SECTION 15010 - GENERAL PROVISION FOR MECHANICAL WORK

PART 1 - GENERAL

Work Included Herein

Furnish everything necessary for and incidental to satisfactory completion of an operating air conditioning, heating and ventilating system including, but not necessarily limited to:

* Packaged "ground mount", "roof top" and/or "split system type" air conditioning units with low pressure duct distribution system and "through-the-wall" heat pump units.
* Grilles, registers, diffusers, extractors, controls and related items required within a complete and satisfactory system.

Perform required operations in strict compliance with applicable laws, codes and ordinances and manufacturer's instructions and specifications.

The drawings are generally diagrammatic and do not show all necessary offsets and bends that may be required. The location of all piping, ducts, conduit, equipment and related items shall be verified in the field.

Obtain and pay for permits, fees, tests and inspections required in connection with this work.

Related Work

* Openings for ducts, grilles, and registers.
* Finish painting.
* Domestic water piping.
* Electric wiring.

Quality Assurance

Everything necessary for and incidental to satisfactory completion of Heating, Ventilating and Air Conditioning Work shall conform, in every respect, to applicable laws, codes and ordinances and the following:

ASME (American Society of Mechanical Engineers)
ASHRAE (American Society of Heating, Refrigeration, and Air Conditioning Engineers)
UMC (Uniform Mechanical Code, latest adopted edition)
BFU (National Board of Fire Underwriters)
NFPA (National Fire Protection Association)
NEMA (National Electrical Manufacturer's Association)
ASTM (American Society for Testing and Materials)
AGA (American Gas Association)
ANSI (American National Standards Institute)
NEC (National Electrical Code, latest adapted edition)
FS (Federal Specifications)
FM (Factory Mutual)

The Owner shall furnish appliances and labor for tests and shall meet expenses of the tests. Tests shall be made before the rough work is covered. System may be tested in parts, if authorized by the Architect and/or Engineer.

SUBMITTALS

Submit a complete list of major items of equipment and materials within thirty consecutive calendar days AFTER award of Contract. Bind product data on submitted items in three-ring, hard-back binder, then submit at one time in a neat and orderly manner. Partial lists and attendant data are prohibited.

Submittals shall include at least the following, but are not necessarily limited thereto:

* Manufacturer's specifications and maintenance and operation (if applicable) instructions. Parts lists when applicable.
* Ratings of equipment and performance data including applicable performance curbs.
* Certified performance curves for ALL pumps.
* Physical properties and dimension. Shipping and performance weights.

Where the equipment or system submitted required more space (either horizontally or vertically, or both) than is shown or indicated as available for said submittal, submit large-scale drawings accompanying such equipment submittal(s) showing floor and room volume space required and service clearances necessary prior to ordering affected equipment of materials. Confirm receipt of Architect's review of such evidence PRIOR TO ORDERING.

Prior to completion of the job, the Contractor shall compile a complete equipment list and maintenance manual. The equipment list shall include the following items for every piece of material, equipment and systems supplied under this Section:

* Name, Model and Manufacturer
* Complete Parts Drawings and List
* Local Supply for Parts and Replacement and Telephone Number
* Local Service Organization for Equipment and Telephone Number
* Tags, Inspection Slips, Instruction Packages, Removed from Equipment as shipped from the factory, properly identified as to the piece of equipment it was taken from
* Submit maintenance manuals in accordance with Section 01700.

Upon completion of the work, prepare Record Drawings in accordance with Section 01700.

Substitutions

In accordance with Section 01631.

PART 2 - PRODUCTS

Acceptable Manufacturers

The following is a list of manufacturers whose equipment is acceptable as to manufacturer, subject to conformance with contract documents. Verify that the equipment will meet all capacities, requirements, space allocations and that the weights will not exceed structural design loads.

* Manual Quadrants: Farr, Vent Fabrics, Duro Dyne, Elgen
* Flexible Duct Connections: Vent Fabrics, Duro Dyne, Elgen
* Access Door Latches: Vent Fabrics, Duro Dyne, Young
* Duct Turns: Tuttle & Bailey, Duro Dyne, Barber-Colman
* Manual Dampers: Honeywell, Air Stream, Krueger, Ruskin
* Fire Dampers: Ruskin, Phillips, Air Balance, Air Stream, Dowco
* Grilles, Registers and Diffusers: Tuttle & Bailey, Titus, Barber-Colman, Krueger, Anemostat, Carnes. Supply

in colors to match adjacent wall finishes.

