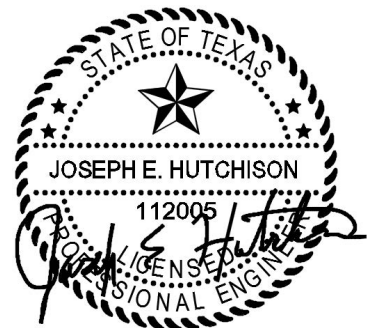


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MEP Engineer:

Joe E. Hutchison, PE



08-14-15

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Identification for Plumbing Piping and Equipment.
 - 2. Sleeves.
 - 3. Mechanical sleeve seals.
 - 4. Formed steel channel.

1.2 SUBMITTALS

- A. Shop Drawings: Submit for piping and equipment identification list of wording, symbols, letter size, and color coding for pipe identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- B. Product Data for Pipe and Equipment Identification: Submit for mechanical identification manufacturers catalog literature for each product required.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with national and local codes and standards.
- B. Maintain one copy of each document on site.

PART 2 PRODUCTS

2.1 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

- A. Furnish materials in accordance with national and local codes and standards
- B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Color and Lettering: Conform to ASME A13.1.
- C. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.2 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sealant: Acrylic; refer to Section 07 90 00.

2.3 MECHANICAL SLEEVE SEALS

A. Manufacturers:

1. Thunderline Link-Seal, Inc.
2. Substitutions: Owner approved equal.

B. Furnish materials in accordance with local codes and ordinances.

2.4 FORMED STEEL CHANNEL

A. Manufacturers:

1. Unistrut Corp.
2. Substitutions: Owner approved equal.

B. Furnish materials in accordance with national and local codes and standards.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves.

3.2 INSTALLATION - PIPING AND EQUIPMENT IDENTIFICATION

A. Install plastic nameplates with adhesive.

3.3 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

E. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install chrome plated stainless steel escutcheons at finished surfaces.

END OF SECTION

SECTION 22 07 00
PLUMBING INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plumbing piping insulation, jackets and accessories.
 - 2. Plumbing equipment insulation, jackets and accessories.

1.2 SUBMITTALS

- A. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
- B. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

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. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.
- D. Perform Work in accordance per manufacturer's recommendations.
- E. Maintain one copy of each document on site.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- B. Maintain temperature before, during, and after installation for minimum period of 24 hours.

1.6 WARRANTY

- A. Furnish five year manufacturer warranty for man made fiber.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:
 - 1. Owens-Corning.
 - 2. Substitutions: Owner approved equal.
- B. Manufacturers for Closed Cell Elastomeric Insulation Products:
 - 1. Aeroflex. Aerocell.
 - 2. Substitutions: Owner approved equal.
- C. Manufacturers for Polyisocyanurate Foam Insulation Products:
 - 1. Dow Chemical Company.
 - 2. Substitutions: Owner approved equal.
- D. Manufacturers for Extruded Polystyrene Insulation Products:
 - 1. Dow Chemical Company.
 - 2. Substitutions: Owner approved equal.

2.2 PIPE INSULATION

- A. TYPE P-1: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.
 - 1. Thermal Conductivity: 0.27 at 75 degrees F.
 - 2. Operating Temperature Range: Range: Minus 70 to 180 degrees F.
- B. TYPE P-2: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.
 - 1. Thermal Conductivity: 0.30 at 75 degrees F.
 - 2. Maximum Service Temperature: 300 degrees F.
 - 3. Operating Temperature Range: Range: Minus 58 to 300 degrees F.
- C. TYPE P-3: ASTM C534, Type I, flexible, nonhalogen, closed cell elastomeric insulation, tubular.
 - 1. Thermal Conductivity: 0.27 at 75 degrees F.
 - 2. Maximum Service Temperature: 250 degrees F.
 - 3. Operating Temperature Range: Range: Minus 58 to 250 degrees F.

2.3 PIPE INSULATION JACKETS

- A. Vapor Retarder Jacket:
 - 1. [ASTM C921,] white Kraft paper with glass fiber yarn, bonded to aluminized film.
 - 2. Water vapor transmission: ASTM E96/E96M; 0.02 perm-inches.
- B. PVC Plastic Pipe Jacket:
 - 1. Product Description: [ASTM D1785,] One piece molded type fitting covers and sheet material, off-white color.
 - 2. Thickness: 10 mil.
 - 3. Connections: Brush on welding adhesive or pressure sensitive color matching vinyl tape.
- C. Field Applied Glass Fiber Fabric Jacket System:
 - 1. Indoor Vapor Retarder Finish:
 - a. Cloth: Untreated; 9 oz/sq yd weight.
 - b. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.4 PIPE INSULATION ACCESSORIES

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.
- B. Covering Adhesive Mastic: Compatible with insulation.
- C. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.
- D. Piping 2 inches diameter and larger: Wood insulation saddle, hard maple. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.
- E. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum single piece construction with self adhesive closure. Thickness to match pipe insulation.
- F. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- G. Adhesives: Compatible with insulation.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify piping has been tested before applying insulation materials.
- B. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

- A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.
- B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 07 84 00 for penetrations of assemblies with fire resistance rating greater than one hour.
- C. Piping Systems Conveying Fluids Below Ambient Temperature:
 - 1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections and expansion joints.
 - 2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
 - 3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.
- D. Hot Piping Systems less than 140 degrees F:
 - 1. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.
- E. Hot Piping Systems greater than 140 degrees F:
 - 1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
 - 3. Insulate flanges and unions at equipment.
- F. Inserts and Shields:
 - 1. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
 - 2. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.
 - a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
 - b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.
- G. Insulation Terminating Points:
 - 1. Condensate Piping: Insulate entire piping system and components to prevent condensation.
- H. Closed Cell Elastomeric Insulation:
 - 1. Push insulation on to piping.
 - 2. Miter joints at elbows.
 - 3. Seal seams and butt joints with manufacturer's recommended adhesive.

4. When application requires multiple layers, apply with joints staggered.
5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

END OF SECTION

SECTION 22 10 00

PLUMBING PIPING AND PUMPS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe hangers and supports.
 - 2. Pipe and pipe fittings.
 - 3. Valves.
 - 4. Piping specialties.
 - 5. Plumbing drainage specialties.
 - 6. Plumbing supply specialties.
 - 7. Plumbing pumps.

1.2 SUBMITTALS

- A. Product Data:
 - 1. Pipe Hangers and Supports: Submit manufacturers catalog data including load carrying capacity.
 - 2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
 - 3. Plumbing drainage specialties: Submit manufacturers catalog information with sizes, capacities, rough-in requirements, service sizes, and finishes.
 - 4. Plumbing supply specialties: Submit manufacturers catalog information with sizes, capacities, rough-in requirements, service sizes, and finishes.
 - 5. Pumps: Include capacities, pump curves, equipment performance, and electrical characteristics.
- B. Pipe Hangers and Supports: Design data, indicate pipe sizes, load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- C. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit spare parts lists and maintenance procedures.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with national and local codes and ordinances.
- B. Maintain one copy of each document on site.

