conforming to lead-free requirements of California Health and Safety Code Section 116875. Construct tank of welded steel for working pressure of 125 psi. Provide specially compounded flexible diaphragm securely sealed into tank to permanently separate air charge from system water, to maintain design expansion capacity.

   1. Tanks shall be IAPMO approved and listed for use with domestic water systems.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   1. Amtrol, Inc.

   2. A.O. Smith Water Products Company.

   3. Watts Water Technologies, Inc.

2.6 IN-LINE DOMESTIC HOT WATER RECIRCULATION PUMPS

A. Provide lead-free in-line domestic water recirculation pumps where indicated on Drawings and of capacities as scheduled on Drawings. Pumps shall be third-party certified by an approved laboratory as complying with California Health and Safety Code Section 116875.

B. Pumps shall be of the centrifugal type with non-overloading characteristics and shall not overload the motor above its nameplate horsepower rating under any operating condition. No allowance for service factor shall be used in pump selection. Motor horsepower shown is minimum; furnish larger motors if necessary to meet the non-overloading requirements.

C. Type: Horizontal, designed for 125 thru 150 psi maximum working pressure and 225 degrees F continuous water temperature.

D. Construction: Bronze casing, non-metallic impeller.

E. Shaft: Ceramic, supported by carbon bearings. Bearings shall be lubricated by the pumped water.

F. Motors shall have permanently lubricated ball bearings. Motors shall meet NEMA specifications. Motors shall have built-in thermal overload or impedance protection.

G. Provide control wiring between field-installed controls, indicating devices, and pump control panels as work of this section, complying with requirements of Division 26 sections:

1. Control wiring specified as work of Division 23 for Automatic Temperature Controls is work of that section.

H. Wire pumps to mechanical control circuits to shut down pump when building is not occupied. Where no control system is installed, furnish pump manufacturers standard timer to automatically turn off circulating pump when hot water is not required.

I. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Grundfos Pumps Corporation.

2. Bell & Gossett, ITT Corporation.

3. Taco Incorporated.

4. Armstrong Pumps, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The Contractor shall be responsible for the examination and acceptance of all conditions affecting the proper construction and/or installation of the Work of this Section and shall not proceed until all unsatisfactory conditions have been corrected. Commencing work shall be construed as acceptance of all conditions by the Contractor as satisfactory for the construction and/or installation of the Work.

3.2 ELECTRIC WATER HEATER INSTALLATION

A. Install electric water heaters as indicated, in accordance with manufacturer's installation instructions and in compliance with applicable codes.

B. Furnish wiring diagram to Electrical Installer. Refer to Division 26 for wiring of units, not work of this section.

C. Connect to hot and cold water lines with shutoff valve, check valve, and dielectric union in the cold water line, and ASME standard pressure and temperature relief valve and dielectric union in the hot water line. Connect drain and relief piping as noted on Drawings.

D. Start-up, test, and adjust electric water heaters in accordance with manufacturer's start-up instructions. Check and calibrate controls.

E. After installation has been completed, seal bottom of heaters without feet to floor with silicone sealer.

3.3 GAS-FIRED WATER HEATER INSTALLATION

A. Install gas-fired water heaters as indicated, in accordance with manufacturer's installation instructions and in compliance with applicable codes.

B. Furnish wiring diagram to Electrical Installer. Refer to Division 26 for wiring of units, not work of this section.

C. Connect to hot and cold water lines with shutoff valves and dielectric unions. Install ASME standard pressure and temperature relief valve. Connect drain and relief piping as noted on Drawings.

D. Start-up, test, and adjust water heaters in accordance with manufacturer's start-up instructions. Check and calibrate controls.

E. Install thermometer, in the top 1/3 of the tank or at hot water discharge at the tank.

F. Confirm that water heater proposed is suitably equipped to be brought into the building through building openings provided, and that heater may be installed and removed through building openings provided.

3.4 PUMP INSTALLATION

A. Install pumps where indicated, in accordance with manufacturer's published instructions, complying with recognized industry practices to ensure that pumps comply with requirements and serve intended purposes.

B. Provide access space around pumps for service as indicated, but in no case less than that recommended by manufacturer.

C. Install in-line pumps with support from overhead structure on each side of pump, or as indicated on Drawings.

D. Support piping from the building structure so as to prevent any strain on the pump casings. Provide a final check for perfect alignment of the piping connections after pump has been secured to its base. Provide valves, accessories, gauges, flexible connections, and supports as indicated.

E. Install electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

F. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is complete and correct.

G. Check alignment, and where necessary, realign shafts of motors and pumps within recommended tolerances by manufacturer.

H. Lubricate pumps before start-up. Start-up in accordance with manufacturer's instructions.

I. Increase piping immediately at pump suction and discharge; flexible couplings and all valves shall be full line size.

J. Trim pump impeller to obtain the desired water flow after installation, without cost to Owner.

K. Pumps shall not be connected to piping before piping is thoroughly flushed and cleaned of all dirt and grit. After piping connections have been made, systems shall be filled before starting pumps. Pumps shall not be run dry under any circumstances.

3.5 DEMONSTRATION AND TRAINING

A. Provide a minimum of 4 hours of training and orientation of Owners staff in proper care and operation of Plumbing Equipment.

3.6 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect. At completion, carefully clean and adjust equipment, fixtures, and trim that are installed as part of this work. Leave systems and equipment in satisfactory operating condition.

3.7 OPERATIONAL TESTS

A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

3.8 CLEANING UP

A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

END OF SECTION

SECTION 23 00 50
BASIC HVAC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Electric motors.
2. Motor starters.
3. Thermometers.
4. Access Doors.
5. Expansion loops.
6. Flexible joints.
7. Motors.
8. Access doors.

1.2 RELATED REQUIREMENTS

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

B. This Section is a part of each Division 23 Section.

1.3 ADDITIONAL REQUIREMENTS

A. Furnish and install incidental work not shown or specified necessary to provide a complete and workable system.

B. Make all temporary connections required to maintain services, including adequate heat and cooling, during the course of the Contract without additional cost to Owner. Notify Owner seven days in advance before disrupting services.

C. Provide for adjustments or modifications to fan and motor sheaves, belts, damper linkages, and other components as required to achieve specified air balance at no additional cost to Owner.

1.4 REFERENCES AND STANDARDS

A. Where material or equipment is specified to conform to referenced standards, it shall be assumed that the most recent edition of the standard in effect at the time of bid shall be used.

1. AABC - Associated Air Balance Council
2. AFBMA - Anti Friction Bearing Manufacturer's Association
3. AMCA - Air Moving and Control Association Inc.
    a. Standard 210 - Laboratory Methods of Testing Fans
4. ANSI - American National Standards Institute
5. ARI - Air-Conditioning and Refrigeration Institute
6. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
7. ASME - American Society of Mechanical Engineers
8. ASTM - American Society for Testing and Materials
9. CCR - California Code of Regulations
    a. Title 8 - Division of Industrial Safety, Subchapter 7; General Industry Safety Orders, Articles 31 through 36
10. CSA – Canadian Standards Association International
11. CSFM - California State Fire Marshal
12. NCPWB - National Certified Pipe Welding Bureau
13. NIST - National Institute of Standards and Technology
14. NEMA - National Electrical Manufacturers' Association
15. NFPA - National Fire Protection Association
16. OSHA - Occupational Safety and Health Act
17. SMACNA - Duct Manuals
18. UL - Underwriters' Laboratories, Inc.

B. Requirements of Regulatory Agencies:

1. The publications listed below form part of this specification; comply with provisions of these publications except as otherwise shown or specified.

a. California Building Code, 2019.

b. California Electrical Code, 2019.

c. California Energy Code, 2019.

d. California Fire Code, 2019.

e. California Green Building Standards Code, 2019.

f. California Mechanical Code, 2019.

g. California Plumbing Code, 2019.

h. California Code of Regulations, Title 24.

i. California Health and Safety Code.

j. CAL-OSHA.

k. California State Fire Marshal, Title 19 CCR.

l. National Fire Protection Association.

m. Occupational Safety and Health Administration.

n. Other applicable state laws.

2. Nothing in Drawings or specifications shall be construed to permit work not conforming to these codes, or to requirements of authorities having jurisdiction. It is not the intent of Drawings or specifications to repeat requirements of codes except where necessary for clarity.

1.5 DRAWINGS

A. Examine Drawings prior to bidding of work and report discrepancies in writing to Architect.

B. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The HVAC Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.

1. Architectural and Structural Drawings shall be considered part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over HVAC Drawings.

2. Because of the small scale of HVAC Drawings, not all offsets, fittings, and accessories required are shown. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide

offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in the locations shown. Obtain the Architects approval prior to relocation of equipment and materials.

3. Relocate equipment and materials installed without prior approval of the Architect. Remove and relocate equipment and materials at Contactors' expense upon Architects' direction.

4. Minor changes in locations of equipment, piping, ducts, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work, or work directly connected to same are installed and providing no additional material is required.

C. Execute work mentioned in the Specifications and not shown on the Drawings, or vice versa, the same as if specifically mentioned or shown in both.

1.6 FEES AND PERMITS

A. Obtain and pay for permits and service required in installation of the Work. Arrange for required inspections and secure approvals from authorities having jurisdiction. Comply with requirements of Division 01.

B. Arrange for utility connections and pay charges incurred, including excess service charges.

C. Coordination:

1. General:

a. Coordinate HVAC Work with trades covered in other Specifications Sections to provide a complete, operable and sanitary installation of the highest quality workmanship.

2. Have fire damper and fire smoke damper installation instructions available at Project site during construction for use by Project Inspector.

3. Electrical Coordination:

a. Refer to the Electrical Drawings and Specifications, Division 26, for service voltage and power feed wiring for equipment specified under this section. Contractor has full responsibility for the following items of work:

1) Review the Electrical Drawings and Division 26 Specifications to verify that electrical services provided are adequate and compatible with equipment requirements.

2) If additional electrical services are required above that indicated on Electrical Drawings and in Division 26, such as

more control interlock conductors, larger feeder, or separate 120 volt control power source, include cost to furnish and install additional electrical services as part of the bid.

3) Prior to proceeding with installation of additional electrical work, submit detailed drawings indicating exact scope of additional electrical work.

4. Mechanical Coordination:

a. Arrange for pipe spaces, chases, slots and openings in building structure during progress of construction, to accommodate mechanical system installation.

b. Coordinate installation of supporting devices. Set sleeves in poured-in-place concrete and other structural components during construction.

c. Coordinate requirements for access panels and doors for mechanical items requiring access where concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section “Access Doors and Frames.”

d. Coordinate with other trades equipment locations, pipe, duct and conduit runs, electrical outlets and fixtures, air inlets and outlets, and structural and architectural features. Provide information on location of piping and seismic bracing to other trades as required for a completely coordinated project.

1.7 SUBMITTALS - GENERAL

A. Refer to Division 01 Submittals Section(s) for additional requirements.

B. Submittal packages may be submitted via email as PDF electronic files, or as printed packages. PDFs shall be legible at actual size (100 percent). Provide seven copies of printed submittal packages.

C. Provide submittal of materials proposed for use as part of this Project. Product names in Specifications and on Drawings are used as standards of quality. Furnish standard items on specified equipment at no extra cost to the Contract regardless of disposition of submittal data. Other materials or methods shall not be used unless approved in writing by Architect. Architect's review will be required even though "or equal" or synonymous terms are used.

1. Partial or incomplete submittals will not be considered.

2. Quantities are Contractor's responsibility and will not be reviewed.

3. Provide materials of the same brand or manufacturer for each class of equipment or material.

4. Identify each item by manufacturer, brand, trade name, number, size, rating, or other data necessary to properly identify and review materials and equipment. Words "as specified" are not sufficient identification.

5. Identify each submittal item by reference to items' Specification Section number and paragraph, by Drawing and detail number, and by unit tag number.

6. Organize submittals in same sequence as in Specification Sections.

7. Show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping entrance, access requirements for installation and maintenance, physical size, mechanical characteristics, foundation and support details, and weight.

    a. Submit Shop Drawings, performance curves, and other pertinent data, showing size and capacity of proposed materials.

    b. Specifically indicate, by drawn detail or note, that equipment complies with each specifically stated requirement of Contract Documents.

    c. Drawings shall be drawn to scale and dimensioned (except schematic diagrams). Drawings may be prepared by vendor but must be submitted as instruments of Contractor, thoroughly checked and signed by Contractor before submission to Architect for review.

    d. Catalog cuts and published material may be included with supplemental scaled drawings.

D. Review of submittals will be only for general conformance with design concept and general compliance with information given in Contract Documents. Review will not include quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with work of other trades, or construction safety precautions, which are sole responsibility of Contractor. Review of a component of an assembly does not indicate acceptance of an assembly. Deviations from Contract Documents not clearly identified by Contractor are Contractor's responsibility and will not be reviewed by Architect.

E. Within reasonable time after award of contract and in ample time to avoid delay of construction, submit to Architect shop drawings or submittals on all items of equipment and materials provided. Provide submittal as a complete package.

1. Shop drawings and submittals shall include Specification Section, Paragraph number, and Drawing unit symbol or detail number for reference. Organize submittals into booklets for each Specification section and submit in loose-leaf binders with index. Deviations from the Contract Documents shall be prominently displayed in the front of the submittal package and referenced to the applicable Contract requirement.

F. Furnish to the Project Inspector complete installation instructions on material and equipment before starting installation.

1.8 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing systems materials and products.

B. Shop Drawings.

C. Sustainable Design Submittals:

1. Product Data: For adhesives and sealants, documentation of compliance including printed statement of VOC content and chemical components.

2. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.

D. Delegated-Design Submittals: For seismic supports, anchorages, restraints, and vibration isolators indicated to comply with performance requirements and design criteria.

1. Calculations performed for use in selection of seismic supports, anchorages, restraints, and vibration isolators shall utilize criteria indicated in Structural Contract Documents.

2. Include design calculations and details for selecting vibration isolators and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the California registered structural engineer responsible for their preparation.

3. Supports, anchorage and restraints for piping, ductwork, and equipment shall be an OSHPD pre-approved system such as TOLCO, ISAT, Mason, or equal. Pipes, ducts and equipment shall be seismically restrained in accordance with requirements of current edition of California Building Code. System shall have current OPM number and shall meet additional requirements of authority having jurisdiction. Provide supporting documentation required by the reviewing authority and the Architect and Engineer. Provide layout drawings showing piping, ductwork and restraint locations.

a. Bracing of Piping, Ductwork, and Equipment: Specifically state how bracing attachment to structure is accomplished. Provide shop drawings indicating seismic restraints, including details of anchorage to building. In-line equipment must be braced independently of piping and ductwork, and in conformance with applicable building codes. Provide calculations to show that pre-approval numbers have been correctly applied in accordance with general information notes of pre-approval documentation.

b. In lieu of the above or for non-standard installations not covered in the above pre-approved systems, Contractor shall provide layout drawings showing piping, ductwork, and restraint locations, and detail supports, attachments and restraints, and furnish supporting calculations and legible details sealed by a California registered structural engineer, in accordance with 2019 California Building Code

4. Additional Requirements: In addition to the above, conform to all state and local requirements.

1.9 INFORMATIONAL SUBMITTALS

A. Provide coordinated layouts for HVAC Ductwork systems, in accordance with Specification Section 23 80 00.

B. Provide evidence of equipment certification to California Energy Code Section 110.1 or 110.2, if not providing Electrically Commutated motors for HVAC fans sized below 1 hp and above 1/12 hp. Refer to specific equipment articles requiring electrically commutated motors.

C. Check, Test, and Start forms, from equipment manufacturers.

D. Check, Test and Start reports.

1.10 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Furnish three complete sets of Operation and Maintenance Manual bound in hardboard binder, and one compact disc containing complete Operation and Maintenance Manual in searchable PDF format. Provide Table of Contents. Provide index tabs for each piece of equipment in binder and disc. Begin compiling data upon approval of submittals.

a. Sets shall incorporate the following:

1) Product Data.

2) Shop Drawings.

3) Record Drawings.

4) Service telephone number, address and contact person for each category of equipment or system.

5) Complete operating instructions for each item of heating, ventilating and air conditioning equipment.

6) Copies of guarantees/warrantees for each item of equipment or systems.

7) Test data and system balancing reports.

8) Typewritten maintenance instructions for each item of equipment listing lubricants to be used, frequency of lubrication, inspections required, adjustment, etc.

9) Manufacturers' bulletins with parts numbers, instructions, etc., for each item of equipment.

10) Temperature control diagrams and literature.

11) A complete list or schedule of all scheduled valves giving the number of the valve, location and the rooms or area controlled by the valve. Identify each valve with a permanently attached metal tag stamped with number to match schedule. Post list in frame under plastic on wall in mechanical room or where directed by Architect.

12) Check test and start reports for each piece of mechanical equipment provided as part of the Work.

13) Commissioning and Preliminary Operation Tests required as part of the Work.

2. Post service telephone numbers and addresses in an appropriate place designated by Architect.

B. Record Drawings:

1. Refer to Division 01 for additional requirements.

2. Upon completion of the Work, deliver to Architect the following:

a. Originals of drawings showing the Work exactly as installed.

b. One complete set of reproducible drawings showing the Work exactly as installed.

c. One compact disc with complete set of drawings in PDF format showing the Work exactly as installed.

d. Provide Contractor's signature, verifying accuracy of record drawings.

e. Obtain the signature of the Inspector of Record for Record Drawings.

1.11 SUBSTITUTIONS

A. Refer to Division 01 for complete instructions. Requirements given below are in addition to or are intended to amplify Division 01 requirements. In case of conflict between requirements given herein and those of Division 01, Division 01 requirements shall apply.

B. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project. Refer to Division 01 for complete instructions.

C. Substitutions will be interpreted to be manufacturers other than those specifically listed in the Contract Documents by brand name, model, or catalog number.

D. Only one request for substitution will be considered for each item of equipment or material.

E. Substitution requests shall include the following:

1. Reason for substitution request.

2. Complete submittal information as described herein; see “Submittals.”

3. Coordinated scale layout drawings depicting position of substituted equipment in relation to other work, with required clearances for operation, maintenance and replacement.

4. List optional features required for substituted equipment to meet functional requirements of the system as indicated in Contract Documents.

5. Explanation of impact on connected utilities.

6. Explanation of impact on structural supports.

F. Installation of reviewed substitution is Contractors’ responsibility. Any mechanical, electrical, structural, or other changes required for installation of substituted equipment or material must be made by Contractor without additional cost to Owner. Review by Architect of substituted equipment or material, will not waive these requirements.

G. Contractor may be required to compensate Architect for costs related to substituted equipment or material.

1.12 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of HVAC systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Contractor's Qualifications: Firm with at least 5 years of successful installation experience on projects with HVAC systems work similar to that required for this Project.

C. Comply with applicable portions of California Mechanical Code pertaining to selection and installation of HVAC materials and products.

D. All materials and products shall be new.

1.13 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment and materials delivered to Project site from weather, humidity and temperature variations, dirt, dust and other contaminants.

1.14 FIELD CONDITIONS

A. Contractor shall visit Project site and examine existing conditions in order to become familiar with Project scope. Verify dimensions shown on Drawings at Project site. Bring discrepancies to the attention of Architect. Failure to examine Project site shall not constitute basis for claims for additional work because of lack of knowledge or location of hidden conditions that affect Project scope.

B. Information on Drawings relative to existing conditions is approximate. Deviations from Drawings necessary during progress of construction to conform to actual conditions shall be approved by the Architect and shall be made without additional cost to the Owner. The Contractor shall be held responsible for damage caused to existing services. Promptly notify the Architect if services are found which are not shown on Drawings.

1.15 WARRANTY

A. Refer to Division 01 for warranty requirements, including effective date of warranty. Refer to specific items of equipment specified herein for warranty duration if different from that specified in Division 01.

B. Repair or replace defective work, material, or part that appears within the warranty period, including damage caused by leaks.

C. On failure to comply with warranty requirements within a reasonable length of time after notification is given, Architect/Owner shall have repairs made at Contractor's expense.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials or equipment of the same type shall be of the same brand wherever possible. All materials shall be new and in first class condition.

B. All sizes, capacities, and efficiency ratings shown are minimum, except that gas capacity is maximum available.

C. Refer to Division 22 10 00 and 23 80 00 for specific system piping materials.

2.2 MATERIALS

A. No material installed as part of this Work shall contain asbestos.

B. California Green Building Code Compliance:

1. HVAC and refrigeration equipment shall not contain CFCs.

2. HVAC and refrigeration equipment shall not contain Halons.

2.3 ELECTRIC MOTORS

A. General Motor Requirements: Comply with NEMA MG 1 unless otherwise indicated. Comply with IEEE 841 for severe-duty motors.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. U.S. Motors.

b. Century Electric.

c. General Electric.

d. Lincoln.

e. Gould.

B. Motor Characteristics: Designed for continuous duty at ambient temperature of 40 deg. C and at altitude of 3300 feet above sea level. Capacity and torque shall be sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

1. Motors exceeding the nameplate amperage shall be promptly replaced at no cost to the Owner. Horsepower shown is minimum and shall be increased as necessary to comply with above requirements. Furnish motors with splash-proof or weatherproof housings, where required or recommended by the manufacturer. Match the nameplate voltage rating with the electrical service supplied. Check Electrical Drawings. Provide a transformer for each motor not wound specifically for system voltage.

C. Polyphase Motors: NEMA MG 1, Design B, medium induction motor, premium efficiency as defined in NEMA MG 1. Select motors with service factor of 1.15. Provide motor with random-wound, squirrel cage rotor, and permanently lubricated or regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading. Temperature rise shall match insulation rating. Provide Class F insulation.

1. Multispeed motors shall have separate windings for each speed.

D. Polyphase Motors with Additional Requirements:

1. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

2. Motors Used with Variable Frequency Controllers:

   a. Separately Connected Motors: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

   b. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.

   c. Premium-Efficient Motors: Class B temperature rise; Class F insulation.

   d. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

   e. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

   f. Each motor shall be provided with a shaft grounding device for stray current protection.

3. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

E. Single-Phase Motors:

1. Select motors with service factor of 1.15.

2. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

   a. Permanent-split capacitor.

   b. Split phase.

   c. Capacitor start, inductor run.

   d. Capacitor start, capacitor run.

3. Motors for HVAC exhaust, transfer, and supply fans larger than 1/12 hp and smaller than 1 hp shall be the following:

   a. Electronically Commutated motor (EC type): Motor shall be electronically commutated type specifically designed for applications, with heavy duty ball bearings. The motor shall be speed controllable down to 20% of full speed and 85% efficient at all speeds.

      1) Exceptions:

         a) Motors in fan-coils and terminal units that operate only when providing heating to the space served.

b) Motors installed in space conditioning equipment certified under 2013 California Energy Code Section 110.1 or 110.2.

4. Contractor's Option: Motors scheduled on Drawings as single-phase, and larger than 1/12 hp and smaller than 1 hp, for applications other than HVAC fans, may be EC type.

5. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

6. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

7. Motors 1/20 HP and Smaller: Shaded-pole type.

8. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.4 MOTOR STARTERS

A. Square D, Allen Bradley, or equal, in NEMA Type 1 enclosure, unless otherwise specified or required. Minimum starter size shall be Size 1. Provide NEMA 3R enclosure where exposed to outdoors.

B. Provide magnetic motor starters for all equipment provided under the Mechanical Work. Starters shall be non-combination type. Provide part winding or reduced voltage start motors where shown or as hereinafter specified. Minimum size starter shall be Size 1.

1. All starters shall have the following:

   a. Cover mounted hand-off-automatic switch. Starters installed exposed in occupied spaces shall have key operated HOA switch.

   b. Ambient compensated thermal overload.

   c. Fused control transformer (for 120 or 24 volt service).

   d. Pilot lights, integral with the starters. Starters located outdoors shall be in NEMA IIIR enclosures.

2. Where three phase motors are provided for two-speed operation, provide two speed motor starters.

3. Starters for single-phase motors shall have thermal overloads. NEMA I enclosure for starters located indoors, NEMA IIIR enclosure for starters located outdoors.

4. Provide OSHA label indicating the device starts automatically.

2.5 THERMOMETERS

A. Marsh, Taylor, Palmer, or equal, 5 inch diameter bimetal dial, adjustable from face, with adjustable positioner, located to be easily read from normal personnel approach. Normal reading shall be at mid-scale.

1. Provide extension for insulation.

2. Provide thermometers with steel bulb chambers and brass separable sockets.

3. Thermometers for air temperature shall have 8 inch minimum stem.

B. Provide Ventlock, Durodyne, or equal thermometer test holes at each air conditioning unit, furnace, and make-up air unit, in mixed air and supply air, and at all locations shown or scheduled on the Drawings. Provide two portable thermometers, with sensing connection arranged to suit test connections.

C. Provide Pete's Plug II, Sisco P/T, or equal, test plug with Nordel core, on inlet and outlet of each coil, boiler, condenser, chiller and heat exchanger and provide two digital electronic test thermometers for each range of fluid temperature and where shown on Drawings.

2.6 ACCESS DOORS

A. Where floors, walls, or ceilings must be penetrated for access to mechanical equipment, provide access doors, 14 inch by 14 inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 20 inch by 30 inch minimum usable opening. Locate access doors/panels for non-obstructed and easy reach.

1. All access doors less than 7'-0" above floors and exposed to public access shall have keyed locks.

B. Access doors shall match those supplied in Division 08 in all respects, except as noted herein.

C. Provide stainless steel access doors for use in toilet rooms, shower rooms, kitchens and other damp areas. Provide steel access doors with prime coat of baked-on paint for all other areas.

D. Where panels are located on ducts or plenums, provide neoprene gaskets to prevent air leakage, and use frames to set door out to flush with insulation.

E. Provide insulated doors where located in internally insulated ducts or casings.

F. Do not locate access doors in highly visible public areas such as lobbies, waiting areas, and primary entrance areas. Coordinate with the Architect when access is required in these areas.

G. Where specific information or details relating to access panels different from the above is shown or given on the Drawings or other Divisions of work, then that information shall supersede this specification.

H. Manufacturers: Subject to compliance with requirements, available manufacturers offering products which may be incorporated into the Work include Milcor, Karp, Nystrom, or Cesco, equal to the following:

1. Milcor

a. Style K (plaster).

b. Style DW (gypsum board).

c. Style M (Masonry).

d. Style "Fire Rated" where required.

2.7 EXPANSION LOOPS

A. Manufactured assembly consisting of inlet and outlet elbow fittings, two sections of flexible metal hose and braid, and 180-degree return bend or center section of flexible hose. Flexible hose shall consist of corrugated metal inner hose and braided outer sheath. Provide assembly selected for 4 inches of movement.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Metraflex Inc., Metraloop series.

2. Unisource Manufacturing, Inc., V series.

2.8 FLEXIBLE JOINTS

A. Where indicated on Drawings, provide Metraflex Metrasphere, Style R, Mason Industries, or equal, Spherical Expansion Joints. Provide control units at each expansion joint, arranged to limit both expansion and compression.

2.9 PIPE GUIDES

A. Where flexible connections are indicated on Drawings, provide Metraflex style IV, B-Line, or equal, pipe guides in locations recommended by manufacturer. Maximum spacing from flexible connection to first pipe guide is 4 pipe diameters, and maximum spacing from second pipe guide is 14 pipe diameters.

2.10 EQUIPMENT IDENTIFICATION

A. Identify each piece of equipment with a permanently attached engraved bakelite plate, 1/2 inch high white letters on black background.

2.11 PIPE IDENTIFICATION

A. Identify each piping system and indicate the direction of flow by means of Seton, Inc., Marking Services Inc., Reef Industries, Inc., or equal, pre-tensioned, coiled semi-rigid plastic pipe labels formed to circumference of pipe, requiring no fasteners or adhesive for attachment to pipe.

B. The legend and flow arrow shall conform to ASME A13.1.

PART 3 - EXECUTION

3.1 EXISTING MATERIALS:

A. Remove existing equipment, piping, wiring, construction, etc., which interferes with Work of this Contract. Promptly return to service upon completion of work in the area. Replace items damaged by Contractor with new material to match existing.

B. Removed materials which will not be re-installed and which are not claimed by Owner shall become the property of Contractor and shall be removed from the Project site. Consult Owner before removing any material from the Project site. Carefully remove materials claimed by Owner to prevent damage and deliver to Owner-designated storage location.

C. Existing piping and wiring not reused and are concealed in building construction may be abandoned in place and all ends shall be capped or plugged. Remove unused piping and wiring exposed in Equipment Rooms or occupied spaces. Material shall be removed from the premises. Disconnect power, water, gas, pump or any other active energy source from piping or electrical service prior to abandoning in place.

3.2 FRAMING, CUTTING, AND PATCHING

A. Special framing, recesses, chases and backing for Work of this Section, unless otherwise specified, are covered under other Specification Sections.

B. Contractor is responsible for placement of pipe sleeves, hangers, inserts, supports, and location of openings for the Work.

C. Cutting, patching, and repairing of existing construction to permit installation of equipment, and materials is the responsibility of Contractor. Repair or replace damage to existing work with skilled mechanics for each trade.

D. Cut existing concrete construction with a concrete saw. Do not utilize pneumatic devices.

E. Core openings through existing construction for passage of new piping and conduits. Cut holes of minimum diameter to suit size of pipe and associated insulation installed. Coordinate with building structure, and obtain Structural Engineer's approval prior to coring through existing construction.

3.3 MECHANICAL DEMOLITION

A. Refer to Division 01 Sections “Cutting and Patching” and “Selective Demolition” for general demolition requirements and procedures.

B. Disconnect, dismantle and remove mechanical systems, equipment, and components indicated to be removed. Coordinate with all other trades.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping to remain with same or compatible piping material. Refrigerant system must be evacuated per EPA requirements.

3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and cap remaining ducts with same or compatible ductwork material.

4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

5. Equipment to Be Removed: Drain down and cap remaining services and remove equipment.

6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.4 ELECTRICAL REQUIREMENTS

A. Provide adequate working space around electrical equipment in compliance with the California Electrical Code. Coordinate the Mechanical Work with the Electrical Work to comply.

B. Furnish necessary control diagrams and instructions for the controls. Before permitting operation of any equipment which is furnished, installed, or modified under this Section, review all associated electrical work, including overload protection devices, and assume complete responsibility for the correctness of the electrical connections and protective devices. Motors and control equipment shall conform to the Standards of the National Electrical Manufacturers' Association. All equipment and connections exposed to the weather shall be NEMA IIIR with factory-wired strip heaters in each starter enclosure and temperature control panel where required to inhibit condensation.

C. All line voltage and low voltage wiring and conduit associated with the Temperature Control System are included in this Section. Wiring and conduit shall comply with Division 26.

3.5 PIPING SYSTEM REQUIREMENTS

A. Drawing plans, schematic and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

3.6 PRIMING AND PAINTING

A. Perform priming and painting on the equipment and materials as specified herein.

B. See Division 09 Painting Section(s) for detailed requirements.

C. Priming and painting:

1. Exposed ferrous metals, including piping, which are not galvanized or factory-finished shall be primed and painted.

a. Black Steel Piping:

1) Primer: One coat gray Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, comparable products by Rust-Oleum, Kelly Moore, or equal.

2) Topcoat: Two coats gray Sherwin-Williams Pro Industrial Waterbased Alkyd Urethane Enamel, comparable products by Rust-Oleum, Kelly Moore, or equal.

b. Interior Ductwork: Refer to Division 09 Painting Section(s). Architect shall select paint color.

2. Metal surfaces of items to be jacketed or insulated except ductwork and piping shall be given two coats of primer unless furnished with equivalent factory finish. Items to be primed shall be properly cleaned by effective means free of rust, dirt, scale, grease and other deleterious matter and then primed with the best available grade of zinc rich primer. After erection or installation, all primed surfaces shall be properly cleaned of any foreign or deleterious matter that might impair proper bonding of subsequent paint coatings. Any abrasion or other damage to the shop or field prime coat shall be properly repaired and touched up with the same material used for the original priming.

3. Where equipment is provided with nameplate data, the nameplate shall be masked off prior to painting. When painting is completed, remove masking material.

3.7 PIPING AND DUCT SYSTEMS INSTALLATION

A. General:

1. All piping shall be concealed unless shown or otherwise directed. Allow sufficient space for ceiling panel removal.

2. Installation of piping shall be made with appropriate fittings. Bending of piping will not be accepted.

3. Install piping to permit application of insulation and to allow valve servicing.

4. Where piping, conduit, or ductwork is left exposed within a room, the same shall be run true to plumb, horizontal, or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.

5. Horizontal runs of pipes, conduits, or ductwork suspended from ceilings shall provide for a maximum headroom clearance. The clearance shall not be less than 6'-6" without written approval from the Architect.

6. Close ends of pipe immediately after installation. Leave closure in place until removal is necessary for completion of installation.

7. At the time of rough installation, or during storage on the construction site and until final startup of the heating and cooling equipment, all duct and other related air distribution component opening shall be covered with tape, plastic, sheet metal, or other methods acceptable to the enforcing agency.

8. Each piping system shall be thoroughly flushed and proved clean before connection to equipment.

9. Pipe the discharge of each relief valve, air vent, backflow preventer, and similar device to floor sink or drain.

10. Install exposed polished or enameled connections with special care showing no tool marks or threads at fittings.

11. Install horizontal valves with valve stem above horizontal.

12. Use reducing fittings; bushings shall not be allowed. Use eccentric reducing fittings wherever necessary to provide free drainage of lines and passage of air.

13. Verify final equipment locations for roughing-in.

14. Where piping is installed in walls within one inch of the face of stud, provide a 16 gauge sheet metal shield plate on the face of the stud. The shield plate shall extend a minimum of 1-1/2 inches beyond the outside diameter of the pipe.

B. Expansion Loops:

1. Install expansion loops where piping crosses building expansion or seismic joints, between buildings, between buildings and canopies, and as indicated on Drawings.

2. Install expansion loops of sizes matching sizes of connected piping.

3. Install grooved-joint expansion joints to grooved-end steel piping.

4. Materials of construction and end fitting type shall be consistent with pipe material and type of gas or liquid conveyed by the piping system in which expansion loop is installed.

C. Sleeves:

1. Install Adjus-to-Crete, Pipeline Seal and Insulator, or equal, pipe sleeves of sufficient size to allow for free motion of pipe, 24 gauge galvanized steel. The space between pipe and sleeves through floor slabs on ground, through outside walls above or below grade, through roof, and other locations as directed shall be caulked with oakum and mastic and made watertight. The space between pipe and sleeve and between sleeve and slab or wall shall be sealed watertight.

2. At Contractor's option, Link-Seal, Metraflex Metraseal, or equal, casing seals may be used in lieu of caulking. Wrap pipes through slabs on grade with 1 inch thick fiberglass insulation to completely isolate the pipe from the concrete.

D. Floor, Wall, and Ceiling Plates:

1. Fit all pipes with or without insulation passing through walls, floors, or ceilings, and all hanger rods penetrating finished ceilings with chrome-plated or stainless escutcheon plates.

E. Firestopping:

1. Pack the annular space between the pipe sleeves and the pipe and between duct openings and ducts through all floors and walls with UL listed fire stop, and sealed at the ends. All pipe penetrations shall be UL listed, Hilti, 3M Pro-Set, or equal.

   a. Install fire caulking behind mechanical services installed within fire rated walls, to maintain continuous rating of wall construction.

2. Provide SpecSeal Systems UL fire rated sleeve/coupling penetrators for each pipe penetration or fixture opening passing through floors, walls, partitions or floor/ceiling assemblies. All Penetrators shall comply with UL Fire Resistance Directory (Latest Edition), and in accordance with CBC requirements.

3. Sleeve penetrators shall have a built in anchor ring for waterproofing and anchoring into concrete pours or use the special fit cored hole penetrator for cored holes.

4. Copper and steel piping shall have SpecSeal plugs on both sides of the penetrator to reduce noise and to provide waterproofing.

5. All above Firestopping systems to be installed in strict accordance with manufacturer's instructions.

6. Alternate firestopping systems are acceptable if approved equal. However, any deviation from the above specification requires the Contractor to be responsible for determining the suitability of the proposed products and their intended use, and the Contractor shall assume all risks and liabilities whatsoever in connection therewith.

F. Flashing:

1. Flashing for penetrations of metal or membrane roof for mechanical items such as flues, ducts, and pipes shall be coordinated with the roofing manufacturer and roofing installer for the specific roofing type. The work of this section shall include furnishing, layout, sizing, and coordination of penetrations required for the mechanical work.

   a. Furnish and install flashing and counterflashing in strict conformance with the requirements of the roofing manufacturer. Submit shop drawing details for review prior to installation.

   b. Furnish and install counterflashing above each flashing required. Provide Stoneman, or equal, vandalproof top and flashing combination. Elmdor/Stoneman Model 1540.

   c. Flues and ducts shall have 24 gauge galvanized sheet metal storm collar securely clamped to the flue above the flashing.

2. For all other types of roofing system, furnish and install around each pipe, where it passes through roof, a flashing and counterflashing. All flashing shall be made of four pound seamless sheet lead with 6 inch minimum skirt and steel reinforced boot. Counterflashing shall be cast iron. For vents, provide vandalproof top and flashing combination. Elmdor/Stoneman Model 1100-4.

G. Hangers and Supports:

1. General: Support ductwork, equipment and piping so that it is firmly held in place by approved iron hangers and supports, and special hangers. Hanger and support components shall support weight of ductwork, equipment and pipe, fluid, and pipe insulation based on spacing between supports with minimum factor of safety of five based on ultimate strength of material used. Do not exceed manufacturer's load rating. Pipe attachments or hangers, of same size as pipe or tubing on which used, or

nearest available. Rigidly fasten hose faucets, fixture stops, compressed air outlets, and similar items to the building construction. The Architect shall approve hanger material before installation. Do not support piping or ductwork with plumbers' tape, wire rope, wood, or other makeshift devices. Where building structural members do not match piping and ductwork support spacing, provide “bridging” support members firmly attached to building structural members in a fashion approved by the structural engineer.

a. Materials, design, and type numbers for support of piping per Manufacturers' Standardization Society (MSS), Standard Practice (SP)-58.

1) Provide copper-plated or felt-lined hangers for use on copper tubing.

b. Materials and design for ductwork support shall be per SMACNA “HVAC Duct Construction Standards, Metal and Flexible.”

2. Hanger components shall be provided by one manufacturer: B-Line, Grinnell, Unistrut, Badger, or equal.

3. Riser clamps: B-line model B3373, or equal.

4. Pipe Hanger and Support Placement and Spacing:

a. Vertical piping support spacing: Provide riser clamps for piping, above each floor, in contact with the floor. Provide support at joints, branches, and horizontal offsets. Provide additional support for vertical piping, spaced at or within the following maximum limits:

Pipe Diameter	Steel Threaded or Welded (Note 3)	Copper Brazed or Soldered (Notes 3, 4)	CPVC & PVC (Note 2)
1/2 - 1”	12 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
1-1/4 - 2”	12 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
2-1/2 - 3”	12 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
Over 4”	12 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)

1) Note 1: Provide mid-story guides.

2) Note 2: For PVC piping, provide for expansion every 30 feet per IAPMO installation standard. For CPVC piping, provide for expansion per IAPMO installation standard.

3) Note 3: Spacing of hangers and supports for piping assembled with mechanical joints shall be in accordance with standards acceptable to authorities having jurisdiction.

4) Note 4: Includes refrigerant piping, including vapor and hot gas pipes.

b. Horizontal piping, hanger and support spacing: Locate hangers and supports at each change of direction, within one foot of elbow, and spaced at or within following maximum limits:

Pipe Diameter	Steel Threaded or Welded (Note 2)	Copper Brazed or Soldered (Notes 2, 3)	CPVC & PVC (Note 1)
1/2 - 1"	6 ft.	5 ft.	3 ft.
1-1/4 - 2"	7 ft.	6 ft.	4 ft.
2-1/2 - 3"	10 ft.	10 ft.	4 ft.
Over 4"	10 ft.	10 ft.	4 ft.

1) Note 1: For PVC piping, provide for expansion every 30 feet per IAPMO installation standard. For CPVC piping, provide for expansion per IAPMO installation standard.

2) Note 2: Spacing of hangers and supports for piping assembled with mechanical joints shall be in accordance with standards acceptable to authorities having jurisdiction.

3) Note 3: Includes all refrigerant piping, including vapor and hot gas pipes.

5. Suspended Piping:

a. Individually suspended piping: B-Line B3690 J-Hanger or B3100 Clevis, complete with threaded rod, or equal. All hangers on supply and return piping handling heating hot water or steam shall have a swing connector at point of support.

Pipe Size	Rod Size Diameter
2" and Smaller	3/8"
2-1/2" to 3-1/2"	1/2"
4" to 5"	5/8"
6"	3/4"

b. Trapeze Suspension: B-Line 1-5/8 inch width channel in accordance with manufacturers' published load ratings. No deflection to exceed 1/180 of a span.

c. Trapeze Supporting Rods: Shall have a safety factor of five; securely anchor to building structure.

d. Pipe Clamps and Straps: B-Line B2000, B2400; isolate copper pipe with two thicknesses of 2 inches wide 10-mil polyvinyl tape. Where used for seismic support systems, provide B-Line B2400 series pipe straps.

e. Concrete Inserts: B-line B22-I continuous insert or B2500 spot insert. Do not use actuated fasteners for support of overhead piping unless approved by Architect.

f. Above Roof: H frame made from Uni-Strut hot-dipped galvanized 1-5/8 inch single or double channel with P-2072A or P-2073A foot secured to roof and surrounded with waterproof roofed-in sleeper. Secure to sleeper with lag screws, and secure sleeper to blocking under roof.

g. Steel Connectors: Beam clamps with retainers.

6. Duct Hanger and Support Spacing: Conform to Requirements of CMC and SMACNA "HVAC Duct Construction Standards, Metal and Flexible."

7. Support to Structure:

a. Wood Structure: Provide and install wood blocking as required to suit structure. Provide lag screws or through bolts with length to suit requirements, and with size (diameter) to match the size of hanger rods required.

1) Do not install Lag screws in tension without written review and acceptance by Structural Engineer.

Side Beam Angle Clip	B-Line B3062 MSS Type 34
Side Beam Angle Clip	B-Line B3060
Ceiling Flange	B-Line B3199

2) Blocking for support of piping shall be not less than 2 inch thick for piping up to 2 inch size. Provide 3 inch blocking for piping up through 5 inch size, and 4 inch blocking for larger piping. Provide support for blocking in accordance with Structural Engineers requirements.

3) Where lag screws are used, length of screw shall be 1/2 inch less than the wood blocking. Pre-drill starter holes for each lag screw.

b. Steel Structure: Provide and install additional steel bracing as required to suit structure. Provide through bolts with length to suit requirements of the structural components. Burning or welding on any structural member may only be done if approved by the Architect.

8. Rubber Neoprene Pipe Isolators:

a. Pipe isolators shall comprise an internal rubber or neoprene material that isolates pipe from hanger and structure. Install at all piping located in acoustical walls. Refer to Architectural Drawings for location of acoustical walls.

b. Isolation material shall be either a rubber or neoprene material that prevents contact between the pipe and the structure. The rubber shall have between a 45 to 55 durometer rating and a minimum thickness of 1/2 inch.

c. Acceptable Suppliers:

1) Vertical runs: Acousto-Plumb or equal.

2) Horizontal runs: B-Line, Vibraclamp; Acousto-Plumb or equal.

9. Provide support for piping through roof, arranged to anchor piping solidly in place at the roof penetration.

10. Provide rigid insulation and a 12 inch long, 18 gauge galvanized sheet iron shield between the covering and the hanger whenever hangers are installed on the outside of the pipe covering.

11. Insulate copper tubing from ferrous materials and hangers with two thicknesses of 3 inch wide, 10 mil polyvinyl tape wrapped around pipe.

12. Provide a support or hanger close to each change of direction of pipe either horizontal or vertical and as near as possible to concentrated loads.

13. Suspend rods from concrete inserts with removable nuts where suspended from concrete decks. Power actuated inserts will not be allowed.

14. On chilled or combination hot and chilled water or refrigerant pipes, install the hangers on the outside of the pipe covering and not in contact with the pipe. Provide rigid insulation and a 12 inch long, 18 gauge galvanized sheet iron shield between the covering and the hanger whenever hangers are installed on the outside of the pipe covering.

3.8 UNION AND FLANGE INSTALLATION

A. Install Epco, Nibco, or equal, dielectric unions or flanges at points of connection between copper or brass piping or material and steel or cast iron pipe or material except in drain piping. Bushings or couplings shall not be used.

B. Install unions in piping NPS 2” and smaller 3 or flanges in piping NPS 2-1/2” and larger whether shown or not at each connection to all equipment and tanks, and at all connections to all automatic valves, such as temperature control valves.

C. Locate the unions for easy removal of the equipment, tank, or valve.

D. Do not install unions or flanges in refrigerant piping systems.

3.9 ACCESS DOOR INSTALLATION

A. Furnish and install access doors wherever required whether shown or not for easy maintenance of mechanical systems; for example, at concealed valves, strainers, traps, cleanouts, dampers, motors, controls, operating equipment, etc. Access doors shall provide for complete removal and replacement of equipment.

3.10 CONCRETE WORK

A. Concrete work required for work of this Section shall be included under another section of the Specification, unless otherwise noted, including poured-in-place concrete work for installing precast manholes, catch basins, etc., and shall include reinforced concrete bases for pumps, tanks, compressors, fan units, boilers, unless the work is specifically indicated on the Drawings to be furnished under this Section.

B. Underground anchors, and pads for valve access boxes are included under this Section of the Specification. Concrete shall be 3000 psi test minimum. Refer to Division 03 for concrete types.

3.11 PIPE PROTECTION

A. Wrap bare galvanized and black steel pipe buried in the ground and to 6" above grade, including piping in conduit, with one of the following, or equal:

1. Polyethylene Coating: Pressure sensitive polyethylene coating, "X-Tru-Coat" as manufactured by Pipe Line Service Corporation or "Green Line" wrap as manufactured by Roystron Products, or equal.

   a. Field Joints and Fittings: Protecto Wrap #1170 tape as manufactured by Pipe Line Service Corporation, or Primer #200 tape by Roystron Products, or equal. Installation shall be as per manufacturer's recommendation and instructions.

2. Tape Wrap: Pressure-sensitive polyvinyl chloride tape, "Transtex #V-l0 or V-20", "Scotchwrap 50", Slipknot l00, PASCO Specialty & Mfg., Inc., or equal, with continuous identification. Tape shall be a minimum of 20 mils thick for fittings and irregular surfaces, two wraps, 50 percent overlap, 40 mils total thickness. Tape shall be laminated with a suitable adhesive; widths as recommended by the manufacturer for the pipe size. Wrap straight lengths of piping with an approved wrapping machine.

B. Field Joints: Valves and Fittings: double wrap polyvinyl chloride tape as above. Provide at least two thicknesses of tape over the joint and extend a minimum of 4 inches over adjacent pipe covering. Build up with primer to match adjacent covering thickness. Width of tape of fittings shall not exceed 3 inches. Tape shall adhere tightly to all surfaces of the fittings without air pockets.

C. Testing: Test completed wrap of piping, including all epoxy painted piping with Tinker and Rasor Co. holiday detector, or equal.

D. Cleaning: Clean all piping thoroughly before wrapping.

1. Inspection: Damaged or defective wraps shall be repaired as directed. No wrapped pipe shall be covered until approved by Architect.

E. Covering: No rocks or sharp edges shall be backfilled against the wrap. When backfilling with other than sand, protect wrap with an outer wrapping of Kraft paper; leave in place during backfill.

3.12 PIPE IDENTIFICATION

A. Provide temporary identification of each pipe installed, at the time of installation. Temporary identification shall be removed and replaced with permanent identification as part of the work.

B. Apply the legend and flow arrow at all valve locations; at all points where the piping enters or leaves a wall, partition, cluster of piping or similar obstruction, at each change of direction, and at approximately 20'-0" intervals on pipe runs. Variations or changes in locations and spacing may be made with the approval of the Architect. There shall be at least one marking in each room. Markings shall be located for maximum visibility from expected personnel approach.

C. Wherever two or more pipes run parallel, the markings shall be supplied in the same relative location on each.

D. Apply the markings after painting and cleaning of piping and insulation is completed.

3.13 EXPANSION ANCHORS IN HARDENED CONCRETE

A. Refer to Structural Drawings.

3.14 PIPING SYSTEM PRESSURE TESTING

A. General:

1. Perform operational tests under simulated or actual service conditions.

2. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.

B. Piping Systems: Test the installations in accordance with the following requirements and applicable codes:

1. Notify the Architect at least seven days in advance of testing.

2. Authority having jurisdiction shall witness tests of piping systems.

3. Piping shall be tested at completion of roughing-in, or at other times as directed by the Architect.

4. Furnish necessary materials, test pumps, gases, instruments and labor required for testing.

5. Isolate from system equipment that may be damaged by test pressure.

6. Make connections to existing systems with flanged connection. During testing of new work, provide a slip-in plate to restrict test pressure to new systems. Remove plate and make final connection to existing system at completion of testing.

a. Authority having jurisdiction shall witness final connection to system.

C. Test Schedule: No loss in pressure or visible leaks shall show after four hours at the pressures indicated.

System Tested	Test Pressure PSI	Test With
All Hot, Chilled, Combination, Condenser Water Piping	Greater of 1-1/2 x WP or 100 psi	Water

D. Testing, Evacuating, Charging and Lubrication of Refrigeration Systems:

1. Pressurize with dry nitrogen and/or refrigerant to 300 psig and test all joints with an electronic detector or halide torch. Release the pressure and attach a high vacuum pump. Evacuate to 4 mm (4000 microns) and hold for 30

minutes. Break to 5 psig with dry nitrogen and allow to remain in the system for ten minutes. Evacuate to 2 mm (2000 microns) and hold for 30 minutes. Use a mercury manometer or electronic vacuum gauge. Do not start timing until recommended vacuum range is reached.

2. At the end of the evacuation, if the system has been proved leak-free, charge with refrigerant and fill the crankcase to the oil level specified by the manufacturer. All refrigerant oil shall be delivered to the location in sealed containers.

3. Replenish for a period of one year without cost to the Owner all refrigerant and oil required to maintain the proper levels.

3.15 OPERATION OF SYSTEMS

A. Do not operate any mechanical equipment for any purpose, temporary or permanent, until all of the following has been completed:

1. Complete all requirements listed under “Check, Test and Start Requirements.”

2. Ductwork and piping has been properly cleaned. Piping systems shall be flushed and treated prior to operation.

3. Filters, strainers etc. are in place.

4. Bearings have been lubricated, and alignment of rotating equipment has been checked.

5. Equipment has been run under observation, and is operating in a satisfactory manner.

B. Provide test and balance agency with one set of Contract Drawings, Specifications, Addenda, Change orders issued, applicable shop drawings and submittals and temperature control drawings.

C. Operate every fire damper, smoke damper, combination smoke and fire damper under normal operating conditions. Activate smoke detectors as required to operate the damper, stage fan, etc. Provide written confirmation that all systems operate in a satisfactory manner.

3.16 CHECK, TEST AND START REQUIREMENTS

A. An authorized representative of the equipment manufacturer shall perform check, test and start of each piece of mechanical equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the check test and start of the equipment.

1. As part of the submittal process, provide a copy of each manufacturer’s printed startup form to be used.

2. Some items of specified equipment may require that check, test and start of equipment must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.

3. Provide all personnel, test instruments, and equipment to properly perform the check, test and start work.

4. When work has been completed, provide copies of reports for review, prior to final observation of work.

B. Provide copies of the completed check, test and start report of each item of equipment, bound with the Operation and Maintenance Manual.

C. Upon completion of the work, provide a schedule of planned maintenance for each piece of equipment. Indicate frequency of service, recommended spare parts (including filters and lubricants), and methods for adjustment and alignment of all equipment components. Provide a copy of the schedule with each Operation and Maintenance Manual. Provide a copy of certification from the Owner's representative indicating that they have been properly instructed in maintenance requirements for the equipment installed.

3.17 PRELIMINARY OPERATIONAL REQUIREMENTS AND TESTS

A. Prior to observation to determine final acceptance, put HVAC, plumbing, and fire protection systems into service and check that work required for that purpose has been done, including but not limited to the following condensed check list. Provide indexed report to tabulating the results of all work.

1. All equipment has been started, checked, lubricated and adjusted in accordance with the manufacturer's recommendations, including modulating power exhausts if present.

2. Correct rotation of motors and ratings of overload heaters are verified.

3. Specified filters are installed and spare filters have been turned over to Owner.

4. All manufacturers' certificates of start-up specified have been delivered to the Owner.

5. All equipment has been cleaned, and damaged painted finishes touched up.

6. Damaged fins on heat exchangers have been combed out.

7. Missing or damaged parts have been replaced.

8. Flushing and chemical treatment of piping systems has been completed and water treatment equipment, where specified, is in operation.

9. Equipment labels, pipe marker labels, ceiling markers and valve tags are installed.

10. Valve tag schedules, corrected control diagrams, sequence of operation lists and start-stop instructions have been posted.

11. Preliminary test and balance work is complete, and reports have been forwarded for review.

12. Automatic control set points are as designated and performance of controls checks out to agree with the sequence of operation.

13. Operation and Maintenance Manuals have been delivered and instructions to the operating personnel have been made.

B. Prior to the observation to determine final acceptance, operate all mechanical systems as required to demonstrate that the installation and performance of these systems conform to the requirements of these specifications.

1. Operate and test all mechanical equipment and systems for a period of at least five consecutive 8 hour days to demonstrate the satisfactory overall operation of the project as a complete unit.

2. Include operation of heating and air conditioning equipment and systems for a period of not less than two 8 hour days at not less than 90 percent of full specified heating and cooling capacities in tests.

3. Commence tests after preliminary balancing and adjustments to equipment have been checked. Immediately before starting tests, install air filters and lubricate all running equipment. Notify the Architect at least seven calendar days in advance of starting the above tests.

4. During the test period, make final adjustments and balancing of equipment, systems controls, and circuits so that all are placed in first class operating condition.

5. Where Utility District rebates are applicable, demonstrate that the systems meet the rebate program requirements.

C. Before handing over the system to Owner replace all filters with complete new set of filters.

D. Review of Contractor's Tests:

1. All tests made by the Contractor or manufacturers' representatives are subject to observation and review by the Owner. Provide timely notice prior to start of each test, in order to allow for observation of testing. Upon the completion of all tests, provide a letter to confirm that all testing has been successful.

E. Test Logs:

1. Maintain test logs listing the tests on all mechanical systems showing dates, items tested, inspectors' names, remarks on success or failure of the tests.

F. Preliminary Operation:

1. The Owner reserves the right to operate portions of the mechanical system on a preliminary basis without voiding the guarantee.

G. Operational Tests:

1. Before operational tests are performed, demonstrate that all systems and components are complete and fully charged with operating fluid and lubricants.

2. Systems shall be operable and capable of maintaining continuous uninterrupted operation during the operating and demonstration period. After all systems have been completely installed, connections made, and tests completed, operate the systems continuously for a period of five working days during the hours of a normal working day.

3. This period of continuous systems operation may be coordinated with the removal of Volatile Organic Compounds (VOCs) from the building prior to occupancy should the Owner decide to implement such a program.

4. Control systems shall be completely operable with settings properly calibrated and adjusted.

5. Rotating equipment shall be in dynamic balance and alignment.

6. If the system fails to operate continuously during the test period, the deficiencies shall be corrected and the entire test repeated.

3.18 CERTIFICATES OF INSTALLATION

A. Contractor shall complete applicable “Certificates of Installation” forms contained in the California Building Energy Efficiency Standards and submit to the authorities having jurisdiction for approval and issuance of final occupancy permit, as described in the California Energy Code.

3.19 ACCEPTANCE REQUIREMENTS

A. Contractor shall complete the applicable Acceptance Requirements for Code Compliance contained in the California Building Energy Efficiency Standards. Refer to T-24 compliance forms on Drawings for systems having Acceptance testing requirements. Contractor shall perform Acceptance tests and complete the appropriate "Certificates of Acceptance." Submit certificates to the authorities having jurisdiction for approval and issuance of final occupancy permit. Contractor shall engage certified HERS Rater to verify duct leakage rate for duct systems indicated on T-24 compliance forms on Drawings as requiring duct leakage rate testing. For additional duct leak testing requirements, refer to Section 238000, "Heating, Ventilating, and Air Conditioning," Article, "Ductwork Sealing and Leak Testing."

1. Covered Processes: In addition to systems listed on T-24 compliance forms on Drawings, complete Acceptance Requirements for the following systems, if applicable to Project:

   a. Parking garage ventilation systems.

   b. Compressed air systems.

   c. Type 1 Kitchen exhaust systems.

3.20 DEMONSTRATION AND TRAINING

A. An authorized representative of the equipment manufacturer shall train Owner-designated personnel in maintenance and adjustment of equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the Owner training for the equipment installed.

1. As part of the submittal process, provide a training agenda outlining major topics and time allowed for each topic.

2. Some items of specified equipment require that training must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.

3. Contractor shall provide three copies of certification by Contractor that training has been completed, signed by Owner's representative, for inclusion in Operation and Maintenance Manual. Certificates shall include:

   a. Listing of Owner-designated personnel completing training, by name and title.

   b. Name and title of training instructor.

   c. Date(s) of training.

d. List of topics covered in training sessions.

4. Refer to specific equipment Articles for minimum training period duration for each piece of equipment.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

2. Balancing Domestic Water Piping Systems.

1.2 RELATED REQUIREMENTS

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

1.3 REFERENCES AND STANDARDS

A. Associated Air Balance Council (AABC)

1. National Standards for Total System Balance, latest edition.

B. National Environmental Balancing Bureau (NEBB)

1. Procedural Standards for Testing and Balancing of Environmental Systems, latest edition.

1.4 DEFINITIONS

A. The intent of this Section is to use the standards pertaining to the TAB specialist engaged to perform the Work of this Contract, with additional requirements specified in this Section. Contract requirements take precedence over corresponding AABC or NEBB standards requirements. Differences in terminology between the Specifications and the specified TAB organization standards do not relieve the TAB entity engaged to perform the Work of this Contract of responsibility from completing the Work as described in the Specifications.

B. Similar Terms: The following table is provided for clarification only:

Similar Terms		
Contract Term	AABC Term	NEBB Term
TAB Specialist	TAB Agency	NEBB Certified Firm
TAB Standard	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems	Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems
TAB Field Supervisor	Test and Balance Engineer	Test and Balance Supervisor

C. AABC: Associated Air Balance Council.

D. NEBB: National Environmental Balancing Bureau.

E. TAB: Testing, adjusting, and balancing.

F. TAB Organization: Body governing practices of TAB Specialists.

G. TAB Specialist: An entity engaged to perform TAB Work.

1.5 ACTION SUBMITTALS

A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.

1.6 INFORMATIONAL SUBMITTALS

A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.

B. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

1. Provide list of similar projects completed by proposed TAB field supervisor.

2. Provide copy of completed TAB report, approved by mechanical engineer of record for a completed project with similar system types and of similar complexity.

C. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

1. Submit examinations report with qualifications data.

D. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

E. Interim Reports. Submit interim reports as specified in Part 3. Include list of system conditions requiring correction and problems not identified in Contract Documents examination report.

F. Certified TAB reports.

1. Provide three printed copies of final TAB report. Provide one electronic file copy in PDF format.

G. Sample report forms.

H. Instrument calibration reports, to include the following:

1. Instrument type and make.

2. Serial number.

3. Application.

4. Dates of use.

5. Dates of calibration.

a. Instruments to be used for testing and balancing shall have been calibrated within a period of one year, or less if so recommended by instrument manufacturer and be checked for accuracy prior to start of work.

1.7 CLOSEOUT SUBMITTALS

A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.

B. Certified TAB reports, for inclusion in Operation and Maintenance Manual.

1.8 QUALITY ASSURANCE

A. Independent TAB Specialist Qualifications: Engage a TAB entity certified by AABC or NEBB.

1. The certification shall be maintained for the entire duration of TAB work for this Project. If TAB specialist loses certification during this period, the Contractor shall immediately notify the Architect and submit another TAB specialist for approval. All work specified in this Section and in other related Sections performed by the TAB specialist shall be invalidated if

the TAB specialist loses certification, and shall be performed by an approved successor.

B. To secure approval for the proposed TAB specialist, submit information certifying that the TAB specialist is either a first tier subcontractor engaged and paid by the Contractor, or is engaged and paid directly by the Owner. TAB specialist shall not be affiliated with any other entity participating in Work of this Contract, including design, furnishing equipment, or construction. In addition, submit evidence of the following:

1. TAB Field Supervisor: Full-time employee of the TAB specialist and certified by AABC or NEBB.

   a. TAB field supervisor shall have minimum 10 years supervisory experience in TAB work.

2. TAB Technician: Full-time employee of the TAB specialist and who is certified by AABC or NEBB as a TAB technician.

   a. TAB technician shall have minimum 4 years TAB field experience.

C. TAB Specialist engaged to perform TAB work in this Project shall be a business limited to and specializing in TAB work, or in TAB work and Commissioning.

D. TAB specialist engaged to perform TAB work shall not also perform commissioning activities on this Project.

E. Certified TAB field supervisor or certified TAB technician shall be present at the Project site at all times when TAB work is performed.

1. TAB specialist shall maintain at the Project site a minimum ratio of one certified field supervisor or technician for each non-certified employee at times when TAB work is being performed.

F. Contractor shall notify Architect in writing within three days of receiving direction resulting in reduction of test and balance scope or other deviations from Contract Documents. Deviations from the TAB plan shall be approved in writing by the mechanical engineer of record for the Project.

G. TAB Standard:

1. Perform TAB work in accordance with the requirements of the standard under which the TAB agencies' qualifications are approved unless Specifications contain different or more stringent requirements:

   a. AABC National Standards for Total System Balance, or

   b. NEBB Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.

2. All recommendations and suggested practices contained in the TAB standard are mandatory. Use provisions of the TAB standard, including checklists and report forms, to the extent to which they are applicable to this Project.

3. Testing, adjusting, balancing procedures, and reporting required for this Project, and not covered by the TAB standard applicable to the TAB specialist engaged to perform the Work of this Contract, shall be submitted for approval by the design engineer.

H. TAB Conference: Meet with Architect and mechanical engineer on approval of the TAB strategies and procedures plan to develop a mutual understanding of the project requirements. Require the participation of the TAB field supervisor. Provide seven days' advance notice of scheduled meeting time and location. TAB conference shall take place at location selected by Architect.

1. Agenda Items:

a. The Contract Documents examination report.

b. The TAB plan.

c. Coordination and cooperation of trades and subcontractors.

d. Coordination of documentation and communication flow, including protocol for resolution tracking and documentation.

2. The requirement for TAB conference may be waived at the discretion of the mechanical engineer of record for the Project.

I. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.

2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

J. TAB Report Forms: Use standard TAB specialist's forms approved by Architect.

K. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.9 PROJECT CONDITIONS

1.10 WARRANTY

A. Provide workmanship and performance warranty applicable to TAB specialist engaged to perform Work of this Contract:

1. AABC Performance Guarantee.

2. NEBB Quality Assurance Program.

B. Refer to Division 01 Specifications for additional requirements.

1.11 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

C. Coordinate TAB work with work of other trades.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contract Documents Examination Report:

1. TAB specialist shall review Contract Documents, including plans and specifications. Provide report listing conditions that would prevent the system(s) from operating in accordance with the sequence of operations specified, or would prevent accurate testing and balancing:

a. Identify each condition requiring correction using equipment designation shown on Drawings. Provide room number, nearest building grid line intersection, or other information necessary to identify location of condition requiring correction.

b. Proposed corrective action necessary for proper system operation.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

I. Examine operating safety interlocks and controls on HVAC equipment.

J. Report conditions requiring correction discovered before and during performance of TAB procedures.

K. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures. TAB plan shall be specific to Project and include the following:

1. General description of each air system and sequence(s) of operation.

2. Complete list of measurements to be performed.

3. Complete list of measurement procedures. Specify types of instruments to be utilized and method of instrument application.

4. Qualifications of personnel assigned to Project.

5. Single-line CAD drawings reflecting all test locations (terminal units, grilles, diffusers, traverse locations, etc.

6. Air terminal correction factors for the following:

a. Air terminal configuration.

b. Flow direction (supply or return/exhaust).

c. Effective area of each size and type of air terminal.

d. Air density.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.

2. Automatic temperature-control systems are operational.

3. Equipment and duct access doors are securely closed.

4. Balance, smoke, and fire dampers are open.

5. Isolating and balancing valves are open and control valves are operational.

6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.

7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.

2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 238000 Heating, Ventilating, and Air Conditioning."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Test each system to verify building or space operating pressure, including all stages of economizer cycle. Maximum building pressure shall not exceed 0.03 inches of pressure.

C. Except as specifically indicated in this Specification, Pitot tube traverses shall be made of each duct to measure airflow. Pitot tubes, associated instruments, traverses, and techniques shall conform to ASHRAE Handbook, HVAC Applications, and ASHRAE Handbook, HVAC Systems and Equipment.

1. Use state-of-the-art instrumentation approved by TAB specialists governing agency..

2. Where ducts' design velocity and air quantity are both less than 1000 fpm/CFM, air quantity may be determined by measurements at terminals served.

D. Test holes shall be placed in straight duct, as far as possible downstream from elbow, bends, take-offs, and other turbulence-generating devices.

E. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

F. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

G. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

H. Verify that motor starters are equipped with properly sized thermal protection.

I. Check dampers for proper position to achieve desired airflow path.

J. Check for airflow blockages.

K. Check condensate drains for proper connections and functioning.

L. Check for proper sealing of air-handling-unit components.

M. Verify that air duct system is sealed as specified in Section 238000 "Heating, Ventilating, and Air Conditioning."

N. Provide for adjustments or modifications to fan and motor sheaves, belts, damper linkages, and other components as required to achieve specified air balance at no additional cost to Owner.

O. Automatically operated dampers shall be adjusted to operate as indicated in Contract Documents. Controls shall be checked for proper calibration.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow. Alternative methods shall be examined for determining total CFM, i.e., Pitot-tube traversing of branch ducts, coil or filter velocity profiles, prior to utilizing airflow values at terminal outlets and inlets.

2. Measure fan static pressures as follows to determine actual static pressure:

   a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.

   b. Measure static pressure directly at the fan outlet.

   c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.

   d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

   a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.

5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.

7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Check operation of relief air dampers. Measure total relief air quantity at each stage of normal, economizer, power exhaust, or power exhaust economizer operation, as applicable to installed equipment. Adjust relief air dampers to provide 100 percent relief in economizer mode. Ensure that relief dampers close completely upon unit shutdown.

C. Check operation of outside air dampers. Measure total outside air quantity at each stage of normal, economizer, power exhaust, or power exhaust economizer operation, as applicable to installed equipment. Adjust outside air dampers to provide 100 percent outside air in economizer mode. Ensure that outside air dampers close completely upon unit shutdown.

D. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

    a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.

3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

E. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading digital backflow compensating hood. Use outlet manufacturer's written instructions and calculating factors only when direct-reading hood cannot be used due to physical obstruction or other limiting factors. Final report shall indicate where values listed have not been obtained by direct measurement.

F. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents, if included.

2. Adjust patterns of adjustable outlets for proper distribution without drafts. Terminal air velocity at five feet above finished floor shall not exceed 50 feet per minute in occupied air conditioned spaces.

G. Do not overpressurize ducts.

3.6 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.

2. Motor horsepower rating.

3. Motor rpm.

4. Efficiency rating.

5. Nameplate and measured voltage, each phase.

6. Nameplate and measured amperage, each phase.

7. Starter manufacturer's name, model number, size, type, and thermal-protection-element rating.

a. Starter strip heater size, type, and rating.

3.7 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.8 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.

2. Wet-bulb temperature of entering and leaving air.

3. Airflow.

4. Air pressure drop.

3.9 GENERAL PROCEDURES FOR PLUMBING SYSTEMS

A. Measure pressure drop across each backflow preventer assembly at design flows.

B. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to

head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.

a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Architect and comply with requirements in Section 225000 “Plumbing Equipment

2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.

a. Monitor motor performance during procedures and do not operate motors in overload conditions.

3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.

4. Report flow rates that are not within range given in article, Tolerances.

C. Set calibrated balancing valves, if installed, at calculated presettings.

D. Measure flow at all stations and adjust, where necessary, to obtain first balance.

1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

E. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

F. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:

1. Determine the balancing station with the highest percentage over indicated flow.

2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.

3. Record settings and mark balancing devices.

G. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

H. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.

I. Check settings and operation of each safety valve. Record settings.

3.10 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 10 percent and minus 0 percent.

2. Air Outlets and Inlets: Plus 5 percent and minus 5 percent.

3. Multiple outlets within single room: Plus 5 percent and minus 0 percent for total airflow within room. Tolerance for individual outlets within a single room having multiple outlets shall be as for “Air Outlets and Inlets”.

a. Room shall be balanced to create pressure relationship (positive, negative, or neutral) with adjacent spaces as indicated on Drawings. Maintain airflow differentials between supply, return, and exhaust indicated on Drawings.

4. Heating-Water Flow Rate: .

5. Cooling-Water Flow Rate: .

B. Set plumbing systems water flow rates within plus or minus 10 percent.

3.11 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Interim Reports: Prepare periodic lists of conditions requiring correction and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.12 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing field supervisor. Report shall

be co-signed by the Contractor, attesting that he has reviewed the report, and the report has been found to be complete and accurate.

2. The certification sheet shall be followed by sheet(s) listing items for which balancing objectives could not be achieved. Provide explanation for failure to achieve balancing objectives for each item listed.

3. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.

2. Fan curves.

3. Manufacturers' test data.

4. Field test reports prepared by system and equipment installers.

5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.

2. Name and address of the TAB specialist.

3. Project name.

4. Project location.

5. Project Performance Guaranty

6. Architect's name and address.

7. Engineer's name and address.

8. Contractor's name and address.

9. Report date.

10. Signature of TAB supervisor who certifies the report.

11. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.

12. Summary of contents including the following:

a. Indicated versus final performance.

b. Notable characteristics of systems.

c. Description of system operation sequence if it varies from the Contract Documents.

13. Nomenclature sheets for each item of equipment.

14. Test conditions for fans and pump performance forms including the following:

a. Settings for outdoor-, return-, and exhaust-air dampers.

b. Conditions of filters.

c. Cooling coil, wet- and dry-bulb conditions.

d. Fan drive settings including settings and percentage of maximum pitch diameter.

e. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.

2. Duct, outlet, and inlet sizes.

3. Pipe and valve sizes and locations.

4. Balancing stations.

5. Position of balancing devices.

E. Air distribution outlets and inlets shall be shown on keyed plans with designation for each outlet and inlet matching designation used in Contract Documents and TAB test reports. Room numbers shall be included in keyed plans and test reports. Where multiple outlets and inlets are installed within a single room, a designation shall be assigned and listed for each outlet and inlet in addition to room number.

F. Test Reports – General:

1. All test reports containing air or liquid flow data shall record flow values prior to system adjustment in addition to required data listed for each test report.

G. Apparatus-Coil Test Reports:

1. Coil Data:

    a. System identification.

    b. Location.

    c. Coil type.

    d. Number of rows.

    e. Fin spacing in fins per inch o.c.

    f. Make and model number.

    g. Face area in sq. ft.

    h. Tube size in NPS.

    i. Tube and fin materials.

    j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

    a. Air flow rate in cfm.

    b. Average face velocity in fpm.

    c. Air pressure drop in inches wg.

    d. Outdoor-air, wet- and dry-bulb temperatures in deg F.

    e. Return-air, wet- and dry-bulb temperatures in deg F.

    f. Entering-air, wet- and dry-bulb temperatures in deg F.

    g. Leaving-air, wet- and dry-bulb temperatures in deg F.

    h. Refrigerant expansion valve and refrigerant types.

H. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

    a. System identification.

    b. Location.

    c. Make and type.

    d. Model number and unit size.

e. Manufacturer's serial number.

f. Fuel type in input data.

g. Output capacity in Btu/h.

h. Ignition type.

i. Burner-control types.

j. Motor horsepower and rpm.

k. Motor volts, phase, and hertz.

l. Motor full-load amperage and service factor.

m. Sheave make, size in inches, and bore.

n. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.

b. Entering-air temperature in deg F.

c. Leaving-air temperature in deg F.

d. Air temperature differential in deg F.

e. Entering-air static pressure in inches wg.

f. Leaving-air static pressure in inches wg.

g. Air static-pressure differential in inches wg.

h. Low-fire fuel input in Btu/h.

i. High-fire fuel input in Btu/h.

j. Manifold pressure in psig.

k. High-temperature-limit setting in deg F.

l. Operating set point in Btu/h.

m. Motor voltage at each connection.

n. Motor amperage for each phase.

o. Heating value of fuel in Btu/h.

I. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

   a. System identification.

   b. Location.

   c. Make and type.

   d. Model number and size.

   e. Manufacturer's serial number.

   f. Arrangement and class.

   g. Sheave make, size in inches, and bore.

   h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

   a. Motor make, and frame type and size.

   b. Horsepower and rpm.

   c. Volts, phase, and hertz.

   d. Full-load amperage and service factor.

   e. Sheave make, size in inches, and bore.

   f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

   g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

   a. Total airflow rate in cfm.

   b. Total system static pressure in inches wg.

   c. Fan rpm.

   d. Discharge static pressure in inches wg.

   e. Suction static pressure in inches wg.

J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

    a. System and air-handling-unit number.

    b. Location and zone.

    c. Traverse air temperature in deg F.

    d. Duct static pressure in inches wg.

    e. Duct size in inches.

    f. Duct area in sq. ft..

    g. Indicated air flow rate in cfm.

    h. Indicated velocity in fpm.

    i. Actual air flow rate in cfm.

    j. Actual average velocity in fpm.

    k. Barometric pressure in psig.

K. Air-Terminal-Device Reports:

1. Unit Data:

    a. System and air-handling unit identification.

    b. Location and zone.

    c. Apparatus used for test.

    d. Area served.

    e. Make.

    f. Number from system diagram.

    g. Type and model number.

    h. Size.

    i. Effective area in sq. ft.

2. Test Data (Indicated and Actual Values):

    a. Air flow rate in cfm.

    b. Air velocity in fpm.

c. Preliminary air flow rate as needed in cfm.

d. Preliminary velocity as needed in fpm.

e. Final air flow rate in cfm.

f. Final velocity in fpm.

g. Space temperature in deg F.

L. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

a. Unit identification.

b. Location.

c. Service.

d. Make and size.

e. Model number and serial number.

f. Water flow rate in gpm.

g. Water pressure differential in feet of head or psig.

h. Required net positive suction head in feet of head or psig.

i. Pump rpm.

j. Impeller diameter in inches.

k. Motor make and frame size.

l. Motor horsepower and rpm.

m. Voltage at each connection.

n. Amperage for each phase.

o. Full-load amperage and service factor.

p. Seal type.

2. Test Data (Indicated and Actual Values):

a. Static head in feet of head or psig.

b. Pump shutoff pressure in feet of head or psig.

c. Actual impeller size in inches.

d. Full-open flow rate in gpm.

e. Full-open pressure in feet of head or psig.

f. Final discharge pressure in feet of head or psig.

g. Final suction pressure in feet of head or psig.

h. Final total pressure in feet of head or psig.

i. Final water flow rate in gpm.

j. Voltage at each connection.

k. Amperage for each phase.

M. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.

b. Serial number.

c. Application.

d. Dates of use.

e. Dates of calibration.

3.13 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.

2. Check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.

b. Measure water flow of at least 5 percent of terminals.

c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.

d. Verify that balancing devices are marked with final balance position.

e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.

2. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Architect.

3. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

4. If rechecks yield measurements that differ from the measurements documented in the final report by more than 10 percent, the measurements shall be noted as "FAILED."

5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.

2. If the second final inspection also fails, Owner may contact the TAB specialists' governing organization for remedial action by the governing organization under the workmanship and performance warranty. See article, Warranty.

3. If remedial action is not provided by the TAB specialists' governing organization in a timely manner, Owner may contract the services of another TAB specialist to complete the TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB specialists' final payment.

D. Prepare test and inspection reports.

3.14 ADDITIONAL TESTS

A. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 80 00
HEATING, VENTILATING AND AIR CONDITIONING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Heat pump units.
2. Split system air conditioning units.
3. Variable Refrigerant Flow - Split system heat pump units.
4. Fan Coils
5. Air cooled condensing units.
6. Cooling coils.
7. Refrigeration piping and fittings.
8. Fans.
9. Relief and intake vents.
10. Air inlets and outlets.
11. Filters.
12. Dampers.
13. Ductwork.
14. Insulation.

1.2 RELATED REQUIREMENTS

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

B. Section 23 00 50, Basic HVAC Materials and Methods.

C. 23 05 93, Testing, Adjusting, and Balancing for HVAC.

D. Section 23 09 23, Direct Digital Control (DDC) System for HVAC.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meetings:

1. Variable Refrigerant Flow System Conference: Installing contractor's foreman shall attend conference at Project site with design Engineer and equipment manufacturer's representative, to comply with requirements of this Section and manufacturer's installation requirements including but not limited to, the following:

a. Proposed deviations from system as shown and described in Contract Documents, including location of system components and impacts to refrigerant pipe sizing.

1) Provide Coordinated Layouts as required by this Section for use in discussion.

b. Refrigerant piping assembly practices.

c. General discussion, question and answer period.

d. Walk site with equipment manufacturer's representative to identify conditions affecting installation of system as designed.

1.4 ACTION SUBMITTALS

A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.

B. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, dimensions, weight, corner or mounting point weights, furnished specialties and accessories; and installation and start-up instructions. Product data shall include applicable product listings and standards. Refer to Section 23 00 50, Basic HVAC Material and Methods for additional requirements.

1. Upon approval of submittal, provide manufacturer's installation and operating instructions to the Project inspector for the following:

a. Fire dampers, smoke dampers, and combination smoke-fire dampers.

C. VRF Systems: Submit system documentation for a fully engineered system, including shop drawings, and wiring and control diagrams, showing location of required manufactured system components, component model numbers and capacities, and size and location of all field-installed components, including piping, required expansion compensation devices, and wiring. Identify proposed deviations from system as shown in Contract Documents.

D. Engineering Data: Submit fan curves and sound power level data for each fan unit. Data shall be at the scheduled capacity. Data shall include the name of the rating agency or independent laboratory.

1.5 INFORMATIONAL SUBMITTALS

A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.

B. Roof Curb Data: For roof mounted equipment where combined weight of equipment unit and roof curb or rail exceeds 400 pounds, submit calculations from manufacturer for roof curbs proving compliance with the seismic requirements of the California Building Code, and ASCE 7-10. Manufacturer shall certify that roof curbs are suitable for use indicated on Drawings and in Specifications for the seismic design category indicated in structural Contract Documents. Calculations shall be stamped and signed by a State of California registered structural engineer.

C. Economizer Fault Detection and Diagnostics (FDD) System Data: For all air-cooled unitary direct-expansion units equipped with an economizer, provide data for third-party supplied California Energy Commission certified FDD controller, documenting compliance with the requirements of California Building Energy Efficiency Standards. Provide evidence of certification.

D. Record of pre-installation meeting.

E. Training Certificates of Completion: Submit certificate from equipment manufacturer, indicating attendance and successful completion of manufacturer's training program for variable refrigerant flow systems installation and service. Training shall include manufacturer's preferred methods for assembling and insulating refrigerant piping and accessories.

F. Coordinated Layouts: Submit coordinated layouts. For requirements refer to article, Coordinated Layouts, in this Section.

1.6 CLOSEOUT SUBMITTALS

A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.

B. Maintenance Data: Submit maintenance data and parts list for each piece of equipment, control, and accessory; including "trouble-shooting guide," in Operation and Maintenance Manual.

C. Record Drawings: Submit Record Drawings of installed ductwork, duct accessories, and outlets and inlets in accordance with requirements of Division 01.

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. Belts: One set(s) for each belt-driven unit.

2. Provide one complete set(s) of filters for each filter bank.

1.8 COORDINATED LAYOUT

A. Coordinated layouts are required to amplify, expand and coordinate the information contained in the Contract Documents.

B. Provide minimum 1/4 inch equals one foot scaled coordinated layout drawings showing plan and pertinent section or elevation views of piping, ductwork, equipment, accessories, and electrical systems. Drawings shall be reproducible and work of each trade represented shall be fully coordinated with structure, other disciplines, and finished surfaces. Drawings shall be presented on a single size sheet. Coordinated layout drawings shall have title block, key plan, north arrow and sufficient grid lines to provide cross-reference to design Drawings.

1. Provide a stamp or title block on each drawing with locations for signatures from all contractors involved, including but not limited to the General, HVAC, Plumbing, Fire Protection, and Electrical contractors. Include statement for signature that the contractor has reviewed the coordinated layout drawings in detail and has coordinated the work of his trade.

2. Show on drawings the intended elevation of all ductwork in accordance with the following example:

a. B.O.D. = 9'-0"
OFFSET UP 6"
B.O.D. = 9'-6"

3. Highlight, encircle or otherwise indicate deviations from the Contract Documents on the coordinated layouts. Architect will not be responsible for identifying deviations from the original Contract Documents.

C. Since scale of contract drawings is small and all offsets and fittings are not shown, Contractor shall make allowances in bid for additional coordination time, detailing, fittings, offsets, hangers and the like to achieve a fully coordinated installation. If changes in duct size are required, equivalent area shall be maintained and the aspect ratio shall not be in excess of 2 to 1 unless approved by the engineer. Drawings shall be submitted for review prior to fabrication and installation. Drawings may be submitted in packages representing at least one quarter of the building ductwork.

D. Check routing on all ductwork before fabricating. Report any discrepancies to Architect. No extra cost will be allowed for failure to conform to above.

1.9 QUALITY ASSURANCE

A. Design Criteria:

1. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture. All gas-fired equipment shall be UL, ETL or CSA listed.

2. Supply all equipment and accessories in accordance with requirements of applicable national, state and local codes.

3. All items of a given type shall be products of the same manufacturer.

4. Scheduled equipment performance is minimum capacity required.

5. Scheduled electrical capacity shall be considered as maximum available.

6. Scheduled gas BTU input shall be considered as maximum available.

B. Variable Refrigerant Flow Split-System Heat Pump Installer Training: Installing contractor shall have completed training in installation and service of VRF system, by equipment manufacturer.

1. Installing contractor shall obtain, at his own cost, equipment manufacturer's VRF system service tool, unless service tool is normally resident on controller specified for this Project.

1.10 FIELD CONDITIONS

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

1. Notify Architect no fewer than two days in advance of proposed interruption of services.

2. Do not interrupt services without Architect's written permission.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2.2 GAS FIRED EQUIPMENT

A. All gas-fired equipment shall be listed for use as a gas appliance.

B. All units shall comply with the emissions requirements of the Air Quality Management District (AQMD) in which they are to be installed.

2.3 SPLIT SYSTEM HEAT PUMPS

A. General: Furnish and install split system air-to-air heat pump system, with R410A refrigerant, and complete with automatic controls. Equipment shall be shipped factory assembled, wired, tested, and ready for field connections.

B. Quality Assurance:

1. Unit shall be ETL or UL listed and labeled.

2. Unit shall be manufactured in a facility registered to ISO 9001:2000.

3. Unit shall be rated in accordance with ARI standard 210.

C. Delivery, Storage and Handling: Follow manufacturer's recommendations.

D. Heating/Cooling System: The total certified heating/cooling capacity shall not be less than scheduled. The compressor power input shall not exceed that of the unit specified.

