SECTION 21 00 01
FIRE SPRINKLER DESIGN-BUILD PERFORMANCE SPECIFICATION

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. This specification consists of the criteria for a design build contract for the design and construction of a fire sprinkler fire protection system for the Karuk Housing Authority's Happy Camp Resident Center. This Specification Section covers design/build performance requirements for the Fire Sprinkler systems. The project shall include the following line items as part of the bid:

1. Complete fire sprinkler system including water supply.

B. Perform a detailed field investigation and prepare design documents, stamped and signed by an Engineer, registered in California, suitable for plan check submission and construction.

C. Furnish material, labor, and equipment to achieve performance in accordance with applicable codes and standards.

1.2 REFERENCES

A. Fire sprinkler design, work, and installation of materials and equipment shall be in accordance with the requirements of local laws, ordinances, the utility purveyors, Authorities Having Jurisdiction, and State codes listed below:

1. NFPA 13, all appendices, installation of sprinkler systems
2. NFPA, Automatic Sprinkler System Handbook
3. NFPA 14, all appendices, standpipe and house systems
4. NFPA 24, all appendices, private fire service mains
5. California Building Code]
6. California Fire Code
7. California Mechanical Code
8. California Plumbing Code
9. State Fire Marshal requirements
10. Underwriters Laboratories Fire Protection Equipment Directory

B. Conflicts, if any, that may exist among the above items will be resolved at the discretion of the Project Engineer.

1.3 REQUIREMENTS

A. The Fire Sprinkler Drawings shall be provided by the Contractor.

B. During design, four (4) submittals shall be submitted to the Architect and Owner for review. Allow fourteen days for Architect's and Owner's review:

1. Schematic Design: 30 days after Notice to Proceed.

2. Design Development: 60 days after Notice to Proceed.

3. Construction Documents: 90 days after Notice to Proceed.

4. Reviewing Agency Submittal: 10 days after receiving Reviewing Agency comments.

5. Construction shall not commence until the detailed Drawings, Specifications, and engineering calculations have been accepted and approved by the Architect, Owner and the Reviewing Agency.

C. Schematic Design and Design Development Submittals:

1. Drawings shall be scalable, dated, stamped by an Engineer registered in the State of California with the word “PRELIMINARY”, and shall be provided in PDF or hardcopy format, 24” x 36” size.

2. Each drawing shall have a border with a sheet number and sheet title.

3. Specifications shall be provided in PDF or hardcopy format, 8.5” x 11” size.

D. Construction Documents and Reviewing Agency Submittals:

1. Drawings shall be scalable, dated, stamped and signed by the Contractor’s Registered Engineer for the State of California, and shall be provided in hardcopy format, 24” x 36” size.

2. Specifications shall be provided in hardcopy format, 8.5” x 11” size.

3. Drawings and Specifications shall be suitable for submission to the Reviewing Agency for review.

E. Coordinate with the mechanical, plumbing, and electrical design Contractors and their Engineers for the Fire Sprinkler equipment and piping being installed as part of this project.

1.4 SUBMITTALS FOR REVIEW

A. Schematic Design Components:

1. Field investigation report including items described in Part 3.2.

2. Drawings shall include:

a. Proposed riser diagram.
b. Locations of equipment and fixtures.

B. Design Development Components (in addition to Schematic Design Components):

1. Drawings shall include:

a. Below grade Fire Sprinkler pipe drawing.

2. Catalog cut sheets for new fire sprinkler system equipment and components, describing for each type:

    a. Assigned Fixture tag.
    b. Manufacturer and model number.
    c. Dimensions.
    d. Mounting type.

3. Fire Sprinkler Specifications outline.

4. All coordination with the Mechanical & Electrical Design Teams.

5. All coordination with the Structural Design Team.

C. Construction Documents Components (in addition to Design Development Components):

1. Drawings shall include:

    a. Complete Fire Sprinkler System Floor Plan Drawings.
    b. Fire Sprinkler Pipe water flow calculations;
    c. California engineering stamp with signature.

2. Fire Sprinkler Specifications.

D. Reviewing Agency Submittal:

1. Reviewing Agency comments and Contractor responses.
2. Drawings with Reviewing Agency comments incorporated.
3. Fire Sprinkler Specifications.
4. Final stamped, signed and approved Drawings suitable for construction.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION

3.1 GENERAL

A. Drawings:

1. Coordinate Drawings with other disciplines, including architectural, structural, civil, landscape, mechanical (plumbing & HVAC) and electrical.

2. Screened line types and fonts shall represent work that is not included in this contract.

3. Bold line types and fonts shall represent work that is included in this contract.

4. Revisions to Drawings after the Construction Documents submittal shall be noted with:

a. Revision notes in the drawing title block including the revision number, brief description, date, and initials of the person responsible for the revision.

b. “Clouds” encompassing the drawing revision.

c. “Delta” blocks adjacent to the clouds with revision numbers corresponding to the associated title block revision notes.

B. Existing Documentation:

1. Coordinate with Architect to obtain record documents (Drawings and/or Specifications) of the existing building.

C. Fire Sprinkler System Design:

1. Fire Sprinkler calculations and design shall be performed in accordance with NFPA-13, the requirements of the California State Fire Code and the requirements of the local Authority Having Jurisdiction.

2. Fire Suppression Water Service piping, below grade, shall be constructed from ductile iron, AWWA C151;

3. Standard pressure wet pipe sprinkler piping system shall be designed to operate at a working pressure of 175 psig maximum;

4. Design the sprinkler system, including a comprehensive engineering analysis, by a qualified professional engineer, using performance criteria specific to the site. The engineer shall be licensed and registered as a Mechanical Engineer State of California and shall submit his/her qualifications to design Fire Sprinkler systems including a list of five (5) previously designed systems.

5. Heated spaces shall be protected with a wet sprinkler system. Piping materials shall be carbon steel, minimum wall thickness shall be Schedule 10.

6. Unheated spaces shall be protected with a dry sprinkler system. Automatic sprinklers shall be attached to piping containing compressed air. Piping materials shall be galvanized steel, minimum wall thickness shall be Schedule 30, or type L copper pipe.

7. Coordinate with mechanical Contractor for location of piping.

3.2 FIELD INVESTIGATION

A. Perform an extensive field investigation and record information required to perform the Fire Protection System design described herein.

B. The field investigation shall cover:

1. All areas required to complete this project's scope of work.

3.3 LOAD ANALYSIS

A. Verify existing line sizes and water pressure as it relates to the city water service.

3.4 UTILITY COORDINATION

A. Coordinate with the water utility for new service, new utility pipeline requirements, and whether a site plan will be required in the Fire Protection drawing set. Coordinate requirements with the Architect and the Owner.

B. Obtain written documentation stating the utility's requirements.

END OF SECTION

SECTION 22 05 00
COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Equipment installation requirements common to equipment sections.
9. Painting and finishing.
10. Supports and anchorages.
11. Flashing.
12. Firestopping relating to plumbing work.
13. Firestopping accessories.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire-rated construction.

G. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.

4. PVC: Polyvinyl chloride plastic.

H. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.3 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

D. Through Penetration Firestopping Of Fire-Rated Assemblies: UL 1479 or ASTM E814 with 0.10-inch water gauge minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1 hour.

1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1 hour.

2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1 hour.

a. Floor Penetrations within Wall Cavities: T-Rating is not required.

E. Through Penetration Fire stopping Of Non-Fire-Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.

1. Non-Combustible Penetrating Items: Non-combustible materials for penetrating items connecting maximum of three stories.

2. Penetrating Items: Materials approved by Authorities Having Jurisdiction for penetrating items connecting maximum of two stories.

F. Fire-Resistant Joint In Fire-Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire-resistant rating as indicated on Drawings for assembly in which joint is installed.

G. Fire-Resistant Joints between Floor Slabs and Exterior Walls: ASTM E119 with 0.10-inch water gauge minimum positive pressure differential to achieve fire-resistant rating as indicated on Drawings for floor assembly.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.5 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Section, ACCESS DOORS AND FRAMES.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Refer to Section, PRODUCT REQUIREMENTS for environmental conditions affecting products on site.

B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

    a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.3 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.

2. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.

3. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.4 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.5 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2. Pressure Plates: Carbon steel. Include two for each sealing element.

3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.6 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral water stop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.7 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.8 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.9 FLASHING

A. Metal Flashing: 26-gauge-thick galvanized steel.

B. Metal Counterflashing: 22-gauge-thick galvanized steel.

C. Lead Flashing:

1. Waterproofing: 5 pounds/square foot sheet lead.
2. Soundproofing: 1 pound/square foot sheet lead.

D. Flexible Flashing: 47-mil-thick sheet butyl; compatible with roofing.

E. Caps: Steel, 22-gauge minimum; 16 gauge at fire-resistant elements.

2.10 FIRESTOPPING

A. Manufacturers:

1. Dow Corning Corp.
2. Hilti Corp.
3. 3M Fire Protection Products

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

1. Silicone Firestopping Elastomeric Firestopping.

2. Foam Firestopping Compounds.

3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.

4. Fiber Stuffing And Sealant Firestopping: Composite fiber stuffing insulation with silicone elastomer for smoke stopping.

5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.

6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.

7. Firestop Pillows: Formed mineral fiber pillows.

2.11 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

C. General:

1. Furnish UL-listed products.
2. Select products with rating not less than rating of wall or floor being penetrated.

D. Non-Rated Surfaces:

1. Stamped-steel, chrome-plated, hinged, split-ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.

2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop-type wall sleeve.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

A. Refer to Section, CUTTING AND PATCHING and Section, SELECTIVE STRUCTURE DEMOLITION for general demolition requirements and procedures.

B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.

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 with same or compatible piping material.

3. Equipment to Be Removed: Disconnect and cap 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.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

D. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

E. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

F. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

G. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

H. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

I. Install piping to permit valve servicing.

J. Install piping at indicated slopes.

K. Install piping free of sags and bends.

L. Install fittings for changes in direction and branch connections.

M. Install piping to allow application of insulation.

N. Select system components with pressure rating equal to or greater than system operating pressure.

O. Install escutcheons for penetrations of walls, ceilings, and floors.

P. Sleeves are not required for core-drilled holes.

Q. Permanent sleeves are not required for holes formed by removable PE sleeves.

R. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

   a. Steel Pipe Sleeves: For pipes smaller than NPS 6.

   b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

   c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Section, SHEET METAL FLASHING AND TRIM for flashing.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Section, JOINT SEALANTS for materials and installation.

S. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.

2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

T. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

U. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Section, PENETRATION FIRESTOPPING for materials.

V. Verify final equipment locations for roughing-in.

W. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1, QUALITY ASSURANCE Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.

3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

5. PVC Nonpressure Piping: Join according to ASTM D 2855.

6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

A. Painting of plumbing systems, equipment, and components is specified in Sections, INTERIOR PAINTING and EXTERIOR PAINTING .

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.

3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.

6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Section, CAST-IN-PLACE CONCRETE [Note to Specifier: 1995 CSI title is BASIC CONCRETE MATERIALS AND METHODS.].

3.8 INSTALLATION – FLASHING

A. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inches minimum clear on sides with 24 inches by 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.

C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 inches by 36 inches sheet size. Fasten flashing to drain clamp device.

D. Seal drains watertight to adjacent materials.

E. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.9 INSTALLATION – FIRESTOPPING

A. Install material at fire-rated construction perimeters and openings containing penetrating sleeves, piping, and other items, requiring firestopping according to manufacturer's instructions to maintain fire ratings per drawings.

3.10 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Section, METAL FABRICATIONS for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.11 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.12 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION

SECION 22 05 03
PIPES AND TUBES FOR PLUMBING PIPING AND EQUIPMENT

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes pipe and pipe fittings for the following systems:

1. Domestic water piping, within 5 feet of building.
2. Sanitary sewer piping, within 5 feet of building.
3. Equipment drains and over flows.
4. Unions and flanges.
5. Underground pipe markers.
6. Bedding and cover materials.

1.2 SUBMITTALS

A. Refer to Section, SUBMITTAL PROCEDURES for submittal procedures.

B. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, and sizes.

C. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.

1.3 QUALITY ASSURANCE

A. Perform work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Refer to Section, PRODUCT REQUIREMENTS for transporting, handling, storing, and protecting products requirements.

B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.7 COORDINATION

A. Refer to Section, ADMINISTRATIVE REQUIREMENTS for coordination requirements.

B. Coordinate installation of buried piping with trenching.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. PVC Pipe: ASTM D1785, Schedule 80 polyvinyl chloride (PVC) material.

1. Fittings: ASTM D2467, Schedule 80, PVC.

2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.2 DOMESTIC WATER PIPING, ABOVE GRADE

A. Cross-linked Polyethylene (PEX-a) Piping: ASTM F876, F877.

1. Fittings:

a. Brass or copper insert fittings with copper or stainless steel crimp rings, ASTM F1807, ASTM F2098.

b. Engineered polymer or lead free brass, ASTM F1960, cold expansion fittings with PEX reinforcing rings.

c. Cold expansion fittings with metal-compression sleeves, ASTM F2080.

d. Plastic insert fittings using copper crimp rings, ASTM F2159.

2.3 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. ABS Pipe: ASTM F628, foam core pipe, Acrylonitrile-Butadiene-Styrene (ABS) material.

1. Fittings: ABS.
2. Joints: ASTM D2235, solvent weld.

B. ABS Pipe: ASTM D2661, Acrylonitrile-Butadiene-Styrene (ABS) material.

1. Fittings: ABS, ASTM D2661.
2. Joints: ASTM D2235, solvent weld.

C. PVC Pipe: ASTM D3034, Type PSM, polyvinyl chloride (PVC) material, bell and spigot style rubber ring sealed gasket joint.

1. Fittings: PVC, ASTM D3034.
2. Joints: ASTM F477, elastomeric gaskets.

D. PVC Pipe: ASTM D1785, Schedule 80, polyvinyl chloride (PVC) material, bell and spigot style solvent sealed joint ends.

1. Fittings: ASTM D2467, Schedule 80, PVC.

2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

E. Plastic Pipe: ASTM D2665, polyvinyl chloride (PVC) material.

1. Fittings: PVC, ASTM D2665.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.4 SANITARY SEWER PIPING, ABOVE GRADE

A. ABS Pipe: ASTM D2751 or ASTM F628, Schedule 40, DWV, Acrylonitrile-Butadiene-Styrene (ABS) material.

1. Fittings: ABS, ASTM D2751.
2. Joints: ASTM D2235, solvent weld.

B. ABS Pipe: ASTM D2661 or ASTM D2751, Acrylonitrile-Butadiene-Styrene (ABS) material.

1. Fittings: ABS, ASTM D2662.
2. Joints: ASTM D2235, solvent weld.

C. PVC Pipe: ASTM D2729, polyvinyl chloride (PVC) material.

1. Fittings: ASTM D2729, PVC.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

D. PVC Pipe: ASTM D2665, polyvinyl chloride (PVC) material.

1. Fittings: ASTM D2665, PVC.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

E. PVC Pipe: ASTM D1785 Schedule 40, or ASTM D2241 SDR-26 for not less than 150 psi pressure rating, polyvinyl chloride (PVC) material.

3. Fittings: ASTM D2466, Schedule 40, PVC.
4. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.5 EQUIPMENT DRAINS AND OVERFLOWS

A. Steel Pipe: ASTM A53/A53M Schedule 40, galvanized.

1. Fittings: ASME B16.3, malleable iron or ASME B16.4, cast iron.

2. Joints: Threaded for pipe 2 inch and smaller; flanged for pipe 2-1/2 inches and larger.

B. Copper Tubing: ASTM B88, Type DWV hard drawn.

1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.

2. Joints: Solder, lead free, ASTM B32**,** 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

C. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26, polyvinyl chloride (PVC) material.

1. Fittings: ASTM D2466, Schedule 40, PVC.

2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

D. ABS Pipe: ASTM D2680 or ASTM D2751, Acrylonitrile-Butadiene-Styrene (ABS) material.

1. Fittings: ABS, ASTM D2751.
2. Joints: ASTM D2235, solvent weld.

2.6 UNIONS AND FLANGES

A. Unions for Pipe 2 Inches and Smaller:

1. Ferrous Piping: Class 150, malleable iron, threaded.

2. Copper Piping: Class 150, bronze unions with brazed joints.

3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

4. PVC Piping: PVC.

5. CPVC Piping: CPVC.

B. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.

2.7 BEDDING AND COVER MATERIALS

A. Bedding: Sand, ASTM C33; fine aggregate, natural or manufactured sand.

B. Soil Backfill from Above Pipe to Finish Grade: Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Refer to Section, ADMINISTRATIVE REQUIREMENTS for verification of existing conditions before starting work.

B. Verify excavations are to required grade, dry, and not over-excavated.

C. Verify trenches are ready to receive piping.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection size, location, and invert are as indicated on Drawings.

B. Establish elevations of buried piping with not less than 2 feet of cover.

C. Establish minimum separation from other services in accordance with local code.

D. Excavate pipe trench in accordance with Section 312000.

E. Install pipe to elevation as indicated on Drawings.

F. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 depth; compact to 95% maximum density.

G. Install pipe on prepared bedding.

H. Route pipe in straight line.

I. Install pipe to allow for expansion and contraction without stressing pipe or joints.

J. Install shutoff and drain valves at locations indicated on Drawings in accordance with Section, GENERAL – DUTY VALVES FOR PLUMBING PIPING .

K. Install trace wire continuous over top of pipe above pipe line; coordinate with Section, FILL. Refer to Section, IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT.

L. Pipe Cover and Backfilling:

1. Backfill trench in accordance with Section, FILL.

2. Maintain optimum moisture content of fill material to attain required compaction density.

3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 12 inches minimum cover over top of jacket. Compact to 95% maximum density.

4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.

5. Do not use wheeled or tracked vehicles for tamping.

3.4 INSTALLATION - ABOVE GROUND PIPING

A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

C. Group piping whenever practical at common elevations.

D. Sleeve pipe passing through partitions, walls, and floors.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

G. Provide access where valves and fittings are not accessible.

H. Install non-conducting dielectric connections wherever jointing dissimilar metals.

I. Slope piping and arrange systems to drain at low points.

J. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

K. Install piping penetrating roofed areas to maintain integrity of roof assembly.

L. Install valves in accordance with Section, GENERAL-DUTY VALVES FOR PLUMBING PIPING.

M. Install piping specialties in accordance with Section, HYDRONIC PIPING SPECIALTIES.

N. Insulate piping. Refer to Section, PLUMBING INSULATION.

O. Install pipe identification in accordance with Section, IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT.

3.5 INSTALLATION - DOMESTIC WATER PIPING SYSTEMS

A. Install domestic water piping system in accordance with Section, FACILITY WATER DISTRIBUTION

3.6 INSTALLATION - SANITARY WASTE AND VENT PIPING SYSTEMS

A. Install sanitary waste and vent piping systems in accordance with Section, FACILITY SANITARY SEWERAGE

3.8 FIELD QUALITY CONTROL

A. Test domestic water piping system in accordance with applicable code & local Authority Having Jurisdiction.

B. Test sanitary waste and vent piping system in accordance with applicable code & local Authority Having Jurisdiction.

C. Test storm drainage piping system in accordance with applicable code & local Authority Having Jurisdiction.

3.9 CLEANING

A. Refer to Section, EXECUTION AND CLOSEOUT REQUIREMENTS for cleaning requirements.

B. Clean and disinfect domestic water distribution system in accordance with Section, FACILITY WATER DISTRIBUTION

END OF SECTION

SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes:

1. Gate valves.
2. Ball valves.
3. Check valves.

1.2 SUBMITTALS

A. Refer to Section, SUBMITTAL PROCEDURES for submittal requirements.

B. Product Data: Submit manufacturer’s catalog information with valve data and ratings for each service.

C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.

1.3 CLOSEOUT SUBMITTALS

A. Refer to Section, EXECUTION AND CLOSEOUT REQUIREMENTS for submittal requirements.

B. Project Record Documents: Record actual locations of valves.

C. Operation And Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Refer to Section, PRODUCT REQUIREMENTS for environmental conditions affecting products on site.