* Duct and Pipe Insulation: Ownes-Corning Fiberglas, Certain Teed, Knauf, Manvile, PPG, Carey, Dow Chemical Company
* Exhaust Fans: Greenheck, Peerless, Barry, ILG, Loren Cook, Penn Ventilator, Broan
* Louvers: Air Stream, Aero-Lite, Titus, Krueger, Ruskin
* Motors: General Electric, Westinghouse, Century, Sterling, U.S. Electric, Louis-Allis Co., Electro Dynamics Co., Allis-Chalmers
* Motor Starters: Allen Bradley, Square D, Cutler-Hammer
* Flexible Duct: Thermaflex, Owens-Corning Fiberglass
* Access Doors: Milcor, Ventgab, American Warming, Potter-Roemer
* Through-the-Wall Air Conditioning Units: General Electric, Amana, Carrier
* Air Conditioning Roof or Ground-Mounted Package and Split System; McQuay, Trane, Carrier, Payne, York, Day & Night, Lennox. Condensate lines are to be piped.

Materials

Ductwork:

* Galvanized Ductwork: Galvanized prime-grade, lock-forming quality steel (LFQ) having a galvanized coating of 1 1/4 ounces total for both sides of one square foot of a sheet. Cross-break all side of duct. All ductwork shall be galvanized steel. Plenums, housings, etc., shall be galvanized steel.
* Turning Vanes: Double thickness hollow vane type, of galvanized sheet steel equal to Tuttle & Bailey or Duro Dyne. Shop fabricated duct turns must be submitted for acceptance prior to any work on project.
* Flexible Connections: 30 ounce closely woven, neoprene coated glass fabric, fire retardant, waterproof, airtight, and minimum 6" wide.
* Flexible Duct: Flexible pre-insulated vinyl coated fiberglass with corrosion resistant steel spiral reinforcing. "Thermaflex" Type MK-E.
* Manual Quadrants: On all low pressure manual dampers, Farr Trim Lok #100 in insulated ducts or inaccessible ducts, and #109 in uninsulated ducts.
* Manual Dampers: Minimum 16 gauge galvanized steel, maximum 8" blade, opposed blade type, with manual locking quadrant.

Access doors in ductwork installed with reinforced angel frames, and made with airtight felt strips. Latches: Ventlock No. 260, as manufactured by Vent-Fabrics, Inc. Access panels and access openings in ducts shall be two gauges heavier than the duct and provided with a rolled steel metal edge. Sealed airtight to the duct with felt edges. Access doors in insulated ducts fabricated of two sheets of sheet metal (double the metal thickness of the duct) sandwiched around a blanket of insulation.

Fire dampers with access panels furnished and installed as described herein to meet the requirements of the UMC and UL. All fire dampers constructed in accordance with NBFU No.90A and local code requirements. Dampers manufactured shall be of the type with the open damper out of the air stream for 100% free area.

All insulation, coverings, vapor barriers, and adhesives shall have a flame spread classifications not to exceed 25 and a smoke developed rating of nor more than 50, and shall comply with NBFU 90A.

Supports shall be specified herein.

Cooling Coil Condensate and Drain Piping: Type 'M' hard drawn copper pipe with wrought copper fittings. Joints in copper pipe prohibited under slabs-on-grade.

Pipe Solder: 95-5 silver solder.

Refrigerant Piping: Type 'L' hard drawn copper tubing with wrought copper fittings. Solder shall be silver solder with a 1050 degrees F, or higher melting point.

Acoustical Insulation: Shall be not less than 2 lbs. density duct liner coated to a smooth finish with a NBFU 90A approved vinyl mat faced glass or neoprene coating which will withstand velocities up to 4000 FPM. Insulation shall be 1/2" thick on supply and return ducts inside building. 1" thick on all ducts on exterior of building, and 1/2' thick on all plenums. Sound absorption of 1/2" thickness shall not be less than .50 at 250 CPS and .60 at 1000 CPS. Minimum K of .28 at 75 degrees F, mean temperature. Duct liner shall meet with erosion test method described in UL Publication No. 181.

Refrigerant Pipe Insulation: 1/2' thick flexible foamed plastic closed cell pipe insulation. Insulation shall have a 'K' factor of not more than .25 at 70 degrees F., and a water vapor transmission rate of 0.1 per-inch or less in conformance with ASTM C177 and ASTM C355 water method.

Vibration Isolators:

Suspended fan-coil or split system A/C units, suspended exhaust fans, etc.: Mason Industries type HD double deflection neoprene hanger with a minimum of 0.40" static deflection.

Equipment

Furnish and install foundations, saddle supports, and bases under al equipment, (except concrete bases provided under Section 03310). Supports shall be as noted. Where suitable supports are not detailed they shall be in accordance with manufacturer's recommendations. Vibrations eliminators shall be provided under all equipment (fans, blowers, air conditioning units) with moving parts.

Mason Industries vibration eliminators shall be properly loaded per the manufacturer's recommendations to eliminate transfer of vibration to the building structure.

Power drive equipment shall be quiet in operation and shall be free of vibration. Metal partitions, ducts, sheet metal housings, etc., shall be constructed and braced to eliminate vibration or rattling when the system is in operation. Connections to equipment shall be so designed and constructed that noise and vibration will not reach the conditioned area through ducts, piping, sheet metal construction or the building construction. Power drive equipment suspended from the structure shall be provided with spring type isolation.