E. Indoor Section: Wall mounted, ceiling surface mounted, or ceiling recessed mounted, as indicated on Drawings.

1. Cabinet:

a. Wall mounted: Molded white high strength plastic.

1) Provide wall mounted unit with factory mounting plate.

b. Ceiling surface mounted: Molded white high strength plastic with provision for outside air duct connection.

c. Ceiling recessed mounted: galvanized steel with provision for outside air duct connection.

2. Fans: Double inlet, forward curved, statically and dynamically balanced.

3. Fan Motor: Direct drive, permanently lubricated, with two or 4 speed operation for unit size scheduled on Drawings.

a. For single-phase fan motors sized larger than 1/12 hp and smaller than 1 hp, refer to Article, Electric Motors, in Section 23 00 50, Basic HVAC Materials and Methods.

4. Air Outlet: With motorized horizontal and vertical vanes.

a. Wall and ceiling surface mounted units: Horizontal vane shall close air outlet upon unit shut-down.

5. Evaporator Coil: Aluminum fins mechanically bonded to copper tubes. Coils shall be pressure leak tested.

6. Insulation: Interior surfaces exposed to the airstream shall be fully insulated.

F. Outdoor Section:

1. Casing: Galvanized steel plate, powder coated with acrylic or polyester.

2. Condenser Fan Grille: ABS plastic.

3. Fan and fan motor: Direct drive, totally enclosed, propeller type, permanently lubricated, horizontal discharge.

4. Compressor: Variable speed rotary type, with crankcase heater and accumulator. Compressor shall be capable of operating at 0 degrees F. Compressor mounted on vibration isolator pads.

5. Coil: Aluminum fins mechanically bonded to copper tubes. Coils shall be pressure leak tested. Provide coil with integral metal guard.

G. Controls: Hard wired, microprocessor based, wall mounted controller with LCD display shall provide the following functions, as a minimum:

1. 7-day programmable timer.

2. Test and check functions.

3. Diagnostic functions.

4. Vane position control.

5. Fan speed adjustment.

6. Temperature adjustment.

7. Automatic restart.

8. Mode selection, including heat/auto/cool/dry/fan.

a. Provide lockable enclosure for wall mounted controller.

H. Safeties: Shall include the following, as a minimum:

1. Five minute compressor anti-recycle timer.

2. High pressure protection.

3. Current and temperature sensing motor overload protection.

I. Filters: Provide manufacturers washable filters for indoor unit. Provide sufficient filters for four complete changes for each unit.

J. Service Access: All components, wiring, and inspection areas shall be completely accessible through removable panels.

K. Refrigerant Piping:

1. Provide factory pre-charged and sealed line set piping, length to suit the location of equipment. Tubing sizes shall be in accordance with manufacturers written instructions.

2. Provide refrigeration piping in accordance with Article, Refrigerant Piping, in this Section.

L. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. DAIKEN.

2. Carrier Corporation.

3. Sanyo Electric Co., Ltd.

M. Owner Training: Manufacturer shall provide one on-site 2-hour training session for Owners' maintenance personnel.

2.4 SPLIT SYSTEM AC UNIT

A. General: Furnish and install split system air conditioner, with R410A refrigerant, and complete with automatic controls. Equipment shall be shipped factory assembled, wired, tested, and ready for field connections.

B. Quality Assurance:

1. Unit shall be ETL or UL listed and labeled.

2. Unit shall be manufactured in a facility registered to ISO 9001:2000.

3. Unit shall be rated in accordance with ARI standard 210.

C. Delivery, Storage and Handling: Follow manufacturer's recommendations.

D. Cooling System: The total certified cooling capacity shall not be less than scheduled. The compressor power input shall not exceed that of the unit specified.

E. Indoor Section: Wall mounted, ceiling surface mounted, or ceiling recessed mounted, as indicated on Drawings.

1. Cabinet:

a. Wall mounted: Molded white high strength plastic.

1) Provide wall mounted unit with factory mounting plate.

b. Ceiling surface mounted: Molded white high strength plastic with provision for outside air duct connection.

c. Ceiling recessed mounted: galvanized steel with provision for outside air duct connection.

2. Fans: Double inlet, forward curved, statically and dynamically balanced.

3. Fan Motor: Direct drive, permanently lubricated, with two or 4 speed operation for unit size scheduled on Drawings.

a. For single-phase fan motors sized larger than 1/12 hp and smaller than 1 hp, refer to Article, Electric Motors, in Section 23 00 50, Basic HVAC Materials and Methods.

4. Air Outlet: With motorized horizontal and vertical vanes.

a. Wall and ceiling surface mounted units: Horizontal vane shall close air outlet upon unit shut-down.

5. Evaporator Coil: Aluminum fins mechanically bonded to copper tubes. Coils shall be pressure leak tested.

6. Insulation: Interior surfaces exposed to the airstream shall be fully insulated.

F. Outdoor Section:

1. Casing: Galvanized steel plate, powder coated with acrylic or polyester.

2. Condenser Fan Grille: ABS plastic.

3. Fan and fan motor: Direct drive, totally enclosed, propeller type, permanently lubricated, horizontal discharge.

4. Compressor: Variable speed rotary type, with crankcase heater and accumulator. Compressor shall be capable of operating at 0 degrees F. Compressor mounted on vibration isolator pads.

5. Coil: Aluminum fins mechanically bonded to copper tubes. Coils shall be pressure leak tested. Provide coil with integral metal guard.

G. Controls: Hard wired, microprocessor based, wall mounted controller with LCD display shall provide the following functions, as a minimum:

1. 7-day programmable timer.

2. Test and check functions.

3. Diagnostic functions.

4. Vane position control.

5. Fan speed adjustment.

6. Temperature adjustment.

7. Automatic restart.

8. Mode selection, including cool/dry/fan.

    a. Provide lockable enclosure for wall mounted controller.

H. Safeties: Shall include the following, as a minimum:

1. Five minute compressor anti-recycle timer.

2. High pressure protection.

3. Current and temperature sensing motor overload protection.

I. Filters: Provide 1 inch thick fiberglass throwaway filters with cardboard holding frames for indoor unit. Provide sufficient filters for four complete changes for each unit.

J. Service Access: All components, wiring, and inspection areas shall be completely accessible through removable panels.

K. Refrigerant Piping:

1. Provide factory pre-charged and sealed line set piping, length to suit the location of equipment. Tubing sizes shall be in accordance with manufacturers written instructions.

2. Provide refrigeration piping in accordance with Article, Refrigerant Piping, in this Section.

L. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Mitsubishi Electric Corporation.

2. Carrier Corporation.

3. Sanyo Electric Co., Ltd.

M. Owner Training: Manufacturer shall provide one on-site 2-hour training session for Owners' maintenance personnel.

2.5 VARIABLE REFRIGERANT FLOW - SPLIT SYSTEM HEAT PUMPS – HEAT RECOVERY TYPE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Basis of Design: Daikin.
2. Carrier.
3. Mitsubishi.

B. Indoor Units

1. General:
   a. Galvanized steel casing.
   b. Ducted, ceiling-recessed, or in-room units per Drawings schedule. Available styles shall include:
      1) Concealed (ducted) units:
         a) Ceiling concealed.
      2) Recessed Units:
         a) Ceiling-recessed units: One-, two-, and four-way throw configurations.
      3) In-room units:
         a) Ceiling-suspended.
         b) Wall-mounted.
   c. Factory assembled and tested with factory wiring, piping, expansion valve, control circuit board, and fan motor. Units shall have, as a minimum, the following functions:
      1) Self-diagnostic function.
      2) Auto restart function.
      3) Auto changeover function.
      4) Emergency operation function.
      5) 3-minute time delay shall provide minimum 3 minute run time for cooling and heating.

d. Indoor unit and refrigerant pipes shall be charged with dehydrated air prior to shipment from the factory.

e. The indoor units shall be equipped with a return air thermistor.

2. Unit Cabinet:

a. The cabinet shall be insulated with foamed polystyrene and polyethylene insulation.

3. Fan:

a. The fan shall be direct-drive type, statically and dynamically balanced impeller with multiple high and low fan speeds. Auto fan setting shall automatically adjust fan speed.

b. The fan motor shall be thermally protected.

c. The fan motor shall be equipped as standard with adjustable external static pressure (ESP) settings.

d. For single-phase fan motors sized larger than 1/12 hp and smaller than 1 hp, refer to Article, Electric Motors, in Section 23 00 50, Basic HVAC Materials and Methods.

e. Ceiling recessed and wall-mounted units shall have motorized louvers to direct airflow in up and down directions, and manually adjusted vanes for side-to-side adjustment of airflow direction.

f. Ceiling suspended units shall have motorized guide vanes to vary airflow direction.

g. All units shall be provided with a condensate drain pan below the coil. Drain pans shall have primary and overflow drains.

h. Ceiling recessed units shall have an integral condensate pump. Refer to Drawings schedule for additional condensate pump requirements.

4. Coil:

a. Coils shall be aluminum fins bonded to internally grooved copper tubes. Fins shall have corrosion-resistant coating.

b. The coils shall be pressure tested at the factory.

c. Unit shall be provided with ball-type refrigerant service valves at each refrigerant piping connection.

d. A condensate pan and drain connections shall be provided under the coil. Provide overflow cutoff switch to disable unit during overflow condition.

5. Filters:

   a. Provide indoor units manufactured to accept washable filter media with two sets for each unit.

   b. Refer to Drawings schedule, and article, Filters, in this Section for filter requirements for ducted, above-ceiling units incorporating mixing boxes.

6. Controls:

   a. Units shall have controls provided by the manufacturer to perform input functions necessary to operate the system.

   b. Operating modes shall include Auto Changeover (heat recovery systems only), Heating, Cooling, Dry, and Fan Only.

   c. Units shall be compatible with a BMS system via optional LonWorks or BACnet gateways.

   d. Units incorporating mixing boxes for economizer operation shall be furnished with economizer control system certified as meeting the requirements for Fault Detection and Diagnostics (FDD) in the California Building Energy and Efficiency Standards.

C. Outdoor Condensing Units:

1. General:

   a. Condensing unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves (when required by manufacturer), 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports and refrigerant accumulator and regulator.

   b. The following safety devices shall be included as part of the condensing unit; high pressure sensor and switch, low pressure sensor, control circuit fuses, over- and under-current protection, phase failure and phase reversal protection, fusible plug or pressure relief valve, and crankcase heater..

   c. All refrigerant lines shall be individually insulated between the condensing units and indoor units. .

   d. The system will automatically restart operation after a power failure without loss of settings.

   e. The condensing units shall be modular in design and allow for side-by-side installation with minimum spacing. Provide kit for field piping

between connected condensing units. Refer to Drawings schedules and diagrams for connected units.

f. To ensure the liquid refrigerant does not flash when supplying to indoor units, the circuit shall be provided with a sub-cooling feature.

g. Oil recovery cycle shall be automatic occurring 2 hours after start of operation, and thereafter every 8 hours of operation. Each system shall maintain continuous heating during oil return operation. Reverse cycle (cooling mode) oil return during heating operation shall not be permitted due to the potential reduction in space temperature.

h. The condensing unit shall be capable of heating operation at 0°F dry bulb ambient temperature without additional low ambient controls or an auxiliary heat source.

1) Provide condensing unit with low ambient kit when scheduled on Drawings. Low ambient kit components shall be furnished with NEMA 4x rated control box for outdoor installation.

2. Unit Cabinet:

a. The condensing unit cabinet shall be weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed galvanized steel panels coated with a baked enamel or powder coat finish.

3. Fan:

a. The condensing unit shall consist of one or more direct-drive, vertical discharge propeller fans with blades constructed of thermoplastic polymer material.

b. The condensing unit fan motor shall be variable-speed digitally commutating (DC) type. Fan motor dipswitch shall allow increase of external static pressure setting.

c. The fan motor shall have inherent protection and permanently lubricated bearings and be mounted on vibration isolators.

d. The fan motor shall be provided with a fan guard to prevent contact with moving parts.

4. Condenser Coil:

a. Coils shall be aluminum fins bonded to internally grooved copper tubes. Fins shall have corrosion-resistant coating.

b. The coils shall be pressure tested at the factory.

c. Unit shall be provided with ball-type refrigerant service valves at each refrigerant piping connection.

d. Condensing unit cabinet shall be provided with metal coil guard.

5. Compressor:

a. The scroll compressors shall be variable speed pulse-width inverter (PVM inverter) controlled type, hermetically sealed, which shall vary the compressor speed to follow fluctuations in total cooling and heating load, determined by the suction gas pressure as measured in the condensing unit.

1) The inverter driven compressor motor in each condensing unit shall be the reluctance DC (digitally commutating) type.

b. Each compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.

c. Oil separators shall be provided as part of the compressor module together with an intelligent oil management system.

d. The compressor shall be isolated to avoid the transmission of vibration.

e. In the event of compressor failure the remaining compressors shall continue to operate and provide heating or cooling as required at a proportionally reduced capacity.

f. Multiple compressor operation sequencing: When multiple condenser modules are combined, operation hours of each compressor shall be balanced by means of a duty cycling function, enabling sequential starting of each module at each start/stop cycle, completion of oil return, and completion of defrost, or every 8 hours.

g. Refrigerant shall be R410a.

D. Indoor Heat Recovery Controllers: Two- or three-pipe refrigerant control units to match outdoor condensing unit configuration. Heat recovery units shall be installed between outdoor condensing units and indoor zone-conditioning units. Indoor heat recovery unit shall operate to remove heat from zones requiring cooling, and distribute that heat to zones requiring heating. Refer to Drawings for unit locations. Refer to Drawings schedules and details for unit configuration and electrical requirements.

E. Refrigerant Piping:

1. All refrigerant lines shall be individually insulated between the condensing units and indoor units.

2. For interconnecting piping between outdoor and indoor equipment, refer to Article, Refrigeration Pipe and Fittings, in this Section.

F. System Controls:

1. General: The controls network shall be capable of supporting remote controllers, schedule timers, system controllers, centralized controllers, an integrated web based interface, graphical user workstation, and system integration to a Building Management Systems via BACnet® and/or LonWorks®.

2. For additional information, Refer to Section 23 09 23, Direct Digital Control System for HVAC.

3. Programmable Local Remote Controller: The programmable local remote controller shall be capable of controlling a minimum of 16 indoor units serving a single zone, and of operation with or without a central controller. Controller shall have the following minimum functions:

   a. On/Off.

   b. Operating mode (cool, heat, auto, dry, and fan, depending on selected system type).

   c. Temperature setting.

   d. Fan speed setting.

   e. Air swing settings.

   f. Room temperature and humidity display.

   g. Occupancy sensor capable.

   h. Schedule operations.

   i. Allow/Prohibit local remote control functions.

   j. Unit level error code display.

   k. Test run.

   l. Set temperature range limit.

   m. Override of scheduled functions for indoor unit groups.

   n. Lock out of On/Off, Mode, Set Temp., Hold-button, and Air Direction.

4. Centralized Controller: The controller shall support system configuration, daily/weekly scheduling, monitoring of operation status, error email notification, online maintenance tool and malfunction monitoring. The controller shall have basic operation controls which can be applied to an

individual indoor unit, a group of indoor units, or all indoor units. (cool, heat, auto, dry, and fan)The central controller shall be able to enable or disable operation of local remote controllers via a PC. Controller shall have the following minimum functions:

a. On/Off.

b. Operating mode (cool, heat, auto, dry, and fan, depending on selected system type).

c. Temperature setting.

d. Fan speed setting.

e. Air swing settings.

f. Room temperature display.

g. Schedule operations.

h. Morning warm-up/cool-down.

i. Night setback setting.

j. Allow/Prohibit local remote control functions.

k. Unit level error code display.

l. External input/output.

m. PC data back-up.

5. BACnet® and/or LonWorks® Gateway: Gateway to allow connection to Energy Management Systems shall allow changes to the following, as a minimum:

a. On/Off.

b. Temperature setting.

c. Alarm.

d. Operating mode.

e. Fan speed setting.

f. Allow/Prohibit local remote control functions.

g. High/Low limit setback temperature (heat recovery systems only).

h. Air direction/swing settings.

6. Web browser: The controls network shall allow multiple individual users to monitor and control user defined zones via a network PC web browser.

G. Factory Service Tool: Provide to Owner equipment manufacturer's VRF system service tool, unless service tool is normally resident on controller specified for this Project.

H. Owner Training: Manufacturer shall provide one on-site 8-hour training session for Owners' maintenance personnel. 8-hour training shall include instruction in use of equipment manufacturer's service tool.

2.6 HIGH EFFICIENCY FURNACE UNIT

A. Provide high efficiency multiple-speed condensing furnace/blower unit for upflow, downflow or horizontal application as indicated on the Drawings. Design unit to conform to the following:

1. California Air Quality Management District emission requirements.

2. ANSI Z 21.47/CSA 2.3 design standard for gas-fired central furnaces.

B. Furnace unit shall have the following certifications:

1. Third party certification by CSA International to current ANSI Z 21.47/CSA 2.3 design standard for gas-fired central furnaces.

2. CSA Blue Star® and Blue Flame® labeled.

3. Efficiency testing per current DOE test procedure as listed in the Federal Register.

4. Federal Trade Commission Energy Guide efficiency labeled.

5. GAMA Consumers' Directory of Certified Efficiency Ratings listed.

C. Unit shall be manufactured in a facility registered to ISO 9001:2000.

D. Warranties:

1. Heat exchangers shall have a 20 year warranty.

2. Entire unit shall have a 5 year warranty.

E. Cabinet:

1. Pre-painted galvanized steel, minimum .030 inches thickness.

2. Acoustically insulated blower section.

3. Removable bottom closure panel for bottom return air configuration.

F. Fans and Motors:

1. Centrifugal supply air blower shall be constructed of galvanized steel, statically and dynamically balanced.

2. Blower motor shall be direct drive variable speed ECM type, with sealed permanently lubricated ball bearings.

3. Inducer motor shall be direct drive variable speed ECM type, with sealed permanently lubricated ball bearings.

G. Heating Section:

1. Primary heat exchanger shall be 20 gauge corrosion resistant aluminized steel of fold-and-crimp sectional design, with Monoport inshot burners and redundant gas valve.

2. Secondary heat exchanger shall be polypropylene laminated steel of fold-and-crimp design.

3. Heat exchanger section shall be insulated with foil-faced insulation.

4. Line voltage ignitor.

5. Sealed combustion system.

H. Filters:

1. Standard filter section shall accommodate 1 inch deep filters. Filters shall conform to the “Air Filters” Article in this Specification Section.

2. When Drawings indicate contractor-fabricated plenum containing filters, plenum shall accommodate 2 inch deep filters. Filters shall conform to the “Air Filters” Article in this Specification Section.

3. Filter section shall use standard size filters.

I. Controls:

1. Fused microprocessor based control board with diagnostic LED and self-test capability.

2. Unit blower shall operate at continuous speed only, adjust to achieve the airflow scheduled on the Drawings. Other blower speed settings shall be locked out.

J. Safeties:

1. Provide pressure switch for proving flow of flue products and manual reset over-temperature switch.

2. Provide with blower access panel safety interlock switch.

K. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Carrier Corporation.

2. Trane Inc.

L. Provide with mixed air plenum with filter rack and return and outside air dampers, arranged as indicated on Drawings.

1. Where economizer operation is indicated on Drawings, provide differential dry-bulb economizer control system, certified as meeting the requirements for Fault Detection and Diagnostics (FDD) in the California Building Energy and Efficiency Standards.

M. Provide condensate pump, arranged as indicated on Drawings, for removal of condensate from furnace units.

N. Owner Training: Manufacturer shall provide one on-site 1-hour training session for Owners' maintenance personnel.

2.7 AIR COOLED CONDENSING UNIT

A. Provide outdoor-mounted, factory assembled, single piece, air-cooled, split-system air conditioner unit suitable for ground or rooftop installation, rated in accordance with ARI Standard 210, and UL or ETL listed and labeled. Provide refrigerant charge R-410A, all internal wiring, piping, controls, compressor, and special features required prior to field start-up. Design unit to conform to the following:

1. ANSI/ASHRAE latest edition.

2. NEC latest edition.

3. Unit cabinet to be capable of withstanding Federal Test Method Standard No. 141 (Method 6061) 500-hr salt spray test.

4. Unit shall be constructed in accordance with UL standards.

B. Unit shall be certified for capacity and efficiency, and listed in the latest ARI directory.

C. Unit shall be manufactured in a facility registered to ISO 9001:2000.

D. Unit shall be Energy Star Qualified.

E. Provide unit with 5 year limited parts warranty.

F. Cabinet:

1. Unit cabinet constructed of galvanized steel, bonderized, and coated with powder coat paint.

G. Fans:

1. Direct-drive propeller type condenser fan, discharging air vertically.

2. Totally enclosed condenser fan motors, 1-phase type with Class B insulation and permanently lubricated bearings, and corrosion resistant shafts.

3. Condenser fan openings equipped with PVC-coated steel wire safety guards.

4. Statically and dynamically balanced fan blades.

H. Compressor:

1. Hermetically sealed compressor mounted on rubber vibration isolators.

2. Compressor with sound insulator.

3. Provide unit with 5 year limited compressor warranty.

I. Refrigeration Components:

1. Refrigerant circuit to include liquid and vapor line shut-off valves with sweat connections.

2. System charge of R-410A refrigerant and compressor oil.

3. Unit to be equipped with factory-supplied high-pressure switch, low pressure switch, and filter drier.

4. Provide unit with manufacturer's refrigerant line set.

5. Provide refrigeration piping in accordance with Article, Refrigerant Piping, in this Section.

J. Condenser Coil:

1. Air-cooled condenser coil constructed of aluminum fins mechanically bonded to copper tubes.

2. Coils shall be leak and pressure tested.

K. Electrical Requirements:

1. Unit shall have single point power connection.

2. Provide unit with 24V control circuit.

L. Operating Characteristics:

1. Unit shall be capable of starting and running a 115 degrees F ambient outdoor temperature per maximum load criteria of ARI Standard 210.

2. Compressor with standard controls shall be capable of operation down to 55 degrees F ambient outdoor temperature.

M. Provide the following additional components and features:

1. Provide evaporator freeze thermostat, winter start control, compressor start assist capacitor and relay, low ambient controller, and ball bearing fan motor.

2. Provide expanded metal coil guard for all sides of the air cooled condensing unit. Coil guard shall be as manufactured by MicroMetl, Can-Fab, or equal.

N. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Carrier Corporation.

2. Trane Inc.

O. Owner Training: Manufacturer shall provide one on-site 1-hour training sessions for Owners' maintenance personnel.

2.8 COOLING COIL

A. Provide direct expansion encased cooling coil.

1. Install encased coil to operate properly in vertical or horizontal position as required. Construct coil with aluminum plate fins mechanically bonded in non-ferrous tubing with all joints brazed ultrasonically. Coil shall have factory-installed refrigerant metering device, refrigerant line fittings which permit mechanical connections, and condensate pan with primary and auxiliary drain connections.

2. Construct casings of galvanneal steel, bonderize, insulate, and finish with baked enamel.

2.9 REFRIGERATION PIPE AND FITTINGS

A. Refrigeration gas and liquid piping shall be type ACR hard drawn copper tubing, cleaned and capped in accordance with ASTM B280, with wrought copper fittings. All joints shall be brazed with Sil-fos under nitrogen purge. Relief valve discharge piping shall be full size of relief discharge port.

1. Manufactured, pre-charged and pre-insulated refrigerant line-set refrigerant piping may be utilized at Contractor's discretion.

a. VRF Systems: Use of manufactured, pre-charged and pre-insulated refrigerant line-set refrigerant piping between outdoor condensing units and indoor heat recovery controllers, or distribution headers and tees is not allowed. When system manufacturer's installation instructions allow use of refrigerant line-set piping between indoor heat recovery controllers, or distribution headers and tees, and air terminal devices, follow instructions for allowable pipe size range and support to avoid forming traps in the piping.

B. Variable Refrigerant Flow Heat Pump Systems Fittings:

1. For systems manufacturers requiring engineered, pre-assembled headers and branch fittings, Contractor shall obtain such fittings from system manufacturer. Fittings shall be suitable for system type and configuration.

2. For systems manufacturers not requiring engineered, pre-assembled headers and branch fittings, Contractor shall furnish fittings complying with manufacturer's requirements.

C. Refrigeration Piping Specialties: Furnish and install Superior, Sporlan, Alco, Henry, or equal, stop valves, solenoid valves, adjustable thermal expansion valves, sight glass, flexible connection, charging valve, and drier with valve bypass in the liquid lines and Superior DFN shell and cartridge suction line filter sized 2-1/2 times tonnage.

1. Install only those refrigeration piping specialties recommended by manufacturer of specific installed equipment.

2.10 REFRIGERANT ACCESS VALVE LOCKING CAPS

A. Each refrigerant circuit access valve located outside buildings, including valves located on roofs, shall be provided with a locking cap. Caps shall be of metal construction, with threaded brass inserts. Caps shall be color-coded according to ASHRAE standards for R22 and R410A refrigerant gasses, universal color for other refrigerant gasses. Caps shall be removable only with cap manufacturer's handheld tool.

1. Provide minimum of two (2) cap removal tools for every ten (10) air conditioning units or other systems containing refrigerant installed under this Project.

2.11 FANS

A. All fans shall be Air Moving and Control Association Inc. (AMCA) labeled.

B. Provide self-aligning, enclosed ball bearings, accessible for lubrication unless specified otherwise.

C. Provide variable speed switch for all direct drive fans.

D. Roof Mounted:

1. Direct or V-belt Drive: Provide one-piece heavy-duty ventilator housings, one piece heavy gauge spun aluminum construction, with weatherproof assembly and integral weather shield. Mount ventilators on curbs furnished by the fan manufacturer. Install with fan assembly level.

2. Fan wheels shall be centrifugal design, statically and dynamically balanced. Tip speed, rpm and motor horsepower shall not exceed listing in manufacturer's catalog for unit specified.

3. Fans shall have integral factory formed base and one piece spinning without welding. Housings shall be provided with wiring channel and are to be of the direct discharge design. Motor and fan assembly shall be on vibration isolating mounts. Fans shall have capacity, speeds and motor sizes as shown.

4. Provide the following accessories:

   a. Gravity backdraft dampers.

   b. Aluminum bird screen with a minimum of 85 percent free area.

   c. Adjustable motor pulley.

E. In-Line Centrifugal Fans:

1. Centrifugal fan with airfoil blades, aluminum or steel housing, externally mounted belt-drive motor, external lube tubes, integral support brackets.

2. Provide sloped roof or flat roof type roof cap, or wall cap to suit the location indicated on the Drawings.

F. Ceiling Mounted Fans:

1. Acoustic lined cabinet, built-in back draft damper, vibration isolated fan and motor, variable speed switch.

2. Provide sloped roof or flat roof type roof cap, or wall cap to suit the location indicated on the Drawings.

G. Fan Drives:

1. Drive Design: The design horsepower rating of each drive shall be at least 1.5 times, single belt drives 2 times, the nameplate rating of the motor with proper allowances for sheave diameters, speed ratio, arcs of contact and belt length.

2. Provide variable speed drives, Dayco, Browning, Woods, or equal. Allow for replacement of fan and motor drives and belts as required to suit the balance requirements of the project.

3. Select variable speed drives to allow an increase or decrease of minimum of ten percent of design fan speed.

H. Motors:

1. Motors of 25 HP and less shall have adjustable pitch sheaves; sheaves on motors above 25 HP may be non-adjustable. Change, at no extra cost to Owner, the non-adjustable sheaves to obtain desired air quantities.

2. For single-phase fan motors sized larger than 1/12 hp and smaller than 1 hp, refer to Article, Electric Motors, in Section 23 00 50, Basic HVAC Materials and Methods.

I. Sheaves: Sheaves shall be cast or fabricated, bored to size or bushed with fully split tapered bushings to fit properly on the shafts. All sheaves shall be secured with keys and set screws.

J. Belts:

1. All belts shall be furnished in matched sets.

2. Belts shall be within 1 degree 30 minutes of true alignment in all cases.

K. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Greenheck Fan Corporation.

2. Loren Cook Company.

3. PennBarry.

4. American Coolair Corporation.

L. Owner Training: Manufacturer shall provide one on-site 1-hour training session for Owners' maintenance personnel.

2.12 RELIEF AND INTAKE VENTS

A. Galvanized steel housing with 1/2 inch mesh screen, counterbalanced backdraft damper and matching prefabricated curb. Omit backdraft damper on intake vents. Provide pitched roof curb for relief vents, and install with backdraft damper level.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Greenheck Fan Corporation.

2. Lauren Cook Company.

3. PennBarry.

4. American Coolair Corporation.

2.13 AIR INLETS AND OUTLETS

A. Except as otherwise indicated, provide manufacturer's standard inlets and outlets where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Ceiling, wall or floor Compatibility: Provide inlets and outlets with border styles that are compatible with adjacent ceiling, wall or floor systems, and that are specifically manufactured to fit into ceiling, wall or floor module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems that will contain each type of air outlet and inlet.

C. Refer to Schedule on Mechanical Drawings for details of inlets and outlets to be used.

2.14 AIR FILTERS

A. Provide MERV 13 disposable pleated media type. Refer to specific equipment Articles for filter depth and for exceptions to this specification. Filters shall conform to the following:

1. Standards:

   a. ASHRAE Standard 52.2-2007.

   b. Underwriters Laboratories: U.L. 900, Class 2.

2. Construction:

   a. Media: Synthetic or cotton-synthetic blend with radial pleats.

   b. Media Frame: High wet-strength beverage board.

   c. Media Support: Welded wire or expanded metal grid bonded to air leaving side of the media.

3. Performance: 2” deep filter shall have a maximum initial air resistance of 0.31 inches w.g.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Camfil Farr, Inc., model 30/30.

2. Flanders Corporation, model 40 LPD.

C. Temporary (Construction Period) Filters:

1. Install new temporary filters in all units that have filter systems installed. Temporary filters shall match the permanent filters that are specified for the units. Replace filters as needed, in accordance with manufacturer's directions, in order to provide protection for the unit prior to occupancy by the Owner.

2. If air handling units are operated during construction of the project, install temporary filters directly over each return air inlet. Filters shall match the permanent filters that are specified for the units. Select size of filter to completely cover the frame of the return air inlet, and tape filters firmly in place to eliminate any construction debris from entering the duct system or unit. Remove the temporary filters upon completion of the work, and repair all damaged paintwork.

D. Spare Filters:

1. Furnish two new, complete sets of filter cartridges for each filter bank on completion and acceptance of the work. Install one set of filters in units (prior to final air balance). Provide units designed to accommodate washable, permanent filters with one washable, permanent filter.

2.15 DAMPERS

A. Backdraft Dampers: Ruskin CBD2, counterbalanced, Nailer Industries, or equal.

B. Manual Air and Balance Dampers: Provide dampers of single blade type or multi-blade type constructed in accordance with SMACNA, "HVAC Duct Construction Standards," except as noted herein.

1. Rectangular Ductwork:

a. Single damper blades may be used in ducts up to 10 inches in height. Dampers shall be 16 gauge minimum. Provide self-locking regulators, equal to Ventlok 641. Provide end bearings equal to Ventlok 607 at each damper. Provide continuous solid 3/8 inch square shafts.

b. Multiple blade dampers shall be equal to Ruskin CD35 Standard Control Damper. Maximum width for multiple damper blades for use in rectangular duct shall not exceed 6 inches.

c. Where duct velocity may be expected to exceed 1500 fpm, provide Ruskin CD-50, or equal, low leakage dampers with airfoil blades.

2. Round Ductwork:

a. Single damper blades may be used in ducts up to 12 inches in diameter. Provide multiple blade opposed blade dampers, with connected linkage, for ductwork larger than 12 inches in diameter.

b. Damper blades for round ductwork shall be 20 gauge steel for ducts up to 12 inches diameter and 16 gauge steel for dampers larger than 12 inches damper. Provide self-locking regulators, equal to Ventlok 641, Durodyne, or equal for operation of dampers. Provide end bearings equal to Ventlok 607 and provide continuous solid 3/8 inch square shafts.

3. Where ductwork is externally insulated, provide self-locking regulators equal to Ventlok 644, Durodyne, or equal for rectangular ductwork, and Ventlok 637, Durodyne, or equal for round ducts.

C. Fire Dampers and Combination Fire/Smoke Dampers:

1. Fire dampers and combination fire/smoke dampers shall be listed and approved by the California State Fire Marshal. Installation shall conform to the manufacturer's UL approved installation instructions.

a. Fire dampers shall be UL 555 classified and labeled as dynamic fire dampers approved for wall and floor installation. They shall ship from the manufacturer as an assembly with a minimum 20-gauge factory installed sleeve. Sleeve length shall suit the requirements of the wall construction. Each dynamic fire damper/sleeve assembly shall ship complete with factory "roll formed" one-piece angles with pre-punched holes for easy installation. Dynamic fire dampers for vertical installation must consist of a single section on sizes up to 33" x 36" and a single section on sizes up to 24" x 24" for horizontal installation. 1-1/2 hour dynamic fire dampers shall be Ruskin DIBD20, Pottorff, or equal. 3 hour dynamic fire dampers shall be Ruskin DIBD230, Pottorff, or equal.

b. Fire dampers for ceiling installation shall be UL 555C classified and labeled as ceiling dampers. They shall be provided with a thermal insulating blanket to fit the inlet or outlet condition if required by the application. Ceiling dampers shall be Ruskin CFD 2, 3, 4 or 5. Ceiling dampers for ceilings constructed of wood shall have UL tested in design L501 and shall be Ruskin CFD7, Pottorff, or equal.

c. Combination fire/smoke dampers. Dampers shall be UL classified and labeled as Leakage Class I Smoke Dampers in accordance with the latest version of UL 555S. Dampers shall be warranted to be free from defects in material and workmanship for a period of 5 years after date of shipment. Damper/actuator assembly shall be tested to full open and full close at minimum 2000 fpm 250° F heated air and 4" w.g. with airflow in both directions. (Specified select: 250° / 350°, 2000 fpm/3000 fpm). Each damper shall be equipped with "controlled closure" quick detect heat actuated release device to prevent duct and HVAC component damage resulting from instantaneous damper closure. Release device shall be EFL type and shall allow reset from outside the sleeve after moderate temperature exposure. (Replacement type fusible links not acceptable.)

d. Two position combination fire smoke dampers shall be equipped with one or more factory installed, direct coupled, 120 volt, single phase, electric actuator for energize open – fail close operation. Dampers with multiple actuators shall be factory wired with single point connection at the EFL heat release devise for connection to poser. Damper actuator shall include minimum one-year energized hold open (no cycles) and spring return (fail) close reliability. Damper/actuator shall include minimum 20,000 full open-full close cycle performances.

e. Modulating combination fire smoke dampers shall be equipped with one or more factory installed contact for modulating signal connection. Damper/actuator shall include minimum 100,000 full open-full close cycle performances with spring return (fail) close on loss of power.

f. Round combination fire smoke dampers up to 24” diameter shall be true round type with minimum 20 gauge galvanized steel designed for lowest pressure drop and noise performance. Bearings shall be stainless steel sleeve turning in an extruded hole in the frame. Blade seals shall be silicone edge designed to withstand 450° F and galvanized steel mechanically locked in to the blade edge (adhesive type seals are not acceptable). Each damper shall be equipped with a factory-installed sleeve of 17 inches minimum length and factory “roll formed” one-piece angles with pre-punched holes. Dampers shall be Ruskin FSDR25, Pottorff, or equal.

g. Round (larger than 24” diameter) or rectangular combination fire smoke dampers shall include roll-formed structural hat channel frame, reinforced at the corners, formed from a single piece of minimum 16 gauge equivalent thickness formed from single piece galvanized steel. Bearings shall be stainless steel turning in an extruded hole in the frame. Blade edge seals shall be silicone rubber designed to withstand 450° F and galvanized steel mechanically locked in to the blade edge (adhesive type seals are not acceptable). Each damper shall be equipped with a factory-installed sleeve of 17” minimum length and factory “roll formed” one-piece angles with pre-punched holes for easy installation. Dampers shall be Ruskin FSD60, Pottorff, or equal.

h. 3-hour rated combination fire smoke dampers shall be Ruskin model FSD60-3, Pottorff, or equal.

i. All FSD60 type dampers shall be AMCA licensed and shall bear the AMCA Seal for Air Performance. AMCA certified testing shall verify pressure drop does not exceed .03” w.g. at a face velocity of 1,000 fpm on a 24” x 24” damper.

j. Wall type fire/smoke damper:

1) Combination fire/smoke dampers for use in the wall of exit corridors shall be classified and labeled as Leakage Class II Smoke Dampers in accordance with the latest version of UL 555S. Dampers shall meet the requirements for combination fire/smoke dampers in paragraph 3 above except AMCA certified testing shall verify pressure drop does not exceed .07" w.g. at a face velocity of 1,000 fpm on a 24" x 24" damper and blades shall be single skin galvanized steel 10 gauge minimum with 3 longitudinal grooves for reinforcement. Dampers shall be Ruskin FSD36, Pottorff, or equal.

2) Front access combination fire/smoke dampers shall meet all the requirements for combination fire/smoke dampers in paragraph 3 above except pressure drop requirement. In addition the dampers shall be constructed so that actuators and all accessories are accessible from the grille side. Actuators and accessories shall be housed within an integral cabinet on the side of the damper frame and shall not be installed in the air stream in front of the damper. The damper sleeve shall be minimum 14" and flanged to accept a steel framed grille. The sleeve shall be covered with fire resistant material. Dampers shall be Ruskin FSD60FA, Pottorff, or equal.

k. Ceiling type fire/smoke damper for tunnel type corridor construction: Combination fire/smoke dampers for use in the corridor ceiling of tunnel type corridor construction shall be UL classified and labeled as Corridor Damper. Dampers shall meet the requirements of paragraph 4a above except pressure drop testing does not require AMCA certification. Dampers shall be Ruskin FSD36C, Pottorff, or equal.

l. Fusible links shall have temperature rating approximately 50° F above normal maximum operating temperature of the heat producing appliance.

1) If project requires re-openable fire/smoke dampers, provide Ruskin 165 ° F / 350° F TS150, NCA or equal. The TS150 firestat replaces the EFL and allows the damper to be re-opened from remote location up to 350 ° F. TS150 shall include full open and full closed damper position contacts for interface with remote position indication panel.

2) Each fire/smoke damper shall be equipped with "controlled closure" quick detect heat actuated release device to prevent duct and HVAC component damage. Release device shall allow easy reset after moderate temperature rise outside the sleeve. Heat release device shall be the Ruskin EFL, NCA or equal.

3) Unless the system is using a validation control system, each fire/smoke damper shall be equipped with a control panel including blade position indicator lights and a key operated switch. The panel cover shall be oversized for flush mount into the wall or ceiling and shall have a brushed look. Control panel shall be Ruskin MCP2, Pottorff, or equal.

2. All actuators used for smoke dampers or combination fire/smoke dampers shall have a cycle time requirement of not more than every twelve months and shall be rated for continuous "0n" duty and shall be provided with internal spring return. Actuators shall be equipped with pilot light, remote key test switch, end switch and circuitry to activate pilot light on remote key (test) switch located in corridor ceiling adjacent to damper. Electric motors shall be Invensys MA-250, MA-253, Honeywell H2000, or equal.

2.16 DUCTWORK

A. Construct and install all sheet metal ductwork in accordance with the California Mechanical Code for 2 inches static pressure for supply air, and 2 inches minimum for return and exhaust air unless otherwise noted on Drawings.

1. Where not in conflict with the California Mechanical Code, construct and install all sheet metal ductwork in accordance with SMACNA HVAC Duct Construction Standards (Metal and Flexible). Where applicable for HVAC work, construct and install sheet metal work in accordance with SMACNA Architectural Sheet Metal Manual.

2. Provide variations in duct size, and additional duct fittings as required to clear obstructions and maintain clearances as approved by the Architect at no extra cost to the Owner.

3. Gauges, joints and bracing shall be in accordance with the California Mechanical Code.

4. Provide beading or cross breaking for all ductwork inside building. Provide cross breaking for ductwork exposed to weather.

5. At the contractor's option, ductwork may be fabricated using the Ductmate, Nexus, Quickduct, Transverse Duct Connection (TDC), Pyramid-Loc duct connection systems, or equal. Fabricate in strict conformance with manufacturer's written installation instructions and in accordance with California Mechanical Code.

a. Seal flanged ends with pressure sensitive high density, closed cell neoprene or polyethylene tape gasket, Thermo 440, or equal.

b. Provide metal clips for duct connections, except at breakaway connections for fire dampers and fire smoke dampers. Provide corner clips at each corner of duct, through bolted, at all locations except at breakaway connections for fire dampers and fire smoke dampers. Where used on locations exposed to weather, provide

continuous metal clip at top and sides of duct, with 1 inch overhang for top side.

B. Design and installation standards:

1. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) for all work in this section.

2. NFPA Compliance: Comply with ANSI/NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," and ANSI/NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."

3. California Mechanical Code.

C. Fabricate all ductwork with sheet metal. Fiberglass ductwork will not be accepted for use on this project.

D. Duct sizes indicated are external sizes.

E. Galvanized Sheet Steel: Lock-forming quality, ASTM A924 and ASTM A653, Coating Designation G 90. Provide mill phosphatized finish for exposed surfaces of ducts exposed to view.

1. Provide mill certification for galvanized material at request of the Project Inspector.

F. Duct Sealants:

1. Sealant shall have a VOC content of 250 g/L or less.

2. Sealant shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

3. Provide one part, non-sag, synthetic latex sealant, formulated with a minimum of 68 percent solids. Sealant shall comply with ASTM E84, Surface Burning Characteristics.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1) Design Polymerics, model DP1010.

2) Polymer Adhesive Sealant Systems Inc, model Airseal #11.

3) McGill Airseal, LLC.

G. Provide sheet metal angle frame at all duct penetrations to wall, floor, roof, or ceiling.

H. Duct Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, straps, trim, and angles for support of ductwork.

I. Rectangular Duct Fabrication:

1. Shop fabricate ductwork of gauges and reinforcement complying with the more stringent of the following standards, except as noted herein.

   a. SMACNA HVAC Duct Construction Standards

   b. California Mechanical Code

2. Fabricate ducts for 2 inch pressure class with minimum duct gauges and reinforcement as follows, except as otherwise noted:

Table A

Duct Dimension	Minimum Gauge	Joint Reinforcement Per CMC
Through 12"	26	Not Required
13" through 18"	24	Not Required
19" through 30"	24	C/4
31" through 42"	22	E/4
43" through 54"	22	F/2
55" through 60"	20	G/4
61" through 84"	20	I/2
85" through 96"	20	J/2
Over 96"	18	K/2

3. Fabricate duct fittings to match adjoining ducts and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to 1.5 times associated duct width. Fabricate to include single thickness turning vane in elbows where space does not permit the above radius or where square elbows are shown. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers. Turning vanes shall be E-Z Rail II, Durodyne, or equal.

4. Fabricate round supply connections at rectangular, plenum type fittings using spin-in type fittings, complete with extractor and volume control damper. Refer to Paragraph “DAMPERS” for damper requirements.

5. Provide drive slip or equivalent flat seams for ducts exposed in the conditioned space or where necessary due to space limitations. On ducts with flat seams, provide standard reinforcing on inside of duct. Duct connection to outlet on exposed duct shall be full size of outer perimeter of outlet flange.

6. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.

7. Provide 20 gauge minimum for ductwork exposed within occupied spaces.

J. Shop-Fabricated, Insulated, Rectangular, Double-Wall Ductwork for Outdoor Applications:

1. Provide insulated, double-wall ductwork for ducts conveying conditioned air, without internal lining, located outdoors.

2. Inner Ducts: Fabricate ducts as specified for single-wall ducts, in gauges and with joint reinforcements given in Table A for 2-inch pressure class or comply with gauges and reinforcements given in SMACNA HVAC Duct Construction Standards (Metal and Flexible) for 4-inch pressure class, as applicable.

3. Outer Ducts: Fabricate as described for inner ducts, except use gauges for the next higher duct size category.

4. Reinforcement of Interstitial Space: Provide 18-gauge galvanized steel intermediate bracing at 24-inch intervals similar to that shown in 2005 (Third Edition) SMACNA HVAC Duct Construction Standards (Metal and Flexible), Figure 9-11. Attach bracing to inner and outer ducts with No. 8 sheet metal screws, 3 inches from corners, 6 inches on center.

5. Interstitial Insulation: Fibrous glass insulation board is specified in article, Insulation Materials. Insulation board shall be minimum R-13 at 3 inches thick. Spot-adhere boards to inner ducts with adhesive recommended by insulation board manufacturer. Butt boards square at corners. Seal joints between insulation boards with pressure-sensitive tape recommended by insulation manufacturer.

   a. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

      1) Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a) Childers Brand; H. B. Fuller Construction Products.

b) Eagle Bridges - Marathon Industries.

c) Foster Brand; H. B. Fuller Construction Products.

d) Mon-Eco Industries, Inc.

2) Fiberglass adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3) Adhesive shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

b. Provide cross-broken ductwork. Ensure that the ductwork will shed water.

1) Ducts with horizontal dimension 12 inches and greater: Slope duct downward from longitudinal midpoint in two directions at 1/4 inch per foot. Duct slope shall not reduce duct airflow free area. Cross-breaking may be omitted for sloped duct surfaces.

K. Rectangular Internally Insulated Duct Fabrication:

1. Provide internal duct lining where indicated on the Drawings, with a minimum of 10'-0" length in each direction from the fan, fan casing, or unit casing. Line all transfer ducts.

a. Where ductwork is exposed to weather or outside the building insulation envelope, provide 2 inch thick, 1-1/2 pound density internal lining with matte facing, with an R-Value of 8.0 minimum.

b. Where ductwork is within the building insulation envelope, lining shall be 1” thick, 1-1/2 pound density, with R-value of 4.2 minimum.

c. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.

d. Where installed exposed in the conditioned space, duct shall be minimum 20 gauge with 1 inch insulation layer (minimum R-value – R-4.2).

e. Cement duct liner in place with nonflammable, non-hardening duct adhesive. Seal all raw edges of insulation inside ductwork with adhesive, including longitudinal liner edges.

f. Provide metal nosing at all locations where liner is preceded by unlined metal.

g. Provide sheet metal weld pins and washers or clinch pins and washers on all ductwork on 12 inch intervals with the first row within 3 inches of the leading edge of each piece of insulation and within 4 inches of corners. No use of adhesive mounted pins will be considered.

1) Install clinched pin fasteners with properly adjusted automatic fastening equipment. Manual installation will not be considered.

2) Install weld pins with properly adjusted automatic fastening equipment. Installation shall not damage the galvanized coating on the outside of the duct.

h. All ductwork, adhesives, lining, sealant, flex duct and the like shall have a flame spread of 25 or less and developed smoke rating of 50 or less when tested in accordance with one of the following test methods: NFPA 255, ASTM E84, or UL 723.

i. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

Manufacturer:	Product:
Johns Manville	Linacoustic RC
CertainTeed Corporation	ToughGard
Fosters Adhesive	85-62
Swifts Adhesive	7336

L. Round and Oval Ductwork Fabrication:

1. Round and oval duct and fittings shall be spiral lockseam or longitudinal seam as indicated in table below. Provide couplings to join each length of duct.

a. At contractors' option, round or oval ductwork may be utilized in place of rectangular ductwork shown on Drawings, provided available space allows installation of round or oval ductwork without compromising space required for installation of products and systems of other trades.

1) Round or oval ductwork utilized in place of rectangular ductwork shown on Drawings shall be sized to have a static

pressure loss equivalent to rectangular duct shown on Drawings.

2) Unlined round or oval duct shall not be utilized in place of rectangular internally lined ductwork shown on Drawings.

2. Fabricate duct fittings to match adjoining ducts and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to 1.5 times associated duct width. Provide two-piece, die-stamped, 45-degree to 90-degree elbows for sizes up to 12 inches; five-piece, 90-degree elbows for sizes 12 inches and above; conical tees; and conical laterals. All reducers shall be placed after a tap has been made on the duct main. Reducers shall be long-taper style.

3. Round Ductwork: Construct of galvanized sheet steel complying with ANSI/ASTM A 653 by the following methods and in minimum gauges listed.

Diameter	Minimum Gauge	Method of Manufacture
Up to 14"	26	Spiral Lockseam
15" to 23"	24	Spiral Lockseam
24" to 36"	22	Spiral Lockseam
37" to 50"	20	Spiral Lockseam
51" to 60"	18	Spiral Lockseam
Over 60"	14	Longitudinal Seam

4. Provide locked seams for spiral duct; fusion welded butt seam for longitudinal seam duct.

5. Fittings and Couplings: Construct of minimum gauges listed. Provide continuous welds along seams at exposed ducts. Provide spot weld bonded seams at concealed ducts.

Diameter	Minimum Gauge
3" to 36"	20
38" to 50"	18
Over 50"	16

6. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.

7. Provide 20 gauge minimum for ductwork exposed within occupied spaces.

M. Round Internally Insulated Duct and Fittings: Where ductwork is exposed to weather or outside the building insulation envelope, construct with outer pressure shell, 2 inch thick (Minimum R-value = R-8) insulation layer, and perforated inner liner. Where ductwork is within the building insulation envelope, construct with outer pressure shell, 1 inch thick (minimum R-value = R4.2) insulation layer, and perforated inner liner. Construct shell and liner of galvanized sheet steel complying with ANSI/ASTM A 653, of spiral lockseam construction (use longitudinal seam for over 59 inches), in minimum gauges listed in table below. Where installed exposed in the conditioned space: duct and fitting outer pressure shell shall be minimum 20 gauge with 1 inch insulation layer (minimum R-value = R-4.2), and perforated inner liner.

Nominal Duct Diameter	Outer Shell	Inner Liner
3" TO 12"	26 gauge	24 gauge
13" TO 24"	24 gauge	24 gauge
25" to 34"	22 gauge	24 gauge
35" to 48"	20 gauge	24 gauge
49" to 58"	18 gauge	24 gauge
Over 59"	16 gauge	20 gauge

1. Fittings and Couplings: Construct of minimum gauges listed. Provide continuous weld along seams of outer shell at exposed ducts. Provide spot weld bonded seams at concealed ducts.

Nominal Duct Diameter	Outer Shell	Inner Liner
3" to 34"	20 gauge	24 gauge
36" to 48"	18 gauge	24 gauge
Over 48"	16 gauge	24 gauge

2. Inner Liner: Perforate with 3/32 inch holes for 22 percent open area. Provide metal spacers welded in position to maintain spacing and concentricity.

3. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.

4. Where installed exposed in the conditioned space, duct shall be minimum 20 gauge with 1 inch insulation layer (minimum R-value – R-4.2).

5. All ductwork, adhesives, lining, sealant, flex duct and the like shall have a flame spread of 25 or less and developed smoke rating of 50 or less when tested in accordance with one of the following test methods: NFPA 255, ASTM E84, or UL 723.

6. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Sheet Metal Div., McGill AirFlow, LLC., Acousti-k27

   b. Semco Duct and Acoustical Products, Inc.

   c. Air Systems Manufacturing, Inc. - Las Vegas

N. Duct Access Doors:

1. Duct Access: Provide hinged access door in rectangular ducts for access to fire dampers, control equipment, etc. Access door size shall be duct diameter wide by duct diameter high for all ducts under 24 inches. Ducts over 24 inches in diameter shall have 24-inch by 18-inch access doors. Minimum size access doors shall be 6 inches by 6 inches.

2. Provide hinged style access doors for round ductwork, NCA Manufacturing, Inc., Model AD-RD-87, Pottorff Series 60, or equal. Access doors shall be 16 gauge galvanized steel with continuous piano hinge. Locks shall be plated steel strike and catch. Provide 1" x 3/8" Polyethylene "Perma Stik" gasket all around door.

O. Flexible Air Ducts:

1. Provide exterior reinforced laminated vapor barrier, fiberglass insulation, encapsulated spring steel wire Helix, and impervious, smooth, non-perforated interior vinyl liner. Individual lengths of flexible ducts shall contain factory fabricated steel connection collars.

   a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

      1) C.A. Schroeder, Inc., Cal Flex model 2PMJ.

      2) ThermaFlex model M KC.

2. Factory made air ducts shall be approved for the use intended and shall conform to the requirements of UL 181 and NFPA 90A. Each portion of a factory-made air duct system shall be identified by the manufacturer with a label or other suitable identification indicating compliance with UL 181, Class 1. Ducts shall be UL listed Class 1, maximum 25/50 smoke and flame spread and shall be installed in accordance with the terms of their listing and the requirements of SMACNA HVAC Duct Construction Standards (Metal and Flexible). Factory-made air ducts shall have the following minimum R-values: R-6.0 for ductwork installed within the building insulation envelope, R-8.0 for ductwork installed outside the building insulation envelope.

3. Flexible ductwork shall be maximum of 5 feet long, and shall be extended to the fullest possible length, in order to minimize pressure drop in the duct.

4. Flexible ducts shall be selected for minimum of 6 inch positive static pressure and minimum of 1 inch negative static pressure.

5. Duct Access Panels:

a. Provide duct access panel assembly of the same material and gauge used for the duct. Duct access panels shall conform to the following:

1) Fasteners: Black steel or stainless steel to match material used for the duct. Panel fasteners shall not penetrate duct wall.

2) Gasket: Comply with NFPA 96, grease-tight, high temperature ceramic fiber, rated for minimum 1500 °F.

P. Provide Ventlon, or equal, flexible connections on inlet and outlet of AC Unit, air handler and exhaust fans. Provide galvanized weather hood over flexible connections exposed to the weather.

2.17 PIPE JOINING MATERIALS

A. Refer to Division 22 and 23 piping sections for special joining materials not listed below.

B. Brazing Filler Metals:

1. General Duty: AWS A5.8, BCup-5 Series, copper-phosphorus unless otherwise indicated. Sil-Fos 15, or equal.

2. Refrigerant Piping:

a. Joining copper to copper: AWS A5.8, BCup-5 Series, copper-phosphorus unless otherwise indicated. Sil-Fos 15, or equal.

b. Joining copper to bronze or steel: AWS A5.8, Bag-1, silver alloy unless otherwise indicated.

2.18 VALVES

A. Ball Valves:

1. 2 inches and smaller: 600 psi CWP, 150 psi SWP, cast bronze body, full port, two piece, threaded ends, and reinforced PTFE seal, conforming to MSS SP-110. Nibco T585-70, Milwaukee BA-400, Stockham T-285, or equal.

2. 2-1/2 inches and larger: Class 150, carbon steel body, full port, two piece, stainless steel vented ball, flanged ends, and reinforced PTFE seal, conforming to MSS SP-72. Nibco F-515-CS-F-66-FS, Milwaukee F20-CS-15-F-02-GO-VB, or equal.

2.19 INSULATION MATERIALS

A. General:

1. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

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

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

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

5. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

6. Adhesives and sealants shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

B. Insulation Materials:

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

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1) Aeroflex USA, Inc.

2) Armacell LLC.

3) K-Flex USA.

2. Mineral-Fiber, Preformed Pipe Insulation:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1) Johns Manville; a Berkshire Hathaway company.

2) Knauf Insulation.

3) Manson Insulation Inc.

4) Owens Corning.

b. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL.

3. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Provide 2-inch wide stapling and taping flange.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1) CertainTeed Corporation.

2) Johns Manville.

3) Knauf Insulation.

4) Owens Corning.

2.20 FIELD APPLIED JACKETS:

A. PVC Jacket and Factory Fabricated Fitting Covers: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

2. Johns Manville, model Zeston, with Zeston 2000 fitting covers.

3. Proto Corporation, model LoSmoke.

B. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Childers Brand; H. B. Fuller Construction Products.

b. ITW Insulation Systems; Illinois Tool Works, Inc.

c. RPR Products, Inc.

2. Finish and thickness are indicated in field-applied jacket schedules.

3. Moisture Barrier for Outdoor Applications: 2.5-mil- thick polysurlyn.

4. Factory-Fabricated Fitting Covers:

a. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.

b. Tee covers.

c. Flange and union covers.

d. End caps.

e. Beveled collars.

f. Valve covers.

g. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.21 TEMPERATURE CONTROL SYSTEM

A. Refer to Section 23 09 23, Direct Digital Control System for HVAC.

PART 3 - EXECUTION

3.1 ROOF MOUNTED EQUIPMENT INSTALLATION

A. Mount and anchor equipment in strict compliance with Drawings details. Alternate anchorage methods will not be considered for roof mounted equipment.

B. Examine rough-in for roof mounted equipment to verify actual locations of piping and duct connections prior to final equipment installation.

C. Verify that piping to be installed adjacent to roof mounted equipment allows service and maintenance.

D. Verify that gas piping will be installed with sufficient clearance for burner removal and service.

E. Install ducts to termination at top of roof curb and install heavy duty rubber gaskets on supply and return openings and on full perimeter of curb, or as required for an airtight installation, prior to setting unit on curb.

F. Cover roof inside each roof mounted air conditioning unit, heat pump unit, and heating and ventilating unit roof curb with 2 inch thick, 3 pound density fiberglass insulation board.

G. Connect supply and return air ducts to horizontal discharge roof mounted equipment with flexible duct connectors specified elsewhere in these Specifications.

H. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.

3.2 SPLIT SYSTEM AC, HEAT PUMP, AND VRF SYSTEMS INSTALLATION

A. General:

1. Install units level and plumb.

2. Install evaporator-fan components as detailed on Drawings.

3. Install ground or roof- mounted condensing units as detailed on Drawings.

4. Install seismic restraints as required by applicable codes. Refer to Article, Submittals, in Section 23 00 50, Basic HVAC Materials and Methods, for delegated design requirements for seismic restraints.

5. Install and connect refrigerant piping as detailed in unit manufacturers' literature. Install piping to allow access to unit.

6. Install cooling coil condensate primary drain pan piping, and overflow, if provided, and run to nearest code-compliant receptacle, or as indicated on Drawings. Install secondary drain pan for units installed over permanent and suspended-tile ceilings. Install secondary drain pan piping and terminate 1/2 inch below ceiling, with escutcheon, in a readily visible location or as shown on Drawings.

7. Install air filters at each indoor unit. Install washable, permanent filters at indoor units designed to accept washable, permanent filters. Refer to Drawings schedule, and Article, Air Filters, in this Section, for filter requirements for ducted, above-ceiling units incorporating mixing boxes.

8. Duct Connections: Duct installation requirements are specified in Article, Ductwork, in this Section. Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning

units with flexible duct connectors. Flexible duct connectors are specified in Article, Ductwork, in this Section.

B. Variable Refrigerant Flow Split System Heat Pumps:

1. The system shall be installed by a factory-trained and certified contractor, in strict conformance with unit manufacturer's instructions.

2. Install indoor heat recovery controllers as detailed on Drawings. Install condensate drain pan piping and run to nearest code-compliant receptacle, or as indicated on Drawings.

a. Indoor Heat Recovery Controllers Identification:

1) Comply with requirements for identification in Section 23 00 50, Basic HVAC Materials and Methods.

2) Identify each control cable on each end and at each terminal with a number-coded identification tag. Each cable shall have a unique tag.

3) Identify each refrigerant connection with label or tag corresponding to the indoor fan coil unit served by the refrigerant piping branch. Use equipment numbers scheduled on Drawings.

3. Install ball-type refrigerant service valves in refrigerant piping at downstream connections of indoor heat recovery units.

4. Install ground or roof- mounted condensing units as detailed on Drawings. Connected condensing units shall allow space for coil cleaning and other required maintenance tasks.

3.3 HIGH EFFICIENCY FURNACE UNIT INSTALLATION

A. Install vent and combustion air piping in strict compliance with manufacturer's installation guidelines. Pipe and fittings shall comply with manufacturer's instructions, flash through roof or wall as specified for piping. Refer to Drawings for special conditions.

1. Provide concentric flue system with single roof or wall penetration. Install in accordance with manufacturer's requirements.

2.

B. Mount horizontally or vertically as indicated on Drawings. Comply with manufacturer's installation requirements specific to mounting orientation.

C. Install cooling coil overflow drain piping and run to nearest receptacle, or as indicated on Drawings.

3.4 REFRIGERANT PIPING INSTALLATION

A. General:

1. Install refrigerant piping according to ASHRAE 15. Install and connect refrigerant piping as detailed in unit manufacturers' literature. Install piping to allow access to unit.

2. Install piping straight and free of kinks, restrictions or traps.

3. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

4. Slope horizontal suction piping 1 inch/10 feet towards compressor.

5. Install fittings for changes in direction and branch connections.

6. Piping under raised floors shall be kept 6 inches minimum above ground; excavate as necessary.

7. Install locking caps on refrigerant access valves located outside building, including valves located on roofs.

8. Insulate refrigerant piping, including liquid and hot gas pipes when required by system manufacturer, and including headers, branches, and other components as detailed in unit manufacturers' literature.

B. Factory Pre-charged and sealed line set piping:

1. Keep the entire system clean and dry during installation.

2. All tubing shall be evacuated and sealed at the factory. The seal must not be broken until ready for assembly.

3. If there is any evidence of dust, moisture, or corrosion, the tubing must be cleaned out by drawing a swab soaked with methyl alcohol through the tubing as many times as necessary to thoroughly clean the tubing.

4. Where line set piping is exposed mounted at grade, on walls, and on roof, enclose in 16 gage galvanized steel enclosure.

   a. In other locations, enclose line set piping in iron or steel piping and fittings or in EMT conduit

C. Field Assembled Refrigerant Piping:

1. Select system components with pressure rating equal to or greater than system operating pressure.

2. Where subject to mechanical injury, enclose refrigerant piping in EMT conduit.

3. Where field assembled refrigerant piping is exposed mounted at grade, on walls, and on roof, enclose in 16 gage galvanized steel enclosure.

4. When brazing, remove solenoid valve coils and sight glasses, also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

3.5 FAN INSTALLATION

A. Ceiling Mounted Fans: Mount variable speed switch within fan housing. Mark final balance point on variable speed switch.

B. Provide access doors for fans or motors mounted in ductwork.

C. Mount all fans as detailed on Drawings and in compliance with CBC standards.

D. Fan motors mounted in air-stream to be totally enclosed.

E. Completely line supply, return or exhaust fan cabinets with 1 inch thick, 3/4 pound density acoustic insulation securely cemented in place.

F. Roof fans shall be mounted level.

G. Provide heavy-duty rubber gasket between exhaust fan mounting flange and roof curb, or as required for an airtight installation.

3.6 RELIEF VENT INSTALLATION

A. Install relief vents to provide a level mounting for backdraft damper.

3.7 AIR INLETS AND OUTLETS INSTALLATION

A. Provide all air inlets and outlets with gaskets and install so that there will be no streaking of the walls or ceilings due to leakage. Duct connection to outlet on exposed duct shall be full size of outer perimeter of outlet flange.

B. Unless otherwise indicated on Drawings, provide rectangular galvanized steel plenum on top of each diffuser and ceiling return for connection to ductwork. Line plenum with internal insulation as indicated for lined ductwork. Size plenum to allow full opening into air terminal. Plenum sheet metal gauge shall be equal to gauge for rectangular equivalent of the branch duct serving the air inlet or outlet.

C. Ceiling-mounted air inlets, outlets, or other services installed in T-Bar type ceiling systems shall be positively attached to the ceiling suspension main runners or to cross runners with the same carrying capacity as the main runners.

1. Air inlets, outlets, or other services weighing not more than 56 pounds shall have two No. 12 gauge hangers connected from the terminal or service to the structure above. These wires may be slack.

2. Support air inlets, outlets, or other services weighing more than 56 pounds directly from the structure above by approved hangers. Provide 4 taut 12

gauge wires each, attached to the fixture and to the structure above. The 4 taut 12 gauge wires, including their attachment to the structure above must be capable of supporting 4 times the weight of the unit.

3. Secure air inlets and outlets to main runners of ceiling suspension system with two No. 8 sheet metal screws at opposing corners.

D. Furnish all air inlets and outlets with a baked prime coat unless otherwise noted. Provide off-white baked enamel finish on ceiling-mounted air inlets and outlets. Paint exposed mounting screws to match the material being secured.

E. Air inlets and outlets shall match all qualities of these specified including appearance, throw, noise level, adjustability, etc.

3.8 FILTER HOUSING INSTALLATION

A. Mount filters in airtight galvanized steel housings furnished by the filter manufacturer, or shop-fabricated. Housings shall incorporate integral tracks to accommodate filters, and flanges for connection to duct or casing system.

1. Sealing: Incorporate positive-sealing gasket material on channels to seal top and bottom of filter cartridge frames and to prevent bypass of unfiltered air.

2. Access Doors: Hinged, with continuous gaskets on perimeter and positive-locking latch handle devices.

B. Air filters shall be accessible for cleaning or replacement.

C. Identify each filter access door with 1/2 inch high minimum stenciled letters.

3.9 TEMPORARY FILTERS

A. Provide temporary filters for fans that are operated during construction; after construction dirt has been removed from the building install new filters at no additional cost to the Owner. In addition to temporary filters at filter location, provide temporary filters on all duct openings which will operate under a negative pressure.

1. Filters used for temporary operation shall be the same as permanent filters for the application. Filters used for duct openings may be 1 inch thick pleated media disposable type.

3.10 DAMPER INSTALLATION

A. All dampers automatically controlled by damper motors are specified under "Temperature Control System" except those specified with items of equipment.

B. Provide opposed blade manual air dampers at each branch duct connection and at locations indicated on the drawings and where necessary to control air flow for balancing system. Provide an opposed blade balancing damper in each zone supply duct. Provide an access panel or Ventlok flush type damper regulator on ceiling or wall for each concealed damper.

C. Install fusible link fire dampers full size of duct at points where shown or required.

D. Provide 18 inch x 12 inch minimum hinged access doors in ductwork and furring for easy access to each fire damper; insulated access doors in insulated ducts. Label access doors with 1/2 inch high red letters.

1. Provide Ventlok Series 100, Durodyne, or equal access doors with hardware for convenient access to all automatic dampers and other components of the system, insulated type in insulated ducts. Provide Ventlok #202 for light duty up to 2 inch thick doors, #260 heavy-duty up to 2 inch thick doors and #310 heavy-duty for greater than 2 inch thick doors. Provide #260 hinges on all hinged and personnel access doors; include gasketing.

3.11 DUCTWORK INSTALLATION

A. Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight and noiseless (no objectionable noise) systems capable of performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections within 1/8 inch misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers, and anchors of type which will hold ducts true to shape and to prevent buckling. Where possible, install ductwork to clear construction by 1/4 inch minimum, except at air inlets and outlets. Where ductwork will not clear construction, secure duct firmly to eliminate noise in the system.

B. Duct Joints: Install duct sealers, pop rivets or sheet metal screws at each fitting and joint. Duct sealer shall be fire retardant. Sheet metal screw for joints shall be minimum #10 size galvanized.

C. Upper connection of support to wood structure shall be with wood screws or lag screws in shear fastened in the upper one half of the wood structural member. Fasteners shall conform to the following schedule:

For ducts with P/2=30"	#10 x 1-1/2" wood screw
For ducts with P/2=72"	1/4"x 1-1/2" lag screw
For ducts with P/2 over 73"	3/8"x 1-1/2" lag screw

D. Upper connection in tension to wood shall not be used unless absolutely necessary. Where deemed necessary the contractor shall submit calculations to show the size fastener and penetration required to support loads in tension from wood in accordance with the following schedule:

For ducts with P/2=30"	260 pounds per hanger
For ducts with P/2=72"	320 pounds per hanger
For ducts with P/2=96"	460 pounds per hanger
For duct with P/2 larger than 120"	NOT ALLOWED

E. Install concrete inserts for support of ductwork in coordination with formwork as required to avoid delays in work.

F. Upper connection to manufactured truss construction must comply with truss manufacturers published requirements and Structural Engineers requirements.

G. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct plus insulation with sheet metal flanges of same gauge as duct. Overlap opening on four sides by at least 1-1/2 inches.

H. Support ductwork in manner complying with SMACNA "HVAC Duct Construction Standards," hangers and supports sections. Where special hanging of ductwork is detailed or shown on Drawings, Drawings shall be followed. Angles shall be attached to overhead construction in a manner so as to allow a minimum of 2 inches of movement in all directions with no bending or sagging of the angle.

1. Except where modified in individual paragraphs of this Section, provide hanger support with minimum 18 gauge straps, 1 inch wide. Fold duct strap over at bottom of duct.

2. Install duct supports to rectangular ducts with sheet metal screws. Provide one screw at top of duct and one screw into strap at bottom of duct.

I. Installation of Flexible Ductwork:

1. Provide flexible ducts with supports at 30 inch centers with 2 inch wide, 26 gauge steel hanger collar attached to the structure with an approved duct hanger. Installation shall minimize sharp radius turns or offsets.

   a. Supports shall be in accordance with SMACNA HVAC Duct Construction Standards (Metal and Flexible).

   b. Make bends to maintain R/W-1.5.

2. Make connections to rigid duct and units with Panduit style draw band at inner liner material, and a second draw band over the outer vapor barrier material.

3. Make connection to duct with spin-in fittings, with air scoop and balance damper.

3.12 PIPE JOINTS AND CONNECTIONS

A. General:

1. Cutting: Cut pipe and tubing square, remove rough edges or burrs. Bevel plain ends of steel pipe.

2. Remove scale, slag, dirt and debris from inside and outside of pipe before assembly.

3. Boss or saddle type fittings or mechanically extracted tube joints will not be allowed.

B. Copper Pipe and Tubing: All joints shall be brazed according to ASME Section IX, Welding and Brazing Qualifications, except pneumatic control piping, and hydronic piping having grooved-end fittings and couplings.

C. Flexible Connections:

1. Furnish and install Thermo Tech., Inc. F/J/R, Metraflex, or equal, flexible couplings with limiter bolts on piping connections to all equipment mounted on anti-vibration bases, except fan coil units under 2000 cfm, on each connection to each base mounted pump and where shown. Couplings shall be suitable for pressure and type of service.

2. Flexible connections in refrigerant lines; Flexonic, Anaconda or equal, metal hose, full size.

3. Anchor piping securely on the system side of each flexible connection.

3.13 INSULATION AND FIELD-APPLIED JACKET INSTALLATION

A. General:

1. The term "piping" used herein includes pipe, air separators, valves, strainers and fittings.

2. Test insulation, jackets, and lap-seal adhesives as a composite product and confirm flame spread of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with UL723, ASTM E84, or NFPA 255.

3. Clean thoroughly, test and have approved, all piping and equipment before installing insulation and/or covering.

4. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, ductwork, and equipment.

5. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment as specified in insulation system schedules.

6. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

7. Install insulation with longitudinal seams at top and bottom of horizontal runs.

8. Install multiple layers of insulation with longitudinal and end seams staggered.

9. Keep insulation materials dry during application and finishing.

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

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

12. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.

13. For piping, ductwork, and equipment, with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

14. Repair all damage to existing pipe, duct and equipment insulation whether or not caused during the work of this contract, to match existing adjacent insulation for thickness and finish, but conforming to flame spread and smoke ratings specified above.

15. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

    a. Install insulation continuously through hangers and around anchor attachments.

    b. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

    c. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

    d. Cover inserts with jacket material matching adjacent insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

B. Piping Insulation Installation:

1. General:

a. Apply insulating cement to fittings, valves and strainers and trowel smooth to the thickness of adjacent covering. Cover with jacket to match piping. Extend covering on valves up to the bonnet. Leave strainer cleanout plugs accessible.

b. Insulate valves and irregular surfaces to match adjacent insulation and cover with two layers of Glasfab saturated in Foster's Sealfas 30-36, 3M, or equal, carried 3 inches over the adjoining pipe insulation. Finish with a coat of Foster's Sealfas 30-36, 3M, or equal. The 3 inch wide SSL end laps furnished with the insulation shall be adhered over the end joints. Seal entire surface of insulation vapor tight, including joints and ends of PVC or aluminum fitting covers.

c. Provide removable insulation covers for items requiring periodic service or inspection.

d. Insulation shall be vapor tight before applying PVC jacket and fitting covers. Verify suitability with manufacturer of insulation.

e. Provide pre-formed PVC valve and fitting covers for indoor piping.

f. Provide factory-fabricated aluminum valve and fitting covers for outdoor piping.

g. Provide Calcium Silicate rigid insulation and sheet metal sleeve, 18 inch minimum length at each pipe hanger. Seal ends of insulation to make vapor tight with jacket.

2. Below-Ambient Services Including Chilled Water Supply and Return and Refrigerant Piping:

a. Insulate valves and irregular surfaces to match adjacent insulation and cover with two layers of woven glass fiber cloth saturated in Foster Sealfas 30-36, 3M, or equal, extending 3 inches over the adjoining pipe insulation. Finish with a coat of Foster Sealfas 30-36, 3M, or equal. The 3 inch wide SSL end laps furnished with the insulation shall be adhered over the end joints. Seal entire surface of insulation vapor tight, including joints and ends of PVC or aluminum fitting covers.

b. Variable refrigerant flow (VRF) heat pump systems: Insulation for VRF system refrigerant piping shall be installed according to VRF unit manufacturer’s instructions.

3. PVC Jacket Installation:

a. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1) Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

4. Aluminum Jacket Installation:

a. Where insulated piping is exposed to the weather apply aluminum jacket secured with 1/2 inch stainless-steel bands on 12 inch centers. Insulation shall be vapor tight before applying metal jacket, and aluminum fitting covers. Install jacketing with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Cover fittings with glass cloth, two coats of Foster Sealfas 30-36, and factory-fabricated aluminum fitting covers, of same material, finish, and thickness as jacket. Insulation shall be vapor tight before applying metal jacket and fitting covers.

C. Duct Insulation Installation:

1. General:

a. Insulation applied to the exterior surface of ducts located in buildings shall have a flame spread of not more than 25 and a smoke-developed rating of not more than 50 when tested as a composite installation including insulation, facing materials, tapes and adhesives as normally applied. Material exposed within ducts or plenum shall have a flame-spread rating of not more than 25 and a smoke-developed rating of not more than 50.

b. Duct insulation applied to the exterior surface of ducts installed outside the building insulation envelope shall meet minimum R-value of R-8 at 3 inches thickness and 3/4 pound per cubic foot density.

c. Duct insulation applied to the exterior surface of ducts installed within the building insulation envelope shall meet minimum R-value of R-4.2 at 1-1/2 inches thickness and 3/4 pound per cubic foot density.

2. Mineral Fiber Blanket Installation:

a. Insulate all unlined concealed supply and return ducts with fiberglass duct wrap, manufactured as a blanket of glass fibers factory laminated to a reinforced foil/kraft vapor retarding facing. Provide 2 inch stapling and taping flange. Wrap insulation entirely around duct and secure with outward clinching staples on 6 inch centers. Provide mechanical fasteners at maximum 18 inch centers for all bottoms of duct which are greater than 24 inches. Lap all insulation joints 3"

minimum. Insulate ducts installed tight against other work before hanging in place. Seal all seams, both longitudinal and transverse, and all staple and mechanical fastener penetrations of facing with scrim backed foil tape or recommended sealant, to provide a vapor tight installation.

3. PVC Jacket Installation:

a. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1) Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.14 DUCTWORK SEALING AND LEAK TESTING

A. All ductwork shall receive a Class A seal.

B. Seal airtight all joints and seams, including standing seams and manufactured joints and seams, of all supply, return and exhaust ducts except those exposed in conditioned space.

C. Leakage Classes:

Pressure Class	Leakage Class	
	Round Duct	Rectangular Duct
2"W.G. or less	8	16
4"W.G. or greater	2	4

D. All duct systems (supply, return, outside air intake, and exhaust), except those identified on compliance forms on Drawings as requiring Acceptance Testing per the requirements of the California Energy Code, shall be tested in accordance with the requirements of SMACNA's "HVAC Air Duct Leakage Test Manual." Test pressure shall be equal to the pressure class of the duct. For additional duct leak testing requirements, refer to Section 230050, "Basic HVAC Materials and Methods," Article, "Acceptance Requirements."

3.15 TEMPERATURE CONTROL SYSTEM INSTALLATION

A. Provide thermostats where indicated on drawings. All wiring shall be in conduit. Provide all relays, transformers and the like to render the control system complete and fully operable. All control conduit to be rigid steel type.

3.16 EQUIPMENT START-UP

A. Initial start-up of the systems and pumps shall be under the direct supervision of the Contractor.

B. Equipment start-up shall not be performed until the piping systems have been flushed and treated and the initial water flow balance has been completed.

C. It shall be the responsibility of the Contractor to assemble and supervise a start-up team consisting of controls contractor, start-up technician, and test and balance contractor; all to work in concert to assure that the systems are started, balanced, and operate in accordance with the design.

D. After start-up is complete, instruct the Owner's personnel in the operation and maintenance of the systems. Obtain from the Owner's representative a signed memo certifying that instruction has been received.

E. For additional requirements, refer to article, Check, Test and Start Requirements, in Section 23 00 50, Basic HVAC Materials and Methods.

3.17 TESTING AND BALANCING

A. For testing and balancing requirements, refer to Section 23 05 93, Testing and Balancing for HVAC.

3.18 CLEANING AND PROTECTION

A. As each duct section is installed, clean interior of ductwork of dust and debris. Clean external surfaces of foreign substances that might cause corrosive deterioration of metal or where ductwork is to be painted.

B. Temporary Closure: At ends of ducts that are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering that will prevent entrance of dust and debris until connections are to be completed.

C. As each internally lined duct section is installed, check internal lining for small cuts, tears, or abrasions. Repair all damage with fire retardant adhesive.

3.19 EQUIPMENT MOUNTING

A. Mount and anchor equipment in strict compliance with Drawings details. Alternate anchorage methods will not be considered for roof mounted equipment.

3.20 INDOOR PIPING INSULATION SCHEDULE

A. Refrigerant Piping:

1. All pipe sizes: Insulation shall be one of the following:

a. Suction piping smaller than 1-1/2 inches diameter:

1) Flexible Elastomeric: 1/2 inch thick.

2) Mineral-Fiber, Preformed Pipe: 1/2 inch thick.

b. Suction piping 1-1/2 inches diameter and larger:

1) Flexible Elastomeric: 1 inch thick.

2) Mineral-Fiber, Preformed Pipe: 1 inch thick.

c. Suction piping for heat pump applications smaller than 1 inch diameter:

1) Flexible Elastomeric: 1 inch thick.

2) Mineral-Fiber, Preformed Pipe: 1 inch thick.

d. Suction piping for heat pump applications 1 inch and larger:

1) Flexible Elastomeric: 1-1/2 inches thick.

2) Mineral-Fiber, Preformed Pipe: 1-1/2 inches thick.

2. When equipment manufacturers' instructions indicate that refrigerant liquid and hot-gas gas piping be insulated, insulation thickness shall be equal to, and applied as described herein for refrigerant suction piping.

3.21 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping:

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

a. Flexible Elastomeric: 2 inches thick.

b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

2. When equipment manufacturers' instructions indicate that refrigerant liquid piping be insulated, insulation thickness shall be equal to, and applied as described herein for refrigerant suction piping.

3.22 INDOOR FIELD-APPLIED PIPING JACKET SCHEDULE

A. Piping, concealed: None.

B. Piping, exposed: PVC, 20 mils thick.

3.23 OUTDOOR FIELD-APPLIED PIPING JACKET SCHEDULE

A. All Piping: Aluminum, Stucco Embossed: Thickness as follows:

Outer Insulation Diameter (Inches)	Minimum Aluminum Jacket Thickness (Inch)	
	Rigid Insulation	Non-Rigid Insulation (Note 1)
8 and Smaller	0.024	0.024

Larger Than 8 Thru 11	0.024	0.024
Larger Than 11 Thru 24	0.024	0.024
Larger Than 24 Thru 36	0.024	0.032
Larger Than 36	0.024	0.040

1. Note 1: Non-rigid Insulation is defined as having a compressive strength of less than 15 psi.

3.24 INDOOR DUCT INSULATION SCHEDULE

A. Minimum R-Value = R-4.2.

B. Supply and Return Ducts: Mineral Fiber Blanket, 1-1/2 inches thick, 0.75 lb/cu. ft.

3.25 OUTDOOR DUCT INSULATION SCHDULE.

A. Refer to article, Ductwork, for internal duct lining. Provide 2 inches thick internal duct lining where indicated on Drawings.

B. Refer to article, Ductwork, for double-wall ductwork with interstitial insulation.

3.26 INDOOR FIELD-APPLIED DUCT JACKET SCHEDULE

A. Insulated ducts in concealed spaces: None.

B. Insulated ducts in exposed unconditioned spaces: PVC, 20 mils thick.

END OF SECTION

SECTION 26 01 00

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The requirements of the General Conditions and Division 1, General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. Related Work in Other Sections, but not limited to the following:

1. Motors, motor controls and low voltage control wiring that are an integral part of equipment assemblies and heating and ventilation controls.
2. Painting of exposed electrical work.
3. Plumbing controls and low voltage wiring.
4. Fire alarm system and devices.
5. Data network and distribution.
6. Intercom system and equipment.

B. Work Included in Contract

1. Provide and install new 277/480V and 120/208V, 3 phase, 4 wire electrical distribution system as detailed on drawings.
2. Provide new interior and exterior lighting systems and controls.
3. Grounding and bonding per NEC.
4. Provide complete telephone/data system per District standards as shown on drawings and specified under Division 27.
5. Provide a complete paging/intercom/clock system and connect to existing Bogen system per District standards as shown on drawings and specified under Division 27.
6. Provide a complete audio/visual classroom system as shown on drawings and specified under Division 27.
7. Provide wiring and hookup of all electrical equipment specified under other specification sections, such as technology systems, mechanical and plumbing equipment.
8. Provide a new fire alarm system with a complete voice evacuation automatic addressable fire alarm system per District standards as detailed on drawings and specified under Division 28 for new building.

1.3 CODES AND STANDARDS

A. In addition to Codes and Standards - Division 1, the following shall apply to this Division:

National Electrical Code with California amendments
California Admin. Code, Titles 17, 19, 24, Part 3.
U.L. Electrical Construction Materials List
Codes, rules and regulations as specified hereinafter

Local city and county agencies

1.4 SUBMITTALS

A. Submittals shall be made in conformance with the General Conditions. The list shall include, for each item, the manufacturer, manufacturer's catalog number, type of class, the rating, capacity, size, etc. Submittals shall include:

1. Conduit & Fittings
2. Boxes & Covers
3. Fuses
4. Wire & Cable
5. Wiring Devices
6. Panelboards
7. Transformers
8. Disconnect Switches
9. Lighting
10. Paging/Intercom/Clock System
11. Telephone/Data Networking System
12. Audio Visual Classroom System
13. Intrusion Alarm System
14. Fire Alarm System

B. Shop Drawings: Submit for approval, detailed construction drawings for each item of fabricated equipment required for the electrical installation. All drawings shall be to scale, fully dimensioned, and provide sufficient detail to clearly indicate the arrangement of the equipment and its component parts. Construction of the equipment shown shall be revised to comply with the drawings and specifications as required by the Architect after review of the shop drawings, and the drawings submitted when requested by the Architect. Shop drawings shall be submitted for the following:

1. Lighting Controls
2. Paging/Intercom/Clock System
3. Telephone/Data Networking System
4. Audio Visual Classroom System
5. Intrusion Alarm System
6. Fire Alarm System

C. Substitution: Provide substitutions as outlined.

1.5 SUPERVISION OF ELECTRICAL WORK

A. Contractor shall personally, or through an authorized and competent representative, constantly supervise the work from beginning to completion and final acceptance. So far as possible, keep same foreman and

workmen throughout the project duration. Work shall be subject to inspection and approval by Architect. Promptly furnish related information when so requested by Architect.