B. Do not install valves underground when bedding is wet or frozen.

PART 2 – PRODUCTS

2.1 Manufacturers:

1. Apollo.
2. Milwaukee.
3. NIBCO.
4. Hammond.
5. Watts.
6. Jamesbury.
7. Victaulic.
8. Bell & Gossett.

9. Mueller.
10. PEX: Provide valves from the same manufacturer as the piping system.

2.2 VALVE FEATURES, GENERAL

A. Valve Design: Rising stem or rising outside screw and yoke stems.

1. Non-rising stem valves may be used where headroom prevents full extension of rising stems.

B. Pressure and Temperature Ratings: As scheduled and required to suit system pressures and temperatures.

C. Sizes: Same size as upstream pipe, unless otherwise indicated.

D. Operators: Provide the following special operator features:

1. Hand wheels, fastened to valve stem, for valves other than quarter turn.

2. Lever handles, on quarter-turn valves 6 inches and smaller, except for plug valves. Provide plug valves with square heads; provide 1 wrench for every 10 plug valves.

3. Chain-wheel operators, for valves 2 inches and larger, installed 72 inches or higher above finished floor elevation. Extend chains to an elevation of 5'-0" above finished floor elevation in mechanical rooms and to 6” above ceiling above T-bar ceilings and above access panel above gypsum board ceilings.

E. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.

F. Bypass and Drain Connections: Comply with MSS SP-45 bypass and drain connections.

G. End Connections: As indicated in the valve specifications.

1. Threads: Comply with ANSI B1.20.1.

2. Flanges: Comply with ANSI B16.1 for cast iron, ANSI B16.5 for steel, and ANSI B16.24 for bronze valves.

3. Solder-Joint: Comply with ANSI B16.18.

4. PEX: ASTM F1960 cold expansion ends.

5. Caution: Where soldered end connections are used, use solder having a melting point below 840 degrees F for gate, globe, and check valves; below 421 degrees F for ball valves.

2.3 GATE VALVES

A. 2 Inches and Smaller: MSS SP 80, Class 125, bronze body, bronze trim, threaded bonnet, inside screw, solid wedge disk, alloy seat rings, solder or threaded ends.

B. 2-1/2 Inches and Larger: MSS SP 70, Class 125, cast iron body, bronze trim, bolted bonnet, hand-wheel, outside screw and yoke, solid wedge disk with bronze seat rings, flanged ends. Furnish chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.4 BALL VALVES

A. 2 Inches and Smaller: MSS SP 110, Class 150, bronze, two-piece body, chrome-plated bronze ball, full port, Teflon seats, blowout-proof stem, solder or threaded ends, lever handle.

1. PEX-to-PEX, Lead Free (LF) Brass Ball Valves (1/2 inch through 2 inch nominal pipe size). Manufacturers: Provide ball valve(s) from the same manufacturer as the piping system.

2. Full-port ball valve: two-piece, ASTM F1960 cold-expansion ends, with PEX-a reinforcing cold-expansion ring

3. LF brass valve with a positive stop shoulder manufactured from C69300 brass

4. In compliance with: 250 CWP, ANSI/NSF 359, ANSI/NSF 14/61, cNSF-us-pw_G lead free 0.25% Lead max., ASTM F1960, ASTM F 877,

B. PVC Body and Trim Valve, 2 Inches And Smaller: 150 psi at 73 degrees F water temperature, maximum service temperature: 140 degrees F ASTM D1784 PVC body and ball, double lever handle, EPDM seals, Teflon seats, full port, single union type with socket ends.

C. CPVC Body and Trim Valve, 2 Inches And Smaller: 150 psi at 73 degrees F water temperature, maximum service temperature: 210 degrees F, ASTM D1784 CPVC body and ball, double lever handle, EPDM seals, Teflon seats, full port, single union type with socket ends.

2.5 CHECK VALVES

A. Horizontal Swing Check Valves:

1. 2 Inches and Smaller: MSS SP 80, Class 150, bronze body and cap, bronze seat, Buna-N disk, solder or threaded ends.

2. 2-1/2 Inches and Larger: MSS SP 71, Class 125, cast iron body, bolted cap, bronze or cast iron disk, renewable disk seal and seat, flanged ends.

B. Spring-Loaded Check Valves:

1. 2 Inches and Smaller: MSS SP 80, Class 250, bronze body, in-line spring lift check, silent closing, Buna-N disk, integral seat, soldered or threaded ends.

2. 2-1/2 Inches and Larger: MSS SP 71, Class 125, wafer style, cast iron body, bronze seat, center guided bronze disk, stainless steel spring and screws, flanged ends.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Refer to Section, ADMINISTRATIVE REQUIREMENTS for verification of existing conditions before starting work.

B. Verify piping system is ready for valve installation.

3.2 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install 3/4-inch ball valves with cap for drains at main shutoff valves, low points of piping, bases of vertical risers, and at equipment.

D. Install valves with clearance for installation of insulation and allowing access.

E. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Section, ACCESS DOORS AND FRAMES.

F. Refer to Section, HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT for pipe hangers.

G. Refer to Section, PLUMBING INSULATION for insulation requirements for valves.

H. Refer to Section, PIPES AND TUBES FOR PLUMBING PIPING AND EQUIPMENT for piping materials applying to various system types.

3.3 VALVE APPLICATIONS

A. Install shutoff and drain valves at locations indicated on Drawings in accordance with this Section.

B. Install ball valves for shutoff and to isolate equipment, part of systems, or vertical risers.

C. Install lever and spring check valves on discharge of pumps in pumped sanitary piping.

D. Install gate valves in domestic water systems for shutoff service.

3.4 VALVE PRESSURE/TEMPERATURE CLASSIFICATION SCHEDULES

A. VALVES, 2 INCHES AND SMALLER:

SERVICE	GATE	BALL	CHECK

Domestic Hot and Cold Water	125	150	125

END OF SECTION

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes:

1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Formed steel channel.
5. Equipment bases and supports.

1.2 SUBMITTALS

A. Refer to Section, SUBMITTAL PROCEDURES for submittal procedures.

B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.

C. Product Data:

1. Hangers and Supports: Submit manufacturers catalog, data including load capacity.

D. Design Data: Indicate load-carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load-carrying capacity of trapeze, multiple pipe, and riser support hangers.

E. Manufacturer's Installation Instructions:

1. Hangers and Supports: Submit special procedures and assembly of components.

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

B. Perform work in accordance with applicable authority for welding hanger and support attachments to building structure.

PART 2 – PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Plumbing Piping - DWV:

1. Conform to MSS SP58, MSS SP69, and MSS SP89.

2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron or carbon steel, adjustable swivel, split ring.

3. Hangers for Pipe Sizes 2 Inches and Larger: carbon steel, adjustable, clevis.

4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

5. Wall Support for Pipe Sizes 3 Inches and Smaller: Cast iron hook.

6. Vertical Support: Steel riser clamp.

7. Floor Support: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.

8. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.

B. Plumbing Piping - Water:

1. Conform to MSS SP58, MSS SP69, and MSS SP89.

2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron or carbon steel, adjustable swivel, split ring.

3. Hangers for Cold Pipe Sizes 2 Inches and Larger: carbon steel, adjustable, clevis.

4. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: carbon steel, adjustable, clevis.

5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

6. Wall Support for Pipe Sizes 3 Inches and Smaller: Cast iron hook.

7. Vertical Support: Steel riser clamp.

8. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.

9. Floor Support for Hot Pipe Sizes 4 Inches and Smaller: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.

10. Copper Pipe Support: Copper-plated, carbon-steel ring.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FORMED STEEL CHANNEL

A. Product Description: Galvanized 12-gauge-thick steel, with holes 1-1/2 inches on center.

PART 3 – EXECUTION

3.1 PREPARATION

A. Obtain permission from Architect before using powder-actuated anchors.

B. Obtain permission from Architect before drilling or cutting structural members.

3.2 INSTALLATION – INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

3.3 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with MSS SP 58, MSS SP 69, and MSS SP 89.

B. Support horizontal piping as scheduled.

C. Install hangers with minimum 1/2-inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2-inch-minimum vertical adjustment.

F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

G. Support vertical piping at every other floor. Support vertical cast iron pipe at each floor at hub.

H. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

I. Support riser piping independently of connected horizontal piping.

J. Provide copper-plated hangers and supports for copper piping.

K. Design hangers for pipe movement without disengagement of supported pipe.

L. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

M. Provide clearance in hangers and from structure and other equipment for installation of insulation.

3.4 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment. Refer to Section, CAST-IN-PLACE CONCRETE.

B. Using templates furnished with equipment, install anchor bolts and accessories for mounting and anchoring equipment.

C. Construct supports of formed-steel channel. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.5 SCHEDULES

PIPE HANGER SPACING	
PIPE MATERIAL	**MAXIMUM HANGER SPACING FEET**
ABS (all sizes)	4
CPVC, 1 inch and smaller	3
CPVC, 1-1/4 inches and larger	4
Copper tube, 1-1/4 inches and smaller	6
Copper tube, 1-1/2 inches and larger	10
PEX	4
PVC (all sizes)	4

HANGER ROD SIZES	
PIPE AND TUBE SIZE INCHES	**ROD SIZE INCHES**
1/2 - 4	3/8
5 - 8	1/2
10 -12	5/8

END OF SECTION

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes:

1. Nameplates.
2. Tags.
3. Pipe markers.
4. Ceiling tacks.
5. Labels.

1.2 CLOSEOUT SUBMITTALS

A. Refer to Section, EXECUTION AND CLOSEOUT REQUIREMENTS for closeout procedures.

B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.3 QUALITY ASSURANCE

A. Conform to NFPA 99 requirements for labeling and identification of medical gas piping systems and accessories.

B. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

PART 2 PART 2 – PRODUCTS

2.1 MECHANICAL IDENTIFICATION MATERIALS

A. Manufacturer:

1. Allen Systems, Inc.

2. Brady (W.H.) Co.; Signmark Div.

3. Industrial Safety Supply Co., Inc.

4. Seton Name Plate Corp.

5. MSI (marketing Services, Inc.)

2.2 NAMEPLATES

A. Product Description: Laminated three-layer plastic with engraved white letters on black background color.

2.3 TAGS

A. Plastic Tags:

1. Laminated three-layer plastic with engraved white letters on black background color. Tag size minimum 1-1/2 inches diameter.

B. Metal Tags:

1. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.

C. Information Tags:

1. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

D. Tag Chart: Typewritten letter size list of applied tags and location plastic laminated.

2.4 PIPE MARKERS

A. Color And Lettering: Conform to ASME A13.1.

1. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

B. Plastic Tape Pipe Markers:

1. Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.

C. Plastic Underground Pipe Markers:

1. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mils thick, manufactured for direct-burial service.

2.5 CEILING TACKS

A. Description: Steel with 3/4-inch-diameter color-coded head.

B. Color code as follows:

1. Plumbing valves: Green.

2.6 LABELS

A. Description: Aluminum, size 1.9 x 0.75 inches, adhesive backed with printed identification and bar code.

PART 3 – EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section **[09 90 00]** for stencil painting.

3.2 INSTALLATION

A. Install identifying devices after completion of coverings and painting.

B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

C. Install labels with sufficient adhesive for permanent adhesion, and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

D. Install tags using corrosion resistant chain. Number tags consecutively by location.

E. Install underground plastic pipe markers 6 inches to 8 inches below finished grade, directly above buried pipe.

F. Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.

G. Identify control panels and major control components outside panels with plastic nameplates.

H. Identify valves in main and branch piping with tags.

I. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4-inch-diameter and smaller. Identify service, flow direction, and pressure. Install in clear view, and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

J. Provide ceiling tacks to locate valves above T-bar-type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 22 07 00
PLUMBING INSULATION

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Piping system insulation.

1.2 SUBMITTALS

A. Refer to Section, SUBMITTAL PROCEDURES for submittal procedures.

B. Product Data: Submit product description, thermal characteristics, and list of materials and thickness for each service and location.

C. Manufacturer's Installation Instructions: Submit manufacturer’s published literature indicating proper installation procedures.

1.3 QUALITY ASSURANCE

D. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.

PART 2 – PRODUCTS

2.1 PIPE INSULATION

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

1. Certainteed Corp.

2. Johns Manville Insulations.

3. Knauf Insulation

4. Owens-Corning Fiberglas Corp.

B. Man Made Mineral Fiber: ASTM C547; rigid molded, noncombustible.

1. k (ksi) factor: 0.24 at 75 degrees F.

2. Maximum service temperature: 850 degrees F.

3. Vapor Retarder Jacket: White Kraft paper with glass fiber yarn and bonded to aluminized film, secured with self-sealing longitudinal laps and butt strips or with outward clinch expanding staples and vapor retarder mastic.

C. Jackets:

1. PVC Plastic: One piece molded type fitting covers and sheet material, off-white color.

    a. Thickness: 10 mil.

    b. Connections: Brush on welding adhesive.

2. Canvas Jacket: UL listed fabric, 6 oz per sq yd, plain weave cotton treated with dilute fire retardant lagging adhesive.

3. Aluminum Jacket: 0.025 inch thick sheet, embossed finish, with longitudinal slip joints and 2 inch laps, die shaped fitting covers with factory attached protective liner.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Refer to Section, ADMINISTRATIVE REQUIREMENTS for coordination and project conditions.

B. Verify piping and equipment has been tested before applying insulation materials.

C. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Exposed Piping: Locate insulation and cover seams in least visible locations.

B. Insulated Pipes Conveying Fluids Below Ambient Temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

C. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

D. Inserts And Shields:

1. Application: Piping or Equipment 1-1/2 inches diameter or larger.

2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.

3. Insert Location: Between support shield and piping and under finish jacket.

4. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.

5. Insert Material: Compression-resistant insulating material suitable for planned temperature range and service.

E. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of 1 hour or less. Provide intumescent

firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section, FIRESTOPPING for penetrations of assemblies with fire resistance rating greater than 1 hour.

F. Pipe Exposed In Mechanical Equipment Rooms Or Finished Spaces: Finish with PVC jacket and fitting covers.

G. Exterior Applications: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover with aluminum jacket with seams located at 3 o'clock or 9 o'clock position on side of horizontal piping, with overlap facing down to shed water or on bottom side of horizontal equipment.

H. Buried Piping: Insulate only where insulation manufacturer recommends insulation product may be installed in trench, tunnel, or direct buried. Install factory-fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open-mesh glass fabric, with 1-mil-thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.

I. Factory Insulated Equipment: Do not insulate.

J. Exposed Equipment: Locate insulation and cover seams in least visible locations.

K. For hot equipment containing fluids over 140 degrees F, insulate flanges and unions with removable sections and jackets.

L. Mineral Fiber Insulated Equipment Containing Fluids above Ambient Temperature: Provide standard jackets, with or without vapor retarder, factory-applied or field-applied. Finish with glass cloth and adhesive.

M. Finish insulation at supports, protrusions, and interruptions.

N. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

3.3 SCHEDULES

A. Piping Insulation Thickness. Piping shall be insulated in accordance with the following table:

Fluid Design Operating Temperature Range (F)	NOMINAL PIPE DIAMETER					
	Runoutsup to 2”	1”& less	1-1/4” to 2”	2-1/2” to 4”	5” to 6”	8” & Above
Domestic and Service Hot Water Systems						
105 & Greater	0.5”	1”.0	1”	1.5”	1.5”	1.5”
Domestic Cold Water System						
40 to 60	0.5”	1.0”	1.0”	1.0”	1.0”	1.0”
Roof Drain Systems						
20 to 100	-	-	1.0”	1.0”	1.0”	1.0”

END OF SECTION

SECTION 22 11 00
FACILITY WATER DISTRIBUTION

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes:

1. Water pressure reducing valves.
2. Relief valves.
3. Hose bibs.
4. Hydrants.
5. Recessed valve box.
6. Backflow preventers.
7. Water hammer arrestors.

1.2 SUBMITTALS

A. Refer to Section, SUBMITTAL PROCEDURES for submittal procedures.

B. Product Data:

8. Valves: Submit manufacturer’s catalog information with valve data and ratings for each service.

9. Domestic Water Specialties: Submit manufacturer’s catalog information, component sizes, rough-in requirements, service sizes, and finishes.

10. Pumps: Submit pump type, capacity, and certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Submit installation instructions for pumps, valves, and accessories.

1.3 CLOSEOUT SUBMITTALS

A. Refer to Section, Execution and Closeout REQUIREMENTS, for closeout procedures.

B. Project Record Documents: Record actual locations of valves and equipment.

C. Operation and Maintenance Data: Submit spare parts list, exploded assembly views, and recommended maintenance intervals.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Refer to Section, PRODUCT REQUIREMENTS for product storage and handling requirements.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Refer to Section, PRODUCT REQUIREMENTS.

B. Do not install underground piping when bedding is wet or frozen.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.7 WARRANTY

A. Refer to Section, EXECUTION AND CLOSEOUT REQUIREMENTS for product warranties and product bonds.

B. Furnish ONE (1)-year manufacturer warranty for domestic water piping.

PART 2 PRODUCTS

2.1 WATER PRESSURE REDUCING VALVES

A. Manufacturers:

1. Apollo.
2. Watts.
3. Zurn Wilkins.

B. 2 Inches and Smaller: MSS SP 80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer.

C. 2 Inches and Larger: MSS SP 85, cast iron body, bronze fitted, elastomeric diaphragm and seat disk, flanged.

2.2 RELIEF VALVES

A. Temperature and Pressure Relief:

1. ANSI Z21.22 certified, bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME certified and labeled.

2.3 HYDRANTS

A. Manufacturers :

1. Josam Co.
2. MIFAB Inc.

3. Jay R. Smith Mfg. Co.
4. Watts
5. Woodford Mfg. Co.
6. Zurn.

B. Wall Hydrant: ASSE 1019; non-freeze, self-draining type with polished-bronze wall plate hose thread spout, hand wheel, and integral vacuum breaker.

2.4 RECESSED VALVE BOX

A. Manufacturers :

1. Acorn Engineering.
2. IPS Corporation.

B. Washing Machine: Plastic preformed rough-in box with brass valves, socket for 2-inch waste, slip-in finishing cover.

C. Refrigerator: Plastic preformed rough-in box with brass valves with wheel handle slip-in finishing cover.

2.5 BACKFLOW PREVENTERS

A. Manufacturers :

1. Apollo.
2. Watts.
3. Zurn.

B. Reduced Pressure Backflow Preventers:

1. Comply with ASSE 1013.

2. Bronze body, with bronze internal parts and stainless steel springs.

3. Two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve opening under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

C. Double Check Valve Assemblies: Comply with ASSE 1012; Bronze body with corrosion-resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

PART 2 – EXECUTION

3.1 EXAMINATION

A. Refer to Section, ADMINISTRATIVE REQUIREMENTS for coordination and Project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

3.3 INSTALLATION – ABOVE-GROUND PIPING

A. Install non-conducting dielectric connections wherever jointing dissimilar metals.

B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

C. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

D. Group piping whenever practical at common elevations.

E. Slope piping and arrange systems to drain at low points.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section, EXPANSION FITTINGS AND LOOPS FOR FIRE-SUPPRESSION PIPING

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section, PLUMBING INSULATION

H. Provide access where valves and fittings are not accessible. .

I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.

J. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. .

K. Install domestic water piping in accordance with ASME B31.9.

L. Sleeve pipes passing through partitions, walls, and floors. Refer to Section, HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**.**

M. Install fire stopping at fire-rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Section**,** FIRE STOPPING

N. Install unions downstream of valves and at equipment or apparatus connections.

O. Install valves with stems upright or horizontal, not inverted.

P. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

Q. Install gate valves for shutoff and to isolate equipment, part of systems, or vertical risers.

R. Provide spring-loaded check valves on discharge of water pumps.

S. Provide flow controls in water circulating systems as indicated on Drawings.

T. Install potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, and interior and exterior hose bibs (WALL HYDRANTS).

U. Pipe relief from valves, backflow preventers, and drains to nearest floor drain.

V. Test backflow preventers in accordance with ASSE 5013 or 5015.

W. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping where shown on drawings.

X. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4 inch minimum, and minimum 18 inches long.

3.4 INSTALLATION - SERVICE CONNECTIONS

A. Provide 18-gauge galvanized sheet metal sleeve around service main to 6 inches above floor and 6 feet minimum below grade. Size for minimum of 2 inches of loose batt insulation stuffing.