1.5 WARRANTY

- A. Furnish five year manufacturer warranty for pumps.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Furnish materials in accordance with local codes and ordinances.
- B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch [Malleable iron] [Carbon steel], adjustable swivel, split ring.
- C. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.
- D. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.
- E. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.
- F. Vertical Support: Steel riser clamp.

2.2 PIPES AND TUBES

- A. Sanitary Sewer Piping, Buried Within 5 Feet of Building and Sanitary Sewer Piping, above Grade:
 - 1. PVC Pipe: ASTM D2665 or ASTM D3034 SDR 26, polyvinyl chloride (PVC) material.
 - a. Fittings: PVC, ASTM D2665 or ASTM D3034.
 - b. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
 - 2. Water Piping, Buried Within 5 Feet of Building:
 - 3. Copper Tubing: ASTM B42, Tempered O61 annealed without fittings.
- B. Water Piping, above Grade:
 - 1. CPVC Pipe: ASTM D2846/D2846M with CPVC fittings and solvent weld joints.
- C. Storm Water Piping, Buried Within 5 Feet of Building and Storm Water Piping, above Grade:
 - 1. PVC Pipe: ASTM D2665 or ASTM D3034 SDR 26, polyvinyl chloride (PVC) material.
 - a. Fittings: PVC, ASTM D2665 or ASTM D3034.
 - b. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
- D. Equipment Drains and Overflows:
 - 1. PVC Pipe: SDR 26, PVC fittings, solvent weld joints.
- E. Flue
 - 1. Type "B" or "C" Double Wall Flue

2.3 VALVES

- A. Manufacturers:

1. NIBCO
 2. Or owner approved equal
- B. For drinking water service, provide valves complying with NSF 61.
- C. Relief Valves:
1. Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

2.4 PIPING SPECIALTIES

2.5 PLUMBING DRAINAGE SPECIALTIES

A. Roof Drains:

1. Manufacturers:
 - a. Wade
2. Roof Drains: Lacquered cast iron body with sump:
 - a. Strainer: Removable metal dome.
 - b. Accessories: Coordinate with roofing type:
 - 1) Membrane flange and membrane clamp with integral gravel stop.
 - 2) Adjustable under deck clamp.
 - 3) Roof sump receiver.
 - 4) Waterproofing flange.
 - 5) Controlled flow weir.
 - 6) Leveling frame.
 - 7) Adjustable extension sleeve for roof insulation.
 - 8) Perforated or slotted ballast guard extension for inverted roof.
 - 9) Perforated stainless steel ballast guard extension.
3. Roof Overflow Drains: Lacquered cast iron body and clamp collar and bottom clamp ring; pipe extended above flood elevation.

B. Floor Drains:

1. Manufacturers:
 - a. Wade
2. Floor Drain: Lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and square, adjustable nickel-bronze strainer.

C. Floor Sinks:

1. Manufacturers:
 - a. Wade
2. Floor Sink (FS-1): Galvanized cast iron body with dome strainer and seepage flange.

D. Cleanouts:

1. Manufacturers:
 - a. IOSAM
 - b. Tyler Pipe
 - c. Wade
 - d. Substitutions: Owner approved equal.
2. Furnish materials in accordance with local codes.

2.6 PLUMBING SUPPLY SPECIALTIES

A. Backflow Preventers:

1. Manufacturers:
 - a. WATTS
 - b. Or owner approved equal.
 - c. Substitutions: Owner approved equal.
2. Furnish materials in accordance with local codes and ordinances.
3. Reduced Pressure Backflow Preventers: ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; pressure relief valve located between check valves; third check valve opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

B. Hose Bibbs/Hydrants:

1. Manufacturers:
 - a. Woodford
 - b. Or owner approved equal
2. Wall Hydrant: Non-freeze, self-draining type with chrome plated wall plate hose thread spout, removable key and vacuum breaker.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify excavations are to required grade, dry, and not over-excavate.

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 piping before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.3 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 over 4 inches.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

3.4 INSTALLATION - PIPING SYSTEMS

- A. Install dielectric connections wherever jointing dissimilar metals.
- B. Install unions downstream of valves and at equipment or apparatus connections.
- C. Route piping parallel to building structure and maintain gradient.
- D. Install piping to maintain headroom. Group piping to conserve space. Group piping whenever practical at common elevations.
- 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. Sleeve pipe passing through partitions, walls and floors.
- H. Install piping system allowing clearance for installation of insulation and access to valves and fittings.
- I. Install identification on piping systems including underground piping. Refer to Section 22 05 00.
- J. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

3.5 INSTALLATION - VALVES

- A. Install valves with stems upright or horizontal, not inverted.
- B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- C. Install ball valves for throttling, bypass, or manual flow control services.

- D. Provide lug end butterfly valves adjacent to equipment when functioning to isolate equipment.
- E. Install spring loaded check valves on discharge of pumps.

3.6 INSTALLATION - PIPING SPECIALTIES

- A. Install pressure gages with pulsation dampers. Provide needle valve or ball valve to isolate each gage. Extend nipples and siphons to allow clearance from insulation.
- B. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.
- C. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- D. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.
- E. Provide drain and hose connection with valve on strainer blow down connection.
- F. Test backflow preventers in accordance with ASSE 5013.

3.7 INSTALLATION - PLUMBING SUPPLY PIPING

- A. Install water piping in accordance with ASME B31.9.
- B. Excavate and backfill in accordance with Section 31 20 00.
- C. Establish elevations of buried piping outside the building to obtain not less than 24 inches of cover.
- D. Slope water piping and arrange to drain at low points.
- E. Install piping from relief valves, back-flow preventers and drains to nearest floor drain.
- F. Disinfecting of Domestic Water Systems:
 - 1. Prior to starting, verify system is complete, flushed and clean.
 - 2. Verify pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda) or acid (hydrochloric).
 - 3. Inject disinfectant, free chlorine in liquid, powder and tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.
 - 4. Bleed water from outlets to obtain distribution and test for disinfectant residual at minimum 15 percent of outlets.
 - 5. Maintain disinfectant in system for 24 hours.
 - 6. When final disinfectant residual tests less than 25 mg/L, repeat treatment.
 - 7. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.
 - 8. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.8 INSTALLATION - PLUMBING DRAINAGE PIPING

- A. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Install with clearance at cleanout for rodding of drainage system.
- B. Encase exterior cleanouts in concrete flush with grade.
- C. Install floor cleanouts at elevation to accommodate finished floor.
- D. Establish elevations of buried piping outside building to provide not less than 36 inches of cover.
- E. Install piping penetrating roofed areas to maintain integrity of roof assembly.
- F. Excavate and backfill in accordance with Section 31 20 00.
- G. Establish invert elevations, slopes for drainage to 1/4 inch per foot, 1/8 inch per foot minimum. Maintain gradients.
- H. Test drainage piping in accordance with local code requirements.

3.9 INSTALLATION - PUMPS

- A. Install line size shut-off valve and strainer on pump suction. Install line size check valve, shut-off valve, and balancing valve on pump discharge.
- B. Install pumps with shaft length allowing sump pumps to be located minimum 24 inches below lowest invert into sump pit and minimum 6 inches clearance from bottom of sump pit.