1.6 EQUIPMENT AND SYSTEMS IDENTIFICATION

A. Name Plates: Provide permanent identification of circuit breakers in switchboards, panels, transformers, disconnects for mechanical and plumbing roof-top equipment and other cabinet enclosed apparatus. Use black bakelite plates, not less than ½" X 3", with engraved white letters, secured with adhesive. Provide voltage along with panel name. Provide red with white letters on FACP, FATC, etc.

B. Stencil Work: Identify all motors and operating apparatus in electrical equipment rooms or semi-concealed spaces, with black or white lacquer lettering, not less than ½" high, placed where readily visible upon inspection.

C. Directories: Provide for power circuits, typewritten, neatly arranged in numerical order, and permanently fixed inside or adjacent to appropriate panel.

D. Provide lamecoid label on all receptacle and switch covers indicating complete circuit number.

E. Provide service description etched on cover of all underground pull boxes.

F. Provide lamecoid label on all receptacle and switch covers indicating complete circuit number.

G. Provide lamecoid label on all blank cover plates indicating circuit number or low voltage system (i.e. future data, intrusion, etc.).

H. Provide lamecoid label on all fire alarm device covers indicating complete device number.

1.7 OPERATING INSTRUCTIONS ON-SITE

A. At time of occupancy, arrange for manufacturer's representatives to instruct building operating and maintenance personnel in use of any equipment requiring operating and maintenance. Arrange for all personnel to be instructed at one time. Pay all costs for such service (minimum of 4 hours).

1.8 ADJACENT WORK

A. Coordinate work and complete with others in furnishing and placing this work.

B. Work to approved shop drawings for work by others and to field measurements as necessary to properly fit the work.

C. Project adjacent work as necessary; adjacent construction or exposed surfaces or surfaces damaged by use of materials or operations under this Section shall be repaired or replaced as directed by Architect.

1.9 DRAWINGS

A. The electrical drawings, which constitute an integral part of this contract, shall serve as the working drawings. They indicate diagrammatically the general layout of the complete electrical system, including the arrangement of feeders, circuits, panelboards, service equipment, and other work. Field verifications of scale dimensions taken from the drawings are directed since actual field locations, distances and elevations will be governed by actual field conditions. Review architectural, structural, mechanical and plumbing drawings and adjust work to conform to all conditions indicated thereon. Discrepancies shown on different plans or between plans and actual field conditions, or between plans and specifications, shall promptly be brought to the attention of the Architect for a decision.

1.10 COORDINATION AND COOPERATION

A. Drawings and specifications are both supplementary and complementary. Taken together, they are intended to define complete working installations of the systems represented, in accordance with approved practice in the trade, and in conformity with all applicable requirements of local jurisdictional offices and officers and codes and enforcing bodies.

B. It shall be presumed that any bid offered under this Division of the Specifications is based on a careful examination of the job site, and of the plans and specifications; that the person(s) or firm(s) awarded a contract hereunder is/are experienced and qualified in the type of work represented; that every effort has been made to prepare complete, accurate and correct plans and specifications; and that reasonable diligence will be exercised in planning and scheduling the work to anticipate conflicts and/or detect errors or omissions. All such shall be immediately reported, and proper resolution agreed on between concerned parties before the work affected is performed. If due to lack of diligence, or to incompetence, failure to anticipate such problems shall not create a valid claim for extra costs or charges.

C. Requirements of other trades, of utility companies, and of fire departments, protective services, communication systems, or other facilities of a utility nature, shall be determined prior to installation of systems, equipment, devices or materials affected by or dependent on such requirements.

D. Unapproved deviations or changes based on a presumption of error or code violation, or work not suitable for its intended function, may not be accepted.

E. Nothing herein shall act to prevent or discourage the contractor from suggesting or discussing possible changes in the work where such might be beneficial to the contractor or the owner, or might facilitate the work of this or other trades.

F. Any work resulting in a claim for a change in the contract price must be approved and fully documented.

1.11 VISIT TO SITE

A. Visit the project site, take requisite measurements, and verify exact location of buildings, utilities, and other facilities, and obtain such other information as is necessary for an intelligent bid. No allowance will subsequently be made by the Architect or Owner for any error or omission on the part of the bidder in this connection.

1.12 RECORD DRAWINGS

A. Record of Job Progress: Keep an accurate dimensional record of the "as-built" locations and of all work; all as required. This record shall be kept up-to-date on blueline prints as the job progresses and shall be available for inspection at all times. It shall be reviewed by inspector prior to each monthly application for payment.

B. Record of Installation: Refer to Supplementary General Conditions.

C. Include on "as-built" drawings:

1. Routing of all buried or concealed electrical feeders and conduits.

D. Upon completion of the work, a completed set of as-built reproducible vellums and electronic file (ACAD 2004) on Cd/DVD disk(s) shall be delivered to the Architect.

1.13 GUARANTEE

A. All work shall be guaranteed for a minimum period of one year from either the official date of completion or from the date of acceptance by the Owner, whichever is the later date. The guarantee period for certain items shall be longer, as indicated in the specification for those items.

B. Should any trouble develop during the guarantee time due to defective material, faulty workmanship, or non-compliance with plans, specifications, codes or directions of the Owner, Architect, Engineer or Inspector, the Contractor shall furnish all necessary labor and materials to correct the trouble without additional charges.

1.14 COMMISSIONING

A. Electrical systems including lighting and lighting controls, occupancy sensors, daylight controls, switching systems, exterior lighting controls and uninterruptible power supplies will be commissioned per the requirements specified in Commissioning Requirements."

END OF SECTION

SECTION 26 05 00

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Electrical identification.
2. Concrete equipment bases.
3. Electrical demolition.
4. Cutting and patching for electrical construction.

1.2 SUBMITTALS

A. Product Data: For utility company electricity-metering components.

B. Shop Drawings: Dimensioned plans and sections or elevation layouts and single-line diagram of electricity-metering component assemblies specific to this Project.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.4 COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings for electrical supports, raceways, and cable with general construction work.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment that requires positioning before closing in the building.

C. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces.

D. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating.

B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

C. Slotted-Steel Channel: Flange edges turned toward web, and 9/16-inch- diameter slotted holes at a maximum of 2 inches o.c., in webs. Strength rating to suit structural loading.

D. Slotted Channel Fittings and Accessories: Recommended by the manufacturer for use with the type and size of channel with which used.

1. Materials: Same as channels and angles, except metal items may be stainless steel.

E. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

F. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

G. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.

H. Expansion Anchors: Carbon-steel wedge or sleeve type.

I. Toggle Bolts: All-steel springhead type.

J. Powder-Driven Threaded Studs: Heat-treated steel.

2.2 ELECTRICAL IDENTIFICATION

A. Identification Device Colors: Use those prescribed by ANSI A13.1, NFPA 70, and these Specifications.

B. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick.

C. Tape Markers for Conductors: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

D. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.

E. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape compounded for permanent direct-burial service, and with the following features:

1. Not less than 6 inches wide by 4 mils thick.

2. Embedded continuous metallic strip or core.

3. Printed legend that indicates type of underground line.

F. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch minimum thickness for signs up to 20 sq. in. and 1/8-inch minimum thickness for larger sizes. Engraved legend in black letters on white background.

G. Warning and Caution Signs: Preprinted; comply with 29 CFR 1910.145, Chapter XVII. Colors, legend, and size appropriate to each application.

1. Interior Units: Aluminum, baked-enamel-finish, punched or drilled for mechanical fasteners.

2. Exterior Units: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate with 0.0396-inch, galvanized-steel backing. 1/4-inch grommets in corners for mounting.

H. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.3 CONCRETE BASES

A. Concrete Forms and Reinforcement Materials: As specified in Division 3 Section "Cast-in-Place Concrete."

B. Concrete: 3000-psi, 28-day compressive strength.

2.4 CONCRETE BOXES

A. Concrete Boxes: Pre-cast reinforced, size and type as shown; Christy, Brooks or approved equal. All underground boxes shall be provided with traffic grade, spring loaded, bolt-down, steel cover.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom.

B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, slotted channel system components.

B. Dry Locations: Steel materials.

C. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four with, 200-lb minimum design load for each support element.

3.3 SUPPORT INSTALLATION

A. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

B. Size supports for multiple raceway or cable runs so capacity can be increased by a 25 percent minimum in the future.

C. Support individual horizontal single raceways with separate, malleable-iron pipe hangers or clamps except use spring-steel fasteners for 1-1/2-inch and smaller single raceways above suspended ceilings and for fastening raceways to slotted channel and angle supports.

D. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

E. Secure electrical items and their supports to building structure, using the following methods unless other fastening methods are indicated:

1. Wood: Wood screws or screw-type nails.

2. Gypsum Board: Toggle bolts. Seal around sleeves with joint compound, both sides of wall.

3. Masonry: Toggle bolts on hollow block and expansion bolts on solid block. Seal around sleeves with mortar, both sides of wall.

4. New Concrete: Concrete inserts with machine screws and bolts.

5. Existing Concrete: Expansion bolts.

6. Structural Steel: Spring-tension clamps.

   a. Comply with AWS D1.1 for field welding.

7. Light Steel Framing: Sheet metal screws.

8. Fasteners for Damp, Wet, or Weather-Exposed Locations: Stainless steel.

9. Light Steel: Sheet-metal screws.

10. Fasteners: Select so load applied to each fastener does not exceed 25 percent of its proof-test load.

3.4 IDENTIFICATION MATERIALS AND DEVICES

A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.

C. Self-Adhesive Identification Products: Clean surfaces before applying.

D. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.

E. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches, overall, use a single line marker.

F. Install warning, caution, and instruction signs where required to comply with 29 CFR 1910.145, Chapter XVII, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Indoors install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

G. Install, where applicable, engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch- high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

H. Provide service description etched on cover of all underground pull boxes.

3.5 FIRESTOPPING

A. Apply firestopping to cable and raceway sleeves and other penetrations of fire-rated floor and wall assemblies to restore original undisturbed fire-resistance ratings of assemblies. Firestopping installation is specified in Division 7 Section "Through-Penetration Firestop Systems."

3.6 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated.

3.7 DEMOLITION

A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.

C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.

D. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.8 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair, refinish and touch up disturbed finish materials and other surfaces to match adjacent undisturbed surfaces.

END OF SECTION

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SECTION 26 05 19

CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.2 SUBMITTALS

A. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 CONDUCTORS AND CABLES

A. Manufacturers:

1. Alcan Aluminum Corporation; Alcan Cable Div.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.

C. Conductor Material: Copper complying with NEMA WC 5 or 7; solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.

D. Conductor Insulation Types: Type THW, THHN-THWN or XHHW complying with NEMA WC 5 or 7.

2.3 CONNECTORS AND SPLICES

A. Manufacturers:

1. AMP Incorporated/Tyco International.
2. Hubbell/Anderson.
3. O-Z/Gedney; EGS Electrical Group LLC.

4. 3M Company; Electrical Products Division.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

A. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway .

C. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and in Crawlspaces: Type THHN-THWN, single conductors in raceway.

E. Exposed Branch Circuits, including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

G. Branch Circuits Concealed in Concrete and below Slabs-on-Grade: Type THHN-THWN, single conductors in raceway.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord.

I. Fire Alarm Circuits: Type THHN-THWN, in raceway.

J. Class 1 Control Circuits: Type THHN-THWN, in raceway.

K. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.2 INSTALLATION

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed feeders parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26.

F. Seal around cables penetrating fire-rated elements according to Section "Through-Penetration Firestop Systems."

G. Identify and color-code conductors and cables according to Division 26 Section "Basic Electrical Materials and Methods."

H. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

I. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.3 FIELD QUALITY CONTROL

A. Testing: Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

B. Test Reports: Prepare a written report to record the following:

1. Test procedures used.

2. Test results that comply with requirements.

3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION

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SECTION 26 05 26

GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes grounding of electrical systems and equipment. Requirements specified in this Section may be supplemented by requirements of other Sections.

1.2 SUBMITTALS

A. Product Data: For ground rods.

B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled under UL 467 as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Boggs, Inc.
2. Copperweld Corp.
3. Dossert Corp.
4. Erico Inc.; Electrical Products Group.
5. Galvan Industries, Inc.
6. Harger Lightning Protection, Inc.
7. Hastings Fiber Glass Products, Inc.
8. Heary Brothers Lightning Protection Co.
9. ILSCO.
10. Kearney/Cooper Power Systems.
11. Korns, C. C. Co.; Division of Robroy Industries.
12. Lightning Master Corp.
13. Lyncole XIT Grounding.
14. O-Z/Gedney Co.; a business of the EGS Electrical Group.
15. Robbins Lightning, Inc.
16. Salisbury, W. H. & Co.
17. Superior Grounding Systems, Inc.

18. Thomas & Betts, Electrical.

2.2 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Division 16 Section "Conductors and Cables."

B. Equipment Grounding Conductors: Insulated with green-colored insulation.

C. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.

D. Grounding Electrode Conductors: Stranded cable.

E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

F. Bare, Solid-Copper Conductors: ASTM B 3.

G. Assembly of Bare, Stranded-Copper Conductors: ASTM B 8.

H. Bare, Tinned-Copper Conductors: ASTM B 33.

I. Copper Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.

J. Copper Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

K. Tinned-Copper Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

L. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulated spacer.

M. Connectors: Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items. Exothermic-welded type, in kit form, selected per manufacturer's written instructions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel.

1. Size: 3/4 inches in diameter by 120 inches long.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

B. In raceways, use insulated equipment grounding conductors.

C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.

2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the indicated height above the floor.

E. Underground Grounding Conductors: Use copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.

F. Equipment Grounding Conductors: Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

1. Install insulated equipment grounding conductors in feeders.

2. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

3. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

4. Air-Duct Equipment Circuits: Install an insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.

5. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install an insulated equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.

6. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location and per Division 27.

a. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a grounding bus per Division 27.

b. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

7. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing an insulated equipment grounding conductor with supply branch-circuit conductors.

G. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.

1. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.

2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except as otherwise indicated. Make connections without exposing steel or damaging copper coating.

H. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

I. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers or supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

J. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

K. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.

L. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.

M. Connections: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.

2. Make connections with clean, bare metal at points of contact.

3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.

5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

6. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

7. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

8. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

9. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

10. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

11. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

N. Manholes and Handholes: Install a driven ground rod close to wall and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide a No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

O. Connections to Manhole Components: Connect exposed-metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

3.2 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.

2. Test completed grounding system at each location where a maximum ground-resistance level is indicated and at service disconnect enclosure grounding terminal. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.

3. Provide drawings locating each ground rod, ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results. Nominal maximum values are as follows:

a. Equipment Rated 500 kVA and Less: 10 ohms.

b. Equipment Rated 500 to 1000 kVA: 5 ohms.

c. Equipment Rated More Than 1000 kVA: 3 ohms.

d. Substations and Pad-Mounted Switching Equipment: 5 ohms.

e. Manhole Grounds: 10 ohms.

END OF SECTION

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SECTION 26 05 29

SEISMIC CONTROLS FOR ELECTRICAL WORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes seismic restraints and other earthquake-damage-reduction measures for electrical components. It applies to and complements optional seismic-restraint requirements in the various electrical component Sections of these Specifications.

1.2 DEFINITIONS

A. Seismic Restraint: A fixed device (a seismic brace, an anchor bolt or stud, or a fastening assembly) used to prevent vertical or horizontal movement, or both vertical and horizontal movement, of an electrical system component during an earthquake.

B. Mobile Structural Element: A part of the building structure such as a slab, floor structure, roof structure, or wall that may move independently of other structural elements during an earthquake.

1.3 SUBMITTALS

A. Product Data: Illustrate and indicate types, styles, materials, strength, fastening provisions, and finish for each type and size of seismic-restraint component used. Include documentation of evaluation and approval of components by agencies acceptable to authorities having jurisdiction.

B. Shop Drawings: For components, physical arrangements, and installation details not defined by Drawings. Indicate materials and show calculations, design analysis, details, and layouts, signed and sealed by a professional engineer.

C. Pre-approval and Evaluation Documentation: By an agency approved by authorities having jurisdiction, showing maximum ratings of restraints.

D. Qualification data.

E. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in California Building Code, unless requirements in this Section are more stringent.

B. Testing Agency Qualifications: An independent testing and inspection agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the inspection indicated.

1.5 PROJECT CONDITIONS

A. Project Seismic Zone and Zone Factor as Defined in CBC.

1.6 COORDINATION

A. Coordinate layout and installation of seismic bracing with building structure, architectural features, and mechanical, fire-protection, electrical, and other building systems.

B. Coordinate concrete bases with building structural system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Amber/Booth Company, Inc.

2. B-Line Systems, Inc.

3. Erico, Inc.

4. GS Metals Corp.

5. Loos & Company, Inc.

6. Mason Industries, Inc,

7. Powerstrut.

8. Thomas & Betts Corp.

9. Unistrut Corporation.

2.2 MATERIALS

A. Use the following materials for restraints:

1. Indoor Dry Locations: Steel, zinc plated.

2. Outdoors and Damp Locations: Galvanized steel.

3. Corrosive Locations: Stainless steel.

2.3 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

A. Strength: Defined in reports by ICBO Evaluation Service or another agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Strength in tension and shear of components shall be at least twice the maximum seismic forces for which they are required to be designed.

B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type.

C. Concrete Inserts: Steel-channel type.

D. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.

E. Welding Lugs: Comply with MSS SP-69, Type 57.

F. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.

G. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.

H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

2.4 SEISMIC-BRACING COMPONENTS

A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch cross section, formed from 0.1046-inch- thick steel, with 9/16-by-7/8-inch slots at a maximum of 2 inches o.c. in webs, and flange edges turned toward web.

1. Materials for Channel: ASTM A 570, GR 33.

2. Materials for Fittings and Accessories: ASTM A 575, ASTM A 576, or ASTM A 36.

3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.

4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.

B. Channel-Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.

C. Hanger Rod Stiffeners: Slotted steel channels, installed vertically, with internally bolted connections to hanger rod.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install seismic restraints according to applicable codes and regulations and as approved by authorities having jurisdiction, unless more stringent requirements are indicated.

B. Install structural attachments as follows:

1. Use bolted connections with steel brackets, slotted channel, and slotted-channel fittings to spread structural loads and reduce stresses.

2. Attachments to New Concrete: Bolt to channel-type concrete inserts or use expansion anchors.

3. Attachments to Existing Concrete: Use expansion anchors.

4. Holes for Expansion Anchors in Concrete: Drill at locations and to depths that avoid reinforcing bars.

5. Attachments to Solid Concrete Masonry Unit Walls: Use expansion anchors.

6. Attachments to Hollow Walls: Bolt to slotted steel channels fastened to wall with expansion anchors.

7. Attachments to Wood Structural Members: Install bolts through members.

8. Attachments to Steel: Bolt to clamps on flanges of beams or on upper truss chords of bar joists.

C. Install electrical equipment anchorage as follows:

1. Anchor panelboards, motor-control centers, motor controls, switchboards, transformers, fused power-circuit devices, control, and distribution units as follows:

a. Anchor equipment rigidly to a single mobile structural element or to a concrete base that is structurally tied to a single mobile structural element.

b. Size concrete bases so expansion anchors will be a minimum of 10 bolt diameters from the edge of the concrete base.

c. Bushings for Floor-Mounted Equipment Anchors: Install to allow for resilient media between anchor bolt or stud and mounting hole in concrete.

d. Anchor Bolt Bushing Assemblies for Wall-Mounted Equipment: Install to allow for resilient media where equipment or equipment-mounting channels are attached to wall.

e. Torque bolts and nuts on studs to values recommended by equipment manufacturer.

D. Install seismic bracing as follows:

1. Install bracing according to spacings and strengths indicated by approved analysis.

2. Expansion and Contraction: Install to allow for thermal movement of braced components.

3. Attachment to Structure: If specific attachment is not indicated, anchor bracing to the structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

E. Accommodation of Differential Seismic Motion: Make flexible connections in raceways, cables, wireway, cable trays, and busway where they cross expansion- and seismic-control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate at electrical equipment anchored to a different mobile structural element from the one supporting them.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing and inspection agency to inspect seismic-control installation for compliance with indicated requirements.

B. Testing Agency: Engage a qualified testing and inspection agency to inspect seismic-control installation for compliance with indicated requirements.

C. Reinspection: Correct deficiencies and verify by reinspection that work complies with requirements.

D. Provide written report of tests and inspections.

END OF SECTION

SECTION 26 13 00

RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets indicated.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 METAL CONDUIT AND TUBING

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Anamet Electrical, Inc.; Anaconda Metal Hose.
4. Electri-Flex Co.
5. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
6. LTV Steel Tubular Products Company.
7. Manhattan/CDT/Cole-Flex.
8. O-Z Gedney; Unit of General Signal.
9. Wheatland Tube Co.

B. Rigid Steel Conduit: ANSI C80.1.

C. Aluminum Rigid Conduit: ANSI C80.5.

D. IMC: ANSI C80.6.

E. EMT and Fittings: ANSI C80.3.

1. Fittings: Compression type.

F. FMC: Aluminum.

G. LFMC: Flexible steel conduit with PVC jacket.

H. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

2.3 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers:

1. American International.

2. Anamet Electrical, Inc.; Anaconda Metal Hose.

3. Arnco Corp.

4. Cantex Inc.

5. Certainteed Corp.; Pipe & Plastics Group.

6. Condux International.

7. ElecSYS, Inc.

8. Electri-Flex Co.

9. Lamson & Sessions; Carlon Electrical Products.

10. Manhattan/CDT/Cole-Flex.

11. RACO; Division of Hubbell, Inc.

12. Spiralduct, Inc./AFC Cable Systems, Inc.

13. Thomas & Betts Corporation.

B. RNC: NEMA TC 2, Schedule 40 and Schedule 80 PVC.

C. RNC Fittings: NEMA TC 3; match to conduit or tubing type and material.

2.4 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.

1. Manufacturers:

a. Airey-Thompson Sentinel Lighting; Wiremold Company (The).

b. Thomas & Betts Corporation.

c. Walker Systems, Inc.; Wiremold Company (The).

d. Wiremold Company (The); Electrical Sales Division.

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC compound with matte texture and manufacturer's standard color.

1. Manufacturers:

a. Butler Manufacturing Co.; Walker Division.

b. Enduro Composite Systems.

c. Hubbell, Inc.; Wiring Device Division.

d. Lamson & Sessions; Carlon Electrical Products.

e. Panduit Corp.

f. Walker Systems, Inc.; Wiremold Company (The).

g. Wiremold Company (The); Electrical Sales Division.

C. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.

2. Emerson/General Signal; Appleton Electric Company.

3. Erickson Electrical Equipment Co.

4. Hoffman.

5. Hubbell, Inc.; Killark Electric Manufacturing Co.

6. O-Z/Gedney; Unit of General Signal.

7. RACO; Division of Hubbell, Inc.

8. Robroy Industries, Inc.; Enclosure Division.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

H. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

I. Concrete Boxes: Pre-cast reinforced, size and type as shown; Christy, Brooks or approved equal. All underground boxes shall be provided with traffic grade, spring loaded, bolt-down, steel cover.

2.6 FACTORY FINISHES

A. Finish: For raceway, enclosure, or cabinet components provide manufacturer's standard prime-coat finish ready for field painting.

2.7 FIRESTOPPING FOR LOW VOLTAGE SLEEVES

A. Firestop Pillows: STI SpecSeal® Brand re-enterable, non-curing, mineral fiber core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag, the following products are acceptable:

1. Specified Technologies Inc. (STI) SpecSeal® Series SSB Pillows.

B. Fire Rated Cable Pathways: STI EZ-PATH™ Brand device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill, the following products are acceptable:

1. Specified Technologies Inc. (STI) EZ-PATH™ Fire Rated Pathway.

2. Specified Technologies Inc. (STI) Mini EZ-PATH™ Fire Rated Pathway.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors:

1. Exposed: Rigid steel or IMC.

2. Concealed: Rigid steel or IMC.

3. Underground, Single Run: RNC.

4. Underground, Grouped: RNC.

5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

6. Boxes and Enclosures: NEMA 250, Type 3R.

7. Underground duct bank conduit spacers.

8. Backfill materials per civil site requirements.

B. Indoors:

1. Exposed: EMT.

2. Concealed: EMT.

3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.

4. Damp or Wet Locations: Rigid steel conduit.

5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:

a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

3. For Outdoor Use – conduit hub, NEMA 4 for conduit connection/terminating to cabinet/panel/boxes.

4. All connectors to be steel. Die cast connectors are not acceptable.

E. Do not install aluminum conduits embedded in or in contact with concrete.

3.2 INSTALLATION

A. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

B. Complete raceway installation before starting conductor installation.

C. Support raceways as specified in Division 16 Section "Basic Electrical Materials and Methods."

D. Install temporary closures to prevent foreign matter from entering raceways.

E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above finished slab.

F. Make bends and offsets so ID is not reduced. Keep legs of bends in same plane and keep straight legs of offsets parallel, unless otherwise indicated.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

1. Install concealed raceways with a minimum of bends in shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.

H. Raceways Embedded in Slabs: Install in middle 1/3 of slab thickness where practical and leave at least 2 inches of concrete cover.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.

2. Space raceways laterally to prevent voids in concrete.

3. Run conduit larger than 1-inch trade size parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.

4. Change from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.

I. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.

1. Run parallel or banked raceways together on common supports.

2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

J. Join raceways with fittings designed and approved for that purpose and make joints tight.

1. Use insulating bushings to protect conductors on all raceways 2” and larger.

K. Tighten set screws of threadless fittings with suitable tools.

L. Terminations:

1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.

2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200 lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

N. Telephone and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

O. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

2. Where otherwise required by NFPA 70.

P. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

Q. Flexible Connections: Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.

R. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.

S. Set floor boxes level and flush with finished floor surface.

T. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.3 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 22 00

FUSES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Cartridge fuses rated 600 V and less for use in switches controllers and motor-control centers.

1.2 SUBMITTALS

A. Product Data: For each fuse type indicated.

B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NEMA FU 1.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Cooper Bussman, Inc.

2. Eagle Electric Mfg. Co., Inc.; Cooper Industries, Inc.

3. Ferraz Shawmut, Inc.

4. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

PART 3 - EXECUTION

3.1 FUSE APPLICATIONS

A. Service Entrance: Class L, fast acting or J, fast acting.

B. Motor Branch Circuits: Class RK5, time delay.

3.2 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.3 IDENTIFICATION

A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION

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SECTION 26 24 20

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Enclosure types and details for types other than NEMA 250, Type 1.

b. Bus configuration, current, and voltage ratings.

c. Short-circuit current rating of panelboards and overcurrent protective devices.

d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Power, signal, and control wiring.

3. Field quality-control test reports.

4. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:

a. Eaton Corporation; Cutler-Hammer Products.

b. General Electric Co.; Electrical Distribution & Protection Div.

c. Siemens Energy & Automation, Inc.

d. Square D.

2.2 MANUFACTURED UNITS

A. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1.

1. Rated for environmental conditions at installed location.

a. Outdoor Locations: NEMA 250, Type 3R.

b. Kitchen Areas: NEMA 250, Type 4.

c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

B. Phase and Ground Buses: Hard-drawn copper, 98 percent conductivity.

C. Conductor Connectors: Suitable for use with conductor material.

1. Ground Lugs and Bus Configured Terminators: Compression type.

D. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.

E. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices. Provide 20% space in all panelboards

F. Panelboard Short-Circuit Rating:

1. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.3 DISTRIBUTION PANELBOARDS

A. Doors: Secured with vault-type latch with tumbler lock; keyed alike. Omit for fused-switch panelboards.

B. Main Overcurrent Protective Devices: Circuit breaker.

C. Branch Overcurrent Protective Devices:

1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units. No tie-handle allowed for multi-pole breakers.

B. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. GFCI Circuit Breakers: Single- and two-pole configurations with 30-mA trip sensitivity.

3. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

a. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.

b. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

c. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Fungus Proofing: Permanent fungicidal treatment for panelboard interior, including overcurrent protective devices and other components for all NEMA 3R panelboards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Comply with mounting and anchoring requirements specified in Division 16 Section "Seismic Controls for Electrical Work."

C. Mount top of trim 74 inches above finished floor, unless otherwise indicated.

D. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

E. Install overcurrent protective devices and controllers.

1. Set field-adjustable switches and circuit-breaker trip ranges.

F. Install filler plates in unused spaces.

G. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future.

H. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Basic Electrical Materials and Methods."

I. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

J. Ground equipment according to Division 26 Section "Grounding and Bonding."

K. Connect wiring according to Division 26 Section "Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

END OF SECTION

SECTION 26 27 00

TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

1. Distribution transformers.

2. Control and signal transformers.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Wiring and connection diagrams.

C. Output Settings Reports: Record of tap adjustments specified in Part 3.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C 57.12.91.

C. Energy-Efficient Transformers Rated 15 kVA and Larger: Certified as meeting NEMA TP 1, Class 1 efficiency levels when tested according to NEMA TP 2. Transformers shall be EPA Energy Star® compliant and bear the Energy Star® label.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Acme Electric Corporation; Power Distribution Products Division.

2. Cutler-Hammer.

3. Federal Pacific Transformer Company; Division of Electro-Mechanical Corp.

4. GE Electrical Distribution & Control.

5. Siemens Energy & Automation, Inc.

6. Square D/Group Schneider NA.

2.2 MATERIALS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Coils: Continuous windings without splices, except for taps.

1. Internal Coil Connections: Brazed or pressure type.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Provide transformers that are internally braced to withstand seismic forces specified in Division 16 Section "Seismic Controls for Electrical Work."

C. Cores: One leg per phase.

D. Enclosure:

1. Ventilated, NEMA 250, Type 2 (indoor)

2. Ventilated, raintight, NEMA 250, Type 3R (for exterior at secured areas)

3. Totally enclosed, nonventilated, with lifting eyes, NEMA 250, type suitable for outdoor use (for exterior at public accessible locations)

4. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

E. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

F. Taps for Transformers Smaller Than 3 kVA: None.

G. Taps for Transformers 7.5 to 24 kVA: Two 5 percent taps below rated voltage.

H. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.

I. Wall Brackets: Manufacturer's standard brackets.

J. Sound levels shall be warranted by the manufacturer not to exceed the following: 1515 to 50KVA - 45dB; 51 to 150kVA - 50dB; 151 to 300kVA - 55dB; 301 to 500kVA - 60dB; 501 to 700kVA - 62dB; 701 to 1000kVA - 64Db

K. Transformers shall be low loss type with minimum efficiencies per NEMA TP1 when operated at 35% of full load capacity. Efficiency shall be tested in accordance with NEMA TP2.

Single Phase		Three Phase	
KVA	Efficiency	KVA	Efficiency
15	97.7%	15	97.0%
25	98.0%	30	97.5%
37.5	98.2%	45	97.7%
50	98.3%	75	98.0%
75	98.5%	112.5	98.2%
100	98.6%	150	98.3%
167	98.7%	225	98.5%
250	98.8%	300	98.6%
333	98.9%	500	98.7%
		750	98.8%
		1000	98.9%

2.4 CONTROL AND SIGNAL TRANSFORMERS

A. Description: Self-cooled, two-winding dry type, rated for continuous duty, complying with NEMA ST 1, and listed and labeled as complying with UL 506.

B. Ratings: Continuous duty. If rating is not indicated, provide at least 50 percent spare capacity above connected peak load.

2.5 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

B. Install floor-mounting transformers level on concrete bases.

3.2 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding."

B. Connect wiring according to Division 26 Section "Conductors and Cables."

3.3 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 5 percent. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

END OF SECTION

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SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Single and duplex receptacles, ground-fault circuit interrupters.
2. Single- and double-pole snap switches and dimmer switches.
3. Device wall plates.
4. Floor service outlets, poke-through assemblies and multioutlet assemblies.

1.2 SUBMITTALS

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

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Wiring Devices:
   a. Bryant Electric, Inc./Hubbell Subsidiary.
   b. Eagle Electric Manufacturing Co., Inc.
   c. Hubbell Incorporated; Wiring Device-Kellems.
   d. Leviton Mfg. Company Inc.
   e. Pass & Seymour/Legrand; Wiring Devices Div.

2. Multioutlet Assemblies:
   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Wiremold Company (The).

3. Poke-Through, Floor Service Outlets and Telephone/Power Poles:
   a. Hubbell Incorporated; Wiring Device-Kellems.

b. Pass & Seymour/Legrand; Wiring Devices Div.

c. Square D/Groupe Schneider NA.

d. Thomas & Betts Corporation.

e. Wiremold Company (The).

2.2 RECEPTACLES

A. Straight-Blade and Locking Receptacles: Heavy-Duty grade.

B. Straight-Blade Receptacles: Hospital grade.

C. GFCI Receptacles: Straight blade, non-feed-through type, Hospital or Heavy-Duty grade, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-3/4-inch deep outlet box without an adapter.

2.3 SWITCHES

A. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.

B. Snap Switches: Heavy-Duty grade, quiet type.

C. Combination Switch and Receptacle: Both devices in a single gang unit with plaster ears and removable tab connector that permit separate or common feed connection.

1. Switch: 20 A, 120/277-V ac.

2. Receptacle: NEMA WD 6, Configuration 5-20R.

D. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible frequency and EMI/RFI filters.

1. Control: Continuously adjustable slider; with single-pole or three-way switching to suit connections.

2. Incandescent Lamp Dimmers: Modular, 120 V, 60 Hz with continuously adjustable rotary knob, toggle switch, or slider; single pole with soft tap or other quiet switch; EMI/RFI filter to eliminate interference; and 5-inch wire connecting leads.

3. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.4 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.

2. Material for Finished Spaces:

a. Steel with white baked enamel, suitable for field painting

b. 0.035-inch thick, satin-finished stainless steel (above counters and in restrooms)

3. Material for Unfinished Spaces: Galvanized steel.

4. Material for Wet Locations: Cast aluminum with spring-loaded, lockable, lift cover, and listed and labeled for use in "wet locations."

2.5 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, solid brass with satin finish.

D. Power Receptacle: NEMA WD 6, Configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: See telecommunication specifications for requirements.

F. Wiremold RFB4-4DB series complete with brackets, devices, corresponding covers and hardware.

2.6 POKE-THROUGH ASSEMBLIES

A. Description: Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service outlet assembly.

1. Service Outlet Assembly: Flush type with two simplex receptacles and space for two RJ-45 jacks.

2. Size: Selected to fit nominal 4-inch cored holes in floor and matched to floor thickness.

3. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.

4. Closure Plug: Arranged to close unused 4-inch cored openings and reestablish fire rating of floor.

5. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors; and a minimum of four, 4-pair, Category 6 voice and data communication cables.

2.7 MULTIOUTLET ASSEMBLIES

A. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

B. Raceway Material: PVC.

C. Wire: No. 12 AWG.

2.8 FINISHES

A. Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies level, plumb, and square with building lines.

B. Install wall dimmers to achieve indicated rating after derating for ganging.

C. Install unshared neutral conductors on line and load side of dimmers.

D. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on bottom. Group adjacent switches under single, multigang wall plates.

E. Remove wall plates and protect devices and assemblies during painting.

F. Adjust locations of floor service outlets to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Basic Electrical Materials and Methods."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

2. Submit same for approval.

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding."

B. Connect wiring according to Division 26 Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections:

1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.

2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following individually mounted, enclosed switches and circuit breakers:

1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers.
4. Enclosures.

1.2 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.

B. Field quality-control test reports.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

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

2.2 FUSIBLE AND NONFUSIBLE SWITCHES

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
3. Siemens Energy & Automation, Inc.
4. Square D/Group Schneider.

B. Fusible Switch, 600 A and Smaller: NEMA KS 1, Type GD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Nonfusible Switch, 600 A and Smaller: NEMA KS 1, Type GD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.

3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open (required for all disconnects located downstream of Variable frequency Drives)

2.3 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.

2. General Electric Co.; Electrical Distribution & Control Division.

3. Siemens Energy & Automation, Inc.

4. Square D/Group Schneider.

B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.

4. GFCI Circuit Breakers: Single- and two-pole configurations with 30-mA trip sensitivity.

C. Molded-Case Circuit-Breaker Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.

2. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.

3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

4. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.

2.4 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Outdoor Locations: NEMA 250, Type 3R.

2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.

3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.

B. Concrete base is specified in Division 26 Section "Basic Electrical Materials and Methods," and concrete materials and installation requirements are specified in Division 3.

C. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

D. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

E. Comply with mounting and anchoring requirements specified in Division 26 Section "Seismic Controls for Electrical Work."

F. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

G. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Basic Electrical Materials and Methods."

3.2 FIELD QUALITY CONTROL

A. Prepare for acceptance testing as follows:

1. Inspect mechanical and electrical connections.

2. Verify switch and relay type and labeling verification.

3. Verify rating of installed fuses.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

END OF SECTION

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SECTION 26 51 00

INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Interior lighting fixtures with lamps and ballasts.
2. Lighting fixtures mounted on exterior building surfaces.
3. Emergency lighting units.
4. Exit signs.
5. Accessories, including fluorescent fixture dimmers, occupancy sensors and lighting fixture retrofitting.

1.2 SUBMITTALS

A. Product Data: For each type of lighting fixture scheduled, arranged in order of fixture designation. Include data on features, accessories, and finishes. Clearly identify ballast(s) and lamp(s) for each lighting fixture.

B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

PART 2 - PRODUCTS

2.1 SUMMARY

A. This Section includes the following:

1. Interior lighting fixtures with lamps and ballasts.
2. Lighting fixtures mounted on exterior building surfaces.
3. Emergency lighting units.
4. Exit signs.
5. Accessories, including fluorescent fixture dimmers, occupancy sensors and lighting fixture retrofitting.

2.2 SUBMITTALS

A. Product Data: For each type of lighting fixture scheduled, arranged in order of fixture designation. Include data on features, accessories, and finishes. Clearly identify ballast(s) and lamp(s) for each lighting fixture.

B. Operation and maintenance data.

2.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.MANUFACTURERS

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

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

2.4 FIXTURES AND COMPONENTS, GENERAL

A. Air-Handling Fluorescent Fixtures: For use with plenum ceiling for air return and heat extraction and for attaching an air-diffuser-boot assembly specified in Division 15 Section "Diffusers, Registers, and Grilles."

1. Air Supply Units: Slots in one or both side trims join with air-diffuser-boot assemblies.

2. Heat Removal Units: Air path leads through lamp cavity.

3. Combination Heat Removal and Air Supply Unit: Heat is removed through lamp cavity at both ends of the fixture door with air supply same as for air supply units.

4. Dampers: Operable from outside fixture for control of return-air volume.

5. Static Fixtures: Air supply slots are blanked off, and fixture appearance matches active units.

2.5 LIGHTING FIXTURES

A. Fixture : See drawings.

2.6 LAMP BALLASTS

A. Description: Include the following features, unless otherwise indicated:

1. Designed for type and quantity of lamps indicated at full light output except for emergency lamps powered by in-fixture battery-packs.

2. Externally fused with slow-blow type rated between 2.65 and 3.0 times the line current.

3. Warranted for 5 years to include replacement ballasts and labor cost, plus lamp warranty for at least 2 years for lamps used with ballast.

B. LED lamps shall include following features:

1. L.E.D. 3000K/3500K - Philips, CREE or approved equal..

2. Comply with NEMA C82.11.

3. Normal Light Output (NLO) BF 0.87.

4. Sound Rating: A.

5. Total harmonic distortion rating of less than 20 percent according to NEMA C82.11.

6. Transient Voltage Protection: IEEE C62.41, Category A.

7. Listed class P automatic reset thermal protection.

8. Lamp Current Crest Factor: Less than 1.7

C. Ballasts for dimmer-controlled fixtures shall comply with general and fixture-related requirements above for electronic ballasts and the following features:

1. Dimming Range: 100 to 5 percent of rated lamp lumens.

2. Ballast Input Watts: Can be reduced to 20 percent of normal.

3. Compatibility: Certified by manufacturer for use with specific dimming system indicated.

2.7 EXIT SIGNS

A. General: Comply with UL 924; for sign colors and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum of rated lamp life.

C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.

2. Charger: Fully automatic, solid-state type with sealed transfer relay.

3. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

2.8 EMERGENCY LIGHTING UNITS

A. General: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type with minimum 10-year nominal life and special warranty.

2. Charger: Fully automatic, solid-state type with sealed transfer relay.

3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

4. Wire Guard: Where indicated, heavy-chrome-plated wire guard protects lamp heads or fixtures.

5. Integral Time-Delay Relay: Holds unit on for fixed interval when power is restored after an outage; time delay permits high-intensity-discharge lamps to restrike and develop adequate output.

2.9 EMERGENCY LIGHTING FIXTURES

A. Internal Type: Self-contained, modular, battery-inverter unit factory mounted within fixture body. Comply with UL 924.

1. Emergency Connection: Operate one lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.

2. Test Switch and Light-Emitting-Diode Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

3. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum seven-year nominal life.

4. Charger: Fully automatic, solid-state, constant-current type.

2.10 LED LAMPS

A. L.E.D. 3000K/3500K - Philips, CREE or approved equal..

2.11 FIXTURE SUPPORT COMPONENTS

A. Comply with Division 16 Section "Basic Electrical Materials and Methods" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated, 12 gage.

E. Wires For Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

2.12 LIGHTING CONTROL DEVICES

A. Dimming Ballast Controls: Sliding-handle type with on/off control; compatible with ballast and having light output and energy input over the full dimming range.

B. Light Level Sensor: Detect changes in ambient lighting level and provide dimming range of 20 to 100 percent in response to change.

1. Sensor Capacity: At least 40 electronic dimming ballasts.

2. Adjustable Ambient Detection Range: 10 to 100 fc minimum

C. Occupancy Sensors: Adjustable sensitivity and off delay time range of 5 to 15 minutes.

1. Device Color:

a. Wall Mounted: White.

b. Ceiling Mounted: White.

2. Occupancy detection indicator.

3. Ultrasonic Sensors: Crystal controlled with circuitry that causes no detection interference between adjacent sensors.

4. Infrared Sensors: With daylight filter and lens to afford coverage applicable to space to be controlled.

Combination Sensors: Ultrasonic and infrared sensors combined.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support.

1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from fixture corners.

2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.

3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.

4. Install at least two independent support rods or wires from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

C. Suspended Fixture Support: As follows:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging. Pendant fixtures shall be free to swing a minimum of 45 degrees from the vertical in all directions without contacting any obstructions. Otherwise, seismic restraints are required.

2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.

3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

4. Continuous Rows: Suspend from cable.

D. Air-Handling Fixtures: Install with dampers closed and ready for adjustment.

E. Adjust aimable fixtures to provide required light intensities.

F. Occupancy sensor and daylighting sensor placement review by factory representative is required before installing sensors.

3.2 COMMISSIONING

G. A. All electrical power and lighting controls will be commissioned per the requirements of Section 01810, Commissioning Requirements. Contractor is to provide a factory representative to start-up, test and commission all lighting controls.

END OF SECTION

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SECTION 26 51 01

LIGHTING CONTROL SYSTEM

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Digital Lighting Controls
2. Relay Panels
3. Emergency Lighting Control (if applicable)

B. Related Sections:

1. Section 26 27 26 - Wiring Devices
2. Section 26 51 00 – Interior Lighting
3. Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections apply to this Section
4. Electrical Sections, including wiring devices, apply to the work of this Section.

C. Control Intent – Control Intent includes, but is not limited to:

1. Defaults and initial calibration settings for such items as time delay, sensitivity, fade rates, etc.
2. Initial sensor and switching zones
3. Initial time switch settings
4. Task lighting and receptacle controls
5. Emergency Lighting control (if applicable)

1.2 REFERENCES

A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)

B. International Electrotechnical Commission (IEC)

C. International Organization for Standardization (ISO)

D. National Electrical Manufacturers Association (NEMA)

E. WD1 (R2005) - General Color Requirements for Wiring Devices.

F. Underwriters Laboratories, Inc. (UL)

1. 20 – Plug Load Controls
2. 508– Industrial Controls
3. 916 – Energy Management Equipment.
4. 924 – Emergency Lighting

1.3 SYSTEM DESCRIPTION & OPERATION

A. The Lighting Control and Automation system as defined under this section covers the following equipment:

1. Digital Occupancy Sensors – Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.

2. Digital Switches – Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.

3. Handheld remotes for personal control – One-button dimming, two-button on/off, or five-button scene remotes provide control using infrared communications. Remote may be configured in the field to control selected loads or scenes without special tools.

4. Digital Daylighting Sensors – Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications can provide switching, bi-level, tri-level or dimming control for daylight harvesting.

5. Digital Room Controllers – Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities.

6. Digital Plug-Load Controllers – Self-configuring, digitally addressable, single relay, plenum-rated application-specific controllers. Selected models include integral current monitoring capabilities.

7. Configuration Tools – Handheld remote for room configuration and relay panel programming provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away. Unit to have Organic LED display, simple pushbutton interface, and allow bi-directional communication of room variables and occupancy sensor settings. Computer software also customizes room settings.

8. Digital Lighting Management (DLM) local network – Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.

9. Digital Lighting Management (DLM) segment network – Linear topology, BACnet MS/TP network (1.5 twisted pair, shielded,) to connect multiple DLM local networks for centralized control.

10. Network Bridge – provides BACnet MS/TP-compliant digital networked communication between rooms, panels and the Segment Manager or building automation system (BAS) and automatically creates BACnet objects representative of connected devices.

11. Segment Manager – provides web browser-based user interface for system control, scheduling, power monitoring, room device parameter administration and reporting.

12. Programming and Configuration software – Optional PC-native application capable of accessing DLM control parameters within a room, for the local network, via a USB adapter, or globally, for many segment networks simultaneously, via BACnet/IP communication.

13. LMCP Digital Lighting Management Relay Panel – provides up to 8, 24, or 48 mechanically latching relays. Relays include a manual override and a single push-on connector for easy installation or removal from the panel. Panel accepts program changes from handheld configuration tool for date and time, location, holidays, event scheduling, button binding and group programming. Provides BACnet MS/TP-compliant digital networked communication between other lighting controls and/or building automation system (BAS).

14. Emergency Lighting Control Unit (ELCU) – allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building

1.4 LIGHTING CONTROL APPLICATIONS

A. Unless relevant provisions of the applicable local Energy Codes are more stringent, provide a minimum application of lighting controls as follows:

1. Space Control Requirements – Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality in all spaces except toilet rooms, storerooms, library stacks, or other applications where hands-free operation is desirable and Automatic-ON occupancy sensors are more appropriate. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room, meeting room, open plan system and training room. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors and Manual-ON switches.

2. Bi-Level Lighting – Provide multi-level controls in all spaces except toilet rooms, storerooms, library stacks, or applications where variable dimming is used.

3. Task Lighting / Plug Loads – Provide automatic shut off of non essential plug loads and task lighting in all spaces except toilet rooms and storerooms. Provide Automatic-ON of plug loads whenever spaces are occupied. For spaces with multiple occupants a single shut off consistent with the overhead lighting may be used for the area.

4. Daylit Areas – Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:

   a. All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones.

   b. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.

   c. Multiple-leveled switched daylight harvesting controls may be utilized for areas marked on drawings.

   d. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.

5. Conference, meeting, training, auditoriums, and multipurpose rooms shall have controls that allow for independent control of each local control zone. Rooms larger than 300 square feet shall instead have at least four (4) pre-set lighting scenes unless otherwise specified. Occupancy / vacancy sensors shall be provided to extinguish all lighting in the space. Spaces with up to four moveable walls shall include controls that can be reconfigured when the room is partitioned.

1.5 SUBMITTALS

A. Submittals Package: Submit the shop drawings, and the product data specified below at the same time as a package.

B. Shop Drawings:

1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.

2. Show exact location of all digital devices, including at minimum sensors, room controllers, and switches for each area on reflected ceiling plans. (Contractor must provide AutoCAD format reflected ceiling plans.)

3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.

4. Network riser diagram including floor and building level details. Include network cable specification and end-of-line termination details, if required. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.

C. Product Data: Catalog sheets, specifications and installation instructions.

D. Include data for each device which:

1. Indicates where sensor is proposed to be installed.

2. Prove that the sensor is suitable for the proposed application.

1.6 QUALITY ASSURANCE

A. Manufacturer: Minimum [10] years experience in manufacture of lighting controls.

1.7 PROJECT CONDITIONS

A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:

1. Ambient temperature: 0° to 40° C (32° to 104° F).

2. Relative humidity: Maximum 90 percent, non-condensing.

1.8 WARRANTY

A. Provide a five year limited manufacturer's warranty on all room control devices and panels.

1.9 MAINTENANCE

A. Spare Parts:

1. Provide 10% spares of each product to be used for maintenance for wall switches, dimmer switches and controllers.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer:

1. WattStopper

a. System: Digital Lighting Management (DLM)

2. Basis of design product: WattStopper Digital Lighting Management (DLM).

B. Substitutions: [If Permitted]

1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional a minimum of 10 working days prior to the bid date and must be made available to all bidders. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.

2. By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring. The contractor shall provide complete engineered shop drawings (including power and control wiring) with deviations from the original design highlighted for review and approval prior to rough-in.

2.2 DIGITAL LIGHTING CONTROLS

A. Furnish the Company's system which accommodates the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories which suit the lighting and electrical system parameters.

2.3 DIGITAL WALL SWITCH OCCUPANCY SENSORS

A. Wallbox mounted passive infrared PIR or dual technology (passive infrared and ultrasonic) digital occupancy sensor with 1 or 2 switch buttons.

B. Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:

1. Digital calibration and pushbutton configuration for the following variables:
    a. Sensitivity – 0-100% in 10% increments
    b. Time delay – 1-30 minutes in 1 minute increments
    c. Test mode – Five second time delay
    d. Detection technology – PIR, Dual Technology activation and/or re-activation.
    e. Walk-through mode
    f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.

2. Programmable control functionality including:
    a. Each sensor may be programmed to control specific loads within a local network.
    b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
    c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.
    d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
        a) Ultrasonic and Passive Infrared
        b) Ultrasonic or Passive Infrared
        c) Ultrasonic only
        d) Passive Infrared only

3. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.

4. Two RJ-45 ports for connection to DLM local network.

5. Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote personal controls.

6. Device Status LEDs including:

    a. PIR detection

    b. Ultrasonic detection

    c. Configuration mode

    d. Load binding

7. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.

8. Assignment of local buttons to specific loads within the room without wiring or special tools

9. Manual override of controlled loads.

10. All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.

C. BACnet object information shall be available for the following objects:

1. Detection state

2. Occupancy sensor time delay

3. Occupancy sensor sensitivity, PIR and Ultrasonic

4. Button state

5. Switch lock control

6. Switch lock status

D. Units shall not have any dip switches or potentiometers for field settings.

E. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

F. Two-button wall switch occupancy sensors, when connected to a single relay dimming room controller, shall operate in the following sequence as a factory default:

1. Left button

    a. Press and release - Turn load on

    b. Press and hold - Raise dimming load

2. Right button

    a. Press and release - Turn load off

    b. Press and hold - Lower dimming load

G. Low voltage momentary pushbuttons shall include the following features:

1. Load/Scene Status LED on each switch button with the following characteristics:

   a. Bi-level LED

   b. Dim locator level indicates power to switch

   c. Bright status level indicates that load or scene is active

2. The following button attributes may be changed or selected using a wireless configuration tool:

   a. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).

   b. Individual button function may be configured to Toggle, On only or Off only.

   c. Individual scenes may be locked to prevent unauthorized change.

   d. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.

   e. Ramp rate may be adjusted for each dimmer switch.

   f. Switch buttons may be bound to any load on a room controller and are not load type dependent; each button may be bound to multiple loads.

H. WattStopper part numbers: LMPW, LMDW. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

2.4 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR

A. Wall or ceiling mounted (to suit installation) passive infrared (PIR), ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor.

B. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:

1. Digital calibration and pushbutton configuration for the following variables:
   a. Sensitivity – 0-100% in 10% increments
   b. Time delay – 1-30 minutes in 1 minute increments
   c. Test mode – Five second time delay
   d. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
   e. Walk-through mode
   f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.

2. Programmable control functionality including:
   a. Each sensor may be programmed to control specific loads within a local network.
   b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
   c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.

d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:

i Ultrasonic and Passive Infrared

ii Ultrasonic or Passive Infrared

iii Ultrasonic only

iv Passive Infrared only

3. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.

4. One or two RJ-45 port(s) for connection to DLM local network.

5. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.

6. Device Status LEDs, which may be disabled for selected applications, including:

   a. PIR detection

   b. Ultrasonic detection

   c. Configuration mode

   d. Load binding

7. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.

8. Manual override of controlled loads.

9. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.

B. BACnet object information shall be available for the following objects:

1. Detection state

2. Occupancy sensor time delay

3. Occupancy sensor sensitivity, PIR and Ultrasonic

C. Units shall not have any dip switches or potentiometers for field settings.

D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

E. WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC

2.5 DIGITAL WALL SWITCHES

A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features:

1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.

2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.

3. Configuration LED on each switch that blinks to indicate data transmission.

4. Load/Scene Status LED on each switch button with the following characteristics:

    a. Bi-level LED

    b. Dim locator level indicates power to switch

    c. Bright status level indicates that load or scene is active

5. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.

6. Programmable control functionality including:

    a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority

    b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.

7. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.

B. BACnet object information shall be available for the following objects:

1. Button state

2. Switch lock control

3. Switch lock status

C. Two RJ-45 ports for connection to DLM local network.

D. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.

E. The following switch attributes may be changed or selected using a wireless configuration tool:

1. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).

2. Individual button function may be configured to Toggle, On only or Off only.

3. Individual scenes may be locked to prevent unauthorized change.

4. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.

5. Ramp rate may be adjusted for each dimmer switch.

6. Switch buttons may be bound to any load on a room controller and are not load type dependant; each button may be bound to multiple loads.

F. WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

2.6 HANDHELD REMOTE CONTROLS

A. Battery-operated handheld devices in 1, 2 and 5 button configurations for remote switching or dimming control. Remote controls shall include the following features:

1. Two-way infrared (IR) transceiver for line of sight communication with DLM local network within up to 30 feet.

2. LED on each button confirms button press.

3. Load buttons may be bound to any load on a room controller and are not load type dependant; each button may be bound to multiple loads.

4. Inactivity timeout to save battery life.

B. A wall mount holster and mounting hardware shall be included with each remote control

C. WattStopper part numbers: LMRH-101, LMRH-102, LMRH-105.

2.7 DIGITAL PARTITION CONTROLS

A. Partition controls shall enable manual or automatic coordination of lighting controls in flexible spaces with up to four moveable walls by reconfiguring the connected digital switches and occupancy sensors.

B. Four-button low voltage pushbutton switch for manual control.

1. Two-way infrared (IR) transceiver for use with configuration remote control.

2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.

3. Configuration LED on each switch that blinks to indicate data transmission.

4. Each button represents one wall; Green button LED indicates status.

5. Two RJ-45 ports for connection to DLM local network.

6. WattStopper part number: LMPS-104. Available in white, light almond, ivory, grey and black; compatible with wall plates with decorator opening.

C. Contact closure interface for automatic control via input from limit switches on movable walls (by others).

1. Operates on Class 2 power supplied by DLM local network.

2. Includes 24VDC output and four input terminals for maintained third party contract closure inputs.

a. Input max. sink/source current: 1-5mA

b. Logic input signal voltage High: >18VDC

c. Logic input signal voltage Low: <2VDC

3. Four status LEDs under hinged cover indicate if walls are open or closed; supports LMPS-104 as remote status indicator.

4. Two RJ-45 ports for connection to DLM local network.

5. WattStopper part number: LMIO-102

2.8 DIGITAL DAYLIGHTING SENSORS

A. Digital daylighting sensors shall work with room controllers to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to a room controller. Daylighting sensors shall be interchangeable without the need for rewiring.

1. Closed loop sensors measure the ambient light in the space and control a single lighting zone.
2. Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones.
3. Dual loop sensors measure both ambient and incoming daylight in the space to insure that proper light levels are maintained as changes to reflective materials are made in a single zone.

B. Digital daylighting sensors shall include the following features:

1. The sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrums. The photo-cell shall have a sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers.
2. Sensor light level range shall be from 1-6,553 footcandles (fc).
3. The capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of room controller(s) and load binding to room controller(s).
4. For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.
5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.
6. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
7. Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.
8. Optional wall switch override shall allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise lighting levels for a selectable period of time or cycle of occupancy.
9. Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
10. Configuration LED status light on device that blinks to indicate data transmission.
11. Status LED indicates test mode, override mode and load binding.
12. Recessed switch on device to turn controlled load(s) ON and OFF.
13. BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:
    a. Light level
    b. Day and night setpoints
    c. Off time delay
    d. On and off setpoints
    e. Up to three zone setpoints

f. Operating mode – on/off, bi-level, tri-level or dimming

14. One RJ-45 port for connection to DLM local network.
15. A choice of accessories to accommodate multiple mounting methods and building materials. The photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-0.62" thickness (LMLS-400, LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62"-1.25" thickness (LMLS-400-L, LMLS-500-L). Mounting brackets are compatible with J boxes (LMLS-MB1) and wall mounting (LMLS-MB2). LMLS-600 photosensor to be mounted on included bracket below skylight well.
16. Any load or group of loads in the room can be assigned to a daylighting zone
17. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).
18. All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.

C. Closed loop digital photosensors shall include the following additional features:

1. An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.
2. Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.
3. Automatically establishes application-specific setpoints following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of loads.
4. WattStopper Product Number: LMLS-400, LMLS-400-L.

D. Open loop digital photosensors shall include the following additional features:

1. An internal photodiode that measures light in a 60-degree angle cutting off the unwanted light from the interior of the room.
2. Automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone.
3. Each of the three discrete daylight zones can include any non overlapping group of loads in the room.
4. WattStopper Product Number: LMLS-500, LMLS-500-L.

E. Dual loop digital photosensors shall include the following additional features:

1. Close loop portion of dual loop device must have an internal photodiode that measures light in a 100 degree angle, cutting off the unwanted light from sources outside of this con
2. Open loop portion of dual loop device must have an internal photodiode that can measure light in a 60 degree angle, cutting off the unwanted light from the interior of the room.
3. Automatically establishes application-specific set-points following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights

from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of load.

4. Device must reference closed loop photosensor information as a base line reference. The device must be able to analyze the open loop photosensor information to determine if an adjustment in light levels is required.
5. Device must be able to automatically commission setpoints each night to provide adjustments to electrical lighting based on changes in overall lighting in the space due to changes in reflectance within the space or changes to daylight contribution based on seasonal changes.
6. Device must include extendable mounting arm to properly position sensor within a skylight well.
7. WattStopper product number LMLS-600

2.9 DIGITAL ROOM CONTROLLERS AND PLUG-LOAD CONTROLLERS

A. Digital controllers for lighting and plug loads automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room and plug load controllers shall be provided to match the room lighting and plug load control requirements. The controllers will be simple to install, and will not have dip switches or potentiometers, or require special configuration for standard Plug n' Go applications. The control units will include the following features:

1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
2. Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf.
3. Multiple room controllers connected together in a local network must automatically prioritize each room controller, without requiring any configuration or setup, so that loads are sequentially assigned using room controller device ID's from highest to lowest.
4. Device Status LEDs to indicate:
    a. Data transmission
    b. Device has power
    c. Status for each load
    d. Configuration status
5. Quick installation features including:
    a. Standard junction box mounting
    b. Quick low voltage connections using standard RJ-45 patch cable
6. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
    a. Turn on to 100%
    b. Remain off
    c. Turn on to last level
7. Each load shall be configurable to operate in the following sequences based on occupancy:
    a. Auto-on/Auto-off (Follow on and off)
    b. Manual-on/Auto-off (Follow off only)

8. The polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
9. BACnet object information shall be available for the following objects:
    a. Load status
    b. Electrical current
    c. Total watts per controller
    d. Schedule state – normal or after-hours
    e. Demand response control and cap level
    f. Room occupancy status
    g. Total room lighting and plug loads watts
    h. Total room watts/sq ft
    i. Force on/off all loads
10. UL 2043 plenum rated
11. Manual override and LED indication for each load
12. Dual voltage (120/277 VAC, 60 Hz), or 347 VAC, 60 Hz (selected models only). 120/277 volt models rated for 20A total load, derating to 16A required for some dimmed loads (forward phase dimming); 347 volt models rated for 15A total load; plug load controllers carry application-specific UL 20 rating for receptacle control.
13. Zero cross circuitry for each load
14. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.

B. On/Off Room Controllers shall include:

1. One or two relay configuration
2. Efficient 150 mA switching power supply
3. Three RJ-45 DLM local network ports with integral strain relief and dust cover
4. WattStopper product numbers: LMRC-101, LMRC-102

C. On/Off/Dimming enhanced Room Controllers shall include:

1. Real time current monitoring
2. Multiple relay configurations
    a. One, two or three relays (LMRC-21x series)
    b. One or two relays (LMRC-22x series)
3. Efficient 250 mA switching power supply
4. Four RJ-45 DLM local network ports with integral strain relief and dust cover
5. One dimming output per relay
    a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting. (LMRC-21x series)

b. Line Voltage, Forward Phase Dimming - Where indicated, one forward phase control line voltage dimming output per relay for control of compatible two-wire or three-wire ballasts, LED drivers, MLV, forward phase compatible ELV, neon/cold cathode and incandescent loads. (LMRC-22x series)

c. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver.

d. The LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.

e. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100% dimming range defined by the minimum and maximum calibration trim.

f. Calibration and trim levels must be set per output channel.

g. Devices that set calibration or trim levels per controller are not acceptable.

h. All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.

6. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.

7. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.

8. The following dimming attributes may be changed or selected using a wireless configuration tool:

   a. Establish preset level for each load from 0-100%

   b. Set high and low trim for each load

   c. Set lamp burn in time for each load up to 100 hours

9. Override button for each load provides the following functions:

   a. Press and release for on/off control

   b. Press and hold for dimming control

10. WattStopper product numbers: LMRC-211, LRMC-212, LRMC-213, LMRC-221, LMRC-222

D. Plug Load Room Controllers shall include:

1. One relay configuration with additional connection for unswitched load

2. Configurable additive time delay to extend plug load time delay beyond occupancy sensor time delay (e.g. a 10 minute additive delay in a space with a 20 minute occupancy sensor delay ensures that plug loads turn off 30 minutes after the space is vacated).

3. Factory default operation is Auto-on/Auto-off, based on occupancy

4. Real time current monitoring of both switched and un-switched load (LMPL-201 only)

5. Efficient switching power supply

   a. 150mA (LMPL-101)

   b. 250mA (LMPL-201)

6. RJ-45 DLM local network ports

   a. Three RJ-45 ports (LMPL-101)

   b. Four RJ-45 ports (LMPL-201)

7. WattStopper product numbers: LMPL-101, LMPL-201.

2.10 DLM LOCAL NETWORK (Room Network)

A. The DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.

B. Features of the DLM local network include:

1. Plug n' Go® automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.

2. Simple replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup.

3. Push n' Learn® configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.

4. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

C. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.

D. If manufacture's pre-terminated Cat5e cables are not used for the installation, the contractor is responsible for testing each cable following installation and supplying manufacturer with test results.

E. WattStopper Product Number: LMRJ-Series

2.11 DLM SEGMENT NETWORK (Room to Room Network)

A. The segment network shall be a linear topology, BACnet-based MS/TP subnet to connect DLM local networks (rooms) and LMCP relay panels for centralized control.

1. Each connected DLM local network shall include a single network bridge (LMBC-300), and the network bridge is the only room-based device that is connected to the segment network.

2. Network bridges, relay panels and segment managers shall include terminal blocks, with provisions for separate "in" and "out" terminations, for segment network connections.

3. The segment network shall utilize 1.5 twisted pair, shielded, cable supplied by the lighting control manufacturer. The maximum cable run for each segment is 4,000 feet. Conductor-to-conductor capacitance of the twisted pair shall be less than 30 pf/ft and have a characteristic impedance of 120 Ohms.

4. Network signal integrity requires that each conductor and ground wire be correctly terminated at every connected device.

5. Substitution of manufacturer-supplied cable must be pre-approved: Manufacturer will not certify network reliability, and reserves the right to void warranty, if non-approved cable is installed, and if terminations are not completed according to manufacturer's specific requirements.

6. Segment networks shall be capable of connecting to BACnet-compliant BAS (provided by others) either directly, via MS/TP, or through NB-ROUTERs, via BACnet/IP or BACnet/Ethernet.

Systems whose room-connected network infrastructure require gateway devices to provide BACnet data to a BAS are unacceptable.

B. WattStopper Product Number: LM-MSTP, LM-MSTP-DB

2.12 CONFIGURATION TOOLS

A. A wireless configuration tool facilitates optional customization of DLM local networks using two-way infrared communications, while PC software connects to each local network via a USB interface.

B. Features and functionality of the wireless configuration tool shall include but not be limited to:

1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.

2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.

3. Must be able to read and modify parameters for room controllers, occupancy sensors, wall switches, daylighting sensors, network bridges and relay panels, and identify room devices by type and serial number.

4. Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors.

5. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.

6. Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.

7. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.

8. Verify status of building level network devices.

C. WattStopper Product Numbers: LMCT-100, LMCI-100/LMCS-100

2.13 NETWORK BRIDGE

A. The network bridge module connects a DLM local network to a BACnet-compliant segment network for communication between rooms, relay panels and a segment manager or BAS. Each local network shall include a network bridge component to provide a connection to the local network room devices. The network bridge shall use industry standard BACnet MS/TP network communication and an optically isolated EIA/TIA RS-485 transceiver.

1. The network bridge shall be provided as a separate module connected on the local network through an available RJ-45 port.

2. Provide Plug n' Go operation to automatically discover room devices connected to the local network and make all device parameters visible to the segment manager via the segment network. No commissioning shall be required for set up of the network bridge on the local network.

3. The network bridge shall automatically create standard BACnet objects for selected room device parameters to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM room devices on each local network. BACnet objects will be created for the addition or replacement of any given in-room DLM device for the installed life of the system. Products requiring that an application-specific point database be

loaded to create or map BACnet objects are not acceptable. Systems not capable of providing BACnet data for control devices via a dedicated BACnet Device ID and physical MS/TP termination per room are not acceptable. Standard BACnet objects shall be provided as follows:

a. Read/write the normal or after hours schedule state for the room

b. Read the detection state of each occupancy sensor

c. Read the aggregate occupancy state of the room

d. Read/write the On/Off state of loads

e. Read/write the dimmed light level of loads

f. Read the button states of switches

g. Read total current in amps, and total power in watts through the room controller

h. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings

i. Activate a preset scene for the room

j. Read/write daylight sensor fade time and day and night setpoints

k. Read the current light level, in footcandles, from interior and exterior photosensors and photocells

l. Set daylight sensor operating mode

m. Read/write wall switch lock status

n. Read watts per square foot for the entire controlled room

o. Write maximum light level per load for demand response mode

p. Read/write activation of demand response mode for the room

q. Activate/restore demand response mode for the room

B. WattStopper product numbers: LMBC-300

2.13 SEGMENT MANAGER

A. For networked applications, the Digital Lighting Management system shall include at least one segment manager to manage network communication. It shall be capable of serving up a graphical user interface via a standard web browser utilizing either unencrypted TCP/IP traffic via a configurable port (default is 80) or 256 bit AES encrypted SSL TCP/IP traffic via a configurable port (default is 443).

B. Each segment manager shall have integral support for at least three segment networks. Segment networks may alternately be connected to the segment manger via external routers and switches, using standard Ethernet structured wiring. Each router shall accommodate one segment network. Provide the quantity of routers and switches as shown on the plans.

C. Operational features of the Segment Manager shall include the following:

1. Connection to PC or LAN via standard Ethernet TCP/IP via standard Ethernet TCP/IP with the option to use SSL encrypted connections for all traffic.

2. Easy to learn and use graphical user interface, compatible with Internet Explorer 8, or equal browser. Shall not require installation of any lighting control software to an end-user PC.

3. Log in security capable of restricting some users to view-only or other limited operations.

4. Automatic discovery of DLM devices and relay panels on the segment network(s). Commissioning beyond activation of the discovery function shall not be required to provide communication, monitoring or control of all local networks and lighting control panels.

5. After discovery, all rooms and panels shall be presented in a standard navigation tree format. Selecting a device from the tree will allow the device settings and operational parameters to be viewed and changed by the user.

6. Ability to view and modify room device operational parameters. It shall be possible to set device parameters independently for normal hours and after hours operation including sensor time delays and sensitivities, and load response to sensor including Manual-On or Auto-On.

7. Ability to set up schedules for rooms and panels, view and override current status of panel channels and relays, and assign relays to groups. Schedules shall automatically set controlled zones or areas to either a normal hours or after hours mode of operation. Support for a minimum of 100 unique schedules, each with up to four time events per day. Support for annual schedules, holiday schedules and unique date-bound schedules.

8. Ability to group rooms and loads for common control by schedules, switches or network commands.

9. Ability to monitor connected load current and display power consumption for areas equipped with room controllers incorporating the integral current monitoring feature.

10. Provide capabilities for integration with a BAS via BACnet protocol. At a minimum, the following points shall be available to the BAS via BACnet IP connection to the segment manager: room occupancy state; room schedule mode; room switch lock control; individual occupancy sensor state; room lighting power; room plug-load power; load ON/OFF state; load dimming level; panel channel schedule state; panel relay state; and Segment Manager Group schedule state control.

11. The Segment Manager shall allow access and control of the overall system database via Native Niagara AX FOX connectivity. Systems that must utilize a Tridium Niagara controller in addition to the programming, scheduling and configuration server are not acceptable.

D. Segment Manager shall support multiple DLM rooms as follows:

1. Support up to 120 network bridges and 900 digital in-room devices (LMSM-3E).

2. Support up to 300 network bridges and 2,200 digital in room devices, connected via network routers and switches (LMSM-6E).

E. WattStopper Product Numbers: LMSM-3E, LMSM-6E, NB-ROUTER, NB-SWITCH, NB-SWITCH-8, NB-SWITCH-16.

2.14 PROGRAMMING, CONFIGURATION AND DOCUMENTATION SOFTWARE

A. PC-native application for optional programming of detailed technician-level parameter information for all DLM products, including all parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected via the optional LMCI-100 USB programming adapter, or globally for many segment networks simultaneously utilizing standard BACnet/IP communication.

1. Additional parameters exposed through this method include but are not limited to:

a. Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.

b. Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.

c. Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.

d. Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.

e. Separate normal hours and after hours per-load button mode with modes including: Do nothing, on only, off only, on and off.

f. Load control polarity reversal so that on events turn loads off and vice versa.

g. Per-load DR (demand response) shed level in units of percent.

h. Load output pulse mode in increments of 1second.

i. Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered On of switched loads in response to a dimmer.

2. Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:

a. Device list report: All devices in a project listed by type.

b. Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.

c. BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.

d. Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.

e. Device parameter report: Per-room lists of all configured parameters accessible via hand held IR programmer for use with O&M documentation.

f. Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100%, 2 = all loads 75%, 3 = all loads 50%, 4 = all loads 25%, 5-16 = same as scene 1).

g. Occupancy sensor report: Basic settings including time delay and sensitivity(ies) for all occupancy sensors.

3. Network-wide programming of parameter data in a spreadsheet-like programming environment including but not limited to the following operations:

a. Set, copy/paste an entire project site of sensor time delays.

b. Set, copy/paste an entire project site of sensor sensitivity settings.

c. Search based on room name and text labels.

d. Filter by product type (i.e. LMRC-212) to allow parameter set by product.

e. Filter by parameter value to search for product with specific configurations.

4. Network-wide firmware upgrading remotely via the BACnet/IP network.

a. Mass firmware update of entire rooms.

b. Mass firmware update of specifically selected rooms or areas.

c. Mass firmware upgrade of specific products.

B. WattStopper Product Number: LMCS-100, LMCI-100

2.15 LMCP LIGHTING CONTROL PANELS

A. Provide lighting control panels in the locations and capacities as indicated on the plans and schedules. Each panel shall be of modular construction and consist of the following components:

1. Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1 - 8 relays, 1 - 24 relays and 6 four-pole contactors, or 1 - 48 relays and 6 four-pole contactors.

2. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. The panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.

3. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. The interior construction shall provide total isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within the assembled panel. The interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. The panel interiors shall include the following features:

a. Removable, plug-in terminal blocks with connections for all low voltage terminations.

b. Individual terminal block, override pushbutton, and LED status light for each relay.

c. Direct wired switch inputs associated with each relay shall support 2-wire momentary switches only.

d. Digital inputs (four RJ-45 jacks) shall support 1-, 2-, 3-, 4-, and 8-button digital switches; digital IO modules capable of receiving 0-5V or 0-10V analog photocell inputs; digital IO modules capable of receiving momentary or maintained contact closure inputs or analog sensor inputs; digital daylighting sensors; and digital occupancy sensors. Inputs are divided into two separate digital networks, each capable of supplying 250mA to connected devices.

e. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems via BACnet.

f. Automatically sequenced operation of relays to reduce impact on the electrical distribution system when large loads are controlled simultaneously.

g. Group and pattern control of relays shall be provided through a simple keypad interface from a handheld IR programmer. Any set of relays can be associated with a group for direct on/off control or pattern (scene) control via a simple programming sequence using the relay override pushbuttons and LED displays for groups 1-8 or a handheld IR programmer for groups 1-99.

h. Relay group status for shall be provided through LED indicators for groups 1-8 and via BACnet for groups 1-99. A solid LED indicates that the last group action called for an ON state and relays in the group are on or in a mixed state.

i. Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:

a) Electrical:

b) 30 amp ballast at 277V

c) 20 amp ballast at 347V

d) 20amp tungsten at 120V

e) 30 amp resistive at 347V

f) 1.5 HP motor at 120V

g) 14,000 amp short circuit current rating (SCCR) at 347V

h) Relays shall be specifically UL 20 listed for control of plug-loads

b) Mechanical:

i) Replaceable, ½" KO mounting with removable Class 2 wire harness.

j) Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel.

k) Dual line and load terminals each support two #14 - #12 solid or stranded conductors.

l) Tested to 300,000 mechanical on/off cycles.

4. Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
5. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.
6. Where indicated, lighting control panels designated for control of emergency lighting shall be provided with factory installed provision for automatic by pass of relays controlling emergency circuits upon loss of normal power. Panels shall be properly listed and labeled for use on emergency lighting circuits and shall meet the requirements of UL924 and NFPA 70 - Article 700.
7. Integral system clock shall provide scheduling capabilities for panel-only projects without DLM segment networks or BAS control.

i. Each panel shall include digital clock capability able to issue system wide automation commands to up to (11) eleven other panels for a total of (12) twelve networked lighting control panels. The clock shall provide capability for up to 254 independent schedule events per panel for each of the ninety-nine system wide channel groups.

j. The clock capability of each panel shall support the time-based energy saving requirements of applicable local energy codes.

k. The clock module shall provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and will include a battery back up for the clock function and program retention in non-volatile FLASH memory. Clocks that require multiple events to meet local code lighting shut off requirements shall not be allowed.

l. The clock capability of each panel shall operate on a basis of ON/OFF or Normal Hours/After Hours messages to automation groups that implement pre-configured control scenarios. Scenarios shall include:

b) Scheduled ON / OFF

c) Manual ON / Scheduled OFF

d) Astro ON / OFF (or Photo ON / OFF)

e) Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)

m. The user interface shall be a portable IR handheld remote control capable of programming any panel in the system (LMCT-100)

n. The clock capability of each panel shall employ non-volatile memory and shall retain user programming and time for a minimum of 10 years.

o. Schedules programmed into the clock of any one panel shall be capable of executing panel local schedule or Dark/Light (photocell or Astro) events for that panel in the event that global network communication is lost. Lighting control panels that are not capable of executing events independently of the global network shall not be acceptable.

8. The lighting control panel can operate as a stand-alone system, or can support schedule, group, and photocell control functions, as configured in a Segment Manager controller, via a segment network connection.

9. The lighting control panel shall support digital communications to facilitate the extension of control to include interoperation with building automation systems and other intelligent field devices. Digital communications shall be RS485 MS/TP-based using the BACnet® protocol.

a. The panel shall have provision for an individual BACnet device ID and shall support the full 2^{22} range (0 – 4,193,304). The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network.

b. The panel shall support MS/TP MAC addresses in the range of 0 – 127 and baud rates of 9600k, 38400k, 76800k, and 115.2k bits per second.

c. Lighting control relays shall be controllable as binary output objects in the instance range of 1 – 64. The state of each relay shall be readable and writable by the BAS via the object present value property.

d. Lighting control relays shall report their true on/off state as binary input objects in the instance range of 1 – 64.

e. The 99 group Normal Hours/After Hours control objects associated with the panel shall be represented by binary value objects in the instance range of 201 – 299. The occupancy state of each channel group shall be readable and writable by the BAS via the object present value property. Commanding 1 to a channel group will put all relays associated with the channel into the normal hours mode. Commanding 0 or NULL shall put the relays into the after hours mode.

f. Setup and commissioning of the panel shall not require manufacturer-specific software or a computer. All configuration of the lighting control panel shall be performed using standard BACnet objects or via the handheld IR programming remote. Provide BACnet objects for panel setup and control as follows:

b) Binary output objects in the instance range of 1 – 64 (one per relay) for on/off control of relays.

c) Binary value objects in the instance range of 1 – 99 (one per channel) for normal hours/after hours schedule control.

d) Binary input objects in the instance range of 1 – 64 (one per relay) for reading true on/off state of the relays.

e) Analog value objects in the instance range of 101 – 199 (one per channel group) shall assign a blink warn time value to each channel. A value of 5

shall activate the blink warn feature for the channel and set a 5-minute grace-time period. A value of 250 shall activate the sweep feature for the channel and enable the use of sweep type automatic wall switches.

g. The description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel.

h. The BO and BV 1 – 99 objects shall support BACnet priority array with a relinquish default of off and after hours respectively. Prioritized writes to the channel BV objects shall propagate prioritized control to each member relay in a way analogous to the BACnet Channel object described in addendum aa. (http://www.bacnet.org/Addenda/Add-135-2010aa.pdf)

i. Panel-aggregate control of relay Force Off at priority 2 shall be available via a single BV5 object. Force On at priority 1 shall be available via a single BV4 object.

j. Lockout of all digital switch buttons connected to a given panel shall be command-able via a single BV2 object. The lock status of any connected switch station shall be represented as BV101-196.

10. WattStopper Product Number: LMCP8, LMCP24 or LMCP48

B. USER INTERFACE

Each lighting control panel system shall be supplied with at least (1) handheld configuration tool (LMCT-100). As a remote programming interface the configuration tool shall allow setup, configuration, and diagnostics of the panel without the need for software or connection of a computer. The user interface shall have the following panel-specific functions as a minimum:

1. Set network parameters including panel device ID, MS/TP MAC address, baud rate and max master range.
2. Relay Group creation of up to 99 groups. Group creation shall result in programming of all seven key relay parameters for member relays. The seven parameters are as follows: After-hours Override Time Delay, Normal Hours Override Time Delay, Action on Transition to Normal Hours, Action on Transition to After Hours, Sensor Action During Normal Hours, Sensor Action During After Hours, Blink-Warn Time for After Hours.
3. Program up to 254 separate scheduled events. Events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays. Holidays are also defined through the User Interface.
4. Program up to 32 separate Dark/Light events. Events shall have a selectable source as either calculated Astro with delay, or a digital IO module with an integral 0-5V or 0-10V analog photocell. Dark/Light events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays.
5. Button binding of digital switches to groups shall be accessible via the handheld IR remote and accomplished from the digital switch station.
6. Programming of panel location information shall be accomplished by the handheld IR remote and include at a minimum LAT, LON, DST zone, and an approximate city/state location.
7. An additional handheld IR remote may optionally be specified to be permanently mounted to the panel interior via a retractable anti-theft lanyard to allow for convenient programming of the panel while assuring that the handheld programmer is always present at that panel. An unlimited number of handheld IR remotes may also be purchased for facilities staff as determined by the end user's representative.
8. WattStopper Product Number: LMCT-100

2.16 EMERGENCY LIGHTING CONTROL DEVICES

A. Emergency Lighting Control Unit – A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:

1. 120/277 volts, 50/60 Hz, 20 amp ballast rating

2. Push to test button

3. Auxiliary contact for remote test or fire alarm system interface

B. WattStopper Product Numbers: ELCU-100, ELCU-200.

PART 3 – EXECUTION

3.1 PRE-INSTALLATION MEETING

A. A factory authorized manufacturer's representative shall provide the electrical contractor a functional overview of the lighting control system prior to installation. The contractor shall schedule the pre-installation site visit after receipt of approved submittals to review the following:

1. Confirm the location and mounting of all digital devices, with special attention to placement of occupancy and daylighting sensors.

2. Review the specifications for low voltage control wiring and termination.

3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.

4. Discuss requirements for integration with other trades.

3.2 CONTRACTOR INSTALLATION AND SERVICES

A. Contractor to install all devices and wiring in a professional manner. All line voltage connections to be tagged to indicate circuit and switched legs.

B. Contractor to install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors. If pre-terminated cable is not used for room/area wiring, the contractor is responsible for testing each field-terminated cable following installation, and shall supply the lighting controls manufactuerer with test results. Contractor to install any room to room network devices using manufacturer-supplied LM-MSTP network wire. Network wire substitution is not permitted and may re-sult in loss of product warranty per DLM SEGMENT NETWORK section of specification. Low voltage wiring topology must comply with manufacturer's specifications. Contractor shall route network wiring as shown in submittal drawings as closely as possible, and shall document final wiring location, routing and topology on as built drawings.

C. Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated. Before start up, contractor shall test all devices to ensure proper communication.

D. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.

1. Adjust time delay so that controlled area remains lighted while occupied.

E. Provide written or computer-generated documentation on the configuration of the system including room by room description including:

1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.

2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)

3. Load Parameters (e.g. blink warning, etc.)

F. Post start-up tuning – After 30 days from occupancy contractor shall adjust sensor time delays and sensitivities to meet the Owner's requirements. Provide a detailed report to the Architect / Owner of post start-up activity.

3.3 FACTORY SERVICES

A. Upon completion of the installation, the manufacturer's factory authorized representative shall start up and verify a complete fully functional system.

B. The electrical contractor shall provide both the manufacturer and the electrical engineer with three weeks written notice of the system start up and adjustment date.

C. Upon completion of the system start up, the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

3.4 COMMISSIONING SUPPORT SERVICES

A. On this project, a commissioning agent will be hired to verify the installation and programming of all building systems, which includes the lighting control system. Manufacturer should include an extra day of technician's time to review the functionality and settings of the lighting control hardware with the commissioning agent, including reviewing submittal drawings and ensuring that instructions on how to configure each device are readily available. Manufacturer is NOT responsible for helping the commissioning agent inspect the individual devices. It will be the commissioning agent's responsibility to create and complete any forms required for the commissioning process, although the manufacturer or contractor may offer spreadsheets and/or printouts to assist the agent with this task.

B. The commissioning agent shall work with the electrical contractor during installation of the lighting control hardware to become familiar with the specific products. The agent may also accompany the manufacturer's technicians during their start-up work to better understand the process of testing, calibration and configuration of the products. However, the contractor and manufacturer shall ensure that interfacing with the agent does not prevent them from completing the requirements outlined in the contract documents.

END OF SECTION

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Exterior luminaires with lamps and ballasts.

1.2 SUBMITTALS

A. Product Data: For each luminaire, arranged in the order of lighting unit designation. Include data on features, accessories, finishes.

B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C2, "National Electrical Safety Code."

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 EXTERIOR LUMINAIRES, GENERAL

A. Comply with UL 1598 and listed for installation in wet locations.

B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

H. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
   1. White Surfaces: 85 percent.