3.5 FIELD QUALITY CONTROL

A. Refer to Section, QUALITY REQUIREMENTS for field inspecting, testing, adjusting, and balancing.

B. Test domestic water piping system in accordance with applicable code and/or local Authority Having Jurisdiction.

3.6 CLEANING

A. Refer to Section, EXECUTION AND CLOSEOUT REQUIREMENTS for cleaning requirements.

B. Disinfect water distribution system in accordance with the state health department, local Authority Having Jurisdiction, and/or state plumbing code as required.

END OF SECTION

SECTION 22 13 00
FACILITY SANITARY SEWERAGE

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes:

1. Cleanouts.

1.2 SUBMITTALS

A. Refer to Section, SUBMITTAL PROCEDURES for submittal procedures.

B. Product Data:

1. Valves: Submit manufacturers catalog information with valve data and ratings for each service.

2. Hangers and Supports: Submit manufacturers catalog information including load capacity.

3. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

C. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

1.3 CLOSEOUT SUBMITTALS

A. Refer to Section, EXECUTION AND CLOSEOUT REQUIREMENTS FOR closeout procedures.

B. Project Record Documents: Record actual locations of equipment and clean-outs.

C. Operation and Maintenance Data: Submit frequency of treatment required for interceptors. Include, spare parts lists, exploded assembly views for pumps and equipment.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Refer to Section, Product Requirements for product storage and handling requirements.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Refer to Section, PRODUCT REQUIREMENTS.

B. Do not install underground piping when bedding is wet or frozen.

PART 2 – PRODUCTS

2.1 CLEANOUTS

A. Exterior Surfaced Areas: Round or Square cast nickel bronze access frame and non-skid cover.

B. Exterior Unsurfaced Areas: Line type with lacquered cast-iron body and round epoxy-coated cover with gasket.

C. Interior Finished Floor Areas: Lacquered cast-iron body with anchor flange, reversible clamping collar, threaded top assembly, and round scored cover with gasket in service areas and round or square depressed cover with gasket to accept floor finish in finished floor areas.

D. Interior Finished Wall Areas: Line type with lacquered cast iron-body and round epoxy-coated cover with gasket, and round stainless steel access cover secured with machine screw.

E. Interior Unfinished Accessible Areas: Caulked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Refer to Section, ADMINISTRATIVE REQUIREMENTS for coordination and Project conditions.

B. Verify excavations are to required grade, dry, and not overexcavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection size, location, and invert is as indicated on Drawings.

B. Establish elevations of buried piping with not less than 12 inches of cover.

C. Establish minimum separation of 12 inches from water piping in accordance with the plumbing code.

D. Remove scale and dirt on inside of piping before assembly.

E. Route pipe in straight line.

F. Install plastic ribbon tape continuous above pipeline. Refer to Section, IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

3.4 INSTALLATION – ABOVE-GROUND PIPING

A. Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum. Maintain gradients. Pipe 4 inch or larger in diameter shall be permitted to have a slope of not less than 1/8 inch per foot.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.

Encase exterior cleanouts in concrete flush with grade.

C. Install floor cleanouts at elevation to accommodate finished floor.

D. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

E. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

F. Install piping to maintain headroom. Do not spread piping, conserve space.

G. Group piping whenever practical at common elevations.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

I. Provide access where cleanouts and fittings are not accessible.

J. Install piping penetrating roofed areas to maintain integrity of roof assembly.

K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.

L. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting..

M. Sleeve pipes passing through partitions, walls, and floors.

N. Install fire stopping at fire-rated construction perimeters and openings containing penetrating sleeves and piping.

O. Support cast iron drainage piping at every joint.

3.5 FIELD QUALITY CONTROL

A. Test sanitary waste and vent piping system in accordance with local Authority Having Jurisdiction.

END OF SECTION

SECTION 22 34 00
FUEL-FIRED DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:

1. Instantaneous gas-fired water heaters.

1.2 SUBMITTALS

A. Refer to Section, SUBMITTAL PROCEDURES for submittal procedures.

B. Product Data:

1. Water Heaters: Submit dimensioned drawings of water heaters indicating components and connections to other equipment and piping. Indicate pump type, capacity, and power requirements.

C. Manufacturer's Installation Instructions: Submit mounting and support requirements.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.3 CLOSEOUT SUBMITTALS

A. Refer to Section, EXECUTION AND CLOSEOUT REQUIREMENTS for closeout procedures.

B. Operation and Maintenance Data: Submit replacement part numbers and availability.

1.4 QUALITY ASSURANCE

A. Conform to ASME Section VIII for construction of water heaters and heat exchangers. Provide boilers registered with National Board of Boiler and Pressure Vessel Inspectors.

PART 2 - PRODUCTS

2.1 INSTANTANEOUS GAS-FIRED WATER HEATERS

A. Manufacturers:

1. BOSCH

B. Construction: Copper piping or tubing complying with NSF 61 barrier materials for potable water, without storage capacity.

1. Tappings: ASME B1.20.1 pipe thread.
2. Pressure Rating: 150 psig.
3. Heat Exchanger: Copper tubing.

4. Insulation: Comply with ASHRAE/IESNA 90.1.
5. Burner: For use with tankless water heaters and for natural-gas fuel.
6. Automatic Ignition: Manufacturer's proprietary system for automatic, gas ignition.
7. Temperature Control: Adjustable thermostat.
8. Jacket: Metal with enameled finish or plastic.

C. Support: Bracket for wall mounting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Maintain manufacturer's recommended clearances around and over water heaters.

B. Connect propane piping to water heater, full size of water heater gas train inlet. Arrange piping with clearances for burner removal and service.

C. Install the following piping accessories on propane piping connections.

1. Strainer.
2. Shutoff valve.
3. Pressure-reducing valve.

D. Install discharge piping from relief valves and drain valves to nearest floor drain.

E. Install devices furnished loose for field mounting.

F. Install control wiring between water heater control panel and field mounted control devices.

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Water closets.
2. Lavatories.
3. Sinks.
4. Floor drains
5. Electric water coolers.
6. Showers.

1.2 SUBMITTALS

A. Refer to Section, SUBMITTAL PROCEDURES for submittal procedures.

B. Product Data: Submit catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Manufacturer's Installation Instructions: Submit installation methods and procedures.

1.3 PERFORMANCE REQUIREMENTS

A. Furnish and install all fixtures and equipment, complete and in place, fully functional and including all accessories and appurtenances required to perform the intended or indicated functions.

1.4 CLOSEOUT SUBMITTALS

A. Refer to Section, EXECUTION AND CLOSEOUT REQUIREMENTS for closeout procedures.

B. Operation and Maintenance Data: Submit fixture, trim, exploded view, and replacement parts lists.

PART 2 – PRODUCTS

2.1 MATERIALS

A. All materials employed in permanent construction shall be new, full weight, in first class condition, and suitable for space provided.

B. All similar materials shall be of one manufacturer. Fixture trim for the entire job shall be supplied by the same manufacturer to the extent possible.

C. Fixtures and their trim shall be complete in every respect, including such items as escutcheons, hanger plates, bolts, supplies, stops, traps, etc.

D. All exposed metal parts of all fixtures, including faucets, waste fittings, indirect waste piping, waste plugs, strainers, flush valves, traps, supplies, and escutcheons shall be polished chrome-plated brass, unless otherwise specified including all parts within a base cabinet.

2.2 SYSTEM ACCESSORIES

A. Fixture Supports & Carriers: All fixture supports shall be ANSI approved to adequately support the fixture. Carrier shall best suit the fixture arrangement and wall space available for the piping arrangement and materials employed.

2.3 FIXTURE CONNECTIONS

A. Fixture Stops: Fixture stops shall be by the primary plumbing fixture manufacturer (such as American Standard or Kohler) or a specialty manufacturing company such as Brass Craft or McGuire. Stops shall be chrome-plated with threaded or solder connection on the water supply inlet. Jam nuts are acceptable only on the fixture side of the stop. Stop handles shall be tool or key operated.

B. Fixture Risers: Risers shall be braided stainless steel.

C. Closet Flange: A heavy cast-iron closet flange shall be installed between each water closet and the soil pipe, gas and water tight, with non-hardening putty.

2.4 PLUMBING FIXTURES

A. Description: See Plumbing Fixture Schedule and/or notes on plans for fixture types and accessories.

B. Manufacturers: In addition to the manufacturer listed on the Plumbing Fixture Schedule, the followed are approved equals.

1. Tank-Type Water Closets

a. American Standard Plumbing
b. Eljer Plumbing ware
c. Kohler Co.
d. TOTO USA

2. Lavatories

a. American Standard Plumbing
b. Eljer Plumbing ware
c. Kohler Co.
d. TOTO USA

3. Sinks

a. American Standard Plumbing
b. Elkay
c. Eljer Plumbingware

d. Kohler Co.

4. Floor Drains and Floor Sinks

a. Jay R. Smith Mfg Co.
b. Josam Co.
c. MIFAB Inc.
d. Sioux Chief
e. Watts.
f. Zurn.

5. Shower Bases

a. American Standard Plumbing
b. FIAT Products
c. Florestone
d. Sterling

6. Electric Water Coolers

a. Elkay
b. Halsey Taylor
c. Haws
d. Oasis

7. Faucets & Shower Valves

a. American Standard
b. Chicago Faucet
c. Delta
d. Kohler
e. Moen
f. Sloan
g. Symmons
h. Toto
i. Zurn

8. Seats

a. Primary fixture manufacturer, or
b. Bemis
c. Church
d. Olsonite

9. Shower Mixing Valves

a. Leonard
b. Powers
c. Symmons

10. Trap Primers

a. Josam
b. Precision Plumbing Products
c. Sioux Chief
d. Watts

11. Lavatory Insulation Kit

a. Plumberex Specialty Products
b. Trubro

PART 3 – EXECUTION

3.1 EXAMINATION

A. Refer to Section, ADMINISTRATIVE REQUIREMENTS for coordination and project conditions.

B. Verify walls and floor finishes are prepared and ready for installation of fixtures.

C. Verify electric power is available and of correct characteristics.

D. Confirm millwork is constructed with adequate provision for installation of counter top lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. All fixtures shall be installed to meet manufacturer's recommendations and local codes.

B. Unless otherwise noted, fixture rough-in shall be at heights shown within contract documents, or if not within contract documents, as recommended by manufacturer. Note special rough-in requirements for handicapped person fixtures.

C. An exposed stop valve shall be installed on each supply to each fixture connection. This includes such items as water fountains and rough-in provisions for ice makers, vending machines, etc. Stops shall be located in an accessible location behind or below the fixture serviced, otherwise in branch piping as approved.

D. Install fixtures complete with all necessary items such as carriers, plates, bolts, and escutcheons. Floor mounted fixtures shall have china bolt caps.

E. Escutcheons shall be installed on piping at all wall penetrations. Escutcheons shall seat tight to the wall.

F. All wall-hung fixtures shall be securely supported by a carrier designed for the specific fixture and mounted tight to wall. The contractor shall provide adequate blocking, reinforcing and stiffening of plumbing wall to adequately support the fixture or wall

support. Fixture installation which causes deflection of the wall will require reopening of the wall and re-support of the fixture. Wall hangers are not acceptable.

G. Set floor drains in place, level and at proper elevation for drainage specified.

H. Use sealing compound Dow #784 white silicone sealant, or approved equal, for the following installations:

1. Rims and trim of stainless steel sinks and drop-in lavatories.

2. Between the wall and the outer edge of wall-hung water closets and urinals.

3. Between the wall and the adjoining edge(s) of mop sinks.

4. Between the floor and the bottom circumference of floor-mounted water closets.

I. Adjust faucets, operating hardware, and flush valves for specified flow. Test all tailpieces, traps, supplies, and faucets for leaks.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop-drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.5 ADJUSTING

A. Refer to Section, EXECUTION AND CLOSEOUT REQUIREMENTS for testing, adjusting, and balancing.

B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

A. Refer to Section, EXECUTION AND CLOSEOUT REQUIREMENTS for final cleaning.

B. Clean plumbing fixtures and equipment.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Refer to Section, EXECUTION AND CLOSEOUT REQUIREMENTS for protecting installed construction.

B. Do not permit use of fixtures before final acceptance.

END OF SECTION

SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Flashing.
5. Equipment installation requirements common to equipment sections.
6. Painting and finishing.
7. Concrete bases.
8. Firestopping relating to HVAC work.
9. Firestopping accessories.
10. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. CPVC: Chlorinated polyvinyl chloride plastic.
2. PE: Polyethylene plastic.
3. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

H. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire-rated construction.

1.4 SYSTEM DESCRIPTION

I. Firestopping Materials: ASTM E814 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1-hour fire rating.

1. Ratings may be 3 hours for firestopping in through-penetrations of 4-hour fire-rated assemblies, unless otherwise required by applicable codes.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

D. Through Penetration Firestopping of Fire-Rated Assemblies: ASTM E814 with 0.10-inch water gauge minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1 hour.

1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1 hour.

2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1 hour.

a. Floor Penetrations within Wall Cavities: T-Rating is not required.

E. Through Penetration Firestopping of Non-Fire-Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.

1. Non-combustible Penetrating Items: Non-combustible materials for penetrating items connecting maximum of three stories.

2. Penetrating Items: Materials approved by Authorities Having Jurisdiction for penetrating items connecting maximum of two stories.

F. Fire-Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

G. Fire-Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10-inch water gauge minimum positive pressure differential to achieve fire-resistant rating as indicated on Drawings for floor assembly.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces.

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: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.

b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:

1. CPVC Piping: ASTM F 493.
2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.4 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

B. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

C. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.6 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.7 FLASHING

A. Metal Flashing: 26-gauge-thick galvanized steel.

B. Metal Counterflashing: 22-gauge-thick galvanized steel.

C. Flexible Flashing: 47-mil-thick sheet butyl; compatible with roofing.

D. Caps: Steel, 22-gauge minimum; 16 gauge at fire-resistant elements.

2.8 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

2.9 FIRESTOPPING

A. Manufacturers:

1. Dow Corning Corp.
2. Hilti Corp.
3. 3M Fire Protection Products

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

2.10 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

C. General:

1. Furnish UL-listed products.
2. Select products with rating not less than rating of wall or floor being penetrated.

D. Non-Rated Surfaces:

1. Stamped-steel, chrome-plated, hinged, split-ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.

2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop-type wall sleeve.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors.

M. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

N. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

O. Verify final equipment locations for roughing-in.

P. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

4. PVC Nonpressure Piping: Join according to ASTM D 2855.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 INSTALLATION – FLASHING

A. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms for sound control.

C. Provide curbs for roof installations 14 inches minimum high above roofing surface. Flash and counterflash with sheet metal; seal watertight. Attach counterflashing to equipment and lap base flashing on roof curbs. Flatten and solder joints.

D. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.6 INSTALLATION – FIRESTOPPING

A. Install material at fire-rated construction perimeters and openings containing penetrating sleeves, piping, and other items, requiring firestopping according to manufacturer’s instructions to maintain fire ratings per drawings.

3.7 PAINTING

A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.9 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes:

1. Testing, adjusting, and balancing of air systems.

2. Measurement of final operating condition of HVAC systems.

1.2 REFERENCES

A. Associated Air Balance Council:

1. AABC MN-1 - National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.

C. Natural Environmental Balancing Bureau:

1. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

1.3 SUBMITTALS

A. Refer to Section, SUBMITTAL PROCEDURES for submittal procedures.

B. Test Reports: Indicate data on AABC MN-1 National Standards for Total System Balance forms or NEBB Report forms.

C. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

D. Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required. Include detailed procedures, agenda, sample report forms, and copy of AABC National Project Performance Guaranty or copy of NEBB Certificate of Conformance Certification.

E. Submit draft copies of report for review prior to final acceptance of Project.

F. Furnish reports in binder manuals, complete with table of contents page and indexing tabs, with cover identification at front and side. Include set of reduced Drawings with air outlets and equipment identified to correspond with datasheets, and indicating thermostat locations.

1.4 CLOSEOUT SUBMITTALS

A. Refer to Section, EXECUTION AND CLOSEOUT REQUIREMENTS for closeout procedures.

B. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report inclusion in operating and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with AABC MN-1 National Standards for Field Measurement and Instrumentation, Total System Balance or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

B. Prior to commencing work, calibrate each instrument to be used.

1.6 QUALIFICATIONS

A. Test and Balance Engineer's Qualifications: A Professional Engineer (either on the installer's staff or an independent consultant), registered in the State in which the services are to be performed, and having at least 3-years of successful testing, adjusting, and balancing experience on projects with testing and balancing requirements similar to those required for this Project.

B. Agency Qualifications:

1. Employ the services of an independent testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust, and balance the building mechanical systems identified above, to produce the design objectives. Services shall include checking installations for conformity to design, measurement, and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

2. The independent testing, adjusting, and balancing agency certified by National Environmental Balancing Bureau (NEBB) or the Associated Air Balance Council (AABC) in those testing and balancing disciplines required for this Project, and having at least one Professional Engineer registered in the State in which the services are to be performed, certified by NEBB or AABC as a Test and Balance Engineer.

1.7 SCHEDULING

A. Refer to Section, ADMINISTRATIVE REQUIREMENTS for coordination and project conditions.

B. Test, adjust, and balance air conditioning systems during summer season and heating systems during winter season, including at least a period of operation at outside conditions within 5 degrees. F wet bulb temperature of maximum summer design condition, and within 10 degrees. F dry bulb temperature of minimum winter design condition. Take final temperature readings during seasonal operation.

C. Schedule and provide assistance in final adjustment and test of life safety system with Fire Authority.

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Refer to Section, ADMINISTRATIVE REQUIREMENTS, for coordination and Project conditions.

B. Verify systems are complete and operable before commencing work. Verify the following:

1. Systems are started and operating in safe and normal condition.

2. Temperature control systems are installed complete and operable.

3. Proper thermal overload protection is in place for electrical equipment.

4. Final filters are clean and in place. If required, install temporary media in addition to final filters.

5. Duct systems are clean of debris.

6. Fans are rotating correctly.

7. Fire and volume dampers are in place and open.

8. Air coil fins are cleaned and combed.

9. Access doors are closed, and duct end caps are in place.

10. Air outlets are installed and connected.

11. Duct system leakage is minimized.

3.2 PREPARATION

A. Furnish instruments required for testing, adjusting, and balancing operations.

3.3 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10% of design.

B. Air Outlets and Inlets: Adjust total to within plus 10% and minus 5% of design to space. Adjust outlets and inlets in space to within plus or minus 10% of design.

3.4 ADJUSTING

A. Refer to Section, EXECUTION AND CLOSEOUT REQUIREMENTS, **[** for testing, adjusting, and balancing.

B. Verify recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.

E. Report defects and deficiencies noted during performance of services, preventing system balance.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.5 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in main ducts by Pitot tube traverse of entire cross-sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts.

E. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.

F. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for 50% loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. At modulating damper locations, take measurements and balance at extreme conditions. Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to obtain required relationship between each to maintain approximately 0.05 inch positive static pressure near building entries.

3.6 PROJECT CLOSEOUT

A. Some system balancing and adjusting will be for comfort. Accordingly, Contractor shall allow for readjusting air quantities or other settings after building completion and occupancy, for user comfort rather than conformance to indicated design values.

END OF SECTION

SECTION 23 07 00
HVAC INSULATION

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes:

1. Ductwork insulation and jackets.
2. Internal ductwork insulation (duct liner).

1.2 SUBMITTALS

A. Product Data: Submit product description, list of materials, and thickness for each service or equipment scheduled and locations.

B. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each mechanical system requiring insulation.

C. Manufacturer's Installation Instructions: Submit manufacturer's installation instructions for each product type.

1.3 QUALITY ASSURANCE

A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.

B. Energy Efficiency: Insulate piping and ductwork in accordance with the California Code of Regulations Title 24.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Do not install insulation and related products when ambient temperatures and conditions are not meeting manufacturer’s requirements.

B. Maintain temperature before, during, and after installation for minimum period of 24 hours.

PART 2 – PRODUCTS

2.1 INSULATION

A. Manufacturer:

1. Armacell
2. Certainteed Corp.
3. Ductmate Industries (duct liner only)
4. Johns Manville Insulations.
5. Knauf Insulation
6. Owens Corning Fiberglas Corp.