Grilles, Registers and Diffusers: As indicated

Provide the dampers painted flat black.

Provide extractors behind all supply grilles, registers and ceiling diffusers.

Units shall be factory prime finished and field painted in color selected by the Architect or as otherwise indicated.

Provide neoprene gasket around inside of frame.

Exhaust Fans: As indicated.

Provide all 1/2HP and smaller motors with flush type manual motor starters (except with built-in motor protection. Provide magnetic across-the-line starters for all motors 3/4 HP and larger complete with all control devices, such as start-stop pushbuttons.

Split System Type Air Conditioning Units: As indicated.

Each unit shall be complete with indoor and outdoor sections with necessary filters, refrigerant piping, insulation, controls, interlocks, relays and connections as required.

Indoor section to be completed with centrifugal type blower, belt or direct connected to a single speed, inherently protected motor, factory built cooling coil with insulated drain pan and remote auxiliary resistance heating, starter, controls, relays.

Filters for each unit shall be external to unit. Provide one set of throwaway filters for use during the construction period. Prior to balancing the system install one set of "farr" 30/30/ throwaway final filters complete with frame, mounting hardware and accessories.

Outdoor section to be complete with weatherproofing housing, insulated compressor, air-cooled condenser, condenser fan or blower, inherently protected blower motor, automatic control panel with starters and relays in a weathertight insulated casing suitable for outdoor installation.

Each system shall be complete in every respect. Furnish controls with provisions for automatic change-over from heating to cooling and from cooling to heating. Factory wire each unit completely for terminal connections of thermostat with a fan "ON-AUTO" switch and a system "HEAT-OFF-AUTO-COOL" switch. Install each unit in strict accordance with manufacturer's recommendations, complete with all accessories, including all control interlocks. Thermostat shall be Honeywell TB74G with Q674S sub-base and locking cover plates.

Through-The-Wall Air Conditioning Units:

Verify electrical requirements prior to ordering.

Wall units shall be 230/208 Volt complete with internal disconnect switch. Refer to drawings for further information.

Contractor shall verify condensate requirements of selected unit and provide drain in wall to daylight if required. Submit shop drawings of selected unit complete with grille color sample options to the architect for review.

Exhaust Fans:

General Building Exhausts

Furnish and install all exhaust fans as noted on the drawings. Fans shall be complete with intake grilles, ductwork and discharge ducts, as shown on the drawings. Ducts passing through wall so roof must be property flashed. Each exhaust fan to be of the type, size and capacity indicated completed with backdraft dampers, and bird screen on discharge. Provide all exhaust fans with approved vibration isolators. All belt drive exhaust fans shall have adjustable motor pulleys for fan speed control. All fans (except toilet exhaust fans 150 cfm and below) must be AMCA certified and approved.

Motors: As indicated, scheduled or required.

Motors shall be type required for service intended and size required for their location. The maximum RPM shall be 1750, except where otherwise specified.

One-half horsepower and smaller motors shall be 120 volt, single phase, 60 cycle, with flush type manual motor starters.

Three-quarter horsepower and larger motors shall have magnetic across-the-line starters and shall be designed for 208, 230 or 460 volts (as noted on the drawings), 3 phase or single phase, 60 cycle current except as may be noted. Contractor shall verify voltage and phase before ordering any equipment.

Motor starters shall be furnished with each motor. Starters and accessories on equipment exposed to weather shall be in a NEMA 3 Raintight Enclosure.

The final alignment of all motors shall be included as part of the work under which the motor is furnished.

V-Belts, Pulleys and Guards: As indicated, scheduled or required.

Belt Drives shall use V-Belts. Multiple Belt Drives shall be matched sets and be so marked at the factory. The V-Belts shall be designed for 150% capacity.

Motors larger than 5 horsepower and drives with more than 2 belts shall be provided with non-adjustable sheaves, providing the specified RPM required for the fan.

Belt guards for belt drives and guard hoods for drive couplings shall be provided. These guards shall be factory-built and furnished with the equipment.

Wiring: In accordance with Section 16100.

Relays, Electrical Controls, Control Switches, Starters and Related Start-Stop Switches: As indicated, scheduled or required.

Access Doors: In accordance with Section 08305.

Fabrication

Ductwork:

Rectangular Duct Construction: Shall conform to the latest edition of the SMACNA Duct Manual for low velocity systems.

Longitudinal seams to be Pittsburgh Lock Groove, hammered flat. Tape all transverse joints of supply, return and exhaust ducts with arabol and canvas.

Provide supplemental stiffening as required to prevent drumming and provide a structurally sound assembly.