2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

I. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

2.2 LAMPS

A. LED fixtures.

B. Turn over job with all lamps in new and operating condition.

2.3 CONTROLS

A. Exterior lighting shall be controlled by existing timeclocks and setup as follows:
1. Connect all new exterior lighting to new lighting control system.
2. Contractor shall coordinate in field for all equipment and wiring required for proper operation of system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lamps in each fixture.

B. Luminaire Attachment: Fasten to indicated structural supports.

C. Adjust luminaires that require field adjustment or aiming.

END OF SECTION

SECTION 27 05 26

TELECOMMUNICATIONS GROUNDING PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, sections included under Divisions 1, 26, and 27 are included as part of this section as though bound herein.

B. Section 27 01 00 General Requirements

C. Section 27 15 00 – Horizontal Cabling

1.2 SUMMARY

A. This Section specifies the minimum materials and performance standards for grounding and bonding installed specifically for telecommunication systems in West Contra Costa Unified School District new construction and remodels.

1. Sections include:
   a. Grounding electrodes and conductors.
   b. Grounding electrodes.
   c. Equipment grounding conductors.
   d. Bonding.

1.3 REFERENCES

A. American National Standards Institute (ANSI) Publication C2-97 – National Electrical Safety Code; ANSI/IEEE Std. 1100-1999 – Recommended Practice for Powering and Grounding Sensitive Electronic Equipment in Industrial and Commercial Power Systems; ANSI/NFPA 780 – Lightning Protection Code Electronic Industries Association and Telecommunication Industries Association (EIA/TIA) Publications:

1. EIA/TIA 568B – Commercial Building Telecommunications Wiring Standard.
2. EIA/TIA 569 – Commercial Building Standard for Telecommunications Pathways.
3. EIA/TIA 607 – Grounding and Bonding for Communications.

B. Institute of Electrical and Electronic Engineers (IEEE) Publication 142 – Recommended Practice for Grounding of Industrial and Commercial Power Systems.

C. National Fire Protection Association (NFPA) Publication:

1. 70 – National Electrical Code (NEC).
2. 780 – Lightning Protection Code.

D. Underwriters Laboratories, Inc. (U.L.) Publication:

1. 83 - Thermoplastic Insulated Wires.
2. 467 - Grounding and Bonding Equipment.
3. 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors.

1.4 REGULATORY REQUIREMENTS

A. The Contractor shall conform to requirements of the National Electrical Code Article 250, California Electrical Code, and requirements for EIA/TIA 607.

B. The Contractor shall furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to the SDUSD as suitable for purpose specified and shown.

1.5 PERFORMANCE REQUIREMENTS

A. Grounding system resistance shall be 5 ohms or less unless otherwise indicated.

B. A telecommunications ground in the form of telecommunication main ground busbar (TMGB) shall be installed in the Main Distribution Frame (MDF) cabinet. It will be directly attached and effectively bonded to the closest point in the building's electrical service grounding electrode system.

C. In the event the building's service grounding electrode system is not in close proximity of the TMGB, install a driven ground rod for the telecommunication grounding system.

D. Each Building Distribution Frame (BDF) shall be effectively bonded with the TMGB in the MDF. Each BDF ground shall be a separate grounding conductor between the BDF and the MDF.

1.6 SUBMITTALS:

A. The following information shall be submitted for review and approval in accordance with Section 26 01 00, "General Electrical Requirements".

1. Catalog Cut:

a. Ground Rod.
b. Ground Connectors
c. Telecommunications Main Grounding Busbar.

2. Ground resistance from each major piece of equipment to the ground electrode. Equipment shall include, but not be limited to the following:

a. Main Distribution Frame (MDF).
b. Building Distribution Frame (BDF).

1.7 WARRANTY

A. Warranty shall comply with the provisions of Section 26 01 00, "General Electrical Requirements".

PART 2 - PRODUCTS

2.1 Telecommunication Main Grounding Bus Bar (TMGB):

A. Provide 2" wide x 3/16" thick copper ground bus, (length as necessary to accommodate all MDF/BDFIDF ground connections).

2.2 GROUND RODS:

A. Provide copper clad steel with adequate diameter to permit driving it full length of the rod in the earth but not less than ¾-inch. Length shall be 10-feet unless otherwise indicated.

2.3 GROUNDING AND BONDING CONDUCTORS

A. Grounding and bonding conductors shall be sized in accordance with Table for equipment grounding conductors, NEC. 250, ANSI/TIA/EIA – 607.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Make mechanical and electrical contact at all MDFs and BDFs. Permanently and effectively ground all equipment as required by all applicable codes, regulations and standards.

B. Drive ground rods full length in a depression at least six (6)-inches below finished grade.

1. Provide minimum No. 4/0 AWG, insulated, stranded copper grounding conductor between TMGB in MDF and electrical system ground

2. Provide minimum No. 6 AWG, insulated, stranded copper grounding conductor between individual BDFs and the MDF TMGB.

3.2 TESTS:

A. All testing shall be performed by the technology contractor and shall be witnessed by the Architect and/or the District's designated representative.

B. As an exception to requirements that may be stated elsewhere in the contract, the Consultant shall be given five (5) working days notice prior to each test.

C. The testing equipment and devices used in performing the required tests shall have a calibration sticker affixed to the device stating the date when calibrated, date due for re-calibration, and the signature of the individual who did the calibration. In addition to the sticker, a certificate shall also contain the brand name and the serial number of the device.

D. Ground Rod Test: Test ground rods for ground resistance value before any wire is connected. A portable testing megger shall be used to test each ground or group of grounds. The auxiliary or reference ground rods shall be ¾-inch copper clad steel, not less than 4-feet in length and driven 3-1/2 feet deep, and shall be installed in a straight line from the ground being tested. Number 14 AWG stranded wire leads with at least 600 volt rubber insulation shall be connected to binding post on the instrument.

1. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground electrode under test. Provide one (1) copy of the megger manufacturer's directions for use of the ground megger indicating the methods to be used.

E. Test Report (Submit four (4) copies in writing):

1. Grounding electrodes and systems (identifying electrodes and systems, each test).

END OF SECTION

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SECTION 27 01 00

GENERAL TECHNOLOGY REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General Requirements

B. Scope: Data, Telephone/Voice

C. Industry Guidelines and Standards

D. Submittals

1.2 GENERAL REQUIREMENTS

A. Manufacturer: The term “manufacturer” shall be defined as the company, or group of companies, that actually produces the products meeting the requirements of Section 2 of this document. The manufacturer shall have a minimum of seven (7) years experience in manufacturing products of this type and shall be ISO 9001 Certified.

B. Contractor: The term “contractor” shall be defined as the company, or group of companies, that actually installs the product. The contractor selected to provide the installation of this system shall be certified by the manufacturer in all aspects of design, installation and testing of the products described herein.

1. The contractor shall hold a valid State of California C-7 Or C-10 Contractor’s license, shall have completed at least ten (10) projects of equal scope, shall have been in business of furnishing and installing systems of this scope and magnitude for at lest three (3) years and capable of being bonded to assure the Owner’s Project Manager of performance and satisfactory service during the guarantee period.
2. The contractor shall hold all other licenses required by the legally constituted authorities having jurisdiction over the work.
3. All work shall be performed under the supervision of a company accredited by the manufacturer and such accreditation must be presented.
4. The contractor shall be a manufacturer’s authorized distributor and warrantee station for the equipment offered and shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The contractor shall maintain a spare set of all major parts for the system at all times.
5. The contractor selected for this Project must adhere to the engineering, installation and test-

ing procedures and utilize the authorized manufacturer components and distribution channels in provisioning this Project.

6. The contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and Category 6 metallic premise distribution systems and have personnel who are adequately trained in the use of such tools and equipment.
7. All of the equipment in this specification shall be furnished and installed by the Authorized Factory Distributor of the equipment. The Contractor shall furnish a letter from the manufacturer of all major equipment, which certifies that the installing contractor is the Authorized Distributor and that the equipment has been installed according to factory intended practices. The Contractor shall furnish a written guarantee from the manufacturer that they will have a service representative assigned to this area for the life of the equipment.
8. All communication system supplied shall be listed by Underwriter's Laboratories under UL Standard 1459. A copy of the UL listing card for the proposed system shall be included with the contractor's submittal.

C. Responsible Person for Contractor: Submit name of the individual authorized to receive construction change documents, and who is responsible for informing others in Contractor's employ or subcontractors of changes in the Work.

1.3 SCOPE OF WORK

A. DATA: The work shall include, but not be limited to the following objectives:
1. Remove existing IDFs and install new IDFs as indicated on plans. Contractor shall coordinate closely with District for required time to complete connection.
2. Only virgin materials shall be used in the construction of cabling.
3. Replace existing fiber optic cable where shown on drawings and terminate all strands of fiber at each rack or wall mounted fiber enclosure. All cables shall be installed with service loops at ground boxes and MDF/IDF locations only. Fiber will be terminated using LC type connectors. Also furnish two (2) meter duplex fiber patch cord for every two terminations. Patch cord is to match fiber type that is installed, i.e. Multi-Mode. Patch cord is to be LC to LC as required by equipment. Note that all fiber optic cable is to be pulled in existing conduits.
4. Installation of a new Category 6 UTP in rooms as required by the drawings or the scope of work. Category 6 terminations will be EIA/TIA standard 568B wiring configuration into RJ45 workstation data jacks (all jacks shall be blue in color for data and all cables shall be blue in color for data). All cables shall be installed with service loops at ground boxes and MDF/IDF locations only.
5. Furnish and install for each IDF a data cabinet, fiber patch panels, copper patch panels, UPS,

and wire management hardware as required by the quantities shown drawings or the scope of work.

6. Mount and install Switches as required by the drawings or the scope of work. Contractor shall notify the District in writing two weeks prior to the expected installation date of switches. Equipment shall be installed within Data Cabinets (provided by the contractor). Data Cabinets will be dual access and fully enclosed (See Materials List)
7. Testing of cables and connections to insure a complete and operable end-to-end data connection using EIA/TIA TSB-67 testing guidelines at level II accuracy for Category 6, and EIA/TIA 455a for fiber.
8. All terminations into patch panel for connection to Switches using contractor supplied patch cords/station cables. For each data cable installed, the contractor shall supply one (1) 3' Category 6 patch cord for the patch panel location. In addition, the contractor shall supply 50% of 7' station cords and 50% of 10' station cords of the total number of data jacks installed. Station cords shall be delivered as directed by computer services in boxes clearly labeled with School name, quantity and size of station cords. Contractor to install patch cords from patch-panel to switches.
9. Set up a complete wire management system at each IDF, this includes wire management organizer(s). Contractor shall provide one horizontal wire manager for each new category 6 patch panel and one horizontal wire manager for each switch installed.
10. Warranty:
    a. Contractor shall warrant the installation and that all approved cabling components meet or exceed the requirements of TIA/EIA-568A, TIA/EIA-568A-A5, and ISO/IEC 11801.
    b. Contractor will provide a minimum of a fifteen (15) year written warranty from the manufacturer(s) for both UTP basic link and fiber optic cable systems. This may require the contractor to certify their installers to the manufacturer's guidelines before the project begins.
    c. The permanent link cabling system shall be warranted for a period of at least 25 years.
    d. The contractor will provide a two (2) year written warranty covering workmanship and materials in compliance with District specifications. All repairs shall be made at no cost to District during the warranty period.
    e. Contractor will provide to the District warranty information covering parts and materials used by the contractor.
    f. Upon hookup of system and system start-up by District, if system troubles should indicate problems with the cables or terminations, it shall be the responsibility of the cable installation contractor to repair any such problems free of charge to the District. The contractor shall start this repair work within a 48 hour period of time from initial notification by Dis-

trict.

B. TELEPHONE/VOICE: The work shall include but not be limited to the following objectives:

1. Only virgin materials shall be used in the construction of cabling.
2. Backbone feeder cables shall be Category 6, size and number of pairs as indicated in drawings and Scope of Work documents. All pairs are to be terminated on 66m, 50 blocks and 89B standoffs.
3. All 66 blocks shall be mounted on blue-boards located in or near data cabinets.
4. Each 66-block shall have a minimum of a mushroom block and mushrooms installed per drawing details.
5. Installation of new Category 6 UTP in rooms as indicated on the drawings. Category 6 terminations will be EIA/TIA standard 568B wiring configuration into RJ45 workstation jacks (all telephone wire and jacks shall be blue in color). All cables shall be installed with service loops at ground boxes and MDF/IDF/CIDF locations only.
6. Testing of cables and connections to insure a complete and operable end-to-end data connection using EIA/TIA TSB-67 testing guidelines at level II accuracy for Category 6.

C. INDUSTRY GUIDELINES AND STANDARDS

1. When Contract Documents differ from governing codes, furnish and install larger size or higher standards called for without extra charge. Notify the District Representative of any discrepancies prior to commencement of construction. Obtain written clarification prior to proceeding with work.
2. Fiber optic cable, electrical cable, wire and connectors shall be installed as indicated, in accordance with the manufacturer's written instructions, the applicable requirements of NEC and the National Electrical Contractors Association's "Standard of Installation", and in accordance with recognized industry practices to ensure that products serve the intended functions.
3. The National Fire Code (NFPA), National Electrical Code (NEC), California Electrical Code (CEC), California Building Code and Local Codes will be followed.
4. Applicable Standards
   a) National Electrical Code (NEC), most recent edition.
   b) ANSI/TIA/EIA-568-B -- Commercial Building Telecommunications Cabling Standard ANSI/TIA/EIA-568-A-1 -- Propagation Delay and Delay Skew Specifications for 100 ohm 4-pair Cable.
   c) ANSI/TIA/EIA-568-A-2 - Commercial Building Standards Updates
   d) ANSI/TIA/EIA-569-A -- Commercial Building Standard for Telecommunications Pathways and Spaces.
   e) ANSI/TIA/EIA-606 -- The Administration Standard for the Telecommunications Infrastruc-

ture of Commercial Buildings.

f) ANSI/TIA/EIA-607 -- Commercial Building Grounding and Bonding Requirements for Telecommunications.

g) ANSI/TIA/EIA TSB-67 -- Transmission Performance Specifications for Field-testing of Unshielded Twisted-Pair Cabling Systems.

h) ANSI/TIA/EIA TSB-75 -- Additional Horizontal Cabling Practices for Open Offices.

i) BICSI -- Telecommunications Distribution Methods Manual.

j) BICSI -- Cabling Installation Manual.

k) IEEE 802.3 "Carrier Sense Multiple Access with Collision Detection".

l) IEEE 802.3ab “Gigabit Ethernet transmission over unshielded twisted pair (UTP)”

m) IEEE 802.z “1000Base-SX transmission over multi-mode fiber and 1000Base-LX transmission over single-mode fiber

n) ISO/IEC DIS 11801, January 6, 1994.

o) UL Cable Certification Program.

p) ANSI X3T9.5 Requirements for UTP at 100 Mbps.

q) EIA/TIA Technical Specification Bulletin 36. Technical Systems Bulletin additional Cable Specifications for Unshielded Twisted-Pair Cables.

r) EIA/TIA Technical Specification Bulletin 40. Technical Systems Bulletin additional Transmission Specifications for Unshielded Twisted-Pair Connecting Hardware.

s) TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications.

t) EIA/TIA-455-61 FOTP-61 Measurement of Fiber or Cable Attenuation Using an OTDR.

u) ANSI/EIA/TIA-455-A-1991 Standard Test Procedures for Fiber Optic Fibers, Cables and Transducers, Sensors, Connecting and Terminating Devices, and other Fiber Optic Components

v) ANSI/ICEA S-83-596-1994, Fiber Optic Premises Distribution Cable.

w) ANSI/ICEA S-87-640-2000, Fiber Optic Outside Plant Communications Cable.

x) ANSI/TIA/EIA-526-7-1998, Optical Power Loss Measurements of Installed Single-mode Fiber Cable Plant-OFSTP-7.

y) ANSI/TIA/EIA-526-14-A-1998, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant-OFSTP-14A.

z) ANSI/TIA/EIA-598-A-1995, Optical Fiber Cable Color Coding.

aa) ANSI/TIA/EIA-604-3-1997, FOCIS 3 Fiber Optic Connector Intermateability Standard.

1.4 SUBMITTALS

A. Pre-construction material submittals
   1. Whenever in the Contract Documents any materials, products, processes or articles are indicated or specified by the name brand of the manufacturer, or by patent or proprietary names, such specifications shall be deemed to be a measure of quality and utility or a standard, and shall be deemed to be followed by the words, “or equal”. It is the intent of this article to comply with Public Contract Code Section 3400.

B. Proposed Product Substitutions
   1. All proposed product substitutions shall be requested as per Section Product Substitution Procedures.

1.5 LOW VOLTAGE ENCLOSURES AND PATHWAYS

A. Single channel surface raceway will be Wiremold 2300 or 2900 series or larger depending on fill ratio. All fittings made for an intended purpose of installation by the manufacturer shall be included as part of this material. Fill shall not exceed 40% and raceways shall be screw in type. Adhesive only raceways are not acceptable.

B. Multi channel surface raceway will be Wiremold 5400, 5500 series depending on fill ratio. All fittings made for an intended purpose of installation by the manufacturer shall be included as part of this material. Fill shall not exceed 40% and raceways shall be screw in type. Adhesive only raceways are not acceptable.

C. Mounting hardware and anchors recommended by the Manufacturer of any material that shall be mounted to the building or structure.
   1. Sheetrock/drywall/wall board: Easy Anchor, toggle bolt, other spread type anchor with load distribution, or approved equal.
   2. Concrete/cinder block/solid masonry: expanding compression type lag, expanding compression type bolt, expanding compression type all tread with nuts, or approved equal.
   3. Tile/Stucco/hollow masonry: toggle bolts or approved equal.
   4. Wood: lags, wood screws, or approved equal.
   5. Metal: clamp, or approved equal.

D. Surface Mount Boxes will be Wiremold 2944 Extra Deep Device Box.

E. Cover plates will be Panduit with four ports (minimum). Blanks will be used to cover any unused ports.

F. Wall mounted phone plates will be Hubbell multi-jack faceplate (p/n BR630DWP) and jacks.

G. Wiremold 5500 faceplates shall be 5507FRJ, Color to match existing or new installed raceway.

H. Wall mounted cabinets shall be either a Hubbell (RE4X with Sound Dampening Kit REKS) or the Chatsworth Cube iT Plus cabinets 24”Hx24”Wx24”D (p/n 11840-224) or 36”Hx24”Wx24”D (p/n 11840-236) with solid door and vents, computer white in color. (NOTE: Size and type of cabinet will

be specified by the District depending on need). Extra package of Phillips mounting screws to be provided with cabinet.

I. Floor mounted cabinets will be Chatsworth Enhanced Steel frame cabinets (p/n 16141-701)

J. Wall mount racks shall be Chatsworth stacker swing-gate rack, minimum of 24" deep, 24" tall (p/n 13602-725), or 36" tall (p/n 13604-725), or approved equal.

K. Floor mount racks shall be Chatsworth 19"W x 7'H standard equipment rack (p/n 55053-503) with Quantity 4 Panduit vertical wire managers (p/n WMPVHC46) and appropriate ladder racking with mounting hardware for structural support.

L. Definitions:

1. A rack is defined as a sideless, bottomless, topless open-rammed support structure for equipment. A rack may be mounted to a wall, ceiling, or to a floor depending on type, size, and District requirements.
2. A cabinet is defined as an enclosed equipment support structure with opening front and rear. A cabinet may be mounted to a wall, or to a floor depending on type, size, and District requirements.
3. All cabinets and swing able racks must be able to open fully with no cable tension, or obstructions.

M. Nomenclature:

1. CIDF cabinets are classroom cabinets /racks specified for mounting within classrooms or offices. Typically a Chatsworth (24Hx24Wx24D) or a Hubbell RE4X (42Hx24.2Wx10D)
2. IDF cabinets are cabinets/racks specified for intermediate distribution frames, typically at the head of a wing and feed one or more classrooms. Typically a Chatsworth (36Hx24Wx24D or 48Hx24Wx24D).
3. MDF cabinets are cabinets/racks specified for main distribution frames. Typically 84" high.
4. All equipment shall be mounted with Phillips screws, unless otherwise specified.

PART 2 - PRODUCTS

2.1 DATA

A. 4-pair 24 AWG Category 6 cable (Data) shall test at 1Gbps. Data cable shall be blue in color. Approved manufacturers are Berktek and General Cable.

B. All Category 6 jacks shall in Panduit and blue in color for data (p/n CJ688TGOR).

C. Category 6 patch panels shall be Panduit Modular Patch Panel (p/n CPP48FMWBLY) loaded with 48 Category 6 RJ45 jacks. Jacks shall be Panduit CJ688TGOR.

D. Wire management will be Panduit Horizontal Cable Management System (p/n NCMH2).

E. New Multi-Mode fiber optic cable shall be OM4, tight buffered, 8.3/125 microns. Approved manufacturer's are OCC and Berk-Tek. No composite cable shall be used.

F. Fiber Optic connectors will be Panduit (or equivalent) LC connectors.

G. Fiber enclosures shall be mounted at the top of the cabinet/rack.

H. The fiber enclosures for the MDF shall be rack mountable with applicable number of LC duplex port connector outlets for termination of all fiber runs (12 strands per IDF). The fiber enclosure for the MDF shall be sized such that the initial installation does not exceed 60% of its capacity. The MDF fiber enclosures shall be Panduit 72 port 19" rack mount (p/n FRME4), loaded with the appropriate number of 6 strand fiber adapter panels (p/n FAP3WEIDSC).

I. The fiber enclosures for the IDF shall be rack mountable with applicable number of LC duplex port connector outlets for termination of all fiber runs (6 strands per CIDF and 12 strands to MDF). The fiber enclosure for the IDF shall be sized such that the initial installation does not exceed 60% of its capacity. The IDF fiber enclosures shall be either the Panduit 72 port unit listed above, or the Panduit 54 port, 19" rack mounted unit (p/n FRME3) loaded with the appropriate number of 6 strand fiber adapter panels (FAP3WEIDSC).

J. Fiber patch cords shall be 1 meter, 2 meter, or 3 meters long, as required and shall be LC to LC connectors or LC to LC as required.

2.2 TELEPHONE/VOICE

A. Voice cable shall be blue in color. Approved manufacturers are Berk-Tek and General Cable.

B. All Category 6 jacks will be Panduit and blue in color for voice (P/n CJ688TGBU).

C. OSP gel/icky pick blocking kits for 25 pair and larger pair count cables shall be 3M Scotchcast 4416 duct sealing kit or approved equal.

2.1 Category 6 66-blocks shall be Siemon or equal and include Siemon's "Lasting Hinge Cover" (P/n MN4LH-2) for labeling purposes.

PART 3 - EXECUTION

3.1 GENERAL REQUIRMENTS

A. The wiring of the system shall be executed in accordance with the drawings and the equipment manufacturer's wiring diagrams. Should any variations in these requirements occur, the contractor shall notify the Owner's Representative before making any changes. It shall be the responsibility of the manufacturer-authorized distributor of the approved equipment to install the equipment and guarantee the system to operate as per plans and specifications.

B. Furnish all conductors, equipment plugs, terminal strips, etc., and labor to install a complete and operable system.

C. Splices of conductors in underground pull boxes are not permitted.

D. The labor employed by the contractor shall be regularly employed in the installation and repair of communication systems and shall be acceptable to the Owner's Representative to engage in the installation and service of this system.

E. The contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc. The contractor shall remove all debris and rubbish occasioned by the electronic systems work from the site. The contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., caused by the performance of this work.

F. The system must meet all local and other prevailing codes.

G. All cabling installations shall be performed by qualified technicians.

H. All cabling shall be splice free.

I. In order to ensure the least amount of cable untwisting, it is required that all cables shall be stripped using a special tool.

J. The use of lubricants (i.e. Blue 77) to facilitate the installation of cables in conduits is highly discouraged. If such a lubricant must be used, the contractor shall verify the acceptability of the lubricant to be used with the cable manufacturer, prior to using such a lubricant. Lubricants that harden after installation are not allowed.

K. Under no circumstance are "channel locks" or other pliers to be used.

L. Plenum rated cable may be run exposed above ceilings, provided the cabling is supported independent of other utilities such as conduits, pipes, and the ceiling support systems. The cable shall not be laid directly on the ciling panels. The use of cable ties shall be done in accordance with the cable manufacturer's requirements. The cable jacket composition must meet local and all other prevailing fire and safety codes.

M. All firewalls penetrated by structured cabling shall be sealed by use of a non-permanent fire blanket or other method in compliance with the current edition of national Fire Protection Association (NFPA) and the National Electric Code (NEC) or other prevailing code. The contractor must not use concrete or other non-removable substance for fire stopping on cable trays, wire ways or conduits.

N. Site Cleaning. Throughout the progress of the plant construction, the contractor shall keep the working area free from debris of all types and remove from the premises all rubbish resulting from any work done by Contractor. On a daily basis and at the completion of its work the Contractor shall, to the extent possible, leave the premises in a clean and finished condition.

O. Conduits. All backbone cabling will run through dedicated conduits. All new conduits will be supplied with a pull string. Contractor shall supply pull string and pull rope for the installation of all cables in existing conduits. For all conduits left with available capacity, Contractor shall replace pull strings with ¼-inch pull rope during the course of his work. Contractor must seal all conduits with an approved sealing compound.

P. Cabling and Termination Identifications. All new cabling shall be of the type specified herein. Any conflicts between cabling types specified and code or design requirements shall be submitted to Owner's Representative for review and final disposition. All cabling shall be neatly laced, dressed and adequately supported. Cabling must be concealed to the fullest extent possible. In addition, a numbering and marking scheme must be used to identify all cable and cabling terminations. All cables, regardless of length, shall be marked and/or numbered at both ends. Marking codes and methodologies shall correspond to the instructions in this specification.

Q. Seismic Requirements. Contractor will install all equipment racks, equipment cabinet enclosures, cable runways, etc. according to the local, state and/or federal code. Contractor will notify Owner's Representative of such requirements and shall provide such bracing as required.

R. Safety Requirements. Contractor will utilize appropriate personnel and display warning signs, signals, flags and/or barricades at the work site to ensure adherence to safety regulations and as prudence requires.

S. Owner or Owner's Representative may view work or testing in progress.

3.2 CABLE ROUTING

A. The cables will be routed to their respective Main Distribution Frame (MDF), Intermediate Distribution Frame (IDF), or to service drop utilizing the shortest path possible.

B. Cable shall not be exposed at any point in the cable path. Contractor is to use appropriate pathway for the situation (i.e. inside wall, conduit, or non metallic surface raceway). EXCEPTION: In MDF ROOM ONLY cables may be exposed and routed in contractor supplied D-rings every 4 feet.

C. Cables shall be protected and sleeved with a conduit in locations where cables need to pass through walls, floors, or hard ceilings. Contractor shall install threaded IMC or rigid conduit with large fender washers, lock rings, and screw on protective bushings on both ends. The fire rating of the wall must be maintained during and after installation.

D. At solid wall location such as plaster, brick, concrete, cinder block, tile, reinforced concrete, Contractor will provide and install surface mounted non-metallic raceways or equivalent. The use of different series raceways is required at locations where cable fill capacities are exceeded.

E. Terminations on block walls will be accomplished with District approved surface mount boxes.

F. Cables will be run vertically inside the wall and into the ceiling space. Terminations on stud walls will be accomplished with cut-in type electrical boxes with a 1" conduit (flex or EMT) extended from the box within the wall to ceiling access space.

G. Service loops:

1. Fiber:
   a. Shall be a minimum of 10' at all MDF and IDF locations.

   b. Shall be a minimum of 6' at all ground box locations that allow for the minimum bend radius specified by the manufacturer.

2. Category 6 (Data and Voice) and CATV/Broadband
   a. Shall be a minimum of 6' at all MDF and IDF locations.
   b. Shall be a minimum of 6' at all ground box locations that allow for the minimum bend radius specified by the manufacturer.

3. Category 6 Voice Feeder Cables
   a. Shall be routed around the perimeter of the backboard in which it is terminated on.
   b. All ground boxes shall have a minimum of 6' service loop.

H. Cables shall be run in corridors wherever possible in order to avoid furniture and work areas so that

access to the cables in unencumbered.

I. The cables are to be as accessible as possible, placed above all other items in the ceiling, including ducts and supports.

J. Do not use pulling means, including fish tape, cable or rope, which can damage the Wiremold raceway.

K. Use pulling compound or lubricant that will not deteriorate cable or conduit.

L. Pulling compound shall be a water base pulling lubricant that will not deteriorate cable or conduit.

M. Cables shall not be pulled across sharp edges. If sharp edges are present a small sleeve, insuliner or grommet shall be installed to protect the cable.

N. Cables shall be pulled free of sharp bends or kinks.

O. Cables shall not be forced or jammed between metal parts, assemblies, etc.

P. Cables shall not be pulled across access doors and pull box covers. Access to all equipment and systems shall be maintained.

Q. Manufacturer's specifications for pulling stress and minimum bend radius shall not be exceeded on any cable.

R. Do not use staples or drive rings.

3.3 CABLE INSTALLATION PARAMETERS

A. Contractor is required to adhere to the following parameters in this section whether or not existing equipment has been placed by Contractor and/or others.

B. Contractor will notify District of any of the following requirements that cannot be met prior to bid.

C. Data UTP specifications.
1. Data terminations shall be T568B configuration unless otherwise specified
2. Category 6 modular patch panels shall be installed in accordance with manufacturer's design and installation guidelines.
3. Data UTP Testing
   a. All data UTP cable shall be tested after installation according to the procedures and acceptability criteria described in EIA/TIA Standards for Category 6 cable and connecting hardware. Test at level 11 compliance.
   b. Data UTP cable shall meet or exceed requirements for 1 Gbps data transmission.
   c. Network certification of all four (4) pair will meet testing criteria for a minimum of 1000BASE-TX
   d. Printed test results (both printed copy and data file copy) shall be provided as documentation of the quality of installation procedures and as a baseline for future troubleshooting.
   e. All UTP testing equipment shall have current calibration certification.

D. Fiber Cable Specification
1. Fiber cable will be multi-mode 50 micron rated at OM4. The number of strands will be specified by the District. Contractor will provide a specification sheet for the cable they will be using on each job.
2. Fiber Optics Connectors
   a. All connectors shall be glass-in-ceramic LC to LC connectors.

3. Fiber Optics Cable Installation and Testing
    a. All spare optical ports and connectors shall have a dust cap in place to protect from the environment.
    b. Contractor shall provide and install blanks in unused spaces of the fiber enclosure.
    c. If fiber is supplied to Contractor by the District it shall be tested before installation, while still on the shipping reel, using and optical time domain reflectometer (OTDR).
    d. The test results shall be compared to the manufacturers test results. A discrepancy of more than 1 dB on any fiber in either window indicates possible shipping damage and the fiber shall be returned to the supplier.
    e. The test results shall be maintained in a file for future reference.
    f. All fiber shall be tested after installation according to the procedures and acceptability criteria described in EIA/TIA 455A (Aug 1991) and all applicable addenda after installation and an 1310/1550 nm power meter and stabilized light source for single mode fiber. OTDR testing is to be performed in any location where the fiber is not continuous, i.e. coupled LC connectors (soft splice), fusion splice and mechanical splice.
    g. The results of these tests (printed OTDR result power meter attenuation results) shall be provided by the installer as documentation of the quality of installation and as a baseline for future troubleshooting, both printed copy and data file copy.
    h. The results shall be compared to the pre-installation test results for significant changes.
    i. All optical test equipment shall have current, traceable calibration certification.
    k. The multi-mode cable shall comply with the following maximum individual fiber loss (cabled): Attenuation 1310 nm, 2.00 dB end to end (basic link) 1550 nm, 1.00 dB end to end (basic link).
    l. Aerial fiber cable mounting hardware shall be matched to the all supporting (ADSS) fiber cable exactly and be installed in accordance with mounting hardware and cabling manufacturers specifications.

E A maximum fill capacity of 40% will be deemed acceptable for conduits and 75% of raceway and surface mold. Contractor shall inform Consultant in writing if this requirement cannot be met. If the Contractor fails to inform the Consultant any labor involved in rerouting cables in such conduit or raceways shall be the soul responsibility of the Contractor.

F. Cable shall be identified with a machine-printed tag identifying the system type in all access points (i.e. junction boxes, ground boxes, MDF, IDF's, etc.) and as they enter or exit the conduit pathway.

G. Contractor will assess whether or not the ceiling space is a plenum air return which shall dictate the use of the listed plenum type or PVC type cable required in the materials specification section. Any cable installations that shall be pulled through underground conduit will require Outside Plant (OSP) cable.

H. All cabling shall be installed with proper stress relief and tied down.

I. Manufacturer's specification for pulling stress and minimum bend radius shall not be exceeded on any fiber optic, data, voice, CATV, CCTV, IP Network Cameras, PA or any other cable.

J. Power feeds of greater than 220 volts shall not be run parallel to the UTP cables. Parallel runs of greater than 20 feet require a minimum separation distance of 3 feet, or 18 inches if cables are contained in a metallic conduit, which is grounded.

K. Multiple conduit runs of 110 volts power distribution shall not be run parallel to the UTP cables. Parallel runs of greater than 20 feet require a minimum separation distance of 18 inches.

L. All power feeds crossing the path of the UTP cables at right angles shall be a minimum of 6 inches in distance from the UTP cables.

M. There shall be an 18 inch separation between the cables and the fluorescent light fixtures.

Contractor shall notify District representative in the event this requirement can not be met.

N. All cable/cabling shall be kept 30 inches away from any heat source; i.e., HVAC ducting, steam valves, etc.

O. Thin Ethernet or Fiber Optic cable/cables shall be identified with a tag as to the system and date, every 30 feet when installed in open trays or suspension systems in ceilings.

P. Station Cable (UTP) or STP runs are not to exceed 295 feet for data and 1000 feet for voice.

Q. Cable splicing at any point of a UTP or STP station cable or any cable installed by the contractor is unacceptable without specific district approval.

R. No cabling is allowed to rest on any ceiling tile or suspension system unless specifically authorized by District. Strapping or mounted to any existing wires (e.g., lighting, ceiling grid, etc.) is not permitted.

S. Cables shall be securely supported to building structure (i.e. stud, beam, or other framing member) within 12 inches of any conduit or raceway entrance.

T. Contractor will place all station cables in the ceiling area on Contractor supplied and installed wire hangers or in floor spaces and raceways.

U. Insulation shall be removed to expose shielding and conductors/fibers to the exact length required by manufacturer for proper termination of plugs, pins and fiber terminations.
   1. Wires and shielding shall not be nicked or damaged in any way upon termination of pins and closure of plug assembly.
   2. Pins and plugs, upon termination, shall not be damaged in any way.

3.4 LABELING AND IDENTIFICATION

A. All cable plant labeling and administration documentation shall conform to ANSI/TIA/EIA 606 Administration Standard.

B. The cables within the rack or cabinets shall be numbered for identification.

C. Equipment used for labeling shall be: Brother “P-Touch” model PT-1750. Label media shall be black typeface on white tape. Tape material shall be ½” wide.

D. Components shall be marked where they are administrated (label at all punch down points, panels, blocks, outlets, etc.).

E. Industry standard color fields should be used where applicable as described in the Standards.

F. All pathways labeled (conduit, trays, etc.).

G. Data UTP Labeling
   1. Wiring termination locations shall be labeled to corresponding pairs at the MDF, IDF, CIDF and at each workstation end.
   2. Cables shall be labeled no more than 3” back from each end of the termination point with a cable

label that matches the faceplate labeling.
3. Contractor will provide tags, straps and adhesive labels. These tags, straps and adhesive labels shall be of high quality that will endure over time.
4. Hand written labels are not acceptable.
5. Each drop shall have a unique label throughout the site. This would allow a cable management system to track each cable pair.
6. Labeling Scheme:

H. Workstation Labeling: The faceplate or surface block shall be labeled with the Room # of the IDF where the cable sources from, the Room # the cable terminates in, and the sequential workstation number (ex. B10(IDF)-B2(RJ45 jack)-09(Workstation number). Each room shall have a sequential workstation number starting with the number 01 (ex. B10-B2-01 through B10-B2-10 and B10-B3-01 through B10-B3-10). The labeling itself shall be in a white background with black lettering.

I. Closet Labeling: Patch panel shall be labeled with the Room # the cable terminates in (RJ45 jack) and sequential workstation number only. The labeling itself shall be in a black background with white lettering.

J. Data Fiber Optics Labeling
1. Fiber termination locations shall be labeled to corresponding fiber strands pairs at the MDF, IDF, and CIDF.
2. The labeling scheme will be provided by the District and will be specific up to and including instructions for the placement of labeling, tags, straps, and adhesive labels.
3. Contractor is expected to provide tags, straps and adhesive labels. These tags, straps and adhesive labels shall be of high quality that will endure over time.
4. Hand written labels are not acceptable.
5. Labeling Scheme:
   i) Each drop shall have a unique label throughout the site. This would allow a cable management system to track each cable.
   ii) Cables shall be labeled approximately 12 inches back from the point where the cable enters the fiber enclosure with a cable label that identifies the origin and destination of the cable.
   iii) Closet labeling; each connection shall be labeled denoting each strands color, origin and destination with name of room or wing.
   iv) The type (single-mode or multi-mode) of fiber optic cable used shall be clearly labeled on the fiber patch panel per drawn details.
   v) Color-coding shall conform to EIA/TIA specifications.

3.5 TESTING OF THE CABLING PLANT

A. Contractor is responsible for supplying all of the required test equipment used to conduct acceptance tests.

B. District reserves the right to be present during any or all of testing.

C. All cabling not tested strictly in accordance with these procedures shall be re-tested at no additional cost to the District.

D. 100% of the installed cabling must be tested. All tests must pass acceptance.

E. Test equipment shall be fully charged prior to each day's testing.

F. Test reports must be submitted in hardcopy or electronic format. Hand-written test reports are not acceptable.

G. Hardcopy reports are to be submitted in labeled 3 ring binders with an attached affidavit verifying passing execution of all tests. For large installations electronic reports with hardcopy summaries are preferred. Hardcopy summary reports shall contain the following information on each row of the report: circuit ID, test specification used, length, date of test, and pass/fail result.

H. Electronic reports are to be submitted on CD format. If proprietary software is used, CD shall contain any necessary software required to view test results. If the results are delivered in a standard format like Excel, Access, CSV files, etc. then software to read these files are not provided. Electronic reports must be accompanied by a Certificate signed by an authorized representative of the Contractor warranting the truth and accuracy of the electronic report. Certificate must reference traceable circuit numbers that match the electronic record.

I. Test reports shall include the following information for each cabling element tested:

1. Wire map results that indicate the cabling has no shorts, opens, miswires, split, reversed, or crossed pairs, and end to end connectivity is achieved.
2. For Category 6 cabling: Attenuation, NEXT, PSNEXT, Return Loss, ELFEXT, and PSELFEXT data that indicate the worst case result, the frequency at which it occurs, the limit at that point, and the margin. These tests shall be performed in a swept frequency manner from 1 MHz to highest relevant frequency, using a swept frequency interval that is consistent with TIA and ISO requirements. Information shall be provided for all pairs or pair combinations and in both directions when required by the appropriate standards. Any individual test that fails the relevant performance specification shall be marked as a FAIL.
3. Length (in meters), propagation delay, and delay skew relative to the relevant limit. Any individual test that fails the relevant performance specification shall be marked as a FAIL.
4. Cable manufacturer, cable model number/type, and NVP
5. Tester manufacturer, model, serial number, hardware version, and software version
6. Circuit ID number and project name
7. Auto-test specification used
8. Overall pass/fail indication
9. Date of test
10. Test reports shall be submitted within 7 business days of completion of testing.

3.6 TEST EQUIPMENT

A. Test equipment used under this contract shall be from manufacturers that have a minimum of 5 years experience in producing field test equipment. Manufacturers must be ISO 9001 certified.

B. All test tools of a given type shall be from the same manufacturer, and have ompatible electronic results output.

C. Test adapter cables must be approved by the manufacturer of the test equipment. Adapters from other sources are not acceptable.

D. Baseline accuracy of the test equipment must exceed TIA Level III, as indicated by independent laboratory testing.

E. Test equipment must be capable of certifying Category 6 and 6 links.

F. Test equipment must have a dynamic range of at least 100 dB to minimize measurement uncertainty.

G. Test equipment must be capable of storing full frequency sweep data for all tests and printing color graphical reports for all swept measurements.

H. Test equipment must include S-Band time domain diagnostics for NEXT and return loss (TDNXT and TDRL) for accurate and efficient troubleshooting.

I. Test equipment must be capable of running individual NEXT, return loss, etc measurements in addition to auto-tests. Individual tests increase productivity when diagnosing faults.

J. Test equipment must include a library of cable types, sorted by major manufacturer.

K. Test equipment must store at least 1000 Category 6 or 6 auto-tests in internal memory.

L. Test equipment must be able to internally group auto-tests and cables in project folders for good records management.

M. Test equipment must include DSP technology for support of advanced measurements.

N. Test equipment must make swept frequency measurements in compliance with TIA standards.

O. The measurement reference plane of the test equipment shall start immediately at the output of the test equipment interface connector. There shall not be a time domain dead zone of any distance that excludes any part of the link from the measurement.

3.7 MDF/IDF/CIDF INSTALLATION PARAMETERS

A. UTP cabling shall conform to a 6 foot separation requirement from main power panels, Switch gear and/or starter motors adjacent to the IDF and termination locations.

B. All data, voice and communications racks and cabinets shall be anchored in accordance with manufacturer specifications and drawn details, to walls and floors and grounded to building ground grid (not to water pipes, etc.). Individual or new ground points are acceptable.

C. All floor mounted racks and cabinets shall have ladder racking from top of rack or cabinet to nearest wall as directed by consultant.

D. Wall mounted racks and cabinets.
1. Backboards shall be made of fire retardant or treated materials. Outside backboards shall be mounted squarely cut, with sanded edges, void free and painted. Backboards made from particle or pressed board materials are not acceptable. Backboards shall be a minimum size of ¾" thick x 36" wide x the height of the rack or cabinet. Backboard shall be painted with white

fire-retardant paint.

2. Inside backboards shall be mounted squarely cut, with sanded edges and void free. Inside backboard shall match the inside dimensions of the installed cabinet. Inside backboard shall be a minimum thickness of ¾".
3. All new racks and cabinets shall be securely mounted to wall studs in accordance with manufacturer specifications and drawn details.

E. All new and existing racks and cabinets shall have a dedicated 110V/AC double duplex outlet installed per specification section, California Electrical Codes, and drawing details.

3.8 DOCUMENTATION AND DRAWINGS

A. As a pre-requisite for the acceptance of the work, the Contractor shall provide all of the following information. The Contractor shall prepare and provide 2 copies of a complete Cable Book as documentation. This cable book shall consist of the following:
   1. Title of Project
   2. Index page detailing the following sections
   3. Site plans (as-built drawings)
   4. Drawings shall be professionally drafted (to scale, within a border similar to design drawings) and reproducible. Hand written drawings are not acceptable.
   5. The drawings shall depict, at a minimum, the following conditions:
      a. The exact MDF/IDF/CIDF locations
      b. Size and routing of backbone cable from each IDF to the MDF.
      c. Station locations and their exact labeling ID(s) which shall match the physical label at the device.
      d. New pathways, conduit, ground boxes, junction boxes, raceway, power poles and floor monuments.
      e. Any other new conditions.
   6. Contractor shall provide 3 sets of as-built drawings, one of which shall be reproducible.
   7. In addition to the hard copy requirements, the as-builts, one of which shall be generated on Visio, and supplied to District. Media shall be recordable CD.
   8. The Contractor shall submit as-built drawings and media no later than 30 days after the installation date.
   9. Price list and contact information for emergency service work.

B. Fiber backbone test results
   1. In sequential order by IDF number

C. Data station cable test results
   1. In sequential order by IDF and then drop number.

D. Voice feeder test results.
   1. In sequential order by IDF number.
   2. Station/Feeder connectivity spread sheet (8-1/2" x 11" hard copy and electronic file, Microsoft Excel format).

E. Voice station cable test results.
   1. In sequential order by IDF number.
   2. Station/Feeder connectivity spread sheet (8-1/2" x 11"hard copy and electronic file, Microsoft Excel format).

F. Warranty certificates and documentation.

3.9 WARRANTY AND SUPPORT SERVICE

A. The warranty shall commence from the date of final written acceptance by the Owner.

B. All conditions for obtaining the manufacturer's Performance Warranty shall be the sole responsibility of the contractor.

C. The contractor shall maintain a competent service organization and shall, if requested, submit a service maintenance agreement to the owner after the end of the guarantee period.

D. A typewritten notice shall be posted at the equipment rack that shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.

E. Extended Product Warranty and Application Assurance:
   1. The 25 Year Extended Product Warranty shall ensure against product defects, that all approved cabling components exceed the specifications of TIA/EIA 568A and ISO/IEC IS 11801, exceed the attenuation and NEXT requirements of TIA/EIA TSB 67 and ISO/IEC IS 11801 for cabling links/channels, that the installation will exceed the loss and bandwidth requirements of TIA/EIA TSB 67 and ISO/IEC IS 11801 for fiber links/channels, for a twenty (20) year period. The warranty shall apply to all passive SCS components. The 20 Year Extended Product Warranty shall cover the replacement or repair of defective product(s) and labor for the replacement or repair of such defective product(s) for a twenty (20) year period.
   2. The 25 Year Application Assurance shall cover the failure of the wiring system to support the application which it was designed to support, as well as additional application(s) introduced in the future, up to 1000 Mbps parallel transmission schemes, by recognized standards or user forums that use the TIA/EIA-568A or ISO/IEC IS 11801 component and link/channel specifications for cabling, for a twenty (20) year period.
   3. Upon successful completion of the installation and subsequent inspection, the Owner's Project Manager shall be provided with a numbered certificate, from the manufacturing company, registering the installation.

F. One-Year Maintenance Service shall be provided as follows:
   1. Emergency Response: Contractor must respond by utilizing remote diagnostics capabilities (as applicable) within thirty minutes of notification. If necessary, Contractor must dispatch at least one certified technician for arrival on-site within two hours of notification.
   2. Non-Emergency Response: Contractor shall respond by utilizing remote diagnostics capabilities and or cause dispatch of at least one certified technician for arrival on-site within one business day of notification.
   3. Definition of "Emergency": For maintenance purposes, "emergency" shall be defined as one or more of the following conditions:
      a. Defects of any riser pairs and/or components involving at least ten percent (10%) of any riser cable's capacity.
      b. Defects of station cable pairs and/or components involving at least ten percent (10%) of any department or group of voice and/or data stations.
      c. Defects significantly impairing any single attendant console.
      d. Defects of any fiber optic cable and/or components involving at least ten percent (10%) of any departments or groups fiber-based systems and/or stations.
      e. Any pre-defined failure as submitted by Owner and agreed to by Contractor.

G. Contractor shall provide extra service upon request on a 24 hour-a-day, 365 day-a-Year basis. Pricing for such service shall be described in the "Cable Book" Documentation.

3.10 FINAL ACCEPTANCE

A. The Owner or Owner's representative may visit the site during the installation of the system to ensure that correct installation practices are being followed.

B. The Owner or Owner's representative will conduct a final job review once the contractor has finished the job. The review will take place within one week after the contractor notifies the owner.

C. Two copies of all certification data and drawings for all identifications shall be provided to the Owner before the Owner's review.

D. The Owner or Owner's representative will review the installation and certification data prior to the system acceptance.

E. The Owner or Owner's representative may test some of the systems features to ensure that the certification data is correct. If a substantial discrepancy is found, the Owner reserves the right to have an independent consultant perform a certification of the entire system. If such a procedure is undertaken, the cost of the testing will be billed back to the contractor.

F. In the event that repairs or adjustments are necessary, the contractor shall make these repairs at his own expense. All repairs shall be completed within 10 days from the time they are discovered.

END OF SECTION

SECTION 27 51 00

ASSISTED LISTENING SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Related Sections

B. Scope of Work

C. Applicable Publications

D. Design Criteria

E. Materials

F. Installation and Execution

G. Testing

H. Training

I. Guarantees and Warranties

1.2 RELATED SECTIONS

A. Specific Division 17 Sections relating to work identified in the Technology Sections including:

1. Section 17000 – General Technology Requirements

1.3 SCOPE OF WORK

A. Scope of Work

1. The following specification has been developed to address the installation of a stand-alone portable sound system. These systems will be for use in school cafeterias, cafetoriums, small auditoriums and outside learning environments. This document is not a stand-alone specification. The installing Contractor shall provide all equipment, labor, materials, and services required to install the complete, operating system. The installation is to be accomplished in accordance with these specifications and accompanying plans. Include with systems all necessary microphones, stands, and cables.

1.4 APPLICABLE PUBLICATIONS

A. As defined in Section 17000 – General Technology Requirements

B. ANSI/ CEC 2013: 2013 California Electrical Code (CEC) Article 820

C. Federal Communications Commission (FCC) Part 15 and Part 76

1.5 DESIGN CRITERIA

A. Specifications of component equipment as set forth in these specifications are MINIMUM requirements, unless otherwise stated, and shall not be construed as limiting the overall quality, quantity or performance characteristics of items furnished in the system. When the Contractor furnishes an item of equipment for which there is a specification contained herein, the item of equipment shall meet or exceed specifications for that item of equipment.

B. All equipment to be supplied under this specification shall be new and the current model of a standard product of a manufacturer of record. A manufacturer of record shall be defined as a company whose main occupation is the manufacture for sale items of equipment.

C. The Contractor shall adhere to the following general design criteria:

1. Any components and/or wiring and cabling that is determined to be operating below manufacturers specifications shall be removed and replaced at no additional cost.

2. Equipment installations shall conform with the architectural design. The Contractor shall be responsible to notify the Owner, or the Owner's appointed representative of any potential conflict prior to bid.

3. The Contractor shall review requirements stated and provide a formal design that will cost- effectively provide maximum coverage for the facility.

2. PART 2 PRODUCTS

2.1 SOUND SYSTEM CABINET

A. The site shall be equipped with a portable 36” high (46” total including casters), 19” wide cabinet with lockable casters used for housing the sound system equipment.

B. The cabinet shall be constructed of the following materials:

1. Top & bottom shall be 16 gauge steel.

2. Sides shall be 16 gauge steel.

3. Rack rail shall be 11 gauge steel, with tapped 10-32 holes in universal E.I.A. spacing.

4. Rear door shall be of 18 gauge steel.

5. Front door shall be of 16 gauge steel.

6. Shall be of welded construction.

7. Shall be phosphate pre-treated and finished in a durable textured black powder coat.

C. OPTIONS

1. Rear rack rail - 10-32 threaded 11 gauge, in universal E.I.A. spacing. Part # PTRK-RR21

2. 19” rack mount drawer - Drawer base shall be 20- gauge steel, top and sides shall be 16-gauge steel. Drawer shall use full extension, ball bearing slides. Part # D4

D. The portable cabinet shall be Middle Atlantic Products, part # PTRK-21 or approved equal.

2.2 AUDIO MIXER/PREAMPLIFIER

A. Mixer shall have the following features:

1. The mixer/power amplifier shall have eight mixer input ports and shall be capable of operation from a 110/120 V, 50/60 Hz line.

2. Each input port shall be usable with microphone, phono pickup or high-level devices.

3. Power output shall be +20dBm at less than 0.5% THD from 30 to 20,000Hz and +18dBm at less than 0.3% THD from 25 to 20,000Hz.

4. Frequency response shall be ±1dB from 20 to 20,000Hz.

5. Source impedance shall be 200/50k ohms with a microphone preamplifier, 50k ohms with a mag. phono preamplifier, 220k ohms with an auxiliary preamplifier, 10k ohms with a bridging transformer, 600 ohms with a line matching transformer and 600 ohms with a paging input.

6. Load impedance shall be 150 or 600 ohms (transformer-isolated output).

7. Equivalent input noise shall be -126dBm with a Lo-Z microphone preamplifier.

8. Output noise shall be 90dB below rated output when all gain controls are off.

9. TOA plug-in accessory modules designed for use with the M-900MK2 mixer preamplifier shall utilize the latest in surface mount component technology and include microphone, line, and special function models.

10. The mixer / preamplifier shall be rack mounted using the TOA MB-25B rack mounting bracket.

11. The mixer preamplifier shall be TOA model M-900MK2 with required modules or approved equal.

2.3 POWER AMPLIFIER

A. The power amplifier shall be a solid-state two-channel model.

B. The amplifier shall provide extensive protection and diagnostic capabilities, including output current limiting, DC protection, circuit breaker, and special thermal protection for the unit's transformers.

C. The front-panel controls shall be two black detented level controls (one for each channel), a power switch, and a circuit breaker for overload protection.

D. Front-mounted indicators shall be:

1. Clip: one red LED per channel which illuminates when the channel's output signal is being overdriven

2. Power: one green LED which indicates that the amplifier has been turned on and AC power is available

3. Fault: one yellow LED which illuminates when amplifier is in protect mode and briefly during normal power-up when amplifier is first switched on.

E. The recommended load impedance shall be 2 to 8 ohms per channel in Stereo, and 8 ohms in Bridge Mono. The amplifier shall be safe when driving any kind of load, including highly reactive ones.

F. The rear-mounted output connectors shall be two four-pole Speakon® connectors and a pair of 5-way binding posts per channel. Rear-mounted input connectors shall be 3-pin balanced XLR connectors.

G. The power amplifier shall meet or exceed the following performance criteria:

1. Input sensitivity for rated output at 4 ohms: 0.725 V.

2. Rated output with both channels driven with 0.5% THD (at 1 kHz) in Dual mode: 250 watts per channel into 2 ohms, 200 watts per channel into 4 ohms, and 145 watts per channel into 8 ohms.

3. Rated output with 0.5% THD (at 1 kHz) in Bridge-Mono mode: 400 watts into 8 ohms and 500 watts into 4 ohms.

4. Frequency Response at 1 watt, 20 Hz to 20 kHz: ±0.75 dB.

5. Phase Response at 1 watt: –10 degrees at 10 Hz, +19 degrees at 20 kHz.

6. Signal to Noise Ratio below rated power (20 Hz to 20 kHz): greater than 100 dB A-weighted.

7. Total Harmonic Distortion at full rated power, 1 kHz: less than 0.15%.

8. Intermodulation Distortion (60 Hz and 7 kHz at 4:1, from full rated output to –40 dB: less than 0.3%.

9. Damping Factor (8 ohms): greater than 200 from 10 to 400 Hz.

H. AC Line Voltages and Frequencies Available (±10%): 120 VAC/60Hz and 230 VAC/50 Hz.

I. The amplifier chassis shall be constructed of steel with a durable black finish and shall be designed for flow-through ventilation from the front panel to the back panel. Internal heat sinks with forced-air cooling shall provide rapid, uniform heat dissipation.

J. The dimensions of the amplifier shall allow for 19 inch (48.3 cm) EIA standard (RS- 310-B) rack mounting.

K. Power Amplifier (190 watts minimum) shall be Crown XLS 202 or approved equal.

2.4 AUDIO INPUT DEVICES

A. Audio Cassette player - Shall be STANDARD

1. Shall mount in any standard 19" rack and shall require no more than 4 rack units of vertical space.

2. Shall include dual audio record/play

3. Cassette player shall play all standard cassettes with exceptional fidelity (50Hz to 15KHz), with less than 0.15% WRMS WOW shall reverse automatically when it reaches its end.

4. Fast forward, fast rewind and eject buttons shall be provided.

5. There shall be separate visual indicators for cassette operation and stereo reception.

B. Audio CD player - Shall be STANDARD

1. Shall mount in any standard 19" rack and shall require no more than 4 rack units of vertical space.

2. 8-times over sampling minimum.

3. Next track, previous track, Fast forward, fast rewind and eject buttons shall be provided.

4. Program play with remote control.

2.5 FM WIRELESS MICROPHONE SYSTEM

A. The wireless microphone system shall be of professional quality with an operating frequency range of 692 to 722 mhz with 64 selectable channels and simultaneous operation of up to sixteen systems. The system shall include the following:

B. Wireless Receiver

1. The wireless receiver shall have 64 selectable channels and a built-in scanner function to scan the RF environment and indicate available channels.

2. The receiving method shall be double super-heterodyne using antenna switching diversity.

3. shall include a S/N ratio of greater than 110 dB (A-weighted), harmonic distortion of less than 1% and frequency response of 100 Hz - 12 kHz, ±3 dB.

4. The receiving sensitivity shall be greater than 80 dB with 20 dBµV input and 40 kHz deviation. Squelch types shall be carrier, noise and tone key with a variable squelch sensitivity of 18 - 40 dBµV and a 32.768 kHz tone key frequency.

5. The receiver shall have two antenna inputs, each with BNC-type connectors, 75 ohm impedance and 9 VDC, 30 mA, available for remote antennas.

6. The unit shall also have two antenna outputs, with BNC-type connectors, 75 ohm impedance, and 0 dB gain, to provide antenna distribution to a maximum of two additional receivers. The audio outputs shall be balanced type with XLR-M jack, and unbalanced type with 1/4" phone jack, both with an output impedance of 600 ohms and switchable sensitivity between MIC (-60 dBV / 1 mV and LINE (-20 dBV / 100 mV).

7. A Mix Input, unbalanced type with 1/4" phone jack with an input impedance of 10 kohms and sensitivity of -20 dBV / 100 mV shall allow the connection of the output of a second receiver or other audio source to be mixed with the main receiver output signal.

8. The front panel shall include an LCD for RF and AF metering as well as frequency setting and scanner functions.

9. Front panel LED's shall include ANT A/B and an AF PEAK that lights at 3 dB below clipping.

10. Front panel controls shall include Menu/Enter, Power, RF/AF/Next and Volume.

11. The wireless receiver shall be powered from the AC mains using a supplied AC-DC adapter with a power consumption of 250 mA (12 VDC).The unit shall operate within a temperature range of +14° F to +122° F (-10° C to +50° C).

12. Unit construction shall be black resin with dimensions of 8.27" W x 1.76" H x 7.09" D (210 mm x 44.6 mm x 180 mm) and weight of 5.2 lbs.(2.35 kg).Included accessories shall be two whip antennas and an external AC-DC adapter (120 VAC, 60 Hz).Up to two units shall be rack-mountable in one standard 19" rack height with an optional rack-mount kit.

13. The diversity wireless receiver shall be the TOA model WT-4800.

14. The wireless diversity receiver rack-mount kit shall be the TOA model MB-WT1/MB-WT2.

C. Wireless Microphone Transmitters

1. The handheld wireless microphone transmitter shall be dynamic type with a cardioid pattern and capable of a maximum input level of 145 dB SPL.

2. The lapel microphone with bodypack shall be electret condenser type with a cardioid pattern and be capable of a maximum input level of 120 dB SPL.

3. The transmission method shall be frequency modulation (F3E) with a PLL-based modulation system operating in the frequency range of 692 - 722 MHz with 64 selectable channels. The RF carrier power shall be no greater than 50 mW with maximum deviation of ±40 kHz and a tone key frequency of 32.768 kHz.

4. The units shall operate for a minimum of 10 hours using a 9 V (6LR61), alkaline type battery.

5. A power LED shall glow continuously to indicate normal operation and flash to indicate low battery level (< 6 VDC).The transmitter shall utilize a 1/4 wave helical antenna.

6. Transmitter controls shall include Power On/Off, Frequency Bank/Channel Select and Input Sensitivity Adjust.

7. The bodypack shall include a TB-4M type input connector compatible with TA-4F type and a rotatable attachment clip.

8. The transmitters shall operate within a temperature range of +14° F to +122° F (-10° C to +50° C).The transmitters shall be constructed of black resin with an additional rubber coating on the handheld transmitter.

9. Dimensions shall be 2.06" dia.x 11" L (52.2 mm x 279.4 mm) for the handheld transmitter and 2.44" W x 5.59" H x 1.26" D (62 mm x 142 mm x 32 mm) for the lapel bodypack transmitter. The lapel microphone cable length shall be 4.76 ft.(1.45 m).

10. The weight (with battery) shall be 0.60 lbs.(270 g) (handheld) and 0.33 lbs.(150 g) for the lapel/bodypack.

11. Included accessories shall be a frequency adjust screw driver and storage case, stand adapter (handheld) and rotatable lapel clip (lapel/bodypack).

12. The wireless handheld microphone shall be the TOA model WM-4200.

13. The wireless lapel microphone with bodypack shall be the TOA model WM-4300.

2.6 ASSISTIVE LISTENING SYSTEM

A. Stationary FM Transmitter

1. The stationary FM transmitter shall be capable of broadcasting on 57 channels. The output power shall be adjustable to quarter, half or full.

2. Channel tuning shall be capable of being locked.

3. The device shall broadcast on both wide and narrow band channels.

4. The device shall have an audio frequency response of 50Hz to 15KHz, +/- 3dB at 72MHz, or of 30Hz to 10kHz, +/- 3dB at 216MHz.

5. It shall have two mixing audio inputs. The device shall have the following audio controls: input level, process control and an adjustable low pass shelving filter.

6. The Transmitter shall be Listen LT-800.

B. Rack Mounting Kit:

1. The mounting kit shall be capable of single and dual racking mounting of a Listen stationary transmitter or stationary receiver.

2. The kit shall include a Plexiglas cover that will prevent end users from making adjustments to the mounted equipment.

3. The kit shall be 19.0 in (48.3 cm) wide, 1.75 in (4.44 cm) high, and 8.0 in (20.3 cm) deep.

4. The Rack Mounting Kit shall be Listen LA-326.

C. FM Receiver (Deluxe)

1. The FM receiver shall be capable of receiving on 57 wide and narrow band channels.

2. The receiver shall be capable of seeking channels.

3. The device shall have an adjustable squelch.

4. The device shall have an audio frequency response of 50Hz to 15KHz, +/- 3dB at 72MHz, or of 30Hz to 10kHz, +/- 3dB at 216MHz.

5. The device will incorporate a stereo headset jack that allows the user to plug in either a mono or stereo headset and listen to the audio normally.

6. The device shall incorporate an LCD display that indicates channel, battery level, low battery, battery charging, RF signal strength.

7. The Receiver shall be Listen LR-400.

D. FM Receiver (Basic)

1. The FM receiver shall be capable of at least receiving on 17 wide band channels.

2. The receiver shall be capable of seeking channels.

3. The device shall have a squelch.

4. The device shall have an audio frequency response of 50Hz to 15KHz, +/- 3dB at 72MHz.

5. The device shall incorporate a stereo headset jack that allows the user to plug in either a mono or stereo headset and listen to audio normally.

6. The receiver shall be Listen LR-300.

E. Ear Speaker

1. The ear speaker shall be a single ear clip that is easily cleaned (solid plastic speaker).

2. Shall be capable for use with any of the specified receivers and have a strong volume out-put

3. The receiver's antenna shall be built in to the headphone cord

4. The ear speaker shall have a cable Length of 36 in and weight 4 oz.

5. Max Input: 130mW maximum

6. Connector: 3.5mm mono

7. The ear speaker shall be Listen LA-164

2.7 LOUD SPEAKERS

A. Assemblies shall consist of 2-way, woofer and tweeter, within environment-resistant housings. Enclosure shall be constructed of paintable UV-resistant, talc impregnated, polypropylene injection molded plastic finished in black.

B. Each unit shall include a stamped, powder coated, aluminum grille and removable C-shaped mounting bracket.

C. All hardware inserts shall be brass and threaded 1/4"-20. The 150 Watt RMS system shall have a 8" (133mm) HYCONE™ treated woofer, and a 1" exit compression driver frequency device. The dividing network crossover frequency shall be 2.5 kHz. The dividing network shall include protection circuits for the high-frequency component.

D. The loudspeaker system shall meet the following performance criteria:

E. Power handling, 150 Watts RMS ; Frequency response, ±3dB from 65 Hz to 20 kHz;. Pressure sensitivity, 92dB SPL at one watt, 100 Hz to 10 kHz measured at a distance of one meter on axis. Impedance shall be 8 ohms nominal.

F. Input connectors shall include (1) sealed 1/4" phone jack and (1) 5-way touch-proof binding post. A tongue-in-groove cover with rubber wire exit grommet shall be provided to protect the input connectors.

G. The loudspeaker system shall exhibit no performance or cosmetic degradation after a 100 hour salt spray test per ASTM B117.

H. The unit shall be 16 1/2"high x 9 1/16"wide x 8 7/16"deep.

I. The indoor/outdoor mini-loudspeaker system shall be Atlas Sound Model SM82-B.

2.8 ADJUSTABLE LOUD SPEAKER EQUIPMENT STAND

A. Shall be designed for easy transportability, set-up and tear-down.

B. Constructed of heavy-duty aluminum and shall be capable of supporting up to 150 lbs.

C. Height adjusts from 48" to 85"

D. Stand shall be equipped with a positive clamping system complete with an airdamped safety release to assure slip-free support of elevated equipment.

E. Vertical tube assembly contains 11.2" and 13.8" tubing.

F. Clutch mechanism includes a protective insert for scratch-free height adjustment.

G. Equipment stand shall be finished in non-reflective ebony.

H. **SSA-7.** Universal platform adapter for stand Model SS33E features two 3/8" x 2" equipment mounting holes to meet a variety of support applications. Material is molded plastic and the finish is ebony.

I. Adjustable Equipment Stand shall be Atlas Sound #SS33E or approved equal.

2.9 CABLES, CONNECTORS AND MISCELLANEOUS HARDWARE

A. Cable gauge sizes are nominal. Cable loss should be calculated and appropriate gauge wire be used for the required load.

B. Microphone Cables

1. Shall be twisted-pair construction to reduce audio bandwidth distortions for better clarity.

2. 87% coverage copper-braided shield rejects RFI and EMI for a lower noise floor and increased resolution.

3. Extra-flexible Duraflex® outer jacket for superior reliability and cut resistance.

4. Heavy-duty black Neutrik® XLR connectors provide increased durability.

5. Available in multiple sizes and pre-terminated.

6. Microphone cables shall be Monster Cable - Standard 100 Microphone cable or approved equal.

C. Loud Speaker Cables

1. Shall be Magnetic Flux Tube® construction and special cable windings for natural music reproduction.

2. Durable jacket for indoor and outdoor use.

3. 24k gold-tipped 1/4" connectors or gold Monster Tips (bananas) for durability and improved signal transfer.

4. Available in multiple sizes and pre-terminated or in spools. Minimum cable length shall be 30' per speaker.

5. Loud speaker cables shall be Monster Cable - Standard 100 speaker cable or approved equal.

D. Input sources shall be comprised of one twisted pair of #18 gage stranded tinned copper conductors, polyethylene shielded with an aluminum foil-mylar shield; a #22 gage stranded tinned copper drain wire and polyvinyl jacket.

E. Three-conductor jumper wire shall consist of solid copper conductors, insulated with polyvinyl chloride and color coded, #22 gage. Colors shall be blue/red and white.

F. Cable Markers:

1. High-grade PVC clip-on or permanent-type cable markers with permanent markings or printed vinyl tape protected by clear shrink tubing.

2. Acceptable: Electrovert Type C or Z or Brady B-702 with Alpha FIT-221 series clear tubing or approved equal.

2.10 PROVIDE ALL NECESSARY POWER SUPPLIES, RELAYS, NETWORKS, AND OTHER REQUIRED COMPONENTS TO MAKE THE SYSTEM FULLY OPERATIONAL.

A. Wiring enclosures, terminal cabinets, outlets, frames of cabinet racks and other enclosures shall be grounded and such grounding shall be done in compliance with requirements of local Electrical Code and as specified herein.

2.11 LOADS ON EQUIPMENT AND COMPONENTS

A. All equipment and component parts shall carry continuously, without undue heating or change in rated value, loads connected thereto and rated output loads where such are specified. All equipment shall be properly fused. All components and parts shall be designed for continuous operation.

B. Operating voltages on capacitors shall not exceed 60% of their rated working voltages.

C. Operating wattage to be dissipated by resistors shall not exceed 25% of their ratings.

3. PART 3 EXECUTION

3.1 GENERAL

A. As it is not practical to enumerate in these specifications all details of fittings and accessory equipment required for proper operation of the system herein described, it is understood that they will be supplied by the Contractor in accordance with manufacturers' installation standards without extra compensation.

B. The Contractor shall provide hardware and cable dressing to be consistent with layout and appearance to acceptable communications industry standards for a "neat" installation.

C. Contractor shall coordinate locations of all components prior to installation to avoid conflicts.

D. The Contractor shall provide any necessary screws, anchors, clamps, tie wraps, distribution rings, and support hardware, etc., necessary to facilitate the installation of the system.

E. It shall be the responsibility of the Contractor to furnish any special installation equipment or tools necessary to properly complete the system. This may include, but is not limited to, tools for terminating cables, testing and splicing equipment, jack stands for cable reels, or cable wenches.

F. The Contractor shall be responsible for printed labels for all cables and cords in distribution cabinets. Handwritten labels are not acceptable.

3.2 CABINET RACK EQUIPMENT INSTALLATION

A. Amplifiers, power supplies and other heavy devices shall be mounted utilizing manufacturer recommended brackets or on steel shelves made by manufacturer of console and cabinet racks.

B. Wiring within console and cabinets shall be installed to conform to standard engineering practice, and shall be terminated on terminal strips having a terminal for each required external connection.

C. Wiring shall be cabled, laced and securely fastened in place so that no weight is imposed on any equipment, control switches, or terminals. Wires carrying audio power shall be shielded.

D. Input and output circuits and terminal strips shall be installed to provide separation necessary for proper operation.

E. Wires shall be identified by number and chart.

F. Conductor shields for each system shall be grounded at one location only. Grounding shall be done within console and cabinet racks.

G. There shall be no metallic connection between systems.

H. Conduits for system and 120 volt AC system shall be bonded together at console and all cabinet racks.

I. 120 volt AC supply conductors shall be terminated directly on disconnect switches specified.

3.3 PERMITS, LICENSES, ORDINANCES AND REGULATIONS

A. Any and all fees that pertain to the Sound System and the work of the Contractor required by state, county or city laws will be paid by the Contractor. All other applicable permits or fees required by law, ordinances, tariffs and regulations shall also be paid by the Contractor. The Contractor must give all notices necessary in connection therewith.

B. The Contractor shall comply with all applicable federal and state laws, regulations, ordinances and codes, including all applicable OSHA and Uniform Commercial Code regulations and requirements and requirements which are in effect at the date of execution of the contract and which place obligations on the Contractor with respect to its performance under the contract. In the event that sections of the contract explicitly address warranties and remedies in a manner which is not consistent with applicable provisions of the UCC, it is agreed that the provisions set forth in the contract shall apply. The Contractor shall submit, prior to their start of tasks that involve work on the Tenant's premises, details of their safety program.

C. The Contractor shall be licensed to operate in the City.

3.4 FINAL TESTS AND ADJUSTMENTS

A. Preliminary Testing: The contractor shall be responsible for the successful testing of ALL Sound Systems and components per systems performance specifications. Any discrepancies are to be resolved to ensure performance prior to acceptance of the distribution system.

B. The installing contractor shall provide termination-to-termination testing and utilize appropriate signal level test equipment.

3.5 TRAINING

A. The Contractor shall properly instruct the Owner or person designated by the Owner as to the correct operational procedures of the system.

B. Provide not less than four hours (two- 2 hour sessions) for instruction of personnel in the operation and maintenance of the systems. This instruction time shall be scheduled as directed by the Owner.

3.6 GUARANTEES AND WARRANTIES

A. Contractor is to guarantee the complete Autonomous Public Address/ sound systems, in writing, against defects in workmanship and material for a minimum of one year after final acceptance. During this time, the entire system must be kept in proper operating condition at no additional labor or material cost to the Owner. The Contractor will delineate the conditions of this warranty for this period.

B. Warranty service must be rendered within 8 hours and all problems resolved within 48 hours of notification by the Technology Consultant.

C. The manufacturer of the major components will maintain a replacement parts department and provide test equipment when needed.

1. A complete parts department will be located in a geographical proximity consistent with rendering service within the stated twenty-four hour period.

2. An ample stock of individual components and equivalent unit replacements will be carried for as long a period as demand warrants. This period will extend beyond the normal life expectancy of the equipment, with ten years being minimum period.

3. Shipping costs associated with providing required equipment not available in local stock shall be the responsibility of the Contractor.

D. Actions which may void warranty shall be identified and submitted for the Owners approval prior to award of contract.

E. The contractor shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment and shall maintain a spare set of all major parts for the system at all times. All circuit packs and boards, instruments and control sub-systems shall be 100 percent backed up with stock at contractors facility.

END OF SECTION

SECTION 27 76 00

PUBLIC ADDRESS and CLOCK SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Refer to the General Conditions and all other Section of Division.

1.2 DESCRIPTION OF WORK

A. Furnish and install all labor, materials, equipment, tools, transportation, supervision, services required to provide and leave ready for operation an existing Bogen Multicom system upgraded to a new Bogen Quantum IP Clock and Public Address system. The contractor shall include all materials and/or equipment necessary to make a complete working installation. The electrical work shall include, but is not limited to the following:

1. Public address speakers, clocks, head end equipment, wiring and connections as indicated on drawings to establish a new fully functional integrated system.
2. Provide new cards and any other equipment at existing Bogen head-in for upgrade to a new IP system.

B. Related work included in other Sections:

1. Section 26 01 00, General Electrical Requirements, applies all work in this Section.

2. Basic Construction Materials and Methods: Section 26 05 00.

3. Complete installation and wiring of each device. The systems shall include conduit, outlet boxes, wiring devices, signaling facilities, programming, staff training and other items as specified.

4. Provide all incidental work and materials involved in installation of the signal equipment including carpentry or structural work for support of junction boxes, conduits, control panels, outlets, etc.

1.3 SUPERVISION AND QUALITY OF WORK

A. The Contractor shall supervise the work of this section, personally, or through an authorized and competent representative.

B. All material and equipment shall be installed in a neat manner. Any material or equipment not installed in the manner described shall upon the order of the Architect, Engineer or District be removed and replaced in satisfactory manner. No additional expense shall be allowed to repair work required.

C. The Contractor shall carefully study and compare all drawings, specifications and other instructions and shall at once report, prior to bid, to the Engineer via the Architect any error, inconsistency or omission that may be discovered.

1.4 CONTRACTOR

A. The contractor shall furnish all equipment, accessories and material required for the installation of a comprehensive communication system in strict compliance with these specifications and applicable contract drawings. Any material and/or equipment necessary for the proper operation of the system, which is not specified or described herein, shall be deemed part of this specification.

1.5 SUBMITTALS AND SUBSTITUTIONS

A. Within thirty-five (35) calendar days after the date of award of the contract, the contractor shall submit to the Architect for review, eight (8) copies of a complete submission. The submission shall consist of five (5) major sections, with each section separated with insertable index tabs. The first section shall be the "index", which shall include the project title and address, name of the firm submitting the proposal and the name of the Architect. Each page in the submission shall be numbered chronologically and shall be summarized in the index. The second section shall include a copy of the authorized distributor's valid C-10 California State Contractors License, letters of factory authorization and guaranteed service, list of projects of equal scope and

list of proposed instrumentation to be used by the contractor. The third section shall contain the comparative specification listing, including a complete listing of the characteristics of the equipment to be furnished. The fourth section shall contain an original factory data sheet for every piece of equipment in the specifications. The fifth section shall contain a wiring destination schedule for each circuit leaving each piece of equipment.

B. The manufacturer's representative shall provide a letter with submittals from the manufacturer of all major equipment stating that the manufacturer's representative is an authorized distributor. This letter shall also state the manufacturer guarantees service performance for the life of the equipment, and that there will always be an authorized distributor assigned to service the area in which the system has been installed.

C. In order to establish quality and standards of performance of equipment required by the Owner, the specified equipment for the communication systems is that of Bogen Communications, Inc. All mechanical, electrical and general information set forth on the respective data sheets for each specified item shall be considered as part of these Specifications and binding herein. Any proposed equal item offered shall be substantiated fully to prove equality. The Architect reserves the right to require a complete sample tested by an independent testing laboratory to prove equality. The decision of the Architect regarding equality of proposed equal items will be final. All base bids must be submitted using the Bogen Communications, Inc. product.

D. All parties understand that any substitution(s) of specified products are done for the purpose of cost savings to the Owner. Therefore, any material substitutions or deviations proposed by the Contractor shall be included with the initial bid and shall show a line item credit to the Owner for each item substituted in lieu of specified products.

1.6 QUALIFICATIONS

A. All work described herein to be done by the manufacturer's authorized representative shall be provided by a documented factory authorized representative of the basic line of equipment to be utilized.

B. As further qualification for bidding and participating in the work under this specification the manufacturer's representative shall hold a valid C-10 Contractor's License issued by the Contractor's State License Board of California. The manufacturer's representative shall have completed at least fifty (50) projects of equal scope, giving satisfactory performance and have been in the business of furnishing and installing sound systems of this type for at least twenty (20) years. The manufacturer's representative shall be capable of being bonded to assure the owner of performance and satisfactory service during the guarantee period.

1.7 EQUIPMENT WARRANTY

A. The contractor shall furnish a letter from the manufacturer of the equipment, which certifies that the equipment has been installed according to factory intended practices, that all the components used in the system are compatible and that all new portions of the systems are operating satisfactorily. Further, the contractor shall furnish a written unconditional guarantee, guaranteeing all parts and all labor for a period of two (2) years after final acceptance of the project by the owner.

1.8 SERVICE FACILITIES

A. The contractor shall make available, and maintain a satisfactory service department capable of furnishing equipment inspection and service. The contractor shall be prepared to offer a service contract for the maintenance of the system beyond the warranty period.

1.9 TRAINING

A. The contractor shall instruct personnel designated by the owner in the proper use, basic care, and maintenance of the equipment. Such training shall be provided as an integral component of the system.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. The manufacturer shall be a United States manufacturer, who has been regularly engaged in the manufacture of communication systems for at least thirty (30) years. The equipment described herein, and furnished per these specifications shall be the product of one manufacturer. All reference to model numbers and other detailed descriptive data is intended to establish standards of design, performance and quality, as required.

Equipment manufactured by Bogen Communications, Inc. shall be acceptable and shall be installed by the Authorized Bogen Distributor of Engineered Sound Products for this region.

B. The communications system shall bear the label of a Nationally Recognized Testing Laboratory (NRTL) such as E.T.L., D.S. & G., or UL and be listed by their re-examination service. All work must be completed in strict accordance with all applicable electrical codes, including NEC Section 800-51 (i), under direction of a qualified and factory approved distributor, to the approval of the owner.

C. The system is to be designed and configured for maximum ease of service and repair. All major components of the system shall be designed as a standard component of one type of card cage. All internal connections of the system shall be with factory keyed plugs designed for fault-free connection. The printed circuit card of the card cage shall be silk screened to indicate the location of each connection.

D. Manufactures: Subject to compliance with requirements specifications, provide the following system:

1. Quantum Multicom IP manufactured by Bogen Communications, Inc., Ramsey, NJ

E. The Specifying authority must approve any alternate system.

F. The intent is to establish a standard of quality, function and features. It is the responsibility of the bidder to insure that the proposed product meets or exceeds every standard set forth in these specifications.

G. The functions and features specified are vital to the operation of this facility; therefore, inclusion in the list of acceptable manufacturers does not release the contractor from strict compliance with the requirements of this specification.

2.2 SYSTEM PARAMETERS

A. The communication system shall be a Bogen Quantum Multicom IP, and shall provide a comprehensive communication network between administrative areas and staff locations throughout the facility. Nonvolatile memory shall store permanent memory and field-programmable memory. A system, which uses a battery to maintain system configuration information, shall not be acceptable.

B. The system shall provide no less than the following features and functions:

1. Telephonic communication (complete with DTMF signaling, dial tone, ringing and busy signals, and data display) on administrative stations shall use two wires. Systems that use more than two wires for communication, tones and data display shall not be acceptable.

2. Amplified-voice communication with loudspeakers shall use a shielded audio pair (shield can be used as one of the two required conductors for administrative phone or call-in switch).

3. The system shall be available in the following configurations:

a. MC2K Wall-mounted in a custom enclosure. Station capacity shall be from 24 to 130 stations. All stations shall have the ability to support displays.

b. MC2KR Rack-mounted. Station capacity shall be from 24 to 250 stations. All telephone stations shall have the ability to support displays.

c. QRC24 & QRC48 Compact Quantum Rack System. Station capacity shall be from 24 to 48 stations. All stations shall have the ability to support displays, with an option to add up to 8 Central Office phone lines.

d. 2223/2233 MC2KR Rack-mounted and integrated with Bogen Multi-Graphic Series 2223 or Series 2233 equipment. In this configuration, Quantum Multicom IP system station capacity shall be expandable up to 250 stations in increments of 24. All telephone stations shall have the ability to support displays. The Multi-Graphic system equipment provides the following: backup fail safe intercom and paging functions (Note: the systems operate independently; if one were to fail, the other provides intercom for student safety), plus two additional program channels, and additional Multi-Graphic functions. It shall be possible, by use of a separate call-in switch, to annunciate only to the Multi-Graphic portion of the system without using additional station ports within the Quantum Multicom IP system.

The above system configurations represent a single processor in the Quantum Multicom IP. Each processor can be combined with up to 63 additional systems (nodes) for a total single facility capacity of up to 16,000 stations. Up to 99 additional facilities can communicate with each other to provide district-wide point-to-point calling and All-Call Paging with up to 1,600,000 stations.

4. The system shall consist of any combination of the following: Administrative Display Phones, Administrative VoIP Phones, and Administrative Phones.

   a. Staff Classroom Stations shall consist of wall- or ceiling-mounted loudspeakers with call-in switches or handsets.

   b. Administrative phone stations shall consist of either VoIP phones, display phones, or DTMF dialing 2500 analog-style telephone sets.

   c. Administrative Display Phones shall be DTMF-dialing digital telephone sets with a 4x16 character LCD display panel. They shall be equipped with a standard 12-key push-button dialing keypad. Phones requiring external LCD displays shall not be accepted as an equal. Optionally, a loudspeaker may be connected at each administrative station location.

      1. Up to 5 Administrative Wall Displays may be added to the Administrative Station for large office areas.

   d. Administrative Display Phones and Administrative Phones shall have the option of including a loudspeaker.

   e. All types of stations except administrative VoIP phones shall utilize the same type of field wiring. Future station alterations shall only require the station type to be changed and the proper software designation to be selected. Alterations shall not require field wiring or system head-end alterations. All field wiring and system head-end equipment shall support any type of station, at the time of installation. All contractor proposals shall reflect this capacity. Failure to submit and bid this project in this manner will be deemed as being in direct conflict of these specifications and will be rejected.

   f. There shall be no limit to the number of administrative display stations within the total capacity of the system.

   g. It shall be possible at any time to change the type of station at any location without equipment or wiring changes except for administrative VoIP phones that utilize existing LAN connections. Systems that limit the quantity of each station type or require future additional equipment and/or system expansion to provide additional administrative telephones shall not be accepted as an equal.

5. The system shall be a global switching system, providing up to 512 unrestricted simultaneous private telephone paths per facility. The system shall also be capable of providing up to 512 amplified intercom paths per facility. One amplified intercom path shall automatically be provided with each increment of 24 stations of system capacity. All hardware, etc., required to achieve the necessary number of amplified-voice intercom channels for this system shall be included in this submittal. Amplified-voice intercom channels shall provide voice-activated switching. Systems requiring the use of a push-to-talk switch on administrative telephones shall not be acceptable. There shall be an automatic level control for return speech during amplified-voice communications. The intercom amplifier shall also provide control over the switch sensitivity and delay times of the VOX circuitry.