7. Reflectix

2.2 DUCTWORK INSULATION

A. Flexible Glass Fiber: ASTM C553; flexible, non-combustible blanket.

1. k (ksi) Value: 0.29 at 75 degrees F.

2. Vapor Retarder Jacket: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, secured with pressure-sensitive tape.

B. Rigid Glass Fiber: ASTM C612; rigid, non-combustible blanket.

1. k (ksi) Value: 0.29 at 75 degrees F.

2. Density: 3.0 lb/cu ft.

3. Vapor Retarder Jacket: Kraft paper with glass fiber yarn and bonded to aluminized film, secured with pressure-sensitive tape.

C. Cellular Foam: ASTM C518 or ASTM C177; flexible, cellular elastomeric, molded or sheet.

1. k (ksi) factor: 0.25 at 75 degrees F.

2. Maximum service temperature: 220 degrees F.

D. Reflective Insulation: ASTM C518; flexible blanket (bubble wrap).

1. Maximum service temperature: 180 degrees F.

E. Duct Liner:

1. Fibrous-Glass Duct Liner: ASTM C1071; flexible, noncombustible blanket.

a. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

b. k (ksi) Value: 0.27 at 75 degrees F.

c. Adhesive: Waterproof fire-retardant type.

d. Liner Fasteners: Galvanized steel, self-adhesive pad or welded with press-on head.

2. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1

2.3 DUCT ACOUSTICAL INSULATION

A. Flexible duct liner, bonded mat of glass fiber coated with a black pigmented fire-resistant coating on the side toward the airstream, nominal 1-inch thickness.

1. Manufacturer:

a. Owens-Corning "QuietR" duct liner.
b. Manville “Linacoustic HP"
c. Armacell “Armaflex”
d. or approved equal.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify piping, equipment, and ductwork are tested and ready for installation.

3.2 INSTALLATION

A. Install duct liner in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Continue insulation vapor barrier through penetrations.

C. External Ductwork Insulation:

1. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

2. For insulated ductwork conveying air below ambient temperature, install vapor barrier jacket. Finish with tape. Seal vapor barrier penetrations with vapor barrier adhesive.

3. For insulated ductwork conveying air above ambient temperature, install with or without standard vapor barrier jacket. Where service access is required, bevel and seal ends of insulation.

4. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

5. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging.

6. For exterior applications, install insulation with vapor barrier jacket. Cover with outdoor jacket.

D. Duct Liner:

1. Duct Lining shall be applied in strict accordance with the latest edition of SMACNA’s “HVAC Duct Construction Standard Metal & Flexible” and NAIMA’s “Fibrous Glass Duct Liner Standard”.

2. Length of mechanical fasteners shall be selected in accordance with the manufacturer's recommendation as listed on each product. Mechanical fasteners shall be installed perpendicular to the duct surface, and in no instance shall the pin compress the liner more than 1/8″ relative to the nominal thickness of the insulation.

3. All exposed edges of the duct liner shall be coated with the factory applied edge coating or an adhesive which conforms to ASTM C 916.

4. When duct lining is applied with an adhesive, the adhesive shall be applied to the sheet metal with a 90% minimum coverage. All exposed duct liner edges not coated by the manufacturer shall be coated with the same adhesive. All rips and tears shall be repaired using this same adhesive.

5. Transverse joints shall be firmly butted with no gaps and coated with adhesive. Longitudinal corner joints shall be overlapped and compressed.

6. When air velocities are 4000 to 6000 FPM, metal nosing shall be applied to all upstream transverse edges to additionally secure the insulation.

3.3 SCHEDULES

A. Ductwork Insulation:

1. Insulation Omitted: Do not insulate fibrous glass ductwork, or lined ductwork. See Section, METAL DUCTWORK for duct liner.

2. Exposed Outdoor Ductwork:

   a. Application Requirements: Insulate all exposed outdoor ductwork.

3. Insulate ductwork according to the following:

   a. All supply air ducts and plenums shall be insulated with a minimum of R-4.2 when located in unconditioned spaces.

   a. All supply and return air ducts and plenums shall be insulated with a minimum of R-8 when located outside the building envelope.

   b. Install acoustical duct liner in all rectangular supply and return air ductwork for the first 10 feet (minimum) of connections to air handling equipment.

END OF SECTION

SECTION 23 11 26
FACILITY LIQUID-PETROLEUM GAS PIPING

PART 1 – GENERAL

1.1 SUMMARY

A. This Section Includes:

1. LPG gas piping below grade.
2. LPG gas piping above grade.
3. Unions and flanges.
1. Strainers.

1.2 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.

B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves, equipment.

C. Provide pipe hangers and supports in accordance with MSS SP 58, MSS SP 69, and MSS SP 89.

D. Use plug or ball valves for shutoff and to isolate equipment, part of systems, or vertical risers.

1.3 DEFINITIONS

A. Where designation LPG is used, it is abbreviation for Liquefied Petroleum Gas, most commonly Propane.

1.4 SUBMITTALS

A. Refer to Section, SUBMITTAL PROCEDURES for submittal procedures.

B. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.

2. Piping Specialties: Submit manufacturers catalog information including capacity, rough-in requirements, and service sizes for the following:

a. Natural gas pressure regulators.
b. Natural gas pressure relief valves.

1.5 CLOSEOUT SUBMITTALS

A. Refer to Section, EXECUTION AND CLOSEOUT REQUIREMENTS for closeout procedures.

B. Project Record Documents: Record actual locations of valves, piping system, and system components.

C. Operation and Maintenance Data: Submit for gas pressure regulators installation instructions, and spare parts lists.

1.6 QUALITY ASSURANCE

A. Perform LPG work in accordance with NFPA 58.

PART 2 – PRODUCTS

2.1 LPG GAS PIPING, BELOW GRADE

A. PE Pipe: ASTM D 2513.

1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.

2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

3. Anodeless Service-Line Risers: Factory fabricated and leak tested.

4. Verify acceptability of couplings in first subparagraph below with authorities having jurisdiction before retaining.

5. Plastic Mechanical Couplings, NPS 1-1/2 and Smaller: Capable of joining PE pipe to PE pipe.

a. PE body with molded-in, stainless-steel support ring.

b. Buna-nitrile seals.

c. Acetal collets.

d. Electro-zinc-plated steel stiffener.

6. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

a. Stainless-steel flanges and tube with epoxy finish.

b. Buna-nitrile seals.

c. Stainless-steel bolts, washers, and nuts.

d. Factory-installed anode for steel-body couplings installed underground.

2.2 LPG GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M forged steel welding type.

2. Joints: Threaded for pipe 2 inches and smaller; welded for pipe 2-1/2 inches and larger.

B. Copper Tubing: ASTM B88, Type L annealed.

1. Fittings: ASME B16.26, cast bronze, compression type.
2. Joints: Flared.

2.3 UNIONS AND FLANGES

A. Unions for Pipe 2 Inches and Smaller:

1. Ferrous Piping: Class 150, malleable iron, threaded.

2. Copper Piping: Class 150, bronze unions with brazed joints.

3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.4 STRAINERS

A. 2 Inches and Smaller: Screwed brass or iron body for 175-psig working pressure, Y pattern with 1/32-inch stainless steel perforated screen.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Refer to Section, ADMINISTRATIVE REQUIREMENTS for coordination and Project conditions.

B. Verify excavations are to required grade, dry, and not overexcavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install hangers and supports in accordance with MSS SP 89.

B. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.

C. Place hangers within 12 inches of each horizontal elbow.

D. Install hangers to allow 1-1/2-inch-minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

E. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.

F. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers or trapeze hangers.

G. Provide copper-plated hangers and supports for copper piping.

H. Provide clearance in hangers and from structure and other equipment for access to valves and fittings.

3.4 INSTALLATION - BURIED PIPING SYSTEMS

A. Install LPG piping in accordance with NFPA 58.

B. Establish elevations of buried piping with not less than 12 inches of cover.

C. Remove scale and dirt on inside of piping before assembly.

D. Excavate pipe trench and place bedding material at trench bottom to provide firm, continuous bearing on the bottom of the trench.

E. Install pipe on prepared bedding.

F. Route pipe in straight line.

G. Install pipe to allow for expansion and contraction without stressing pipe or joints.

H. A yellow insulated copper tracer wire or other approved conductor (18 AWG minimum) shall be installed adjacent to underground nonmetallic piping. Access shall be provided to the tracer wire or the tracer wire shall terminate above ground at each end of the nonmetallic piping.

3.5 INSTALLATION – ABOVE-GROUND PIPING SYSTEMS

A. Install LPG piping in accordance with NFPA 58.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient.

D. Install piping to conserve building space and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Sleeve pipe passing through partitions, walls and floors.

H. Install firestopping at fire-rated construction perimeters and openings containing penetrating sleeves and piping.

I. Provide clearance for installation of insulation and access to valves and fittings.

J. Provide access where valves and fittings are not exposed**.**

K. Where pipe support members are welded to structural building framing, scrape, brush clean, weld, and apply one coat of zinc rich primer.

L. Install vent piping from gas pressure reducing valves to outdoors and terminate in weatherproof hood.

M. Install valves with stems upright or horizontal, not inverted.

N. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

O. Install gas pressure regulator with tee fitting between regulator and upstream shutoff valve. Cap or plug one opening of tee fitting.

P. Install gas pressure regulator with tee fitting not less than 10 pipe diameters downstream of regulator. Cap or plug one opening of tee fitting.

Q. Install gas pressure regulator with independent vent full size opening on regulator and terminate outdoors.

3.6 FIELD QUALITY CONTROL

A. Pressure test LPG piping in accordance with NFPA 58.

END OF SECTION

SECTION 23 30 00
HVAC AIR DISTRIBUTION

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes:

1. Ductwork.
2. Ductwork accessories.
3. Air Outlets.

1.2 SUBMITTALS

A. Product Data:

1. Submit sizes, capacities, materials, controls, and connections to other work.

2. Submit catalog performance ratings, construction, electric and duct connections, flashing, and dimensions for fans and exhausters.

B. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts lists, and wiring diagrams.

C. Manufacturer's Installation Instructions: Submit relevant instructions.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit instructions for filter replacement, spare parts lists, and wiring diagrams.

PART 2 – PRODUCTS

2.1 DUCTWORK

A. Duct Materials:

1. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G60 zinc coating of in conformance with ASTM A90/A90M.

2. Fasteners: Rivets, bolts, or sheetmetal screws.

3. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

B. Ductwork Fabrication:

1. Fabricate and support rectangular ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

2. Fabricate and support round ducts with longitudinal seams in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible (Round Duct Construction Standards), and as indicated on Drawings. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

3. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide turning vanes.

4. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment, and 45 degrees convergence downstream.

5. Fabricate continuously welded round two gauges heavier than duct gauges indicated in SMACNA Standard. Minimum 4-inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

6. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

C. Insulated Flexible Ducts:

1. Manufacturers:

a. Flexmaster.
a. Hercules.
b. Hart & Cooley.
c. Flexible Technologies.
d. JP Lamborn.

2. Product Description: Two ply-vinyl film supported by helical-wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.

a. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
b. Maximum Velocity: 4,000 fpm.
c. Temperature Range: -10 degrees F to 160 degrees F.
d. Thermal Resistance: 4.2-square-feet-hour-degree F per BTU.

D. Single-Wall Spiral Round Ducts:

1. Product Description: UL 181, Class 1, round spiral lock seam duct constructed of galvanized steel.

E. Transverse Duct Connection System:

1. Product Description: SMACNA “E” rated rigidity class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

2.2 DUCT ACCESSORIES

A. Volume Control Dampers:

1. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

2. Fabricate splitter dampers of material matching duct gauge to 24 inches in size in each direction, and two gauges heavier for larger sizes. Secure with continuous hinge or rod. Operate with minimum 1/4-inch-diameter rod.

3. Fabricate single blade dampers for duct sizes to 12 inches x 30 inches.

4. Fabricate multiblade damper of opposed blade pattern with maximum blade sizes 8 inches x 72 inches. Assemble center and edge crimped blades in prime-coated or galvanized channel frame with suitable hardware.

5. Except in round ductwork 12 inches and smaller, furnish end bearings.

6. Furnish locking, indicating quadrant regulators on single and multiblade dampers. Where width exceeds 30 inches, furnish regulator at both ends.

B. Turning Vanes:

1. Manufactured Turning Vanes for Metal Ducts: Single wall curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting

2. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

C. Flexible Duct Connections:

1. UL listed fire-retardant Neoprene-coated woven glass fiber fabric to NFPA 90A, approximately 3 inches wide, crimped into metal edging strip.

D. Duct Access Doors:

1. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

2. Access doors smaller than 12 inches square, secured with sash locks. Access doors with sheet metal screw fasteners are not acceptable.

E. Gravity Roof Ventilators:

1. Product Description: Square or round type, with aluminum housing; aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.

2. Roof Curb: 12 inches high of galvanized steel or aluminum construction with continuously welded seams, built-in cant strips, 1-inch insulation and curb bottom, and factory-installed nailer strip.

2.3 AIR OUTLETS AND INLETS

A. Manufacturers:

1. Grilles, registers, and diffusers:

a. Krueger Mfg. Co.
b. Anemostat Products Div.; Dymanics Corp. of America.
c. Carnes Co.; Div. of Wehr Corp.
d. Titus Products Div.; Philips Industries, Inc.
e. Tuttle & Bailey; Div. of Interpace Corp.
f. Price Air Distribution Products
g. Metal-Aire.
h. Nailor Industries.
i. J & J.

2. Louvers:

a. Airolite Co.
b. American Warming & Ventilating Inc.
c. Arrow United Industries, Inc.
d. Industrial Louvers, Inc.
e. Louvers & Dampers, Inc.
f. Ruskin Mfg. Co.
g. Greenheck, Inc.
h. Cesco.
i. United.
j. C & S.
k. Daniel Mfg.
l. Dowco.

B. Ceiling Diffusers:

1. General: Except as otherwise indicated, provide manufacturer’s standard ceiling air diffusers where shown; of size, shape, capacity, and type indicated; constructed of materials and components as indicated, and as required for complete installation.

2. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

3. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling, air diffuser.

C. Registers/Grilles:

1. General: Except as otherwise indicated, provide manufacturer's standard registers and grilles where shown; of size, shape, capacity, and type indicated; constructed of materials and components as indicated, and as required for complete installation.

2. Performance: Provide registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device and listed in manufacturer's current data.

3. Wall and Ceiling Compatibility: Provide registers and grilles with border styles that are compatible with adjacent wall and ceiling systems, and that are specifically manufactured to fit into wall and ceiling construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of construction which will contain each type of wall register and grille.

4. Types: Provide registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule.

D. Louvers:

1. General: Except as otherwise indicated, provide manufacturer's standard louvers where shown; of size, shape, capacity, and type indicated; constructed of materials and components as indicated, and as required for complete installation.

2. Performance: Provide louvers that have minimum free area, and maximum pressure drop of each type as listed in manufacturer's current data, complying with louver schedule.

3. Substrate Compatibility: Provide louvers with frame and sill styles that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support, for weatherproof installation. Refer to general construction drawings and specifications for types of substrate which will contain each type of louver.

4. Materials: Construct of aluminum extrusions, ASTM B221, Alloy 6063-T52. Weld units or use stainless steel fasteners.

5. Louver Screens: On inside face of exterior louvers, provide 1/2-inch-square mesh anodized aluminum wire bird screens mounted in removable extruded-aluminum frames.

6. Color: Final color of louvers to be selected by Architect.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify sizes of equipment connections before fabricating transitions.

B. Verify rated walls are ready for fire damper installation.

C. Verify ducts and equipment installation is ready for accessories.

D. Check location of air outlets and inlets, and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.2 INSTALLATION

A. Metal Ducts: Install in accordance with SMACNA Duct Construction Standards - Metal and Flexible.

B. Connect flexible ducts to metal ducts with drawbands.

C. Use crimp joints with or without bead for joining round duct sizes 8 inches and smaller with crimp in direction of airflow.

D. Install flexible connections immediately adjacent to fans and motorized equipment. Install flexible connections specified between fan inlet and discharge ductwork. Prevent flexible connectors being in tension while running.

E. Cut openings in ductwork to accommodate thermometers and controllers. Cut pitot tube openings for testing of systems, complete with metal can with spring device or screw to eliminate against air leakage.

F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

G. Connect diffusers or troffer boots to low-pressure ducts with 5 feet maximum length of flexible duct. Hold in place with strap or clamp.

H. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

I. Install balancing dampers on duct take-off to diffusers and grilles and registers, regardless of whether dampers are specified as part of diffuser, or grille and register assembly.

J. Paint ductwork visible behind air outlets and inlets matte black.

K. Do not operate fans until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

L. Install fans with resilient mountings and flexible electrical leads.

M. Install sheaves required for final air balance.

N. Install safety screen where fan inlet or outlet is exposed.

END OF SECTION

SECTION 23 72 00
AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Packaged energy recovery units.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, furnished specialties, and accessories.

B. Shop Drawings: For air-to-air energy recovery equipment. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

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

C. Operation and Maintenance Data: For air-to-air energy recovery equipment to include in maintenance manuals.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRCA Compliance: Roof curbs for roof-mounted equipment shall be constructed according to recommendations of NRCA.

C. UL Compliance: Packaged heat recovery ventilators shall comply with requirements in UL 1812, "Ducted Heat Recovery Ventilators"; or UL 1815, "Nonducted Heat Recovery Ventilators."

1.4 COORDINATION

A. Coordinate layout and installation of air-to-air energy recovery equipment 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.

1.5 EXTRA MATERIALS

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

1. Filters: One set(s) of each type of filter specified.

PART 2 – PRODUCTS

2.1 PACKAGED ENERGY RECOVERY UNITS

A. Manufacturers:

1. Carnes.
2. Greenheck Fan Corporation.
3. Loren Cook Company.
4. Mitsubishi Electric Inc.; HVAC Advanced Products Division.
5. Munters.
6. RenewAire LLC.
7. SEMCO Incorporated.
8. Trane; American Standard Inc.
9. Venmar CES Inc.

B. Housing: Manufacturer's standard construction with corrosion-protection coating and exterior finish, gasketed and calked weathertight, hinged access doors with neoprene gaskets for inspection and access to internal parts, minimum 1-inch-thick thermal insulation, knockouts for electrical and piping connections, exterior drain connection, and lifting lugs.

1. Exhaust: Spring-return, two-position, motor-operated damper.

2. Supply: Spring-return, two-position, motor-operated damper.

C. Heat Recovery Device: Fixed-plate heat exchanger.

D. Supply and Exhaust Fans: Centrifugal fan with restrained, spring isolators and flexible duct connections.

1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section, COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT.

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

3. Controllers, Electrical Devices, And Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

E. Disposable Panel Filters:

1. Comply with NFPA 90A.

2. Provide minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

3. Provide filter holding frames arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lift out from access plenum.

4. Factory-fabricated, viscous-coated, flat-panel type.

5. MERV (ASHRAE 52.2): 5.

2.2 CONTROLS

A. Time Clock: Solid-state, programmable, microprocessor-based unit for wall mounting with up to eight on/off cycles per day and battery backup protection of program settings against power failure to energize unit.

PART 3 – EXECUTION

3.1 EXAMINATION

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

B. Examine casing insulation materials and filter media before air-to-air energy recovery equipment installation. Reject insulation materials and filter media that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for electrical services to verify actual locations of connections before installation.

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

3.2 INSTALLATION

A. Install fixed-plate heat exchangers so supply and exhaust airstreams flow in opposite directions.

B. Suspended Units: Suspend and brace units from structural-steel support frame using threaded steel rods and spring hangers.

C. Install units with clearances for service and maintenance.

D. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

3.3 CONNECTIONS

A. Comply with requirements for ductwork specified in Section, METAL DUCTS.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air-to-air energy recovery units.

END OF SECTION

SECTION 23 81 03
PACKAGED ROOFTOP AIR CONDITIONING UNITS

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes:

1. Packaged rooftop air conditioning units.

1.2 DEFINITIONS

A. Energy Efficiency Ratio (EER) - Ratio of net cooling capacity in Btuh to total rate of electric input in watts under designated operating conditions.