3.10 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed and clean. Verify pH of water to be treated is between 7.4 and 7.6 by adding alkali caustic soda or soda ash or acid hydrochloric.
- B. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual. Bleed water from outlets to accomplish distribution.
- C. Maintain disinfectant in system for 24 hours. When final disinfectant residual tests less than 25 mg/L, repeat treatment.
- D. Flush disinfectant from system. Take samples no sooner than 24 hours after flushing, and analyze in accordance with AWWA C601.

3.11 SCHEDULES

- A. Refer to plans for all equipment schedules.

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Water closets.
 - 2. Urinals.
 - 3. Lavatories.
 - 4. Sinks.
 - 5. Bathtubs.
 - 6. Electric water coolers.
 - 7. Service sinks.
 - 8. Dishwashers.
 - 9. Clothes washers (laundry room).

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's literature for plumbing fixtures.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit literature and parts list.

1.4 QUALITY ASSURANCE

- A. Provide plumbing fixture fittings in accordance with ASME A112.18.1 that prevent backflow from fixture into water distribution system.
- B. Maintain one approved copy of each document on site.

1.5 WARRANTY

- A. Furnish 5 year manufacturer warranties for electric water cooler compressor.

PART 2 PRODUCTS

2.1 TANK TYPE WATER CLOSETS

- A. Manufacturers: (for Club only)
 - 1. Kohler Toilet Model No. K-3999-0 with Cachet Elongated Toilet Seat Model No. K-4636-0.
 - 2. Flush volume 1.28 gal.
 - 3. Substitutions: Owner approved equal.

- B. Manufactures;(for Units)
 - 1. Mansfield, alto with elongated bowl
 - 2. Substitutions: Owner approved equal.

2.2 WALL HUNG URINALS

- A. Manufacturers:
 - 1. Kohler Model K-5016-ER-0
 - 2. Substitutions: Owner approved equal.
- B. Urinal: ASME A112.19.2M or ANSI Z124.9, vitreous china, wall hung urinal with shields, integral trap, 3/4 inch top spud, steel supporting hanger; maximum 0.5 gallon flush volume.
- C. Flush Valve: Exposed chrome plated, diaphragm type with oscillating handle, escutcheon, integral screwdriver stop, vacuum breaker.

2.3 LAVATORIES

- A. Manufacturers: (for Club only)
 - 1. Kohler Model Verticyl K-2882-0
 - 2. Faucet, Kallista Model No. P24401-CR with 1.5 gpm flow rate.
 - 3. Substitutions: Owner approved equal.
- B. Vitreous China Counter Undermount Lavatory.
- C. Manufacturers: (for Units)
 - 1. Mansfield 237 MS Oval
 - 2. Substitutions: Owner approved equal.

2.4 SINKS

- A. Manufacturers: (for Club only)
 - 1. Kitchen: Elkay USA Model No. ELUHAD281655PD
 - 2. Breakroom: Elkay USA Model No. GECCR3321
 - 3. Faucet, Kohler Model No. K-7547-4-BL with 1.8 gpm flow rate.
 - 4. Reception Bar Sink: Kohler Model No. K-5287-NA
 - 5. Faucet, Brizo Model No. 3970LF-BLST with 1.8 gpm flow rate.
 - 6. Substitutions: Owner approved equal.
- B. Manufacturers: (for Units)
 - 1. Dayton Kingsford
 - 2. Substitutions: Owner approved equal.

2.5 ELECTRIC WATER COOLERS

- A. Manufacturers:
 - 1. Elkay.
 - 2. Substitutions: Owner approved equal.
- B. Fountain: ARI 1010; surface mounted electric water cooler with stainless steel top, vinyl on steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, mounting bracket, refrigerated with integral air cooled condenser.
- C. Capacity: 8gpm of 50 degree F water with inlet at 80 degree F and room temperature of 90 degree F 120 volt compressor.

2.6 SERVICE SINKS

- A. Manufacturers:
 - 1. Kohler.
 - 2. Substitutions: Owner approved equal.
- B. Bowl: 22 x 18 x 12 inch deep, porcelain enameled inside only cast iron roll-rim sink, with 12 inch high back, concealed hanger, chrome plated strainer, cast iron P-trap with adjustable floor flange.
- C. Trim: Per schedule.

2.7 DISHWASHER

- A. Manufacturers:
 - 1. General Electric.
 - 2. Substitutions: Owner approved equal.

2.8 CLOTHES WASHER

- A. Manufacturers:
 - 1. Maytag
 - 2. Substitutions: Owner approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify adjacent construction is ready to receive rough-in work of this section.
- B. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.2 INSTALLATION

- A. Install each fixture with chrome plated rigid or flexible supplies with screwdriver stops, reducers, and escutcheons.
- B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

END OF SECTION

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Identification for HVAC Equipment.
 - 2. Sleeves.
 - 3. Mechanical sleeve seals.

1.2 SUBMITTALS

- A. Shop Drawings: Submit for piping and equipment identification list of wording, symbols, letter size, and color coding for pipe identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- B. Product Data for Pipe and Equipment Identification: Submit for mechanical identification manufacturers catalog literature for each product required.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with national and local codes and ordinances.
- B. Maintain one approved copy of each document on site.

PART 2 PRODUCTS

2.1 IDENTIFICATION FOR HVAC EQUIPMENT

- A. Manufacturers:
 - 1. Goodman.
 - 2. Substitutions: Owner approved equal.

2.2 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- C. Sleeves for Round Ductwork: Galvanized steel.
- D. Sleeves for Rectangular Ductwork: Galvanized steel.

E. Sealant: Acrylic.

2.3 MECHANICAL SLEEVE SEALS

A. Manufacturers:

1. Thunderline Link-Seal, Inc.
2. Substitutions: Owner approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves.

3.2 INSTALLATION - PIPING AND EQUIPMENT IDENTIFICATION

A. Install plastic nameplates with adhesive.

B. Install plastic tags with corrosion resistant metal chain.

3.3 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

E. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install chrome plated steel escutcheons at finished surfaces.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Testing, adjusting, and balancing of air systems.

1.2 SUBMITTALS

- A. Draft Reports: Submit for review prior to final acceptance of Project.
- B. Test Reports: Submit prior to final acceptance of Project and for inclusion in operating and maintenance manuals. Assemble in soft cover, letter size, 3-ring binder, with table of contents page and tabs, and cover identification. Include reduced scale drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with national and local codes and ordinances.
- B. Report Forms: AABC MN-1 National Standards for Total System Balance forms, Forms prepared following NEBB forms.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Mechanical contractor shall provide all testing and balancing in accordance with the local codes and requirements of the city.
- B. Before starting work, verify systems are complete and operable.
- C. Report defects, deficiencies, or abnormal conditions in mechanical systems preventing system balance.
- D. Beginning of work means acceptance of existing conditions.