6. It is of utmost importance that emergency calls from staff stations receive prompt attention. Therefore, it is important that there be an alternate destination in case the emergency call does not get answered at the primary location. To this end:

   a. The system shall provide 911 Dial-Through with specific outside line(s) dedicated only for this function to ensure that the line is available all the time for 911 calls. The 911 Dial-Through is available to any station that can dial.

   b. The 911 CO lines will be pre-configured and reserved. If the 911 reserved lines are busy, the normal CO lines will be connected to route the 911 calls. If all the normal CO lines are busy, the ongoing call shall be disconnected and the 911 call shall be placed.

c. Staff-generated Emergency calls shall be treated as the second highest system priority. Therefore, all Emergency calls shall annunciate at the top of the call queue of their respective administrative telephone(s). Should that emergency call go unanswered for 15 seconds, the call shall be re-routed to an alternate speaker station then prompt the caller to make a verbal call for help. During the transfer, the original administrative telephone shall continue to ring the distinctive Emergency Ring. Should the Emergency Transfer to Station have an associated administrative telephone, it too shall ring the distinctive Emergency ring.

d. The Emergency Transfer to Station shall be field programmable.

e. Should the original administrative telephone be engaged in a non-emergency conversation, its conversation shall be automatically terminated, indicated with an alert tone, and then reconnected to the station that generated the Emergency Call.

f. Should the administrative telephone be engaged in an emergency conversation, successive emergency calls shall log into the call queue as well as transfer to the Emergency Transfer Station for their verbal call for help. Upon termination of the initial emergency conversation, the next one shall immediately ring the administrative telephone.

g. Systems failing to transfer unanswered Emergency calls or failing to immediately connect to the administrative telephone shall not be deemed as equal.

7. There shall be a System-Wide Facility Emergency All-Call feature. The Emergency All-Call shall be accessed from designated administrative phones or by the activation of an external contact closure which shall give the third audio program input emergency status. The Emergency All-Call function shall have the highest system priority and shall override all other loudspeaker-related functions including Time Tone Distribution.

   a. Considering that emergencies calls are to be treated with the highest level of concern. Systems which do not regard Emergency-All-Call page from an administrative telephone with the highest priority shall not be deemed as equal.

   b. Upon picking up the receiver and dialing "9", a menu shall appear on the display prompting the user to enter each subsequent digit. In this way, the user shall not be required to memorize complicated key sequences in order to access emergency functions.

   c. The Emergency All-Call shall capture complete system priority, and shall be transmitted over all speakers in the facility. It shall also activate an external relay, which can be used to automatically override volume controls and other systems.

   d. Systems without Emergency All-Call, or systems with All-Call that cannot be activated by external means, or which do not capture complete system priority or activate an external relay, shall not be acceptable.

8. There shall be at least four Dedicated Emergency Alarm Tones. Each may be accessed by dialing a three-digit number from designated administrative telephones. These emergency tones should be separate from the time tones. Systems using external alarm generators, or having less than four emergency alarm tones shall not be acceptable.

   a. Upon picking up the receiver and dialing "9", a menu shall appear on the display prompting the user to enter each subsequent digit. In this way, the user shall not be required to memorize complicated key sequences in order to access Emergency Alarm Tones.

9. There shall be four (4) External-Function Relay Driver Outputs, accessible from designated Quantum Commander Users or Administrative Display Telephones by dialing a four-digit number. These outputs remain set until accessed and reset at a later time. The user shall have the ability to review the status of each relay driver. A plain English menu, prompting the user through the fields without requiring the user to remember any dialing sequences shall support this feature. Systems that require the user to remember complicated dialing schemes or prompt the user via cryptic commands shall not be deemed equal.

   a. The stations shall be capable of being programmed for security contact relays for use with magnetic locks, motion detectors, cameras or any low-voltage, dry contact creating device. System using security stations for control of external functions shall not be acceptable.

b. Upon picking up the receiver and dialing "9", a menu shall appear on the display prompting the user to enter each subsequent digit. In this way, the user shall not be required to memorize complicated key sequences in order to access external relay functions.

10. There shall be a program-material interface included with each node, which shall accept up to four (4) Bogen Power Vector Series program modules. Systems requiring an external program source interface shall not be acceptable.

11. There shall be an outside line feature. The circuitry shall interface with the station ports of an external telephone system, and shall provide facilities for up to 960 incoming lines per facility which shall be designated by the user to ring "day" and "night" administrative display stations or administrative stations. Where an administrative display station is designated to receive outside line calls, the phone shall ring with a unique tone and the outside line number shall appear on the display panel. The option shall also provide the ability to make outside line calls from Administrative Display Stations or Administrative Stations. This ability shall be programmable for each phone and there shall be thirty-two Classes of Service available to any station. This feature shall be capable of supporting DID, DISA, and a Security DISA function.

    a. Cellular system access for Security is of the utmost concern. Wireless security page offers a password-protected Security DISA feature that shall be accessible only from authorized Police, Fire, Emergency personal or an off-premise security office, which monitors the facility's security system. It shall function as follows: upon confirmation of the password DISA number, the system shall allow security personnel to dial access any station and monitor the activity without pre-announce tone or the privacy tone. This will then allow the security office to determine exactly what the conditions are in the station and the actions need to be taken.

12. The system shall provide for field-programmable three-, four-, five-, or six-digit architectural station numbers.

13. There shall be an automatic level control for return speech during amplified-voice communications.

14. Each station loudspeaker shall be assignable to any one, any combination, or all of 64 Multi-purpose zones or any of the 16,000 hard-wired zones per facility.

    a. Each station loudspeaker shall be assignable to any one, any combination, or all of 64 Multi-purpose zones. Systems with less than 64 Multi-purpose zones shall not be acceptable.

15. There shall be thirty-two (32) Flexible Time-Signaling Schedules with a total of 1024 user-programmed events per facility. Each event shall sound one of user-selected tones or external audio. It shall be possible to assign each schedule to a day of the week, or manually change schedules from an authorized Quantum Commander User via Web browser. Systems, which do not provide a minimum of thirty-two (32) flexible time-signaling schedules or a choice of eight (8) time tones plus external audio, shall not be acceptable.

16. An internal program clock (with battery backup) shall be included, allowing a total of 1024 user-programmed events per facility. It shall be possible to synchronize the internal program clock with an external master clock. Systems, which do not provide an internal program clock and/or can not synchronize with an external master clock to meet these specifications, are not equal.

    a. There shall be thirty-two (32) flexible time-signaling schedules. It shall be possible to assign each schedule to a day of the week, or manually change schedules from an authorized Quantum Commander User via Web browser on the LAN/WAN.

    b. The built-in Master Clock corrects time by accessing the LAN/WAN NTP time server.

    c. The Quantum Processor is capable of adjusting the Daylight Savings Time automatically.

    d. Each event shall be able to be directed to any one or more of the sixty-four (64) Multi-purpose time-signaling zones.

    e. Each of the 64 Multi-purpose zones shall have a programmable "tone duration" unique unto itself. For example: the gymnasium shall receive a time tone for ten (10) seconds while the rest of the facility receives a tone for five (5) seconds.

f. Each event shall sound one of eight (8) user-selected tones or external audio. Each event may utilize a different custom tone. It shall be utilized to send the gymnasium, shop classes, and pool (if necessary), a separate time tone to indicate "clean up." Minutes later the entire facility can then receive the same time tone to indicate class change.

g. Each of the eight (8) Distinct Time Tone Signals may be manually activated by selected Administrative Display Phones or from an authorized Quantum Commander User via web-browser. These tone signals shall remain active as long as the telephone remains off-hook, or until canceled from the keypad or Quantum Commander.

1. Upon picking up the receiver and dialing "9", a menu shall appear on the display prompting the user to enter the next digit. In this way, the user shall not be required to memorize complicated key sequences in order to access manual time-tone functions.

2. Systems that do not provide at least thirty-two (32) flexible time signaling schedules or do not provide automatic activation of schedules shall not be acceptable.

h. Shall have the capability to control Analog, Digital and Wireless Secondary Clocks.

17. There shall be a zone-page/all-page feature that is accessible by selected administrative VoIP phones and administrative phones.

a. There shall be automatic muting of the loudspeaker in the area where a page is originating.

b. There shall be a pre-announce tone signal at any loudspeaker selected for voice paging.

18. There shall be a voice-intercom feature that is accessible by selected administrative phones, administrative VoIP phones and all administrative display phones.

a. There shall be a periodic privacy tone signal at any loudspeaker selected for amplified-voice communication.

b. There shall be a pre-announce tone signal at any loudspeaker selected for voice-intercom communication.

c. Privacy and pre-announce tone signals shall be capable of being disabled during system initialization.

d. There shall be an automatic switchover to private telephone communication should the person at the loudspeaker pick up his handset.

e. By picking up the receiver and dialing the first digit of the number of the station to be called, that number shall appear on the display along with a loudspeaker symbol, prompting the user to enter the next digits. There shall be no confusion as to the type of conversation that is to be established.

19. There shall be a telephonic communication feature, which is accessible by all Administrative VoIP Phones, Administrative Phones, and Administrative Display Phones.

2.3 COMPONENTS AND DESCRIPTIONS

A. The Quantum Multicom IP must be capable of supporting the existing Multicom 2000 hardware and functions as well as the new features across the Quantum Processor's interfaced over the LAN. The VoIP capabilities of the QSPC1 Quantum Processor Card will enable the support of the features across the various processors' nodes. The sections below cover how the system will handle each of the existing and the new features in the QSPC1 product. Systems that do not allow the reuse of existing equipment or are not backwards compatible shall not be deemed acceptable. Systems that don't allow processors to be seamlessly integrated via the LAN/WAN are not considered equal.

B. Quantum Multicom IP

1. The Quantum facility shall have a minimum of one node/processor and a maximum of 64 interconnected nodes/processors. A maximum of 100 facilities can be interconnected into a district.

2. The station numbers, program buses, etc. shall be identified with a QSPC1#, Station card# and port# or QSPC1#, program#.

3. Audio Information will be transmitted between the processors on the LAN/WAN using VoIP technology. Quantum will utilize all of the existing Multicom 2000 hardware except the current processor card. Thus making Quantum Multicom IP backwards-compatible with existing Multicom 2000 systems.

4. The processor software shall be upgradeable via Quantum Commander. The System shall maintain Active/Standby loads and whenever the upgrade takes place, the current active load shall be overwritten as Standby and new load shall be copied as Active. The system shall reset itself and boot up with the latest load once the upgrade is success. If the system can not come up with a new load, it shall revert to the old working load.

5. It shall be possible for Quantum schools to exchange 'station-to-station' calls and 'inter-facility All-Call paging' to a single facility or all facilities in a district using VoIP technology.

6. The primary QSPC1 shall be configured to act as a Gateway for facility point-to-point calls. Using Quantum Commander, every facility shall be configured with the IP addresses of the primary QSPC1 systems of all the other known facilities (maximum of 99 additional), and an organizationally private multicast IP address (i.e. 239.192.x.y series), which shall be used for inter-facility paging.

7. The maximum number of simultaneous inter-facility point-to-point calls supported is based on the actual performance of the network and the CPU load. The voice quality of the inter-facility calls may vary based on the network conditions.

8. The system shall facilitate the playing of short audio clips repetitively played until stopped by the Quantum Commander User or administrative display phone MCDS3 whichever occurs earlier.

9. A built-in Master Program Clock, with battery backup, shall be included to automatically control class change or other signals. The Master Program Clock shall have 1024 events that may be programmed into any of the 32 time signaling schedules, and/or 32 flexible holiday schedules. Systems that rely on external master clock shall not be considered equivalent.

10. Network Time Synchronization. The system shall be capable of periodic update/synchronization of the processor's time with a Network Time Server via the school's LAN/WAN network. Systems that do not provide Network Time Synchronization will not be deemed equivalent.

C. Quantum Commander

1. The processor utilizes a web-based programming tool. The Quantum Commander is built into the QSPC1 processor card and upon boot up, users can login to the Quantum Commander Web Server via their web browser.

2. The Quantum Commander shall be broken into three access levels depending on user access credentials. Systems that do not provide at least three (3) levels of access are not equal.

3. Only the Administrator and Technician shall have access to add/delete/modify the database objects.

4. Users shall have display only access to see the data objects that include configuration, alarms, and performance data and perform certain operations based on the user's CoS (Class of Service).

D. Administrative Display Phone

1. Administrative Display Phones shall be Bogen Model MCDS4. The administrative telephone display panel shows the time of day and day of week, the current time signaling schedule, and the station numbers and call-in priority of staff stations that have called that particular administrative station. A 3-key response is used to scroll the display, and answer or erase normal, urgent, and security calls. Depending upon the system access level, an administrative station can use display menus to activate zone pages, alarm signals and external functions, as well as select program sources and distribute or cancel a program to any or all speakers or zones.

2. Administrative stations shall have the ability to dial and have the option of dialing either the loudspeaker or phone at each station location. The system shall automatically switch from phone-to-intercom

communication to phone-to-phone communication when the staff handset or enhanced staff phone on the receiving end of the call is lifted.

3. The Administrative Display Phone shall display the classroom number of any station that calls 911. This feature will notify the main office when a classroom has dialed 911 emergency centers so that administrators can direct emergency personnel to the correct physical location in the building when they arrive. Systems that do not provide this feature will not be deemed equal.

E. Administrative Wall Display

1. Administrative wall display shall be a Bogen Model MCWD. The wall display shows the time of day, current time signaling schedule that is running, and the station numbers and call-in priority of call switches, and emergencies from Administrative VoIP Phone and Administrative Phones.

2. The Administrative Wall Display shall display the classroom number of any station that calls 911. This feature will notify the main office when a classroom has dialed the 911 emergency centers so that administrators can direct emergency personnel to the correct physical location in the building when they arrive. Systems that do not provide this feature will not be deemed equal.

F. Administrative Phone

1. Classroom phones shall be one of the following Bogen Model(s)

   a. MCDS4 – Administrative Display Phone
   b. MCIPP – Administrative VoIP Phone (Desk or Wall)
   c. MCESS – Administrative Desk Phone
   d. MCWESS – Administrative Wall Phone.

2. The Station goes Off-Hook and dials the 3- to 6-digit (preceded by an * if calling a telephone instead of loudspeaker) number of the desired station. The call is routed to any station (admin/staff).The classroom phone shall be capable of the following features:

   a. Emergency Call involves going off hook and flash hook the switch at least four times. The Call is then switched to the assigned Admin Phone. This requires the display of the architectural number on the Administrative Display phone and or Wall Display. Systems that do not provide this feature are not equivalent.

   b. Alarm Distribution

   c. Audio Program On/Off

   d. Call Forward activation for All-Calls/Busy/No Answer/Busy or No Answer

   e. Cancel Call Forward

   f. Conference Calling

   g. Transfer Call

   h. Dial administrative phone, dial the station number to call to the speaker or dial the station number preceded with * to call the phone. The call shall be routed to the administrative display phone and/or administrative wall display showing the architectural number that is calling.

   i. Emergency All-Call shall be broadcasted to all the stations in the facility.

   j. Place Outside Call

   k. Remote Answer

   l. Single-Zone/All-Station Page

   m. Call Waiting Tone for Outside Calls, and it shall be possible to feed the call waiting tone to the Administrative Phone during a conversation.

G. Classroom Call Staff Stations (as indicated on the drawings)

a. Staff Stations shall be Bogen Model:

1. SC-1 – Call Switch

b. Shall be capable of Normal/Urgent/Emergency Calls

c. Normal/Urgent Call involves pressing the Call Switch once or lifting the Telephone Handset. The Call is then switched to the Admin Phone. This requires the display of the architectural number on the Admin phone and/or Wall Display.

d. Emergency Call involves pressing the emergency call switch; flash hook the switch at least 4 times in a non-dial analog handset with Call Level Normal or Urgent; pressing the call switch or hook switch one time in a non-dial analog handset with Call Level Emergency only. The Call is then switched to the Admin Phone. This requires the display of the architectural number on the Admin phone and/or Wall Display.

e. Emergency Link Transfer - If the emergency call is unanswered by the Administrative Display Phone and the emergency link transfer is provisioned and programmed; the emergency call will be forwarded to the loudspeaker associated with that station. Any station/admin phone with speaker can be programmed for the Emergency Link Transfer. Systems that do not provide Emergency Link Transfer will not be considered equal.

f. Bogen contractor shall run wiring from call switch to audio/visual interface at A/V control box in ceiling in classrooms. When audio/visual system handheld controller panic button is pressed emergency call system shall engage.

H. Secondary Clocks

a. Analog Synchronous Clocks with minute and second hands.

The secondary clock shall be a Bogen BCAM series clock with automatic-selectable correction protocols. It shall be designed to be used in either a 2-wire or 3-wire system. Upon receipt of the digital signal, the clock shall immediately self-correct. The secondary clock shall also accept sync-wire communication protocols with hourly and daily correction. The secondary clock shall have a microprocessor-based movement and shall be capable of being used as a stand-alone clock. The clock shall have a low-profile/semi-flush smooth surface metal case. The crystal shall be shatterproof polycarbonate with no visible molding marks. Glass is unacceptable. The clock shall have black hour and minute hands and a red second hand. The clock shall have U.L., cUL. and F.C.C. compliance's.

b. Digital Clock, minimum 4inch high LED unit

The clock shall be 4.0" in height with a full 4.0" high efficiency red LED numeral display (optional 2.5" when specified per plans). The clock shall operate as an RS485 digital secondary clock or as a Digital Communication 2-wire secondary clock with 12/24-hour display format and two levels of adjustable brightness and shall feature immediate correction for time changes. The clock shall have messaging capabilities including "BELL" and "FIRE". When input is lost, the colon of the clock display shall flash. The clock bezel shall be anti-glare red with a smooth surface. No external screws or studs shall be visible on the bezel or clock housing. The clock shall have UL, cUL and FCC compliance's.

I. Intercom/Paging System Speakers

1. Interior Speakers shall be Bogen:

a. Flush Wall/Ceiling Speakers: S86T725PG8W/RE84

b. Ceiling Speakers: CSD2X2 Drop-In Ceiling Speakers

c. Surface Wall Speakers: MB8TSQ/SL Metal Box Speakers

d. Surface Wall Speakers:WBS8T725 Wood Baffle Speakers

2. Combination Clock/Speakers shall be:

   a. Flush Clock/Speaker Combination: Lowell SCB-300/PC312 Enclosure with a Bogen S86T725 Speaker and a Bogen BCAW-1BS-12R-1 Secondary Clock

   b. Surface Clock/Speaker Combination: Lowell SCB700/PC712 Enclosure with a Bogen S86T725 Speaker and a Bogen BCAW-1BS-12R-1 Secondary Clock.

   c. Provide AA-PPRC in classrooms with audio/visual system. Bogen contractor shall install and connect wiring from priority page controller to Bogen speaker and audio/visual system contacts for shut off of audio/visual speakers when Bogen speakers are engaged.

3. Outdoor / Gym / Multi-Purpose Room Speakers shall be Bogen:

   a. FMH15T mounted in BBFM6 flush-mounted vandal-resistant enclosure/BBFM6 flush-mounted vandal-resistant enclosure with FMHAR8 adapter ring and SGHD8 heavy duty grille.

J. Quantum Commander

1. The processor utilizes a web-based programming tool. The Quantum Commander is built into the QSPC1 processor card, and upon boot up, user can login to the Quantum Commander Web Server.

2. The Quantum Commander shall be broken into three access levels depending on user access credentials. Systems that do not provide at least three (3) Levels of access are not equivalent. The three levels are:

   a. User
   b. Administrator
   c. Technician

3. Only the Administrator and Technician shall have access to add/delete/modify the database objects.

4. Users shall have display only access to see the data objects that include configuration, alarms, and performance data and perform certain operations based on the user's CoS (Class of Service).

5. The following Menu Items must be available on the Multicom IP Quantum Commander:

   a. File - Open Database, New System, Save, Delete, Report and Exit, Upload Database, Download Database, Download Software, Diagnostics, Tones and Announcements, Relay Configuration, Program Distribution, Media Assignment, List Passwords, Add Password, and Change Password.

   b. There shall be an audible ring signal announcing that a call has been placed to that station.

   c. Upon picking up the receiver and dialing * (star), a telephone symbol shall appear on the display, prompting the user to enter the number of the station to be called. There shall be no confusion as to the type of conversation that is to be established.

   d. There shall be an automatic disconnect of Staff Handsets left off-hook to prevent them from tying up communications channels. The station shall receive a busy signal and shall automatically disconnect after 45 seconds. Systems shall also be capable of doing off hook emergency call-in.

   e. There shall be an automatic disconnect of Administrative Display Phones, Administrative VoIP Phones, and Administrative Phones to prevent them from tying up communications channels. When a phone goes off-hook and does not initiate a call within ten seconds, the station shall receive a busy signal and shall automatically disconnect after 45 more seconds.

   f. Staff and Administrative Phone Stations may be programmed to ring an Administrative Display Phone during day hours and another Administrative Phone during night hours. Day and Night Hours shall be user-programmable. Assignment of Staff Stations shall not be restricted to any particular Administrative Station. Systems that limit the number and assignment of staff call-in to particular Administrative Station of Administrative Stations shall not be acceptable.

6. Each staff call station shall be programmable for one of three call-in types, as follows:

Normal / Emergency
Urgent / Emergency
Emergency

a. Staff Call Stations programmed for access Normal / Emergency or Urgent / Emergency shall be able to initiate an emergency call by repeated flashing of the hook switch or repeated pressing of the call-in switch. Systems, which require additional switches and/or conductors to initiate an emergency call, shall not be acceptable.

b. Emergency Calls from Administrative VoIP Phones, Administrative Phones or Staff Call Switch Stations shall interrupt a non-emergency call in progress at the designated Administrative Display Phone. The administrator shall receive a warning tone and be connected to the emergency caller. The disconnected party shall receive a busy signal. Systems which do not provide emergency call interrupt shall not be acceptable.

c. It shall be possible to connect a single push emergency call-in switch to any Administrative VoIP Phone or Administrative Phone, without effecting normal station operation.

d. Normal and Urgent calls shall be logged into queue for the designated administrative display phones.

e. Administrative Display Phones shall ring for a period of 45 seconds when they receive a call, and then stop ringing.

f. Each queue shall first be sorted according to call priority (emergency calls, then urgent calls, and then normal calls). Calls are sorted within each priority level on a first-in, first-out basis. When a call is answered, it shall automatically be removed from the queue. Systems, which do not sort calls according to priority and order received, shall not be acceptable. 1) The display shall simultaneously show up to four (4) Staff Call Switch Station Calls pending. Additional calls, beyond four (4), shall be indicated by an arrow pointing down thus prompting the user that additional calls are waiting.

g. It shall be possible to answer any incoming call simply by picking up the handset while it is ringing. It shall not be necessary to hit any buttons to answer a call unless the call has dropped into the queue.

7. Administrative VoIP Phones or Administrative Phones shall receive dial tone upon going off-hook. Outgoing calls are made by dialing the desired station. Incoming calls can be directed to the telephone or to the associated loudspeaker for a hands-free reply. There shall be an automatic switchover from loudspeaker to private telephone communication should the person pick up the handset.

   a. Administrative VoIP Phones or Administrative Phones shall be able to make a normal call to any Administrative Display Phone by dialing the number. They shall also be able to initiate an Emergency Call by flashing the hook switch. Emergency Calls shall ring the Designated Day/Night Administrative Display Phone and then their speaker will be connected to the emergency station if not answered within a predetermined time period. The system shall provide for selected administrators to have a PIN Numbers. By dialing the PIN at any system telephone, the administrator shall have access to emergency paging regardless of the restrictions on the particular phone being used.

8. Student Phone

   a. Student Phone shall be supported. The Student Phone can only make 10-digit (7 digit or less than or equal to 10 digit), 0 local and 911 calls. The call duration shall be set to 5 minutes. The dial tone shall be fed momentarily at 00:04:30, 00:04:40, 00:04:50, then at five minutes, calls are disconnected. The student phone can not receive any incoming calls.

   b. The Station is not allowed to dial the same number within 30 minutes and a busy signal shall be fed to the Station if the number is dialed.

9. Administrative Display Phones shall be equipped with a 4x16 character alphanumeric display panel.

   a. Administrative Display Phones shall receive dial tone upon going off-hook. Outgoing calls are made by dialing the desired stations. Incoming calls can be directed to the telephone or to the associated loudspeaker for a hands-free reply. There shall be an automatic switchover from loudspeaker to private telephone communication should the person pick up his handset.

b. The display shall normally show the time of day and day of week, the current time signaling schedule, and the numbers of up to four stations calling in along with the call-in status of each station (normal, urgent, emergency). When dialing from the Administrative Display Phone, the display shall indicate the station number and type of station (loudspeaker or handset) being dialed.

c. The display shall also provide user-friendly menu selections to assist the operator when paging and distributing program material. Displays shall be in English with internationally recognized symbols for maximum ease of use. Systems, which require the operator to memorize long lists of operating symbols or control codes, shall not be acceptable.

d. Administrative Display Phones shall be programmable for one of 3 station types for system access, as follows:

i. Shall permit dialing any station in the system; turn program material on/off at their location; scroll, erase and auto-dial call-waiting queue; make conference calls and transfer calls; call forward to other administrative stations; make all-zone pages and emergency all-zone pages; have access to outside lines and be designated to receive outside line calls.

ii. Select and distribute or cancel program material to any combination of stations, paging zones, or all zones; set/reset alarm/external functions and zone paging.

iii. Bump or join a conversation in progress, manually initiate time tones.

e. Program selection, and its distribution or cancellation shall be accomplished from a designated administrative display telephone, with the assistance of the menu display system. Distribution and cancellation shall be to any one, or combination of speakers, or any zone(s), or all zones. It shall be possible to provide three program channels at the same time.

f. It shall be possible, via an Administrative Display telephone, to manually initiate any of eight (8) tones or any of the emergency tones. The tones shall be separate and distinctly different from the emergency tones. The tone selected shall continue to sound until it is canceled, or until the administrative display phone is placed back on-hook.

g. Each Administrative Phone shall maintain a unique queue of all stations calling that particular phone.

10. System programming shall be from an authorized Quantum Commander User via Web browser. All system programming data shall be stored in nonvolatile memory. A valid password shall be required to gain access to the following programmable functions:

a. Station Initialization shall be accomplished from an authorized Quantum Commander User via web browser. All station initialization data shall be stored in nonvolatile memory. A password (separate from the password necessary for system programming) shall be required to gain access to the following station initialization parameters:

1. Programming and diagnostics shall be built into the Quantum Commander web server browser and be accessible only by authorized personnel. Diagnostics shall indicate passes and failures of system memory, system clock, all audio busses, tone generators, DTMF generators and decoders and the integrity of the field wiring.

2. The diagnostics feature shall be the Quantum Commander. It shall be possible to individually select the test and card, or all to run diagnostics on. This shall be a standard feature of the system and supplied at the time of installation. It shall be accessible only by authorized stations and personnel.

3. Systems not capable of supporting web-based diagnostics, and any computer interface for programming and diagnostics, nor supportive of built-in diagnostics for the end user shall not be deemed as equal.

11. Rollover EOL (End-Of-Line Device)

a. This feature shall be supported for all the Stations (Staff/Enhanced/Admin/SIP) configured with a loudspeaker. Based on the dialed sequence, (*xxx, xxx) the call will be connected to the corresponding

station/speaker. If the speaker/station is busy, the call is rolled over to the station/speaker corresponding to that station.

b. If a handset station, configured with this feature, is busy when an Admin User calls the station, the call shall be rolled over to the associated speaker. If the speaker is also busy in this case, then the Admin call can bump the conversation.

c. Rollover End-of-Line features not applicable with the Station with Call Switch or Station without the speaker.

d. For calls initiated by a call switch or a non-dial handset, rollover to the admin speaker shall not happen.

12. Admin AAA Group (Always An Answer)

a. This is an Administrative Phone feature. This feature shall be programmed from the Bogen Commander. A maximum of 10 Admin Phones will be supported in an Admin Group and there shall be a maximum of 32 Admin Groups per facility.

b. Once the Admin Group is set:

i. For normal calls, if the primary Day/Night Admin Phone is busy/no answer, all the phones in the Admin Group shall ring.

ii. For emergency calls, if the primary day/night phone does not answer, all the phones in the Admin Group shall ring.

iii. On no answer from any of the admin phones and if the emergency announce link is configured, the call shall be transferred to the emergency announce link as per the existing procedures.

iv. On answer from any of the Admin Phones, all the other phones shall stop ringing.

2.4 EQUIPMENT

A. To fulfill the requirements, the following control equipment shall be provided:

1. Bogen TCPER 60" communications rack.
2. One (1) Bogen QSPC1-IP processor card.
3. One (1) Bogen MC512 power supply.
4. One (1) Bogen MC2626 power supply.
5. One (1) Bogen MCAPI audio program interface.
6. One (1) Bogen rack mounting mainframe.
7. Five (5) Bogen MCAC analog cards.
8. One (1) Bogen MCSC station card.
9. Five (5) Bogen MCRRP relay cards.
10. One (1) Bogen CDR-1 AM/FM CD Player
11. One (1) Bogen DCM-290P Five Disk changer
12. One (1) Bogen HTA250 amplifier.
13. One (1) MCTC telephone access card with full interface to the school telephone system.

14. TRIPPLITE BC1400 UPS unit.
15. Middle Atlantic CBS-ERK-20 Base with Casters
16. Bogen ACFDS AC Line Filter
17. Bogen SAX-1R Aux Mic Module (Qty. 2)
18. Bogen MCTC Telephone Interface Card
19. Bogen MCOC Telephone Line Card
20. Bogen MCOCA Telephone Ribbon Cable
21. Bogen WMT-1A 600 Ohm Transformer
22. SSI EX-Bell J-40 Pin Outs with Relays
23. SSI CR-2 Clock Correction Relays
24. SSI 25' Power Cord Extension
25. SSI 25' Green RJ-45 Patch Cord
26. 6 Port Side Loaded Quick Port with Colored Jacks
27. AT Audio Cord for Future External Source
28. 25 Pair 22 Gauge Umbilical Cord properly laced and terminated to Bogen SK-2522 and 66M Connection Panels

B. Accessory Equipment: As Required (See Section 2.3 Above).

2.5 TERMINAL BLOCKS

A. All conductors in all-terminal cabinets, equipment rack, etc., shall be terminated on Siemens 66M1-50 punch blocks or approved equal.

2.6 WIRING CABLES

A. Each Speaker/Call Switch to console: West Penn 357.

B. Outdoor speakers: West Penn #291.

C. Clock Cable: West Penn 236 or THWN in conduit.

D. Speaker Multi Conductor Cables: General Cable 25 pair 22 gauge direct burial PE-22 overall shield cable. Quantity per wing as required.

E. All cables and wires shall be Copper and shall be installed in raceways per C.E.C. Code. All conductors and wires shall be new when delivered to the job site in unbroken packages, with the manufacturer's name and voltage class that shall be plainly indicated on cables and wires.

F. All cables and wires shall be National, General Electric, General Cable, West Penn or approved equal. All conductors installed in underground conduit shall be type "THWN" or UL listed for wet location or direct burial.

PART 3 – EXECUTION

3.1 DIVISION OF WORK

A. While all work included under this specification is the complete responsibility of the contractor, the division of actual work listed following shall occur.

B. The conduit, outlets, terminal cabinets, etc., which form part of the rough-in work shall be furnished and installed completely by the electrical contractor. The manufacturer's authorized representative shall perform the balance of the system, including installation of speakers and equipment, making all connections, etc. The entire responsibility of the system, its operation, function, testing and complete maintenance for one (1) year after final acceptance of the project by the owner, shall also be the responsibility of the manufacturer's authorized representative.

3.2 INSTALLATION

A. Plug disconnect: All major equipment components shall be fully pluggable by means of multi-pin receptacles and matching plugs to provide for ease of maintenance and service.

B. Protection of cables: Cables within terminal cabinets, equipment racks, etc., shall be grouped and bundled (harnessed) as to type and laced with No. 12 cord waxed linen lacing twine or T & B "Ty-Rap" cable. Edge protection material ("cat-track") shall be installed on edges of holes, lips of ducts or any other point where cables or harnesses cross metallic edge.

C. Cable identification: Cable conductors shall be color-coded and individual cables shall be individually identified. Each cable identification shall be a unique number, located approximately 1-1/2" from cable connection at both ends of cable. Numbers shall be approximately 1/4" in height. These unique numbers shall appear on the As-Built Drawings.

D. Shielding: Cable shielding shall be connected to common ground at point of lowest audio level and shall be free from ground at any other point. Cable shields shall be terminated in same manner as conductors.

E. Provide complete "in service" instructions of system operation to school personnel. Assist in programming of telephone system.

3.3 GROUNDING

A. The Contractor shall provide all necessary grounding for the entire system in accordance with and required by the National Electric Code, and the State of California "Safety Orders".

3.4 TEST AND ADJUSTING

A. The Contractor shall furnish all required test instruments and equipment. Each piece of equipment and the entire systems shall be adjusted and readjusted to insure proper function of all equipment, elimination of noise, and vibration and left improper operating condition.

3.5 ACCEPTANCE

A. Before the work shall be accepted, the Electrical Contractor shall demonstrate to the District and the Engineer that the entire installation is complete and in proper operating condition and the Contract has been properly and fully executed.

B. Upon acceptance of the work, the Contractor shall deliver to the District a written guarantee to the effect that all parts of the work, including all individual items of equipment and materials and the systems as a whole, shall be free from defects for a period of one year. Upon proper notice, the Contractor shall make good, at their expense any defect that develops or becomes apparent during this period.

END OF SECTION

SECTION 27 80 00

SMART CLASSROOM AUDIO VISUAL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stand-alone, networkable, scalable, one-room AV control and presentation system with user control panel and software.

B. Related Information:

1. Division 12 Section "Window Treatments" for window treatments controlled by the AV control system.
2. Division 25 Section "Integrated Automation Control of Electrical Systems" for software and integration hardware for network lighting controls.
3. Division 27 Section "Common Work Results for Communications".
4. Division 27 Section "Schedules for Communications".
5. Division 26 Section "Instrumentation and Control for Electrical Systems" for lighting controlled by central, modular, or network control system.
6. Division 27 Section "Communications Horizontal Cabling" for communications cabling requirements for modular control system.
7. Division 27 Section "Audio-Visual Communications" for communications and network cabling requirements for Audio-Visual systems and over all control systems communications.

1.2 REFERENCES

A. National Fire Protection Association (NFPA):

1. NFPA 70 - National Electrical Code.
2. ANSI/TIA/EIA-588-C.0 – General Cabling Standards
3. ANSI/TIA/EIA-568-C.1 -- Commercial Building Cabling Standard
4. ANSI/TIA/EIA-568-C.2 -- Balanced Twisted Pair Cabling Standard
5. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
6. ANSI S12.60:2002 Acoustic Performance Criteria, Design Requirements, Guidelines for Schools
7. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
8. ANSI/TIA/EIA-569-B -- Commercial Building Standard for Telecommunications Pathways and Spaces
9. ISO/IEC 18010:2002 (2002) – Pathways and Spaces for Customer Premises Cabling
10. ANSI/TIA/EIA-606(A) -- The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
11. ISO/IEC 14763-1:1999 (1999) – Implementation and Operation of Customer Premises Cabling, Part 1 – Administration
12. J-STD-607-A -- Commercial Building Grounding and Bonding Requirements for Telecommunications
13. IEEE 1100 – IEEE Emerald Book
14. NFPA 780 Standard for the Installation of Lightning Protection
15. Cal/OSHA-Pocket Guide for the Construction Industry (recent edition)
16. BICSI -- Telecommunications Distribution Methods Manual (TDMM)
17. BICSI - Information Transport Systems Installation Methods Manual
18. BICSI - AV Design Reference Manual

19. BICSI – Network Design Reference Manual
20. Federal Communications Commission
21. Federal, state, and local codes, rules, regulations, and ordinances governing the work

1.3 REFERENCES

A. ABBREVIATIONS

1. AV: Audio Visual.

1.4 SYSTEM DESCRIPTION

A. For each classroom, the Contractor shall furnish and install a complete, networkable, scalable AV control and presentation System. The AV equipment must be housed in lockable enclosures. For classrooms with hard ceilings, a surface wall-mounted low profile enclosure FrontRow # 320-2000-004 must be provided. For classrooms with dropped ceiling (lay-in tiles), a recessed lay-in ceiling-mounted 2x2 plenum enclosure FrontRow # 1000-00122

B. Each enclosure will have the following equipment:

1. Network Controller / amplifier FrontRow #ICR-01 with corresponding power supply, power cord, audio, serial, IR control and Infrared sensor cables.
2. PoE switch # POE-X
3. Audio Extractor #AUD-EXT
4. TP-Link network switch # TP-LINK
5. One IR sensor FrontRow # 950CS to be installed on a ceiling rail (installing parts included in the sensor kit).
6. Plenum 110v.power strip (# CMPL-PWR)

C. Face plates. Each classroom will have a two-gang AV input plates at +18” AFF. These plates shall include the following AV termination points:

1. Single HDMI (type A), one VGA Din 15, one 3.5 mm audio in, at +18’AFF
2. One USB (type B), one 3.5 mm audio out, at +18” AFF

D. Intercom Call trigger/microphone: One single-gang microphone/call button FrontRow # CB-75 to be installed at +42” AFF

E. Device Control: One two-gang touch control pad FrontRow #CB6000 at +42” AFF 6” to the left of the Balt Whiteboard. Power to the control pad is not necessary since it is powered through the CAT5e to which it connects to the ICR-01 in the ceiling enclosure.

F. Speakers.

1. For open ceiling classrooms (without lay-in dropped ceilings) four (4) surface wall-mounted speaker/infrared sensor arrays, FrontRow #SP-IR, shall be placed according to manufacturer’s standard.
2. For classrooms with lay-in dropped ceilings, four (4) lay-in 2x1 ceiling speakers, FrontRow # SP-L2-4, shall be placed according to manufacturer’s standard.

G. Video Components of the System per classroom:

1. One flat panel display

H. Software: All software necessary to access full functionality of the system shall be licensed to the Owner without further chargers or recurring license fees

I. The System is to include all equipment, cabling, materials, labor, and training as required to install and test a complete and operating System as described herein.

J. Contractor shall follow installation instructions provided by the manufacturer. Installation drawings shall show the location and general arrangement of equipment, electrical systems and related items. They shall be followed as closely as elements of the construction will permit.

K. Contractor shall examine the installation drawings and verify the conditions governing the work on the job site. Contractor shall arrange accordingly, providing such fittings, horizontal cable raceways, conduits, junction boxes and accessories as may be required to meet such conditions.

L. Deviations from the installation drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the Systems, shall not be made without the written approval of the Engineer.

1.7 ACTION SUBMITTALS

A. Product Data: For each type of product required, demonstrating compliance with requirements.

B. Shop Drawings: Indicate the following:

1. Schematic diagram of controlled circuits.

2. Circuits and emergency circuits with capacity and phase, control zones, load type and voltage per circuit.

1.6 INFORMATIONAL SUBMITTALS

A. Sample of manufacturer's warranty.

B. Installation and setup guides.

1.7 CLOSEOUT SUBMITTALS

A. Operating and maintenance instructions.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualification: Manufacturer of controller with minimum five years record of satisfactory manufacturing and support of components comparable to basis of design system.

B. Source Requirements: Provide control panel, amplifier/switch, loudspeaker, receiver, microphone hardware and software through a single source from a single manufacturer.

C. All miscellaneous equipment required for a complete, professional installation shall be included in the base bid. No allowances for any additional equipment, hardware, cabling, or miscellaneous will be considered unless specifically excluded from the base bid.

D. All work materials shall be removed at the end of the work day and the work area left in the same condition as found.

E. The work herein specified shall be performed by fully competent workmen, in a thorough manner. All materials furnished by the Contractor shall be new, and all work shall be completed to the satisfaction of the Architect/Engineer.

F. All equipment shall be held firmly in place. This shall include speakers, receiver/amplifiers, cables, etc. Fastenings and supports shall be adequate to support their loads with a safety factor of at least three. All switches, connectors, outlets, etc., shall be clearly, logically, and permanently marked during installation.

G. The Contractor must take such precautions as are necessary to guard against electromagnetic and electrostatic hum and ground loops, to supply adequate ventilation, and to install the equipment so as to provide maximum safety to the person who operates it.

H. Care shall be exercised in wiring so as to avoid damage to the cables (e.g., stapling, pinching, excessive bending) and to the equipment. All joints and connections shall be made with lead-free rosin-core solder or with mechanical connectors approved by the Engineer. All wiring shall be executed in strict adherence to standard broadcast practices.

I. The Contractor shall be an established communications and electronics Contractor that has had and currently maintains a locally run and operated business for at least five years. The Contractor shall utilize a duly authorized reseller of the equipment supplied for this project location with full Manufacturer's warranty privileges.

J. The Contractor shall test the installed System according to the Manufacturer’s instructions and verify that the equipment has been installed properly and is functioning as designed.

K. Manufacturer Qualifications: Approved manufacturer of controller listed in this Section with minimum five years record of satisfactory manufacturing and support of components comparable to basis of design system.

1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:

a. Product data indicating compliance with requirements of this Section.

b. Samples of each component.

c. Sample submittals from similar project.

d. Project references: Minimum of 5 completed installations, with Owner and Architect contact information.

e. Sample warranty.

2. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.

3. Approved manufacturers must comply with separate requirements of Submittals Article.

L. Regulatory Requirements: Provide components and systems that comply with requirements of the following:

1. Refer to Section 1.2 A.

1.9 COORDINATION

A. Coordinate integrated AV controls with systems and components specified in the following sections:

1. Division 11 Section "Audio-Visual Equipment."

2. Division 12 Section "Window Treatments."

3. Division 23 Section "Instrumentation and Control for HVAC."

4. Division 25 Section "Integrated Automation Control of Electrical Systems."

5. Division 26 Section "Wiring Devices."

6. Division 26 Section "Lighting Devices."

7. Division 26 Section "Interior Lighting."

8. Division 27 Section "Communications Horizontal Cabling."

9. Division 27 Section "Audio-Visual Communications."

10. Division 27 Section "Audio-Video Systems."

11. Division 27 Section “Intercom and PA Communications.”

12. Division 28 Section "Electronic Access Control and Intrusion Detection."

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of controls system that fail in materials or workmanship within the specified warranty period following substantial completion.

1. Warranty Period: Wireless transmitters, wireless receivers, infrared sensors, loudspeakers, and charging stands: 5 years.

2. Warranty Period: Rechargeable batteries, power cords, power supplies: 1 year.

3. Warranty Period: Other components: 3 years.

B. Manufacturer's Extended Support Service: Extended telephone support: Unlimited period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products of FrontRow Calypso LLC, 1609 Corporate Circle, Petaluma, CA 94954, Phone +1 707 227 0735, www.gofrontrow.com. The parts numbers in numeral 2.2 below correspond to the kit order number, which includes cables and accessories that are necessary to meet the performance criteria. Substitution request to follow procedure setup in General Conditions and to be approved by the Owner Representative 15 days prior to Bid date.

2.2 CLASSROOM AV SYSTEM COMPONENTS

The AV System will be configured into three different designs; A, B and C. The following performance parameters for devices include all parts. For information about individual configuration components refer to section 1.4, 1.5 and 1.6

1. Control panel:
    1. Basis specification: FrontRow #CB-6000
    2. Mounting: Dual-gang
    3. User controls: 9cm/3.5in 320x240 resolution color touch screen
    4. Pages: 5
    5. Control/Jump Buttons/Page: 8
    6. Simultaneous control capacity: Unlimited network (IP addressable) devices, 2 bi-directional serial devices, plus 1 IR device or 1 GPI
    7. Security pass-code: Yes
    8. Battery back-up: Yes
    9. File-based cloning: Yes
    10. IR command learning: Yes
    11. Configuration: Via web-browser
    12. I/O:
        a. 1x RJ-45 for power and control of 2 bi-directional serial and either 1 IR device or GPI
        b. 1x RJ-45 for 10/100Mb network, power
    13. Serial Baud rate: 2400 to 115k
    14. Weight: 113g/4oz
    15. Power: 12VDC, 125mA (via Cat 5)
    16. Size: 11.4 x 11.4 x 3.3cm/4.5 x 4.5 x 1.3125in
    17. Time Synchronization with network time server: Yes (via DRS-5000)
2. Media Receiver / Amplifier ICR-01:
    1. Basis specification: PlenumCore with ICR-01 Smart Receiver
    2. Audio inputs:
        a. 3x analog stereo (RCA)
        b. Intercom (RJ45)
    3. Audio outputs:
        a. 1x audio line out (3.5mm TS)
        b. 1x audio line out with gain control (3.5mm TS)
        c. Intercom (RJ45)
    4. Network support:
        a. 10/100 Mb/s (Auto Sensing)

5. USB Support
   a. 1x USB Type B connector
6. Digital Page-override: Yes (via FrontRow Conductor)
7. Analog Page-override: Yes
8. Must include software that can run on the user's computer for the purpose of system control
9. Must include active digital feedback suppression
10. All audio from microphones and line inputs must be digitally processed
11. Must include a 12-band EQ accessible via software only – not a physical EQ
12. Must include automatic speaker tuning option
13. Must include speech clarifying technology. This feature must be adjustable in software.
14. Must include an automated lesson-capture, titling, and processing feature that records computer screen activity and all system audio
15. Must include a means of suppressing audio echo when using the system to enhance the audibility of a video conferencing application. This feature must be enabled/disabled in software.
16. Must include a means of suppressing all student microphone and media audio whenever the teacher speaks. This feature must be enabled/disabled/adjustable in software
17. Must allow the ability to adjust volume of each microphone / line input individually
18. Audio over IP: Yes
19. Additional outputs: IR, COM (RS232 serial)
20. Amplifier Type: 92% efficient class D
21. Continuous Power @ 1% THD:
    a. 15 watts (rms) per channel @ 4 ohms
    b. 10 watts (rms) per channel @ 8 ohms
22. Frequency Response: 50Hz – 20kHz
23. THD: <1% @ 1 kHz
24. Signal to Noise: >70dB
25. Power input requirements: 18VDC, 3.4A
26. The Media Receiver shall include a Beacon for a visible means of displaying the status of the system in the classroom (power / active intercom call / active announcement / etc.). The visible indicator brightness must be adjustable.
27. The Media receiver shall include the ability to allow control of volume, control of other devices (projectors / displays) or begin lecture capture via the use of voice commands using the teacher microphone.
28. Infrared Microphone Receiver
    a. Receiving frequencies: 2.1MHz, 2.4MHz (2.8MHz, 3.3MHz & 3.6MHz with expansion module)
    b. Wavelength: 940nm
    c. Operating range: 18.5m/60ft line-of-sight (typical)
    d. Size (wxhxd): 34.92 x 16.8 x 5.5cm/ 13.75 x 6.5 x 2.75in
    e. Weight: 1.72 kg/3.8lbs
    f. Reception area: 163m²/1225ft² (with sensor)
    g. External sensor ports: 3, RCA

h. User programmable trigger button embedded in microphone for customizable emergency alerts, office communication or device control.

29. The Media Receiver shall be manufactured using a lead-free process and be free of hazardous metals and materials (RoHS compliant)

30. The Media Receiver shall be UL listed

3. Mounting:

1. Plenum-rated 2x2 ceiling enclosure, FrontRow CMPL-2X2

a. Lockable lid: Yes

b. ETL Listed for UL 2043 compliance: Yes

c. Dimensions: 23.81” x 23.70” x 3.22”

d. Weight (enclosure only): 18.5 lbs

e. Mounting hardware to include 4 cable locks, 2 cable clamps and 1 nylon bushing.

2. Surface mounted enclosure, FrontRow 1000-00122:

a. Lockable lid: Yes

b. ETL Listed for UL 2043 compliance: Yes

F. Network Switch #6400-00013

a. Inputs/Outputs: 5 RJ45 Ports

b. Network Support: 10/100Mb/s (Auto Sensing)

c. Connection Type: Supports Auto MDI/MDIX

d. Flow Control: IEEE 802.3x

e. Weight: .11 kg/.25lbs

f. Size (wxhxd): 10.4 x 2.2 x 7cm/4.06 x .875 x 2.75in

G. Loudspeakers:

1. Basis specification: FrontRow SP-L2 Lay-in speakers with plenum rated speaker cables

2. Mounting type: Ceiling mount

3. Size: 2ft x 2ft (23.82” x 23.82” x 3.44”)

4. Accessories: support cables

5. Frequency response: 65Hz – 17kHz EIA 426A standard

6. Calculated maximum system output: 103dB-SPL, 12W/1M

7. Average sensitivity: 92dB-SPL 1W/1M

8. Impedance: 8 Ohm

9. Loudspeaker power rating: 12W-RMS EIA 426A Standard

10. Nominal coverage angle: 100˚ included angle -6dB/2kHz half space

11. Audio connection: Pre-cut 17.8cm/7in color-coded leads

12. Cable type: 18 AWG 2 conductor UL listed CL2P or better plenum-rated

13. Compliance: UL Listed 1480, UL Listed 2043, RoHS - shall be manufactured using a lead-free process and be free of known hazardous metals and materials

H. Infrared Microphone Sensor

1. Basis specification: FrontRow 950CS

2. Indicator: LED power

3. Mounting type: Drop ceiling acoustic tile or sheetrock ceiling

4. Sensor module receiving frequencies: 2.3MHz & 2.8Mhz
5. Sensor power: powered by receiver
6. Minimum sensor operating range: 18.5m/60 ft.line-of-sight
7. Minimum sensor reception area: 232m2/2500 ft2
8. Minimum cable length: 15.25m/50ft
9. Cable type: RG58/u coaxial cable CL3P shielded, UL listed, Plenum rated jacket

I. RoHS compliance: Must be manufactured using a lead-free process and be free of known hazardous metals and materials.

J. AV connection wall plates

1. HDMI / VGA / AUDIO IN
   a. Inputs: male HDMI, VGA Din 15, 3.5 mm audio jack
   b. Profile: single-gang Decora® style wall plate
   c. Cabling: Plenum-rated 66ft HDMI optical
   d. Optical HDMI Video Specification:

      Resolution (HDTV) 4K/UHD(3840x2160, FHD(1080p)

      Resolution (PC) All VESA Resolution (4096×2160) / All VESA Resolution (1920×1200)

      Data Rates 10.2 Gbps

      Pixel Clock Rates 300 MHz

      Power Consumption 0.25W
   e. Cable Specification

      Length(m) Max100

      Diameter 3.4mm

      Weight 10m 0.18kg / 100m 1.64kg

      Tension 500N (50kg)

      Jacket Plenum (CMP-OF) / LSZH (Low smoke zero halogen) / Poly Urethane

2. USB (type B) / 3.5 mm audio jack
   a. Inputs: USB type B pass through and 3.5 mm audio out jack.

K. Teacher Transmitter/Microphone:

   a. Basis specification: FrontRow ITM-02 Pendant Microphone Transmitter
   b. Transmission type: Infrared
   c. Transmitting frequency: 2.1MHz, 2.3MHz, 2.4MHz, 2.8MHz, 3.3MHz, 3.6MHz programmable
   d. Frequency response: 70Hz – 8kHz
   e. Microphone: Unidirectional cardioid
   f. Minimum typical battery life: 7 hours
   g. Battery type: Li-Ion, 3.7V, 850mAH
   h. Operating range using IRG3 technology: 30.5m/100ft, line of sight
   i. Must allow adjustment of transmit power via software
   j. Maximum size (wxhxd): 7.4 x 6.6 x 1.3cm/2.9 x 2.6 x 0.5in
   k. Maximum weight including battery and lanyard: 73.7g/2.6oz

l. Indicators: LEDs for power on, battery status, and mute

m. Must have a maximum of one user control on the outside of the case: a combination wake/mute/voice command/trigger button

n. Must have a channel select switch inside battery compartment

o. Channel selection switch positions must be programmable to a minimum of 7 channels via software

p. When used with an IP based Intercom system, the teacher transmitter/microphone must allow use as the intercom microphone during an intercom call

q. Must have the following inputs/outputs:

a. 3.5mm aux input

b. Charge/programming jack

c. Must be identifiable in software via a user-customizable name

d. Must transmit data on battery status to receiver that is visible to the user on desktop software

e. RoHS compliance: The transmitter shall be manufactured using a lead-free process and be free of hazardous metals and materials

f. UL/cUL listing: The transmitter/microphone shall be UL and cUL listed

L. Charging Cradle

a. Basis specification: FrontRow IMC-01 Charger

b. Minimum number of charging pockets: 2

c. Each charging pocket must be able to charge either the teacher microphone or the student microphone

d. Maximum size (wxhxd): 8.9 x 4.6 x 11.4cm/3.5 x 1.8 x 4.5in

e. Maximum weight: 226.7g/8oz

f. Power supply: 5.9V dc

g. RoHS compliance: The charging cradle shall be manufactured using a lead-free process and be free of hazardous metals and materials

h. UL/cUL listing: The charging cradle shall be UL and c-UL listed

M. Power Over Ethernet (for audio PA and Intercom communications only):

a. Basis of design: FrontRow POE-X

b. Network support: 10/100Mb/s (auto sensing)

c. Power output: 21W

d. INPUTS/OUTPUTS

(1) Network input jack with POE (RJ45)

(1) Network output jack (RJ45)

(1) Corded power plug (2.1mm)

e. MIDSPAN INJECTOR REQUIREMENTS

POE Type: High Power Midspan Injector

POE Standard: POE IEEE 802.3at

Device Pin-out: 1pins 4,5 DC power (+), pins 7, 8 DC power (–)

POE Protection: Over Temp, Over Current, Over/Under Voltage

Power: >30W per Port

PART 3 – EXECUTION

3.1 EXAMINATION

A. Prior to installation, examine work area to verify measurements, and that commencing installation complies with manufacturer's requirements.

3.2 INSTALLATION

A. Comply with requirements of Division 27 Sections "Common Work Results for Communications."

B. Do not install AV or control devices until space is enclosed, HVAC systems are running, and overhead and wet work in work space are complete.

C. Install control devices in accordance with manufacturer's instructions.

D. Install speakers in accordance with manufacturer's instructions.

E. Install projector and mount in accordance with manufacturer's instructions.

F. Grounding: Provide electrical grounding in accordance with NFPA 70.

G. Perform setup for each audio-visual equipment component.

3.3 SYSTEM STARTUP

A. Provide system startup and adjustment to occupied conditions in accordance with manufacturer's recommendations.

B. Perform operational testing to verify compliance with Specifications. Adjust as required.

3.4 CLOSEOUT ACTIVITIES

A. Demonstration: The Contractor shall demonstrate the System to operate in accordance with the requirements of these specifications as well as the Manufacturer's performance specifications. The test shall be performed in the presence of an authorized representative of the Owner.

B. Should such a demonstration of performance show that the Contractor has not properly installed the System, the Contractor shall make all commercially reasonable changes or adjustments at no additional cost to the Owner.

C. Training: Train Owner's personnel to operate, maintain, and program AV controls, two in-service trainings at minimum.

END OF SECTION

SECTION 27 96 00

INTRUSION ALARM SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Integrated Digital Alarm Communicator and Access Control System (DACS), including but not limited to the following:

1. Control panel.
2. Enclosures.
3. Lock and key.
4. Power Supplies.
5. Accessories required to provide a complete DACS.
6. System O and I manual.
7. System programming.
8. Batteries.
9. Wiring.
10. Conduits.

B. The Contractor shall be responsible for identifying requirements for permits from the local police department for the installation of the alarm system specified herein and shall assist the Owner in obtaining the relevant alarm permits.

1.2 RELATED SECTIONS

A. Section 26 05 00 - Basic Electrical Methods and Materials: Intrusion detection systems Infrastructure.

1.3 SYSTEM DESCRIPTION

A. A functionally complete, integrated Digital Alarm Communicator System (DACS) per manufacturer's guidelines, codes and specification requirements.

1. The DACS shall include a Control Panel with built-in, supervised telephone line interface.
2. The DACS shall include recording and retention of event information in a dedicated event log.
3. The DACS shall incorporate an integral real-time clock, calendar, and a test timer.
4. The DACS shall incorporate battery charging capabilities with supervision of battery voltage and battery leads.
5. The DACS shall accommodate a time / event-based scheduling system.
6. The DACS shall be capable of supervision of peripheral devices and communications interfaces.
7. The DACS shall support the connection and reporting of intrusion, fire detection and access control devices to a remote Digital Alarm Communicator Receiver (DACR).
8. The DACS shall accommodate configuration and operation of separate, independent areas.

9. The DACS shall accommodate hard-wired or wireless point expansion via expansion point interface modules and RF receivers.

10. The DACS shall have electrically supervised detection loops and power supplies with battery(s) maintenance. This supervision shall be programmable for the purposes of reporting this information to the DACR.

11. The DACS shall be capable of monitoring and switching to active telephone lines when trying to establish communications with the DACR and transmitting a report.

12. The DACS shall be capable of sending (manually or automatically) test and status reports to remote DACRs.

13. The DACS shall be able to accommodate test, diagnostics, and configuration programming functions locally or remotely via a portable programmer or a computer running the Remote Programming Software (RPS).

14. The DACS shall annunciate alarm, trouble, service reminders, and other relevant system status messages in custom English text at the ACC.

1.4 REFERENCES

A. National Electric Code, Article 760.

B. National Fire Alarm Code (NFPA 72).

C. Administrative Council for Terminal Attachments (ACTA):

1. ANSI/TIA-968-A-2002 Technical Requirements for Connection of Terminal Equipment to the Telephone Network.

D. American National Standards Institute (ANSI):

1. ANSI C63.4 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

E. California State Fire Marshal (CSFM):

1. Title 19, California Code of Regulations, Building Material Listing Program (BML).

F. Federal Communications Commission (FCC):

1. Title 47 C.F.R. Part 15; Class B – Radiated and Conducted Emissions.

2. Title 47 C.F.R. Part 68; rules governing the connection of Terminal Equipment (TE) to the Public Switched Telephone Network (PSTN).

G. The National Institute of Standards and Technology of the United States of America (NIST):

1. Federal Information Processing Standards Publications 197 (FIPS 197) –Advanced Encryption Standard (AES).

H. International Organization For Standardization (ISO):

1. 9001 - Quality System.

I. Underwriters Laboratories, Inc. (UL):

1. UL 50 - Enclosures for Electrical Equipment.
2. UL 294 – Access Control System Units.
3. UL 365 - Police Station Connected Burglar Alarm Units and Systems.
4. UL 609 - Local Burglar Alarm Units and Systems.
5. UL 864 - Control Units System for Fire-Protective Signaling System.
6. UL 985 - Household Fire Warning System Units.
7. UL 1023 - Household Burglar Alarm System Units.
8. UL 1076 – Proprietary Burglar Alarm Units and Systems
9. UL 1610 - Central Station Burglar-Alarm Units.
10. UL 60950-1 - Information Technology Equipment - Safety.
11. UL 636 – Hold up alarms

1.5 SUBMITTALS

A. Submit under provisions of section 01300.

B. Product Data: Manufacturer's data, user and installation manuals for all equipment and software programs including computer equipment and other equipment required for complete Digital Alarm Communicator and Access Control System (DACS), including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Shop drawings shall provide details of proposed system and the work to be provided. Include point-to-point drawings of systems and wiring diagrams of individual devices.

1. Detailed wiring diagrams and system description.
2. System device locations on architectural floor plans.
3. Full Schematic of system, including wiring information for all devices.

D. Documentation to be submitted by the Contractor upon completion of system installation:

1. "As-builts": Upon completion of installation, the Contractor shall prepare "as-built" drawings of the system. These "As-builts" shall be 30 inches by 42 inches (76 cm by 107 cm) format mylar reproducible drawings of each floor plan indicating exact device locations, panel terminations, cable routes and wire numbers as tagged and color-coded on the cable tag.
    a. Additionally, final point-to-point wiring diagrams of each type of device (on 30 inches by 42 inches (76 cm by 107 cm) format) shall be included in the "as-builts."
    b. "As-builts" shall be submitted to the Owner for approval prior to the system acceptance walk-through.
2. Operation and maintenance manuals: Three sets of operating manuals shall be provided explaining the operation and maintenance of the system.

3. Parts list.

4. Maintenance required and maintenance schedule.

E. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

F. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualification:

1. The system shall be the standard product of one manufacturer, and the manufacturer shall have been in business manufacturing similar products for at least 5 years.

2. Manufacturer's Quality System: Registered to ISO 9001:2000 Quality Standard.

B. Installer Qualification:

1. Minimum of five years experience installing access control, surveillance and security systems and devices.

2. After-sales support: The Contractor shall be a factory-authorized and trained dealer of the system and shall be factory-trained and certified to maintain/repair the system after system acceptance.

C. System Requirements:

1. All equipment, systems, and materials furnished and installed under this section shall be installed in accordance with the applicable standards of:

a. National Codes: NEC, NFPA, UBC, BOCA, SBCCI, IBC as applicable.

b. Approvals and listings: UL, FM, ANSI SIA CP-01, CSFM, NYC-CoA, as applicable.

c. Local Authorities Having Jurisdiction (AHJ).

D. Mock-Up: provide a mock-up for evaluation of installation techniques and application workmanship.

1. Finish system in areas designated by Architect.

2. Do not proceed with remaining work until workmanship and aesthetics are approved by Architect.

3. Remake mock-up area as required to produce acceptable work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened, undamaged containers; and unharmed original identification labels.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Protect store materials from environmental and temperature conditions following manufacturer's instructions.

D. Handle and operate products and systems according to manufacturer's instructions.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended

by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 WARRANTY

A. All components, parts, and assemblies supplied by the manufacturers and installed by the Contractor shall be warranted against defects in material and workmanship for a period of at least 12 months (parts and labor), commencing upon date of acceptance by Owner. A qualified factory-trained service representative shall provide warranty service.

B. Service/Maintenance:

1. System maintenance and repair of system or workmanship defects during the warranty period shall be provided by the Contractor free of charge (parts and labor).

2. Periodic testing of the system shall be carried out on a monthly or quarterly basis to ensure the integrity of the control panel, the sensing devices, and the telephone lines.

3. The installer shall correct any system defect within six hours of receipt of call from the Owner.

4. Extended service/maintenance agreements shall be offered by the Contractor for up to four years after the warranty expires. The agreement shall be renewable monthly, quarterly, or yearly.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Bosch Security Systems, Inc.; 130 Perinton Parkway; Fairport, NY 14450. ASD. Toll Free Tel: 800-289-0096. Tel: 585-223-4060. Email: request info (presales.support@us.bosch.com). Web: www.boschsecurity.us.

B. Substitutions: ***.

C. Requests for substitutions will be considered in accordance with provisions of section 01600.

2.2 GENERAL DESCRIPTION

A. Control Panel and Features:

1. The DACS control panel shall be Bosch Security Systems, Inc. model D9412GV4 comprising a fully integrated intrusion, fire, and access control system. The control panel shall support the following:

a. The DACS system is capable of being utilized as a combination Intrusion and Fire system per code. Fully integrated intrusion, access and fire functions allow users to interface with 1 system instead of 3

b. Integrated Telephone Line Interface with programmable options for signaling and supervision.

c. Conettix IP based communication option provides high-speed, secure alarm transport and control.

d. 32 programmable areas with perimeter and interior partitioning.

e. 8 on-board, class B hardwired points with expansion capability for a total of 246 wired or wireless points.

f. Compatibility with touch-screen color LCD, vacuum fluorescent, ATM style LCD or LED style Alarm Command Centers.

g. Local or remote programming, test, and diagnostic capability via a computer running the Remote Programming Software (RPS).

h. The system shall support the use of an Apple iOS device for control. Functions to include arming, diarming, control of outputs, lock, unlock, cycle and secure access doors.

i. Integrated real time clock, calendar, test timer and programmable scheduling capability for relay control and automatic execution of system functions based on a time / event.

j. Provide 1.4 amps of power for standby operation and 2 amps of alarm power, both rated at 12 VDC.

k. 2 wet-contact relay outputs and 1 Auxiliary wet-contact relay output with expansion capability for up to an additional 128 dry-contact relay outputs.

l. Integrated battery charger with reverse hook up protection, battery supervision and battery deep discharge protection.

m. Supervision of peripheral devices and communications interface(s).

B. Point Functionality and Expansion:

1. Each point in the system shall be programmable to provide the following type of response in the system:

a. Always on (24 hour response).

b. On when the system is Master Armed.

c. Only on when the system is Perimeter Armed.

d. Displays / Does Not Display at the ACC when the point is activated.

e. Provides / Does Not Provide entry warning tone.

f. Sounds / Does Not Sound audible alarm indication.

g. The Point is bypassable / not bypassable.

h. Alarm Verification with programmable verification time.

i. Relay activation by Point.

j. Provides / Does Not Provide "watch point" capability.

k. Provides Swinger Bypass.

l. Defers Bypass Report.

m. Can return to the system after being force armed and then restoring.

n. Can return to the system after being bypassed and then restoring.

2. The DACS shall be capable of supporting "group zoning." Group zoning refers to the combining of points into a separately identifiable and separately annunciated (programmable text) areas.

3. The DACS shall be capable of allowing variable point response times via programming. Point response times shall be programmable over a range of 300 milliseconds to 4.5 seconds.

4. The DACS shall have the capability to expand up to 246 separately identifiable points, of which 8 are on-board and 238 are off-board wired or wireless addressable points connected to multiplexed backbone trunks via wired modules and/or wireless receivers.

a. The 8 on-board points shall be able to accommodate powered class B functionality using a powered loop interface module.

b. Point Expansion Modules (Wired and Wireless) shall be able to be located remote to the main panel to a maximum distance of 1000 feet.

5. The DACS shall have the capability to expand up to 75 separately identifiable points, of which 8 are on-board and 67 are off-board addressable points connected to multiplexed backbone trunks via wired modules and/or wireless receivers.

    a. The 8 on-board points shall be able to accommodate powered class B functionality using a powered loop interface module.

    b. Point Expansion Modules (Wired and Wireless) shall be able to be located remote to the main panel to a maximum distance of 1000 feet.

6. Capability to expand up to 40 separately identifiable points, of which 8 are on-board and 32 are off-board addressable points connected to multiplexed backbone trunks via wired modules and/or wireless receivers.

    a. The 8 on-board points shall be able to accommodate powered class B functionality using a powered loop interface module.

    b. Point Expansion Modules (Wired and Wireless) shall be able to be located remote to the main panel to a maximum distance of 1000 feet.

7. Capability to expand up to 40 separately-identifiable points of which 8 are on-board points and 32 are off-board addressable points connected to point expansion modules and/or wireless receivers.

8. Capability to expand up to 24 separately-identifiable points of which 8 are on-board points and 16 are off-board addressable points connected to point expansion modules and/or wireless receivers

C. Areas/Accounts:

1. The DACS shall support 32 independent areas. Each of the 32 areas shall have custom text associated with the armed state, disarmed state and point-off-normal state.

2. All of the areas must be capable of Master (All) and/or Perimeter (Part) arming (excluding predefined Interior protection).

3. The DACS shall be capable of logically grouping 1 or more points into an area, or conversely, dividing 2 or more points into two or more areas.

4. Any area shall be configurable to allow arming by specific users when a programmable number of devices are faulted or bypassed.

5. Areas shall be independently controlled by their corresponding ACC.

6. Area(s) shall accommodate assignment of independent account numbers to define annunciation, control, and reporting functions.

7. The DACS shall be capable of linking multiple areas to a shared area which may be automatically controlled (hallway or lobby).

8. The DACS shall accommodate conditional area arming dependant on the state of other areas (master or associate). Any area can be configured for perimeter and interior arming, not requiring a separate area for this function.

D. Output Relay Expansion: The DACS shall provide the capability for output relay expansion using relay expansion modules. Independent control of relay functions by area shall be possible through programming assignments.

1. The DACS shall be capable of activating 128 additional relay outputs for auxiliary functions based on its classifications (area vs. panel wide). Output Expansion Modules shall be able to be located remote to the main panel to a maximum distance of 1000 feet. 8 relays (Form C) are to be provided per octo-relay module

2. The DACS shall be capable of activating 64 additional relay outputs for auxiliary functions based on its classifications (area vs. panel wide). Output Expansion Modules shall be able to be located remote

to the main panel to a maximum distance of 1000 feet. 8 relays (Form C) are to be provided per octo-relay module

3. The DACS shall be capable of activating 24 additional relay outputs for auxiliary functions based on its classifications (area vs. panel wide). Output Expansion Modules shall be able to be located remote to the main panel to a maximum distance of 1000 feet. 8 relays (Form C) are to be provided per octo-relay module

4. The DACS shall be capable of activating 16 additional relay outputs for auxiliary functions based on its classifications (area vs. panel wide). 8 relays (Form C) are to be provided per octo-relay module

5. The DACS shall be capable of activating 8 additional relay outputs for auxiliary functions based on its classifications (area vs. panel wide). 8 relays (Form C) are to be provided per octo-relay module

6. The DACS shall be capable of controlling relays and automatically executing system functions based on a time / event scheduling program. The program can be hour, day of week or day of month based.

7. Relays and other outputs may be programmed to follow up to 14 different area conditions or up to 12 panel conditions. Relays may also be programmed to follow individual points or groups of points.

8. The DACS shall support 4 different types of alarm output selections: Steady, Pulsed, California Standard, and Temporal Code 3.

E. Scheduling: The DACS shall support scheduling capabilities with the following characteristics:

1. Arm / Disarm specific area(s) based on open/close windows.

2. Bypass / Unbypass point(s).

3. Activate / Deactivate relay(s).

4. Send test reports.

5. Up to 4 programmable holiday schedules of 366 days each (includes leap year). Based on the holiday settings, different time windows for open/close and other system functions can be executed.

6. Automatic adjustment of system clock for daylight savings time.

7. Turn an Access Authority Level On / Off.

8. Hold a Door Open (unlocked and shunted).

9. Secure a Door Closed (locked, no valid cards will allow entry).

10. Return a Door to Normal Operation (locked, valid cards will allow entry).

11. Turn recording of Access Granted events On/ Off (and transmittal if routing is ON).

12. Turn recording of Access Denied events On/ Off (and transmittal if routing is ON).

F. Alarm Command Centers:

1. The DACS shall accommodate connection with up to 32 ACCs, each capable of displaying custom English text on touch screen liquid crystal or vacuum fluorescent (VF) displays.

2. The Alarm Command Centers shall accommodate viewing and configuration of system parameters including:

a. Network Parameters:

1) DHCP Enable/Disable for the selected network module.

2) UPnP Enable/Disable for the selected network module.

3) IP Address for the selected network module

4) Subnet Mask for the selected network module.

5) Default Gateway for the selected network module.

6) Port Number for the selected network module - The module's port number shall range from 0 to 65,535.

7) DNS Server Address for the selected module's DNS server IP address

8) DNS Host Name for the selected module. The DNS host name shall contain up to 63 characters.

9) AES Encryption Key Size – Enable/Disable encryption by selecting the AES encryption key size for the selected network module.

10) AES Encryption Key String - The user shall be able to display, add and modify the AES encryption string based upon the key size previously configured for the selected network module.

b. Point Parameters:

1) Point Selection between one and the maximum number of points in the control panel.

2) Point Registration to allow system response from a specific physical point on any one of the expansion modules; On-board, Point expansion modules (wired or wireless), and Access.

3) Wireless points shall be able to be enrolled in the system via an auto learn feature.

c. Event Routing Parameters to allow programming of upto 4 report routing groups as well as configuration of primary and secondary paths.

3. The DACS shall accommodate connection with up to 8 ACCs, each capable of displaying custom English text on liquid crystal or vacuum fluorescent (VF) displays.

4. The ACC's shall be capable of displaying point status, arm/disarm status, and carry out user command functions.

5. The ACC can be programmed to respond to the entry of any of the specifically authorized user passcodes.

6. The ACCs shall be able to be configured to control a specific area, or group of areas, or all areas in the system.

7. The ACCs shall be able to be temporarily re-addressed to view the status of a remote area.

8. The ACC's shall be able to provide different audible tones for Intrusion, Fire alarms, and system troubles

G. User Passcodes and Authority: Passcodes shall be programmable with authority levels to allow users to operate any or all areas.

1. Up to 99 different passcodes shall be accommodated

2. Each passcode shall be 3 to 6 digits (variable) and be assigned a 16-character user name that shall be printed on the local printer and DACR with associated opening and closing reports from the user.

3. User access to System features and functions shall be configurable based on 14 individually programmable levels of authority assigned to the user passcode. Additionally, the system shall have the capability to assign to the user passcode, a different authority level in each of the areas. A service

passcode can be assigned to the servicing agent allowing the agent limited access to system functions. User-programmable / activated functions include:

a. Arming the system: All areas, specific area(s) only, perimeter instant, perimeter delayed, perimeter partial, watch mode, and arming the system with a duress passcode.

b. Disarming the system: All areas, specific area(s) only and disarming with a duress passcode.

c. Viewing system status: Faulted points, event memory, bypassed points, area status and point status.

d. Implementation functions: Bypass a point, unbypass a point, reset sensors, silence bell, activating relays, initiating the remote programming function locally to allow programming the system from a remote location.

e. Testing the system: Local Walk test, Service Walk test, Fire test, send report to remote DACR to check the telephone link, and programming the time and date for the next test report transmission.

f. Change system parameters: ACC display brightness, system time and date, and add/delete/change passcodes.

g. Extend the closing time of the system.

h. Transmitting special alerts and activating audible and visible signals.

i. Executing multiple commands / ACC keystrokes from a single Menu / Command List item. This function shall be able to have a 16 character (alphanumeric) title to identify it on the ACC display.

j. Editing of time / event based scheduling program from the ACC.

k. The DACS shall also provide a "service menu" to implement functions such as viewing and printing the system log, displaying the system firmware revision number, and defaulting (toggling) text displays between custom and default text displays for troubleshooting.

4. The DACS shall allow users to change their own user passcode from the Alarm Command Center (ACC). Managers shall be capable of changing the user passcodes and authority assignments by area of other users from the ACC.

5. The DACS shall incorporate a programmable "Passcode Follows Scope" feature to allow users to arm or disarm only the area they are entering with one simple command or control all areas from one ACC.

H. Communication: The DACS shall be capable of reporting system events and supervisory reports including alarm, trouble, missing modules, restorals, system status, AC failure, battery status to primary and secondary off-site DACR's. The following features shall be supported.

1. The DACS shall be capable of communicating via dial-up analog telephone lines, over a LAN/WAN/Internet using a wired network interface module, or over a cellular network using a GSM/GPRS interface module.

2. The DACS shall be capable of communicating via dial-up analog telephone lines, over a LAN/WAN/Internet using a wired dialer capture network interface module.

3. The Bosch ModemIIIa² communications format shall be utilized for optimum system performance. The ModemIIIa² format provides the maximum data information to the receiver for alarms, troubles, restorals, bypasses, relay activation, opening/closings, and card access. The detailed information includes the point numbers with text, peripheral device numbers, user numbers with text, and area information. As an alternative format, Contact ID may be used when a non-Bosch receiver is used although it will include less detailed information like point or user text.

4. The DACS shall have the capability of communicating with up to 8 different DACRs using up to 4 different phone numbers, up to 24-digits in length and/or 4 URL/IP addresses over a network.

5. The DACS shall have the capability of communicating with up to 5 different DACRs using up to 4 different phone numbers, up to 32-digits in length or 1 IP address using a dialer capture network interface module.

6. The DACS shall support 2 telephone lines using a dual phone line module. The lines shall be capable of being alternated for the transmission of consecutive events.

7. The DACS shall report to a Commercial Central Station that is using a Bosch D6600 Receiver/Gateway or a Bosch D6100i Receiver using ModemIIIa² as a preferred format or Contact ID as an alternate format.

8. The DACR shall provide the transmission information sent from the DACS that includes alarms, troubles, restorals, bypasses, relay activation, opening/closings, and card access. When using the ModemIIIa² format the detailed information includes the point numbers with text, peripheral device numbers, user numbers with text, and area information.

9. The DACS reports shall be classified, by event, into eleven subcategories or "report groups." Each group represents similar types of events. Individual events within each group shall be selectively enabled or disabled for transmission. The eleven report groups shall be as follows:

    a. Fire Reports.

    b. Burglar Reports.

    c. User Reports.

    d. Test Reports.

    e. Diagnostic Reports.

    f. Relay Reports.

    g. Auto Function Reports.

    h. RPS Reports.

    i. Point Reports.

    j. User Change Reports.

    k. Access Reports.

10. The DACS shall be capable of listening to the telephone line when calls are answered by other devices on the premises side of the phone line and determining if a special tone is being sent from RPS (Remote Programming Software) and intercepting the call for RPS Sessions.

11. The DACS shall be have the capability to verify the integrity of the remote communications path and switch to alternate paths when a communications failure occurs.

12. The DACS shall be capable of unattended mode of operation whereby programming and configuration updates are automatically transferred using the Remote Programming Software (RPS). These updates can initiate from either the control panel or the remote computer using RPS.

I. Network Communication: The DACS shall be capable of network communications over a LAN, WAN, Intranet, or the Internet. The system shall include supervision of the network communication utilizing configurable periodic heartbeats to the Digital Alarm Communications Receiver (DACR). The DACR shall provide notification of the loss of communications from a networked system after a programmable timeframe since the last communication. The notification options shall be programmable and include local annunciation or indication to automation software.

1. The network interface module shall be capable of supporting Dynamic Host Communication Protocol (DHCP) to obtain an IP Address.

2. The system shall support a method of authentication between the control panel and the receiver to ensure that the control panel has not been compromised or replaced.

3. The network interface modules shall be capable of supporting encryption using a minimum of 128-bit AES Encryption (Rijndael) certified by NIST (National Institute of Standards and Technology).

4. The network interface modules shall support a 10/100BaseT connection to an Ethernet network.

5. The control panel shall be capable of network communication with a programmable poll time to send periodic heartbeats to the receiver, programmable ACK Wait time, and programmable retry time. In the situation where a communication path is unsuccessful, the control panel shall be capable of attempting backup communication through an available communication method to the same receiver or a backup receiver.

    a. The control panel shall have the ability to automatically adjust the heartbeat rate of a backup path that is using GPRS to the heartbeat rate of the primary path in case of a primary path failure. Upon restoral of the primary path, the heartbeat rate of the backup path shall automatically restore to the original rate. This allows a system utilizing GPRS communications to keep the wireless charges low.

    b. The network communication between the control panel and the receiver shall use ModemIIIa².

    c. The control panel shall be capable of two-way communication using a wired network interface module with a 10/100BaseT on a LAN/WAN/Internet configuration or with a wireless GPRS module on the Internet.

    d. The control panel shall be capable of configuring the destination of the receiver using a URL or static IP Address.

    e. The control panel shall be capable of using DNS to lookup the IP Address of the receiver when programmed with a URL.

    f. The control panel shall support UPnP for automated Port Forward configuration in the router where the control panel is installed.

    g. The control panel shall support AutoIP to enable the RPS software to connect to the control panel locally using an IP Direct connection.

    h. The control panel shall support configuration of the IP parameters from the keypad eliminating the need for a PC to configure the IP device.

    i. The control panel shall support network diagnostics from a keypad to allow local testing of network connectivity. The diagnotics should include, Ethernet cable connected, gateway configuration ok, DNS lookup operational, and external network connectivity (such as the Internet) operational.

    j. The system shall be capable of meeting DCID 6/9 and UL 2050 standards.

6. The system shall use a Dialer Capture Network Module (C900V2) to convert standard PSTN communications to send the messages to the receiver using the IP network.

    a. The Dialer Capture Network Module enables IP communications from the PSTN based DACS to the receiver using an IP network.

    b. The Dialer Capture Network Module shall include supervision of the network communication utilizing periodic heartbeats to the Digital Alarm Communications Receiver (DACR). The DACR shall provide notification of the loss of communications from a networked system after a programmable timeframe since the last communication.

J. Event Log: The DACS shall maintain a log of events indicating time, day, month, year type of event,

account number, area number, user ID, point text, user text and primary/secondary event route. The system shall allow the following characteristics:

1. The DACS shall be capable of storing up to 254 events.

2. The DACS shall support the printing of these events on a local printer.

3. The DACS shall support viewing of logs locally at the ACC and remotely via an upload to a remote central station computer running the RPS software.

4. The DACS shall provide notification via a report to the DACR when the event log reaches a programmable “percent full capacity". This allows retrieval of stored events via RPS to prevent any loss of event history.

5. Group, signal type and area can route events to specific printers.

6. Each DACR shall be designated as a primary, backup, or duplicate destination for each report group. Assigning an event to multiple routing groups provides for duplicate destinations for the event. The transmission of grouped events allows the reporting of different types of information to different remote DACRs.

K. Testing, Diagnostic, and Programming Facilities: The DACS shall be capable of sending (manually or automatically) test and status reports to remote DACRs.

1. The DACS shall be capable of sending automatic tests daily, weekly or once every 28 days. Automatic test times shall be programmable to provide an offset of up to 24 hours from the current time.

2. Automatic test reports shall be programmable to be deferred by one test interval if any other report is transmitted in the current interval.

3. Automatic test reports and remote system access for diagnostics shall be supported via a remote central station computer with Remote Programming Software (RPS).

4. The DACS shall be programmable locally or remotely. Programming shall be accomplished via a command center or a computer with a remote programmer and diagnostic software package (RPS).

5. The DACS shall allow an on-site user to initiate remote programming while on-line with the servicing location. The remote programming device must provide a compare feature and allow for downloading either the stored program or the (un)modified program copied from the panel.

6. The DACS shall allow the local programming option to be disabled and must provide a method to program a panel while no one is on premises, when the panel shares a line with an answering machine.

7. The DACS shall accommodate IP Diagnostic to verify settings and operation of the network interface modules; Host name, MAC address, IPV4 address assignment. The IP Connection test shall include; Link test to verify physical cable integrity, Ping test to verify gateway response, ping test to verify address on the internet.

8. Wireless point diagnostics shall include signal strength and device states of registered wireless points in the system.

9. The number of system testing and programming sessions shall be restricted via the use of program locking features and passwords. Passcode protection in excess of sixteen million combinations is required.

10. New modules support enhanced diagnostics through RPS

L. Miscellaneous Features: Programmable alarm output timer, 31 programmable entry delay times, exit delay programmable by area, individually programmable point of protection text, point bypassing, key switch arming capability with LED outputs, and fire verification.

M. False Alarm Reduction: The DACS shall comply with all ANSI SIA CP-01 requirements for false alarm reduction

N. Ambush Detection: The DACS shall include an early ambush feature that requires that the user disarm, and then inspect the facility within a specified time period, before entering their passcode or a different authorized passcode again. If the user does not enter a passcode a second time, a duress event is generated. If the user does enter a passcode within the specified time period, the system disarms.

O. Two man rule: The DACS shall include a programmable feature that requires 2 separate passcodes to be entered to disarm the system. After 1 passcode is entered, the system will prompt for a second passcode to be entered on the same ACC. Without the second passcode, the system shall not disarm.

P. User-Programmable Features: The DACS shall provide a menu driven interface to provide a user-friendly command structure for programming / customizing the system to the operational criteria of the application. The DACS shall be capable of being operated via:

1. The Command Structure.

2. Menu / Command List.

2.3 SYSTEM INTERFACE REQUIREMENTS

A. Grounding: The Contractor shall properly earth ground the DACS to prevent electrostatic charges and other transient electrical surges from damaging the DACS panel.

B. Primary power: The Contractor shall provide a dedicated 120 VAC power circuit to the DACS system. This circuit shall be connected to the emergency power system. The 120 VAC is stepped down to power the DACS panel using a class two, plug-in transformer. This power circuit shall be properly rated to continuously power all points and functions indefinitely in full alarm condition.