B. Seasonal Energy Efficiency Ratio (SEER) - Total cooling output of an air conditioner during its normal annual usage period for cooling (in Btu) divided by total electric energy input during the same period (in Wh).

1.3 SUBMITTALS

A. Refer to Section, SUBMITTAL PROCEDURES for submittal procedures.

B. Product Data: Submit data indicating:

1. Cooling and heating capacities.

2. Dimensions.

3. Weights.

4. Rough-in connections and connection requirements.

5. Duct connections.

6. Electrical requirements with electrical characteristics and connection requirements.

7. Controls.

8. Accessories.

C. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include startup instructions.

1.4 CLOSEOUT SUBMITTALS

A. Refer to Section, EXECUTION AND CLOSEOUT REQUIREMENTS for closeout procedures.

B. Project Record Documents: Record actual locations of controls installed remotely from units.

C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.5 QUALITY ASSURANCE

A. Cooling Capacity: Rate in accordance with ARI 210/240 or ARI 340/360.

B. Sound Rating: Measure in accordance with ARI 270.

C. Insulation and adhesives: Meet requirements of NFPA 90A.

D. Performance Requirements: Conform to minimum EER or SEER per schedule when tested in accordance with ARI 210/240 or ARI 340/360.

E. Outside Air Damper Leakage: Test in accordance with AMCA 500.

1.6 COORDINATION

A. Refer to Section, ADMINISTRATIVE REQUIREMENTS for coordination requirements.

B. Coordinate installation of roof curbs with roof structure, roof deck, and roof membrane installation.

PART 2 – PRODUCTS

2.1 ROOFTOP AIR CONDITIONING UNITS

A. Manufacturers:

1. Aaon Incorporated.
2. Bryant.
3. Carrier Corp.
4. Lennox International.
5. McQuay International.
6. The Trane Company.
7. York International.

B. Product Description: Self-contained, packaged, factory assembled and wired, consisting of roof curb, cabinet, supply fan, refrigerant cooling coil, compressor, refrigeration circuit, condenser, gas-fired heating section, air filters, mixed air casing, controls, and accessories.

C. Configuration: As indicated on Drawings.

D. Roof Mounting Curb: 14-inch-high, galvanized steel, channel frame with gaskets, nailer strips. Full perimeter type for mounting under entire unit.

E. Cabinet:

1. Designed for outdoor installation with weatherproof construction.

2. Panels: Constructed of steel with baked enamel finish meeting salt spray test in accordance with ASTM B117. Furnish access doors or removable access panels.

3. Insulation: Factory applied to exposed vertical and horizontal panels, aluminum foil-faced glass fiber with edges protected from erosion.

F. Supply Fan: Forward curved centrifugal type, resiliently mounted with high-efficiency motor. Motor permanently lubricated with built-in thermal overload protection.

G. Evaporator Coil: Constructed of copper tubes expanded onto aluminum fins. Galvanized drain pan with piping connection. Factory leak tested under water.

H. Compressor: Hermetically sealed, resiliently mounted with positive lubrication, and internal motor overload protection.

I. Refrigeration circuit: Furnish the following for each circuit expansion device, filter-drier, suction, discharge, and liquid line service valves with gauge ports, high- and low-pressure safety controls. Dehydrate and factory charge each circuit with oil and refrigerant.

J. Condenser:

1. Condenser Fan: Direct-drive propeller fans statically and dynamically balanced. Wired to operate with compressor. Motor permanently lubricated with built-in thermal overload protection. Furnish high-efficiency fan motors.

K. Gas-Fired Heating Section:

1. Heat Exchangers: Aluminized steel, welded construction.

2. Gas Burner: Burner with adjustable combustion air supply, pressure regulator, gas valves, manual shutoff, intermittent spark or glow coil ignition, flame-sensing device, and automatic 100% shutoff pilot. Require unit fan operation before allowing gas valve to open.

L. Air Filters: 2-inch-thick glass fiber disposable media in metal frames.

M. Mixed Air Casing:

1. Outside Air Damper Leakage: Maximum 4 cfm per square foot at 1.0-inch wg pressure differential.

2. Outside Air Damper: Manual, for fixed outside air quantity. Furnish rain hood with screen.

3. Outside Air Damper: Automatic, two-position spring return. Interlocked to open when supply fan starts. Outside air damper normally closed and return air damper normally open. Furnish rain hood with screen.

4. Economizer: Fully-modulating motorized outside air and return air dampers controlled by dry-bulb controller with minimum position setting. Outside air damper normally closed and return air damper normally open.

   a. Furnish barometric relief damper with powered exhaust.

   b. Furnish rainhood with screen.

N. Controls:

1. Furnish low-limit thermostat in supply air to close outside air damper and stop supply fan.

2. Furnish terminal strip on unit for connection of operating controls to remote panel.

3. Thermostat: 7-day programmable electronic space thermostat with 2-stage heating and 1- or 2-stage cooling with automatic changeover and heating setback and cooling setup capability. Furnish system selector switch off-heat-auto-cool and fan control switch, auto-on.

O. Accessories:

1. Convenience Outlet: Factory-installed, 115-volt, 15-amp, GFCI type, internally mounted.

2. LPG conversion kit.

3. See schedule for additional accessories.

P. Disconnect Switch: Factory-mounted, non-fused type, interlocked with access door, accessible from outside unit, with power lockout capability.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Refer to Section, ADMINISTRATIVE REQUIREMENTS for coordination and project conditions.

B. Verify roof curbs are installed, and dimensions are as instructed by manufacturer.

3.2 INSTALLATION

A. Connect units to supply, and return ductwork with flexible connections.

B. Install condensate piping with trap, and route from drain pan to splash block**.**

C. Install components furnished loose for field mounting.

D. Install electrical devices furnished loose for field mounting.

E. Install control wiring between unit and field installed accessories.

3.3 INSTALLATION - PROPANE HEATING SECTION

A. Connect propane piping in accordance with NFPA 58.

B. Connect propane piping to unit, full size of unit gas train inlet. Arrange piping with clearances for burner service.

C. Install the following piping accessories on propane piping connections.

1. Strainer.

2. Pressure gauge.

3. Shutoff valve.

4. Pressure reducing valve.

3.4 MANUFACTURER'S FIELD SERVICES

A. Refer to Section, QUALITY REQUIREMENTS for manufacturer’s field services requirements.

B. Furnish initial startup and shutdown during first year of operation, including routine servicing and checkout.

3.5 CLEANING

A. Refer to Section, EXECUTION AND CLOSEOUT REQUIREMENTS for cleaning requirements.

B. Vacuum clean coils and inside of unit cabinet.

C. Install temporary filters during construction period. Replace with permanent filters at Substantial Completion.

3.6 DEMONSTRATION

A. Refer to Section, EXECUTION AND CLOSEOUT REQUIREMENTS for demonstration and training requirements.

B. Demonstrate unit operation and maintenance.

C. Furnish services of manufacturer's technical representative for one 8-hour day to instruct Owner's personnel in operation and maintenance of units. Schedule training with Owner; provide at least 7 days’ notice to Architect/Engineer of training date.

END OF SECTION

SECTION 23 81 27
DUCTLESS SPLIT SYSTEMS

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

1.2 SUBMITTALS

A. Product Data: Submit data indicating:

1. Cooling and heating capacities.
2. Dimensions.
3. Weights.
4. Rough-in connections and connection requirements.
5. Duct connections.
6. Electrical requirements with electrical characteristics and connection requirements.
7. Controls.
8. Accessories.

B. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of controls installed remotely from units.

B. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.4 QUALITY ASSURANCE

A. Performance Requirements: Energy efficiency not less than prescribed by the California Title 24 when used in combination with compressors and evaporator coils when tested in accordance with ARI.

B. Sound Rating: Measure in accordance with ARI 270.

C. Insulation and adhesives: Meet requirements of NFPA 90A.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following. Note: All manufacturers listed may not be capable of supplying all products covered by this section.

1. Carrier Corp.
2. Daikin
3. Fujitsu
4. LG
5. Mitsubishi
6. Samsung

2.2 WALL-MOUNTING, EVAPORATOR-FAN COMPONENTS

A. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Fan: Direct drive, centrifugal fan.

D. Filters: Permanent, cleanable.

2.3 CONDENSING UNIT

A. General: Factory assembled and tested air cooled condensing units, consisting of casing, compressors, condensers, coils, condenser fans and motors, and unit controls.

B. Unit Casings: Exposed casing surfaces constructed of galvanized steel with manufacturer's standard baked enamel finish. Designed for outdoor installation and complete with weather protection for components and controls, and complete with removable panels for required access to compressors, controls, condenser fans, motors, and drives.

C. Compressor: Single refrigeration circuit with rotary compressors, resiliently mounted, with positive lubrication, and internal motor overload protection.

D. Condenser Coil: Constructed of copper tubing mechanically bonded to aluminum fins, factory leak and pressure tested.

E. Heat Pump Components: Reversing valve and low-temperature air cut-off thermostat.

F. Controls: Furnish operating and safety controls including high and low pressure cutouts. Control transformer. Furnish magnetic contactors for compressor and condenser fan motors.

G. Condenser Fans and Drives: Direct drive propeller fans statically and dynamically balanced. Wired to operate with compressor. Permanently lubricated ball bearing type motors with built-in thermal overload protection. Furnish high efficiency fan motors.

H. Condensing Unit Accessories: Furnish the following accessories:

1. Time delay relay.
2. Anti-short cycle timer.
3. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
4. Locking-type tamper resistant caps for all refrigerant circuit access ports.

I. Refrigeration specialties: Furnish the following for each circuit:

1. Charge of compressor oil.
2. Holding charge of refrigerant.
3. Replaceable core type filter drier.
4. Liquid line sight glass and moisture indicator.
5. Shut-off valves on suction and liquid piping.
6. Liquid line solenoid valve.
7. Charging valve.
8. Oil level sight glass.
9. Crankcase heater.
10. Hot gas muffler.
11. Pressure relief device.

2.4 CONTROLS

A. Thermostat: 7 day programmable electronic space thermostat with single stage heating and two stage cooling with automatic changeover and heating setback and cooling setup capability. Furnish system selector switch off-heat-auto-cool and fan control switch, auto-on.

2.5 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Disconnect Switch: Factory mounted, non-fused type, interlocked with access door, accessible from outside unit, with power lockout capability.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify concrete pad for condensing unit is ready for unit installation.

3.2 INSTALLATION - AIR HANDLING UNIT

A. Install condensate piping with trap and route from drain pan to nearest floor drain or other approved condensate disposal location.

B. Install components furnished loose for field mounting.

3.3 INSTALLATION - CONDENSING UNIT

A. Install units on concrete foundations. Secure units to pads with expansion bolts or similar.

B. Install refrigerant piping from unit to condensing unit. Install refrigerant specialties furnished with unit.

C. Evacuate refrigerant piping and install initial charge of refrigerant.

D. Install electrical devices furnished loose for field mounting.

E. Install control wiring between air handling unit, condensing unit, and field installed accessories.

F. Install connection to electrical power wiring in accordance with Division 16.

3.4 MANUFACTURER'S FIELD SERVICES

A. Furnish initial start-up and shutdown during first year of operation, including routine servicing and checkout.

3.5 CLEANING

A. Vacuum clean coils and inside of unit cabinet.

B. Install new filters in units at Substantial Completion.

3.6 DEMONSTRATION

A. Demonstrate air handling unit operation and maintenance.

B. Demonstrate starting, maintenance, and operation of condensing unit.

C. Furnish services of manufacturer's technical representative for 8 hour day to instruct Owner's personnel in operation and maintenance of units. Schedule training with Owner, provide at least 7 days’ notice to Architect/Engineer of training date.

3.7 PROTECTION OF FINISHED WORK

A. Do not operate air handling units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

SECTION 26 05 00
ELECTRICAL

PART 1 – GENERAL

1.1 COMMON WORK RESULTS FOR ELECTRICAL

A. This Section covers electrical work, complete. Furnish material, labor, and equipment in accordance with these Specifications, the accompanying Drawings, and the directions of the Engineer.

1.2 GENERAL

A. Description of Project: Power the distribution and lighting for the new 11,400-square-foot Happy Camp Resident Center for the Karuk Tribe in Happy Camp, California. This project consists of:

- Regulation High School Court With Bleachers
- Residential Grade Kitchen
- Restrooms
- IT Room
- Storage Room
- Computer Lab
- Office
- Exercise Room

The Project also requires the following related work and systems:

- Power Distribution and Lighting

- Electric Service – Coordinate with Pacific Power: Bradly Robinson, 530-842-8603

- Site Telephone Services – Coordinate with Siskiyou Telephone for final utility requirements: Carl Eastlick, 530-467-6151

- This Project includes a fire alarm design/build performance specification. Coordinate electrical requirements with system installer.

B. Intent of Drawings: Exact conduit locations are not shown unless so indicated or specifically dimensioned.

1.3 ELECTRICAL

A. Electrical installations shall meet all applicable requirements of referenced NFPA and other documents. In addition, comply with all requirements of the Authorities Having Jurisdiction.

B. This project includes furnishing, installing, and/or interfacing with equipment and systems. Coordinate with and among system suppliers, and furnish and install all materials and devices necessary for complete and operable systems. Systems shall meet specified requirements, as well as conform to manufacturer recommendations.

C. Some products are specified on the Drawings and not in these Specifications. Submittal requirements shall apply to all specified products, whether specified on the Drawings or in these Specifications.

D. Provide all first-quality new materials.

E. Furnish and install all incidental items not specifically shown or specified which are required by good practice to provide complete systems.

F. All of the work executed under this Section shall meet the requirements of related disciplines as if fully stated herein.

G. See Architectural documents for other requirements including as applicable General Conditions, Bidding and Construction Schedule, Safety Requirements, Mobilization Requirements, and other Contract Terms and Conditions.

H. All Contract Documents, including but not limited to Plans, Specifications, Instructions to Bidders, and other published documents, are a part of the Contract.

I. See Architectural documents for fire-stopping requirements, and comply with State Fire Marshal requirements for approved and listed fire-stopping systems. See Architectural Drawings for fire-stop finish details. At a minimum, penetration of fire-rated walls, floor-ceilings, and roof-ceilings shall meet Uniform Building Code (UBC) Sections 709 and 710.

1.4 CODES, PERMITS, AND REGULATIONS

A. Do all work and install materials and equipment in accordance with the requirements of the National Electrical Code (NEC), NFPA 70, 72, 77, and 101, Underwriters Laboratories (UL), applicable State and local laws and ordinances, and the power company.

B. Conflicts, if any, that may exist among the above items, will be resolved at the discretion of the Engineer.

C. Wherever the requirements of the Specifications or Drawings exceed those of the items above, the requirements of the Specifications or Drawings shall govern.

1.5 SUBMITTALS

A. General:

1. Provide complete submittals as specified herein and as required to completely describe the equipment and systems being provided.

2. Refer to other specifications, as applicable, for additional submittal requirements.

3. Revise and resubmit all submittal information until acceptable to the Engineer.

4. Review of submittal information by the Engineer shall not relieve the Contractor of responsibility for meeting the requirements of the Drawings and Specifications or for errors and omissions in submittals.

B. Product Submittals:

1. Before any material is fabricated or shipped, furnish to the Engineer full details, shop drawings, dimensions, catalog cuts, schematic (elementary) diagrams, wiring diagrams, and other descriptive matter as required to fully describe the products specified under this Section.

2. For service entrance equipment, meter base, and other related materials, obtain written approval of submittals from the serving utility before submitting to the Engineer.

1.6 APPROVALS AND INSPECTIONS

A. Plan, coordinate, and obtain approvals and inspections from all applicable agencies and Authorities Having Jurisdiction.

1.7 WARRANTY

A. The work and materials covered in this Section shall be guaranteed for a period of 1 year from the date of acceptance thereof against defective materials, design, and workmanship.

PART 2 – PRODUCTS

2.1 MATERIAL AND EQUIPMENT

A. Materials and equipment for this project are as specified in the individual sections.

PART 3 – EXECUTION

3.1 GENERAL

A. Work shall be performed in a workmanlike manner by craftsmen skilled in the particular trade. Work shall be performed in accordance with the Drawings, Specifications, manufacturers' recommendations, and the best practice of the trade. Completed work shall present a neat and finished appearance.

B. Coordinate electrical work with the Owner and the work of other trades to avoid conflicts, errors, delays, and unnecessary interference during construction.

3.2 PROTECTION DURING CONSTRUCTION

A. Throughout this Contract, provide protection for materials and equipment against loss or damage and from the effects of weather.

B. Following installation, protect materials, equipment, and insulation from corrosion, physical damage, and moisture.

3.3 MATERIAL AND EQUIPMENT INSTALLATION

A. Follow the manufacturer's installation recommendations unless otherwise indicated.

B. Coordinate equipment seismic bracing requirements with the local authorities and manufacturer of equipment.

C. Completed work shall present a neat and finished appearance. Furnish and install incidental items not specifically shown or required by good practice to provide a complete electrical system.

D. Provide engraved nameplates for all pieces of equipment. Plates shall be screw-on, 3-ply, black face, white 1/4-inch-high Gothic lettering.

E. Install freestanding equipment in accordance with the manufacturer's recommendations. Unless noted otherwise, mount freestanding equipment on a 3-1/2-inch concrete pad. Secure freestanding equipment rigidly to floors or mounting pads with anchor bolts, expansion shields, or other approved means.

F. Unless noted otherwise, pieces of freestanding equipment located adjacent to one

END OF SECTION

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 – GENERAL

1.1 SCOPE

A. The work under this Section covers low-voltage conductors, terminations, and installation.

PART 2 – PRODUCTS

2.1 MATERIAL AND EQUIPMENT

A. Materials and equipment for this project shall all be first-quality, new materials, free from any defects, in first-class condition, with ratings as shown on these Drawings.

2.2 CONDUCTORS

A. This Article covers insulated wire and cable, not buses.

B. Conductors shall be copper unless aluminum is indicated. Unless noted otherwise, power and discrete conductors shall be stranded 600-volt type THWN (wet) or THHN (dry).

C. For control, signaling, communications, and networking interconnection, conductors and cabling shall meet the following:

1. Conform to manufacturer recommendations.

2. Meet all applicable standards referenced in Section 26 05 00, ELECTRICAL.

3. Be suitable for the environment in which they are installed. See Section 26 05 33 for Metal Clad Cable.

PART 3 – EXECUTION

3.1 CONDUCTORS AND TERMINATIONS

A. General:

1. Wire shall be continuous from outlet to outlet of the raceway system. Conductors shall not be smaller than No. 12 AWG for lighting and power circuits, No. 14 AWG for control circuits, and No. 18 AWG for twisted shielded cables, unless otherwise indicated.

2. Conductors shall be stranded; except solid conductors No. 10 AWG and No. 12 AWG may be used for branch circuit power wiring and for lighting and receptacle circuits.

3. Provide adequate length pigtails for conductors connected by others.

B. Splices and Terminations:

1. Preferably, conductors shall be run between pieces of equipment without splices. Splices, where required, shall be made in accessible boxes only. Splices shall not be made below finish grade unless indicated on the Drawings or approved by the Engineer.

2. Soldering shall not be used, except where required by the type of device terminals.

3. Make splices and terminations of stranded conductors using crimp-type or mechanical devices suitable for the type and size of conductor used.

4. For control wiring, use preinsulated ring-tongue crimp-type devices, except where terminals of factory-supplied equipment do not so allow. Use terminals, connectors, and installation tools as recommended by the manufacturer. Crimp-type lugs shall be applied with a tool so designed that once the crimping action is started, the tool cannot be removed until the crimping action is completed.

5. Do not use wire nuts or solder for splices or terminations; except wire nuts may be used with solid wires as indicated below.

6. For solid conductors No. 12AWG and smaller and for terminations at individual lighting fixtures, make splices and terminations using wire nuts or threaded mechanical devices suitable for the type and size of the conductor used. Wire nuts shall be the coiled, spring-loaded type. Do not use wire nuts constructed of one solid piece (not spring loaded).

7. For solid conductors No. 10AWG and larger, make splices and terminations using threaded mechanical devices suitable for the type and size of conductor used.