3.2 INSTALLATION TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust to within plus or minus 10 percent of design.

3.3 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to deliver design supply, return, and exhaust air quantities within previously stated tolerances.
- B. Make air quantity measurements in ducts by traverse of entire cross sectional area of duct in common area HVAC systems.
- C. Measure air quantities at air inlets and outlets.
- D. Use volume control devices to regulate air quantities only to extent those adjustments do not create objectionable air motion or sound levels. Change volume using dampers mounted in ducts.
- E. Adjust outside air, return air, and exhaust air dampers for design conditions.
- F. At modulating damper locations, take measurements and balance at extreme conditions.
- G. All testing and balancing procedures shall conform and be in accordance with the local codes and requirements of the city.

3.4 FIELD QUALITY CONTROL

- A. Verify recorded data represents actually measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices. Set and lock memory stops.

END OF SECTION

SECTION 23 07 00
HVAC INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. HVAC piping insulation, jackets and accessories.
 - 2. HVAC ductwork insulation, jackets, and accessories.

1.2 SUBMITTALS

- A. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
- B. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

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. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.
- D. Maintain 1 copy of each document on site.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- B. Maintain temperature before, during, and after installation for minimum period of 24 hours.

1.6 WARRANTY

- A. Furnish five year manufacturer warranty for man made fiber.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:
 - 1. Owens-Corning.
- B. Manufacturers for Closed Cell Elastomeric Insulation Products:
 - 1. Aeroflex. Aerocell.
 - 2. Substitutions: Owner approved equal.

2.2 PIPE INSULATION

- A. TYPE P-5: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.
 - 1. Thermal Conductivity: 0.27 at 75 degrees F.
 - 2. Operating Temperature Range: Range: Minus 70 to 180 degrees F.
- B. TYPE P-11: ASTM C533; Type I, hydrous calcium silicate pipe insulation, rigid molded white; asbestos free.
 - 1. Thermal Conductivity: 0.45 at 200 degrees F.
 - 2. Operating Temperature Range: 140 to 1200 degrees F.

2.3 PIPE INSULATION JACKETS

- A. Field Applied Glass Fiber Fabric Jacket System:
 - 1. Indoor Vapor Retarder Finish:
 - a. Cloth: Untreated; 9 oz/sq yd weight.

2.4 DUCTWORK INSULATION ACCESSORIES

- A. Lagging Adhesive: Fire retardant type with maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- B. Impale Anchors: Galvanized steel, 12 gage self-adhesive pad.
- C. Adhesives: Compatible with insulation.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION - EQUIPMENT

- A. Factory Insulated Equipment: Do not insulate.

3.3 INSTALLATION - DUCTWORK SYSTEMS

- A. Duct dimensions indicated on Drawings are finished inside dimensions.
- B. Duct and Plenum Liner:
 - 1. Adhere insulation with adhesive for 100 percent coverage.
 - 2. Secure insulation with mechanical liner fasteners. Comply with SMACNA Standards for spacing.
 - 3. Seal and smooth joints. Seal and coat transverse joints.
 - 4. Seal liner surface penetrations with adhesive.
 - 5. Cut insulation for tight overlapped corner joints. Support top pieces of liner at edges with side pieces.

END OF SECTION

SECTION 23 30 00

HVAC AIR DISTRIBUTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Ductwork.
 - 2. Ductwork accessories.
 - 3. Fans.
 - 4. Terminal units.
 - 5. Air Outlets.
 - 6. Filters.

1.2 SUBMITTALS

- A. Shop Drawings - Duct Fabrication Drawings: Not required.
- B. Product Data: Not required.
- C. Operation and Maintenance Data: Not required.
- D. Manufacturer's Installation Instructions: Not required.
- E. Field Quality Control Reports.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Not required.

PART 2 PRODUCTS

2.1 DUCTWORK

- A. Duct Materials:
 - 1. Galvanized Steel Ducts: Galvanized steel sheet, lock-forming quality.
- 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, gages, 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, gages, 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 airfoil turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.
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 and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 4 inch (100 mm) 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.

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 gage to 24 inches size in each direction, and two gages 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 x 30 inch.
4. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 8 x 72 inch. 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 multi-blade dampers. Where width exceeds 30 inches, furnish regulator at both ends.

B. Turning Devices and Extractors:

1. Multi-blade device with blades aligned in short dimension; steel or aluminum construction; with individually adjustable blades, mounting straps.
2. Multi-blade device with radius blades attached to pivoting frame and bracket, steel or aluminum construction, with push-pull operator strap.

C. Flexible Duct Connections:

1. UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A.

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.

2.3 AIR OUTLETS AND INLETS

A. Manufacturers:

1. Metal-Aire

2. Substitutions: Owner approved equal.

B. Grilles: White, stamped metal face.

2.4 FILTERS

A. Manufacturers:

1. American Air Filter: MERV-7 or equal.
2. Substitutions: Owner approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Metal Ducts: Install in accordance with SMACNA Duct Construction Standards - Metal and Flexible.

B. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

C. Fiberglass Ducts: Install in accordance with SMACNA Fibrous Glass Duct Construction Standards.

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. Install back-draft dampers on discharge of exhaust fans.

F. Install duct insulation specified in Section 22 07 00 Plumbing Insulation.

G. Install fire dampers with perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

H. Inaccessible fire dampers.

I. Access Door Sizes: Install minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access. Install 4 x 4 inch for balancing dampers only.

J. Install fire dampers, combination fire and smoke dampers and smoke dampers with perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

K. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A.

L. 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. In clubhouse only.

M. Do not operate fans until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

N. Install sheaves required for final air balance.

3.2 TESTING

A. For ductwork designed for 3 inches w.c. above ambient, pressure test minimum 25 percent of ductwork after duct cleaning, but before duct insulation is applied or ductwork is concealed.

1. Test in accordance with SMACNA HVAC Air Duct Leakage Test Manual.
2. Maximum Allowable Leakage: In accordance with ICC IECC.

3.3 SCHEDULES

A. Refer to plans for all schedules.

END OF SECTION

SECTION 23 81 26

SPLIT-SYSTEM AIR CONDITIONERS (VRF)

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Air handling unit.
 - 2. Condensing unit.

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.
- C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.
- D. Manufacturer's Field Reports: Submit start-up report for each unit.

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 Rating (EER) not less than prescribed by ASHRAE 90.1 when used in combination with compressors and evaporator coils when tested in accordance with ARI 210/240.
- B. Cooling Capacity: Rate in accordance with ARI 210/240.
- C. Sound Rating: Measure in accordance with ARI 270.

- D. Insulation and adhesives: Meet requirements of NFPA 90A.
- E. Perform Work in accordance with national and local codes.
- F. Maintain one copy of each document on site.

1.5 WARRANTY

- A. Furnish five year manufacturer warranty for compressors.

1.6 MAINTENANCE SERVICE

- A. Furnish service and maintenance of equipment for one year from Date of Substantial Completion. Include maintenance items as shown in manufacturer's operating and maintenance data, including filter replacements, fan belt replacement, and controls checkout and adjustments.
- B. Furnish 24-hour emergency service on breakdowns and malfunctions for this maintenance period.