C. Primary power supervision: When the primary power source fails, the system can be configured to report an "AC Fail" message to a commercial central station.

1. The message can also be programmed to "tag-along" with another message transmitted to the central station.

2. The system will always display a loss of primary power on the ACC and may be configured to provide additional audible warning.

3. The transmission delay of this message is programmable from 5 seconds to 86 minutes with an optional 6 to 12 hour transmission delay

D. Secondary power (standby battery): The Contractor shall provide adequate battery power as defined by the relevant application criteria, (UL 864 and UL 985 for alarm installations or NFPA 72 chapters for fire applications). Appropriate battery chargers shall be provided consistent with the battery back-up capacity. The most current accepted version of NFPA 72 and any applicable local codes or AHJ requirements must be met accordingly.

E. Secondary power supervision: When the secondary power source experiences a 85 percent depletion of its standby capacity, the system can be configured to report a "Low Battery" message to a commercial central station. The system will always display a low battery condition on the ACC and may be configured to provide additional audible warning.

F. Telephone interface: The control panel in the DACS shall be equipped with a phone line monitor and shall interface with the phone lines via RJ-31X jacks for supervision of the telephone line connection.

1. The telephone line interface shall conform with FCC rules (Title 47 C.F.R. part 68).

2. When a telephone line is determined to be out of service by the DACS panel, the event will be annunciated locally on the ACC and transmitted to the central station over the alternate communications interface. The transmission delay of this message is programmable from ten to two-

hundred forty seconds.

3. When a telephone line is determined to be out of service by the DACS panel, the event will be annunciated locally based on programming options

4. A telephone line switching module shall be used to interface to a second telephone line.

G. Ethernet Interface: The DACS may use an Ethernet interface module as the primary, or back-up means of communicating to a DACR.

1. Built-in IP-based alarm transport, programming, and control

2. The module shall accommodate 128-bit AES encryption.

3. 10BASE T or 100BASE T network connection

4. Full-duplex and half-duplex support

H. GSM/GPRS interface: The DACS may use an GSM/GPRS radio module as the primary, or backup, means of communicating to a DACR. Up to 4 IP Addresses shall be available for routing system events. The supervision time shall be programmable with a range of 5 to 65,535 seconds. This module shall accommodate 128-bit AES encryption.

I. Auxiliary function control interfaces: The DACS shall accommodate auxiliary functions such as activating bells, strobes, or lights and shall be accomplished using the optional application specific relay modules. These auxiliary interfaces shall be electrically isolated to avoid inter-system interferences or damage to the system.

J. Wiring: The contractor shall provide cables consistent with the manufacturer's recommendations. The following general guidelines shall be followed for wiring installation:

1. Wiring shall be appropriately color-coded with permanent wire markers. Copper conductors shall be used.

2. All signal cables provided under this contract shall be Class II, plenum-rated cable where required. Where subject to mechanical damage, wiring shall be enclosed in metal conduits or surface metallic raceway.

3. Data wires shall not be enclosed in conduit or raceways containing AC power wires.

4. Where EMI may interfere with the proper operation of the DACS circuits, twisted/shielded cable shall be used.

K. Environmental Conditions: The DACS shall be designed to meet the following environmental conditions:

1. The system shall be designed for a storage temperature of -10° C to 70°C (14° F to 158°F).

2. The system shall be designed for an operating temperature of 0° C to 50°C (32° F to 120°F).

3. The system shall be designed for normal operation in an 85% relative humidity environment.

4. The system shall meet or exceed the requirements of FCC rules Title 47 C.F.R. Part 15, Class B devices, and Part 68, IEC EMC directive

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive devices and notify adverse conditions affecting installation or subsequent operation.

B. Do not begin installation until unacceptable conditions are corrected.

C. If preparation is the responsibility of another installer, notify architect of unsatisfactory preparation before proceeding.

D. Ensure selected location is secure and offers protection from accidental damage.

E. Location shall provide reasonable temperature and humidity conditions, free from sources of electrical and electromagnetic interference.

F. Ensure power source is protected against accidental shutoff.

G. Install all equipment and materials in accordance with the "current" recommendations of the manufacturer. The work shall also be in accordance with:

1. Installation criteria defined in these specifications and in the construction documents.

2. Factory Representative can be the Bosch Security Systems Inc Security Dealer.

3. Approved submittals.

4. Applicable requirements of referenced standards.

H. The contractor shall provide the following services as part of the contract:

1. Supervision of sub-contractors.

2. Coordination of other contractors for system-related work (electrical contractor, finish hardware contractor, architect, and general contractor).

3. Attending site construction/coordination meetings.

4. Keeping updated construction drawings at the construction site.

5. Meeting construction deadlines per the construction schedule.

I. Programming of the system shall include the following tasks:

1. Programming system configuration parameters (hardware and software, zone/circuit numbers, communication parameters).

2. Programming operational parameters such as opening/closing reports and windows, system response text (custom English) displays of events, activation of relays that drive auxiliary devices, and identifying types of zones/loops.

3. Programming passcodes according to the authorities and functions defined by the owner.

4. Other system programming tasks required by the owner. These additional programming requirements shall be coordinated between the owner and the contractor.

5. Operational Testing: The contractor shall perform thorough operational testing and verify that all system components are fully operational.

6. Hard-copy System Printout: The contractor shall submit a hard-copy system printout of all components tested and certify 100 percent operation indicating all devices/panels/units have passed the test criteria set forth by the manufacturer.

7. Acceptance Test Plan Form: An acceptance test plan form shall be prepared/provided by the contractor prior to the acceptance walk-through.

8. This form shall include separate sections for each device/panel/unit as well as a column indicating the manufacturer's performance allowance/margin, a column indicating the result of the testing performed

by the contractor (pass/fail), and an empty column for recording findings during the walk-through.

9. Fire Alarm Systems shall comply with NFPA 72 Standards for inspection, testing, and maintenance.

J. The contractor shall certify completion in writing and schedule the commissioning walk-through. The contractor shall provide all the tools and personnel needed to conduct an efficient commissioning process.

3.2 FIELD QUALITY CONTROL

A. Installation contractor shall submit a written test report that the system has been 100 percent tested and approved. Final test shall be witnessed by the owner, engineer, electrical contractor, chief security officer, and performed by the installation contractor. Final test report shall be received and acknowledged by the owner prior to request for final payment.

B. Provide instruction to the owner's satisfaction with regard to proper use and operation of the system.

C. Determine and report all problems to the manufacturer's customer service department.

3.3 ADJUSTING

A. System maintenance and repair of system or workmanship defects during the warranty period shall be provided by the Contractor free of charge (parts and labor).

B. Periodic testing of the system shall be carried out on a monthly or quarterly basis to ensure the integrity of the control panel, the sensing devices, and the telephone lines.

C. The installer shall correct any system defect within six hours of receipt of call from the Owner.

3.4 DEMONSTRATION

A. Demonstrate at final inspection that surveillance system and devices functions properly.

1. The Contractor upon completion of installation shall furnish training in the complete operation of the systems.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before substantial completion.

END OF SECTION

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SECTION 28 31 00

NETWORKED FIRE ALARM SYSTEM

PART 1 – GENERAL

1.1 RELATED SECTIONS

A. Section (27 16 50) - (Data Networking).

1.2 DESCRIPTION

A. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.

B. The facility shall have an emergency voice alarm communication system. Digitally stored message sequences shall notify the building occupants that a fire or life safety condition has been reported. Message generator(s) shall be capable of automatically distributing up to eight (8) simultaneous, unique messages to appropriate audio zones within the facility based on the type and location of the initiating event. The Fire Command Center (FCC) shall also support Emergency manual voice announcement capability for both system wide or selected audio zones, and shall include provisions for the system operator to override automatic messages system wide or in selected zones.

C. The system shall be able to support additional, alternate Fire Command Centers, which shall be capable of simultaneous monitoring of all system events. Alternate Fire Command Centers shall also support an approved method of transferring the control functions to an alternate Fire Command Center when necessary. All Fire Command Centers shall be individually capable of assuming Audio Command functions such as Emergency Paging, audio zone control functions, and Firefighter's Telephone communication functions.

D. Each designated zone shall transmit separate and different alarm, supervisory and trouble signals to the Fire Command Center (FCC) and designated personnel in other buildings at the site via a multiplex communication network.

E. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof). It's acceptable for peripheral devices to be manufactured outside of the U.S. by a division of the U.S. based parent company.

F. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

G. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final checkout and to ensure the systems integrity.

1.3 SCOPE:

A. A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance to the project specifications and drawings.

B. Provide 12 strand single mode fiber optic cable for Digital Audio per plans and manufacturers requirements.

C. Basic Performance:

1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on Class B Signaling Line Circuits (SLC).
2. Device Circuits (IDC) shall be wired Class B as part of an addressable device connected by the SLC Circuit.
3. Notification Appliance Circuits (NAC) shall be wired Class B as part of an addressable device connected by the SLC Circuit.
4. A single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
5. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.
6. Speaker circuits may be controlled by NAC outputs built into the amplifiers, which shall function as addressable points on the Digital Audio Loop.
7. NAC speaker circuits shall be arranged such that there is a minimum of one speaker circuit per floor of the building or smoke zone which ever is greater.
8. Audio amplifiers and tone generating equipment shall be electrically supervised for normal and abnormal conditions.
9. NAC speaker circuits and control equipment shall be arranged such that loss of any one (1) speaker circuit will not cause the loss of any other speaker circuit in the system.
10. Two-way emergency telephone communication circuits shall be supervised for open and short circuit conditions.
11. Speaker circuits shall be arranged such that there is a minimum of one speaker circuit per smoke zone.
12. Speaker circuits shall be electrically supervised for open and short circuit conditions. If a short circuit exists on a speaker circuit, it shall not be possible to activate that circuit.
13. Audio amplifiers and tone generating equipment shall be electrically supervised for abnormal conditions. Digital amplifiers shall provide built-in speaker circuits, field configurable as four Class B (Style Y) circuits.
14. Digital amplifiers shall be capable of storing up to two minutes of digitally recorded audio messages and tones. The digital amplifiers shall also be capable of supervising the connection to the associated digital message generator, and upon loss of that connection shall be capable of one of the following system responses:

    a. The digital amplifier shall automatically broadcast the stored audio message.
    b. The digital amplifier shall switch to a mode where a local bus input on the digital amplifier will accept an input to initiate a broadcast of the stored message. This bus input shall be connected to a NAC on a local FACP for the purpose of providing an alternate means of initiating an emergency message during a communication fault condition.
    c. Speaker circuits shall be either 25 VRMS or 70VRMS. Speaker circuits shall have 20% space capacity for future expansion or increased power output requirements.
    d. Two-way emergency telephone (Fire Fighter Telephone) communication shall be supported between the Audio Command Center and up to seven (7) remote Fire Fighter's Telephone locations simultaneously on a telephone riser.
    e. Means shall be provided to connect FFT voice communications to the speaker circuits in order to allow voice paging over the speaker circuit from a telephone handset.
    f. The digital audio message generator shall be of reliable, non-moving parts, and support the digital storage of up to 32 minutes of tones and emergency messages, shall support programming options to string audio segments together to create up to 1000 messages, or to loop messages and parts of messages to repeat for pre-determined cycles or indefinitely.

1.4 GUARANTEE:

A. The fire alarm control panel, voice panels and any head-end equipment shall have a manufacturer's warranty of a minimum of 3 years.

1.5 POST CONTRACT MAINTENANCE:

A. Complete maintenance and repair service for the fire detection system shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years after expiration of the guaranty.

B. As part of the bid/proposal, include a quote for a maintenance contract to provide all maintenance, required tests, and list pricing for any replacement products included on the bill of materials, along with the list pricing for products not on the bill of materials; if test and inspection rates are different than full service rates the bid/proposal shall include pricing for all levels for a minimum period of five (5) years Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

C. Include also a quote for unscheduled maintenance/repairs, including hourly rates for technicians trained on this equipment, and response travel costs for each year of the maintenance period. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

D. As part of the submittal, include a quotation for all parts and material, and all installation and test labor as needed to increase the number of intelligent or addressable devices by ten percent (10%). This quotation shall include intelligent smoke detectors, intelligent heat detectors, addressable manual stations, addressable monitor modules and addressable modules equal in number to one tenth of the number required to meet this specification (list actual quantity of each type).

E. The quotation shall include installation, test labor, and labor to reprogram the system for this 10% expansion. If additional FACP hardware is required, include the material and labor necessary to install this hardware.

F. Do not include cost of conduit or wire or the cost to install conduit or wire except for labor to make final connections at the FACP and at each intelligent addressable device. Do not include the cost of conventional peripherals or the cost of initiating devices or notification appliances connected to the addressable monitor/control modules.

G. Submittals that do not include this estimate of post contract expansion cost will not be accepted.

1.6 APPLICABLE STANDARDS AND SPECIFICATIONS:

A. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.

B. National Fire Protection Association (NFPA) - USA:

No. 12	Extinguishing Systems (low and high)
No. 12A	Halon 1301 Extinguishing Systems
No. 13	Sprinkler Systems
No. 15	Water Spray Systems
No. 16	Foam / Water Deluge and Spray Systems
No. 17	Dry Chemical Extinguishing Systems
No. 17A	Wet Chemical Extinguishing Systems
No. 2001	Clean Agent Extinguishing Systems
No. 70	National Electric Code
No. 90A	Air Conditioning Systems
No. 92A	Smoke Control Systems
No. 92B	Smoke Management Systems in Malls, Atria, Large Areas
No. 72	National Fire Alarm Code

C. Underwriters Laboratories Inc. (UL) - USA:

No. 268	Smoke Detectors for Fire Protective Signaling Systems
No. 864	Control Units for Fire Protective Signaling Systems
No. 2572	Mass Notification Systems
No. 217	Smoke Detectors, Single and Multiple Station
No. 228	Door Closers - Holders for Fire Protective Signaling Systems

No. 268A	Smoke Detectors for Duct Applications
No. 521	Heat Detectors for Fire Protective Signaling Systems
No. 464	Audible Signaling Appliances
No. 38	Manually Actuated Signaling Boxes
No. 1481	Power Supplies for Fire Protective Signaling Systems
No. 346	Waterflow Indicators for Fire Protective Signaling Systems
No. 1076	Control Units for Burglar Alarm Proprietary Protective Signaling Systems
No. 1971	Visual Notification Appliances
No. 2017	Standard for General-Purpose Signaling Devices and Systems
No.60950	Safety of Information Technology Equipment

D. Local and State Building Codes.

E. All requirements of the Authority Having Jurisdiction (AHJ).

1.7 APPROVALS:

A. The system shall have proper listing and/or approval from the following nationally recognized agencies:

UL Underwriters Laboratories, Inc
FM Factory Mutual
CSFM California State Fire Marshal

B. The system shall be certified for seismic applications in accordance with the California Building Code (CBC). The basis for qualification of seismic approval shall be via shake table testing.

PART 2 - PRODUCTS

2.1 MAIN FIRE ALARM CONTROL PANEL OR NETWORK NODE:

A. Main FACP or network node shall be a NOTIFIER Model NFS2-3030 and shall contain a microprocessor based Central Processing Unit (CPU) and power supply. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system controlled devices.

B. In conjunction with intelligent Loop Control Modules and Loop Expander Modules, the main FACP shall perform the following functions:

1. Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
2. Supervise all initiating signaling and notification circuits throughout the facility by way of connection to addressable monitor and control modules.
3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed. In the event of CPU failure, all SLC loop modules shall fallback to degrade mode. Such degrade mode shall treat the corresponding SLC loop control modules and associated detection devices as conventional two-wire operation. Any activation of a detector in this mode shall automatically activate associated Notification Appliance Circuits.

2.2 System Capacity and General Operation

A. The FACP shall be capable of communicating on Noti-Fire-Net over a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently regenerative communication format and protocol. The network shall support communication speed up to 100 Mb and support up to 200 panels / nodes per network.

B. The control panel shall be capable of expansion via up to 10 SLC loops. Each module shall support up to 318 analog/addressable devices for a maximum system capacity of 3180 points. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit 640-character liquid crystal display, individual, color coded system status LEDs, and a keypad for the control of the fire alarm system. Said LCD shall also support graphic bit maps capable of displaying the company name and logo of either company.

C. All programming or editing of the existing program in the system shall be achieved without interrupting the alarm monitoring functions of the fire alarm control panel.

D. The FACP shall be able to provide the following software and hardware features:

1. Pre-signal and Positive Alarm Sequence: The system shall provide means to cause alarm signals to only sound in specific areas with a delay of the alarm from 60 to up to 180 seconds after start of alarm processing. In addition, a Positive Alarm Sequence selection shall be available that allows a 15-second time period for acknowledging an alarm signal from a fire detection/initiating device. If the alarm is not acknowledged within 15 seconds, all local and remote outputs shall automatically activate immediately.
2. Smoke Detector Pre-alarm Indication at Control Panel: To obtain early warning of incipient or potential fire conditions, the system shall support a programmable option to determine system response to real-time detector sensing values above the programmed setting. Two levels of Pre-alarm indication shall be available at the control panel: alert and action.
3. Alert: It shall be possible to set individual smoke detectors for pre-programmed pre-alarm thresholds. If the individual threshold is reached, the pre-alarm condition shall be activated.
4. Action: If programmed for Action and the detector reaches a level exceeding the pre-programmed level, the control panel shall indicate an action condition. Sounder bases installed with either heat or smoke detectors shall automatically activate on action Pre-Alarm level, with general evacuation on Alarm level.
5. The system shall support a detector response time to meet world annunciation requirements of less than 3 seconds.
6. Device Blink Control: Means shall be provided to turn off detector/module LED strobes for special areas.
7. NFPA 72 Smoke Detector Sensitivity Test: The system shall provide an automatic smoke detector test function that meets the sensitivity testing requirements of NFPA 72.
8. Programmable Trouble Reminder: The system shall provide means to automatically initiate a reminder that troubles exist in the system. The reminder will appear on the system display and (if enabled) will sound a piezo alarm.
9. On-line or Off-line programming: The system shall provide means to allow panel programming either through an off-line software utility program away from the panel or while connected and on-line. The system shall also support upload and download of programmed database and panel executive system program to a Personal Computer/laptop. A single change to one CPU database shall not require a database download to other CPUs.
10. History Events: The panel shall maintain a history file of the last 4000 events, each with a time and date stamp. History events shall include all alarms, troubles, operator actions, and programming entries. The control panels shall also maintain a 1000 event Alarm History buffer, which consists of the 1000 most recent alarm events from the 4000 event history file.
11. Smoke Control Modes: The system shall provide means to perform FSCS mode Smoke Control to meet NFPA-92A and 90B and HVAC mode to meet NFPA 90A.
12. The system shall provide means for all SLC devices on any SLC loop to be auto programmed into the system by specific address. The system shall recognize specific device type ID's and associate that ID with the corresponding address of the device.
13. Passwords and Users: The system shall support two password levels, master and user. Up to 9 user passwords shall be available, each of which may be assigned access to the programming change menus, the alter status menus, or both. Only the master password shall allow access to password change screens.
14. Block Acknowledge: The system shall support a block Acknowledge for Trouble Conditions
15. Sensitivity Adjust: The system shall provide Automatic Detector Sensitivity Adjust based on Occupancy schedules including a Holiday list of up to 15 days.
16. Environmental Drift Control: The system shall provide means for setting Environmental Drift Compensation by device. When a detector accumulates dust in the chamber and reaches an unacceptable level but yet still below the allowed limit, the control panel shall indicate a

maintenance alert warning. When the detector accumulates dust in the chamber above the allowed limit, the control panel shall indicate a maintenance urgent warning.

17. Custom Action Messages: The system shall provide means to enter up to 100 custom action messages of up to 160 characters each. It shall be possible to assign any of the 100 messages to any point.
18. Local Mode: If communication is lost to the central processor the system shall provide added survivability through the intelligent loop control modules. Inputs from devices connected to the SLC and loop control modules shall activate outputs on the same loop when the inputs and outputs have been set with point programming to participate in local mode or when the type codes are of the same type: that is, an input with a fire alarm type code shall activate an output with a fire alarm type code.
19. Read status preview - enabled and disabled points: Prior to re-enabling points, the system shall inform the user that a disabled device is in the alarm state. This shall provide notice that the device must be reset before the device is enabled thereby avoiding activation of the notification circuits.
20. Custom Graphics: When fitted with an LCD display, the panel shall permit uploading of a custom bit-mapped graphic to the display screen.
21. Multi-Detector and Cooperating Detectors: The system shall provide means to link one detector with up to two detectors at other addresses on the same loop in cooperative multi-detector sensing. There shall be no requirement for sequential addresses on the detectors and the alarm event shall be a result ofall cooperating detectors chamber readings.
22. ACTIVE EVENT: The system shall provide a Type ID called FIRE CONTROL for purposes of air-handling shutdown, which shall be intended to override normal operating automatic functions. Activation of a FIRE CONTROL point shall cause the control panel to (1) initiate the monitor module Control-by-Event, (2) send a message to the panel display, history buffer, installed printer and annunciators, (3) shall not light an indicator at the control panel, (4) Shall display ACTIVE on the LCD as well a display a FIRE CONTROL Type Code and other information specific to the device.
23. NON-FIRE Alarm Module Reporting: A point with a type ID of NON-FIRE shall be available for use for energy management or other non-fire situations. NON-FIRE point operation shall not affect control panel operation nor shall it display a message at the panel LDC. Activation of a NON-FIRE point shall activate control by event logic but shall not cause any indication on the control panel.
24. Mass Notification Override:The system shall be UL 2572 listed for Mass Notification and shall be capable, based on the Risk Analysis, of being programmed so that Mass Notification/Emergency Communications events take precedence over fire alarm events.
25. Security Monitor Points: The system shall provide means to monitor any point as a type security.
26. One-Man Walk Test: The system shall provide both a basic and advanced walk test for testing the entire fire alarm system. The basic walk test shall allow a single operator to run audible tests on the panel. All logic equation automation shall be suspended during the test and while annunciators can be enabled for the test, all shall default to the disabled state. During an advanced walk test, field-supplied output point programming will react to input stimuli such as CBE and logic equations. When points are activated in advanced test mode, each initiating event shall latch the input. The advanced test shall be audible and shall be used for pull station verification, magnet activated tests on input devices, input and output device and wiring operation/verification.
27. Control By Event Functions: CBE software functions shall provide means to program a variety of output responses based on various initiating events. The control panel shall operate CBE through lists of zones. A zone shall become listed when it is added to a point's zone map through point programming. Each input point such as detector, monitor module or panel circuit module shall support listing of up to 10 zones into its programmed zone map.
28. Permitted zone types shall be general zone, releasing zone and special zone. Each output point (control module, panel circuit module) can support a list of up to 10 zones including general zone, logic zone, releasing zone and trouble zone. It shall be possible for output points to be assigned to list general alarm. Non-Alarm or Supervisory points shall not activate the general alarm zone.
29. 1000 General Zones: The system shall support up to 1000 general purpose software zones for linking inputs to outputs. When an input device activates, any general zone programmed into that device's zone map will be active and any output device that has an active general zone in its map will be active. It shall also be possible to use general zone as arguments in logic equations.
30. 1000 Logic Equations: The system shall support up to 1000 logic equations for AND, OR, NOT, ONLY1, ANYX, XZONE or RANGE operators that allow conditional I/O linking. When any logic equation becomes true, all output points mapped to the logic zone shall activate.
31. 100 trouble equations per device: The system shall provide support for up to 100 trouble equations for each device, which shall permit programming parameters to be altered, based on specific fault

conditions. If the trouble equation becomes true, all output points mapped to the trouble zone shall activate.

32. Control-By-Time: A time based logic function shall be available to delay an action for a specific period of time based upon a logic input with tracking feature. A latched version shall also be available. Another version of this shall permit activation on specific days of the week or year with ability to set and restore based on a 24 hour time schedule on any day of the week or year.
33. Multiple agent releasing zones: The system shall support up to 10 releasing zones to protect against 10 independent hazards. Releasing zones shall provide up to three cross-zone and four abort options to satisfy any local jurisdiction requirements.
34. Alarm Verification, by device, with timer and tally: The system shall provide a user-defined global software timer function that can be set for a specific detector. The timer function shall delay an alarm signal for a user-specified time period and the control panel shall ignore the alarm verification timer if another alarm is detected during the verification period. It shall also be possible to set a maximum verification count between 0 and 20 with the "0" setting producing no alarm verification. When the counter exceeds the threshold value entered, a trouble shall be generated to the panel.
35. Secure/Access Operation: The system shall have the capability of configuring input modules to monitor status of door contact or other security type sensors. These input modules shall be able to be commanded from the normally 'Secure' state to an 'Access' state. While in the secure state, the module will transmit alarm conditions to the controller, which shall be annunciated on the LCD and LED displays. The modules shall be placed into the Access state either through the LCD display or through predefined operator keys. While in the Access state, all alarms from the module will be shunted. Placing the module into the access state shall cause a discrete LED associated with input point to flash, but no other trouble or disable condition will be annunciated. Change from Secure to Access and reverse shall be transmitted to the central monitoring station on a per zone basis. Systems that cause or indicate a trouble or disable condition are unacceptable.

E. Network Communication

1. The FACP shall be capable of communicating on Noti-Fire-Net over a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently regenerative communication format and protocol. The network shall support communication speed up to 100 Mb and support up to 200 panels/nodes per network.

F. Central Processing Unit

1. The Central Processing Unit shall contain and execute all control-by-event (including Boolean functions including but not limited to AND, OR, NOT, ANYx, and CROSSZONE) programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost with system primary and secondary power failure.
2. The Central Processing Unit shall also provide a real-time clock for time annotation, to the second, of all system events. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.
3. The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable.
4. The CPU shall provide an EIA-232 interface between the fire alarm control panel and the UL Listed Electronic Data Processing (EDP) peripherals.
5. The CPU shall provide two EIA-485 ports for the serial connection to annunciation and control subsystem components.
6. The EIA-232 serial output circuit shall be optically isolated to assure protection from earth ground.

G. Display

1. The system display shall provide a 640-character backlit alphanumeric Liquid Crystal Display (LCD). It shall also provide eleven Light-Emitting-Diodes (LEDs) that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM, SECURITY, SUPERVISORY, SYSTEM TROUBLE, OTHER EVENT, SIGNALS SILENCED, POINT DISABLED, CONTROLS ACTIVE, and CPU FAILURE.
2. The system display shall provide a keypad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password

levels with up to ten (one Master and nine User) passwords shall be accessible through the display interface assembly to prevent unauthorized system control or programming.

H. Loop (Signaling Line Circuit) Control Module:

1. The Loop Control Module shall monitor and control a minimum of 318 intelligent addressable devices. This includes 159 intelligent detectors (Ionization, Photoelectric, or Thermal) and 159monitor or control modules.
2. The Loop Control Module shall contain its own microprocessor and shall be capable of operating in a local/degrade mode (any addressable device input shall be capable of activating any or all addressable device outputs) in the unlikely event of a failure in the main CPU.
3. Each Loop shall be capable of operating as a NFPA Style 4 (Class B) circuit. Fault isolation modules shall be installed between each addressable SLC device per the manufacturers installation instructions. Systems which cannot provide full loop loading in Style 7 configurations are not acceptable.
4. The SLC interface board shall receive analog or digital information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular device. Each SLC Loop shall be isolated and equipped to annunciate an Earth Fault condition. The SLC interface board software shall include software to automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and the automatic determination of detector maintenance requirements.

I. Digital Voice Command Center

1. The Digital Voice Command Center located with the FACP, shall contain all equipment required for all audio control, emergency telephone system control, signaling and supervisory functions. This shall include speaker zone indication and control, telephone circuit indication and control, digital voice units, microphone and main telephone handset.
2. Function: The Voice Command Center equipment shall perform the following functions:

   a. Operate as a supervised multi-channel emergency voice communication system.
   b. Operate as a two-way emergency telephone system control center.
   c. Audibly and visually annunciate the active or trouble condition of every speaker circuit and emergency telephone circuit.
   d. Audibly and visually annunciate any trouble condition for digital tone and voice units required for normal operation of the system.
   e. Provide all-call Emergency Paging activities through activation of a single control switch.
   f. As required, provide vectored paging control to specific audio zones via dedicated control switches.
   g. Provide a factory recorded "library" of voice messages and tones in standard WAV. File format, which may be edited and saved on a PC running a current Windows® operating system.
   h. Provide a software utility capable of off-line programming for the DVC operation and the audio message files. This utility shall support the creation of new programs as well as editing and saving existing program files. Uploading or downloading the DVC shall not inhibit the emergency operation of other nodes on the fire alarm network.
   i. Support an optional mode of operation with four analog audio outputs capable of being used with UL 864 fire-listed analog audio amplifiers and SLC controlled switching.
   j. The Digital Voice Command shall be modular in construction, and shall be capable of being field programmable without requiring the return of any components to the manufacturer and without requiring use of any external computers or other programming equipment.
   k. The Digital Voice Command and associated equipment shall be protected against unusually high voltage surges or line transients.

J. Power Supply:

1. The Main Power Supply shall operate on 120/240 VAC, 50/60 Hz, and shall provide all necessary power for the FACP.
2. The Main Power Supply shall provide the required power to the CPU using a switching 24 VDC regulator and shall incorporate a battery charger for 24 hours of standby power using dual-rate charging techniques for fast battery recharge.

3. The Main Power Supply shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge. The supply shall be capable of charging batteries ranging in capacity from 7-200 amp-hours within a 48-hour period.
4. The Main Power Supply shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
5. The Main Power Supply shall be power-limited per UL864 requirements.
6. The Main Power Supply shall communicate power supply, line voltage, battery status and charger status to the local LCD display. Any abnormal condition shall be annunicated and logged to the system alarm history log.
7. Addressable Charger Power SupplyThe auxiliary addressable power supply is a remote 24 VDC power supply used to power Notification Devices and field devices that require regulated 24 VDC power. . NOTIFIER model # ACPS-610
8. The addressable power supply for the fire detection system shall provide up to a minimum of 6.0 amps of 24 volt DC regulated power for Notification Appliance Circuit (NAC) power or 10.0 amps of 24 volt DC general power. The power supply shall have an additional 0.5 amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 12 - 200 amp hour batteries.
9. The addressable power supply shall provide four individually addressable Notification Appliance Circuits that may be configured as Class "B" circuits. All circuits shall be power-limited per UL 864 requirements.
10. The addressable power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single addressable power supply shall be capable of supporting both synchronized and non-synchronized Notification Devices at the same time.
11. The addressable power supply shall operate on 120 or 240 VAC, 50/60 Hz.
12. The interface to the power supply from the Fire Alarm Control Panel (FACP) shall be via the Signaling Line Circuit (SLC) or other multiplexed means Power supplies that do not use an intelligent interface are not suitable substitutes. The required wiring from the FACP to the addressable power supply shall be a single unshielded twisted pair wire.
13. The addressable power supply shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the SLC.
14. The addressable power supply shall have an AC Power Loss Delay option. If this option is utilized and the addressable power supply experiences an AC power loss, reporting of the incident to the FACP will be delayed. A delay time of zero, two, eight or sixteen hours shall be programmable.
15. The addressable power supply shall have an option for Canadian Trouble Reporting and this option shall be programmable.
16. The addressable power supply mounts in either the FACP backbox or it's own dedicated surface mounted backbox with cover.
17. Each of the power supply's four output circuits shall be programmed- for Notification Appliance Circuit or General Purpose 24 VDC power. Any output circuit shall be able to provide up to 2.5 amps of 24 VDC power.
18. The addressable power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired Class "B" or by the use of and end-of-line resistor. When the power supply's output circuit is selected as General 24 VDC power, the circuit shall be individually supervised when an end-of-line relay is used.
19. When selected for Notification Appliance Circuits, the output circuits shall be individually programmable for Temporal.
20. When selected as a Notification Appliance Circuit, the output circuits of the addressable power supply shall have the option to be coded by the use of a universal zone coder.
21. The addressable power supply shall interface and synchronize with other power supplies of the same type. The required wiring to interface multiple addressable power supplies shall be a single unshielded, twisted pair wire.
22. An individual or multiple interfaced addressable power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.

K. Audio Amplifiers

1. The Audio Amplifiers will provide Audio Power () for distribution to speaker circuits.
2. Multiple audio amplifiers may be mounted in a single enclosure, either to supply incremental audio power, or to function as an automatically switched backup amplifier(s).
3. The audio amplifier shall include an integral power supply, and shall provide built-in LED indicators for the following conditions:

    a. Earth Fault on DAP A (Digital Audio Port A)
    b. Earth Fault on DAP B (Digital Audio Port B)
    c. Audio Amplifier Failure Detected Trouble
    d. Active Alarm Bus input
    e. Audio Detected on Aux Input A
    f. Audio Detected on Aux Input B
    g. Audio Detected on Firefighter's Telephone Riser
    h. Receiving Audio from digital audio riser
    i. Short circuit on speaker circuit 1
    j. Short circuit on speaker circuit 2
    k. Short circuit on speaker circuit 3
    l. Short circuit on speaker circuit 4
    m. Data Transmitted on DAP A
    n. Data Received on DAP A
    o. Data Transmitted on DAP B
    p. Data Received on DAP B
    q. Board failure
    r. Active fiber optic media connection on port A (fiber optic media applications)
    s. Active fiber optic media connection on port B (fiber optic media applications)
    t. Power supply Earth Fault
    u. Power supply 5V present
    v. Power supply conditions - Brownout, High Battery, Low Battery, Charger Trouble

4. The audio amplifier shall provide the following built-in controls:

    a. Amplifier Address Selection Switches
    b. Signal Silence of communication loss annunciation Reset
    c. Level adjustment for background music
    d. Enable/Disable for Earth Fault detection on DAP A
    e. Enable/Disable for Earth Fault detection on DAP A
    f. Switch for 2-wire/4-wire FFT riser

5. Adjustment of the correct audio level for the amplifier shall not require any special tools or test equipment.
6. Includes audio input and amplified output supervision, back up input, and automatic switch over function, (if primary amplifier should fail).
7. System shall be capable of backing up digital amplifiers.
8. One-to-one backup shall be provided by either a plug-in amplifier card or a designated backup amplifier of identical model as the primary amplifier.
9. One designated backup amplifier shall be capable of backing up multiple primary amplifiers mounted in the same or adjacent cabinets.
10. Multi-channel operation from a single amplifier shall be supported by the addition of an optional plug-in amplifier card.

L. Audio Message Generator (Prerecorded Voice)/Speaker Control:

1. Each initiating zone or intelligent device shall interface with an emergency voice communication system capable of transmitting a prerecorded voice message to all speakers in the building.
2. Actuation of any alarm initiating device shall cause a prerecorded message to sound over the speakers. The message shall be repeated four (4) times. Pre- and post-message tones shall be supported.
3. A built-in microphone shall be provided to allow paging through speaker circuits.
4. System paging from emergency telephone circuits shall be supported.
5. The audio message generator shall have the following indicators and controls to allow for proper operator understanding and control:

a. Lamp Test
b. Trouble
c. Off-Line Trouble
d. Microphone Trouble
e. Phone Trouble
f. Busy/Wait
g. Page Inhibited
h. Pre/Post Announcement Tone

M. Controls with associated LED Indicators:

1. Speaker Switches/Indicators

a. The speaker circuit control switches/indicators shall include visual indication of active and trouble status for each speaker circuit in the system.
b. The speaker circuit control panel shall include switches to manually activate or deactivate each speaker circuit in the system.

2. Emergency Two-Way Telephone Control Switches/Indicators

a. The emergency telephone circuit control panel shall include visual indication of active and trouble status for each telephone circuit in the system.
b. The telephone circuit control panel shall include switches to manually activate or deactivate each telephone circuit in the system.

N. Remote Transmissions:

1. Provide local energy or polarity reversal or trip circuits as required.
2. The system shall be capable of operating a polarity reversal or local energy or fire alarm transmitter for automatically transmitting fire information to the fire department.
3. Provide capability and equipment for transmission of zone alarm and trouble signals to remote operator's terminals, system printers and annunciators.
4. Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required features.

O. Field Programming

1. The system shall be programmable, configurable and expandable in the field without the need for special tools, laptop computers, or other electronic interface equipment. There shall be no firmware changes required to field modify the system time, point information, equations, or annunciator programming/information.
2. All field defined programs shall be stored in non-volatile memory.Two levels of password protection shall be provided in addition to a key-lock cabinet. One level shall be used for status level changes such as point/zone disable or manual on/off commands (Building Manager). A second (higher-level) shall be used for actual change of the life safety program (installer). These passwords shall be five (5) digits at a minimum. Upon entry of an invalid password for the third time within a one minute time period an encrypted number shall be displayed. This number can be used as a reference for determining a forgotten password. .
3. The system programming shall be "backed" up via an upload/download program, and stored on compatible removable media. A system back-up disk shall be completed and given in duplicate to the building owner and/or operator upon completion of the final inspection. The program that performs this function shall be "non-proprietary", in that, it shall be possible to forward it to the building owner/operator upon his or her request.
4. The installer's field programming and hardware shall be functionally tested on a computer against known parameters/norms which are established by the FACP manufacturer. A software program shall test Input-to-Output correlations, device Type ID associations, point associations, time equations, etc. This test shall be performed on an IBM-compatible PC with a verification software package. A report shall be generated of the test results and two copies turned in to the engineer(s) on record.

P. Specific System Operations

1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.
2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 0 to 60 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

Q. System Point Operations:

1. Any addressable device in the system shall have the capability to be enabled or disabled through the system keypad or video terminal.
2. System output points shall be capable of being turned on or off from the system keypad or the video terminal.
3. Point Read: The system shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point shall be annunciated for the parameters listed:

    a. Device Status.
    b. Device Type.
    c. Custom Device Label.
    d. Software Zone Label.
    e. Device Zone Assignments.
    f. Analog Detector Sensitivity.
    g. All Program Parameters.

4. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 4000 system events. Each of these events will be stored, with time and date stamp, until an operator requests that the contents be either displayed or printed. The contents of the history buffer may be manually reviewed; one event at a time, and the actual number of activations may also be displayed and or printed. History events shall include all alarms, troubles, operator actions, and programming entries.
5. The history buffer shall use non-volatile memory. Systems which use volatile memory for history storage are not acceptable.
6. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time.
7. If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the trouble mode, and the particular Intelligent Detector will be annunciated on the system display, and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
8. The system shall include the ability (programmable) to indicate a "pre-alarm" condition. This will be used to alert maintenance personal when a detector is at 80% of its alarm threshold in a 60 second period.

W. System Maintenance Analysis and Reporting

1. The system shall automatically track NFPA 72 installation and testing requirements for all addressable devices to ensure that every device is functionally tested upon installation and then periodically as required by the Code.
2. If after twelve months any device has not been functionally tested a led shall illuminate on the CPU or Network annunciator indicating the device that needs testing.
3. The system shall automatically track device testing to ensure that a visual inspection is performed at least semi-annually.
4. If after six months a device has not been indicated as "visually inspected" a led shall illuminate on the CPU or Network annunciator indicating the device that needs testing.

5. A hand-held IR tool may be used to interact with each SLC device to indicate that a visual inspection has been performed. The IR device will explicitly identify the device by loop and address to ensure the correct visual inspection has been performed.
6. A comprehensive report shall be available from the laptop programmer which shows a predictive report of all devices that have upcoming testing requirements. These reports shall be configurable as either 30, 60 or 90 day predictive, current status, and "all database."
7. Systems that do not automatically track the individual testing requirements of the field devices will not be accepted.

2.3 SYSTEM COMPONENTS:

A. Fixed Emergency Telephone Handset

1. The telephone cabinet shall be painted red and clearly labeled emergency telephone. The cabinets shall be located where shown on drawings.
2. The handset cradle shall have a switch connection such that lifting the handset off of the cradle shall send a signal to the fire command center which shall audibly and visually indicate its on-line (off-hook) condition.
3. The two-way emergency telephone system shall support a maximum of seven (7) handsets on line (off hook) without degradation of the signal.

B. Universal Digital Alarm Communicator Transmitter (UDACT). The UDACT is an interface for communicating digital information between a fire alarm control panel and an UL-Listed central station.

1. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.
2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to two different telephone numbers.
3. The UDACT shall be capable of transmitting events in 4+2, SIA, and Contact ID.
4. Communication shall include vital system status such as:

    a. Independent Zone (Alarm, trouble, non-alarm, supervisory)
    b. Independent Addressable Device Status
    c. AC (Mains) Power Loss
    d. Low Battery and Earth Fault
    e. System Off Normal
    f. 12 and 24 Hour Test Signal
    g. Abnormal Test Signal (per UL requirements)
    h. EIA-485 Communications Failure
    i. Phone Line Failure

5. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 3,064 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.
6. The UDACT shall be capable of being programmed with the same programming utility as the host FACP, and saved, edited and uploaded and downloaded using the utility. UDACT shall be capable of being programmed online or offline. The programming utility shall also support upgrading UDACT operating firmware.
7. The UDACT shall be capable of generating Central Station reports providing detailed programming information for each point along with the central station point address.
8. An IP or IP/GSM Communicator option shall be available to interface to the UDACT and be capable of transmitting signals over the internet/intranet or Cellular (GSM) network to a compatible receiver.

C. Field Wiring Terminal Blocks

1. For ease of service all panel I/O wiring terminal blocks shall be removable, plug-in types and have sufficient capacity for #18 to #12 AWG wire. Terminal blocks that are permanently fixed are not acceptable.

D. Printer

1. The printer shall provide hard-copy printout of all changes in status of the system and shall time-stamp such printouts with the current time-of-day and date. The printer shall be standard carriage with 80-characters per line and shall use standard pin-feed paper. The printer shall be enclosed in a separate cabinet suitable for placement on a desktop or table. The printer shall communicate with the control panel using an interface complying with Electrical Industries Association standard EIA-232D. Power to the printer shall be 120 VAC @ 60 Hz.
2. The system shall have a strip printer capable of being mounted directly in the main FACP enclosure. Alarms shall be printed in easy-to-read RED, other messages, such as a trouble, shall be printed in BLACK. This printer shall receive power from the system power supply and shall operate via battery back-up if AC mains are lost. The strip printer shall be UL 864 listed.
3. The system shall have a strip printer capable of being mounted directly in the main FACP enclosure. Alarms shall be printed in easy-to-read RED, other messages, such as a trouble, shall be printed in BLACK. This printer shall receive power from the system power supply and shall operate via battery back-up if AC mains are lost. The strip printer shall be UL 864 listed.

2.5 SYSTEM COMPONENTS - ADDRESSABLE DEVICES

A. Addressable Devices – General

1. Addressable devices shall provide an address-setting means using rotary decimal switches. Addressable devices that require the address be programmed using a programming utility are not an allowable substitute.
2. Addressable devices shall use simple to install and maintain decade, decimal address switches. Devices shall be capable of being set to an address in a range of 001 to 159.
3. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.
4. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.
5. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.
6. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
7. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.
8. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.
9. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature.
10. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
11. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.

12. Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.
13. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.
14. Addressable modules shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box. An optional surface mount Lexan enclosure shall be available.

B. Addressable Manual Fire Alarm Box (manual station)

1. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status; NOTIFIER model # NBG-12LX. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

C. Intelligent Photoelectric Smoke Detector: The intelligent photoelectric smoke detector shall be NOTIFIER model # FSP-851 and shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

D. Intelligent Thermal Detectors: The intelligent thermal detectors shall be NOTIFIER FST- series addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. A high heat thermal detector rated at 190 degrees Fahrenheit shall also be available. The thermal detectors shall connect via two wires to the fire alarm control panel signaling line circuit.

E. Intelligent Duct Smoke Detector: The smoke detector housing shall accommodate an intelligent photoelectric detector that provides continuous analog monitoring and alarm verification from the panel. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system. The Intelligent Duct Smoke Detector shall support the installation of addressable Photoelectric detector capable or being tested remotely. The Intelligent Duct Detector housing shall be model # FSD-751PL.

F. Addressable Dry Contact Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs. The addressable monitor module shall be NOTIFIER model # FMM-1 (Class B) or FMM-101 (Class B)
2. The IDC zone shall be suitable for Style B/Class B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.
4. For multiple dry contact monitoring a module shall be available that provides 10 Style B or 5 Style D input circuits; NOTIFIER model # XP10-M.

G. Addressable Control Module

1. Addressable control modules shall be provided to supervise and control the operation of one conventional circuit of compatible Notification Appliances, 24 VDC powered, polarized audio/visual notification appliances; NOTIFIER model # FCM-1
2. The control module NAC may be wired for Style Y (Class B) with a current rating of and 3 Amps for Style Y.

3. Audio/visual power shall be provided by a separate supervised circuit from the main fire alarm control panel or from a supervised UL listed remote supply.

H. Addressable Relay Module:

1. Addressable Relay Modules shall be available for HVAC control and other network building functions; NOTIFIER model # FRM-1.
2. The module shall provide two form C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.
3. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary devices energize at the same time on the same pair of wires;
4. For multiple relay control a module shall be available that provides 6 programmable Form-C relays; NOTIFIER model # XP6-R.

I. Isolator Module: Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building; NOTIFIER model # ISO-X.

1. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
2. The isolator module shall not require address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
3. The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

J. Serially Connected Annunciator Requirements

1. The annunciator shall communicate to the fire alarm control panel via an EIA 485 (multi-drop) two-wire communications loop. The system shall support two 6,000 ft. EIA-485 wire runs. Up to 32 annunciators, each configured up to 96 points, may be connected to the connection, for a system capacity of 3,072 points of annunciation.
2. An EIA-485 repeater shall be available to extend the EIA-485 wire distance in 3,000 ft. increments. The repeater shall be UL864 approved.
3. Each annunciator shall provide up to 96 alarm and 97 trouble indications using a long-life programmable color LED's. Up to 96 control switches shall also be available for the control of Fire Alarm Control Panel functions. The annunciator will also have an "ON-LINE" LED, local piezo sounder, local acknowledge and lamp test switch, and custom zone/function identification labels.
4. The annunciator may be field configured to operate as a "Fan Control Annunciator". When configured as "Fan Control," the annunciator may be used to manually control fan or damper operation and can be set to override automatic commands to all fans/dampers programmed to the annunciator.
5. Annunciator switches may be programmed for System control such as, Global Acknowledge, Global Signal Silence, Global System Reset, and on/off control of any control point in the system.
6. An optional module shall be available to utilize annunciator points to drive EIA-485 driven relays. This shall extend the system point capacity by 3,072 remote contacts.
7. The LED annunciator shall offer an interface to a graphic style annunciator and provide each of the features listed above.

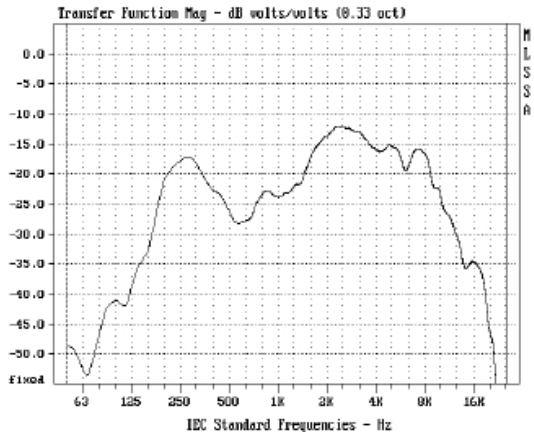
K. Speakers

1. The speaker shall be listed to UL 1480 for Fire Protective Signaling Systems. It shall be a dual-voltage transformer speaker capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
2. A universal mounting plate shall be used for mounting ceiling and wall speaker products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate.
3. Speakers shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open

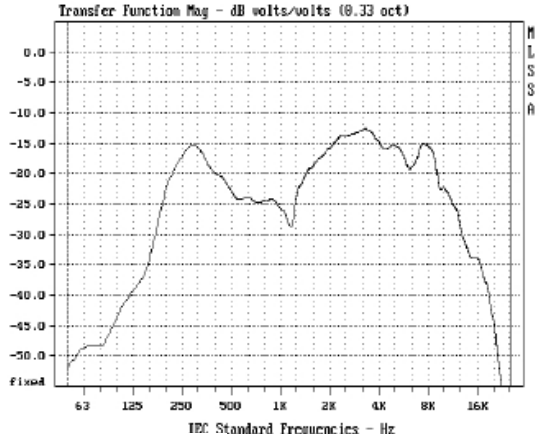
circuit if the device is removed. Speaker design shall isolate speaker components to reduce ground fault incidents.

4. The speaker shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction.
5. All notification appliances shall be backward compatible.

Ceiling Speaker
Wide Band Frequency Response



Wall Speaker
Wide Band Frequency Response



Note: The wide band frequency response is derived using MLS methods

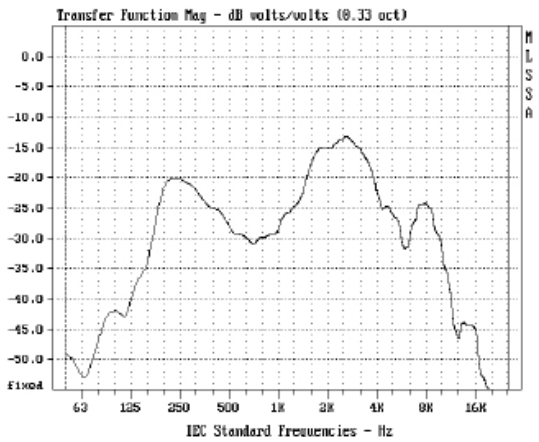
L. Speaker Strobes

1. The speaker strobe shall be listed to UL 1971 and UL 1480 and be approved for fire protective signaling systems. It shall be a dual-voltage transformer speaker strobe capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
2. A universal mounting plate shall be used for mounting ceiling and wall speaker strobe products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate.
3. Speaker strobes shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker strobe design shall isolate speaker components to reduce ground fault incidents.
4. The speaker strobe shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction. The strobe shall consist of a xenon flash tube with associated lens/reflector system and operate on either 12V or 24V. The strobe shall also feature selectable candela output, providing options for 15 or 15/75 candela when operating on 12V and 15, 15/75, 30, 75, 110, or 115 when operating on 24V. The strobe shall comply with NFPA 72 and the Americans with Disabilities Act requirement for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range.
5. All notification appliances shall be backward compatible.

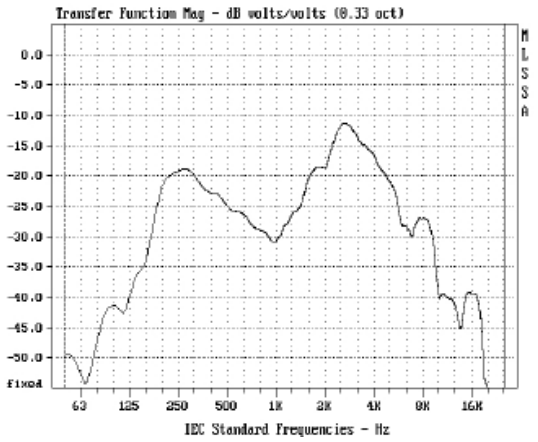
Ceiling Speaker Strobe

Wall Speaker Strobe

Wide Band Frequency Response



Wide Band Frequency Response



Note: The wide band frequency response is derived using MLS methods

6. Strobe lights shall meet the requirements of the ADA, UL Standard 1971and be fully synchronized.

PART 3 - EXECUTION

3.1. INSTALLATION:

A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

D. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

3.2. TEST:

The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72.

A. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

B. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

C. Verify activation of all waterflow switches.

D. Open initiating device circuits and verify that the trouble signal actuates.

E. Open and short signaling line circuits and verify that the trouble signal actuates.

F. Open and short notification appliance circuits and verify that trouble signal actuates.

G. Ground all circuits and verify response of trouble signals.

H. Check presence and audibility of tone at all alarm notification devices.

I. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.

J. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

K. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.3. FINAL INSPECTION:

A. At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.

3.4. INSTRUCTION

A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

END OF SECTION

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SECTION 31 10 00
SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Removing existing vegetation.
2. Clearing and grubbing.
3. Stripping and stockpiling topsoil.
4. Removing above- and below-grade site improvements.
5. Temporary erosion- and sedimentation-control measures.

B. Related Sections:

1. Section 015000 "Temporary Facilities and Controls" for temporary utility services, construction and support facilities, security and protection facilities**,** and temporary erosion- and sedimentation-control measures.
2. Section 017300 "Execution" for field engineering and surveying.

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain SCHOOL DISTRICT's property, cleared materials shall become subcontractor's property and shall be removed from Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or videotape.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference if requested by OWNER.

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from SCHOOL DISTRICT and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by ENGINEER or authorities having jurisdiction.

B. Salvable Improvements: Carefully remove items indicated to be salvaged or discovered on site and store on SCHOOL DISTRICT's premises per SCHOOL DISTRICT direction.

C. Utility Locator Service: Notify SCHOOL DISTRICT for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

E. The following practices are prohibited within protection zones:

1. Storage of construction material, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

H. Soil Stripping, Handling, and Stockpiling: Perform as directed by geotechnical report**.**

I. Potential non-reusable soil – SCHOOL DISTRICT shall remove or provide information on the location of any soil that does not meet SCHOOL DISTRICT internal soil reuse policy.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to SCHOOL DISTRICT.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. General: Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection." Protect California red-legged frog per mandated conservation efforts documented by SCHOOL DISTRICT.

3.4 EXISTING UTILITIES

A. SCHOOL DISTRICT will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by subcontractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.
2. SCHOOL DISTRICT will arrange to shut off indicated utilities when requested by subcontractor.

C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by SCHOOL DISTRICT or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify SCHOOL DISTRICT not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without SCHOOL DISTRICT's written permission.

D. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Grind down stumps and remove roots, obstructions, and debris to a depth of 24 inches below exposed subgrade.
2. Use only hand methods for grubbing within protection zones.
3. Chip removed tree branches and dispose of off-site or per SCHOOL DISTRICT recommendation.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground, according to geotechnical recommendations.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 8 inches (200 mm) in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off SCHOOL DISTRICT's property.

B. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 31 10 00

1. Install separation geotextile if required on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape subbase course and base course to required crown elevations and cross-slope grades.
4. Place subbase course and base course 6 inches (150 mm) or less in compacted thickness in a single layer.
5. Place subbase course and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches (300 mm) wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.17 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.18 FIELD QUALITY CONTROL

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

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material and maximum lift thickness comply with requirements.
3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

B. Testing Agency: SCHOOL DISTRICT will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by SCHOOL DISTRICT.

E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and/or ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet (30 m) or less of wall length, but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet (46 m) or less of trench length, but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.19 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by SCHOOL DISTRICT; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off SCHOOL DISTRICT's property.

B. Transport surplus satisfactory soil to designated storage areas on SCHOOL DISTRICT's property. Stockpile or spread soil as directed by SCHOOL DISTRICT.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off SCHOOL DISTRICT's property.

END OF SECTION 31 20 00

SECTION 31 23 00
TRENCHING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.1 SUMMARY

A. Trench, backfill, and compact as specified herein and as needed for installation of underground utilities associated with the Work.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 01 of these Specifications.

1.2 SYSTEM DESCRIPTION

A. Quality Assurance:

1. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

2. Use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.

3. In addition to complying with requirements of governmental agencies having jurisdiction, comply with the directions of the construction soil engineer.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Fill and backfill materials:

1. Provide soil materials free from organic matter and deleterious substances, containing no rocks or lumps over 3” in greatest dimension, and with not more than 10% of the rocks or lumps larger than 1” in their greatest dimension.

2. Fill material is subject to the approval of the construction soil engineer, and is that material removed from excavations or imported from offsite borrow areas, predominantly granular, non-expansive soil free from roots and other deleterious matter.

3. Imported fill material shall, in addition, have 10 to 40% by weight passing the #200 sieve, a plasticity index of less than 15, and a liquid limit of less than 30%.

2.2 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 FINISH ELEVATIONS AND LINES

A. Comply with documents and existing elevations.

3.3 PROCEDURES

A. Utilities:

1. Unless shown to be removed, protect active utility lines shown on the Drawings or otherwise made known to the Contractor prior to trenching. If damaged, repair or replace at no additional cost to the Owner.

2. If active utility lines are encountered, and are not shown on the Drawings or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.

3. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.

4. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Architect and secure his instructions.

5. Do not proceed with permanent relocation of utilities until written instructions are received from the Architect.

B. Protection of persons and property:

1. Barricade open holes and depressions occurring as part of the Work, and post warning lights on property adjacent to or with public access.

2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.

3. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement, lateral movement, washout, and other hazards created by operations under this Section.

C. De-watering:

1. Remove all water, including rainwater; encountered during trench and substructure work to an approved location by pumps, drains, and other approved methods.

2. Keep trenches and site construction area free from water.

D. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.

E. Maintain access to adjacent areas at all times.

3.4 TRENCHING

A. Provide sheeting and shoring necessary for protection of the Work and for the safety of personnel.

1. Prior to backfilling, remove all sheeting.

2. Do not permit sheeting to remain in the trenches except when, in the opinion of the Architect, field conditions or the type of sheeting or methods of construction such as use of concrete bedding are such as to make removal of sheeting impracticable. In such cases, the Architect may permit portions of sheeting to be cut off and remain in the trench.

B. Open cut:

1. Excavate for utilities by open cut.

2. If conditions at the site prevent such open cut, and if approved by the Architect, trenching may be used.

3. Short sections of a trench may be tunneled if, in the opinion of the Architect, the conductor can be installed safely and backfill can be compacted properly into such tunnel.

4. Where it becomes necessary to excavate beyond the limits of normal excavation lines in order to remove boulders or other interfering objects, backfill the voids remaining after removal of the objects as directed by the construction soil engineer.

5. When the void is below the subgrade for the utility bedding, use approved earth materials and compact to the relative density directed by the construction soil engineer, but in no case to a relative density less than 90%.

6. When the void is the side of the utility trench or open cut, use approved earth or sand compacted as approved by the construction soil engineer, but in no case to a relative density less than 85%.

7. Remove boulders and other interfering objects, and backfill voids left by such removals, at no additional cost to the Owner.

8. Excavating for appurtenances:

a. Excavate for manholes and similar structures to a distance sufficient to leave at least 12” clear between outer surfaces and the embankment or shoring that may be used to hold and protect the banks.

b. Overdepth excavation beyond such appurtenances that has not been directed will be considered unauthorized. Fill with sand, gravel, or lean concrete as directed by the construction soil engineer, and at no additional cost to the Owner.

C. Trench to the minimum width necessary for proper installation of the utility, with sides as nearly vertical as possible. Accurately grade the bottom to provide uniform bearing for the utility.

D. Depressions:

1. Dig bell holes and depressions for joints after the trench has been graded. Provide uniform bearing for the pipe on prepared bottom of the trench.

2. Except where rock is encountered, do not excavate below the depth indicated or specified.

3. Where rock is encountered, excavate rock to a minimum overdepth of 4" below the trench depth indicated or specified.

E. Where utility runs traverse public property or are subject to governmental or utility company jurisdiction, provide depth, bedding, over, and other requirements as sedt forth by legally constituted authority having jurisdiction, but in no case less than the depth shown in the Contract Documents.

F. Where trenching occurs in existing lawns, remove turf in sections and keep damp. Replace turf upon completion of the backfilling.

G. Cover:

1. Provide minimum trench depth indicated below to maintain a minimum cover over the top of the installed item below the finish grade or subgrade:

a. Areas subject to vehicular traffic:

(1) Sanitary sewers: 24";

(2) Storm drains: 24".

b. Areas not subject to vehicular traffic:

(1) Sanitary sewers: 18";

(2) Storm drains: 18".

c. All areas:

(1) Water lines: 18";

(2) Natural gas lines: 18";

(3) Electrical cables: 24";

(4) Electrical ducts: 18".

d. Concrete encased:

(1) Pipe sleeves for water and gas lines: 18";

(2) Sanitary sewers and storm drains: 12";

(3) Electrical ducts: 18".

2. Where utilities are under a concrete structure slab or pavement, the minimum depth need only be sufficient to completely encase the conduit or pipe sleeve, and electrical long radius rigid metal conduit rise, provided it will not interfere with the structural integrity of the slab or pavement.

3. Where the minimum cover is not provided, encase the pipes in concrete as indicated. Provide concrete with a minimum 28-day compressive strength of 2500 psi.

3.5 BEDDING

A. Provide bedding as indicated in the Drawings.

3.6 BACKFILLING

A. General:

1. Do not completely backfill trenches until required pressure and leakage tests have been performed, and until the utilities systems as installed conform to the requirements specified in the pertinent Sections of these Specifications.

2. Except as otherwise specified or directed for special conditions, backfill trenches to the ground surface with selected material approved by the construction soil engineer.

3. Reopen trenches that have been improperly backfilled, to a depth as required for proper compaction. Refill and compact as specified, or otherwise correct to the approval of the construction soil engineer.

4. Do not allow or cause any of the Work performed or installed to be covered up or enclosed by work of this Section prior to required inspections, tests, and approvals.

5. Should any of the Work be so enclosed or covered up before it has been approved, uncover all such Work and, after approvals have been made, refill and compact as specified, all at no additional cost to the Owner.

B. Lower portion of trench:

1. Deposit approved backfill and bedding material in layers of 12” maximum thickness, and compact with suitable tampers to 90% relative density (85% in landscape areas), until there is a cover of not less than 24” over sewers and 12” over other utility lines.

2. Take special care in backfilling and bedding operations to not damage pipe and pipe coatings.

C. Remainder of trench:

1. Except for special materials for pavements, backfill the remainder of the trench with approved backfill.

2. Deposit backfill material in layers not exceeding the thickness specified, and compact each layer to the minimum density indicated by the construction soil engineer.

D. Adjacent to buildings: Mechanically compact backfill within ten feet of buildings.

E. Consolidation of backfill by jetting with water may be permitted, when specifically approved by the construction soil engineer, in areas other than building and pavement areas.

3.7 TEST FOR DISPLACEMENT OF SEWERS AND STORM DRAINS

A. Check sewers and storm drains to determine whether displacement has occurred after the trench has been backfilled to above the pipe and has been compacted as specified.

B. Flash a light between manholes or, if the manholes have not yet been constructed, between the locations of the manholes, by means of a flashlight or by reflecting sunlight with a mirror.

C. If the illuminated interior of the pipeline shows poor alignment, displaced pipes, or any other defects, correct the defects to the specified conditions and at no additional cost to the Owner.

3.8 PIPE JACKING

A. The Contractor may, at his option, install steel pipe casings, tongue and groove reinforced concrete pipes, and steel pipes under existing roads or pavements by jacking into place using procedures approved by the governmental agencies having jurisdiction and approved by the construction soil engineer.

3.9 TUNNELING OPERATIONS

A. The Contractor may, at his option, tunnel pipes into position using procedures approved by the construction soil engineer and the governmental agencies having jurisdiction.

3.10 FIELD QUALITY CONTROL

A. The construction soil engineer will instruct open cuts and trenches before installation of utilities, and will make the following tests:

1. Assure that trenches are not backfilled until all tests have been completed;

2. Check backfilling for proper layer thickness and compaction;

3. Verify that test results conform to the specified requirements, and that sufficient tests are performed;

4. Assure that defective work is removed and properly replaced.

END OF SECTION 31 23 00

SECTION 32 12 16
ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 REFERENCES

A. The following documents form a part of these specifications to the extent stated herein.

B. State of California, Department of Transportation (CALTRANS)

CALTRANS Standard Specifications:
- Sec 26. Aggregate Bases
- Sec 37. Bituminous Seals
- Sec 39. Asphalt Concrete
- Sec 88 Geosynthetics
- Sec 92. Asphalts
- Sec 93. Liquid Asphalts
- Sec 94. Asphaltic Emulsions

1.3 SUMMARY

A. Section Includes:

1. Cold milling of existing asphalt pavement.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving.
4. Hot-mix asphalt overlay.
5. Asphalt curbs.
6. Asphalt traffic-calming devices.
7. Asphalt surface treatments.

B. Related Requirements:

1. Section 312000 "Earth Moving" for subgrade preparation, fill material, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.

1.4 PRECONSTRUCTION MEETINGS

A. Preconstruction Conference: Conduct conference if required by SCHOOL DISTRICT.

1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

   a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
   b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include technical data and tested physical and performance properties.

2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
3. Job-Mix Designs: For each job mix proposed for the Work.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and testing agency.

B. Material Certificates: For each paving material.

C. Material Test Reports: For each paving material, by a qualified testing agency.

D. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Perform work in accordance with the State of California, Department of Transportation (CALTRANS) Standard Specifications, Sec 26, 37, 39, 88 92, 93, and 94.

B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of State of California, Department of Transportation (CALTRANS) Standard Specifications for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Tack Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
2. Slurry Seal: Comply with CALTRANS Standard Specification Section 37-3.03D(4)(a)(iii);
3. Asphalt Base Course: Minimum surface temperature of 50 deg F (10 deg C) and rising at time of placement.
4. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.6 deg C) at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

General: Use materials and gradations that comply with CALTRANS Standard Specification Section 39-1.02E: Aggregate:

1. 1/2-inch maximum HMA, Type A for asphalt concrete overlay

2.2 ASPHALT MATERIALS

A. Asphalt Binder: Comply with CALTRANS Standard Specification Section 39-1.02C

Hot Mix Asphalt PG 64-10.

B. Tack Coat: Comply with CALTRANS Standard Specification Section 39-1.02B, Hot Mix Asphalt, grade SS1h asphaltic emulsion.

C. Fog Seal: Comply with CALTRANS Standard Specification Section 37-2.02D; Bituminous Seals, grade SS1h asphaltic emulsion.

D. Water: Potable.

2.3 AUXILIARY MATERIALS

A. Reclaimed Asphalt Pavement: Comply with CALTRANS Standard Specification Section 39-1.02F.

B. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.

C. Sand: Comply with CALTRANS Standard Specification Section 39-1.02E.

D. Geotechnical Subsurface Reinforcement: Comply with CALTRANS Standard Specification Section 88-102D

2.4 MIXES

A. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes complying with CALTRANS sec 39-1.03 and complying with the following requirements:

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

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

3.2 COLD MILLING

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.

1. Mill to a depth of 2 inches (50 mm).
2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
3. Control rate of milling to prevent tearing of existing asphalt course.
4. Repair or replace curbs, manholes, and other construction damaged during cold milling.
5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
6. Patch surface depressions deeper than 1 inch (25 mm) after milling, before wearing course is laid.
7. Handle milled asphalt material according to approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."
8. Keep milled pavement surface free of loose material and dust.
9. Do not allow milled materials to accumulate on-site unless requested by SCHOOL DISTRICT.

3.3 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 gal./sq. yd. (0.2 L/sq. m).

1. Allow tack coat to cure per manufacturers requirements, undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

C. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

D. Placing Patch Material: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.4 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch (25 mm) in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches (75 mm) thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch (6 mm).

1. Clean cracks and joints in existing hot-mix asphalt pavement.
2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.
3. Use hot-applied joint sealant to seal cracks and joints more than 1/2 inch (12 mm) wide. Fill flush with surface of existing pavement and remove excess.
4. Refer to “3.3 Patching” for cracks greater than ½ inch.

3.5 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.15 gal./sq. yd. (0.6 L/sq. m).

1. Allow tack coat to cure per manufacturers requirements undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.6 GEOSYNTHETIC PAVEMENT INSTALLATION

A. Comply with CALTRANS Standard Specification Section 39-1.09.

B. Apply asphalt binder uniformly to existing pavement surfaces at a rate of 0.25 gal./sq. yd. (to 1.0 L/sq. m).

C. Place paving geosynthetic promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches (100 mm) and transverse joints 6 inches (150 mm).

D. Protect paving geosynthetic from traffic and other damage, and place hot-mix asphalt overlay the same day.

3.7 PLACING HOT-MIX ASPHALT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at a minimum temperature of 250 deg F (121 deg C).
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches (25 to 38 mm) from strip to strip to ensure proper compaction of mix along longitudinal joints.
2. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.8 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

3.9 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927, but not less than 94 percent or greater than 100 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.10 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch (13 mm).
2. Surface Course: Plus 1/4 inch (6 mm), no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 12-foot (3.6-m) straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch (6 mm).
2. Surface Course: 1/8 inch (3 mm).
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

3.11 SURFACE TREATMENTS

A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.

B. Slurry Seals: Apply slurry seals according to CALTRANS Standard Specification Section 37-3.

1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: SCHOOL DISTRICT will engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. FLOOD TEST

A. Prior to application of seal coat, perform a flood test in the presence of SCHOOL DISTRICT.

Method:

1. Flood the entire asphaltic concrete paved area with water by use of a tank truck or hoses.

2. If a depression is found where water ponds to a depth of more than 1/8" in six feet, fill or otherwise correct to provide proper drainage.

3. Feather and smooth the edges of fill so that the joint between fill and original surface is invisible.

3.13 WASTE HANDLING

A. General: Handle asphalt-paving waste according to approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."

END OF SECTION 32 12 16

SECTION 32 13 13
CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 REFERENCES

A. The following documents form a part of these specifications to the extent stated herein.

B. State of California, Department of Transportation (CALTRANS)

1. CALTRANS Standard Specifications:
   Sec 37 Bituminous Seals
   Sec 90 Concrete

1.3 SUMMARY

A. Section Includes:

1. Driveways.
2. Roadways.
3. Parking lots.
4. Curbs and gutters.
5. Walks.

B. Related Sections:

1. Section 033000 "Cast-in-Place Concrete" for general building applications of concrete.

1.4 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.5 ACTION SUBMITTALS

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

B. Design Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

D. Other Action Submittals:

1. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

E. Color:

1. Light colored concrete can reduce heat island effect in urban areas. Specify concrete with an emissivity of .9 when tested for ASTM 408 and an initial reflectance of at least .25 when tested for ASTM E903.

1.6 INFORMATIONAL SUBMITTALS

A. Perform submittals in accordance with CALTRANS Sec 90-1.01C

1.7 QUALITY CONTROL and ASSURANCE

A. Perform Quality Control and Assurance in accordance with CALTRANS Sec 90-1.01D

B. Retain subparagraph below, which is required by ACI 301 and ASTM C 31. ASTM C 1077 notes that relevant field or laboratory technician certification by ACI, NRMCA, PCA, or the National Institute for Certification in Engineering Technologies may demonstrate evidence of competence.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

C. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.

D. ACI Publications: Comply with ACI 301 unless otherwise indicated.

1.8 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities based on the California Manual of Uniform Traffic Control Devices (CA MUTCD).

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F (12.8 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C).

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet (30.5 m) or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.2 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from steel wire into flat sheets.

B. Reinforcing Bars: ASTM A 615, Grade 60 (Grade 420); deformed.

C. Galvanized Reinforcing Bars: ASTM A 767, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615, Grade 60 (Grade 420) deformed bars.

D. Epoxy-Coated Reinforcing Bars: ASTM A 775 or ASTM A 934; with ASTM A 615, Grade 60 (Grade 420) deformed bars.

E. Steel Bar Mats: ASTM A 184; with ASTM A 615, Grade 60 (Grade 420), deformed bars; assembled with clips.

F. Joint Dowel Bars: ASTM A 615, Grade 60 (Grade 420) plain-steel bars ; zinc coated (galvanized) after fabrication according to ASTM A 767, Class I coating. Cut bars true to length with ends square and free of burrs.

G. Epoxy-Coated, Joint Dowel Bars: ASTM A 775; with ASTM A 615, Grade 60 (Grade 420), plain-steel bars.

H. Tie Bars: ASTM A 615, Grade 60 (Grade 420), deformed.

I. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

J. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

K. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

L. Zinc Repair Material: ASTM A 780.

2.3 CONCRETE MATERIALS

A. Perform in accordance with CALTRANS Sec 90-1.02 MATERIALS

1. Sec 90-1.02A General
2. Sec 90-1.02B Cementitious Materials
3. Sec 90-1.02C Aggregates
4. Sec 90-1.02D Water
5. Sec 90-1.02E Admixtures
6. Sec 90-1.02F Proportioning Concrete
7. Sec 90-1.02G Mixing and Transporting Concrete
8. Sec 90-1.02H Concrete in Corrosive Environments
9. Sec 90-1.02I Concrete in Freeze-Thaw Areas
10. Sec 90-1.02J Curing Compound

B. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.

1. Color: Match SCHOOL DISTRICT's sample per architect's drawings.

2.4 CURING MATERIALS

A. Perform in accordance with CALTRANS Sec 90-1.03 CONSTRUCTION
1. Sec 90-1.03A General
2. Sec 90-1.03B Curing Concrete
3. Sec 90-1.03C Protecting Concrete

2.5 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch (3 to 6 mm). Use only when approved by SCHOOL DISTRICT.

F. Pigmented Mineral Dry-Shake Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement. Use only when approved by SCHOOL DISTRICT.

1. Color: Match SCHOOL DISTRICT's sample.

G. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch (9.5-mm) sieve and 85 percent retained on a No. 8 (2.36-mm) sieve.

2.6 DETECTABLE WARNING MATERIALS

A. Detectable Warning Stamp: Semirigid polyurethane mats with formed underside capable of imprinting detectable warning pattern on plastic concrete; perforated with a vent hole at each dome.

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

   a. Advanced Surfaces Inc.
   b. Superior Decorative by Dayton Superior.
   c. Or equal

2. Size of Stamp: One piece matching detectable warning area shown on Drawings.

B. Liquid Release Agent: Manufacturer's standard, clear, evaporating formulation designed to facilitate release of stamp mats.

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

   a. Advanced Surfaces Inc.; Liquid Release.
   b. Superior Decorative by Dayton Superior; Pro Liquid Release.
   c. Or equal

2.7 PAVEMENT MARKINGS

A. Refer to Specification 321723 “PAVEMENT MARKINGS AND SIGNS”

2.8 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.

B. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 4000 psi.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content according to ASTM C260:

D. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with SCHOOL DISTRICT approval.

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

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

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch (50-mm) overlap of adjacent mats.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
2. Provide tie bars at sides of paving strips where indicated.
3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 50 feet (15.25 m) unless otherwise indicated.

2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch (6-mm) radius. Repeat grooving of contraction joints after applying surface finishes.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

3. Doweled contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch (6-mm) radius. Repeat tooling of edges after applying surface finishes.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation**,** and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

H. Screed paving surface with a straightedge and strike off.

I. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

J. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Subcontractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms**,** steel reinforcement**,** and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

K. Slip Resistance: While the surface is still plastic, provide a textured finish by drawing a fiber bristle broom uniformly over the surface.

1. Unless otherwise directed by the Architect, provide the texturing in one direction only.

2. Provide medium broom texturing for surfaces less than 6%

3. Provide heavy broom texturing for surfaces equal to or greater than 6%

L. FLOAT FINISHING

M. General: Do not add water to concrete surfaces during finishing operations.

N. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

3.7 DETECTABLE WARNINGS

A. Stamped Detectable Warnings: Install stamped detectable warnings as part of a continuous concrete paving placement and according to stamp-mat manufacturer's written instructions.

1. Before using stamp mats, verify that the vent holes are unobstructed.
2. Apply liquid release agent to the concrete surface and the stamp mat.

3. Stamping: While initially finished concrete is plastic, accurately align and place stamp mats in sequence. Uniformly load, gently vibrate, and press mats into concrete to produce imprint pattern on concrete surface. Load and tamp mats directly perpendicular to the stamp-mat surface to prevent distortion in shape of domes. Press and tamp until mortar begins to come through all of the vent holes. Gently remove stamp mats.
4. Trimming: After 24 hours, cut off the tips of mortar formed by the vent holes.
5. Remove residual release agent according to manufacturer's written instructions, but no fewer than three days after stamping concrete. High-pressure-wash surface and joint patterns, taking care not to damage stamped concrete. Control, collect, and legally dispose of runoff.

3.8 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screening, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm) and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.9 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch (19 mm).
2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).

3. Surface: Gap below 10-foot- (3-m-) long, unleveled straightedge not to exceed 1/2 inch (13 mm).
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches (13 mm per 300 mm) of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch (25 mm).
6. Vertical Alignment of Dowels: 1/4 inch (6 mm).
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches (6 mm per 300 mm) of dowel.
8. Joint Spacing: 3 inches (75 mm).
9. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
10. Joint Width: Plus 1/8 inch (3 mm), no minus.

3.10 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with SCHOOL DISTRICT.

B. Allow concrete paving to cure for a minimum of 28 days and be dry before starting pavement marking or as instructed by SCHOOL DISTRICT.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.
2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal. (0.72 kg/L).

3.11 WHEEL STOPS

A. Install wheel stops in bed of adhesive applied as recommended by manufacturer.

B. Securely attach wheel stops to paving with not less than two steel dowels located at one-quarter to one-third points. Install dowels in drilled holes in the paving and bond dowels to wheel stop. Recess head of dowel beneath top of wheel stop.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: SCHOOL DISTRICT will engage a qualified testing agency to perform tests and inspections.

B. Test results shall be reported in writing to SCHOOL DISTRICT, concrete manufacturer, and Subcontractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

C. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by SCHOOL DISTRICT but will not be used as sole basis for approval or rejection of concrete.

D. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by SCHOOL DISTRICT.

E. Concrete paving will be considered defective if it does not pass tests and inspections.

F. Additional testing and inspecting, at Subcontractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

G. Prepare test and inspection reports.

3.13 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by SCHOOL DISTRICT.

B. Drill test cores, where directed by SCHOOL DISTRICT, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

SECTION 32 13 16
DECORATIVE CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The scope of work outlined in this Section includes the following items of work, as detailed in these Contract Specifications, as shown on the Contract Drawings or reasonably implied therefrom and is not limited to the following items:

1. Concrete cheek wall
2. Concrete mowband
3. Concrete steps
4. Concrete planter wall

1.02 RELATED REQUIREMENTS

A. These Contract Specifications are part of the Contract Drawings and shall include all labor, materials, equipment, reasonable incidentals, and services necessary for the execution of the Work installed complete in place.

B. Refer to all other sections, determine the extent and character of related work, and coordinate all work to produce a complete, properly constructed product.

1.03 RELATED SECTIONS

A.	Section 09 96 33	Graffiti-Resistant Coatings
B.	Section 31 00 00	Earthwork
C.	Section 31 10 00	Site Clearing
D.	Section 32 84 00	Irrigation System

1.04 QUALITY ASSURANCE

A. Materials and methods of construction shall comply with the following standards:

1. ASTM International, (ASTM).
2. American Concrete Institute, (ACI).
3. Specification for Measuring, Mixing and Placing Concrete, (ACI 304)
4. Specification for Hot Weather Concreting (ACI 305)

5. Specification for Cold Weather Concreting (ACI 306)

6. Building Code Requirements for Structural Concrete (ACI 318)

7. Specification for Formwork for Concrete (ACI 347)

8. ASTM C309 – Liquid Membrane-Forming Compounds for Curing Concrete.

9. ASTM C979 – Pigments for Integrally Colored Concrete.

10. State Standard Specifications, California Department of Transportation.

11. American National Standards Institute, (ANSI).

12. Bay Area Air Quality Management District, Sandblasting Guidelines.

B. Inspection by City and Other Governing and Regulatory Authorities: Allow the Engineer and other governing and regulatory authorities to perform testing and inspection of materials and practices associated with construction within their jurisdiction on the Worksite during business hours for the purpose of ensuring that the Work is in compliance with the requirements of the Contract Drawings, Contract Specifications, and other local, state and federal laws and regulations.

C. Engineer Quality Control:

1. The Engineer will perform quality control through observation, inspection, sampling and testing.

D. All manufacturer's specifications and details shall be included as part of the contract documents. Contractor shall review all MFR requirements, standards, specifications and details prior to bid and include all mix designs, additives, and incidentals required.

E. Installing contractor shall have successfully completed within the last 3 years at least 30 concrete applications similar in type and size to that of this project and who will assign mechanics from these earlier applications to this project, of which one will serve as lead mechanic for the complete duration of the project.

F. Supervision: On site Decorative Concrete foreman must have a minimum of 10 years experience installing Architectural Cast-in-place concrete. Submit project list of installer qualifications, demonstration of square footage installed, number of projects, and contact information to verify experience. The supervising foreman shall be onsite during all decorative concrete placement and finishing work for the complete duration of the project.

G. Maintain field records of time, date of placing, curing and removal of forms of concrete in each portion of work.

H. Samples:

1. Sample panel: Before ordering material for concrete paving, provide sample panel, minimum 4' x 4' of each color and finish, using specified materials. Show color, texture, pattern, edging, and joint treatments. Contractor to provide additional

samples at no additional cost to contract until all colors and finishes have been approved by the Engineer and Engineer of Record.

a. Where applicable, the approved sample panel may be a portion of the work and remain in place. Location as directed by the Engineer. Contractor will be required to provide additional panels as necessary, until approved.

b. All concrete flatwork shall be by set precedent for the Warm Springs District. First order concrete flatwork shall be determined by the project which places decorative Concrete flatwork first. Concrete work which follows shall match in colors, finishes, cement, sand, and aggregate. Contractor shall be responsible for matching First Order work of adjacent developments if applicable at no additional cost to the Contract.

2. Sample wall: Before ordering material for concrete paving, provide sample panel, minimum 3' section of wall, using specified materials. Show color, texture, pattern, edging, graffiti coating, and joint treatments. Contractor to provide additional samples at no additional cost to contract until all colors and finishes have been approved.

1.05 SUBMITTALS

A. General: Refer to Section 01 33 00 – Submittals for Shop Drawings, Product Data, and Samples for submittal requirements and procedures.

B. Submit concrete mix designs for each concrete type. Obtain approval before placing concrete.

1. Pedestrian flatwork Concrete

C. Product data:

1. Submit complete materials list of items proposed for the work. Identify materials source.

2. Submit admixture, curing compound, retarder, and accessory item product data, if used.

3. Submit material certificates for aggregates, fly ash, slag, reinforcing, dowels, sealants, diamond dowels, and joint fillers.

4. Submit manufacturer’s product data and specifications for all accessories and incidentals

D. Submit concrete delivery tickets. Show the following:

1. Batch number.

2. Mix by class or sack content with maximum size aggregate.

3. Admixtures.

4. Slump.

5. Time of loading.

E. Submit concrete test reports.

F. Trial batch shrinkage tests, when required as specified herein, shall show conformance with the “Drying Shrinkage” requirements specified in Article 2.01I.

1.06 DELIVERY, STORAGE AND HANDLING

A. Work notification: Notify the Owner’s Representative at least 24 hours prior to installation of concrete.

B. Establish and maintain required lines and grade elevations. All concrete shall slope to drain with no ponding of water.

C. Do not install concrete work over wet, saturated, muddy, or frozen subgrade.

D. Do not install concrete when air temperature is below 40 degrees F. Use of calcium chloride, salt, or any other admixture to prevent concrete from freezing is prohibited.

E. Protect adjacent work.

F. Provide temporary barricades and warning lights as required for protection of project work and public safety.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Portland Cement: ASTM C150, Type II, natural color, unless otherwise noted.

B. Supplementary Cementitious Materials (SCM):

1. Fly Ash: ASTM C618, Type F. Combined Fly ash and slag shall equal no more than 25% total.

2. Slag Cement: ASTM 989, GR 100 or GR 120. Combined Fly ash and slag shall equal no more than 25% total.

3. Metakaolin: ASTM C618, Type N.

a. MetaMax by BASF Kaolin (Part of BASF Corporation) (or approved equal)

C. Aggregate: Provide minimum 50% ASTM C33 normal weight aggregates, 3/4" maximum size, clean, uncoated crushed stone or gravel coarse aggregate free of materials which cause staining or rust spots; fine aggregate shall be clean natural sand.