C. For control, signaling, communications, and networking interconnections, do the following:

1. Coordinate interconnection among systems and sources of supply. Provide all required interconnection.

2. Comply with all requirements, including those covered in standards called out in Section 26 05 00, ELECTRICAL.

3. Obtain and conform to recommendations and requirements of system manufacturers.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SCOPE

A. The work under this Section covers grounding.

PART 2 – PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for this project shall be first-quality, new materials, free from any defects, in first-class condition, with ratings as shown on these Drawings.

PART 3 – EXECUTION

3.1 GENERAL

A. Work shall be performed in a workmanlike manner by craftsmen skilled in the particular trade. Work shall be performed in accordance with the Drawings, Specifications, manufacturers' recommendations, and the best practice of the trade. Completed work shall present a neat and finished appearance. Reference items below for specific requirements.

1. Complete electrical system shall be grounded in accordance with the presently adopted edition of the National Electrical Code (NEC) and as shown on the Drawings.

2. Unless otherwise indicated, ground all exposed noncurrent-carrying metallic parts of electrical equipment, raceway systems, and the neutral of all wiring systems in accordance with the NEC, and other applicable laws and regulations. Where metallic conduit is not grounded at its termination, it shall be separately grounded with a ground clamp and ground wire.

3. Provide grounding points (foundation ground points) at each building and structure. Grounding electrode shall be No. 4 minimum-size, 20-foot-minimum-length piece of reinforcing steel located near the bottom of the concrete foundation. Attach the ground wires to the reinforcing steel by thermite welding.

4. Where ground rods are indicated or used, they shall be copper clad, not less than 3/4 inch in diameter, 10 feet long, driven into the earth such that at least 8 feet is in contact with the soil, as required by NEC Article 250-52. Excess length may be cut off.

5. Make ground connections by brazing, thermite welding, or with approved compression grounding connectors. Grounding and bonding to steel shall be done with thermite welding.

6. The point of contact of each thermite weld shall be wire brushed or filed to a bare metal surface. Thermite welding cartridges and molds shall be used in accordance with the manufacturer's recommendations. After the welds have been made and cooled, slag shall be brushed from the welded area and the joint thoroughly cleaned. Use materials made by Burndy, Erico (Cadweld), or equal.

7. Compression grounding connectors shall meet the following requirements:

    a. Compression grounding connectors shall be suitable for the intended use; shall be suitable for direct-burial and embedded applications; and shall be designed for connecting to copper and copper-clad conductors, both stranded and solid, and to copper-clad, galvanized, and stainless steel ground rods.

    b. Connectors shall be prefilled with corrosion-inhibiting compound which is compatible with the conductors being joined.

    c. Connectors shall meet the requirements of IEEE standard 837-2002 (or later revision), and shall be listed by UL for direct burial in earth and embedment in concrete.

    d. Connectors shall be selected and installed according to the recommendations of the manufacturer.

    e. Compression grounding connectors shall be Burndy "Hyground," or equal.

8. At the request of, and in the presence of the authorized inspector, the Contractor shall provide system resistance readings.

END OF SECTION

SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SCOPE

A. The work under this Section covers all raceway and boxes for electrical systems.

PART 2 – PRODUCTS

2.1 MATERIAL AND EQUIPMENT

B. Materials and equipment for this project shall be first-quality, new materials, free from any defects, in first-class condition, with ratings as shown on these Drawings.

2.2 CONDUIT

A. Galvanized Rigid Steel Conduit (GRS): Rigid steel conduit including couplings, elbows, nipples, and other fittings shall be galvanized after fabrication by hot-dipping, electroplating, or a metalizing process. Conduit bodies and covers shall be of cast malleable galvanized ferrous materials. Provide covers with gaskets.

B. Electrical Metallic Tubing (EMT): Electrical metallic tubing, including couplings and elbows, shall meet the requirements of the National Electrical Code (NEC).

C. Rigid PVC Conduit (PVC): Rigid polyvinyl chloride (PVC) conduit shall be schedule 40 UL listed for concrete-encased, direct burial underground, and exposed use. PVC conduit shall be rated 90 degrees C.

D. Flexible Conduit (flex): Flexible conduit shall be moistureproof flexible steel, polyvinyl chloride jacketed, UL approved, and shall be Anaconda Sealtite conduit, Electriflex, or equal. Flexible conduit used in dry, concealed areas for lighting fixtures may be non-moistureproof flexible steel conduit, Anaconda Type CN, Triangle Tristeel, or equal.

E. Metal Clad Cable (MC): Factory assembly of one or more insulated circuit conductors, enclosed in an armor of interlocking sheath. Connectors and fittings used on MC Cable shall be listed and identified for the cable type.

2.3 BOXES

A. General:

1. Boxes shall not be smaller than required to meet the minimum requirements of the National Electrical Code (NEC).

2. Install boxes in a rigid and satisfactory manner, and support boxes independently of the conduit.

B. Sheet Steel Boxes, Small (Up To 4” X 4”):

1. These boxes shall include sizes up to 4 inches square and ganged switch boxes.

2. Sheet steel boxes shall be zinc- or cadmium-plated, and shall be of the one-piece stamped or drawn type, or welded, except when not available in the size required.

3. Provide boxes of adequate size without using box extensions.

4. For hollow masonry construction, provide boxes of sufficient depth so that conduit knockouts or hubs are in the masonry void space.

5. Provide covers and device plates as called out under RACEWAY SYSTEM. Type to be Used, in the Part, EXECUTION.

C. Sheet Steel Boxes, Large (Larger Than 4” X 4”):

1. Boxes shall be 16-gauge sheet steel, minimum, with welded seams.

2. Boxes shall be NEMA 1, minimum, in dry locations and NEMA 3R, minimum, in damp and wet locations.

3. Provide hinged covers on boxes with length or width greater than 24 inches. Hinges shall be full length, with stainless steel hinge pins. Hinged covers shall have secure closing provisions. Provide draw-pull catches (two minimum), three-point latch with a single handle, or clamps on three sides to clamp the cover.

4. Finish shall be ANSI 61 gray over a primer and rust inhibitor.

5. Boxes shall be Hoffman, Tanco, Keystone, Electromate, or equal.

D. Cast Boxes:

1. Cast boxes shall be galvanized malleable ferrous metal, gasketed and watertight, with threaded conduit hubs and mounting lugs. Boxes shall have a minimum (inside) depth of 2 inches.

2. Provide stamped steel covers with gaskets and stainless steel or galvanized steel screws; except provide weatherproof cast covers for switches and receptacles outdoors and in other wet or damp locations.

3. Cast boxes shall be Crouse Hinds FD, Appleton FD, or equal.

PART 3 – EXECUTION

3.1 RACEWAY SYSTEM

A. General: Raceway system shall be installed in accordance with the National Electrical Code (NEC). Unless otherwise specified or indicated, wiring shall consist of insulated conductors installed in raceways of the types indicated.

B. Types to be Used: Minimum size conduit shall be 1/2-inch; except 3/4-inch minimum shall be used for embedded conduit, unless indicated otherwise on the Drawings. Use the following types of conduit and boxes for the locations listed below, unless shown otherwise on the Drawings.

1. Use electrical metallic tubing (EMT) with sheet steel boxes and stamped steel covers in exposed, interior, dry locations.

2. Concealed locations: In concealed locations (sheet rock walls, ceilings), use EMT conduit with sheet steel boxes. Use stamped steel covers and device plates in dry locations, and use cast weatherproof covers and device plates with gaskets in wet and damp locations; except use plastic covers and device plates in dry, finished areas.

3. EMT may be used in place of PVC in dry, concealed locations, and GRS may be used as a substitute in any location.

4. Use liquidtight flexible metal conduit (flex) for the last 18 to 36 inches of conduit run to a piece of equipment where required to isolate vibration or to facilitate maintenance or adjustment. Flexible metal conduit (non-moistureproof) may be used in dry, concealed areas for lighting fixtures.

5. Use MC Cable in concealed interior locations (sheet rock walls, ceilings). Not to be used for home runs.

6. Use rigid polyvinyl chloride (PVC) conduit for buried and embedded locations, except use galvanized rigid steel (GRS) at least 5 feet on both sides of penetrations through footings and outside walls, under equipment mounting pads, where embedded in exterior light pole foundations, and where conduit changes from underground to exposed or from embedded to exposed.

7. Use galvanized rigid steel conduit (GRS) outdoors and in wet locations. Provide cast weatherproof covers and device plates with gaskets in wet and damp locations.

C. Boxes:

1. Provide each outlet in the wiring or raceway systems with a box to suit the conditions encountered. Provide flush or recessed fixtures with separate junction boxes when required by the fixture terminal temperature requirements. Boxes used with concealed conduits shall be flush mounted, unless otherwise indicated on the Drawings.

2. Install boxes in a rigid and satisfactory manner, and support boxes independently of the conduit.

D. Installation:

1. Conduit system installation shall meet or exceed the requirements of the NEC. Raceways shall be entirely free of obstructions or shall be replaced. All conduit shall be reamed, deburred, and cleaned for proper introduction of wires and cables. Immediately after installation, plug or cap all conduit ends with watertight and dusttight conduit seals until the time for pulling wires.

2. Conduit shall be of the greatest practicable single length between joints.

3. Install conduit, boxes, and fittings outdoors or in other wet locations so as to prevent water from entering the conduit. Do not run conduit through equipment foundation pads.

4. Empty ducts and conduits shall be identified at both ends and shall be capped and provided with a flat pull tape (Mule Tape, or equal).

5. For PVC conduit, use factory-made ells where applicable. Use approved heating methods for forming all other bends. Provide expansion joints as required by the NEC and as recommended by the manufacturer. When joining PVC conduit to metallic fittings, use approved PVC terminal adapters. When joining PVC conduit to rigid steel conduit, use an approved PVC female adapter. PVC conduit joints shall be solvent-welded with solvent recommended by the conduit manufacturer. Where PVC conduit is used, a separate grounding conductor shall be run with the conductors.

6. Concealed, embedded, and buried conduits shall emerge at right angles and shall have none of the curved portion of a bend exposed. Embedded and underground ells shall be galvanized rigid steel conduit.

7. Where conduit size is 4 inches or less, final connection to motors, wall- or ceiling-mounted fans, dry transformers, and to other equipment where flexible connection is desired or required to minimize vibration or to facilitate maintenance or removal of equipment, shall be made with flexible conduit. Length shall be 18 inches to 36 inches, unless otherwise approved by the Engineer.

8. Flexible conduit shall not be used as a ground. Where flexible conduit is used, a separate grounding conductor shall be run with the conductors. Flexible conduit shall be secured with conduit clamps or equivalent means except where the flexible conduit is fished and where sections less than 4 feet in length are used in concealed areas for lighting fixtures.

9. For steel conduit installed underground, wrap the entire length with tape using 1/2-inch overlap. Use PVC-based pressure-sensitive all-weather tape, 20-mil minimum thickness, as recommended by the manufacturer for corrosion protection of underground conduits. Tape shall be Scotchwrap 51 or equal.

3.2 UNDERGROUND AND EMBEDDED CONDUIT

A. Arrangement and Routing:

1. Arrange multiple conduit runs substantially in accordance with details shown on the Drawings.

2. Make minor changes in location or cross section as necessary to avoid obstructions or conflicts.

3. Where piping or other utility systems are encountered or being installed along a raceway route, maintain a 12-inch minimum vertical separation between raceways and other systems at crossings. Maintain a 12-inch minimum separation between raceways and other systems in parallel runs. Do not place raceways over valves or couplings in other piping systems which may restrict access.

B. Except as otherwise indicated, cover for underground and embedded conduit shall be as tabulated in Table 1, except conduit under building slabs may be just below the slab. Do not embed conduit in slabs. Conduit installation shall meet the requirements of the NEC.

TABLE 1
COVER REQUIREMENTS FOR BURIED RACEWAYS

Type of Buried Raceway	Areas of Vehicle Access (Roads, Parking Areas, etc.)	Other Areas
Direct-Buried Conduit	36 inches, with warning tape 12 inches above conduit	18 inches, with warning tape 12 inches above conduit

C. Separate parallel runs of four or more conduits in a single trench or embedded duct bank with preformed, nonmetallic spacers designed for the purpose. Install spacers at 6 feet or at intervals not greater than that specified in the NEC for support of the type

of conduit used. Support conduits installed in fill areas suitably to prevent accidental bending until backfilling is complete.

D. Trenching and Backfill:

1. Trench bottoms shall be free of rocks and other hard objects. Bedding material shall be used for a depth of 3 inches below the conduit or cable, and bedding material shall be used for the zone 6 inches above the conduit or cable.

2. Bedding material shall contain no rocks larger than 3/4 inch in diameter and shall be free from roots and debris.

3. Unless otherwise shown on the Drawings, that zone from 6 inches above the conduit to the top of the trench shall be the material removed from the trench; except that it shall contain no rocks larger than 6 inches and shall be free of roots and debris.

4. Where conduit trenches are located in roads or in structural backfill, the compaction requirements shall be as required for those areas. Where conduit trenches are located in an area where backfill material specifications are more rigid than those of this section, the trench backfill shall meet the more rigid specification. In any event, trench backfill compaction shall be at least equal to that of the material adjacent to the trench.

5. Conduits shall be placed parallel in the bottom of the trench. Where conduits are required to cross, they shall be separated by a minimum of 3 inches of bedding material. Where more than one level of conduit are placed in the same trench, they shall be separated by a minimum of 3 inches of bedding material.

6. As shown in Table 1, backfill shall include warning tape over the entire length of the run.

7. Conduit trenches in areas to be paved or improved under this project shall be installed and backfilled before the area is paved or improved.

8. All existing improvements damaged as a result of the Contractor’s operation shall be reconstructed by the Contractor at no cost to the Owner.

E. Penetrations:

1. Penetration of any fire-rated partition shall be protected in accordance with the Uniform Building Code 709 and 710.

3.3 WARNING TAPE

A. Provide heavy-gauge, yellow plastic tape of 6 inch minimum width for use in trenches containing electric circuits. Utilize tape made of material resistant to corrosive soil. Use tape with printed warning that an electric circuit is located below the tape.

B. Manufacturers and types: ITT Blackburn Type YT or RT, Griffolyn Co. Terra-Tape, or equal.

END OF SECTION

SECTION 26 08 00
COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SCOPE

A. The work under this Section includes commissioning of the electrical system for this remodel.

PART 2 – PRODUCTS

2.1 MATERIAL AND EQUIPMENT

A. Materials and equipment for this project are as specified in the individual sections.

PART 3 – EXECUTION

3.1 COMMISSIONING OF ELECTRICAL SYSTEMS

A. The electrical system shall be furnished, installed, started up, tested, and commissioned in accordance with the National Electrical Code (NEC).

B. This project includes furnishing, installing, and/or interfacing with numerous package systems. Execute all required testing for each system, meeting the following requirements:

- Perform specified testing as applicable to the system(s) at hand.
- Perform all testing as recommended by the manufacturers.
- Perform all testing as called for in the referenced standards.
- Perform all testing as required by the Authorities Having Jurisdiction.

C. Once the facility has been started up and is operating, a witnessed Functional Acceptance Test (FAT) shall be performed on the equipment and systems to demonstrate that they are operating as specified and meet the requirements and intent of the Drawings and Specifications. The Contractor shall prepare a test procedure(s) and conduct the test(s).

D. The FAT shall be performed by the Contractor.

E. The FAT shall include any Contractor's personnel, subcontractors, suppliers' representatives, and other necessary personnel required for a successful test. The Contractor is responsible for coordinating among required personnel.

F. The FAT shall operate all equipment and systems over the full operating range, shall demonstrate proper operation of alarms and indicators, and, in general, shall demon-

strate that the equipment and systems meet the requirements and intent of the Drawings and Specifications.

G. If any equipment or system fails the FAT, the Contractor shall correct the problem and shall repeat the test until it is successful.

H. The FAT shall be performed in the presence of the Architect and the Owner.

I. Submit marked-up “as-built” Drawings with final installed arrangements, including equipment model numbers and performance data.

J. Submit operation and maintenance manuals.

PART 4 – PAYMENT

4.1 PAYMENT

A. Payment for the work covered in this Section shall be included as part of the lump sum bid.

END OF SECTION

SECTION 26 24 00
SWITCHBOARDS AND PANELBOARDS

PART 1 – GENERAL

1.1 SCOPE

A. The work under this Section covers all switchboards and panelboards for this project.

PART 2 – PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for this project shall be first-quality, new materials, free from any defects, in first-class condition, with ratings as shown on these Drawings.

B. Service equipment shall include a meter base, copper busing, and other materials and work that will provide service to the facility. Materials and work shall be UL listed and shall meet the requirements of Electrical Utility Service Entrance Requirements Committee (EUSERC) and the utility company. Provide panels rated for the available short-circuit current of the electrical system. Service equipment shall be Square “D”, Cutler-Hammer, Siemens, or equal.

2.2 PANELBOARDS

A. Lighting and power panelboards shall be circuit breaker type as indicated and shall meet the standards established by Underwriters Laboratories (UL), NEMA PB 1, and the National Electric Code (NEC). Provide panelboards with fully rated short-circuit current equipment ratings. Series-rated equipment ratings are not acceptable. Panels used as service entrance equipment shall have UL approval for that use. Provide copper busing.

2.3 CIRCUIT BREAKERS

A. Circuit breakers shall be of the indicating type providing ON, TRIPPED, and OFF positions of the operating handle. Include provisions for padlocking circuit breakers in the OFF position (except in panelboards). Circuit breakers shall be quick-make, quick-break, with thermal-magnetic action. (An overload of one pole of all multiple-pole circuit breakers shall automatically cause all poles to open). Circuit breakers shall meet the requirements of UL 489. Unless noted otherwise, interrupting rating shall be not less than 10,000 amps rms symmetrical. Where they are used as service entrance equipment, circuit breakers shall have UL approval for that use.

B. The use of tandem or dual circuit breakers in a normal single-pole space to provide the number of poles or spaces specified is not acceptable.

C. GFCI (ground fault circuit interrupter) breakers shall trip in approximately 0.025 second with a ground fault of 5mA.

PART 3 – EXECUTION

3.1 GENERAL

A. Work shall be performed in a workmanlike manner by craftsmen skilled in the particular trade. Work shall be performed in accordance with the Drawings, Specifications, manufacturers' recommendations, and the best practice of the trade. Completed work shall present a neat and finished appearance. Reference items below for specific requirements.

B. For service entrance equipment, meter base, and other related materials, obtain written approval of submittals from the serving utility before submitting to the Engineer.

C. Install panels in compliance with seismic requirements, Authorities Having Jurisdiction, and manufacturer recommendations.

D. Provide typewritten index of all branch circuits for each panelboard.

E. Provide phenolic nameplate.

END OF SECTION

SECTION 26 27 00
LOW-VOLTAGE DISTRIBUTION EQUIPMENT

PART 1 – GENERAL

1.1 SCOPE

A. The work under this Section covers disconnect switches for this project.

PART 2 – PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for this project shall be first-quality, new materials, free from any defects, in first-class condition, with ratings as shown on these drawings. Disconnect shall be Square D, Cutler-Hammer or equal.

2.2 DISCONNECTING MEANS

A. General

1. Disconnecting means, whether switches, circuit breakers, or connectors, shall be listed and rated for the intended use, shall be applied according to the recommendations of the manufacturer, and shall meet other applicable requirements of this Section.

B. Safety Switches (Disconnect Switches)

1. Safety switches shall be UL listed, heavy duty (HD), motor rated, load break, quick-make, quick-break type meeting the requirements of NEMA KS 1.

2. Switches shall be enclosed in suitable NEMA-rated enclosures with external operating handle lockable in the OFF position. Enclosures and switches shall be interlocked to prevent opening the cover with the switch in the ON position. Provide a defeater mechanism for this interlock.

3. Fused switches shall be provided with current-limiting fuses and rejection clips.

PART 3 – EXECUTION

3.1 GENERAL

A. Work shall be performed in a workmanlike manner by craftsmen skilled in the particular trade. Work shall be performed in accordance with the Drawings, Specifications, manufacturers' recommendations, and the best practice of the trade. Completed work shall present a neat and finished appearance. Reference items below for specific requirements.

B. Install disconnects in compliance with seismic requirements, Authorities Having Jurisdiction, and manufacturer recommendations.