PART 2 PRODUCTS

2.1 SPLIT SYSTEM AIR CONDITIONING UNITS (VRF)

- A. Manufacturers:
 - 1. LG Multi V (VRF).
 - 2. Substitutions: Owner approved equal.
- B. Furnish materials in accordance with national and local codes.
- C. Product Description: Split system consisting of air handling unit and condensing unit including cabinet, evaporator fan, refrigerant cooling coil, compressor, refrigeration circuit, condenser, electric heating coil, air filters, controls, air handling unit accessories, condensing unit accessories, and refrigeration specialties.

2.2 AIR HANDLING UNIT

- A. Configuration: As indicated on Drawings.
- B. Cabinet:
 - 1. Panels: Constructed of galvanized steel with baked enamel finish. Access Panels: Located on both sides of unit. Furnish with duct collars on inlets and outlets.
 - 2. Insulation: Factory applied to each surface to insulate entire cabinet.
- C. Evaporator Fan: Forward curved centrifugal type, resiliently mounted with high efficiency motor complying with NEMA MG1, Type 1. Motor permanently lubricated with built-in thermal overload protection.

- D. Evaporator Coil: Constructed of copper tubes expanded onto aluminum fins. Factory leak tested under water. Removable, PVC construction, double-sloped drain pan with piping connections on both sides.
- E. Refrigeration System: Single refrigeration circuits controlled by factory installed thermal expansion valve.
- F. Electric Heating Coil: Helical nickel-chrome resistance wire coil heating elements with refractory ceramic support bushings easily accessible with automatic reset thermal cut-out, built-in contactors, galvanized steel frame, control circuit transformer and fuse, load fuses.
- G. Air Filters: Washable resin or Plasma.
- H. Air Handling Unit Accessories:
 - 1. Return Air Grille: mounted in return air opening of aluminum construction and fixed louvers.
 - 2. Mounting Sub base with construction and finish matching unit casing.

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 semi-hermetic reciprocating type compressors, resiliently mounted, with positive lubrication, and internal motor overload protection.
- D. Condenser Coil: Constructed of copper tubing mechanically bonded to aluminum, factory leak and pressure tested.
- E. Controls: Furnish operating and safety controls including high and low pressure cutouts. Control transformer. Furnish magnetic contactors for compressor and condenser fan motors.
- F. 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.
- G. Condensing Unit Accessories: Furnish the following accessories:
 - 1. Controls to provide low ambient cooling to 0 degrees F.
 - 2. Time delay relay.
 - 3. Anti-short cycle timer.
 - 4. Disconnect switch.
 - 5. Vibration isolators.

6. Condenser Coil Guard: Condenser fan openings furnished with PVC coated steel wire safety guards.
7. Suction and discharge pressure gauges.

H. Refrigeration specialties: Furnish the following:

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: Remote space thermostat with two stage heating and single stage cooling with manual changeover. Furnish system selector switch heat-off-cool.
- B. Thermostat: 7 day programmable electronic space thermostat with two stage heating and single stage cooling with manual changeover and heating setback and cooling setup capability. Furnish system selector switch heat-off-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.
- B. 120/240 volts, single phase operation.

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 air handling units on vibration isolators.
- B. Connect air handling units to supply and return ductwork with flexible connections.
- C. Install condensate piping with trap and route from drain pan to condensate drainage system.
- D. Install components furnished loose for field mounting.

- E. Install connection to electrical power wiring in accordance with Section 26 05 03.
- F. Install Work in accordance with national and local codes.

3.3 INSTALLATION - CONDENSING UNIT

- A. Install units on concrete foundations. Refer to Section 03 30 00.
- 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 temporary filters during construction period. Replace with permanent filters at Substantial Completion.

3.6 DEMONSTRATION

- A. Demonstrate air handling unit operation and maintenance.
- B. Demonstrate starting, maintenance, and operation of condensing unit including low ambient temperature operation.

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.

3.8 SCHEDULES

- A. Refer to plans for schedules.

END OF SECTION

SECTION 26 05 00

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes grounding electrodes and conductors; bonding methods and materials; conduit and equipment supports, anchors and fasteners; and nameplates and wire markers.

1.2 SYSTEM DESCRIPTION

- A. Grounding systems use metal underground pipe and driven ground rod as grounding electrodes. Grounding system connections use mechanical fasteners.
- B. All grounding shall be done in accordance with Article 250 of the NEC and local code requirements.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's catalog data for grounding electrodes and connections; for fastening components; and nameplates, labels, and markers.

PART 2 PRODUCTS

2.1 ROD ELECTRODES

- A. Manufacturers:
 - 1. ERICO.
 - 2. Substitutions: Owner approved equal.
- B. Product Description: Copper or copper-clad steel, 1/2 inch diameter rod electrode, 10 feet in length.

2.2 NAMEPLATES

- A. Product Description: Engraved three-layer laminated plastic nameplate, black letters on white background.
- B. Letter Size:
 - 1. 1/4 inch letters for identifying grouped equipment and loads.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install rod electrodes at locations indicated.
- B. Fabricate supports from structural steel or formed steel members.
- C. Install nameplate parallel to equipment lines. Secure nameplate to equipment front using screws or rivets.

END OF SECTION

SECTION 26 05 03

EQUIPMENT WIRING CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes electrical connections to equipment.

1.2 REFERENCES

- A. National Electrical Manufacturers Association:
 - 1. NEMA WD 1 - General Requirements for Wiring Devices.
 - 2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit wiring device manufacturer's catalog information showing dimensions, configurations, and construction.
- C. Manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Submittal procedures.
- B. Project Record Documents: Record actual locations, sizes, and configurations of equipment connections.

1.5 COORDINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
- C. Determine connection locations and requirements.
- D. Sequence rough-in of electrical connections to coordinate with installation of equipment.
- E. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 PRODUCTS

2.1 CORD AND PLUGS

- A. Attachment Plug Construction: Conform to NEMA WD 1.
- B. Configuration: NEMA WD 6; match receptacle configuration at outlet furnished for equipment.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify equipment is ready for electrical connection, for wiring, and to be energized.

3.2 INSTALLATION

- A. Make electrical connections.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Install receptacle outlet to accommodate connection with attachment plug.
- E. Install cord and cap for field-supplied attachment plug.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

3.3 ADJUSTING

- A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide

personnel to operate electrical system and checkout wiring connection components and configurations.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Rod electrodes.
 - 2. Active electrodes.
 - 3. Wire.
 - 4. Grounding well components.
 - 5. Mechanical connectors.

1.2 SYSTEM DESCRIPTION

- A. Grounding systems use the following elements as grounding electrodes:
 - 1. Metal underground water pipe.
 - 2. Metal building frame.
 - 3. Concrete-encased electrode.
 - 4. Ground ring.
 - 5. Rod electrode.

1.3 DESIGN REQUIREMENTS

- A. System to be as required by the City of Austin and NEC 250.

1.4 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 5 ohms maximum.

1.5 SUBMITTALS

- A. Product Data: Not required.
- B. Test Reports: Required.
- C. Manufacturer's Installation Instructions: Not required.