D. Recycled Aggregate: Provide minimum 30%, maximum 50% Class 2 aggregate subbase, ¾” size, meeting Caltrans Section 25 and Section 26 of the standard specifications.

E. Water: ASTM C 1602, Clean, fresh, and potable.

F. Chemical admixtures: ASTM C494.

1. BASF Corporation – (800) 628-9990 (or approved equal)

G. Latex Portland Cement Grout: ANSI A108.10. Color of grout to blend with stone veneer. Submit sample for review.

H. Concrete Admixtures and Color Additives: Color per Contract Drawings, as approved by the Landscape Architect.

I. Drying Shrinkage of Concrete:

1. A trial batch of the proposed (mix design) concrete shall be prepared using the aggregates, cement, and admixture proposed for this work. From the trial batch, three specimens (4 inches by 4 inches by 11 inches) for determining "Drying Shrinkage" shall be prepared, cured, dried, and measured. Shrinkage of specimens for cast-in-place concrete shall not exceed 0.040 percent when measured in accordance with ASTM C157/C157M and ASTM C490/C490M after 21 days of drying.

2.02 MIXES

A. Provide Class A ready-mixed concrete. Batch mixing at site not acceptable.

1. For all landscape site concrete: Use Portland Cement Concrete containing not less than 658 pounds of cementitious materials cubic yard, with a 28 day compressive strength of not less than 3000 p.s.i..

B. Indicate water added to mix at job site on each delivery ticket. Show quantity of water added. Site water tempered mixes exceeding specified slump range will be rejected as not complying with specification requirements.

2.03 ACCESSORIES

A. Granular base: Class II Aggregate Base.

B. Forms: Wood or metal of sufficient strength to resist concrete placement pressure and to maintain horizontal and vertical alignment during concrete placement. Provide forms straight, free of defects and distortion, and height equal to full depth of concrete work.

1. Provide 2" nominal thickness, surfaced plank wood forms for straight sections. Use flexible metal, 1" lumber or plywood forms to form radius bends.

2. Lumber to be new #2 grade or better. Do not use used form lumber

3. Perform form layout with a digital electronic transit for line layout accuracy.

4. Allow forms to remain in place long enough to allow concrete to set properly. Remove forms when appropriate.

C. Joint Filler: ASTM D1751, premolded non-extruding asphalt-impregnated fiberboard, thickness indicated.

D. Curing compound: ASTM C309, non-yellowing, non-staining liquid membrane-forming type containing a fugitive dye. Chlorinated rubber compounds not acceptable for exterior use.

1. BASF Corporation; MasterKure 1315 WB – (800) 243-6739

2. Admixtures Inc.; Colorful Clear Curing Compound – (626) 357-3263 or http://admixtures.home.att.net/

3. Cure & Sealer Lithocrete® Sealer or HLQ 125.

E. Joint Sealants: Two-component polysulfide or polyurethane elastomeric type complying with FS TT-S-00227, self-leveling, designed for foot traffic. Provide vehicular rated sealant in all vehicular areas. Colors shall match paving.

F. Reinforcing steel: ASTM A615, A616, or A617, Grade 60, new domestic deformed steel bars.

G. Welded Steel Wire Reinforcement - Plain Wire: ASTM A1064/A1064M, wire sizes and center-to-center spacings as indicated.

H. Welded Steel Wire Reinforcement - Deformed Wire: ASTM A1064/A1064M, wire sizes and center-to-center spacings as indicated.

I. Steel Bar Mats - Deformed Bars: ASTM A184/A184M, using ASTM A706 deformed bars, sizes and spacings of members as indicated, welded or clipped at intersections.

J. Accessories: Provide reinforcement accessories, consisting of bar supports, spacers, hangers, chairs, ties, and similar items as required for spacing, assembling, and supporting reinforcement in place. Conform with CRSI referenced standards and the following requirements:

1. For footings, grade beams, and slabs on grade, provide supports with precast concrete or mortar bases or plates or horizontal runners where wetted base materials will not support chair legs.

K. Form release agent: Non-staining chemical form release agent free of oils, waxes, and other materials harmful to concrete.

1. BASF Corporation; “MasterFinish RL” Series – (800) 628-9990

L. Reveals/Chamfer strips: Shall be plastic or polyvinyl coated for easy release. Available from Barker Steel, www.barker.com, or approved equal.

M. Provide all stirrups, ties, anchors, shown or required to be cast into precast members.

N. Bolts, Nuts, and Washers: ASTM A307. Provide hot-dip galvanized fasteners for exterior use. Paint to match adjacent metal work.

O. Waterproofing at Walls and Stormwater Terrace

1. Tremco 250GC, Tremco 150

2. Approved equal.

P. Glare Reducing Agents

1. Lampblack in dry form, in accordance with the requirements of ASTM " Standard Specification for Lampblack", Designation D 209, in the proportion of from ½ to ¾ pound over cubic yard of concrete.

2. An approved liquid or semi-paste black colorant intended for use integrally in concrete mixes. The proportion required, generally from 10 to 40 ounces liquid measure per cubic yard of concrete, may be affected by the colorant used. Curing in this case shall be by the pigmented curing compound method.

3. All visible Standard Gray concrete work shall include Lampblack as indicated above.

Q. Surface retarder

1. BASF Corporation; "MasterFinish" Series

2. Dayton Superior Top Cast

3. or approved equal.

R. Graffiti coatings to be applied to Decorative Concrete shall be in compliance with Section 09 96 33 - Graffiti Resistant Coatings.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine subgrades and installation conditions. Do not start concrete work until unsatisfactory conditions are corrected.

B. Review all Architectural, Civil and Structural Contract Drawings for items which require coordination.

C. Contractor and Engineer to field review location, orientation, and elevations of all utility boxes, structures, drainage elements, and footings with the proposed grades, walls, score pattern and joint layouts prior to the placement of work. Correct any deficient items prior to proceeding with Decorative Concrete work.

3.02 PREPARATION

A. Prepare subgrade in accordance with Earthwork, Section 31 00 00.

B. Provide compacted base material as shown on Contract Documents. Compact base to 95% of the maximum dry density in accordance with ASTM D1557.

C. Remove loose material and debris from base surface before placing concrete.

D. Install, align, and level forms. Stake and brace forms in place. Maintain following grade and alignment tolerances:

1. Top of form: Maximum 1/8" in 10'-0".

2. Vertical face: Maximum 1/2" in 10'-0".

E. Coat form surfaces in contact with concrete with form release agent. Clean forms after each use and coat with form release agent as necessary to assure separation from concrete without damage.

F. Install, set, and build-in work furnished under other specification sections. Provide adequate notification for installation of necessary items.

G. Install pipe sleeves for irrigation system furnished under Section 32 84 00. Stake location of irrigation sleeves.

H. All waterproof membranes and drainage courses shall be reviewed and approved in writing by the associated manufacturer's representative or Engineer.

3.03 PLACING REINFORCEMENT

A. Place all reinforcement as shown on the Contract Drawings. Place accurately and securely fasten and support reinforcement to prevent displacement before or during pouring. Hang footing bars from forms. Support wire mesh with suitable metal cradles.

B. Clean, bend and place reinforcement in accordance with current requirements of the ACI Manual of Concrete Practice.

C. Dowels: Provide dowels where indicated or required for connecting construction and for maintaining structural and reinforcement continuity. Dowels shall be tied securely in place before concrete is deposited. Provide additional bars for proper support and anchorage where required. Do not bend dowels after embedment.

D. Welded Wire Reinforcement:

1. Wire fabric shall be installed in lengths as long as practicable and shall be wire-tied at all laps and splices. End laps shall be offset in adjacent widths. Lap welded wire fabric in accordance with applicable requirements of ACI 318.

2. Where required welded wire fabric shall be secured in position with suitable supports, accessories, and tie wire as indicated and required to ensure against movement from workers and placement of concrete lift fabric as concrete is placed to assure proper embedment at position indicated.

E. Reinforcement Splices:

1. Reinforcing bars - 24 bar diameter minimum, except as otherwise noted.

3.04 INSTALLATION

A. Concrete placement:

1. Comply with ACI 304 “Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete”, and as specified.

2. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placing, and curing. In cold weather comply with ACI 306, “Standard Specification for Cold Weather Concreting”. In hot weather comply with ACI 305, “Standard Specification for Hot Weather Concreting”.

3. Moisten base to provide a uniform dampened condition at the time concrete is placed. Verify structures are at required finish elevation and alignment before placing concrete.

4. Place and spread concrete to the full depth of the forms. Use only square-end shovels or concrete rakes for hand-spreading and consolidating operations to prevent segregation of aggregate and dislocation of reinforcement.

5. Place concrete in a continuous operation between expansion joints. Provide construction joints where sections cannot be placed continuously.

6. Place concrete as indicated on the plans in one course, monolith construction, for the full width and depth of concrete work.

7. Strike-off and bull-float concrete after consolidating. Level ridges and fill voids. Check surface with a 10'-0" straightedge. Fill depressions and refloat repaired areas. Darby the concrete surface to provide a smooth level surface ready for finishing.

B. Joints:

1. Provide expansion joints using premolded joint filler at concrete work abutting curbs, walls, structures, walks, utility boxes and other fixed objects.

a. Locate expansion joints as indicated or at a distance at 20’ maximum, where paving patterns collide, between existing and new work, between pedestrian and vehicular paving, around all light post foundations and around all structural foundations.

b. Coordinate all expansion joints with interlocking paver fields and fixed objects.

c. Install joint fillers full-width and depth of joint. Recess top edge below finish grade for joint sealants.

d. Provide joint fillers in single lengths for the full slab width, whenever possible. Fasten joint filler sections together when multiple lengths are required.

e. Protect the top edge of the joint filler during concrete placement.

f. Brooming. After the curing period, expansion joints shall be carefully cleaned and filled with approved joint sealant to just below adjacent paved surface in such a manner as to avoid spilling on paved surfaces or overflow from joint.

2. Saw cut joints ¼ depth of slab as indicated on the Contract Drawings. Contractor to allow concrete to cure as required before beginning operations.

3. Saw cuts shall be of a consistent depth, and visually straight.

C. Finishes:

1. Broom Finish: Shall be obtained by drawing a stiff bristled broom across a floated finish. Direction of brooming to be perpendicular to direction of work or otherwise shown on Contract Drawings.

2. Sand Blast Finish:

a. Perform in as continuous an operation as possible, utilizing the same work crew to maintain continuity of finish.

b. Depth of Cut: Use an abrasive grit of the proper type and gradation to expose the aggregate and surrounding matrix surfaces to match approved sample panel.

c. Blast corners and edge patterns carefully, using backup boards, in order to maintain a uniform corner or edge line.

d. Use same nozzle, nozzle pressure and blasting technique as used for sample panel.

e. Maintain control of abrasive grit and concrete dust in each area of blasting. Clean up and remove all expended abrasive grit, concrete dust, and debris at the end of each day of blasting operations.

3. Top Cast Finish: Install per mfr specifications and details

D. Curing:

1. Cure concrete with a clear, non-staining liquid membrane-forming compound. Spray apply in accordance with manufacturer's recommended coverage rate. Apply curing compound immediately after completing surface finish.

2. After Concrete is placed, cure concrete for a minimum of seven (7) days without foot traffic and a minimum thirty (30) days without vehicular traffic. If a curing compound is required, refer to Section 2.03 of this specification for acceptable curing compounds or install a moisture retaining, non-staining, non-woven, curing cover and maintain sufficient moisture under cover to provide for 100% humidity conditions at concrete surface for a minimum of 7 days. Cover shall be reflective

in nature to prevent excessive heat build up under cover and allow for optimal curing conditions.

E. Install Graffiti Resistant Coatings to Plaza Wall 1, Plaza Wall 2, Plaza Wall 3, and Plaza Wall 4 in accordance with Section 09 96 33 - Graffiti Resistant Coatings.

3.05 TESTING

A. Provide slump test on first load of concrete delivered each day and whenever requested due to changes in consistency or appearance of concrete.

3.06 TOLERANCES

A. Comply with ACI 117, “Specifications for Tolerances for Concrete Construction and Materials”

3.07 PROTECTION

A. Protect concrete work from damage due to construction and vehicular traffic until Final acceptance. Exclude construction and vehicular traffic from concrete pavements for at least 14 days.

B. Protection: Protect precast concrete items from chipping, spalling, cracking, or other damage until the Work is accepted by the Engineer and Engineer of Record.

C. Concrete work subject to traffic shall be heavily protected by the contractor as required to ensure damage does not occur. Damaged concrete shall be considered Defective Concrete as specified in section 3.08 herein.

3.08 DEFECTIVE CONCRETE

A. Concrete work which does not meet the Contract Specifications or Contract Drawings shall be considered defective concrete.

B. Color and finish of all concrete work shall match. Inconsistent color, and finishing shall be considered defective concrete.

C. All walls shall be plumb, straight with top of wall held level. Walls which are not plumb, straight, or level shall be considered defective concrete.

D. All joints shall be straight and true. Joints which are not straight shall be considered defective concrete.

E. Concrete work which ponds, does not conform to ADA requirements, does not match grading, is of poor finish, has poor scoring depth, map cracking, chipped, cracked, or otherwise deemed non acceptable shall be considered defective concrete.

F. Defective concrete shall be repaired or replaced as directed by the Engineer, at no added expense to the Contract. Repair materials may include specialty cements, reinforcement grouts, dry pack, admixtures, epoxy and aggregates as necessary.

1. Engineer's authorization for the Contractor to repair defective concrete work does not provide an acceptance of defective concrete work. All final repair work that does not meet the approval of the Engineer or Engineer of Record shall be rejected, removed and replaced at no additional cost to the contract.

2. In general, minor defective work may be repaired by use of dry pack. If defective work is serious or affects the strength of the structure or the appearance, the Engineer may require the removal and replacement of the portion of the structure.

3. Immediately after removing forms, all concrete surfaces shall be inspected any poor joints voids, rock pockets, tie holes, except as specified, etc., shall be patched at once, but not until the surfaces have first been reviewed by the Engineer and Engineer of Record. Submit patching mixture and method proposed for use, for review prior to commencing work.

4. Repaired or Replaced work shall match existing work. Work which does not match may require full removal and replacement.

5. All labor, materials, equipment, incidentals, and work related to the repairs or replacement of Concrete work shall be done at no additional cost to the Contract.

3.09 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, debris, and equipment. Repair damage resulting from concrete operations.

B. Sweep concrete sidewalks and pavement; wash free of stains, discoloration, dirt, and other foreign material immediately prior to final acceptance.

END OF SECTION

SECTION 32 14 20
INTERLOCKING PAVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Interlocking pavers shall be placed at the locations shown in the plans, as specified in these specifications, and as directed by the Architect.

1.2 SCOPE OF WORK

A. Work specified in this section includes furnishing all labor, materials, and equipment, performing all operations in connection with the Interlocking paving work as indicated on the Drawings and specified herein.

B. Submittals: Submit two paver samples in each color for approval.

C. Sample Mockup: Provide 10'x10' mockup of each paver sample, size, and color for review by owner and landscape architect.

D. Product Handling: Pavers shall be delivered and unloaded at job site on pallets and bound in such a manner that no damage occurs to the product during hauling, handling or unloading at site.

E. Project Conditions: Install pavers only under conditions stipulated in manufacturer's instructions.

1.3 QUALITY ASSURANCE

A. When reference is made to Standard Specifications in these specifications, it shall mean the "Standard Specifications, State of California, Division of Highways," May 2006 Edition.

B. Manufacturer Qualifications:

1. Paver manufacturer shall be an Interlocking Concrete Pavement Producer

2. Paver manufacturer shall be a member in good standing with the National Concrete Masonry Association.

3. Paver manufacturer shall provide systematic testing of concrete pavers during production by a National Concrete Masonry Association Certified Masonry Testing Technician.

4. Paver manufacturer shall provide independent quality assurance test results for concrete pavers manufactured and tested within a calendar year.

C. Installer Qualifications:

1. Engage an installer who has successfully completed within the last 3 years at least 6 unit paver applications similar in type and size to that of this project and who will assign mechanics from these earlier applications to this project, of which one will serve as lead mechanic.

2. The installer shall also hold a current certificate from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program. An ICPI certified foreman shall be present on-site at all times for all work related to Interlocking Pavers.

1.4 SUBMITTALS

A. Field-Constructed Mock-Up: Prior to installation of unit pavers, fabricate mock-up using materials, pattern and treatment indicated for project work. Build a mock-up in the form of a panel at the site, in a location indicated or directed, full thickness and approximately 10'x10' unless otherwise indicated. Provide range of color, texture and workmanship to be expected in the completed work. Obtain Engineers acceptance of visual qualities of mock-up before start of concrete paver work. Retain mock-up as the control sample until work is completed.

Do not change source of brands for paver units, setting materials, or sand grout during progress of work.

B. Prior to the start of construction the Paver Contractor shall coordinate the layout, staking, and installation of all utilities so that their location will match the layout of the interlocking paver bands. Contractor shall establish a construction meeting to coordinate layout.

C. Submit all samples, manufacturer specifications, manufacturer cut sheets, manufacturer details, paver incidentals, ASTM certifications for all sand, ASTM certification for base rock, and warranties for review and approval.

D. Submit project list with name of project, location, and owner of 3 unit paver applications similar in type and size to that of this project from the last 3 years.

E. Provide product data for pavers, sand laying course and all accessories.

F. 1 quart of joint sand for review of color.

G. Submit list of ICP: Certified Foremen who shall be onsite during all paver construction.

H. Submit testing reports from Geotech and/ or 3rd party Geotech Inspector for verification of all subgrade work and preparation. All work shall be in conformance with the Geotech report, details and specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pavers: Interlocking concrete paving stones, as per plans. Pavers shall have a minimum compressive strength at 562.4 kg per sq. cm (8000 psi) in accord with ASTM C-140. The average absorption rate shall not be greater than 5% with no individual unit absorption greater than 7%. Pavers shall contain add mixture to prevent efflorescence.

B. Sand Laying Course: Clean sand per ASTM C-33 per ICPI and CSA A23.1.

C. Sand for Joints: Clean sand per ASTM C-144 and CSA 179 per ICPI.

D. Aggregate: Provide minimum 50% ASTM C33 normal weight aggregates, 3/4" maximum size, clean, uncoated crushed stone or gravel coarse aggregate free of materials which cause staining or rust spots; fine aggregate shall be clean natural sand.

E. Recycled Aggregate: Provide minimum 30%, maximum 50% Class 2 aggregate subbase, ¾" size, meeting Caltrans Section 25 and Section 26 of the standard specifications.

F. Paver Sealer: Natural Luster by Seal 'N Lock System.

G. Edge Restraint: Snap Edge paver Edge by Sek per plans.

H. Mortar setting bed: Per plans

PART 3 - EXECUTION

3.1 INSTALLATION

A. Inspect and verify that all grading, drainage, and root barriers are complete and in place.

B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures

C. Place aggregate base in thickness indicated. Compact by tamping with plate vibrator.

D. Set pavers with a minimum joint width of 1/16 inch (1.6 mm) and a maximum of 1/8 inch (3 mm), being careful not to disturb leveling base. If pavers have spacer bars, place pavers hand tight against spacer bars.

E. Do not use paving stones with chips, cracks, voids, discolorations or other defects which might be visible or cause staining in finished work.

F. Pavers shall be clean and free of foreign substances before installation. Layout pavers to minimize cutting. Paving work shall be plumb, level and true to line and grade. Pavers shall be installed to properly coincide and align with adjacent work and elevations. Paving stones to be installed hand tight and level on the undisturbed #8 aggregate laying course.

G. Pavers shall be laid per plan.

H. All utilities shall be centered in paver bands and be square to paver bands and fields.

I. All cutting shall be done with a masonry saw.

J. Do not exceed 1.60 mm (1/16”) offset unit-to-unit offset from flush, and a tolerance of 3 mm (1/8”) in .61 m (2’-0”) and 6 mm (1/4”) in 3.05 m (10’-0”) from level or slope as indicated, for finished surface of paving. Use lines to hold pattern lines true.

K. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf (16- to 22-kN) compaction force at 80 to 90 Hz.

3.2 SAND SET BED INSTALLATION

A. Spread bedding sand evenly over the base course and screed to a nominal 1 in. (25 mm) thickness, not exceeding 11/2 in. (40 mm) thickness. Spread bedding sand evenly over the base course and screed rails, using the rails and/or edge restraints to produce a nominal 1 in. (25 mm) thickness, allowing for specified variation in the base surface.

1. Do not disturb screeded sand.
2. Screeded area shall not substantially exceed that which is covered by pavers in one day.
3. Do not use bedding sand to fill depressions in the base surface.

B. Lay pavers in pattern(s) shown on drawings. Place units hand tight without using hammers. Make horizontal adjustments to placement of laid pavers with rubber hammers and pry bars as required.

C. Provide joints between pavers between [1/16 in. and 3/16 in. (2 and 5 mm)] wide. No more than 5% of the joints shall exceed [1/4 in. (6 mm)] wide to achieve straight bond lines.

D. Joint (bond) lines shall not deviate more than ±1/2 in. (±15 mm) over 50 ft. (15 m) from string lines.

E. Fill gaps at the edges of the paved area with cut pavers or edge units.

F. Cut pavers to be placed along the edge with a [double blade paver splitter or] masonry saw.

G. Cut pavers at edges as indicated on the drawings.

H. Keep skid steer and forklift equipment off newly laid pavers that have not received initial compaction and joint sand.

I. Use a low-amplitude plate compactor capable of at least minimum of 4,000 lbf (18 kN) at a frequency of 75 to 100 Hz to vibrate the pavers into the sand. Remove any cracked or damaged pavers and replace with new units.

J. Simultaneously spread, sweep and compact dry joint sand into joints continuously until full. This will require at least 4 to 6 passes with a plate compactor. Do not compact within 6 ft (2 m) of unrestrained edges of paving units.

K. All work within 6 ft. (2 m) of the laying face must shall be left fully compacted with sand-filled joints at the end of each day or compacted upon acceptance of the work. Cover the laying face or any incomplete areas with plastic sheets overnight if not closed with cut and compacted pavers with joint sand to prevent exposed bedding sand from becoming saturated from rainfall.

L. Remove excess sand from surface when installation is complete. Excess joint sand can remain on surface of pavers to aid in protecting their surface especially when additional construction occurs after their installation. If this is the case, delete the article above and use the article below. Designate person responsible for directing timing of removal of excess joint sand.

M. Allow excess joint sand to remain on surface to protect pavers from damage from other trades. Remove excess sand when directed by [Architect].

N. Surface shall be broom clean after removal of excess joint sand.

3.3 CLEAN-UP

A. Remove all debris, pallets, broken stones, excess sand, etc. from job site. Wash down completed installation and provide a clean, finished workman-like installation.

3.4 REPAIR AND PROTECTION

A. Remove and replace paving stones which are loose, chipped, broken, stained, shows efflorescence or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment to eliminate evidence of replacement.

B. Provide final protection and maintain conditions in a manner acceptable to the Engineer which ensures unit paver work being without damage or deterioration at time of substantial completion.

3.5 MAINTENANCE

A. Contractor shall provide an additional 100sf (mixed) of each paver size and color palletized and protected to the owner.

B. Any defective paver work in which joints are visibly not aligned, crooked, have ponding, low points, rocking in place, do not meet ICPI standards or the approval of the landscape architect and/or owner shall be removed and replaced to the satisfaction of the landscape architect and/or owner.

END OF SECTION

SECTION 32 15 40
DECOMPOSED GRANITE PAVING

PART 1 - GENERAL

1.01 PROVISIONS

A. The requirements of the General Conditions, Supplementary Conditions, and Division 1, General Requirements apply to the work of this Section.

1.02 INCLUDED WORK

A. Decomposed Granite

1.03 RELATED WORK

A. Section 31 32 00 - Site Grading

1.04 REFERENCES AND STANDARDS

A. Standard Specifications: Where referred to in these Specifications, "State Specifications" shall mean the California Caltrans Specifications, latest edition.

B. Percent Compaction: As referred to in these Specifications, percent compaction or relative compaction is required in-place dry density of material expressed as a percentage of the maximum dry density of the same material determined in accordance with Caltrans 216. Optimum moisture content is the moisture content corresponding to the maximum dry density determined by Caltrans 216.

C. American Society for Testing and Materials, (ASTM).

1.05 QUALITY ASSURANCE

A. Decomposed granite paving shall comply with these specifications and all applicable sections of the above named references and standards.

B. Installation: Performed only by skilled workmen with satisfactory record of performance on completed projects of comparable size and quality.

C. Sample Panel: Before starting decomposed granite paving, provide a sample panel including redwood headers. Build panel at the site of full thickness and approximately 4 feet x 4 feet. Correct and rebuild sample panel until Owner's Representative acceptance of the work. Retain panel during construction as a standard for completed paving work.

1. The approved sample panel may be a portion of the work and remain in place. Location as directed by the Owner's Representative.

D. Do not change source of decomposed granite during the course of the work.

1.06 SUBMITTALS

A. Submit manufacturer's product data and specifications.

B. Submit the following material samples for Owner's Representative written approval prior to delivery of materials to site, or preparation of sample panel. Provide suppliers sieve analysis with each sample.

1. Base Course: one-half cubic foot.
2. Surface Course: one-half cubic foot.

C. Submit material certificates for base materials.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store loose granular materials in a well drained area on a solid surface to prevent mixing with foreign materials.

1.08 PROJECT CONDITIONS

A. Review installation procedures and coordinate paving work with other work affected by decomposed granite paving work. Do not begin the work until installation of trees and boulders is complete.

B. Protect partially completed paving against weather damage when work is not in progress.

C. Provide temporary barricades and warning lights as required for protection of project work and public safety.

D. Protect adjacent work from damage, soiling, or staining during paving operations.

PART 2 - PRODUCTS

2.01 DECOMPOSED GRANITE

A. Base Course: ¾" base rock per State Specifications; color: Tan or buff; California Gold by Felton Quarry, Granite Construction co., (408) 335-3445.

B. Surface Course: #4 minus Path Fines by Felton Quarry, Granite Construction Co., (408) 335-3445, decomposed granite; color: Tan or buff.

Sieve Size	Percent Passing
3/8"	89-99
#4	95-100
#8	75-90
#30	35-50
#200	10-19

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the substrate under which paving is to be installed. Notify the Owner's Representative, in writing, of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 LINES AND LEVELS

A. Finished grade of decomposed granite shall be ¼" to ½" below top of existing curb and top of existing walk. Any settlement below this level shall be corrected.

B. Surfaces shall be true to within 1/8" inch when tested in any direction with a 10 foot straightedge. There shall be no pools of water standing on the pavement after a rain.

C. Transition between changes in vertical gradient of walks and paving shall be smooth and gradual with no abrupt or sharp changes.

3.03 PREPARATION OF SUBGRADE

A. Preparation of subgrade: specified in Section 31 32 00 - Site Grading.

3.04 WEED CONTROL

A. Apply soil sterilizer over subgrade prior to installing paving in accordance with the manufacturer's printed instructions.

3.05 DECOMPOSED GRANITE

A. General: Uniformly spread approved material and compact to grades and lines shown. Compaction shall be made by power rollers to 90%. Each lift shall be compacted separately immediately after placement. Apply water as required.

B. Base Course: Place over prepared subgrade, and compact to depth shown. Finish to a tolerance of +¼".

C. Surface Course: Place surface material over base course and compact to depth shown.

D. When surface areas have been rolled and it becomes necessary to add thin layer of material to bring surface to grade, previously rolled or compacted area shall be scarified to provide bond with added material.

E. Finish surface of walks shall be uniform in appearance as to texture and color, and shall have a firm stable consistency, resistant to erosion.

3.06 PROTECTION

A. Restrict traffic from paving surfaces during construction and until final project acceptance by Owner's Representative.

3.07 CLEANING

A. Perform cleaning during installation of work and upon completion of the work. Remove from site all excess materials, debris, and equipment. Repair damage resulting from crushed stone paving operations.

END OF SECTION

SECTION 32 17 23
PAVEMENT MARKINGS AND SIGNS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes
1. Painted markings applied to asphalt and concrete pavement.
2. Signs and guide markers
3. Pavement markers
4. Parking bumpers

B. Related Requirements:

1. Section 099113 "Exterior Painting" for painting exterior concrete surfaces other than pavement.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference if required by SCHOOL DISTRICT..

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

a. Pavement aging period before application of pavement markings.
b. Review requirements for protecting pavement markings, including restriction of traffic during installation period.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include technical data and tested physical and performance properties.

B. Shop Drawings: For signage.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the following documents to form a part of these specifications to the extent stated herein from the State of California Department of Transportation (CALTRANS) for pavement marking work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

B. CALTRANS Manual on Uniform Traffic Control Devices (MUTCD)
State of California, Department of Transportation (CALTRANS)

CALTRANS Standard Specifications:
Sec 56. Signs
Sec 82 Markers and Delineators
Sec 84 Traffic Stripes and Pavement Markings
Sec 85. Pavement Markers
Sec 94. Asphaltic Emulsions

1.6 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F (12.8 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C) or per Manufacturer's instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide manufacturer's name; product name or designation or comparable product by one of the following:

1. PPG Industries.
2. Or equal

2.2 PAVEMENT-MARKING PAINT

A. Refer to CALTRANS "Painted Traffic Stripes and Pavement Markings" section 84-3. Marking paint shall be as slip resistant as the adjacent surface.

B. Pavement-Marking Paint: The paint for traffic stripes and pavement markings must comply with the specification for the paint type and color shown in CALTRANS table 84.3.
1. Waterborne traffic line-
a. Color white, yellow, and black-State Specification PTWB-01R2
2. Waterborne traffic line for the international symbol of accessibility and other curb markings
a. Color Blue, red, and green- Federal Specification TT-P-1952E

C. Glass Beads: Refer to CALTRANS "Traffic Stripes and Pavement Markings" section 84-1.02

2.3 PAVEMENT MARKERS

A. Amber Bi-Directional Pavement Markers: Reflective type; Hawkins-Hawkins Co. "V16C-88AY," Westway, Type "D" or equal.

B. Blue Bi-Directional Pavement Markers: Reflective type; Hawkins-Hawkins Co. Inc. “V16C-88AB,” Astro Optics Corp. “The Hydrant-Lite Marker,” or equal.

C. Amber Mono-Directional Pavement Markers: Reflective type; Hawkins-Hawkins Co. "V16C-88BY," Zumar 88B, Type ” H," or equal.

D. Clear Pavement Markers: Center-mount plastic reflectors, 4 inch diameter; Hawkins-Hawkins Co. "V16C-PMKR-W," Type ” A," or equal.

E. VOC Content: Pavement markings used on building interior shall have a VOC content of 150 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.

B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

C. Mark and stripe uniformly in design, position, and application in accordance with CA MUTCD.

3.2 PAVEMENT MARKING

A. Refer to CALTRANS “Traffic Stripes and Pavement Markings” section 84-3.03

B. Do not apply pavement-marking paint until layout, colors, and placement have been verified with SCHOOL DISTRICT.

C. Allow paving to age for a minimum of 30 days before starting pavement marking.

D. Sweep and clean surface to eliminate loose material and dust.

E. Apply 2 coats of paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply second coat of paint only after first coat has dried. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond the stencil. Apply paint so that it cannot run beneath the stencil. Protect adjacent surfaces against splatter or stains.
2. Broadcast glass beads uniformly into wet markings at a rate of 5 lb/gal. (0.6 kg/L).

3.3 PROTECTING AND CLEANING

A. Protect pavement markings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by paint manufacturer recommendations.

3.4 SIGNS AND GUIDE MARKERS

A. Install signs and guide markers at locations shown on the drawings in accordance with CALTRANS Sec 56, CALTRANS Sec 82 and CA MUTCD

3.5 PAVEMENT MARKERS

A. Install pavement markers at locations shown on the drawings in accordance with CALTRANS Sec 85 and CA MUTCD.

3.6 PARKING BUMPERS

A. Set and level bumpers on pavement with an adhesive consisting of asphaltic emulsion, and nail to the pavement with two No. 5 x 2-foot-long deformed bars. Apply the asphaltic emulsion in accordance with CALTRANS Sec 94-1.02.

END OF SECTION 32 17 23

SECTION 32 18 13
SYNTHETIC GRASS SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Furnish all labor, materials, tools and equipment necessary to install synthetic grass surfacing system as indicated on the plans and as specified herein; including components and accessories required for a complete installation, including but not limited to:
   1. Acceptance of prepared sub-base.
   2. Coordination with related trades to ensure a complete, integrated, and timely installation: aggregate base course, sub-base material (tested for permeability), grading and compacting, piping and drain components (when required); as provided under its respective trade section.

1.3 REFERENCE STANDARDS

A. ASTM – American Society for Testing and Materials.
   1. D1577 - Standard Test Method for Linear Density of Textile Fiber.
   2. D5848 - Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Covering.
   3. D1338 - Standard Test Method for Tuft Bind of Pile Yarn Floor Covering.
   4. D1682 - Standard Method of Test for Breaking Load and Elongation of Textile Fabrics.
   5. D5034 - Standard Test Method of Breaking Strength and Elongation of Textile Fabrics (Grab Test).
   6. D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
   7. D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials.

1.4 PERFORMANCE REQUIREMENTS

A. Completed synthetic grass surfacing system shall be capable of meeting the following performance requirements:
   1. ASTM D4491: Water permeability test. Synthetic grass surface shall drain at a rate of 250 inches or more, of water per hour.
   2. ASTM D1338: Tuft bind. Synthetic grass surfacing shall have a tuft bind, without infill material of 8 pounds or more.

1.5 SUBMITTALS

A. Substitutions: Other products are acceptable if in compliance with all requirements of these specifications. Submit alternate products to Architect for approval prior to bidding in accordance Section 01 25 13, Product Substitution Procedures.
   1. Provide substantiation that proposed system does not violate any other manufacturer's patents, patents allowed or patents pending.
   2. Provide a sample copy of insured, non-prorated warranty and insurance policy information.

B. Comply with Section 01 33 00, Submittals Procedures. Submit for approval prior to fabrication.

C. Product Data:
   1. Submit manufacturer's catalog cuts, material safety data sheets (MSDS), brochures, specifications; preparation and installation instructions and recommendations.
   2. Submit fiber manufacturer's name, type of fiber and composition of fiber.
   3. Submit data in sufficient detail to indicate compliance with the contract documents.
   4. Submit manufacturer's instructions for installation.

D. Samples: Submit samples, illustrating details of finished product in amounts as required by General Requirements, or as requested by Architect.

E. List of existing installations: Submit list including respective the Owner's Representative and telephone number.

F. Warranties: Submit warranty and ensure that forms have been completed in Owner's name and registered with approved manufacturer.

1.6 QUALITY ASSURANCE

A. Comply with Section 01 43 00, Quality Assurance.

B. Manufacturer Qualifications: Engaged in manufacturing synthetic grass surfacing products for a minimum of fifteen (15) years.
   1. The Manufacturer shall be experienced in the manufacturing and installation of specified type of synthetic grass surfacing system. This includes use of a ridged monofilament fiber, texturized monofilament fiber, backing, the backing coating, and the installation method.
   2. The Manufacturer shall own and operate its own manufacturing plant. Manufacturing the fiber, tufting of the fibers into the backing materials and coating of the synthetic grass system must be done in-house by manufacturer.
   3. The Manufacturer must hold ISO 9001, ISO 14001 and OHSAS 18001 certifications demonstrating its manufacturing efficiency with regards to quality, environment and safety management systems.

C. Installer/Contractor Qualifications: Company shall specialize in performing the work of this section.
   1. The Installer/Contractor shall be an authorized Field Turf/Easy Turf distributor.
   2. The Company shall provide competent workmen skilled in this specified type of

synthetic grass system installation.

3. The designated Supervisory Personnel on the project shall be certified, in writing by the manufacturer, as competent in the installation of specified type of synthetic grass system, including gluing seams and proper installation of the infill material.
4. The Company shall be certified by the manufacturer and licensed (if required).

D. Pre-Installation Conference: Conduct conference at project site at time to be determined by Architect. Review methods and procedures related to installation including, but not limited to, the following:

1. Inspect and discuss existing conditions and preparatory work performed under other contracts.
2. In addition to the Contractor and the installer, arrange for the attendance of installers affected by the Work, the Owner's Representative, and the Architect.

E. The Installer/Contractor shall verify special conditions required for the installation of the synthetic grass system if required.

F. The Installer/Contractor shall notify the Architect of any discrepancies.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 60 00, Product Requirements.

B. Deliver and store components with labels intact and legible.

C. Store materials/components in a secure manner, under cover and elevated above grade.

D. Protect from damage during storage, handling and installation. Protect from damage by other trades.

E. Inspect all delivered materials and products to ensure they are undamaged and in good condition.

1.8 SEQUENCING AND SCHEDULING

A. Coordinate the Work with installation of work of related trades as the Work proceeds.

B. Sequence the Work in order to prevent deterioration of installed system.

1.9 WARRANTY

A. See Section 01 78 00, Closeout Submittals, for Additional Warranty Requirements.

B. The Installer/Contractor (Heavenly Greens) shall provide a manufacturer's warranty to the Owner's Representative that covers defects in materials and workmanship of the synthetic grass product for a period of eight (8) years from the date of substantial completion. The synthetic grass manufacturer must verify that their representative has inspected the installation and that the work conforms to the manufacturer's requirements. The manufacturer's warranty shall include general wear and damage caused from UV degradation. The warranty shall specifically exclude vandalism, and acts of God beyond the control of the Owner's Representative or the manufacturer. The warranty shall be fully third party insured; pre-paid for the entire 8 year term and

be non-prorated. The Installer/Contractor (Heavenly Greens) shall provide a warranty to the Owner's Representative that covers defects in the installation workmanship, and further warrant that the installation was done in accordance with both the manufacturer's recommendations and any written directives of the manufacturer's representative. The insurance policy must be underwritten by an "AM Best" A rated carrier and must reflect the following values:

1. Pre-Paid 8-year insured warranty.
2. Maximum per claim coverage amount of $13,000,000.
3. Minimum of thirteen million dollar ($13,000,000) annual aggregate.
4. Must cover full 100% replacement value of total square footage installed.
5. Policies that include self-insurance or self-retention clauses shall not be considered.
6. Policy cannot include any form of deductible amount.
7. Sample policy must be provided at time of bid to prove that policy is in force. A letter from an agent or a sample Certificate of Insurance will not be acceptable.

PART 2 - PRODUCTS

2.1 MANUFACTURER AND DISTRIBUTOR

A. Approved Manufacturer: FieldTurf USA, Inc. 175 N. Industrial Blvd, Calhoun, GA 30701

B. Approved Distributor: Heavenly Greens, 370 Umbarger Road San Jose, Ca 95111, 408-600-2183 – Contact: Brad Borgman

2.2 MATERIALS AND PRODUCTS

A. Field Turf Nutmeg Lush with Envirofill infill - Synthetic grass surfacing system shall consist of the following:

1. Synthetic grass surfacing made with a combination of ridged monofilament polyethylene fibers and texturized monofilament fibers, tufted into a fibrous, non-perforated, porous backing.
2. Infill: Envirofill with acrylic coated sand to partially cover synthetic grass. Glue, thread, seaming fabric and other materials used to install and mark the synthetic grass.

B. Synthetic grass surfacing system shall have the following properties:

Standard	Property	Specification
ASTM D1577	Fiber Denier	10800
	HALS UV Stabilizer	10000 ppm
	Inner Face Support Ridges	≥6
	Outer Face Support Ridges	≥10
ASTM D1577	Secondary Fiber Denier	5000

ASTM D5823	Pile Height	1.625”
ASTM D5793	Stitch Gauge	3/8”
ASTM D5848	Pile Weight	65 oz/square yard
ASTM D5848	Primary Backing	7oz/square yard
ASTM D5848	Secondary Backing	22 oz/square yard
ASTM D5848	Total Weight	94 oz/square yard
ASTM D1338	Tuft Bind (Without Infill)	8+ lbs
ASTM D4491	Turf Permeability	250 inches/hour
	Infill Material Depth	1 inch
	Infill Component	2.75 lbs/square foot
	Total Product Weight	490 oz/square yard

C. Synthetic grass surfacing product shall consist of ridged monofilament fibers and texturized monofilament fibers tufted into a primary backing with a secondary backing.

D. Backing:
   1. Primary backing shall be a double-layered polypropylene fabric treated with UV inhibitors.
   2. Secondary backing shall consist of an application of porous urethane to permanently lock the fiber tufts in place.
   3. Perforated (with punched holes), backed turf is unacceptable.
   4. Turf with attached scrim in lieu of porous urethane is unacceptable.

E. Primary fiber shall be 10,800 denier, low friction, and UV-resistant fiber measuring not less than 1.625 inches high. Secondary fiber shall be 5000 denier.

F. Infill materials shall be approved by the manufacturer.
   1. Infill shall consist of graded dust-free silica sand. Graded dust-free acrylic coated silica sand may be substituted for silica sand as requested by Architect.

G. Glue and seaming fabric, for seaming of synthetic grass shall be as recommended by the synthetic grass manufacturer.

2.3 QUALITY CONTROL IN MANUFACTURING

A. The manufacturer shall own and operate its own manufacturing plant in North America. Both tufting of the fibers into the backing materials and coating of the turf system must be done in-house by the synthetic grass manufacturer. Outsourcing of either is unacceptable.

B. The manufacturer shall have full-time certified in-house inspectors at their manufacturing plant that are experts with industry standards.

C. The manufacturer’s full-time in-house certified inspectors shall perform pre-tufting fiber testing on tensile strength, elongation, tenacity, and denier, upon receipt of fiber spools from fiber manufacturer.

D. Primary backing shall be inspected by the manufacturer’s full-time certified in-house inspectors before tufting begins.

E. The manufacturer’s full-time in-house certified inspectors shall verify “pick count”, yarn

density in relation to the backing, to ensure the accurate amount of face yarn per square inch.

F. The manufacturer's full-time, in-house, certified inspectors shall perform product inspections at all levels of production including during the tufting process and at the final stages before the synthetic grass is loaded onto the truck for delivery.

G. The manufacturer shall have its own, in-house laboratory where samples of synthetic grass are retained and analyzed, based on standard industry tests, performed by full-time, in-house, certified inspectors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that all sub-base leveling is complete prior to installation.

B. Installer/Contractor shall examine the surface to receive the synthetic grass and accept the sub-base planarity in writing prior to the beginning of installation.
   1. Acceptance is dependent upon the Owner's Representative test results indicating compaction and planarity are in compliance with manufacturer's specifications.
   2. The surface shall be accepted by Installer as "clean" as installation commences and shall be maintained in that condition throughout the process.

C. Compaction of the aggregate base shall be 95%, in accordance with ASTM D1557 (Modified Proctor procedure); and the surface tolerance shall not exceed 0-1/4 inch over 10 feet and 0-1/2 inch from design grade.

D. Correct conditions detrimental to timely and proper completion of Work.

E. Do not proceed until unsatisfactory conditions are corrected.

F. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

A. Prior to the beginning of installation, inspect the sub-base for tolerance to grade.

B. Sub-base acceptance shall be subject to receipt of test results (by others) for compaction and planarity that sub-base is in compliance with manufacturer's specifications and recommendations.

C. When requested by Architect, installed sub-base shall be tested for porosity prior to the installation of the synthetic grass system. A sub base that drains poorly is an unacceptable substrate.

3.3 INSTALLATION

A. The installation shall be performed in full compliance with approved Shop Drawings.

B. Only trained technicians, skilled in the installation of synthetic grass systems working under the direct supervision of the approved installer supervisors, shall undertake any cutting, sewing, gluing, shearing, top-dressing or brushing operations.

C. The designated Supervisory personnel on the project must be certified, in writing by the manufacturer, as competent in the installation of this material, including gluing seams and proper installation of the Infill material.

D. Install at location(s) indicated, to comply with final shop drawings, manufacturers'/installer's instructions.

E. The Installer/Contractor shall strictly adhere to specified procedures. Any variance from these requirements shall be provided in writing, by the manufacturer's on-site representative, and submitted to the Architect and/or Owner's Representative, verifying that the changes do not in any way affect the Warranty. Infill materials shall be approved by the manufacturer and installed in accordance with the manufacturer's standard procedures.

F. Synthetic grass system shall be installed directly over the properly prepared aggregate base. Extreme care shall be taken to avoid disturbing the aggregate base, both in regard to compaction and planarity.
   1. Repair and properly compact any disturbed areas of the aggregate base as recommended by manufacturer.
   2. Seams shall be flat, tight, and permanent with no separation or fraying.

G. Infill Materials:
   1. Infill materials shall be applied in thin lifts. The turf shall be brushed as the material is applied. The infill material shall be installed to a depth determined by the manufacturer.
   2. Infill material shall be installed in a systematic order.
   3. Infill materials shall be installed to fill the voids between the fibers and allow the fibers to remain vertical and non-directional. The Infill installation consists of graded dust-free silica sand. Graded dust-free acrylic coated silica sand may be substituted for silica sand as requested by Architect.
   4. The Infill materials shall be installed to a depth of 1". Infill density shall consist of 2.75 pounds of graded silica sand per square foot. The Infill shall be placed so that there is a void of .625" to the top of the fibers.
   5. The Installer/Contractor shall keep area clean throughout the project and clear of debris. Upon completion of installation, the finished project shall be inspected by the installation crew and an installation supervisor.

3.4 PROTECTION

A. Protect completed synthetic grass surfacing system throughout construction process until project completed.

END OF SECTION

SECTION 32 31 13
CHAIN LINK FENCES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. References:
   1. CLFMI – Chain Link Fence Manufacturer's Institute, "Product Manual", 10015 Old Columbia Road, Suite B-215, Columbia, MD.

1.02 DESCRIPTION

A. Work to be included:
   1. Furnish and install all chain-link fencing as shown and as specified, including all accessories for a complete and proper installation.
   2. Furnish all, labor, materials, equipment, facilities, transportation and services to complete all yard fencing and accessories and related work as shown on the drawings and/or specified herein.

B. Related work:
   1. Section 31 00 00: Earthwork
   2. Section 31 10 00: Site Clearing
   3. Section 32 13 13: Concrete Paving

1.03 SUBMITTALS

A. All submittal data shall be forwarded in a single package to the Owner's Representative within 60 days of award of contract.

B. Product data: Material descriptions, construction details, Component profiles and finishes for the following:
   1. Fence posts, rails, and fittings.
   2. Chain link fabric, reinforcements, and attachments.
   3. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;

C. Shop drawings: Show locations of fence, each gate, posts, rails, and tension wires and details of extended posts, extensions arms, gate swing, or other operation, hardware, and accessories. Indicate materials, dimensions, sizes, weights, and finishes of components. Include plans, elevations, sections, gate swing and other required

installation and operations clearances, and details of post anchorage and attachment and bracing.

D. Material/Color samples required shall be complete set of Metal sections and parts demonstrating all items proposed for the work.

E. Samples for Verification: For the following products, in sizes indicated, showing the full range of color, texture, and pattern variations expected. Prepare samples from the same material to be used for the work.

1. PVC-coated steel wire (for fabric) in 6-inch lengths.

1.04 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work in this section.

B. Make all field measurements as required prior to fabrication and installation.

C. Coordination: Coordinate with other trades to ensure proper sequencing and fitting of construction.

D. Shop Assembly: Preassemble items in shop to greatest possible extent to minimize field slicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordination of installation.

1.05 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner's representative not less than [two] 2 days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's written permission

B. Field Measurements: Verify layout information for chain link fences shown in Drawings in relation to property survey and existing structures. If discrepancies occur, notify Owner's Representative.

1.06 DELIVERY, STORAGE AND HANDLING

A. Product Delivery Requirements, Storage and Handling Requirements – Comply with pertinent provisions of Section 01 65 00 and 01 66 00.

1.07 GUARANTEE

A. Provide one (1) year written guarantee against material and workmanship.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General

1. Materials shall conform to ASTM F1083 and ASTM A392 ferrous metals, zinc coated, and detailed specifications forming the various parts thereto; and other requirements specified herein. Zinc-coat metal members (including fabric, posts, rails, hardware and other ferrous metal items) after fabrication shall be reasonably free of excessive roughness, blisters and sal-ammoniac spots.

B. Chain Link Fence

1. Height: Shown on drawings.
2. All posts, rails, and appurtenances shall be hot dipped zinc coated steel, 1.2 oz per square foot, per ASTM specifications A53, A123, or A153, whichever is applicable.
3. Top Rail: Required, fitted with suitable expansion sleeves and means for securing rail to each gate, corner, and/or end post. Top rail shall be 1 5/8" O.D. standard pipe 2.27 lbs. per foot of section or 1'5/8" x 1'1/4" roll form section with minimum bending strength of 192 pounds. Rails to have a two (2) ounce zinc coating PSF of surface.
4. Mid/Brace Rail: Required for all fences greater than 7' - 0" tall. Mid Rail shall be 1 5/8" O.D. standard pipe 2.27 lbs. per foot of section or 1'5/8" x 1'1/4" roll form section with minimum bending strength of 192 pounds. Rails to have a two (2) ounce zinc coating PSF of surface.
5. Bottom Rail: Required, fitted with suitable expansion sleeves and means for securing rail to each gate, corner, and/or end post.
6. Chain Link Fabric: 9 gauge, 1 ¾" mesh.
   a. Fabric shall be zinc coated steel wire, coated with 1.8 ounces of zinc per square foot conforming to requirements in ASTM A 392. The material shall receive a PVC or Polyolefin Elastomer coating, thermally fused to 9 gauge zinc coated steel core wire per ASTM-F668 Class 2B. Core wire tensile strength 75,000 psi minimum. Fabric shall be knuckled at top and bottom.
   b. PVC Color: Black.
   c. Top and bottom selvage shall have twisted and/or knuckled finish. See table below for guidelines.

Fence Height	Selvage Treatment
Up to 6' height	Knuckle both selvages
Above 6' height	Twisted on top edge, knuckled on bottom edge

7. Line Post: O.D. shall be per chart below, standard pipe @ 3.65 #/L.F. or roll form section with minimum 201 pound bending strength perpendicular to fence lines.

For fabric heights over 8 foot, “C” section roll form or H-post with minimum bending strength of 314 pounds shall be used. Zinc coating to be 1.8 ounces PSF surface.

Fence Height	4’ or less	4’ to 8’	8’ to 10’	16’
Line Post	1- 7/8” O.D.	2- 3/8” O.D.	2- 7/8” O.D.	4” O.D.

8. End, Corner, and Pull Posts: Shall be per chart below. Zinc coating to be 1.8 ounces PSF surface.

Fence Height	4’ or less	4’ to 8’	8’ to 10’	10 to 12’	12 to16’
End, Corner and Pull Post	2- 3/8” O.D.	2- 7/8” O.D.	3- 1/2” O.D.	4” O.D.	4- 1/2” O.D.

9. Pipe posts shall have tops which exclude moisture.
10. End, corner, pull, and gate posts shall have braces with same material as top rail and trussed to line posts with 3/8” rods and tighteners.
11. Hinges: Galvanized pressed steel or malleable iron to suit gate size, non lift-off type, offset to permit 180 degree gate opening. Provide 1 pair of hinges for each leaf of each gate.
12. Post Footings: Shall be concrete foundation of 1-2-4 mix. Footing diameter and depth per chart below.

Fence Height	4’ or less	4’ to 8’	8’ to 10’	16’
Conc. Post Footing	3’ x 12” DIA.	3’ x 12’ DIA.	5’ x 18” DIA.	6’ x 24” DIA.

2.02 TOLERANCE

A. Standard mill tolerances will apply. Installation shall be by experienced fence erectors, on lines and grades furnished by the Owner. All material will be tested for meeting of specifications for design, strength, shape, weight, and coating. Mill certificates confirming compliance with the herein described components will be submitted for approval upon request.

2.03 FABRICATION

A. According to Manufacturer’s Details and Specifications.

PART 3 - EXECUTION

3.01 INSTALLATION

A. GENERAL - Related Work

1. Neatly excavate post holes per fencing post and footing chart requirements listed above. Holes shall be clean and free from loose dirt and water before placing posts and concrete.
2. Hand trim grade at fence lines as necessary to lower high spots away from bottom edge of fabric.
3. Paving or other surfaces receiving posts shall be neatly cut prior to drilling post holes. Upon completion of post setting and concrete work at said locations, earth disturbed shall be backfilled and compacted to 95% density and the cut paving or other surfacing shall be neatly repaired to the original condition.

3.02 CHAIN LINK INSTALLATION

A. Posts shall be set plumb on all sides and with tops uniformly aligned. Set posts, post sleeves and strikes in round concrete footings in grade as shown or required. Concrete shall be thoroughly compacted by rodding as placed; bevel tops and finish smooth. Set and grout posts into sleeves where required; neatly finish smooth and flush with adjacent surfaces.

B. Post:

1. Terminal Post: Locate terminal end, corner, and gate posts per ASTM 567 and terminal pull posts at changes in horizontal or vertical alignment changes of fifteen (15) degrees or more.
2. Line Posts: Install for all intermediate locations between end, corner and gate posts. Uniformly space at not over 10’ center to center, 8’ center to center for 12’ high fence, measured parallel to grade, or space as shown.
3. Corner Posts: Install at points where a change in alignment is 300 or greater. Where an alignment change occurs adjacent to a gate opening, use gate post in lieu of corner post.
4. End Posts: Install at each terminal end of individual runs of fencing.

C. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch diameter hog rings of same material and finish fabric wire, spaced a maximum of 24 inches O.C. Install tension wire before stretching fabric.

1. Top Tension Wire: Install tension wire through post cap loops.
2. Bottom Tension Wire: Install tension wire within 6 inches of bottom fabric and tie to each post with not less than same gage and type wire.

D. Top Rail: Install according to ASTM F 567, maintain plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended by fencing manufacturer.

E. Intermediate Rail: Install in one piece, spanning between post, using fittings, special offset fittings and accessories.

F. Bottom Rail: Install, spanning between posts, using fittings and accessories.

G. Chain Link Fabric: Apply fabric to [inside, outside] of enclosing framework. Leave a minimum clearance of 1 inch, maximum 1-3/4 inch between finish grade and surface and bottom selvage, unless otherwise directed by Owner's Representative. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released and displays no sagging or buckling.

H. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

I. Maximum Spacing: Tie fabric to line posts 12 inches O.C. and to braces 24 inches O.C.

J. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.03 CLEAN-UP

A. Remove from the site all debris resulting from the work of this section.

END OF SECTION

SECTION 32 31 17
DECORATIVE PERFORATED PANELS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The scope of work outlined in this Section includes the following items of work, as detailed in these Contract Specifications, as shown on the Contract Drawings or reasonably implied therefrom and is not limited to the following items:

1. 6'H DECORATIVE METAL FENCE

2. 6'H DECORATIVE METAL SINGLE GATE

3. 12'W DECORATIVE METAL MAINTENANCE GATES

1.02 RELATED REQUIREMENTS

A. These Contract Specifications are part of the Contract Drawings and shall include all labor, materials, equipment, reasonable incidentals, and services necessary for the execution of the Work installed complete in place.

B. Refer to all other sections, determine the extent and character of related work, and coordinate all work to produce a complete, properly constructed product.

C. Embedded anchor plates and structural connections. Coordinate support sizes and locations.

1.03 RELATED SECTIONS

A. Section 05 50 00 Metal Fabrications

B. Section 09 91 00 Painting

C. Section 32 13 16 Decorative Concrete

1.04 SUBMITTALS

A. General: Refer to Section 01 33 00 – Submittals for Shop Drawings, Product Data, and Samples for submittal requirements and procedures.

B. Product Data: Supplier's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.

3. Description of materials, components, fabrication and finishes.

C. Shop Drawings: Supplier's shop drawings, including plans, elevations, sections and details indicating materials, components, sizes, dimensions, tolerances, hardware, fasteners, finishes, options, accessories and installation methods. Provide details of attaching metal panels to supports.

D. Verification Samples: For each product specified, provide two 3” x 6” samples of paint color chips representing supplier's full range of available finishes and colors. If needed, up to six different paint samples may be provided for design review.

E. Pattern Samples: One full panel to dimension and shape with pattern, color and finish as shown on the Contract Drawings.

F. Closeout Submittals: Supplier's maintenance and cleaning instructions and warranty.

G. Extra Materials

1. Provide 4 panels of each color, size, and finish of additional material for use by the Owner for maintenance and repair. Palletize, wrap and protect all material for delivery to the Owner’s maintenance yard.

2. Provide 1 gallon of paint, sealed for delivery to the Owner’s maintenance yard.

1.05 QUALITY CONTROL AND ASSURANCE

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

1. Build mockups at client’s request as indicated on the Drawings. Demonstrate the proposed range of aesthetic effects and fabrication.

2. Retain and maintain mockup during construction in an undisturbed condition as a standard for judging the completed work.

3. Approved mockup in an undisturbed condition may become part of the completed work at the time of final inspection.

1.06 PROJECT CONDITIONS

A. Installer to verify actual locations of walls and other construction contiguous with metal panels by field measurements before fabrication and indicate measurements on shop drawings. Coordinate construction to ensure that panels conform to built openings.

B. Where measurements cannot be taken without delaying the Work, Installer to guarantee panel dimensions will fit and proceed with fabrication of product without field verification. Coordinate construction to ensure that panels conform to guaranteed openings.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements: Deliver materials in manufacturer’s original packaging with corresponding labels and identifying information.

1. Unload, store, and erect panels in a manner to prevent bending, warping, twisting, and surface damage.

B. Storage and Handling Requirements

1. Store panels vertically, covered with appropriate weathertight and ventilated covering. Store panels to ensure dryness. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

2. Do not stack pallets. Panels that are stacked need to be protected from each successive panel above and below.

3. Avoid overhandling and excessively moving panels in order to maintain protective packaging.

PART 2 - PRODUCTS

2.01 ACCEPTABLE SUPPLIER

A. Steel Crest, Phoenix, AZ 85-4- 602-429-0469 (jack@steelcrestonline.com) www.steelcrestonline.com

2.02 MATERIALS

A. Fasteners for metal panels shall be anti-theft, countersunk hardware.

B. Avoid fastening dissimilar materials; separate all panels, posts and hardware with isolating hardware.

C. Brackets, Flanges and Anchors: Same metal and finish as supported metal panels, unless otherwise indicated.

2.03 ORNAMENTAL PERFORATED METAL PANELS

A. Metal Surfaces: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations or blemishes; unless allowed for specific metal types and finishes.

B. Material: 11 gauge Cold Rolled Steel

C. Laser Cut Patterns:

1. Custom per Contract Drawings.

2.04 FABRICATION

A. Fabricate metal panel assemblies to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish and anchorage, but not less than required to support structural loads.

B. Fabricate systems in accordance with approved shop drawings and the supplier's instructions. Form work true to line and level with accurate angles and surfaces.

C. Assemble metal panels in the shop to greatest extent possible to minimize field splicing and assembly.

D. Cut, drill and laser cut metals cleanly and accurately. Remove burrs and ease edges; unless allowed for specific metal types and finishes. Remove sharp or rough areas on exposed surfaces.

E. Cut, reinforce, drill and tap as indicated to receive finish hardware, screws and similar items.

F. Use grommets, bushings and washers or methods as recommended by the supplier for separation of dissimilar metals.

2.05 FINISHES

A. Comply with NAAMM's MFM for recommendations for applying and designating finishes.

B. Appearance of Finished Work:

1. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved samples.

2. Noticeable variations in same piece are not acceptable, except for steel and anodized aluminum.

3. 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.

2.06 FINISHES FOR ALUMINUM

A. Painted finish per Section

1. Color: Per Contract Drawings

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Installer to verify field measurements are acceptable to suit assembly tolerances.

C. Installer to verify posts, supports and anchors are correctly positioned and set.

3.02 PREPARATION

A. Provide items required to be cast into concrete or embedded in masonry with setting templates.

B. Installer to take field measurements after permanent end terminations are in place and prior to preparation of shop drawings and fabrication, to ensure fitting of work.

C. Prepare surfaces using the methods recommended by the supplier for achieving the best result for the substrate under the Project conditions.

3.03 INSTALLATION

A. Install metal panels in accordance with supplier's instructions.

B. Install metal panels plumb, level, square, true to line and rigid. Fit exposed connections together to form tight, hairline joints.

C. Adjust metal panels before anchoring to ensure alignment at abutting joints.

D. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood or dissimilar metals, with a heavy coat of bituminous paint.

E. Use supplier's supplied stainless steel hardware for panel-to-panel connections.

F. Attach metal panels securely in place using anchorage devices and fasteners as indicated on the Contract Drawings and Specifications.

G. Corrosion Resistance: Separate incompatible materials to prevent galvanic corrosion.

H. Install decorative perforated panel components plumb, equally spaced, and rigid, scribed to adjacent finishes, in accordance with approved shop Contract Drawings and product data. Align all panels to provide a visually seamless, and secure installation.

3.04 ADJUSTING

A. Touch-up, repair, or replace damaged products before final inspection. Manufacturer to provide proper coating for repainting any exposed steel surfaces.

B. Return and replace items that cannot be refinished in field.

C. All work which does not meet the approval of the Engineer shall be repaired or replaced at the discretion of the Engineer. Unapproved work shall include but not be limited to damaged material, warped material, damaged finishes, unlevel installation, racked installations and unaligned installations.

3.05 CLEANING

A. Clean metal panels with water and light detergent promptly after installation in accordance with supplier's instructions.

B. Do not use harsh cleaning materials or methods that will damage finish.

C. Do not use abrasive cleaners.

3.06 PROTECTION

A. Protect finishes of metal panels from damage during construction period with temporary protective coverings approved by metal panel supplier. Remove protective coverings at the time of final inspection.

B. Replace defective or damaged components. Restore finishes damaged during installation and construction period so no evidence remains of correction work.

C. Touch-up, repair or replace damaged products before final inspection. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit or provide new unit.

END OF SECTION

SECTION 32 84 00
IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall provide all labor, materials, supplies, tools, and transportation and perform all operations in connection with and reasonably incidental to complete the installation of the automatic sprinkler irrigation systems as shown on the drawings. Items hereinafter are included as an aid to take off, and are not necessarily a complete list of work items.

1. Trenching, stockpiling, excavation, materials, and refilling trenches.

2. Furnishing materials and installation for complete system including piping, valves, fittings, sprinkler heads, automatic controls, and final adjustment of heads to insure complete coverage.

3. Line voltage connections to the irrigation controllers and low voltage control wiring from controllers to remote control valves.

4. Replacement of unsatisfactory materials.

5. Clean-up, inspection and approval.

6. All work of every description mentioned in the specification and/or addenda thereto, all other labor, and materials reasonably incidental to the satisfactory completion of the work, including clean-up of the site, as directed by the Project Representative.

7. Tests.

8. As-built record drawings.

B. Work Specified Elsewhere:

1. Irrigation water stub-out.

2. 120 volt A.C. electrical stub-out to controller location.

3. Irrigation piping in structure.

4. Irrigation sleeves.

5. Electrical conduit in structure for 24-volt wire.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Irrigation System:

1. Measurement: Irrigation system installation is measured on a lump sum basis.

2. Payment: The contract lump sum price paid for the Irrigation System shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing and installing the Irrigation System, complete in place.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer catalog information on all material to be used on the project as specified on the legend, notes, details and plans. Redline or highlight exact items on page to be submitted. Complete material list shall be submitted prior to performing any work.

B. Substitutions: No substitution will be permitted without prior written approval by the Project Representative. If the product is approved and, in the opinion of the Project Representative, the substituted product does not perform as well as the specified product, the Contractor shall replace it with the specified product at no additional cost to the Project Representative.

C. All equipment or materials installed or furnished without prior approval of the Project Representative may be rejected and the Contractor may be required to remove the equipment or material at their own expense.

1.4 CLOSEOUT SUBMITTALS

A. Project As-built Record Documents: The Contractor shall maintain in good order in the field office, one complete set of black line prints of all sprinkler drawings which form a part of the contract, showing all water lines, electrical, sprinklers, valves, stub-outs. In the event any work is not installed as indicated on the drawings, such work shall be corrected and dimensioned accurately from the building walls. All underground stub-outs for future connections and valves shall be located and dimensioned accurately from building walls on all as-built record drawings. In addition to the hard copies a full sized scanned PDF will be required at completion.

B. Controller Chart:

1. Provide one laminated controller chart showing the area covered by controller for each automatic controller supplied at the maximum size controller door will allow. Chart shall be a reduced drawing of the actual "as-built" system. If controller sequence is not legible when the drawing is reduced to door size, the drawing shall be enlarged to a size that is readable and placed folded, in a sealed plastic container, inside the controller door.

2. Controller chart shall be a blackline print with a different color used to show area of coverage for each station. Charts must be completed and approved by the Project Representative prior to final inspection of the irrigation system.

3. Locate all dripline flush valves and dripline indicators on colored plans if the locations differ from design plans.

C. Controller Cloud Based Communication and Flow Sensor installation confirmation:

1. Provide written confirmation that the cloud-based communications are set up and operational between controller(s) and cloud-based server.

2. If controller is a two-wire type controller. Provide confirmation that the controller is communicating with each decoder valve on system and there are no error messages logged on the cloud-based communication system. Provide a printout of information to Landscape Architect or Irrigation Consultant.

3. Provide written confirmation from the distributor/manufacturer's representative that the controller is communicating with flow sensors and that the correct "k" and "offsets" are setup and utilized properly. The “k” and “offsets” are pre-set numbers you plug into the controller software based on the flow sensor size and type when calibrating the flow sensor. Confirm that flow values have been "learned" and recorded for each valve on the controller, and the correct gpm per valve is shown and verified on a printout and provided to Landscape Architect or Irrigation Consultant. Flow alarms and automatic shut offs should be set up after plant establishment.

D. Maintenance and Operating Instructions and Manuals:

1. Contractor shall prepare an Operation and Maintenance Manual, organized in a 3-ring binder, containing the following information.

   a. Contractor's name, address, and telephone number. Duration of guarantee, periods as specified herein, list of equipment with names and addresses of local manufacturer’s representatives with duration of written warranties. Complete operating and maintenance instructions on all equipment spare parts lists and related manufacturer's information.

2. Submit the Operation and Maintenance Manual to the Project Representative within 10 Calendar Days of completion of work of this Section and as a condition of project acceptance.

E. Irrigation Audit, Irrigation Survey, and Irrigation Water Use Analysis:

1. All landscape irrigation audits shall be conducted by a local agency landscape irrigation auditor or a third party certified landscape irrigation auditor. Landscape audits shall not be conducted by the person who design the landscape or installed landscape.

2. In large projects or projects with multiple landscape installations (i.e. production home developments) an audit rate of 1 to 7 lots or approximately 15% will satisfy this requirement.

3. For new construction and rehabilitated landscape projects installed after December 1,2015, as described in Section 490.1:

   a. The project applicant shall submit an irrigation audit report with the Certificate of Completion to the local agency that may include, but is not limited to: inspection, system tune-up, system test with distribution uniformity, reporting overspray or run off that causes overland flow, and

preparation of an irrigation schedule, including configuring irrigation controllers with application rate, soil types, plant factor, slop, exposure and any other factors necessary for accurate programming.

1.5 QUALITY ASSURANCE & GENERAL REQUIREMENTS

A. Qualifications: The Contractor, personally or through an authorized and competent representative, shall supervise the work constantly, and shall as far as possible keep the same foreman and workmen on the job from commencement to completion. The workmanship of the entire job must in every way be first class, and only experienced and competent workmen will be allowed on the job. A minimum of five years' experience of installing irrigation systems of similar scope, size and complexity as the system being installed under this scope of work is required for all on-site job superintendents.

B. Manufacturer's installation instructions and best practices: Manufacturer's installation instructions shall be followed in all cases when not shown in the Drawings or Specifications.

C. O.S.H.A. Compliance: All articles and services covered by this specification shall meet or exceed the safety standards established under the Federal Occupational Safety and Health Act of 1970, together with all amendments in effect as of the date of this specification.

D. All irrigation systems shall be installed to meet or exceed the requirements set forth in the California Department of Water Resources Model Water Efficient Landscape Ordinance.

E. Codes and Standards: Comply with all applicable codes and standards.

1. All work and materials shall be in full accordance with the latest rules and regulations of the National Electric Code; published by the Western Plumbing Officials Association; California Code of Regulations, Title 23, Division 2. Department of Water Resources, Chapter 2.7. Model Water Efficient Landscape Ordinance; and other State or local laws regulations. Nothing in these drawings or specifications is to be construed as to permit work not conforming to these codes.

2. When the specifications call for materials or construction of a better quality or larger size than required by the above mentioned rules and regulations, the provision of the specifications shall take precedence over the requirements of said rules and regulations.

3. Contractor shall furnish, without extra charge, any additional material and labor when required by the compliance with these rules and regulations, though the work be not mentioned in these particular specifications or shown on the drawings.

4. The Contractor shall erect and maintain barricades, guards, warning signs, and lights as necessary or required by O.S.H.A. regulations for the protection of the public or workmen.

5. Any existing buildings, equipment, piping, pipe covering sewers, etc., damaged by the Contractor during the course of his work shall be replaced or repaired by the Contractor in a manner satisfactory to the Project Representative and at Contractor's own expense, before final payment is made. The Contractor shall be responsible for damage caused by leaks in the piping systems being installed or having been installed under this contract. He/she shall repair, at his/her own expense, all damage so caused, in a manner satisfactory to the Project Representative.

6. The Contractor shall pay for all permits, licenses, and fees required.

1.6 EXISTING CONDITIONS

A. Protection of Existing Structures and Utilities

1. The Drawings show, if applicable, existing above and below grade structures and utilities that are known to the Project Representative. Locate known existing installations before proceeding with construction operations that may cause damage to such installations. Existing installations shall be kept in service where possible and damage to them shall be repaired with no adjustment of Contract Sum. Verify with Project Representative if As Built drawings are available.

2. If other structures or utilities are encountered, request Project Representative to provide direction on how to proceed with the Work. If a structure or utility is damaged, take appropriate action to ensure the safety of persons and property.

B. Trench Interference with Existing Tree Root Systems: Prior to trenching, layout main and lateral line locations within drip Line of trees and review locations with Project Representative. Relocate any lines that may interfere with existing root systems to avoid or reduce damage to root systems as accepted by Project Representative.

C. Provide barricades, coverings, warning signs, lights and other protection required by local code or OSHA to prevent damage to existing improvements to remain and to protect the public.

1.7 LAYOUT OF WORK

A. The Contractor shall stake out the irrigation system as shown on the drawings. These areas shall be checked by the Contractor and Project Representative before construction is started. Any changes, deletions or additions shall be determined at this check.

B. Due to the scale of the Drawings, it is not possible to indicate all piping offsets, fittings, sleeves, etc., which may be required. Carefully investigate the conditions affected all of the work and plan accordingly, and furnish all required fittings. Install system in such a manner to avoid conflicts with planting, utilities and architectural features.

C. Do not install the irrigation system as shown on the Drawings when it is obvious in the field that obstructions, grade differences or discrepancies in arc dimensions exist that might not have been considered. Bring such obstruction or differences to the attention of the Project Representative. Notify and coordinate irrigation Work with applicable contractors for location and installation of piping and sleeves through or under walls, pavement and structures. In the event this notification is not given, the Contractor shall assume full responsibility for any revision necessary.

1.8 SEQUENCING AND SCHEDULING

A. Acceptance: Do not install main line trenching prior to acceptance by Project Representative of rough grades completed under another Section.

B. Coordination: Coordinate with the all other trades the sleeving, power requirements of the project, prior to the start of construction.

1.9 INSTRUCTION

A. After the system has been installed and approved, the Contractor shall instruct the Project Representative and or Maintenance Contractor, in complete operation and maintenance of the irrigation system.

PART 2 - MATERIALS

2.1 PIPE AND FITTINGS

A. Main lines (constant pressure); 2.5” and smaller shall be PVC 1120-Schedule 40 plastic pipe. Pipe shall be made from NSF approved Type 1, Grade 1 PVC compound conforming to ASTM D1785.

1. Solvent weld main lines: At changes in direction or branch mains, use appropriate Schedule 40 PVC solvent weld fittings as approved by the Uniform Plumbing Code.

B. Lateral lines (non-pressure): 3/4" and larger shall be 1120-Schedule 40 PVC plastic pipe. All lateral lines shall be connected with Schedule 40, Type I, Grade I, PVC solvent weld fittings.

C. Connections between main lines and RCV’s shall be of Schedule 80 PVC (threaded both ends) nipples and fittings.

D. Swing joints shall be as shown on construction details.

2.2 MASTER CONTROL VALVE

A. Master control valve shall be a normally open 24 VAC solenoid actuated globe pattern valve.

B. Valves shall be made of brass with a minimum pressure rating of 200 PSI

C. Valve shall have external and internal bleed for manual operation.

D. Valve model and size shall be as shown on drawings.

2.3 FLOW SENSORS

A. Inline flow sensors shall be installed in accordance with the manufacturer's installation instructions. Contractor is responsible for the installation, all required materials and connections of the flow sensors for complete operation with the irrigation controller.

B. Flow sensor size and model shall be listed on the drawings.

2.4 FLOW SENSOR CABLE AND CONDUIT

A. Flow sensor wire shall be shielded cable Paige model 7171D or approved equal.

B. Maximum cable distance from controller to flow sensor shall be 2000 ft.

C. Install flow sensor cable in a 1" grey SCH 40 PVC conduit with long sweep elbows.

D. Conduit and flow sensor cable shall be routed with mainline wherever possible. Provide a minimum 6" separation between conduit and pressure main line.

E. Provide 10" round gray electrical pull boxes a minimum of every 200 ft, at each change in direction and adjacent to each controller. Heat brand lid of pull box "FSB".

2.5 GATE VALVES

A. Gate valves 2.5" and smaller shall meet the following requirements:

1. Valves shall be of stainless steel (304 or higher) or bronze/brass construction with non-rising stem, cross handle and threaded connections.

2. Valves shall be Leemco Model #LGT-SS, Nibco T-113-K or approved equal. Size as shown on the drawings

3. Install in 10" diameter plastic valve box as detailed.

2.6 QUICK COUPLING VALVES

A. Quick coupling valves shall be as shown on the drawings. Install in 10" diameter plastic valve box as detailed.

2.7 CONTROLLERS

A. Controller's size and model shall be as listed on the drawings.

B. Final location(s) of controller shall be approved by the Project Representative.

C. Controller requires 120v power. Maximum power output of controller is 2.5 amps.

D. Install Controller and accessories as detailed and per Manufacturer's details.

2.8 CONTROL WIRE

A. Control wire shall be copper with U.L. approval for direct burial in ground, size #14- Common ground wire shall have white insulating jacket; control wire shall have insulating jacket of color other than white or yellow. Runs over 2,000 lineal feet shall be #12- AWG-UF 600 volt copper wire. Splices shall be made with 3M-DBY seal packs.

B. Provide a separate ground wire for each controller.

C. Provide a minimum of two spare control wires into each RCV box for future. Spare wires shall be yellow in color.

2.9 ELECTRIC REMOTE CONTROL VALVES

A. Electric remote control valves sizes shall be shown on drawings.

B. Electric remote control valve shall be a normally closed 24 VAC solenoid actuated globe pattern valve.

C. Valves shall be made of durable glass-filled nylon with a pressure rating of 200 PSI

D. Valve shall have external and internal bleed for manual operation.

E. Provide and install one Schedule 80 PVC FIPT threaded true union ball valve with EPDM O-rings on the upstream side of valve and one Schedule 80 union on the downstream side of valve. Ball valve shall be Spears True Union model 2300. Match valve size when sizing ball valve and union.

F. All electric remote control valves for dripline or drip systems shall include a wye filter with a 200 mesh stainless steel screen and pressure regulator on the valve or downstream of the valve.

2.10 IDENTIFICATION TAG

A. Identification tags for all electric control valves shall be manufactured by Christy. Tag numbers shall match stationing in controller and as shown on as-built drawings. Provide one yellow station number tag for each electric control valve as follows:

1. Potable water systems: Christy ID.STD.Y1

2.11 VALVES BOXES

A. ELECTRIC REMOTE CONTROL VALVE BOXES:

1. All electric remote control valve boxes that service non-drip systems shall be installed within a NDS Pro Series Model 214BC, 213BCBLK (14”x19”) or 221BCB, 222BCB BLK (13” x 24”) plastic valve box with bolt down plastic lid or approved equal. Size of box is dependent on the size of valve. Lid shall be marked: "Irrigation Control Valve."

2. All electric remote control valve boxes that service dripline or drip systems shall be installed within a NDS Pro Series Model 221 BCB (13” x 24”) plastic valve box with bolt down plastic lid or approved equal. Lid shall be marked: "Irrigation Control Valve."

3. Use black colored boxes in shrub and groundcover areas and green in turf areas.

4. Heat brand controller letter and numbers into lid. Minimum text height to be 2”.

B. GATE VALVE AND QUICK COUPLING VALVE BOXES:

1. All gate valve and quick coupling valve shall be installed within a NDS Pro Series Model 212BCB or 211BBCBLK plastic valve box with plastic lid or approved equal. Use 8” sleeve to encase gate valve.

2. Use black colored boxes in shrub and groundcover areas and green in turf areas.

3. Heat brand the letters “GV” into lid. Minimum text height to be 2”.

C. DRIP COMPONENT BOXES:

1. All drip components shall be installed within a 6” round black plastic valve box with plastic lid. NDS Standard Series Model 107BC plastic valve box with plastic lid or approved.

2.12 SPRINKLER HEADS AND BUBBLERS

A. All sprinkler heads shall be as listed on the drawings.

B. Pop-up spray sprinklers shall include a built in check valve in the body to hold up to 14 feet of head.

C. Pop-up spray sprinklers shall include built in pressure regulation in the body.

D. Use 30 psi regulators for all spray nozzles and 45 psi regulators for all rotating nozzles. Use 12” pop-ups in shrub and ground cover areas and 6” pop-ups in turf areas.

E. Riser units and nipples shall be the same size as the inlet to the sprinkler body.

2.13 DRIPLINE & DRIPLINE COMPONENTS

A. Dripline shall be as listed on the drawings.

B. Tubing shall be low density, UV resistant, polyethylene tubing with internal pressure-compensating, drip emitters impregnated into the tubing spaced at 12 or 18 inches

C. The built in emitters shall be capable of delivering 0.53 gallons per hour per emitter.

D. All dripline systems shall have a manual flush valve at each isolated zone within the systems. Multiple flush valves may be required per drip zone.

E. All dripline systems shall have air relief valve(s) at the highest elevation point(s) within each isolated zone. Install one air relief valve for every 500 linear feet of dripline.

2.14 CHECK VALVE

A. Spring check valve shall be Schedule 40 PVC with ½ lb spring and stem rated at 150 PSI.

B. Check valves shall be NDS. Use KSC series swing check valve for all uphill flow direction valves and KC series spring check for all downhill flow direction valves. Size per line size of lateral line.

2.15 MISCELLANEOUS INSTALLATION MATERIALS

A. Solvent cement and primer for solvent weld joints shall be of make and type approved by manufacturer(s) of pipe and fittings. Cement shall be maintained at proper consistency throughout use.

B. Pipe joint compound shall be non-hardening, non-toxic materials designed specifically for use on threaded connections in water carrying pipe. Performance shall be same as RectorSeal #5.

2.16 MISCELLANEOUS EQUIPMENT

A. Provide all equipment called for by the drawings.

B. Provide to the Project Representative at completion of the maintenance period, three (3) each of all operating and servicing keys and wrenches required for complete maintenance and operation of all heads and valve. Include all wrenches necessary for complete disassembly of all heads and valves.

PART 3 - INSTALLATION

3.1 PREPARATION

A. Schedule and coordinate placement of materials and equipment in a manner to effect the earliest completion of work in conformance with construction and progress schedule.

3.2 HANDLING AND STORAGE

A. Protect work and materials from damage during construction and storage as directed by the Project Representative.

B. Handle plastic pipe carefully; especially protect it from prolonged exposure to sunlight. Any section of pipe that has been damaged will be discarded and removed and replaced if installed.

3.3 LAYOUT

A. Lay out work as accurately as possible in accordance with diagrammatic drawings.

B. Where site conditions do not permit location of piping, valves and heads where shown, notify Project Representative immediately and determine relocation in joint conference.

C. Prior to installation, the Contractor shall stake out the routing of all pressurized main lines and sprinkler heads for approval by Project Representative.

D. Run pipelines and automatic control wiring in common trenches wherever practical.

3.4 EXCAVATING AND TRENCHING

A. Excavation shall be in all cases ample in size to permit the pipes to be laid at the elevations intended and to permit ample space for joining.

B. Make trenches for pipelines deep enough to provide minimum cover from finish grade as follows:

1. 18” minimum cover over main lines to control valves and quick coupling valves.

2. 18” minimum cover over control wires from controller to valves.

3. 12” minimum cover over RCV controlled lateral lines to sprinkler heads.

C. Restore surfaces, existing underground installations, etc., damaged or cut as a result of excavations, to original conditions in a manner approved by the Project Representative.

D. Where other utilities interfere with irrigation trenching and pipe work, adjust the trench depth as instructed by the Project Representative.

3.5 ASSEMBLING PIPELINES

A. All pipe shall be assembled free from dirt and pipe scale. Field cut ends shall be reamed only to full pipe diameter with rough edges and burrs removed.

B. Install plastic pipe in accordance with manufacturer’s recommendations.

C. Install 3” wide detectable warning tape above all pressurized main lines as shown in the details. Use Christy model #TA-DT-3-BIRR for potable irrigation systems.

D. Solvent Weld Joint:

1. Prepare joint by first making sure the pipe end is square. Then, de-burring the pipe end, and clean pipe and fitting of dirt, dust and moisture.

2. Dry insert pipe into fitting to check for proper sizing. Pipe should enter fitting 1/3 to 2/3 depth of socket.

3. Coat the inside socket surface of the fitting and the male end of the pipe with P-70 primer (manufactured by Weld-On). Then without delay, apply Weld-On 711 cement liberally to the male end of the pipe and also apply 711 cement lightly to the inside of the socket. At this time, apply a second coat of cement to the pipe end.

4. Insert pipe immediately into fitting and turn 1/4 turn to distribute cement and remove air bubbles. The pipe must seat to the bottom of the socket and fitting. Check alignment of the fitting. Pipe and fitting shall be aligned properly without strain to either.

5. Hold joint still for approximately thirty (30) seconds and then wipe the excess cement from the pipe and fitting.

6. Cure joint a minimum of thirty (30) minutes before handling, at least six (6) hours before allowing water in the pipe.

E. Threaded Joint:

1. Field threading of plastic pipe or fittings is not permitted. Only factory formed threads will be permitted.

2. Factory made nipples shall be used wherever possible. Field cut threads in metallic pipe will be permitted only where absolutely necessary. When field threading, cut threads accurately on axis with sharp dies.

3. All threaded joints shall be made up with pipe joint compound. Apply compound to male threads only.

4. Where assembling metallic pipe to metallic fitting or valve, not more than three (3) full threads shall show when joint is made up.

5. Where assembling to threaded plastic fitting, take up joint no more than one full turn beyond hand tight.

6. Where assembling plastic pipe, use strap type friction wrench only; do not use metal-jawed wrench.

F. Cap or plug openings as pipeline is assembled to prevent entrance of dirt or obstructions. Remove caps or plugs only when necessary to continue assembly.

G. Where pipes or control wires pass through sleeves, provide removable non-decaying plug at ends of sleeve to prevent entrance of earth.

3.6 REMOTE CONTROL VALVES

A. Install where shown on drawings and group together where practical. Limit one remote control valve per box.

B. Locate valve boxes 12” from and perpendicular to walk edges, buildings and walls. Provide 12” between valve boxes where valves are grouped together.