Construct all fittings, elbows and transitions to provide a minimum of noise and resistance. Where space permits, construct elbows with a minimum radius of 1 1/2 times the width (or depth), and transitions with a change not to exceed 1" in 4". When structural conditions necessitate (or as otherwise indicated), make fittings and elbows as sharply as required, but with double thickness turning vanes. Heel elbows shall be prohibited.

Provide double thickness turning vanes in all 90 degree square elbows and in all elbows which have a radius less than 1 1/2 times the width (or depth) of the duct.

Paint all ductwork, turning vanes, insulation, etc., visible through grilles, registers, or ceiling diffusers, flat black.

Tape all cross joints in sheet metal ductwork with arabol and canvas.

Make all ductwork exposed to elements weathertight.

Duct size shown are to the inside of acoustical linings. Increase the size of al sheet metal ducts as required to accommodate insulation.

Before fabrication, check all ductwork with the building construction for dimensions, locations, clearance, etc. Make up ducts with any necessary variations to conform to the details of the construction of the buildings, to suit the space available and to fit the equipment furnished. The entire duct system must be substantially constructed, rigidly erected and free of any duct vibration and noises.

PART 3 - EXECUTION

Preparation

Cut existing work as necessary to properly install work. Structural members including floor slabs above grade shall not be cut without written consent.

Cutting of walls, floors, ceilings, and roof to accommodate ductwork, piping, conduit, or other items shall be done by the Contractor. The exact location and size of each opening required to accommodate the equipment shall be determined by the Contractor who shall furnish sleeves, caps, or flashings required to fill or close the openings. Provide final grouting and concrete fill, if required. Saw cut floor slab, where required, to full depth of slab. Core drill openings for piping installed AFTER concrete and/or masonry is completed.

Jackhammers or equipment producing excessive noise shall not be used. Other means shall be at the Contractor's option.

Installation

No valves, traps, controls, or unions, shall be placed in any pipe line at a location that will be inaccessible after the system is completed.

Any dampers, controls, valves, piping controls, expansion joints or other apparatus which must be located in an inaccessible location shall be provided with suitable access doors (fitted in a framed hole) which will permit proper operation and servicing of the apparatus.

Install foundation and vibration isolation supports and bases under all equipment. Provide vibration isolation under all equipment such as blowers, air handling units and exhaust fans that have moving parts.

Install factory fabricated air conditioning units as shown.

Locate indoor units of split-system type air conditioners to provide proper clearance on access side of unit.

Install coil condensate and drain piping as shown. Support piping as required. Support optional plastic piping at a maximum of 5'-0" on center and all changes in direction. Provide Ptraps on all drain piping connections to equipment.

Install refrigerant piping between condensing units and evaporator units as indicated; include final connection. Provide refrigerant flexible connections at all equipment. Cut all copper piping smooth and square. Clean all fittings before installation. Dirty or oily pipes shall be thoroughly swabbed out with clean waste and carbon tetrachloride. All piping shall be thoroughly tested for leaks and proved tight before charging. Tests shall include not less than 20 inch vacuum held for 24 hours. Final test shall be a halide torch test at all joints after charging and before insulation is applied.

Insulate all refrigerant suction piping with pipe insulation. Install insulation by slitting tubular sections and applying over piping. Fabricate covers for fittings from insulation in conformance with manufacturer's recommendations. Seal joints; but ends, and miters with fire-retardant, waterproof adhesive (Armstrong 520). Taped joints prohibited. Finish all pipe insulation exposed to exterior with two coats of Armaflex finish for closed cell formed plastic insulation.

Duct Installation: Install ductwork using skilled mechanics in strict conformance with the latest SMACNA Manual for low velocity ductwork.

Support ducts from hanger straps or hanger rods per "SMACNA Manual for Low Velocity Duct Construction", latest edition. Ducts with a maximum dimension of 60" shall be supported on not lighter than 1" wide, 16 gauge galvanized steel strap or 3/8" diameter steel rods, a maximum of 8 foot on center. Support duct 61" to 120" with 2' x 1/4" thick galvanized steel angle trapeze and 3/8" diameter steel rods. Support ducts 121" to 240" maximum dimensions with 2

1/2" x 2 1/2" x 3/16" thick galvanized steel angles and 3/8" diameter steel rod supports.

Duct Insulation: Insulation shall be applied by a licensed insulation contractor. Where observation of the work being installed indicates that the specification is not being complied with, the entire section of the insulation shall be removed and re-installed as specified.

Supply ducts, return air ducts and elsewhere as indicated shall be acoustically lined, for a minimum distance of 10 feet from the air conditioning unit or as otherwise indicated.

Piping: Furnish and install all piping systems complete as indicated with valves, pipe fittings and connections. Provide dialetric unions between ferrous and non-ferrous piping connections. Lines shall be laid to drain and shall be free from sags or traps. Provide drain cocks at low points and air vents at high points. Support horizontal piping with hangers or brackets. Do not use perforated metal tape.