1.6 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Required.

1.7 QUALITY ASSURANCE

- A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.

PART 2 PRODUCTS

2.1 ROD ELECTRODES

- A. Manufacturers:
 - 1. Erico, Inc.
- B. Product Description:
 - 1. Material: Copper-clad steel.
 - 2. Diameter: 3/4 inch.
 - 3. Length: 8 feet.
- C. Connector: U-bolt clamp.

2.2 WIRE

- A. Material: Stranded copper.
- B. Foundation Electrodes: 4 AWG.
- C. Grounding Electrode Conductor: Copper conductor bare.
- D. Bonding Conductor: Copper conductor bare.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with IEEE 142.
- B. Install grounding electrode conductor and connect to reinforcing steel in foundation footing.
- C. Install continuous grounding using underground cold water system and building steel as grounding electrode. Where water piping is not available, install artificial station ground by means of driven rods or buried electrodes.
- D. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.
- E. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with NEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits by

means of grounding bushings on terminations at panelboards with installed number 12 conductor to grounding bus.

3.2 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.13.
- C. Perform ground resistance testing in accordance with IEEE 142.
- D. Perform leakage current tests in accordance with NFPA 99.
- E. Perform continuity testing in accordance with IEEE 142.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Nameplates.
 - 2. Labels.
 - 3. Wire markers.
 - 4. Conduit markers.
 - 5. Stencils.
 - 6. Underground Warning Tape.
 - 7. Lockout Devices.

1.2 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data:
 - 1. Submit manufacturer's catalog literature for each product required.
 - 2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.
- C. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.3 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing Work of this section with three years experience approved by manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

- B. Accept identification products on site in original containers. Inspect for damage.
- C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.
- B. Install labels and nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

1.7 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for extra materials.
- B. Furnish two containers of spray-on adhesive.

PART 2 PRODUCTS

2.1 NAMEPLATES

- A. Product Description: Laminated three-layer plastic with engraved black letters on white contrasting background color.
- B. Letter Size:
 - 1. 1/4 inch (6 mm) high letters for identifying grouped equipment and loads.
- C. Minimum nameplate thickness: 1/8 inch.

2.2 LABELS

- A. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background.

2.3 WIRE MARKERS

- A. Description: split sleeve wire markers.
- B. Legend:
 - 1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.
 - 2. Control Circuits: Control wire number as indicated on schematic and interconnection diagrams, Drawings.

2.4 CONDUIT AND RACEWAY MARKERS

- A. Description: Nameplate fastened with straps, Nameplate fastened with adhesive, Labels fastened with adhesive, Stencils.
- B. Color:
 - 1. 208 Volt System: Black lettering on white background.
- C. Legend:
 - 1. 208 Volt System: 208 VOLTS.

2.5 STENCILS

- A. Stencils: With clean cut symbols and letters of following size:
 - 1. Up to 2 inches Outside Diameter of Raceway: 1/2 inch high letters.
 - 2. 2-1/2 to 6 inches Outside Diameter of Raceway: 1 inch high letters.
- B. Stencil Paint: As specified in Section 09 90 00 semi-gloss enamel, colors conforming to the following:
 - 1. Black lettering on white background.

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 painting.
- B. Nameplate Installation:
 - 1. Install nameplate parallel to equipment lines.
 - 2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.
 - 3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.
 - 4. Secure nameplate to equipment front using screws.
 - 5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
 - 6. Install nameplates for the following:
 - a. Switchboards.
 - b. Panelboards.
 - c. Transformers.
 - d. Service Disconnects.
- C. Label Installation:

1. Install label parallel to equipment lines.
 2. Install label for identification of individual control device stations.
 3. Install labels for permanent adhesion and seal with clear lacquer.
- D. Wire Marker Installation:
1. Install wire marker for each conductor at panelboard, pull boxes, outlet and junction boxes and each load connection.
 2. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
 3. Install labels at data outlets identifying patch panel and port designation as indicated on Drawings.
- E. Conduit Marker Installation:
1. Install conduit marker for each conduit longer than six feet.
 2. Conduit Raceway Marker Spacing: 20 feet on center.

END OF SECTION

SECTION 26 22 00

TRANSFORMERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Dry type transformers

1.2 SUBMITTALS

- A. Product Data: Required.
- B. Test Reports: Required.

1.3 CLOSEOUT SUBMITTALS

- A. Record Documentation: Required.

PART 2 PRODUCTS

2.1 DRY TYPE TRANSFORMERS

- A. Manufacturer List:
 - 1. Cutler-Hammer as basis of design.
- B. Substitution: Owner approved equal.
- C. Description: NEMA ST 20, factory-assembled, air-cooled, dry type transformers.
 - 1. Mounting: Trapeze.
- D. Operation
 - 1. Primary Voltage: 208 volts, 3 phase.
 - 2. Secondary Voltage: 208Y/120 volts, 3 phase.
 - 3. Sound Levels: NEMA ST 20.
- E. Materials:
 - 1. Coil Conductors: Continuous copper.
 - 2. Enclosure: NEMA ST 20, ventilated. Furnish lifting eyes or brackets and trapeze mount.

END OF SECTION

SECTION 26 24 13

SWITCHBOARDS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes main switchboards.
- B. Related Sections:
 - 1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
 - 2. Section 26 05 53 - Identification for Electrical Systems.
 - 3. Section 26 25 00 - Enclosed Bus Assemblies.
 - 4. Section 26 28 13 - Fuses.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI C12.1 - Code for Electricity Metering.
 - 2. ANSI C39.1 - Requirements, Electrical Analog Indicating Instruments.
- B. Institute of Electrical and Electronics Engineers:
 - 1. IEEE C57.13 - Standard Requirements for Instrument Transformers.
 - 2. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
- C. National Electrical Manufacturers Association:
 - 1. NEMA FU 1 - Low Voltage Cartridge Fuses.
 - 2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
 - 3. NEMA PB 2 - Deadfront Distribution Switchboards.
 - 4. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less.
- D. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- E. Underwriters Laboratories Inc.:
 - 1. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars for each phase, [neutral,] and ground; and switchboard instrument details.

- C. Product Data: Submit electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of equipment and components.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations, configurations, and ratings of switchboards and their components on single line diagrams and plan layouts.
- C. Operation and Maintenance Data: Submit spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Deliver in 48 inch maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.
- C. Accept switchboards on site. Inspect for damage.
- D. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.
- E. Handle in accordance with NEMA PB 2.1. Lift only with lugs provided. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements.
- B. Conform to NEMA PB 2 service conditions during and after installation of switchboards.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 SEQUENCING

- A. Section 01 10 00 - Summary: Work sequence.
- B. Sequence Work to avoid interferences with building finishes and installation of other products.

1.10 MAINTENANCE MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish two of each key.
- C. Furnish two fuse pullers.

1.11 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish three of each size and type of fuse installed.