C. Provide phenolic nameplates.

D. Provide fuses as required.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 – GENERAL

1.1 SCOPE

A. The work under this Section covers all wiring devices for electrical system.

PART 2 – PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for this project shall be first-quality, new materials free from any defects, in first-class condition, with ratings shown on these Drawings.

2.2 COVERS AND DEVICE PLATES

A. Plastic device plates shall be of one-piece ivory nylon, phenolic, or urea with smooth exterior faces, and shall have metal screws with oval heads and color matching that of the plate. Coordinate cover plate color with the Architect. Plastic device plates shall be Hubbell phenolic plates, Leviton plastic plates, or equal.

B. Stamped steel covers and device plates shall be one-piece, and shall fit closely and tightly to the box on which they are installed. Covers shall be zinc- or cadmium-plated, with galvanized or stainless steel screws, and shall have gaskets in wet and damp locations. On surface-mounted boxes, device plates shall be raised with rounded edges and shall not extend beyond the sides of the box.

C. Cast covers and plates shall be galvanized malleable ferrous metal with gaskets and stainless steel screws; except cast receptacle plates shall be die-cast, copper-free aluminum.

1. Cast switch plates in wet and damp locations shall have integral external operators for each switch. Plates shall be Crouse Hinds “Feralog” DS Series, Appleton malleable iron FSK Series, or equal.

2. Cast receptacle plates in wet and damp locations shall have spring-loaded, gasketed, weatherproof covers for each receptacle. These plates shall be weatherproof when in use (with attachment plug cap inserted), as described in NEC 406.8(B). Plates shall be Thomas & Betts Red Dot Code Keeper, Carlon Weatherproof, Appleton Weatherproof, or equal.

2.3 WIRING DEVICES, RECEPTACLES, AND WALL SWITCHES

A. General: Provide receptacles and wall switches, in suitable enclosures.

B. Single and Duplex Convenience Receptacles: Receptacles shall be NEMA 5-15 configuration and rating (two pole, three wire, grounding, 15 amperes, 125 volts). Wire terminals shall be screw type. Receptacles shall be Hubbell 5262I, Leviton 5262I, or equal.

C. GFCI Receptacles: Receptacles with ground fault circuit interrupters (GFCI) shall be UL listed, shall be duplex, shall have NEMA 5-15 configuration and rating, and shall fit standard-sized outlet boxes. Interrupters shall trip on a 5-mA ground fault, not on overloads, shall be capable of interrupting 1,000 amperes without damage, and shall have provision for testing. GFCI receptacles shall be Hubbell GF5262I, Leviton 6599I, or equal.

D. Wall switches shall be totally enclosed. Operating handles shall be of ivory-colored phenolic composition. Switches shall be rated 20 amperes at 120/277 volts, 60 Hz, and shall be suitable for the control of tungsten lamp loads. Wire terminals shall be screw type. Switches shall be UL listed.

PART 3 – EXECUTION

3.1 GENERAL

A. Work shall be performed in a workmanlike manner by craftsmen skilled in the particular trade. Work shall be performed in accordance with the Drawings, Specifications, manufacturers' recommendations, and the best practice of the trade. Completed work shall present a neat and finished appearance. Reference items below for specific requirements.

B. Locations of electrical outlets and other electrical system components shown on Drawings are approximate unless dimensioned. Check for and resolve conflicts with openings, structural members, and equipment having fixed locations.

C. Install all items per manufacturer recommendations, NEC, and local Building Codes.

END OF SECTION

SECTION 26 50 00
LIGHTING

PART 1 – GENERAL

1.1 SCOPE

A. The work under this Section covers all lighting equipment for this project.

PART 2 – PRODUCTS

2.1 MATERIAL AND EQUIPMENT

A. Materials and equipment for this project shall be first-quality, new materials, free from any defects, in first-class condition, with ratings as shown on these Drawings.

B. Lighting fixtures shall be of the types and sizes shown on the Drawings, and shall be furnished and installed complete with mounting devices and junction boxes where required.

C. Fluorescent fixtures hung in continuous rows shall have wiring channels approved for use as wireways.

PART 3 – EXECUTION

3.1 GENERAL

A. Work shall be performed in a workmanlike manner by craftsmen skilled in the particular trade. Work shall be performed in accordance with the Drawings, Specifications, manufacturers' recommendations, and the best practice of the trade. Completed work shall present a neat and finished appearance. Reference items below for specific requirements.

1. Locations of light fixtures and other electrical system components shown on Drawings are approximate unless dimensioned. Check for and resolve conflicts with openings, structural members, and equipment having fixed locations.

2. Deliver lamps to the project in their original cartons. After construction of the total project is completed, wash fixtures, clean lamps, touch up any paint scratches or chips, remove labels from fixture lenses, and replace noisy ballasts.

END OF SECTION

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2011 CSI FORMAT
APRIL 2015

SECTION 27 20 00
HORIZONTAL CABLING

PART 1 – GENERAL

1.1 SCOPE

A. Cabling:

The horizontal portion of the telecommunications cabling system extends from the work area outlet/connector to the horizontal fields to the IT room.

B. Paths:

These horizontal cabling paths typically consist of cabling in support of Telecommunications and Data. The pathway begins at the outlet connector, through the cabling in the wall/ceiling/floor and then to the patch panel in the IT room.

1.2 QUALITY ASSURANCE

A. All cable shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the Contract Documents shall be subject to the control and approval of the Owner. Equipment and materials shall be of the quality and manufacturer indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval by the Engineer.

B. Strictly adhere to all NEC, NFPA, OSHPD, ANSI/TIA/EIA 569-B, and BICSI Standards that govern installation practices when installing horizontal cabling.

C. Materials and work specified herein shall comply with the applicable requirements of:

1. ANSI/TIA/EIA - 568-C Telecommunications Cabling Standard (including all the latest amendments and applicable addenda).

2. ANSI/TIA/EIA - 569-B Pathway and Spaces.

3. NFPA 70.

4. BICSI Telecommunications Distribution Methods Manual.

5. FCC 47 CFR Part 68.

6. NEMA – 250.

7. NEC - Articles 770 and 800.

8. ADA - Americans with Disabilities Act .

9. ISO/IEC 11801 (International) Generic Cabling for Customer Premises Standard (including all the latest amendments and applicable addenda).

1.3 SUBMITTALS

A. Manufacturers' catalog sheets, specifications, and installation instructions for the following: Cable, modular jacks media adapters, optical fiber connectors, faceplates, and modular jacks.

B. Submit applicable installer/contractor certification documentation and certification information and requirements from manufacturer.

PART 2 – PRODUCTS

2.1 HORIZONTAL CABLING TO THE WORKSTATION

A. Horizontal workstation cabling shall be 100-ohm unshielded twisted pair cable (UTP).

B. Physical Characteristics:

1. Voice/Data cable shall be 100-ohm 4-pair Category 6 or higher.

2. Shall be appropriate for the environment in which it is installed (plenum or PVC).

3. Cable color requirements:

Color	Description
Blue	Voice communications
Yellow	Data/voice communications

C. Transmission Characteristics:

1. The following cable specifications shall be met by the cable manufacturer for 4-pair UTP/ScTP Category 6 cables:

2. Attenuation:

a. Cables shall exhibit worst-case attenuation less than the values specified in the following table.

	Cat-6
Frequency Range	1-250 MHZ
Worst-Case	21.7 dB

3. Near End Crosstalk (NEXT) Loss:

   a. Cables shall exhibit worst-case NEXT loss greater than the values specified in the following table.

	Cat-6
Frequency Range	1-250 MHz
Worst-Case Cable Next Loss	39.9 dB

4. Power Sum Near-End Crosstalk (PSNEXT) loss:

   a. Cables shall exhibit worst-case PSNEXT loss greater than the values specified in the following table.

	Cat-6
Frequency Range	1-250 MHz
Worst-Case PS Next Loss	37.1 dB

5. Equal Level Far-End Crosstalk (ELFEXT):

   a. Cables shall exhibit worst-case ELFEXT greater than the values specified in the following table.

	Cat-6
Frequency Range	1-250 MHz
Worst-Case ELFEXT	15.3 dB

6. Power Sum Equal Level Far-End Crosstalk (PSELFEXT):

   a. Cables shall exhibit worst-case PSELFEXT loss greater than the values specified in the following table.

	Cat-6
Frequency Range	1-250 MHz
Worst-Case PSELFEXT	12.3 dB

7. Return Loss:

   a. Cables shall exhibit worst-case return loss greater than the values specified in the following table.

	Cat-6
Frequency Range	1-250 Mhz
Worst-Case Return Loss	8 dB

8. Propagation Delay (ANSI/TIA/EIA-568-C):

   a. Cables shall exhibit worst-case propagation delay less than the values specified in the following table.

	Cat-6
Frequency Range	1-250 MHz
Worst-Case Propagation Delay	546 ns

9. Delay Skew (ANSI/TIA/EIA-568-C):

   a. Cables shall exhibit worst-case delay skew less than the values specified in the following table per 100 meters.

	Cat-6
Frequency Range	1-250 MHz
Worst-Case Delay Skew	25 ns

2.2 CATEGORY 6 DATA/VOICE JACKS

A. Physical Characteristics:

1. Cable Color Requirements:

Color	Description
Blue	Voice communications
Yellow	Data/voice communications

2. Shall be 8-position/8-conductor with 110 IDC termination.

3. Shall have both straight and angled mounting.

4. Shall be backwards compatible to allow lower performing categories of cables or connecting hardware to operate to their full capacity.

5. Shall provide universal application/multivendor support.

6. Shall support T568B standards wiring options.

7. Shall be constructed of high impact, flame-retardant thermoplastic.

8. Shall be made by an ISO 9001-Certified Manufacturer.

9. Shall be capable of accepting 24-26 AWG copper cable.

B. Transmission characteristics (as tested in accordance with ANSI/TIA/EIA-568-B and ISO/IEC 11801 Category 6 compliant):

1. The following requirements shall also be met (NEXT loss and FEXT tested in both differential and common modes):

Parameters	Performance @ 250 MHz
NEXT Loss	33.1 dB
ELFEXT	15.3 dB
Insertion Loss (Attenuation)	36 dB
Return Loss	8 dB

2. Shall be UL VERIFIED (or equivalent) for TIA/EIA Category 6 electrical performance.

3. Shall be UL LISTED 1863 and CSA C22.2 approved or equivalent.

2.3 WORK AREA EQUIPMENT CORDS

A. Category 6:

1. Physical Characteristics:

a. Shall be round, and consist of eight insulated 24 AWG, stranded copper conductors, arranged in four color-coded twisted-pairs within a flame-retardant jacket.

b. Shall be equipped with modular 8-position plugs on both ends, wired straight through with standards compliant wiring.

c. Shall be backwards compatible with lower performing categories.

d. Shall use modular plugs, which meet or exceed FCC CFR 47 part 68, subpart F, and IEC 60603-7 specifications, and have 50 micro-inches minimum of gold plating over nickel contacts.

e. Shall have matching color strain relief boot with a snagless design which shall meet the flex test requirements of 1,000 cycles with boots and 100 cycles without boots.

f. Shall be resistant to corrosion from humidity, extreme temperatures, and airborne contaminants.

g. Shall utilize cable that exhibits power sum NEXT performance.

h. Shall be available in any custom length and standard lengths of feet (3, 5, 7, 10, 15, 20, and 25 feet).

i. Shall be made by an ISO 9001-Certified Manufacturer.

2. Electrical Specifications:

a. Shall have an input impedance without averaging: 100W + 15% from 1-100 MHz, + 22% from 100-200 MHz, and + 32% from 200-250 MHz.

b. Shall be 100% transmission tested for performance up to 250 MHz. Manufacturer shall guarantee cords are compatible with proposed Cat 6 links.

c. Shall utilize cable that is UL VERIFIED (or equivalent) for TIA/EIA proposed Category 6 electrical performance.

d. Shall be UL LISTED 1863.

2.4 FACEPLATES

A. Physical Characteristics:

1. Shall be available in single-gang and double-gang white configurations.

a. Single Gang: 2.76” x 4.53” x 0.31”
b. Double Gang: 4.53” x 4.60” x 0.31”

2. Shall be applicable for copper applications.

3. Shall have designation labels for circuit identification, with a clear plastic cover.

4. Shall have, as a minimum, the standard colors of Office White, Gray, and Electrical Ivory.

5. Shall have optional modular furniture adapters available (stainless steel with 1-1/4-inch hole for split duct).

6. Shall have stainless steel options available.

7. Shall have surface-mount boxes and standoff rings available for both single- and double-gang faceplates.

8. Shall be made by an ISO 9001-Certified Manufacturer.

2.5 SURFACE-MOUNT BOXES

A. Physical Characteristics:

1. Shall be 6- or 12-port version with magnet-type attachment.

2. Shall have built-in cable management for copper applications.

3. Shall accept modular Cat-6 jacks, as well as all media adapters.

4. Shall be available in Office White, Gray, and Electrical Ivory.

5. Shall have at least three sides with breakouts and an opening in the base for cable or raceway entry.

6. Shall have a designation area for printed or adhesive labels for circuit identification with clear plastic protector.

7. Shall have color-coded designations for jack identification.

8. Shall be made by an ISO 9001-Certified Manufacturer.

2.6 WALL PHONE JACK ASSEMBLY

A. Physical Characteristics:

1. Shall be constructed of stainless steel.

2. Shall have mounting lugs designed to mate with corresponding telephone baseplate or adapter.

3. Shall mount to single-gang outlet box or to wall directly.

4. Shall be a RJ14C jack.

5. Shall be wired to USOC BU/WH, OR/WH pair 1&2.

PART 3 – EXECUTION

3.1 HORIZONTAL WORKSTATION CABLE INSTALLATION

A. UTP Cable:

1. All wiring concealed in walls or soffits shall be installed in a neat and orderly fashion, parallel with the wall suspended with “J” hooks every four feet.

2. All exposed wiring shall be installed in surface raceway.

3. All wiring above ceilings shall be installed in open-top cable hangers, or “J” hooks.

4. Cable above accessible ceilings shall be supported 4 feet to 5 feet on center from cable support attached to building structure.

5. Do not untwist cable pairs more than 0.5 inch when terminating.

6. The Contractor shall be responsible for replacing all cables that do not pass manufacturer testing specifications.

7. Maximum length shall be 295 feet.

8. Cable shall have no physical defects such as cuts, tears, or bulges in the outer jacket. Cables with defects shall be replaced.

9. Install cable in neat and workmanlike manner. Neatly bundle and tie all cable in closets. Leave sufficient cable for 90-degree sweeps at all vertical drops.

10. Maintain the following clearances from EMI sources:

    a. Power cable - 6 inches
    b. Fluorescent Lights - 12 inches
    c. Transformers - 36 inches

11. Cable jackets that are chaffed or burned exposing internal conductor insulation or have any bare copper ("shiners") shall be replaced.

12. Firestop all openings where cable is installed through a fire barrier.

3.2 INSERTS AND FACEPLATES

A. All cables shall be terminated with modular jacks that snap into a faceplate mounted on a wall outlet box, surface raceways, or power pole.

B. Outlet boxes shall be secured to building with mechanical fasteners. Adhesive fasteners are not allowed.

C. All extra openings to be filled with blank inserts.

D. Terminate cable per TIA/EIA-T568-C standard pin assignments.

E. Locate so that combined length of cables and cords from panel to phone or computer does not exceed 10 feet.

END OF SECTION

SECTION 27 21 00
LABELING STANDARD

PART 1 GENERAL

1.1 SCOPE

A. All new Telecom cabling and equipment require proper labeling and accountability. This Section is to set forth guidelines for labeling cabling and equipment assigned for installation.

1.2 QUALITY ASSURANCE

A. All new labeling is to coincide with current Owner labeling practices and new installs that require additional methods will revert to the following:

1. ANSI/TIA/EIA 606 standards for sampling.

2. Contact the Owner's representative for clarification.

1.3 SUBMITTAL

A. All submittals require printed samples of intended labeling materials to be used. It is the Contractor's responsibility to present samples for approval before application in the project.

B. Labeling is an intricate part of each project and will be a segment requiring approval by the Owner's representative prior to final acceptance of a project.

PART 2 – LABELING

2.1 CONTRACTOR RESPONSIBILITY FOR LABELING AND LIABILITY

A. All labeling schemes for telecommunication components (patching panels, termination blocks, cables, etc.) will be coordinated with the Owner. The Owner will approve all labeling schemes before Contractor applies labels.

B. Verify all room numbers, facility names and building numbers, and utility vault numbers with the Owner prior to labeling. Match numbering with construction drawings of final room labeling scheme if required.

C. The Contractor shall apply the Owner's label format for all outlet and patch panel labeling standards as described in this specification. Label all components end-to-end.

D. Permanent labels shall be utilized for all outlets, termination blocks, patch-panels, distribution junction boxes, cables of all telecommunication service media, and shall be

of a composite/configuration that is difficult to remove, peel off, or fade by exposure of natural elements. A materials sample shall be required for final Owner approval.

E. Labels will be applied with care and replaced immediately if they begin to peel, tear, or fade away from its mounted surface. Contractor will be required to coordinate the labeling with the Owner and make adjustments where/when necessary at Contractor's expense.

F. Except when utilizing P-Touch or similar machine, labeling schemes defined by the Owner are typically custom made using laminating machine and CAD or word processing software packages.

G. Contractor may contract the services of labeling manufacturer/supplier provided a final product is approved by the Owner before applied in the field.

2.2 LABEL TYPES:

A. All labels will be of machine (Brothers P-Touch) or equal or computer-generated (Brady, Tyson) or equal text and sized to match available label locations, labeling windows, predefined labeling areas of components unless identified otherwise by the Owner.

2.3 CROSS-CONNECT FIELD LABELING:

A. BIX's FRAME Cabling:

1. All voice station cabling shall terminate on 4-pair BIX blocks (not outlet locations) with a blue labeling strip.

2. Label the pair count at the beginning and end positions of each labeling strip for all high-capacity cables (above 4-pair cables). Place the cable's identification test on the top label strip and center.

3. Label to be **BLACK** text on CLEAR field.

B. BIX's Blocks:

1. Labeling strips for work area station cable runs shall be 4-pair demarcated and **BLUE** in color.

2.4 FACEPLATES (VOICE AND DATA)

A. Utilize the label window of work area outlet/faceplates to identify service originating room locations. The top label window of a typical work area outlet might read:

1.1 V63 V64 D76 D68

B. The number 1.1 is the telecommunication room serving the station drop, the V63, V64, and D37, D38 are the sequenced voice jack positions. The voice and data jack numbers may not necessarily match in sequence. However, all faceplates must contain sequential numbering scheme beginning with an odd number.

C. Faceplates without label windows shall have a label at the top-left corner of the outlet device after mounting outlet into position.

2.5 PATCH PANELS – GENERAL DATA

A. Label all patch panel ports with the identical numbers used at workstation outlet jack locations. Label patch panel with the name of the service on the panel's upper left corner only for specialized systems, for example:

1. Typical tie copper cable label:

   "HC 3.2-2 TIE"

   These cable names are to be provided by the Owner's representative.

2. Labels are to be **BLACK** text on **WHITE** field.

2.6 HC CABLE (HORIZONTAL COPPER CABLING)

A. Labeling of copper cables with 25 pair or more conductors, or all fiber-optic cables, will contain the following information:

Contractor's Name:	xxx
Date Installed:	4/02/02
Cable Type:	OCNP/06 MM/SM
Cable To And From Location:	3.1 to 3.2
Cable Name/Count:	FHC-1-12

B. Utilize cable ties on all labels, and implement the label scheme the Owner provides to the Contractor.

C. Cable label will be cut and sized to the cable's outer sheath.

D. Place labels in full view of personnel viewing cable identifier. If several cables are bundled together or run side-by-side, all labels will be at the same level height.

E. Label to be **BLACK** text on **WHITE** field.

2.7 STATION CABLE (VOICE)

A. When required by the Owner's representative, station cables will have a label at each end of each cable.

B. Label shall be **BLACK** text on **WHITE** field or **WHITE** text on **BLACK** field.

C. Labels shall be wrap-around self-laminating adhesive.

PART 3 – EXECUTION

3.1 PATCH PANEL ADAPTERS

A. Typical labels for single and duplex SC connectors adapters.

1. All ports and/or bulkheads shall have two sets of labels.

2. All labels are to be printed horizontally and placed onto the panel cover vertically.

B. Cable label to include: Date Installed, Strands, Core Size, and Installation Contractor's Name.

C. Place labels in full view of personnel viewing cable identifier. If several cables are bundled together or run side-by-side, all labels will be at the same level height.