Apply and hold 120 psi hydrostatic test for 4 hours with no drop in pressure for all pumped systems. Gravity drain piping shall be filled and the joints observed for leaks. Repair and retest as required.

Grilles, Registers and Diffusers: Install grilles, registers, ceiling diffusers where indicated. Size and model as indicated. Grilles, registers and ceiling diffusers must be set flush and true to the wall or ceiling to prevent air leakage around the edges.

Exhaust Fans: Install exhaust fans complete with bases, speed switches, and duct connections as indicated.

Wiring:

* Refer to Section 16000 for mounting of all magnetic starters and motor speed control apparatus with connections from starters to motors.
* Relays, electrical controls, control switches, etc., shall be furnished and delivered together with identification and instructions. Line voltage exterior wiring will be performed under Section 16000. Wiring not shown and required to properly connect equipment, including connections to special safety or control apparatus not shown shall be a part of this Contract.
* Starters and related start-stop pushbutton switches shall be furnishes and installed. Starters furnishes with equipment (i.e., package units) are to be furnished under the Section specifying the prime equipment, and connected under Section 16000.

Adjusting and Cleaning

Balance the air systems for the core areas as herein specified. Work shall be performed by qualified personnel listed with NEBB or by an independent balancing agency listed with AABC. Results shall be tabulated on approved forms and submitted for review before closeout of the project. Balance work shall be performed with approved, accurately calibrated instruments, maintained and in good working order. Include an extended warranty of 90 days after completion of balance work, during which time the engineer at his discretion may request a recheck or resetting of any quantity. Provide technicians to assist the engineer in making any adjustments he may require during this period of time.

Adjust all fan speeds to provide the required capacity. Balance for uniform temperatures throughout. Advise the Contractor of, and be responsible for the installation of any additional opposed blade volume dampers (with locking quadrants) necessary to properly balance the system without increasing noise levels in occupied spaces.

Record the following data:
* Supply and return air quantities and static pressure at each outlet and at each fan.
* Fan and motor RPM.
* Motor nameplate and actual operating amperage, volts, phase and hertz.

Adjust all temperature controls for proper operation.

Verify that power is properly supplied to all electric motors and that all electric controls are properly hooked up and operating at the control circuits. Furnish a list of the voltage and current readings taken under load of all motors.

Check all work and see that all controls are in good working order and properly adjusted. After the equipment has been properly checked and adjusted. Contractor shall start up and run all the equipment to determine that the controls and equipment are all operating properly and that the installation is complete. When the tests or inspections show that the work is in any way defective or at variance with the specifications, immediately make all changes necessary to correct the work and remedy defects; defective material and equipment shall be removed from the premises.

After the tests have been performed on the air conditioning and air handling systems, make without costs, not more than two changes in the size of the nonadjustable sheaves to obtain air quantities.

At the completion of the work, exposed heating, air conditioning and other equipment, piping, apparatus, walls, floors, ceilings, and material shall be thoroughly cleaned of oil, grease, dirt, rust, cement, and plaster. Exposed surfaces shall be cleaned of oil and grease spots and left smooth and clean. Cracks and corners shall be scraped out clean. Finished surfaces shall be cleaned and polished.

Damage to glass, finish or structure of adjacent work shall be properly repaired or replaced. Unused construction materials in or about the buildings and construction area and dirt and rubbish caused by the work under this Section shall be removed from the site. The premises shall be left in a neat, clean and usable condition.

END OF SECTION 15010

SECTION 15400 - GENERAL PROVISIONS FOR PLUMBING WORK

PART 1 - GENERAL

Work Included

Everything necessary for and incidental to satisfactory completion of Plumbing Work shall conform, in every respect, to all local applicable laws, codes and ordinances. This work includes, but is not necessarily limited to:

* The installation of complete sanitary plumbing, waste and vent systems with connections to plumbing fixtures equipment and sewer lines. (Vents to exit through roof on rear of building.)
* The installation of domestic water piping with services to fixtures and equipment using same, including valves, controls and related items.
* The installation of special equipment furnished under other sections within this Specification.
* The installation of insulation specified herein for domestic hot water piping.
* Supervision of erection, balancing and adjustments and instructions for proper operations and maintenance.
* Furnishing and installation of plumbing fixtures.
* Sterilization of potable water system.
* Obtain and pay for meter permits, fees, tests, and inspections required in connection with work.

Quality Assurance

Everything necessary for and incidental to satisfactory completion of Plumbing work shall conform, in every respect, to applicable laws, codes and ordinances and the following:

ASME (American Society of Mechanical Engineers)
ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineers)
UPC (Uniform Plumbing Code, latest adopted edition)
NBFU (National Board of Fire Underwriters)
AWWA (American Waterworks Association)
AGA (American Gas Association)
ASTM (American Society for Testing and Materials)
ANSI (American National Standards Institute)
FS (Federal Specifications)
NFPA (National Fire Protection Association)
FM (Factory Mutual)
NEMA (National Electrical Manufacturer's Association)

Pressure vessels shall be ASME Code constructed and stamped.