PART 2 PRODUCTS

2.1 DISTRIBUTION SWITCHBOARDS

- A. Manufacturers:
 - 1. Square D.
 - 2. Substitutions: Owner approved equal.
- B. Product Description: NEMA PB 2, enclosed switchboard with electrical ratings and configurations as indicated on Drawings.
- C. Device Mounting:
 - 1. Refer to plans and schedules.
- D. Bus:
 - 1. Material: Copper with standard size.
 - 2. Connections: Bolted, accessible from front for maintenance.
 - 3. Bus bars.
- E. Ground Bus: Insulated, extend length of switchboard.
- F. Line and Load Terminations: Accessible from front only of switchboard, suitable for conductor materials and sizes as indicated on Drawings.
- G. Utility Metering Compartment: Furnish metering transformer compartment for Utility Company's use, in accordance with Utility Company requirements.
- H. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.
- I. Mimic Bus: Show bussing, connections and devices in single line form on front panels of switchboard using black color factory painting, fastened flat against panel face with screws.

2.2 FUSIBLE SWITCH ASSEMBLIES

- A. Manufacturers:

1. Square D.
 2. Substitutions: Owner approved equal.
- B. Product Description: NEMA KS 1, Type HD, load interrupter knife switch. Handle lockable in OFF position.
- C. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses.

2.3 MOLDED CASE CIRCUIT BREAKER

- A. Manufacturers:
1. Square D.
 2. Substitutions: Owner approved equal.
- B. Product Description: UL 489, molded-case circuit breaker.
- C. Field-Adjustable Trip Circuit Breaker: Circuit breakers with frame sizes 200 amperes and larger have mechanism for adjusting continuous current.
- D. Field-Changeable Ampere Rating Circuit Breaker: Circuit breakers with frame sizes 200 amperes and larger have changeable trip units.
- E. Current Limiting Circuit Breaker: Circuit breaker indicated as current-limiting have automatically-resetting current limiting elements in each pole. Let-through Current and Energy: Less than permitted for same size Class RK-5 fuse.
- F. Solid-State Circuit Breaker: Electronic sensing, timing, and tripping circuits for adjustable current settings; ground fault trip with zero sequence type ground fault sensor; instantaneous trip; and adjustable short time trip.
- G. Current Limiter: Designed for application with molded case circuit breaker.
1. Coordinate limiter size with trip rating of circuit breaker to prevent nuisance tripping and to achieve interrupting current rating specified for circuit breaker.
 2. Interlocks trip circuit breaker and prevent closing circuit breaker when limiter compartment cover is removed or when one or more limiter is not in place or has operated.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Distribution and branch circuit panelboards.
- B. Related Requirements:
 - 1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
 - 2. Section 26 05 53 - Identification for Electrical Systems.

1.2 REFERENCE STANDARDS

- A. National Electrical Manufacturers Association:
 - 1. NEMA PB 1 - Panelboards.
 - 2. NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.
- B. National Fire Protection Association:
 - 1. NFPA 70 - National Electrical Code.
- C. Underwriters Laboratories Inc.:
 - 1. UL 50 - Cabinets and Boxes
 - 2. UL 67 - Safety for Panelboards.
 - 3. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit catalog data showing specified features of standard products.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
- D. Source Quality control submittals: Indicate results of factory tests and inspections.
- E. Field Quality Control Submittals: Indicate results of Contractor furnished tests and inspections.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

- B. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.
- C. Operation and Maintenance Data: Submit spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance products.
- B. Extra Stock Materials:
 - 1. Furnish two of each panelboard key. Panelboards keyed alike to Owner's current keying system.

1.6 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 DISTRIBUTION PANELBOARDS

- A. Manufacturer List:
 - 1. Square-D as basis of design.
- B. Substitution Limitations:
 - 1. Section 01 60 00 - Product Requirements: Requirements for substitutions for other manufacturers and products.
 - 2. Substitutions: Owner approved equal.
- C. Description: NEMA PB 1, circuit breaker type panelboard.
- D. Materials:
 - 1. Panelboard Bus: Copper, current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.
 - 2. Molded Case Circuit Breakers: UL 489, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Furnish circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
 - 3. Molded Case Circuit Breakers with Current Limiters: UL 489, circuit breakers with replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole.
 - 4. Current Limiting Molded Case Circuit Breakers: UL 489, circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical

amperes, let-through current and energy level less than permitted for same size NEMA FU 1, Class RK-5 fuse.

2.2 BRANCH CIRCUIT PANELBOARDS

A. Manufacturer List:

1. Square D as basis of design.

B. Substitution Limitations:

1. Section 01 60 00 - Product Requirements: Requirements for substitutions for other manufacturers and products.

C. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.

D. Materials:

1. Panelboard Bus: Copper, current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard; furnish insulated ground bus as indicated on Drawings.
2. For non-linear load applications subject to harmonics furnish 200 percent rated, plated copper, solid neutral.
3. Minimum Integrated Short Circuit Rating: 65,000 amperes rms, or as indicated on Drawings].
4. Molded Case Circuit Breakers: UL 489, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers as indicated on Drawings. Provide UL class 760 arc-fault interrupter circuit breakers as indicated on Drawings. Do not use tandem circuit breakers.
5. Current Limiting Molded Case Circuit Breakers: UL 489, circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size NEMA FU 1, Class RK-5 fuse.
6. Enclosure: NEMA PB 1.

E. Cabinet Front: Flush or Surface cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock keyed alike. Finishes: Refer to plans for mountings.

1. Finish in manufacturer's standard gray enamel.

2.3 PANELBOARD

A. Description:

1. Panelboards
 - a. Top or bottom feed as indicated on Drawings. Furnish circuit directory inside door.
 - b. Construct box of galvanized steel. Box size as indicated on Drawings.
 - c. Main bus constructed of copper and rated for load current.
 - d. Furnish interior with branch circuit breakers.
 - e. Furnish standard rated, neutral assembly with copper neutral bus.
 - f. Furnish with insulated ground bus and safety ground bus.

- g. Furnish wiring gutters in accordance with NEC.
- h. Field connections to panelboard: main lug and/or main breaker type, as indicated on drawings.
- i. Construct with mounted trim and NEMA.
- j. Furnish with branch breaker positions and nominal current rating as indicated on Drawings.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install panelboards and load centers in accordance with NEMA PB 1.1.
- B. Install panelboards and load centers plumb.
- C. Install recessed panelboards and load centers flush with wall finishes.
- D. Height: 6 feet (1800 mm) to top of panelboard and load center; install panelboards taller than 6 feet (1800 mm) with bottom no more than 4 inches (100 mm) above floor.
- E. Install filler plates for unused spaces in panelboards.
- F. Provide typed or neatly handwritten circuit directory for each branch circuit panelboard and load center. Revise directory to reflect circuiting changes to balance phase loads. Identify each circuit as to its clear, evident and specific purpose of use.
- G. Install engraved plastic nameplates in accordance with Section 26 05 53.
- H. Install spare conduits out of each recessed panelboard to accessible location above ceiling or below floor. Minimum spare conduits: 5 empty 1 inch. Identify each as SPARE.
- I. Ground and bond panelboard enclosure according to Section 26 05 26. Connect equipment ground bars of panels in accordance with NFPA 70.