D. Label to be **BLACK** text on **WHITE** field, unless identified otherwise.

E. Label to be produced of a UV resistant material and sealed to prevent encroachment of environmental elements from destroying the label when outside fiber is implemented.

END OF THIS SECTION

SECTION 27 22 00
TESTING AND IDENTIFICATION

PART 1 GENERAL

1.1 SCOPE

A. This Section includes the minimum requirements for the testing, certification administration and identification of backbone and horizontal cabling.

1.2 QUALITY ASSURANCE

A. All testing procedures and testers shall comply with applicable requirements of:

1. TIA/EIA TSB-67 Field Testing of UTP (including the latest amendments and applicable addenda).

2. TIA/EIA 568-A Annex H (including the latest amendments and applicable addenda).

B. Identification and administration work specified herein shall comply with the applicable requirements of:

1. ANSI/TIA/EIA – 606-A Administration Standards (including the latest amendments and applicable addenda).

2. ANSI/TIA/EIA - 569-A Pathway and Spaces.

3. ANSI/TIA/EIA - 568-A Telecommunications Cabling Standard (including the latest amendments and applicable addenda).

4. BICSI Telecommunications Distribution Methods Manual.

1.3 SUBMITTALS

A. Manufacturers' catalog sheets and specifications for fiber and copper cable testers.

B. Test reports.

PART 2 – PRODUCTS

2.1 COPPER 100 OHM UTP TESTERS

A. Electronic User Interface records.

B. Date stamp of all tests.

C. Physical interface shall be modular RJ-45 connector and a serial port with DB-9 connector.

D. Shall have auto-testing to determine if cable meets the requirements of TIA/EIA SB -67 standards.

E. Shall use injector for complete wire mapping and TDR for determining cable length.

F. Shall measure NEXT for all pair combinations and Attenuation on all pairs from 1.0 to 250 MHz.

2.2 LABELS

A. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969 and ANSI/TIA/EIA 606-A specifications.

B. Shall be preprinted or laser printed type.

C. Where used for cable marking provide vinyl substrate with a black lettering on white background that self laminates the printed area when wrapped around the cable. If cable jacket is white, provide cable label with printing area that is any other color than white, preferably orange or yellow - so that the labels are easily distinguishable.

PART 3 – EXECUTION

3.1 COPPER 100 OHM UTP CABLE TESTING

A. General

1. The testing parameters called for in this section shall apply for up to 90 meters of horizontal cable, a work area equipment cord, an RJ45 outlet and 2 cross connect connections in the closet. Testing to be done with a Fluke 4000, 2000, Pentascanner, Microtester, TDR type testers that provide TDR and wire map test records.

2. Test cable with test set to match the nominal velocity of propagation (NVP) for the cable as stated by the cable manufacturer of the cable being installed.

3. The test parameters shall include Wire Map, Length, Attenuation and near end crosstalk (NEXT)

4. The Bit error rate (BER) shall not exceed10-100.

B. Wire Map

1. The wire map test shall verify pair to pin termination at each end and check for connectivity errors. The wire map shall indicate the following for each of the eight conductors:

   a. Continuity to the remote end
   b. Shorts between any two or more conductors
   c. Crossed pairs
   d. Reversed pairs
   e. Split pairs
   f. Any other miswiring

C. Cable Length

1. The maximum length of the test link including the test equipment cords shall be 94 meters.

D. Testing

The link ATTENUATION and NEXT of all cables shall be tested. The link is the sum of the attenuation of all connecting hardware, 10 meters of patch and equipment cords, and 90 meters of cable. The following tables indicate the acceptable values:

1. Category 6 UTP

   a. DC Resistance

      The resistance of any conductor shall not exceed 9.0 ohms per 100 meters at or corrected to a temperature of 20°C.

   b. DC Resistance Unbalance

      The resistance unbalance between the two conductors of any pair shall not exceed 3% when measured at or corrected to a temperature of 20°C.

   c. Capacitance

      The capacitance of any pair at 1 kHz and measured at or corrected to a temperature of 20 deg C shall not exceed 15 pf per ft nominal.

   d. Impedance

      The cable shall have a typical input impedance meeting the following values based on swept cable input measurements only. Curve fitting or smoothing functions will not be utilized to improve the values.

Input Impedance: (6)	
1.0 - 20.0 MHz	100 +/- 12 Ohms
20.0 - 200.0 MHz	100 +/- 15 Ohms
200.0 - 310.0 MHz	100 +/- 20 Ohms
310.0 - 350.0 MHz	100 +/- 22 Ohms
Impedance (6)	
Frequency (MHz)	**Impedance Spec (ohms)**
1.0	100 +/- 12
4.0	100 +/- 12
8.0	100 +/- 12
10.0	100 +/- 12
16.0	100 +/- 12
20.0	100 +/- 12
25.0	100 +/- 15
31.25	100 +/- 15
62.5	100 +/- 15
100.0	100 +/- 15
155.0	100 +/- 15
200.0	100 +/- 15
250.0	100 +/- 20
350.0	100 +/- 22

e. Return Loss (RL)

The RL values shall be based on swept frequency cable input measurements only. Curve fitting or smoothing will not be accepted.

Return Loss (RL) (6)	
Frequency (MHz)	**Min Return Loss (dB)**
1.0	20.0
4.0	23.0
8.0	24.5
10.0	25.0
16.0	25.0
20.0	25.0
25.0	24.3
31.25	23.6
62.5	21.5
100.0	21.0
155.0	21.0
200.0	31.0
250.0	18.0

350.0	17.0

f. Attenuation

The attenuation is derived from swept frequency signal level measurements at the output of cable lengths greater than or equal to 100 m (328 ft). The maximum attenuation of any pair, in dB per 100 m, measured at or corrected to a temperature of 20° C shall be less than or equal to the values calculated from the following equation from 1 to 350 MHz. The values listed in the table are for information only and are calculated from the equation.

Attenuation = 1.808*Sqrt[freq] + 0.017*freq + 0.05/Sqrt[freq])

Attenuation (6)	
Frequency (MHz)	**Attenuation (dB/100m)**
0.772	1.7
1.0	1.9
4.0	3.7
8.0	5.3
10.0	5.9
16.0	7.6
20.0	8.4
25.0	9.5
31.25	10.7
62.5	15.5
100.0	19.9
155.0	25.3
200.0	29.1
250.0	33.0
350.0	40.0

g. Power-Sum Near End Crosstalk (PSNEXT)

PSNEXT loss is derived from swept frequency measurements using a network analyzer and a s-parameter test set. The minimum PSNEXT loss for any pair combination at room temperature shall be greater than or equal to the value determined using the following formula. The values listed in the table are for information only and are calculated from the equation.

PSNEXT(f) = 74 dB - 15 log(freq/0.772)

(PSNEXT) (6)	
Frequency (MHz)	**Min PSNEXT (dB)**
0.772	74
1.0	72.3
4.0	63.3
8.0	58.8
10.0	57.3
16.0	54.3
20.0	52.8
25.0	51.3
31.25	49.9
62.5	45.4
100.0	42.3
155.0	39.5
200.0	37.8
250.0	36.3
350.0	34.2

h. Power Sum Equal Level Far End Crosstalk (PSELFEXT)

PSELFEXT loss is derived from swept frequency measurements using a network analyzer and a s-parameter test set. The minimum PSELFEXT loss for any pair combination at room temperature shall be greater than or equal to the value determined using the following formula. The values listed in the table are for information only and are calculated from the equation.

PSELFEXT(f) = 67 dB - 20 log(freq/0.772)

PSELFEXT (6)	
Frequency (MHz)	**Min PSELFEXT (dB/100 m)**
0.772	67.0
1.0	64.8
4.0	52.7
8.0	46.7
10.0	44.8
16.0	40.7
20.0	38.7
25.0	36.8
31.25	34.9
62.5	28.8
100.0	24.8
155.0	20.9
200.0	18.7
250.0	-
300.0	-
350.0	-

i. Propagation Delay

The propagation delay of any pair at 10 MHz shall not exceed 510ns/100m.

j. Propagation Delay Skew

The propagation delay skew between any two pairs shall not exceed 18 ns/100m at 10 MHz.

k. Powersum Attenuation to Crosstalk Ratio (ACR) dB/100m.

Powersum Attenuation to Crosstalk Ratio (6)	
Frequency (MHz)	**Min Psum ACR (dB/100m)**
0.772	72
1.0	70
4.0	59
8.0	53
10.0	51
16.0	46
20.0	44
25.0	42
31.25	39
62.5	30
100.0	25
155.0	16
200.0	10
250.0	3
300.0	>0
350.0	-

3.2 LABELING AND IDENTIFICATION

Confirm all specific labeling requirements with customer's project coordinator prior to cable installation or termination.

A. Cables

1. Backbone cables shall be marked at each endpoint and at all intermediate pull/ access points or junction boxes. Label shall indicate origination and destination Telecommunication Room ID, cable ID and strand or pair range.

2. Horizontal cables shall be marked at each end with the same designation.

B. Patch Panels (Copper)

Shall be labeled as noted on the drawings, individual ports shall come labeled from the factory with a number designation.

C. Faceplates

Shall be labeled to indicate the Telecommunication Room, patch panel and panel port to which the cable is wired for each cable that it houses. In the case of block terminated cables the label shall indicate the Telecommunication Room and "V" cable number.

3.3 DATA REPORTING AND ACCURACY

A. General: A Pass or Fail result for each parameter shall be determined by the allowable limits for each parameter. If the test result of a parameter is closer to the test limit than the accuracy of the tester, it shall be marked with an asterisk. Data at all measured points shall be uploaded to a P.C. and printed on a laser printer.

B. Wire Map: Wire map tests shall be marked "Pass" if wiring is determined correct.

C. Length: Test results shall be provided in meters and marked "Pass or Fail" based on the length vs. allowable length.

D. Attenuation: Report the attenuation value and the frequency at point of failure or the highest frequency passed. Measured attenuation values lower than 3dB used for a pass/fail determination. Report the attenuation per unit length for links longer than 15 meters.

E. NEXT: Report the NEXT value and "pass or fail" for samples based on the following:

NEXT	
Frequency Range (MHz)	**Maximum Step Size (MHz)**
1 - 31.35	0.15
31.25 - 100	0.25

3.4 RECORD COPY AND AS - BUILT DRAWINGS

A. Provide computer-generated reports in Word format that details each communication path from the outlet to the patch panel. Format report with one test result per page in ascending order. Provide file to owner on a CD-R.

B. Provide record copy drawings periodically throughout the project or as requested by the project manager and at end of the project.

C. Record copy drawings shall include notations reflecting the as-built conditions of any additions to or variation from the base specifications and drawings provided.

D. Test Results

1. Horizontal Copper Cabling

The Contractor shall test all cables and submit all horizontal copper cable test result data in electronic format, with the resulting file formatted with one test result per 8.5" x 11" page. Export or Download the test results from the cable tester to a *.txt format.

a. High Pair-Count Copper Cables

The Contractor shall test all high-count copper cables and submit test result information in an electronic format. Acceptable formats are Word or Excel. See project coordinator for required format for test report documentation.

END OF SECTION

SECTION 28 00 01
FIRE ALARM SYSTEM PERFORMANCE

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. This project includes design-of a fully addressable fire alarm system for the new 11,400-square-foot Happy Camp Resident Center in Happy Camp, California. This Specification Section covers design-build performance requirements for manual and automatic fire alarm systems.

B. Furnish material, labor, and equipment to achieve performance in accordance with applicable codes and standards.

1.2 REFERENCES

A. Fire alarm system design, work, and installation of materials and equipment shall be in accordance with the requirements of local laws, ordinances, the utility purveyors, Authorities Having Jurisdiction, and State codes listed below.

1. NFPA 72 – National Fire Alarm Code
2. UFC – Uniform Fire Code
3. Life Safety Code
4. National Electrical Code

B. Conflicts, if any that may exist among the above items will be resolved at the discretion of the Project Engineer.

1.3 REQUIREMENTS

A. The Fire Alarm Contractor shall prepare a design, complete, meeting the requirements of the Contract Documents, under a deferred approval process. The design and installation shall meet the requirements of the Authorities Having Jurisdiction, including the Building Department and the State Fire Marshal. The system and all components shall be listed by Underwriter Laboratories, Inc., for use in Fire Protective Signaling systems under the following standards as applicable:

1. UL 38 – Manually Actuated Signaling Boxes
2. UL 50 – Cabinets and Boxes
3. UL 268 – Smoke Detectors for Fire Protective Signaling Systems
4. UL 268A – Smoke Detectors for Duct Applications
5. UL 346 – Waterflow Indicators for Fire Protective Signaling Systems
6. UL 464 – Audible Signaling Appliances
7. UL 521 – Heat Detectors for Fire Protective Signaling Systems
8. UL 864 – Control Units for Fire Protective Signaling Systems
9. UL 1481 – Power Supplies for Fire Protective Signaling Systems
10. UL 1971 – Visual Signaling Appliances

B. It is the sole responsibility of the Fire Alarm Contractor to obtain approvals of the Authorities Having Jurisdiction. As described in this Specification, provide a complete

shop drawing package to the State Fire Marshall, and if required, to the local Building Department.

C. Develop all documentation described under submittals, and other documentation as required.

D. The design shall be coordinated among trades and sources of supply.

E. Following approval by the Authorities Having Jurisdiction, submit the approved design package to the Owner's representatives for review.

F. Prior to rough-in, conduct a pre-installation conference as described in this Specification.

G. An emergency warning system with visual strobe devices is required for the hearing impaired, and shall be shown.

H. Provide smoke detectors as required for operation of smoke dampers, duct detectors with test switch to shut down air conditioning equipment, and protection of openings in fire-rated partitions. Include monitoring of sprinkler system flow, tamper switches, and backflow preventer.

I. The work shall not be started until the detailed drawings, specifications, and engineering calculations have been accepted and approved by the State Fire Marshal. Contractor shall provide approved copy to the Engineer.

J. Conform with NFPA 72, UFC, and Document Drawings. Where conflict exists between applicable code and Document Drawings, comply with the stricter requirement.

K. Operator control of the fire alarm system shall be possible at the fire alarm control panel (FACP) and at the annunciator. Operator control includes arming or disarming the system acknowledging alarms, and observing system status.

L. All field circuits shall be supervised. Field circuit failure shall occur on open circuit, closed circuit, or foreign grounded circuit. On field wiring failure, the operator shall be able to discern the source of the failure on the control panel. In the event of alarm system trouble arising from field circuit failure, logic unit failure, or loss of 60-Hz power, then an alarm shall be reported.

1.4 SUBMITTALS FOR REVIEW

A. Provide complete detailed design submittal to the State Fire Marshal within 14 days of the Notice-to-Proceed. The detailed design submittal shall include the following, minimum:

1. Indicate what type of system is being provided.

2. Provide catalog data, SFM listing number, and model number for every fire alarm system component.

3. Provide single-line diagram, riser, and point-to-point wiring diagrams, and sequence of system operation matrix.

4. An emergency warning system with visual strobe devices is required for the hearing impaired.

5. Indicate the conduit sizes, quantity and type of conductors, and whether the system is power limited or non-power limited.

6. Provide battery calculations for the entire system (24-hour standby, 5-minute alarm time).

7. Provide floor plans showing locations of all fire alarm equipment. Interconnect wiring, remote power supplies, and annunciator.

8. Provide smoke detectors as required for operation of smoke dampers, duct detectors with test switch to shut down air conditioning equipment, and protection of openings in fire-rated partitions. Includes monitor sprinkler system flow, tamper switches, and backflow preventer.

9. Provide monitoring of the fire sprinkler riser flow switch.

10. Provide voltage drop calculations for both initiation and signal circuits.

11. Sequence of operations/events: Include detail on arming/disarming, audible alarming, visual indications, and acknowledge sequencing.

12. Submit system documentation to Authorities Having Jurisdiction for approval. Revise submittal as required and obtain written approval from the Fire Marshal. Submit letter of approval for Engineer review.

B. Shop Drawings: Include locations of devices and equipment, conduit routing, wiring requirements, device cutsheets, and a complete system diagram.

1.5 SUBMITTALS FOR INFORMATION

A. NFPA 72 system test report.

1.6 QUALITY ASSURANCE

A. Installer: Authorized by manufacturer to install and service products furnished under this Section.

B. It will be the responsibility of the fire alarm contractor to ensure proper specification adherence for system operation, final connection, test, turnover, warranty compliance, and after-market service. The installer of the equipment specified must be factory-trained and certified.

C. All equipment and components shall be new and the manufacturer’s current model. The materials, appliances, equipment, and devices shall be tested and listed by a Nationally recognized testing organization in accordance with the latest NFPA 72 edition with State amendments.

D. All equipment and components shall be installed in strict compliance with manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

E. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place. Fasteners and supports shall be adequate to support the required load.

F. The installing contractor shall provide a copy of current documentation, indicating that the subcontractors installing fire alarm systems or devices are certified by Underwriters Laboratories (UL) in its product directories under the listing category, "PROTECTIVE SIGNALING SERVICES – LOCAL, AUXILIARY, REMOTE STATION, AND PROPRIETARY." The fire alarm equipment installing contractor must also provide complete installation of all wiring and equipment.

1.7 PRE-INSTALLATION FIRE ALARM CONFERENCE

A. Convene pre-installation conference prior to installation of back boxes and raceway components to support fire alarm devices. The Fire Alarm Contractor shall provide copies of design documents to participants in the conference.

B. Attendees:

1. General Contractor
2. Electrical Subcontractor
3. Architect and Engineer
4. Owner (Owner's Representative)
5. Fire Marshal
6. Fire Alarm Contractor

C. Notify Architect and Engineer 7 working days prior to meeting.

D. Prepare agenda, and preside at meeting. Include the following topics:

1. Review locations, mounting heights, and installation requirements for all devices.
2. Review interconnection requirements.

E. Document final locations, connection points, and mounting heights where at variance with Drawings. Distribute documentation to affected subcontractors and to the Architect and the Engineer.

PART 2 – <u>PRODUCTS</u> – NOT USED

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions and NFPA 72.

B. The fire alarm/life safety installation shall comply fully with all local, State, and National codes, and the local Authority Having Jurisdiction.

C. Install cable in conduit in spaces above gypsum board ceilings and soffits.

D. Do not run cable or conduit exposed.

E. Program FACP to meet local Fire Marshal requirements.

F. Support cable independently of ceiling members, ceiling support wires, pipes, conduits, and air conditioning ducts.

G. Install conduit under provisions of Section, “RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS”.

H. All wiring shall be in accordance with the National Electrical Code, local codes, National Fire Protection Association Standard No. 72 with State amendments.

I. Fire alarm control panel and all other equipment shall be mounted with the center of all operable reset buttons, located a maximum of 48 inches front approach/54 inches side approach above floor level.

J. The fire alarm control panel and power supply shall be connected to a dedicated branch circuit, maximum 20 amperes. This circuit shall have a red handle with lock-on device and labeled as FIRE ALARM.

K. Fire sprinkler activation detecting system(s) shall each be indicated on a separate zone in the fire alarm control panel.

L. A terminal cabinet shall be installed in the electric room for the fire alarm system. All fire alarm wiring shall terminate on UL-approved strips in this terminal cabinet. All wiring shall be labeled at each termination strip. Wiring shall be configured such that all end-of-line resistors will be installed at the terminal cabinet.

3.2 FIELD QUALITY CONTROL

A. Test in accordance with NFPA 72.

B. As a part of this Contract, the Contractor shall return to provide 100% test of all devices and the operation of the system, including battery tests, after a period of 1 year from the final acceptance of the system. The test shall meet current guidelines as established by NFPA. All test results shall be documented and results provided to the Owner. All defective parts shall be replaced at no cost to the Owner.

C. Provide three copies of operation and maintenance manuals. Manuals shall include the following:

1. Equipment suppliers
2. Service contact names, addresses, and telephone numbers
3. Record (as-built) Contract Drawings marked in red pencil to show work revisions
4. Test reports

END OF SECTION