The drawings are generally diagrammatic and do not show all necessary offsets and bends that may be required. The location of all ducts, conduit, equipment, and related items shall be verified in the field.

Test soil, waste, vent, water, gas piping, and obtain approval of the Owner. Furnish equipment required for tests.

Drainage System

Water Test: Plug ALL openings throughout the entire drainage and venting system. Fill the entire system with water in sections 12 to 14 feet in height. The system must hold water for minimum 4 hours without showing a drop greater than 4". Conduct the test in a portion of the system in the same manner as described for the entire system, except that a vertical stack 10 feet above the highest horizontal line tested may be installed and filled with water to maintain sufficient pressure.

Water System: Upon completion of the roughing-in and before setting fixtures, test the entire hot and cold water piping systems at a hydrostatic pressure of not less than 100 pounds per square inch gauge, and proved tight at this pressure for not less than 4 hours in order to permit the inspection of joints. Where a portion of the water piping system is to be concealed before completion, test this portion separately in the same manner as described for the entire system.

Gas System: Air pressure test, not less than 50 psig for one hour.

Defective Work: If inspection or test shows defects, replace such defective work or material and repeat inspection and tests. Make repairs to piping with new material. Caulking of screwed joints or holes prohibited.

Submittals

Submit a complete list of major items of equipment and materials within thirty consecutive calendar days AFTER award of Contract. Bind product data on submitted items in three-ring, hard-back binder, then submit at one time in a neat and orderly manner. Partial lists and attendant data are prohibited. Submittals shall include at least the following but are not necessarily limited thereto:

1. Manufacturer's specifications and maintenance and operation (if applicable) instructions. Parts lists when applicable.
2. Ratings of equipment and performance data including applicable performance curves.
3. Certified performance curves for ALL pumps.
4. Physical properties and dimensions.
5. Shipping and performance weights.

Where submittal data describes items in addition to that (those) items(s) specified or being proposed for the work, the item being submitted shall be clearly and concisely marked on the submittal sheet(s) and superfluous data shall be crossed out or otherwise noted as "not applicable".

Where the equipment or system submitted requires more space (either horizontally or vertically, or both) than is shown or indicated as available for said submittal, submit large-scale drawings accompanying such equipment submittal(s) showing floor and room volume space required and service clearances necessary prior to ordering affected equipment or materials. Confirm receipt of Architect's review of such evidence PRIOR TO ORDERING.

Prior to completion of the job, compile a complete equipment list and maintenance manual. Include the following items for every piece of material equipment furnished hereunder:

* Name, model and manufacturer.
* Complete parts drawing and list.
* Local supply for parts and replacement and telephone number.
* Local service organization for equipment and telephone number.
* Tags, inspection Slips, Instruction Packages, removed from equipment as shipped from the factory, properly identified as to the piece of equipment it was taken from

Prior to final payment, prepare Record Drawings in accordance with Section 01700.

Submit certifying data that ACP pipe and fittings have been tested in the United States to ASTM Specifications.

Substitutions

In accordance with Section 01600.

PART 2 - PRODUCTS

Acceptable Manufacturers

The following is a list of manufacturers whose equipment is acceptable as to manufacturer, subject to conformance with contract documents. Verify that the equipment will meet all capacities, requirements, space allocations and that the weights will not exceed structural design loads.

* Plumbing Fixtures: Plumbing fixtures and drains shall be as scheduled.
* Drinking Fountains: As manufactured by Halsey Taylor. Fountain shall have upfront and side hand-operated controls.
* Water Heaters: State, A.O. Smith.
* Circulating Pumps: Armstrong, B&B, Thrush, Paco, Taco.
* Water Softeners: Servi-soft, Water Refining, Bruner, Culligan.
* Plumbing Trim: Standard, Eljer, Crane, Chicago, or as indicated elsewhere.
* Fixture Supports: J.R. Smith, Wade, Josam and Zurn.
* Cleanouts: Zurn, Wade, Josam, J.R. Smith.
* Floor Drains and Floor Sinks: Zurn, Smith, Josam.

Materials

Sanitary and Rainwater Pipe: Cast iron standard weight, mechanical joint. (Exception: IAMPO approved ABS or PVC may be utilized under structure if approved by local authorities.) Pipe to be sound insulated with 1 1/2" mineral wool pipe wrap.

Drainage Fittings: Cast iron standard weight, mechanical joint. (Exception: IAMPO approved ABS or PVC may be utilized under structure if approved by local authorities.)

Gas Supply Piping System:

Gas: (Buried) Schedule 40 PVC, marked for gas use, buried 18" below grade with 14 gauge copper tracer wire. Riser to 9" above grade shall be made with an approved, anodeless steel riser and transition. (Above Grade) Standard weight steel, with threaded joints. Use black pipe indoors, galvanized outdoors.