3.2 FIELD QUALITY CONTROL

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform circuit breaker inspections and tests listed in NETA ATS, Section 7.6.

3.3 ADJUSTING

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for starting and adjusting.

- B. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

3.4 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Clean existing panelboards and load centers to remain or to be reinstalled.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes wall switches; wall dimmers; receptacles; multi outlet assembly; and device plates and decorative box covers.
- B. Related Sections:
 - 1. Section 26 05 33 - Raceway and Boxes for Electrical Systems: Outlet boxes for wiring devices.

1.2 REFERENCES

- A. National Electrical Manufacturers Association:
 - 1. NEMA WD 1 - General Requirements for Wiring Devices.
 - 2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.5 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 PRODUCTS

2.1 WALL SWITCHES

- A. Manufacturers:
 - 1. Leviton Manufacturing Company.
 - 2. Substitutions: Owner approved equal.

- B. Single Pole Switch:
 - 1. Leviton Manufacturing Company.
 - 2. Substitutions: Owner approved equal.
- C. Double Pole Switch:
 - 1. Leviton Manufacturing Company.
 - 2. Substitutions: Owner approved equal.

2.2 RECEPTACLES

- A. Single Convenience Receptacle:
 - 1. Leviton Manufacturing Company.
 - 2. Substitutions: Owner approved equal.

2.3 WALL PLATES

- A. Manufacturers:
 - 1. Leviton Manufacturing Company.
 - 2. Substitutions: Owner approved equal.
- B. Decorative Cover Plate: Smooth 302 stainless steel.
- C. Jumbo Cover Plate: Smooth 302 stainless steel.
- D. Weatherproof Cover Plate: Gasketed cast metal.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify outlet boxes are installed at proper height.
- C. Verify wall openings are neatly cut and completely covered by wall plates.
- D. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

- A. Clean debris from outlet boxes.

3.3 EXISTING WORK

- A. Disconnect and remove abandoned wiring devices.
- B. Modify installation to maintain access to existing wiring devices to remain active.

- C. Clean and repair existing wiring devices to remain or to be reinstalled.

3.4 INSTALLATION

- A. Install devices plumb and level.
- B. Install switches with OFF position down.
- C. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- D. Do not share neutral conductor on load side of dimmers.
- E. Install receptacles with grounding pole on bottom.
- F. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
- G. Install wall plates on flush mounted switches, receptacles, and blank outlets.
- H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- I. Connect wiring devices by wrapping solid conductor around screw terminal. Install stranded conductor for branch circuits 10 AWG and smaller. When stranded conductors are used in lieu of solid, use crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under device screws.
- J. Use jumbo size plates for outlets installed in masonry walls.
- K. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.5 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes provided under Section 26 05 33 to obtain mounting heights as indicated on drawings.

3.6 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements, 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect each wiring device for defects.
- C. Operate each wall switch with circuit energized and verify proper operation.
- D. Verify each receptacle device is energized.

- E. Test each receptacle device for proper polarity.
- F. Test each GFCI receptacle device for proper operation.

3.7 ADJUSTING

- A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust devices and wall plates to be flush and level.

3.8 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.
- B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 26 50 00

LIGHTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes interior luminaires, lamps, ballasts, and accessories.

1.2 SUBMITTALS

- A. Product Data: Submit dimensions, ratings, and performance data.

PART 2 PRODUCTS

2.1 LUMINAIRES

- A. Product Description: Complete luminaire assemblies, with features, options, and accessories as indicated on Drawings.
- B. Substitutions: Owner approved equal.

2.2 EMERGENCY LIGHTING UNITS

- A. Manufacturers:
 - 1. Refer to schedule on plans.
 - 2. Substitutions: Owner approved equal.
- B. Product Description: Self-contained incandescent emergency lighting unit.
- C. Lamps: 12 watt minimum, sealed beam type in nickel or chrome plated steel housing.
- D. Electrical Connection: Conduit connection.
- E. Input Voltage: 120 volts.

2.3 EXIT SIGNS

- A. Manufacturers:
 - 1. Refer to plans for schedule.
 - 2. Substitutions: Owner approved equal.
- B. Product Description: Exit sign fixture with integral battery power supply.
- C. Face: Translucent face with red letters on white background.

D. Input Voltage: 120 volts.

E. Lamps: 5 W per side, maximum.

2.4 INCANDESCENT LAMPS

A. Manufacturers:

1. General Electric Corp.
2. Substitutions: Owner approved equal.

2.5 FLUORESCENT LAMPS

A. Manufacturers:

1. General Electric Corp.
2. Substitutions: Owner approved equal.

PART 3 EXECUTION

END OF SECTION

SECTION 27 00 00
COMMUNICATIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes arrangement with Telephone Utility Company for service and premises telephone pathways, and premises wiring.

1.2 SYSTEM DESCRIPTION

- A. Service entrance from Telephone Utility Company to termination backboard per telephone company requirements.

PART 2 PRODUCTS

2.1 TELEPHONE TERMINATION BACKBOARDS

- A. Material: Plywood.
- B. Size: 3/4 inch thick dimension per telephone company requirements.

2.2 INSTALLATION

- A. Install pathways in accordance with EIA/TIA 569.
- B. Install wire and cable in accordance with EIA/TIA 570.
- C. Finish paint termination backboards with durable white enamel prior to installation of telephone equipment.
- D. Install termination backboards plumb, and attach securely to building wall at each corner. Install cabinet trim plumb.
- E. Install pull wire or polyethylene pulling string in each empty telephone conduit over 10 feet (3 m) in length or containing bend.

END OF SECTION

SECTION 28 31 00

FIRE DETECTION AND ALARM

PART 1 GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment and related items required for complete installation of fire alarm system.
- B. The Contractor shall be responsible for all engineering and design of the system.
- C. The fire alarm system shall provide supervision of the flow switch and tamper valve of each fire sprinkler system, provide general alarm, and communicate signals to a constantly attended station via two telephone lines.
- D. System shall conform to requirements of local city and state codes, designed and installed under supervision of licensed person.
- E. System shall contain min. 20,000-volt surge protectors, or larger if required by manufacturer, protecting all components of the system. Each system shall be equipped with grounding of all equipment conforming to manufacturer's requirements and all local and national fire and electrical codes.
- F. Submit four copies of proposed system design consisting of drawings, specifications, and catalog data covering all systems and equipment.

1.2 REFERENCES

PART 2 PRODUCTS

2.1 System shall include, but not be limited to the following:

- A. Fire alarm control panel with annunciator, standby battery and signal lights.
- B. Flow and tamper switches.
- C. Audible and visual devices.
- D. Wiring of all components.
- E. Surge Protectors.

- 2.2 All components shall bear the UL label and shall comply with all requirements of the Owner's insurance carrier.

PART 3 EXECUTION

- 3.1 Contractor shall determine locations for all devices and coordinate such location with the Architect and the local authority.
- 3.2 Contractor shall arrange for the Electrical Contractor to install needed boxes, conduit and 120-volt wiring.

END OF SECTION