C. Thoroughly flush main line before installing valves.

D. Install in shrub or groundcover areas where possible.

E. Label control line wire at each valve with an I.D. tag, indicating identification number of valve (controller and station number). Attach label to control wire.

F. Flow control stems shall be adjusted or tuned per manufacturer recommendations.

G. Install 18GA ½" x ½" square stainless-steel Type 304 wire mesh under all valve boxes and wrap up the sides of the valves. Adhere wire mesh to sides of box with stainless-steel screws and washers as required. Refer to details for more information.

3.7 AUTOMATIC CONTROL WIRE

A. Run lines along mains wherever practical. Tie wires in bundles with pipe wrapping tape at 10' intervals and allow slack for contraction between strappings.

B. Loop a minimum of three (3) feet of extra wire in each valve box; both control wire and ground wire.

C. Connections shall be made by crimping bare wires with brass connectors and sealing with watertight resin sealer packs.

D. Splicing will be permitted only on runs exceeding 2500'. Locate all splices at valve locations within valve boxes.

E. Where control lines pass under paving, they shall pass through Schedule 40 electrical PVC conduit. Do not tape wire in bundles inside conduit.

3.8 AUTOMATIC CONTROLLER

A. Provide and install automatic irrigation controller in approximate locations shown on drawings. The exact location will be determined on the site by the Project Representative. Provide conduit and wire and connect to 120 volt switch accessible to controller for ease of maintenance.

B. Connect control lines to controller in sequential arrangement according to assigned identification number on valve. Each control line wire shall be labeled at controller with a permanent non-fading label indicating station number of valve controlled. Attach label to control wire.

C. Provide each irrigation controller with its own independent low voltage common ground wire.

3.9 BUBBLERS, SPRINKLER HEADS AND QUICK COUPLING VALVES

A. Thoroughly flush lines before installing heads, bubblers or QCV's.

B. Locate bubblers, heads and QCV's as shown in the drawings and details.

C. Adjust sprinkler heads for proper distribution and trim.

3.10 DRIPLINE AND DRIPLINE COMPONENTS

A. Thoroughly all flush lines driplines.

B. Install dripline a minimum of 12" away from all buildings and 6" off hardscapes for shrubs and groundcover. 2" of paving for all no-mow or sod type grasses.

C. Space driplines equally throughout the planting area as detailed. Refer to legend for emitter and row spacing of dripline. Adjust alternate rows so emitters are spaced in a triangular pattern.

D. All dripline tubing shall be buried 4” below finish grade and stapled down every 4’ and at each change in direction with a 6” tubing stake.

E. For slopes greater than 10:1, modify dripline row spacing on the bottom 1/3 of the slope to be 25% greater at the bottom of the slope.

F. Install flush valves at the low end of each drip zone minimum of 2 valves are required for each valve. Refer to manufacturer details for installation instructions.

G. Install air vacuum relief valve(s) at high point(s) of each planting area. Refer to drawings for approximate locations. Revise locations in field based on actual grades of the site. Locate 1 valve per every 500’ of dripline. Refer to manufacturer details for installation instructions.

H. Thoroughly saturate soil prior to planting. Provide additional surface watering as required to keep plant root systems moist during planting establishment period.

3.11 BACKFILLING

A. Backfill only after piping and wire has been inspected and approved.

B. Backfill material shall be the earth excavated from the trenches, free from rocks, concrete chunks, and other foreign or coarse materials.

C. Place backfill materials in 6" layers and compact by jetting or tamping to a minimum compaction of 90 percent of original soil density.

D. Dress off areas to finish grade and remove excess soil, rocks, or debris remaining after backfill is completed.

E. If settlement occurs along trenches, and adjustments in pipes, valves, and sprinkler heads, soil, sod, or paving are necessary to bring the system, soil, sod, or paving to the proper level or the permanent grade, the Contractor, as part of the work under this contract, shall make all adjustments without extra cost to the Project Representative.

3.12 FIELD QUALITY CONTROL

A. Coverage Tests:

1. Perform coverage tests in the presence of Project Representative, after sprinkler or drip system is completed. Test system to assure that all areas are irrigated completely and uniformly.

2. Do not spray onto pavement or structures. Adjust arc nozzles as needed to provide full coverage without over spray.

B. Adjusting and Cleaning:

1. System adjustment:

   a. Valves: Adjust flow for proper operation.

   b. Heads: Adjust for alignment and coverage.

   c. If it is determined that coverage could be improved by adding additional driplines or a nozzle change, make such changes as required to provide adequate coverage to all plant material.

   d. Perform final cleaning of all risers, dripline, heads, and equipment for proper operation. Demonstrate operation and uniform coverage in the presence of the Project Representative prior before final acceptance.

3.13 TESTING

Perform test as specified below. Remake any faulty joints with all new materials. Use of cement or caulking to seal leaks is absolutely prohibited.
Contractor shall:

A. Notify the Project Representative at least three (3) days in advance of testing.

B. Perform testing at his/hers own expense.

C. Center load piping with small amount of backfill to prevent arching or slipping under pressure. No fitting shall be covered

D. Apply the following tests after welded plastic pipe joints have cured at least twenty-four (24) hours.

1. Solvent Weld Mainline: Remove all the air from the piping system then test live (constant pressure) and QCV lines hydrostatically at 125 PSI minimum. Lines will be approved if test pressure is maintained for six (6) hours. The lines shall be restored to the original test pressure. The Contractor shall make tests and repairs as necessary until test conditions are met.

2. Test RCV controlled lateral lines with water at line pressure and visually inspect for leaks. Retest after correcting defects.

3.14 GUARANTEE

A. It shall be the responsibility of the Contractor to fill and repair all depressions and replace all necessary lawn and planting due to the settlement of irrigation trenches for one year following completion and acceptance of the job.

B. The Contractor shall also guarantee all materials, equipment and workmanship furnished by him to be free of all defects of workmanship and materials, and shall agree to replace at his expense, at any time within one year after installation is accepted, any and all defective parts that may be found.

3.15 MAINTENANCE

A. Continuously maintain irrigation system in areas indicated in the Contract during the progress of work and for a period of 90 days after substantial completion.

B. It is Contractor's responsibility to turn over the irrigation in a first-class condition at the end of the maintenance period.

C. Maintenance Schedule: Contractor shall submit schedule of maintenance tasks to be performed for Project Representative review and approval. At a minimum, maintenance staff shall be on-site two times per month. It is not the intention of these Specifications to allow a "quick cleanup" at the end of the maintenance period, but rather that the work be continuous and ongoing.

D. Proper irrigation system maintenance includes the overall supervision of the system, controller scheduling, routine adjustments and necessary repairs.

E. Maintain irrigation system for optimum performance, as per manufacturer's specifications, by inspecting the entire system on an on-going basis. This includes cleaning and adjusting all bubbler heads, dripline and valves for proper coverage

3.16 CLEAN-UP

A. When work of this section has been completed and at such other times as may be directed, remove all trash, debris, surplus materials, and equipment from site.

3.17 WINTERIZATION OF IRRIGATION SYSTEM

A. The Contractor shall be responsible for draining irrigation system in preparation for the first winter after construction has been completed. Instruct Owner's representatives in proper procedures.

B. Winterization shall proceed as follows:

1. Close gate valve in irrigation main line located at the water meter.

2. Insert quick coupling quill, connected to air compressor, into quick coupling valve located at water meter.

3. Following start of air compressor, program irrigation controller through three (3) complete cycles or until all water has been forced out of the system.

4. Insert quick coupling quill into QCV at dead end runs of main line to force out all remaining trapped water.

5. Remove compressor, leaving gate valve to irrigation system closed.

END OF SECTION 32 84 00

SECTION 32 90 00
LANDSCAPE PLANTING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work to be Included:

1. Furnish all labor, materials, equipment, rentals, facilities, transportation, incidentals, excavations, submittals and services for installation of plant material and related work as shown on the drawings and/or specified herein including all topsoil, compost, headers, fertilizer, organic materials, plant materials, plant labels, tree stakes, mulch, maintenance, warranties and all other incidentals to planting work and as necessary for a complete and full installation of Landscape Planting.

B. Related Work:

1. Section 00 31 19 -- Utilities: Contractor shall fully acquaint himself with the existing conditions particularly in reference to underground piping. Any damage caused by contractor to work of other trades shall be repaired by him at no cost to the Owner.
2. Section 31 00 00 -- Earthwork: Close coordination shall be maintained with those Contractors performing rough grade operations and installing utilities and pavement to insure proper timing of the work.
3. Section 31 10 00 – Site Clearing
4. Section 32 13 13 –Concrete Work
5. Section 32 84 00 – Irrigation: Irrigation system shall be installed and operative before beginning planting operation

1.02 RELATED DOCUMENTS

A. The General and Supplementary Conditions and General Requirements apply to the work herein specified.

B. References:

1. Nomenclature: "Western Garden Book," Sunset Publishing Co., Menlo Park, CA, 2001 edition or current edition.
2. Plant Material Standards: “American Standard for Nursery Stock”, American Nursery & Landscape Association, 1000 Vermont Avenue, NW Suite 300, Washington, DC, or current edition.
3. Staking and guying procedures: "Staking Landscape Trees", University of California Extension, Publication #2576, or current publication.
4. Pruning procedures: "Tree Pruning Guidelines", International Society of Arboriculture, Savoy, IL, 1995 or current edition, conforms to ANSI-A300-1995 tree pruning specifications and guidelines.
5. Manufacturer's recommendations.

1.03 REGULATORY REQUIREMENTS

A. Comply with Federal and State laws requiring inspection for plant diseases and infestations.

B. Conform to all federal, state, county, district, local codes and requirements for installation, preparation and maintenance as referenced herein and as applicable.

C. Certificates of inspection required by law for transportation shall accompany invoice for each shipment of plants. Submit inspection certificates with each shipment of plants and deliver certificates to the Owner's Representative after acceptance of material.

D. Inspection by Federal or State Governments at place of growth does not preclude rejection of plants at project site.

1.04 PERFORMANCE REQUIREMENTS

A. Supervision: Assign a full-time employee to the job as Foreman for the duration of the Contract with a minimum of four (4) years experience in landscape installation. Foreman to be present during the entire installation. Notify Owner's Representative of all changes in supervision.

1.05 QUALITY ASSURANCE

A. Personnel:

1. All planting and turf work shall be performed by competent and efficient personnel familiar with planting and turf procedures under the supervision of a Qualified Foreman.
2. Installing contractor shall have successfully completed within the last 3 years at least 3 planting applications similar in type and size to that of this project.

B. Plant Material Standards:

1. Plant Certification: All plants must meet specifications of Federal, State, and County laws requiring inspection for plant disease and insect infestations. Inspection certifications required by law shall accompany each shipment, invoice and order for stock.
2. Codes and Standards: Nursery stock shall meet the standards of the current edition of the "American Standard for Nursery Stock", "Agricultural Code of California" and the "Regulations of the Director of Agriculture Pertaining to Nursery Stock". They shall be true to type and name in accordance with "Standardized Plant Names", Second Edition.
3. Use only nursery-grown stock that is free from insect pests and diseases. Any required clearances shall be obtained prior to shipment of plant material.
4. Plants shall be subject to inspection and approval of the Landscape Architect at place of growth or upon delivery for conformity to specifications. Such approval shall not impair the right of inspection and rejection during progress of the work.

Wherever the terms "approve", "approval" or "approved" are used herein they mean approval of the Landscape Architect in writing.

5. Contract Grown Plants: Contract grown plant material does not relieve the landscape contractor of providing materials which do not match or exceed standard nursery stock. Plants which do not meet standards shall be rejected and the Contractor shall provide nursery grown stock as required at no additional cost to the Owner or contract.

1.06 SUBSTITUTIONS

A. Substitutions: Substitutions of plant materials will not be permitted unless authorized in writing by Owner's Representative. If proof is submitted that any plant specified is not obtainable, a proposal will be considered for use of the nearest equivalent size or variety with corresponding adjustment of Contract price. Such proof shall be substantiated and submitted in writing to Owner's Representative.

B. The Contractor shall submit a list of un-available plants per project plant list and a list of all nurseries and plant brokers contacted a maximum of 15 days after Notice to Proceed.

C. The Landscape Architect reserves the right to require the Contractor to replace at the Contractor's cost any plants which the Contractor has installed without the Landscape Architect's approval.

1.07 PROOF OF PLANT AVAILABILITY

A. These provisions shall not relieve Contractor of the responsibility of obtaining specified materials in advance if special growing conditions or other arrangements must be made in order to supply specified materials. Contractor shall secure all material and provide proof of such within 30 days of Notice to Proceed in order to guarantee plant availability at time of planting. .

B. Payment for the procurement of plant material, including possible incidentals such as storage and maintenance at nursery after purchase or contract growing plants, is the full responsibility of the Contractor.

1.08 SUBMITTALS

All submittal data shall be forwarded in a single package to the Owner's Representative within 15 days of award of contract.

A. Furnish 6 copies of manufacturers' literature for the following items:

1. Plant Supplier’s List:

a. Submit documentation to the Owner's Representative within 30 days of Notice to Proceed, that all plants listed on the plans have been ordered. Substitution of size or species due to unavailability must be requested in writing within 15 days of Notice to Proceed.

2. Fertilizer

3. Fertilizer Tablets
4. Filter Fabric
5. Organic Amendment
6. Pre-Emergence Weed Killer
7. Root Control Barriers
8. Storm Water Soil Mix
9. Top Mulch
10. Tree Guying
11. Tree Support Poles
12. Tree Ties

B. Soil Testing: Provide soil analysis from an approved testing laboratory. Soil analysis using Saturate Media Analysis will not be allowed and rejected outright for soil analysis. Soil analysis shall include pH, salinity, sodium hazard, boron hazard, lime content, organic matter, soil texture and available nutrient levels. Submit test results, analysis, and recommendations for:

1. Existing site topsoil (1 sample per acre)

   Top Soil Analysis: After approval of rough grading and topsoil placement, obtain three representative samples of topsoil taken from approved site locations and submit to approved testing agency for "agricultural suitability" analysis report, including evaluation of physical and chemical properties of soil and recommendations for adding amendment and fertilizers to the soil. Upon approval of the Laboratory's report by the Owner's Representative, the report recommendations become a part of the Specifications. Adjust the quantities of soil amendment, fertilizer and other additives to conform to the report.

2. Import top soil

   Imported Top Soil Analysis: Submit sample to approved testing agency for "agricultural suitability" analysis report, including evaluation of physical and chemical properties of soil and recommendations for adding amendment and fertilizers to the soil. Upon approval of the Laboratory's report by the Owner's Representative, the soil and report recommendations become a part of the Specifications. Adjust the quantities of soil, soil amendment, fertilizer and other additives to conform to the report.

3. Imported Soil Fill

   Imported Soil Fill shall fall within acceptable tolerances for plant fertility and suitability and shall have a pH value between 6 and 7.5. Imported soil fill that exceed acceptable levels for Macro and Micro – Nutrients for plants as indicated in soil laboratory testing will be rejected and shall not be used for project.

4. Storm Water/Retention/bioswale/Rain Garden Soil Mix.
5. Organic Amendment.

C. Submit one (1) quart sample each of mulch and organic amendment.

D. Certificates of Compliance, receipts, and /or delivery tickets for the following:

1. Soil amendment, chemical and physical properties. Do not deliver amendment to the site without approval of submittals by Owner's Representative.
2. Storm Water Soil Mix. Do not deliver soil mix to the site without approval of submittals by Owner's Representative.
3. Quantity of soil amendment delivered to site for incorporation into soil.
4. Sod: Submit information from sod farm company, including type and percentage of seed mixture for approval by Owner's Representative.
5. Grass Seed Mixes.
6. Vegetable Planter Soil Mix – sand and amendment analysis.
7. All other soil amendments, soils, compost, and mulch delivered to the site.

1.09 ADDITIONAL SAMPLES AND TESTS

A. Owner's Representative reserves the right to take and analyze samples of materials for conformity to specifications at any time. Contractor shall furnish samples upon request by Owner's Representative. Rejected materials shall be immediately removed from the site at Contractor's expense. Cost of testing of materials not meeting specifications shall be paid by Contractor.

1.10 SELECTION AND TAGGING OF PLANT MATERIAL

A. Contractor shall select and tag all plant material within 30 days of Notice to Proceed. Plant material which is not available, or not possible to contract grow shall be noted to the Landscape Architect within 15 days of Notice to Proceed so substitutions may be selected. Contractor shall source material from out of state or thru a plant broker if not locally available. Contractor shall submit lists of all nurseries and plant brokers contacted for availability.

B. Plants shall be subject to inspection and approval by Owner's Representative at place of growth if the Owner's Representative so chooses, and upon delivery for conformity to specifications. Such approval shall not impair the right of inspection and rejection during progress of the work. Submit written request for inspection of plant material at place of growth to Owner's Representative. Written request shall state the place of growth and quantity of plants to be inspected. Owner's Representative reserves right to refuse inspection at this time if, in his judgment, a sufficient quantity of plants is not available for inspection.

C. Plants identified as "selected specimen" shall be approved and tagged at place of growth by Owner's Representative. For distant material, submit photographs for pre-inspection review.

1.11 PROJECT SITE CONDITIONS

A. Site Visit: At beginning of work, visit and walk the site with the Owner's Representative to clarify scope of work and understand existing project site conditions. Identify location of utilities and other improvements. Notify Owner's Representative of conflicts prior to start of work for resolution.

B. Access: Inspect project site and become familiar with the accessing requirements and restrictions. At time of submitting bid, provide written notice of any conditions that would prevent installation of the specified plant material.

1.12 JOB CONDITIONS

A. Delivery:

1. Deliver manufactured materials in original containers with brand and maker's name marked thereon. Materials in broken containers or showing evidence of damage will be rejected and must be immediately removed from the site. Odorous materials shall not be brought to the site until they are to be used. Deliver quantities necessary to complete the work shown on the Drawings. Any discrepancy in the quantities given on the plans shall not entitle Contractor to additional remuneration.
2. Deliver Bulk materials to the job site and store to deter mixing with other bulk materials, saturation by rainwater, contamination and/or contact with other deleterious substances or materials.
3. Deliver plants with identification labels.
    a. Labels should state correct name and size.
    b. Use durable, water-proof labels with water resistant ink that will remain legible for at least 60 days.
4. Protect plant materials during transport to prevent damage to rootball or desiccation of leaves.
5. Remove unacceptable plant materials immediately from job site.
6. Contractor shall endeavor to coordinate delivery with installation schedule so that plant material is installed on the same day.

B. Storage:

1. Plants: Maintain plant material in healthy growing condition at all times. Protect plants from drying winds, vandals and animals. Keep plants that cannot be installed immediately in the shade, if shade plants and in the sun, if sun plants. Water and feed as necessary. Owner's Representative reserves the right to reject plants that decline in quality after delivery to site.

C. Under no circumstances shall any work be performed if the temperature exceeds 90 degrees or is below 40 degrees. No planting shall be done with the soil saturated with water.

1.13 PROTECTION OF EXISTING PLANTS TO REMAIN

A. Do not store materials or equipment, permit burning, or operate or park equipment under the branches of any existing plant to remain except as actually required for construction in those areas.

B. Provide barricades, fences or other barriers as necessary at the drip line to protect existing plants to remain from damage during construction.

C. Notify Owner's Representative in any case where Contractor feels grading or other construction called for by Contract Documents may damage existing plants to remain.

D. If existing plants to remain are damaged during construction, Contractor shall replace such plants of the same species and size as those damaged at no cost to Owner. Determination of extent of damage and value of damaged plant shall rest solely with Owner's Representative.

PART 2 - PRODUCTS

2.01 SOIL AMENDMENTS

A. The following organic amendments, soil amendments, and fertilizer rates and quantities are to be used for bid basis only. Contractor shall arrange and pay for testing by an accredited soils laboratory of existing site soil after rough grading operations are complete, and shall amend the soils according to said laboratory's recommendations. The soils recommendations shall be considered a part of this specification.

B. Topsoil: Provide topsoil as required to complete landscape work. Topsoil to be furnished shall be fertile and friable, possessing characteristics of representative productive soils on the site. It shall not contain toxic substances which may be harmful to plant growth. If herbicide contamination is suspected then a radish/rye grass growth trial must be performed. Consult with Owner's Representative prior to decision to test. It shall be uniformly textured and free of all objectionable foreign materials, oil, or chemicals which may be injurious to plant growth. Natural topsoil shall possess a pH factor between 5.5 and 7.5, a sodium adsorption ratio (SAR) of less than 8, a boron concentration of the saturation extract of less than 1 ppm, and salinity of the saturation extract at 25 degrees C. of less than 4.0 millimhos per centimeter.

Obtain topsoil from naturally well- drained sites where topsoil occurs in a depth of not less than 4 inches; do not obtain from bogs or marshes. Topsoil from the project stockpile which meets the requirements is acceptable.

C. Obtain topsoil from naturally well- drained sites where topsoil occurs in a depth of not less than 4 inches; do not obtain from bogs or marshes. Topsoil from the project stockpile that meets the requirements is acceptable.

D. Imported Topsoil: Topsoil shall be tested by an approved soils laboratory for compatibility with existing on-site soils and fertility. Contractor shall submit soil laboratory's analysis and amendment recommendations. Imported topsoil shall be subject to inspection by Owner's Representative at the project site. Remove rejected topsoil immediately at Contractor's expense. The imported topsoil shall be blended on site with the following ratio:

1 part of compost blended with 2 parts of imported soil.

E. Imported Soil Fill

1. Import soil fill as needed to complete the job with the following properties:

a. Imported planting soil pH value to be between 6.0 and 7.5 with boron concentration of the saturation extract of less than 1 ppm, salinity of the saturation extract at 25 degrees C. of less than 4.0 millimoles, and a sodium absorption rate (SAR) of less than 8.

b. Silt and clay content of imported planting soil is not to exceed that of the existing soil it is to be placed over.

c. Do not deliver topsoil to the site until Owner's Representative has reviewed soils report and has approved submittals by Owner's Representative.

F. Organic Amendment:

1. For bidding purposes, assume Soil Amender Compost, available from Organic Solutions, ph. 707-751-0466 or approved equal. Application rate per 1000 square feet:

6 cubic yards Organic Compost

2. Organic Amendment: Feedstock shall be no longer recognizable. Compost amendment shall contain fairly uniform particle size, no weed sprouts. Submit a nutrient analysis and testing data from a third party or soil lab, such as the STA Seal of Testing Assurance by the US Composting Council; or OMRI, Organic Materials Review Institute. Organic Compost shall meet the following criteria:

a. Particle size: 100% passing a 1" screen or smaller.

b. Salt Concentration: Must be reported; may vary but < 4.0 mmhos/cm preferred. Soil should be test. <2.5 mmhos/cm preferred for soil/compost blend.

c. Feedstock Materials shall be specified and include at one or more of the following: landscape/yard trimmings, grass clippings, food scraps, and agricultural crop residues.

d. Nutrient Content: provide analysis detailing nutrient content including N-P-K; Ca; Mg; S; and Bo. Nitrogen content 1% or above preferred.

e. Trace Contaminants Metals (Lead, Mercury, etc.). Product must meet US EPA, 40 CFR 503 regulations.

f. pH: pH shall be between 5.5 and 8.

g. Visible Contaminants: compost shall be relatively free of inert ingredients, including glass, plastic and paper, < 0.1 % by weight or volume.

h. Moisture Content shall be between 35% - 55% of dry solids.

i. Organic Matter Content: 50% - 60% by dry wt. preferred, 30-70% acceptable.

j. Carbon and Nitrogen Ratio: C:N < 20:1.

k. Stability/Maturity: shall have a dark brown color and a soil-like odor. Compost exhibiting a sour or putrid smell, containing recognizable grass or leaves, or is hot (120F) upon delivery or rewetting is not acceptable.

l. Weed seed/pathogen destruction: provide proof of process to further reduce pathogens (PFRP). For example, turned windrows must reach min. 55C for 15 days with at least 5 turnings during that period.

G. Storm Water Soil Mix: Soil mix shall have a minimum percolation rate of 5" per hour and be amended per Soil and Plant lab test results. Depth of soil shall be as specified on the Civil Engineer plans. Mix shall be Terravida by TMT or approved equal.

H. Fertilizer:

1. Turf and groundcover areas:
   a. 6N-20P-20K, 25 lbs. per 1,000 square feet or 6N-24P-24P, 15 lbs per 1,000 square feet.
   b. Starting one month after planting, on a monthly basis until start of Maintenance Period, apply 12N-8P-16K fertilizer. 7 lbs. per 1,000 square feet.
2. Shrubs and trees:
   a. 21 gram tablet 20N-10P-5K slow release fertilizer tablets as manufactured by Agriform or approved equal. Apply according to Manufacturer's instructions and as follows:
      1) 36" Box shall receive 36 tablets
      2) 24" Box shall receive 24 tablets
      3) 15 Gallon shall receive 10 tablets
      4) 5 Gallon shall receive 3 tablets
      5) 1&2 Gallon shall receive 2 tablets
   b. Starting one month after planting, on a monthly basis until start of maintenance Period, apply 12N-8P-16K fertilizer 7 lbs. per 1,000 square feet.

2.02 TOP MULCH

A. Recycled Pro-Chip Decorative Mulch, dark brown Available from Earth Tones Mulch, 1-800-536-6702, or approved equal.

2.03 GROUNDCOVERS, TREES, AND SHRUBS

A. All plant materials shall be nursery grown in accordance with the best known horticulture practices and under climatic conditions similar to those in the locality of the project. Container stock shall have grown in the containers in which delivered for at least six (6) months, but not over two years. No container plants that have cracked or broken balls of earth when taken from container shall be planted except upon special approval by Owner's Representative.

B. Roots to be healthy and extend to the bottoms and sides the container with no signs of restriction due to kinked, circular or distorted growth or deformed or circling roots at the liner stage. Rooting to be extensive enough to hold the rootball together during planting, but not as dense as to discourage root establishment into surrounding soils. No plants with roots that have encircled themselves will be accepted. In case of any unsatisfactory root system, a total group of plants may be rejected.

C. Plants shall be vigorous and shall have a normal habit of growth. Plants shall be free of damage by insects, pests, diseases or wind; burns from insecticides or fertilizer; and stunted growth due to lack of water, lack of food, diseases, or other causes. Plants shall be in conformity with the sizes shown on the drawings.

D. Trees: Unless otherwise specified, tree trunks shall be straight with leader intact, undamaged, and uncut. All old abrasions and cuts are acceptable only if completely callused over.

E. Quantities: Quantities necessary to complete the work as shown on the drawings shall be furnished.

2.04 TREE SUPPORT POLES

A. Peeled, lodge pole pine logs, treated with Chemonite or ACQ or approved equal, clean, smooth, new, and sized as follows:

1. Three inch (3") diameter by ten (10') long for trees greater than 8 feet high and 1 inch caliper.

2.05 TREE GUYING

A. For trees up to 3 inch caliper, 1/16 inch galvanized steel cable, with rubber tree collar, 12 inch minimum long, and secured with cable clamp, and attached to anchor for below-grade location, Duckbill Model 40 DTS, or approved equal.

B. For trees 3 inches to 6 inches caliper, 1/8 inch galvanized steel cable with rubber tree collar, 21 inches minimum long, and secured with cable clamp, 3 inches take-up eye to eye turnbuckle, and attached to anchor for below-grade location, Duckbill Model 68 DTS, or approved equal.

C. Each guy wire shall be installed with 1 inch VC pipe, 3 foot long sleeve, as warning device.

2.06 TREE TIES

A. Flexible strap, 24 inch minimum length without sharp edges adjacent to trunk, V.I.T. cinch-ti, or approved equal.

B. Water source shall be provided by Owner. Contractor shall provide transport as required.

2.07 ROOT CONTROL BARRIERS

A. Root barrier CP 24-2, min. thickness .080", Century Products (714) 632-7083. Root barrier shall be used on all trees 5' or closer to pavement, utilities, curbs, etc. Or approved equal.

2.08 FILTER FABRIC

A. Filter Fabric: Polyester non-woven filter fabric with uniform fiber distribution by “Terra Bond” #1115, “Mirafi, Inc.” #140NS, or approved equal.

2.09 PRE-EMERGENCE WEED KILLER

A. Clean non-staining as recommended by a licensed pest control specialist and as approved by Owner’s Representative in compliance with the Owner’s Representative’s Integrated Pest Management Policy.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspections by the Landscape Contractor:
   1. Before proceeding with the work: Carefully inspect all areas and verify all dimensions and quantities.
   2. In the event of discrepancy, immediately notify the Owner's Representative. Do not proceed with this installation in areas of discrepancies until all such discrepancies have been fully resolved.
   3. Planting operations shall be performed only during periods when beneficial results can be obtained. When excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped until conditions are satisfactory.
   4. Inspect trees, shrubs and ground cover plants for injury, insect infestations, and proper pruning.
   5. General contractor shall coordinate rough grading of site to ensure the Landscape Contractor shall receive all planting areas graded to $\pm$0.10 ft. of finish grades shown on the Drawings. Allow for depth of soil amendments and mulch in determining the difference between finished subgrade in groundcover and shrub beds. Verify that subgrades are not compacted. Do not proceed until detrimental conditions are corrected. Contractor shall take precautions during the excavation of all planting areas to not undermine or damage all adjacent pavements, footings and their associated subgrades.

3.02 FIELD QUALITY CONTROL/INSPECTIONS

A. Progress observations: In addition to the installation observations specified below, the Owner's Representative may make periodic progress observations.

B. Installation observations: Request at least 4 working days in advance:
   1. Observation of finish grading.
   2. Observation of plant material upon delivery to site.
   3. Observation of layout and placement of plant material at time of planting.
   4. Observation of any planting drainage problems, as identified by Contractor.

The above shall be considered check points and the Contractor shall only proceed with the work after the Owner's Representative has visited the site and determined that the work is proceeding satisfactorily.

C. Maintenance Observations: For the purpose of establishing the start of Maintenance Period and observing completion of the Work of this Section through Final Acceptance. Request at least 7 working days in advance:

1. Observation for Maintenance Period commencement.
2. Observation for Final Acceptance.

3.03 REVIEW AND ACCEPTANCE OF PLANT MATERIAL

A. Upon plant delivery, arrange material so that canopies or branch tips are not touching so that Owner's Representative can review plant material at project site.

B. Do not install material that has not been reviewed and accepted by Owner's Representative.

C. Arrange and pay for permits and inspections required for delivery of plant material.

3.04 FINE GRADING AND SOIL PREPARATION

A. General Fine Grading and Soil Preparation

1. The Contractor shall prepare the site for landscaping. In the areas designated for landscaping on the plans, he shall inspect planting areas and remove all base rock and other foreign material.
2. Rip in two directions all planting areas full depth of compacted fill (to a minimum of 12 inches) into undisturbed native soil prior to backfilling. Uniformly distribute and spread planting soil backfill in planting areas in layers not to exceed 18" and compact to a maximum of 85% relative compaction.
3. When the planting soil differs in clay and silt content from the subsoil it is to be placed upon, install a 4-inch thick lift of planting soil on the subgrade and rototill into the subgrade 6 inches deep before installing the remaining required planting soil.
4. Do not work planting soil in a wet or muddy condition or dump or spread in areas where subgrade is not in proper condition.
5. Water settling, puddling, and jetting of fill and backfill materials, as a compaction method is not acceptable.
6. Maintain moisture content of materials during compaction operations within required moisture range to obtain indicated compaction density.

B. The Contractor shall alleviate compacted soils before planting, for all landscaped areas that cannot be protected during construction.

1. Scarification: Scarify all planting areas prior to fine grading in order to ensure relative compaction of 85% or less. Any planting areas which become compacted in excess of 85% due to construction activities shall be thoroughly cross-ripped to

the maximum depth feasible to alleviate that condition, taking care to avoid all existing drainage and subsurface utility lines. See plans.

2. Scarification of any planting area that cannot be accomplished with a tractor shall be accomplished by an alternative method approved by the Owner's Representative to the specified depth to ensure proper drainage.

C. Drag to a smooth, even surface. Grade to form all swales, pitch to catch basins, streets, curb, etc. to ensure uniform surface drainage. Areas requiring grading include adjacent transition areas that shall be uniformly level or sloped between finish elevations. Provide surface drainage of planted area. Correct drainage conditions that may be detrimental to the growth of plant material or which will result in excessive retention of water in tree pits. Minimum slope in landscape areas shall be two percent (2%) or as shown on drawings. Slope away from building.

D. Cultivation and Placement of Amendment:

1. Hold finish grade and/or mulch surface in planting areas 1/2-inch below adjacent pavement surfaces, tops of curbs, manholes, etc.
2. Spread soil amendment, fertilizers and other additives evenly over installed and rough graded topsoil in all planting areas including turf, ground cover and shrub areas at the rates specified in the soils analysis report. For bid basis, use the following rates (Do not apply fertilizer to areas to be hydroseeded):
3. In areas to be planted with shrubs cultivate to a depth of 18". In turf and groundcover areas, cultivate soil to a depth of 8". Incorporate 6 cubic yards per 1000 square feet of organic amendment. Prior to planting incorporate to a depth of 6" the following fertilizers, per 1000 square feet:
   a. 6N-20P-20K at 25 lbs/1000 sq. ft. or 6N-24P-24K at 15 lbs/1000 sq. ft.
   b. Iron Sulfate: 2.5 lbs. per 1,000 square feet.
   c. Soil Sulfur: 15 lbs per 1,000 square feet.
   d. Agricultural Gypsum: 25 lbs per 1000 square feet
4. Areas within the driplines of existing trees shall be hand cultivated.

E. Finish Preparation in Turf Areas:

1. Roll to compact amended soil to not more than 85% compaction. Finish grade shall be 1" below adjacent paving, curbs, or walls unless otherwise shown on drawings. Finish out smoothing, even surfacing conforming to established grades after settlement. Rake immediately prior to planting.
2. If rain is likely between completion of soil preparation and planting, precautions shall be taken to prevent erosion of the soil.

F. Soil Mix for Backfill of Shrubs, Trees and Ground Covers: The following ingredients shall be tumbled to achieve a homogeneous mix:

1. Organic amendment 1 cubic yard
2. Topsoil 3 cubic yards

G. Contractor to remove any lime treated soil from planting areas and over excavate for drainage prior to the placement of top soil and import soil backfill.

H. Soil Mix for Backfill of Pots: The following ingredients shall be tumbled to achieve a homogeneous mix:

1. Organic amendment 1 cubic yard
2. Topsoil 3 cubic yards

Top dress each pot with one pound of Osmacoat 17-7-12 fertilizer.

3.05 HANDLING OF PLANTS

A. Prevent damage to plant material. Lift and handle plants only from bottom of rootball.

B. Do not plant material that has not been reviewed by Owner's Representative upon delivery to the project site, or that has been rejected for any reason. Do not plant under unfavorable weather conditions.

C. The Contractor shall protect all utilities, vegetation, and structures during work.

D. Trees shall be located a minimum of 3' from walls, overheads, walks, headers, and other trees within the project. If conflicts arise between size of areas and plans, Contractor shall contact Owner's Representative for resolution. Failure to make such conflicts known to the Owner's Representative will result in Contractor's liability to relocate the materials.

3.06 SHRUBS AND TREES

A. Preparation:

1. Owner's Representative will review, for conformance to design intent, locations of all plants in the field prior to planting. Notify Owner's Representative and schedule layout review sufficiently in advance of planting to allow for review and adjustment without disrupting construction schedule.
2. Stake layout of trees in field before installing irrigation. Mark tree and shrub locations on site using stakes, gypsum or similar approved means and secure location approval by the Owner's Representative before plant holes are dug. Adjust as necessary prior to planting. Owner's Representative reserves the right to make minor adjustments in the layout of all plant material; adjust irrigation system as necessary.

B. Excavation:

1. Excavate container grown tree, shrub, groundcovers and vine pits as follows. If rocks, underground construction work, tree roots or other unknown obstructions are encountered in the excavation of plant holes; Owner's Representative may select alternate locations. Report all such conditions in writing to the Owner's Representative. Where locations cannot be changed, submit a written proposal and cost estimate for removing the obstructions to a depth of not less than 6 inches below the required hole's depth. Obtain Owner's Representative's instructions prior to proceeding with the work affected.

Excavation for	Width	Depth
Boxed Trees	Box + 24"	Box + 12"

Canned Trees/Shrubs (15 gal) or larger	Can + 24"	Can + 12"
Canned Shrubs/Vines (2.5 to 5 gal)	Can + 18"	Can + 8"
Canned Shrubs/Groundcover/Vines (1 gal)	Can + 12”	Can + 6”

All plant pits shall be dug with vertical walls. The sides and bottoms of all planting pits shall be thoroughly scarified to ensure root penetration.

C. Percolation Testing:

1. Contractor shall verify water drainage of all planting pits with a percolation test prior to planting.
2. Fill full sized planting pit with water and observe in 24 hours.
3. Notify Owner's Representative if planting pit has not fully drained before proceeding with the planting operation for all areas not draining, and all soil conditions considered detrimental to growth of plant material. State condition, and proposal and cost estimate for correcting the condition.
4. Obtain Owner's Representative's instructions prior to proceeding with work affected.
5. Repeat drainage testing and correction of conditions until tests are passed.
6. Failure to perform drainage tests, or to notify Owner's Representative in writing of conditions specified above, renders Contractor responsible for all plant failure that occurs as a result of inadequate drainage or detrimental soil conditions, as determined by Owner's Representative.

D. Plants in Containers:

1. Plants shall be removed carefully from their containers after the containers have been cut on two sides minimum; fifteen-gallon containers shall be opened in three places. In the case of boxed plant specimens, the wood shall be removed at the sides and at the bottom of the box.
2. After removing plant material from its container, stimulate root growth by making four or five vertical cuts 1" deep around the circumference of the root ball.
3. Do not lift or handle plants by the top, stems, or trunk at any time. All plants shall be lifted in such a manner that the root ball is supported from the underside.
4. The Contractor shall check all plants for adequate root systems. If the root system is defective, he shall remove deficient plants from the site and replace them with new ones.

E. Planting:

1. Carefully remove and set plants and trees without damaging the rootball. Do not install plants or trees with damaged rootballs. Cutting or scoring of rootballs to be done only if species is known to be tolerant of such treatment. Superficially cut tolerant plants’ edge roots vertically on three sides using a knife.
2. For trees remove sides of boxes after positioning the plant and partially backfilling.
3. Center plant in pit or trench over tamped mound.
4. Face for best effect.
5. Set plant plumb and hold rigidly in position.

6. All plants shall be set in the ground so that the root ball will be flush with the finish grade. All plants that settle below the finish grade within 30 days of acceptance of the work shall be replanted in the proper position. In case a total section of planting area settles, the Contractor shall lift the plants, import additional soil mix, regrade, and replant, at no additional cost to the Owner.
7. Back fill:
    a. Backfill plant holes with soil mix as specified, free from rocks, clods or lumpy material. Backfill native soil free of soil amendments under rootball and foot tamp to prevent settlement.
    b. Set plants in backfill with top of the rootball 2 inches above finished grade. Backfill remainder of hole and soak thoroughly by jetting with a hose and pipe section. Water backfill until saturated the full depth of the hole. Thoroughly water all plants immediately after planting, eliminating air pockets. Prevent erosion.
    c. The filled pit shall be flush with surrounding grade when complete.
8. When the plant pit has been approximately one half filled, place planting tablets according to the manufacturer's schedule and per Section 2.01 Subsection K Fertilizer, paragraph 2.
9. Build 6" high watering basin berms around trees and shrubs to drain through rootball. Basins are not required around trees in turf areas.
10. Apply post-planting fertilizer.
11. Planting operation for plants in raised concrete planters is same as above except that finish grade of soil mix shall be 1 1/2" below top of planter walls. Planters may be backfilled with excess topsoil up to the depth specified for plant pits above which backfill shall be soil mix.
12. Planting operations for plants in precast planters is the same as stated in paragraph11 above. Fill entire planter with soil mix. Place planters as shown on planting plans.

3.07 GROUNDCOVER AREAS

A. Planting:
1. Plant in neat, straight, parallel and staggered rows as indicated on plan. Plant first row one-half required ground cover spacing behind adjacent curbs, structures, or other plant bed limits. Plant ground cover to edge of water basins of adjacent trees and shrubs.
2. Space plants equally and uniformly at spacing indicated on the Drawings, which are the maximum and in a triangular pattern.
3. Plant pits shall be sufficiently large so that the root can be freely suspended in the pit. After backfilling the pit, firm the soil so that there will be no air space around the roots.
4. Apply post-planting fertilizer.
5. Mulch all ground cover areas with 3" layer of mulch.

3.08 TOP MULCH

A. Except where rock mulch is required, mulch all shrub and ground cover areas with organic mulch to a 3 inch depth. Mulch ring at trees in turf areas to be 3 foot diameter for up to 36 inch box. Do not pile mulch around crowns of plants. Keep root crown free of mulch.

3.09 TREE STAKING

A. Stake trees as indicated on the Drawings. Drive stake until solid and remove excess stake protruding above top tree tie to prevent rubbing against branches. Allow 1 to 3 inches sway in trunk or branches; do not pull tight.

B. Tying: Find the proper support height by holding the trunk in one hand and pulling the top to one side and releasing it. The lowest height, at which the trunk will return to the upright position when the top is released, is the height at which to attach tree ties.

3.10 ROOT GUARD

A. Install as detailed and as specified below. If not shown, install in accordance with manufacturer's recommendations. Excavate an additional 12 inches below the proposed bottom edge of tree root barrier, then compact this space with the original excavation materials. Install the panels so that the vertical root deflecting ribs on the panels face inward, toward the root ball. The double top edge of the barrier should be positioned flush with finished grade. Install root barrier as indicated and at locations on drawings.

B. Install root control barrier for all trees located within 5 feet-0 inches of paved areas, in accordance with manufacturer's recommendations.

C. Root Barrier shall be installed in a linear fashion and shall never circle a tree.

3.11 PRUNING

A. Tree and Shrub: Pruning shall be performed as required to maintain a natural appearance, promote healthy and vigorous growth, and eliminate diseased or damaged growth.

B. Trees shall be pruned to thin crown and avoid wind damage, eliminate narrow V-shaped branch forks that lack strength, eliminate sucker growth, and maintain a radial branching pattern to avoid crossing branches.

C. Under no circumstances will stripping of lower branches ("raising-up") of young trees be permitted. Lower branches shall be retained in a "tipped back" or pinched condition with as much foliage as possible to promote caliper trunk growth (tapered trunk).

D. Major pruning of trees to compensate for root loss or for aesthetic reasons shall be done only with approval of the Owner's Representative.

E. Shrubs shall not be clipped into balled or boxed forms, unless such is required by the design and directed by the Owner's Representative.

F. All pruning shall be made flush to lateral branches, buds, or trunk. "Stubbing" will not be permitted.

G. Damage: All cuts over 1" resulting from pruning or wind breakage shall be inspected periodically for insect infestation or disease.

3.12 WATERING

A. Water all trees, shrubs and ground cover immediately after planting. Apply water to all plants as often and in sufficient amount as conditions may require to keep the plants in a healthy vigorous growing condition until completion of the Contract. Do supplemental hand watering of trees and shrubs during the first 3 weeks of plant establishment as necessary.

3.13 CLEAN UP

A. Keep all areas of work clean and neat at all times. Upon completion of planting, all cans, boxes, and other debris that is a part of the planting operation shall be removed from the site.

B. All pavements shall be washed off, and site shall be left in an absolutely clean condition. All planting areas shall be cultivated and weed free before final inspection. Clean-up operations shall take place throughout the course of work so that walks and drives are clean at all time.

3.14 PRE-MAINTENANCE/PLANT ESTABLISHMENT PERIOD REVIEW AND APPROVAL OF PLANTING

A. Notify the Owner's Representative a minimum of five (5) days prior to requested Punch List and for Final Acceptance Review. Before the reviews, complete the following:
   1. Complete all work per Specifications and Plans.
   2. Present all planted areas neat and clean with all weeds removed and all plants installed and appearing healthy.
   3. Plumb all tree stakes.
   4. Seed or hydroseed all areas per plans.
   5. Turf sod all areas per plans.
   6. Settlement: Reset plants that have shift or settled.

B. Punchlist Inspection:
   1. At this time the Contractor shall have completed all phases of the Plans and Specifications for planting and irrigation. Any discrepancies shall be noted at that time and the Contractor shall make appropriate corrections before the Final Acceptance of the work and the beginning of Maintenance Period is established.

2. No partial approvals will be given.

C. Final Acceptance

1. Should it be determined at the Final Acceptance visit that any punchlist item is incomplete, any further review of the site will be terminated until all items are guaranteed, in writing, to be complete by the Contractor. The cost of additional site visits by the Owner's Representative to verify completion of work shall be paid for by the Contractor.

3.15 PLANT ESTABLISHMENT MAINTENANCE PERIOND

A. The planting establishment maintenance period required shall be 90 calendar days after all planting is complete, turf is seeded, and installation approved.

B. Maintenance period shall not start until all elements of construction, planting, and irrigation for the entire project are complete. Project will not be segmented into maintenance phases, unless specifically authorized in writing by the Owner's authorized representative.

C. A longer plant establishment – maintenance period may be required if the turf is not thick, vigorous and even, or if the plant material is not acceptably maintained during the maintenance period. The maintenance period may be suspended at any time upon written notice to the Contractor that the landscaping is not being acceptably maintained, and the day count suspended until the landscape is brought up to acceptable standards as determined by the Owner's Representative.

D. Contractor shall furnish all labor, material, equipment, and services required to maintain the landscape in a healthy and attractive condition for a period of 90 days.

E. Maintenance shall include fertilization, watering, insect and disease control, weed control, weekly trash removal, mulching, restaking trees, tightening of guys, resetting plants to proper grades or upright position, and restoration of watering basins.

F. Maintenance of grass areas shall consist of fertilizing, watering, weeding, mowing, repair of all erosion, and reseeding as necessary to establish a uniform stand of the specified grasses. Areas and parts of areas which fail to show a uniform stand of grass for any reason shall be (reseeded or) resodded until all areas are covered with a satisfactory stand of grass. (Mulch reseeded areas with 1/4 in. of specified peat moss).

G. The Contractor's maintenance period will be extended if the provisions required within the plans and specifications are not filled.

H. General Requirements:

1. Keep all walks and paved areas clean. Keep the site clear of debris resulting from landscape work or maintenance.
2. Repair all damaged planted areas, and replace plants and reseed or resod grass immediately upon discovery of damage or loss.

3. Check sprinkler system at each watering; adjust coverage and clean heads immediately. Adjust timing of sprinkler controller to prevent flooding.
4. Keep Contract area free from weeds by cultivating, hoeing or hand pulling. Use of chemical weed killers will not relieve the Contractor of the responsibility of keeping areas free of weeds over 1-inch high at all times.
5. Settlement: Reset plants that shift or settle before end of maintenance period. Crowns of trees shall be at the following minimum height above surrounding finish grade at end of maintenance period: 24 inch box and smaller - 2 inches.
6. Protect all areas against damage, including erosion and trespass, and provide proper safeguards. Maintain and keep all temporary barriers erected to prevent trespass.

I. Tree, Shrub and Ground Cover Maintenance:
1. Maintain during the entire establishment period by regular watering, cultivating, weeding, repair of stakes and ties, and spraying for insect pests. Prune when requested by the Owner's Representative.
2. Keep watering basins in good condition and weed-free at all times.
3. Replace all damaged, unhealthy or dead trees, shrubs, vines and ground covers with new stock immediately, size as indicated on the drawings.

J. Turf:
1. Maintain during the entire establishment period. Cut as frequently as growth of grass requires. Cut to a height of two inches (2"), unless otherwise directed by the Owner's Representative.
2. Maintain appropriate soil moisture at all times for healthy and vigorous turf grass.
3. Trim edges of turf at paving and header boards at time of second cutting, and at each later cutting.
4. Keep the designated area under trees free of turf at all times. Do not create low area around base of tree.
5. Keep turf areas free of undesirable weeds and grasses by the application of suitable selective weed killers or hand pulling.
6. Reseed all damaged areas as soon as evident.
7. Repair any hollow, settled or eroded areas by filling, rolling and resodding.

K. Non-irrigated Erosion Control Areas: To be watered by winter rains.

L. Watering:
1. All plants shall be kept watered as often as it is necessary to keep them in optimum, vigorous growth. The turf shall, at no time, show a lack of fresh green color or a loss of resilience due to lack of water. Watering shall be done preferably during the early morning hours.
2. Water shall be controlled so that there will be no excessive run-off, ponding, or overwatering.

M. Root Growth: Periodically the Contractor shall check the progress of the root growth within the back fill area. As the root growth increases beyond the root ball, the frequency

of watering shall be reduced so that the roots are encouraged to grow to a lower soil depth. Watering then shall be less frequent, but applications shall be very slow and the Contractor shall assure himself that water does penetrate to the depth of the former plant pit.

N. Weed Control:

1. Weeds shall be kept under control, either by hand or by the application of herbicides designed for use on any type of weeds invading the planting areas.
2. All equipment used for herbicides shall be properly cleaned before it is used on this project. Herbicides shall be applied at temperatures recommended by the manufacturers. Herbicides shall not be used during windy or gusty days. All possible precautions shall be taken to protect vegetation which is susceptible to damage from the particular herbicides to be used.
3. The bases of all plants shall be kept completely free of weeds. Periodically, the base of the trees and shrubs shall be cultivated in order to allow better penetration of water, but such cultivation shall be carefully done in order not to destroy surface roots.

O. Mowing:

1. All mowing shall be done in a neat and orderly manner. Equipment shall be moved onto and off the area to be mowed in such a manner that it will not leave tracks or marks that detract from the finish turf. Timber shall be provided to move equipment over curbs, stairs, or similar constructions.
2. Mowing equipment shall be kept in optimum operating condition. The equipment shall be washed before initial use on the project so that there will be no chance of introducing foreign seeds or diseases onto the project.
3. Frequency of mowing shall be determined by the rate of growth of the grass. During seasons of peak growth mowing may have to be done every five days to six days; under normal conditions once a week should be adequate.
4. The average mowing height shall be 1-1/2". The grass blades must be cut sharply and cleanly. The turf must be cut evenly so that no ridges remain in the finish cut. The direction of mowing shall be alternated each time.

P. Spraying:

1. All shrubs and trees shall be inspected at least twice a month during the growing period to determine the need for spraying to control insect damage, fungus development or any other disease that might be attacking the plants. Preventative spraying shall be done only with the approval of the Owner's Representative.
2. Operators of spray equipment shall take all reasonable precautions to protect themselves, other people and buildings from spray. The Contractor shall have all permits and licenses required for such an operation. Where applicable, dormant spray shall be applied to shrubs and trees during the winter period.
3. All equipment shall be properly washed before and after use.
4. No spraying shall take place during windy or gusty days.

Q. Staking and Guying: Stakes and guys shall be inspected a minimum of two times a month to assure that the wires and ties are tight and no damage has occurred to the tree trunk or branches.

R. Fertilizing:

1. Upon approval and after submitting fertilizer delivery tags, top dress all turf and ground cover areas by broad-casting 12-8-16 fertilizer at the rate of 7 lbs. per 1,000 square feet evenly throughout, and reapply every forty-five (45) days until acceptable or as appropriate to prevailing climatic conditions and type of plant or turf grass.
2. Apply ammonium sulfate fertilizer as necessary to maintain vigorous, green grass between fertilizing mentioned above.

S. Litter:

1. The Contractor shall remove promptly after pruning, trimming, and weeding or other work required under the contract, all debris generated by his performance of the work. Immediately after working in the areas of public walks, driveways or paved areas, they shall be vacuumed clean with suitable equipment. All areas covered by this contract shall be kept free of the following items: bottles, cans, paper cardboard or metallic items. Common debris and litter shall be disposed of in an appropriate manner.

T. Pruning:

1. Prune as necessary to remove injured twigs and branches, dead wood, and suckers.

3.16 FINAL PLANTING REVIEW AND WRITTEN ACCEPTANCE (TURN OVER ACCEPTANCE)

A. Final Review: At the conclusion of the planting establishment period, schedule a final review for Final Written Acceptance/Turn Over Acceptance. The conference shall include the Owner. Any discrepancies shall be noted at that time and the Contractor shall make appropriate corrections before the Final Written Acceptance of the work and the beginning of Guarantee Period is established.

B. Final Written Acceptance/Turn Over Inspection: A conference including the Owner shall be held at the completion of all project improvements and all corrective work. The Contractor shall continue to maintain the project at his own expense until all deficiencies have been corrected. Once completed, the Contractor shall request the Owner's Representative and Owner to visit the site and approve the project as complete. The Owner's Representative will accept the landscape project in writing. The date of the Final Written Acceptance letter shall be the first day of the guarantee period.

C. Prior to either review, weed and rake all planted areas, repair plant basins, mow and edge turf, plumb tree stakes, clear the site of all debris and present in a neat, orderly manner.

D. Submit written notice requesting review at least 5 days before the anticipated review.

3.17 GUARANTEE AND REPLACEMENT

A. Guarantee period shall be extended for a period of one year from the date of Final Written Acceptance.

B. All plants shall be guaranteed to be alive and healthy as determined by the Owner's Representative at the end of the guarantee period.

C. Plant materials supplied by Owner shall be under similar warranty against defective workmanship during the planting operations. Plant material exhibiting conditions which are determined by the Owner's Representative as being unacceptable, due to workmanship by the Contractor, shall be replaced at no additional cost to the Owner.

D. The Contractor shall replace, in accordance with the Drawings and Specifications throughout the guarantee period, any plants that die, or in opinion of the Owner's Representative, are in an unhealthy or unsightly condition, and or have lost their natural shape due to dead branches, excessive pruning, inadequate or improper maintenance, or any other causes due to the Contractor's negligence. The Contractor shall not be held responsible for acts of vandalism occurring after the beginning of the guarantee period.

END OF SECTION

SECTION 33 11 00
WATER DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Provide water distribution system as shown on the Drawings, specified herein, and needed for a complete and proper installation.

B. Related work:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.

1.2 SUBMITTALS

A. Comply with pertinent provisions of General Requirements.
   1. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
   2. Materials list of items proposed to be provided under this Section;
   3. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;
   4. Names and addresses of the nearest service and maintenance organization that readily stocks repair parts;
   5. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. General:
   1. Assume connection point to building service lines as being approximately five feet outside buildings and structures to which service is required.
   2. Pipe materials less than 3" size: Use rigid copper, type K pipes.
   3. Pipe materials 3" size and larger: Use cast iron, ductile iron, or plastic pipes unless otherwise indicated or approved in advance by the Architect.

B. Pipe less than 3” diameter: All domestic water supply (potable) plumbing shall be rigid copper, type K including all pipes and fittings. Provide the following materials:
   1. Above ground, provide Type “L” copper.
   2. Below ground, provide Type “K” copper.

C. Pipe 3” diameter and larger:
   1. Cast iron pipe:
      a. Comply with ANSI A-21.6 or ANSI A-21.8, with working pressure of not less than 150 psi unless otherwise shown or specified.

b. Use cement mortar lining complying with ANSI A-21.4 or AWWA C205, standard thickness.

2. Ductile iron pipe:
   a. Comply with ANSI A 21.51, with working pressure of not less than 150 psi unless otherwise shown or specified.
   b. Use cement mortar lining complying with ANSI A 21.4 or AWWA C205, standard thickness.
3. Plastic pipe:
   a. Use polyvinyl-chloride (PVC) complying with AWWA C900, Class 150 DR 18.

D. Joints:
1. Copper Water Tube:
   a. Joints in copper tubing shall be made by the appropriate use of approved copper or copper alloy fittings.
   b. All connections to be sweated.
   c. Excessive Water Pressure. Where local static water pressure is in excess of eighty (80) pounds per square inch (551 kPa), an approved type pressure regulator preceded by an adequate strainer shall be installed and the static pressure reduced to eighty (80) pounds per square inch (551 kPa) or less. For potable water services up to and including one and one-half (1-1/2) inch (38.1 mm) regulators, provision shall be made to prevent pressure on the building side of the regulator from exceeding main supply pressure. Approved regulators with integral bypasses are acceptable. Each such regulator and strainer shall be accessibly located and shall have the strainer readily accessible for cleaning without removing the regulator or strainer body or disconnecting the supply piping. All pipe size determinations shall be based on eighty (80) percent of the reduced pressure when using Table 6-4.
2. Insulating joints:
   a. Provide between non-threaded ferrous and non-ferrous metallic pipe, fittings, and valves.
   b. Use sandwich type flange insulating gasket of the dielectric type, insulating washers, and insulating sleeves for flange bolts.
   c. Use full faced insulating gaskets with outside diameter equal to the flange outside diameter.
   d. Use full length bolt insulating sleeves.
   e. Install in a manner to prevent metal-to-metal contact of dissimilar metallic piping elements.

E. Valves
1. Gate valves:
   a. Use ball valves designed for a working pressure of not less than 150 psi. Ball valves district standard on all sites.
   b. Provide connections as required for the piping in which they are installed.
   c. Provide a clear waterway equal to the full nominal diameter of the valve, openable by turning counter clockwise.
   d. Provide an arrow on the operating nut or wheel, cast in metal, indicating direction of opening.
   e. Valves smaller than 3":
      1) Provide all bronze, screwed, single wedge disc, screw-in bonnet, packing gland, and nut, with non-rising stem.
      2) Buried valves: Install in suitable precast concrete hand hole with cover marked "WATER."
   f. Valves 3" and larger:
      1) Design in accordance with AWWA C500, standard, bronze trimmed, non-rising stem, solid wedge disc valves.

2) Buried valves: Provide 2" operating nuts and in a suitable valve box with extension and marked cover.
3) Provide tee handle socket operating wrenches of suitable size.

2. Check valves:
a. Use check valves designed for a working pressure of not less than 150 psi, or as indicated or directed, with a clear waterway equal to the full nominal diameter of the valve.
b. Use valves designed to permit flow in one direction, when the inlet pressure is greater than the discharge pressure, and to close tightly to prevent return flow when discharge pressure exceeds inlet pressure.
c. Distinctly cast on the body of each valve:
1) Manufacturer's name, initials, or trademark by which he can be identified readily;
2) Valve size;
3) Working pressure;
4) Direction of flow.
d. Valves 2" and smaller: Provide all bronze, designed for screwed fittings.
e. Valves larger than 2":
1) Provide iron body, bronze mounted, with flanged ends, of the non-slam type;
2) Provide class 125 flanges complying with ANSI B-16.1.

F. Service fittings:
1. PVC mains smaller than 2" in diameter:
a. Make 3/4" maximum service with tees or plastic valve tees.
b. Acceptable products:
1) As manufactured by Mueller Company, Decatur, Illinois.
2. PVC mains 2" to 3-1/2" in diameter: For 3/4" service to 1" service, use bronze service clamp and bronze corporation stop designed for PVC pipe.
3. Service clamps and corporation stops:
a. Use bronze.
b. Provide service clamp with flattened straps and molded neoprene gaskets.
4. Services larger than those stated above: Make with standard tees on new lines, and tapping tees on existing lines.

2.2 TAPPING SLEEVES

A. Provide sleeve type coupling for existing water mains, furnished with outlet flanged to American 125 standard (ASA series 15):
1. Acceptable products:
a. Clow Corporation, Corona, California; boltless type:
1) Model C1 series for existing cast iron mains, complying with AWWA class A;
2) Model CA for class 150 and class 200 existing asbestos cement mains.
b. Coordinate requirements of tapping sleeves with gate valves and other fittings as required.

2.3 VALVE BOXES

A. Valves 3" and larger:
1. Use service box of cast iron, extension type of the required length, with screw adjustment.
2. Provide the word "WATER" cast into the cover.
3. Acceptable products:
a. Alhambra Foundry Company, Alhambra, California:
1) For valves 6" and smaller: Model A-3004;

2) For valves 8" and larger: Model 3005.

B. Valves 2-1/2" and smaller:
1. Use precast concrete box with the word "WATER" cast into the cover.
2. Provide risers on pipe line to place valve within box depth.
3. Acceptable products:
a. Manufactured by Brooks Products, Inc., El Monte, CA.
b. Or equal

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 FIELD MEASUREMENT

A. Make necessary measurements in the field to assure precise fit of items in accordance with the approved design.

3.3 HANDLING

A. Handle pipe accessories so as to ensure delivery to the trench in sound, undamaged condition:
1. Carry pipe into position; do not drag.
2. Use pinch bars or tongs for aligning or turning the pipe only on the bare end of the pipe.

B. Thoroughly clean interior of pipe and accessories before lowering pipe into trench. Keep clean during laying operations by plugging or other method approved by the Architect.

C. Before installation, inspect each piece of pipe and each fitting for defects:
1. Material found to be defective before or after laying: Replace with sound material meeting the specified requirements, and without additional cost to the Owner.

D. Rubber gaskets: Store in a cool dark place until just prior to time of installation.

3.4 PIPE CUTTING

A. Cut pipe neatly and without damage to the pipe.

B. Unless otherwise recommended by the pipe manufacturer, and authorized by the Architect, cut pipe with mechanical cutter only.
1. Use wheel cutters when practicable.
2. Cut plastic pipe square, and remove all burrs.

3.5 LOCATING

A. Locate water pipe at least ten feet away, horizontally, from sewer pipes.
1. Where bottom of the water pipe will be at least 12" above top of the sewer pipe, locate water pipe at least six feet away, horizontally, from the sewer pipe.

B. Where water lines cross under gravity-flow sewer lines, fully encase the sewer pipe in concrete for a distance of at least ten feet each side of the crossing, or provide pressure pipe with no joint located within 36" of the crossing.
   1. Cross water lines in cases above sewage force mains or inverted siphons at least 24" above the sewer line.
   2. Encase in concrete those joints in the sewer main closer, horizontally, than 36" to the crossing.

C. Do not place water lines in the same trench with sewer lines or electric wiring.

3.6 JOINT DEFLECTION

A. Cast iron pipe:
   1. Maximum allowable deflection will be given in AWWA C600.
   2. Table I shows maximum deflections for 18 foot lengths of pipe. For other lengths, deflection may vary proportionately.
   3. If alignment requires deflection exceeding limits shown in Table I, furnish special bends or a sufficient number of shorter lengths of pipe to provide angular deflections within the limits shown.
   4. Table I, deflection in inches:

Diameter:	Push-on joint pipe:	Mechanical joint pipe:
3"	19"	31"
4"	19"	31"
6"	19"	27"
8"	19"	10"

B. Plastic pipe: Unless a lesser amount is recommended by the pipe manufacturer, maximum allowable deflections from a straight line or grade, or offsets, will be five degrees.

3.7 PLACING AND LAYING

A. General:
   1. Lower pipe and accessories into trench by means of derrick, ropes, belt slings, or other equipment approved by the Architect.
   2. Do not dump or drop any of the materials of this Section into the trench.
   3. Except where necessary in making connections to other lines, lay pipe with the bells facing in the direction of laying.
   4. Rest the full length of each section of pipe solidly on the pipe bed, with recesses excavated to accommodate bells, couplings, and joints.
   5. Take up and relay pipe that has the grade or joint disturbed after laying.
   6. 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.
   7. Securely close open ends of pipe, fittings, and valves when work is not in progress.
   8. Where any part of coating or lining is damaged, repair to the approval of the Architect and at no additional cost to the Owner.

B. Plastic pipe:
   1. Position pipe and fittings in trench in a manner that identifying markings will be readily visible for inspection.
   2. Cutting and joining:
      a. Protect against abrasion from serrated holding devices.

b. Remove burrs and glosses from surfaces to be jointed; use abrasive paper, file, or steel wool.
c. Remove dirt, dust, and moisture by wiping clean with chemical cleaner or dry cloth.
d. Using a pure bristle paint brush, apply an even coat of the specified solvent cement in the fitting socket and on the surface of the pipe to be joined
e. Promptly insert pipe into bottom of the fitting socket; turn the pipe slightly to assure an even distribution of cement.
f. Remove excess solvent cement from exterior of the joint.
g. Should cement begin to dry before the joint is made, reapply cement before assembling.
h. Allow at least one hour for the joint to gain strength before handling or installing the pipe.

3. Do not thread plastic pipe; make connections only with the solvent cement or with special adapter fittings designed for the purpose.
4. Align pipe system components without strain.
5. Support piping at intervals of not more than four feet, at ends, branch fittings, and change of direction or elevation.
6. Support plastic pipe in trenches with a 3" layer of sand. Allow no rocks, debris, or potentially damaging substances within 6" of plastic pipe in trenches.
7. Provide an electrically continuous type tracing wire insulated number 12 – gauge copper wire tracer wire in the trench along the pipe, fastened to the pipe at 20 foot intervals, and terminating aboveground with a 12" lead taped around each riser.

C. Connections: Use specials and fittings to suit the actual conditions where connections are made between new work and existing mains. Use only those specials and fittings approved by the utility having jurisdiction.

D. Sleeves:
1. Where pipe passes through walls of valve pits or structures, provide cast iron wall sleeves.
2. Fill annular space between walls and sleeves with rich cement mortar.
3. Fill annular space between pipe and sleeves with mastic.

3.8 JOINTING

A. Joints:
1. Cast iron pipe, ductile iron pipe, mechanical joints, and push-on type joints: Install in accordance with AWWA C600, modified as necessary by the recommendation of the manufacturer to provide for special requirements of ductile iron pipe.
2. Make connections between different types of pipe and accessories with transition fittings.
3. Rubber gaskets: Handle, lubricate where necessary, and install in strict accordance with the recommendations of the manufacturer.

3.9 SETTING VALVES AND VALVE BOXES

A. General:
1. Center valve boxes on the valves, setting plumb.
2. Tamp earth fill around each valve box to a distance of four feet on all sides, or to the undisturbed trench face if less than four feet.
3. Tighten stuffing boxes, and fully open and close each valve to assure that all parts are in working condition.

B. Service boxes:

1. Where water lines are located below paved streets having curbs, install boxes directly back of the curbs.
2. Where no curbing exists, install boxes in accessible locations beyond limits of street surfacing, walks, and driveways.

3.10 THRUST BLOCKS

A. General:
1. Provide thrust blocks, or metal tie rods and clamps or lugs, on plugs, caps, tees, and bends deflecting 22-1/2 degrees or more either vertically or horizontally, and on water lines 6" in diameter or larger.
2. Provide concrete thrust blocking with a compressive strength of at least 2500 psi in 28 days.

B. Installation:
1. Locate thrust blocking between solid ground and the fitting to be anchored.
2. Unless otherwise shown or directed by the Architect, place the base and thrust bearing sides of thrust blocking directly against undisturbed earth.
3. Sides of thrust blocking not subject to thrust may be placed against forms.
4. Place thrust blocking so the fitting joints will be accessible for repair.
5. Protect steel rods and clamps by galvanizing or by coating with bituminous paint.

3.11 TESTING AND INSPECTING

A. Closing uninspected work: Do not allow or cause any of the work of this Section to be covered up or enclosed until after it has been completely inspected and tested, and has been approved by the Architect.

B. Hydrostatic tests:
1. Where any section of a water line is provided with concrete thrust blocking for fittings, do not make hydrostatic tests until at least five days after installation of the concrete thrust blocking, unless otherwise directed by the Architect.
2. Devise a method for disposal of waste water from hydrostatic tests, and for disinfection, as approved in advance by the Architect.

C. Pressure tests:
1. After the pipe is laid, the joints completed, fire hydrants permanently installed, and the trench partially backfilled leaving the joints exposed for examination, subject the newly laid piping and valved sections of water distribution and service piping to a hydrostatic pressure of 200 psi.
2. Open and close each valve several times during the test.
3. Carefully examine exposed pipe, joints, fittings, and valves.
4. Replace or remake joints showing visible leakage.
5. Remove cracked pipe, defective pipe, and cracked or defective joints, fittings, and valves. Replace with sound material and repeat the test until results are satisfactory.
6. Make repair and replacement without additional cost to the Owner.

D. Leakage test:
1. Conduct leakage test after the pressure test has been completed satisfactorily.
2. Duration of each leakage test: At least two hours.
3. During the test, subject water lines to a pressure of 200 psi.
4. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

5. No piping installation will be accepted until the leakage is less than the number of gallons per hour as determined by formula: "L = 0.00304 ND x sq root of P," where:
   a. L = allowable leakage in gallons per hour;
   b. N = number of joints in length of pipe under test;
   c. D = nominal diameter of pipe in inches; and
   d. P = average test pressure in lbs per sq inch.
6. The allowable leakage in gallons per hour, per joint, at 200 psi average test pressure shall be in accordance with Table II.
7. Should any test of pipe disclose leakage greater than that specified in Table II, locate and repair the defective joint or joints until the leakage is within the specified allowance, and at no additional cost to the Owner.
8. Table II:

Diameter:	Leakage in gal:	Diameter	Leakage in gal:
2"	0.0153	12"	0.0915
3"	0.0231	14"	0.1070
4"	0.0306	16"	0.1225
6"	0.0458	18"	0.1375
8"	0.0610	20"	0.1530
10"	0.0765	24"	0.1830

E. Time for making test:
   1. Except for joint material setting, or where concrete reaction backing necessitates a five day delay, pipelines jointed with rubber gaskets, mechanical, or pushon joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill.
   2. Cement mortar lined pipe may be filled with water as recommended by the manufacturer before being subjected to the pressure test and subsequent leakage test.

F. Disinfection:
   1. Before acceptance of the potable water system, disinfect each unit of completed water supply, distribution, and service line in accordance with AWWA C651-92.
   2. Perform all such tests and disinfection in a manner approved by governmental agencies having jurisdiction.
   3. Furnish two copies of a Certificate of Disinfection to the Architect.

3.12 PAINTING

A. Paint valves, pipe, and vents exposed to view.

END OF SECTION 33 11 00

SECTION 33 12 00

UTILITY VALVES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Valves and hydrants used in piped utility distribution systems

1.2 RELATED SECTIONS

A. Section 33 11 00 "Utility Distribution Systems"

1.3 REFERENCES

A. The following documents form a part of these specifications to the extent stated herein.

B. Code of Federal Regulations (CFR)

1. 29 CFR 1910.7 Definitions and Requirements for a Nationally Recognized Testing Laboratory (NRTL)

C. American National Standards Institute (ANSI)

D. American Society of Mechanical Engineers (ASME)

1. ASME B16.1 Cast Iron Pipe Flanges and Flanged Fittings

E. ASTM International (ASTM)

1. ASTM A 48 Gray Iron Castings
2. ASTM A 126 Gray Iron Castings for Valves, Flanges, and Pipe Fittings
3. ASTM A 436 Austenitic Gray Iron Castings
4. ASTM A 536 Ductile Iron Castings

F. American Water Works Association (AWWA)

1. AWWA C500 Metal-Seated Gate Valves for Water Supply Service
2. AWWA C502 Dry-Barrel Fire Hydrants
3. AWWA C504 Rubber-Seated Butterfly Valves
4. AWWA C509 Resilient-Seated Gate Valves for Water Supply Service
5. AWWA C550 Protective Interior Coatings for Valves and Hydrants

1.4 DEFINITIONS

BB	=	Bolted bonnet
IBBM	=	Iron body, bronze mounted
NBR	=	Acrylonitrile/butadiene
NRS	=	Nonrising stem
NST	=	National Standard fire hose thread
OS&Y	=	Outside screw and yoke
PTFE	=	Polytetrafluoroethylene
WOG	=	Water, oil, and gas (pressure)
WP	=	Working pressure

PART 2 - PRODUCTS

2.1 VALVES

A. Gate Valves:

1. V-1F: Sizes 2 through 12 inches, IBBM, 200-lb cold water, class 125 ANSI flange, double-disc, NRS with 2-inch square operating nut (installed with adapter if necessary), o-ring stem seal (packing gland not acceptable), coal tar or asphalt-varnish dipped, AWWA C500; Mueller "A2380-6," Stockham "G-745-0," American-Darling "52," or equal.
2. V-1N: Sizes 4 through 12 inches, resilient wedge, 200-lb cold water, class 125 ANSI flange, NRS with 2-inch square operating nut, cast-iron body, SBR resilient seat on disc, o-ring stem seal, AWWA C509; epoxy-lined and coated in accordance with AWWA C550; Stockham "G-700-0," Waterous "Series 500," M&H "AWWA C509-306B," or equal.
3. V-1P: Sizes 4 through 12 inches, resilient wedge, 200-lb cold water, class 125 ANSI flange, NRS with hand wheel, cast-iron body, styrene-butadiene-rubber (SBR) resilient seat on disc, o-ring stem seal, AWWA C509; epoxy-lined and coated in accordance with AWWA C550; Stockham "G-700-0," Waterous "Series 500," M&H "AWWA C509-306B," or equal.

4. V-2Q: Sizes 2-1/2 through 12 inches, tested and listed or labeled by any nationally recognized testing laboratory (NRTL) recognized under 29 CFR 1910.7; IBBM, 175-lb cold water, class 125 ANSI flange, solid wedge, OS&Y, bronze stem; Mueller "A2073-6," American-Darling "55," or equal.

B. Check Valves:

1. V-50E: Sizes 2-1/2 through 12 inches, swing type, NRTL approved, IBBM, 175-lb cold water, class 125 ANSI flange, BB, for use in vertical or horizontal position, renewable composition disc and bronze seat ring; Stockham "G-940," American-Darling "52-SC," Mueller "A2122-6," or equal.
2. V-50P: Alarm check valve, sizes 4 through 8 inches, NRTL approved, 125-lb ASME B16.1 flange, 175-lb cold water; Grinnell "F200," Reliable "E," Viking "F-1," or equal.
3. V-50Q: Wafer check valve, sizes 4 through 8 inches, 175-lb cold water, NRTL approved, iron body, buna-n seat, spring loaded; Stockham "WG-990," ITT Kennedy, or equal.

2.2 HYDRANTS

A. Wet-Barrel Fire Hydrants (V-100B): 6-inch California-type fire hydrant with wet barrel, 175-lb working pressure, cast iron, bronze trim, 6-inch inside diameter (I.D.) waterway, two 2-1/2 inch fire hose outlets, and one 4-1/2 inch lower steamer outlet each outlet with NSFHT (National Standard Fire Hose Thread) and independently valved with 1-1/8 inch pentagon operating nut on cap; 29-3/4 inch overall height from bottom of body flange; hydrant complete with 6-inch bury (length of bury to suit depth of water main connection as indicated on the drawings) with manufacturer's standard factory-applied primer; Rich "76," Logan "651," or equal. Substitutes shall also have dimensions identical to Rich "76."

B. Dry-Barrel Fire Hydrants (V-100W):

1. Hydrants shall be designed, manufactured, and tested in accordance with AWWA C502.
2. Hydrants shall be traffic-type with a replaceable breakable unit immediately above the ground line for minimizing repairs due to traffic damage.

3. Hydrants shall be of a dry-barrel configuration to prevent water loss due to traffic damage and freezing.
4. Hydrants shall be constructed such that the main valve closes with water pressure to assure no loss of water in the event of damage to the upper portion of the fire hydrant.
5. Main valve opening shall have a diameter of at least 5-1/4 inches to assure optimum flow.
6. Standpipe (hydrant barrel) inside diameter shall not be less than 7-1/4 inches.
7. Hydrant shall be of a "dry top" design with o-ring seals to ensure that the operating threads will be protected from water entry.
8. Hydrant operating nut shall turn LEFT to open in order to maintain uniformity with presently installed hydrants, and direction of OPEN shall be clearly marked at the top of the hydrant.
9. Operating and cap nuts shall be pentagon in shape; dimension shall be 1-1/2 inches point to flat (standard).
10. Hydrants shall have a 6-inch inlet of flanged design for ease of installation.
11. Hydrants shall have an automatic drain that is operated by the main valve rod and shall have two plugged drains in the shoe of the hydrants. These plugged drains shall be brass lined to prevent rusting.
12. Hydrants shall have two 2-1/2 inch nozzles having NST threads and one 4-1/2 inch pumper nozzle having NST threads. Provide the caps with rubber gaskets to prevent leakage; if nut design caps are supplied, they shall conform to item 9. Caps shall be equipped with stainless steel chains and pear links. Wire chains and cables are unacceptable. The minimum distance from the ground line to the center line of the lowest nozzle shall be 18 inches.
13. Hydrant nozzle section shall be able to rotate through 360 degrees with respect to the standpipe. Such rotation shall not place the operating rod in a position so as to obstruct the flow through any nozzle.
14. The fire hydrants shall be tagged with the bury length shown on the drawings.
15. The outside of the hydrant top section shall be painted with at least one coat of primer and one finished coat of industrial enamel, yellow in color to match existing hydrants in the system.
16. Hydrants with springs, toggles, and other excessive parts which may present expensive maintenance problems will not be considered.
17. Flow characteristics and friction loss through the hydrant shall not exceed AWWA C502.
18. Hydrants shall be Waterous Pacer "WB-67" or equal (no known equal).

C. Fire Hose Adapters (V-101C): 2-1/2 inch bronze, class 150 ANSI flange one end, male NSFHT other end, with cap and chain, to be assembled from the following components:

1. 2-1/2 inch class 150 ANSI threaded bronze flange
2. Bronze male hose nipple; one end 2-1/2 inch iron pipe thread, other end 2-1/2 inch NSFHT; Western Fire Equipment Co. "3A008," Potter-Roemer Inc. "146," Wilkirk Inc. "14-146," or equal
3. Bronze hose cap; Western Fire Equipment Co. "3A05," Potter-Roemer Inc. "126," Wilkirk Inc. "17-126," or equal
4. Bronze chain for attaching hose cap to hose nipple

D. Post Indicator Valves (PIV):

1. V-102A: Gate valve, 4 through 14 inches, indicator post type; NRTL approved; IBBM, 175-lb cold water, class 125 ANSI flange, double disc, NRS, with indicator post flange and 2-inch square operating nut, asphalt-varnish dipped; Clow "F-5722," Waterous Co. "series 300," or equal; for use with indicator post V-102B (specified below).

2. V-102B: Indicator post, adjustable type; NRTL approved; for use with indicator-post type gate valve V-102A (specified above); cast iron, 1-1/4 inch wrench nut; Clow "F-5750," Waterous Co. "A240," or equal. Specify valve size; lengths as required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to section 33 00 00 "Utility Distribution Systems" for installation.

END OF SECTION 33 12 00

SECTION 33 31 00
SANITARY UTILITY SEWERAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Non-pressure couplings.
3. Expansion joints and deflection fittings.
4. Cleanouts.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Expansion joints and deflection fittings.
2. Backwater valves.

1.4 INFORMATIONAL SUBMITTALS

A. Construction Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

B. Profile Drawings: Show system piping in elevation. Draw profiles to horizontal scale of not less than 1 inch equals 50 feet (1:500) and to vertical scale of not less than 1 inch equals 5 feet (1:50). Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

C. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.

D. Field quality-control reports.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

1.6 PROJECT CONDITIONS

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

1. Notify MVWSD no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without MVWSD written permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D 3034, SDR 26, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

2.2 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Alhambra foundry A-1241.
   b. Or equal

2. Description: ASTM A-48, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

4. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.3 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 3000 psi (27.6 MPa) minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain if required.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel if required.

C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain if required.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel if required.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

D. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

E. Install gravity-flow, nonpressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope shown on drawings unless otherwise indicated.
2. Install PVC Type PSM sewer piping according to ASTM D 2321 and ASTM F 1668.

F. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, drainage piping according to the following:
1. Join PVC Type PSM sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.

3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use PVC pipe fittings in sewer pipes at branches for cleanouts, and use PVC pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, per details . Set with tops flush with above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Section 221316 "Sanitary Waste and Vent Piping."

B. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch (150-mm) overlap with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches (150 mm) of concrete for minimum length of 12 inches (300 mm) to provide additional support of collar from connection to undisturbed ground.

    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi (20.7 MPa) unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.6 IDENTIFICATION

A. Comply with requirements in Section 31 20 00 "Earth Moving" for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.

1. Use detectable warning tape over ferrous piping.

2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.7 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

    a. Fill sewer piping with water. Test with pressure of at least 10-foot (3-m) head of water, and maintain such pressure without leakage for at least 15 minutes.
    b. Close openings in system and fill with water.
    c. Purge air and refill with water.
    d. Disconnect water supply.
    e. Test and inspect joints for leaks.

6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

    a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
    b. Option: Test concrete gravity sewer piping according to ASTM C 924 (ASTM C 924M).

7. Manholes: Perform hydraulic test according to ASTM C 969 (ASTM C 969M).

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.8 CLEANING

A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION 33 31 00

SECTION 33 41 00

STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Cleanouts.
3. Drains.
4. Catch basins.
5. Pipe outlets.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings:

C.

1. Catch basins. Include plans, elevations, sections, details, frames, covers, and grates.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle catch basins according to manufacturer's written rigging instructions.

1.5 PROJECT CONDITIONS

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

1. Notify SCHOOL DISTRICT no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without SCHOOL DISTRICT's written permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D 3034, SDR 26, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

2.2 CLEANOUTS

A. Cast-Iron Cleanouts:

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

   a. Alhambra Foundary
   b. Or equal

2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
3. Sewer Pipe Fitting and Riser to Cleanout: PVC pipe and fittings.
4. Description: PVC body with PVC threaded plug. Include PVC storm utility pipe fitting and riser to cleanout of same material as storm utility piping.

2.3 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

2.4 CATCH BASINS

A. Standard Precast Concrete Catch Basins:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
3. Riser Sections: 4-inch (102-mm) minimum thickness, 48-inch (1200-mm) diameter, and lengths to provide depth indicated.
4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
5. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
6. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch (150- to 225-mm) total thickness, that match 24-inch- (610-mm-) diameter frame and grate.
8. Pipe Connectors: ASTM C 923 (ASTM C 923M), resilient, of size required, for each pipe connecting to base section.

B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings.

1. Size: 24 by 24 inches (610 by 610 mm) minimum unless otherwise indicated.
2. Grate Free Area: Approximately 50 percent unless otherwise indicated.

C. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch (102-mm) minimum width flange, and 26-inch- (660-mm-) diameter flat grate with small square or short-slotted drainage openings.

1. Grate Free Area: Per ADA standards.

2.5 PIPE OUTLETS

A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.
B. Riprap Basins: Broken, irregularly sized and shaped, graded stone according to the National Stone, Sand & Gravel Association (NSSGA's) "Quarried Stone for Erosion and Sediment Control."

1. Average Size: NSSGA No. R-5, screen opening 5 inches (127 mm).

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install piping with 36-inch (915-mm) minimum cover or per plan.
3. Install PVC profile gravity sewer piping according to ASTM D 2321 and ASTM F 1668.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.

3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use PVC pipe fittings in sewer pipes at branches for cleanouts and PVC pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

B.

1. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.

C. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch (25 mm) above surrounding earth grade.

D. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 DRAIN INSTALLATION

A. Install type of drains in locations indicated on plans.

B. Fasten grates to drains if indicated.

C. Set drain frames and covers with tops flush with pavement surface.

D. Assemble trench sections with flanged joints.

3.6 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.7 STORMWATER INLET AND OUTLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.

B. Construct riprap of broken stone, as indicated.

C. Install outlets that spill onto grade, anchored with concrete, where indicated.

D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

E. Construct energy dissipaters at outlets, as indicated.

3.8 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.9 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Section 221413 "Facility Storm Drainage Piping."

B. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch (150-mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).

3. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.10 IDENTIFICATION

A. Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.11 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

    a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
    b. Option: Test plastic piping according to ASTM F 1417.
    c. Option: Test concrete piping according to ASTM C 924 (ASTM C 924M).

6. Force-Main Storm Drainage Piping: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig (1035 kPa).

   a. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.12 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION 334100