Domestic Water Piping System:

Above Ground: Copper Type 'L' hard drawn ASTM B-88.

Below Ground: (Set in concrete or under concrete) Copper Type 'L' soft drawn ASTM B-88.

Below Ground: (Not in or under concrete or inside building and as indicated) Use type 'L' copper or asbestos cement pipe (ACP) ASTM C-296 equal to Manville Class 150.

Wrapping Tape: 20 mil polyethylene tape.

Fittings:

Copper: Wrought copper, conforming to ANSI B16.2, use 95-5 silver solder.

Indirect Waste, Relief Valve and Miscellaneous Drains: Copper, Type M, hard drawn.

Identification (Copper) Color identifying pipe with size, manufacturer's trade mark, and conform to the following schedule:

Type 'L' Copper - blue

Gate Valves: "Milwaukee" #1502 ball valve, 125 psi, all bronze solder type. Full port area.

Check Valves: "Milwaukee" #1509, 125 psi, bronze body, bronze disc, solder type horizontal swing check.

Pipe drains to consist of 1/2" glove valves with renewable discs and 3/4" hose nipples.

Sterilizing Solution: Sodium hypochlorite solution conforming to FS-O-8-441, Grade D.

Piping Insulation: Fiberglass premolded insulation with all service jackets, minimum density of 3.5 PCF thermal conductivity ('K' factor) of .24 at a mean temperature of 85 degrees F. Provide an additional 8 oz. canvas jacket with arabol finish around all exposed pipe insulation. Thickness as specified herein.

Cleanout Materials: Iron body with extra heavy bronze plugs screwed into caulking ferrules.

Flashing: Sheet lead weighing no less than 3 lbs. per square foot.

Pipe Hangers: Kin-line No. 450F. Hangers shall permit adjustments of vertical heights without disassembly or removal from pipe.

Solder: 1050 degree F. Eutectic silver solder.

Valve Tags: Bronze, 1 1/2" minimum square for plumbing work. Imprint tag with the name of Contractor and valve number preceded with "P" (Plumbing).

Equipment

Fixtures: As specified, scheduled or indicated.

Support wall hung fixtures with Zurn "Monolithic" supports of appropriate pattern.

Water Softener: Furnish, install and place in operation automatic water softening equipment as indicated and specified:

Continuous Sequence Electro-Selector programmable 100% solid state electronic control for volume initiated regeneration of 2 individual tanks. The control will be used with a single-compatible totalizing meter. The control will be capable of regenerating successive tanks in the system as required by total water flow through the system. The control will have the ability to place regenerated tanks back into service immediately, or to place them on standby until the next regeneration is called for and the method shall be programmable by the user.

The number of tanks shall be selectable from the face on the control. The control will be provided with a switch to allow the user to take any tank of service, upon which the control will cycle among the remaining components of the system to continue providing softened water.

The control will have provisions for individual adjustment of backwash, brine/rinse, and brine refill time cycles. Each step will be adjustable from 0 to 255 minutes in length, in one-minute increments. The control will be capable of indicating (1) system capacity remaining before the next regeneration, (2)

which softener or group of softeners, (3) steps of the softeners is to be regenerated next, and (5) capacity overload to indicate usage beyond system capacity.

The control will be housed in a NEMA 4X industrial enclosure. The control will include a transformer for operation on 24 volts or less, with a back-up self charging battery.

The softener tank shall be made of butt-welded industrial grade steel, designed for a working pressure of 30 to 125 psig dynamic with minimum burst pressure of 325 psig. Tank will be provided with a monolithic lining of inert, nonleachable virgin polyethylene material at least 30 mils thick, permanently bonded to the tank interior by heat fusion. The tank exterior will be coated with a polyurethane finish of three coats: (1) sprayed-on smooth primer sealer, (2)
sprayed-on smooth intermediate coat, and (3) sprayed-on textured finish coating for chip resistance. Resin tanks and brine tank will be warranted against failure caused by faulty material or workmanship for a period of five years.

A combination salt storage tank with cover, and brine tank well shall be supplied as part of the system. The tank shall be sufficient size to hold salt for at least 8 regenerations between refills. The tank shall be made of corrosion-free one-piece molded polyethylene or fiberglass reinforced plastic material.

Resin tanks, brine tank, and valve sections will be warranted against failure caused by faulty material or workmanship, defective parts, for a period of five years.

The 5-cycle main control valve shall be constructed of corrosion-free inert thermoset reinforced phenolic polymer that complies with the regulations of the Food and Drug Administration. The valve will be completely hydraulic in operation, with no electric motors, and shall have built-in educators. All valve seals will be static O-rings; no sliding seals shall be allowed. The manufacturer of the control valve shall be the same as the manufacturer of the system. The valve shall be serviceable with ordinary hand tools, and designed in such a way that service can be performed without disassembly of exterior valving and without disconnecting existing inlet and outlet plumbing connections.

The 5-cycle control valve shall be warranted against failure caused by faulty material or workmanship for a period of five years.

A complete set of instruction for installation and operation of the softener system will be included. Start-up service shall be available from a local distributor or representative, as well as from the manufacturer. A complete water test kit for conducting soap hardness tests shall be included.

Water Heater: Furnish, install and place in operation a natural gas fired water heating system complete in every respect and ready for use by Owner without special effort or knowledge.

Water Heating System: AGA approved, storage type with glasslined tank. Fiberglass insulation with decorative metal jacket, designed and constructed for indoor used as a domestic water heater. ASME pressure relief valve with full-size discharge line to grade or to an approved receptor. Integral controls, including flow switch wiring, and transformer. Gas pressure insulator, shut off and gas piping for all valves. Verify if natural or propane gas is available prior to any construction.

Drains:

* Provide cast iron body with lacquer finish and inside caulk outlet. Where installed in surfaces having waterproofing membrane, provide drains with non-puncturing flashing clamp device and anchoring flange. Type of grate to be furnished on floor sinks as indicated.
* Equipment Rooms and Unfinished Areas: Zurn Z-547 with Duco coated east iron strainer and shallow type bucket strainer.
* Toilet Rooms and Finished Areas: Zurn AZ-415 with Type "y" nickel-bronze strainer 6" x 6", and combination membrane flashing clamp and anchoring flange.

* Finished Areas: Zurn-1806, CIAR enameled floor sink with bottom dome strainer, and combination membrane flashing clamp and anchoring flange.
* Roof Drain: Zurn Z-100 ERC with extension sleeve, roof sump receiver and underdeck clamp.

Cleanouts:

* Concrete and Tile Floors: "Zurn" Z1400-s with scoriated nickel-bronze top.
* Interior Unfinished Floors: "Zurn" Z1450-7 Cast Iron cleanout raised head bronze plug.
* Interior Finished Walls: "Zurn" Z1445-1.
* Trap Primers: "Zurn" Z1022, 1/2" automatic trap primer with solder unions.
* Wiring and Controls: In accordance Section 16000 and as specified herein.
* Access Doors: In accordance with Section 08305.

PART 3 - EXECUTION

Preparation

Cut existing work under direct supervision of Project Superintendent as may be necessary to properly install work. Structural members shall not be cut without the written consent of the Architect or Engineer.

Cutting of walls, floors, ceilings, and roof to accommodate piping, etc., will be done by the Contractor. The exact locations and size of each required shall be determined by the Contractor. The Contractor shall furnish sleeves, caps and flashings, required to fill or close the openings. Provide final grouting and concrete fill, if required. Core drill openings for piping.

Jackhammers or equipment producing excessive noise shall not be used. Other means shall be at Contractor's option.

Perform necessary excavation, shoring, and backfilling required for the proper laying of pipes inside the building, and outside as otherwise directed by the Architect.

Excavate trenches open cut, keep trench banks as nearly vertical as practicable. Excavate trenches true to line and make bottoms not less than 18" wide but no wider than necessary to provide ample work room. Grade trench bottoms accurately. Machines grade only to the top line of the pipes, doing the balance by hand. Do not cut any trench near or under footings without first consulting the Architect.

Backfill in accordance with Section 02200.

Pipe Sleeves: Provide pipe sleeves for piping through floors and walls. Fit pipe passing through masonry or concrete walls with the steel or cast iron pipe sleeves. Fit pipe passing through concrete floors with steel pipe sleeves.

Sleeves to have a minimum of 1/4" clearance between sleeve and service pipe or be not less than two sized larger than the service pipe (Exception: ground floor).

Installation

General:

* No valves, traps, controls or unions shall be placed in any pipe line at a location that will be inaccessible after the system is completed.
* Controls, trap primers, valves and piping controls, expansion joints or other apparatus which must be located in an inaccessible location shall be provided with suitable access doors (fitted in a framed hole) which will permit proper operation and servicing of the apparatus.
* Make required connections of plumbing services to the equipment furnished under other sections of the work or by Owner, including condensate drain piping.

* Heating and Air Conditioning: Provide required water and natural gas, including shut-off valve, backflow prevention devices and final connections, as required.
* Special Equipment, i.e. Ice Machines, etc.: Make rough and final connections to special equipment, including piping, stop valves, fittings, etc. Exposed piping shall be chrome plated brass.

Fixtures:

* Install each fixture, control value, or other plumbing item at the exact height and location shown or in accordance with the manufacturer's rough-in drawings.
* Set fixture supplies, trap and trap arm squarely with wall, in line with fixture outlet, without any offsets, angles or bends.
* Properly align fixture connections to prevent any undue strain on equipment or fixtures. "Cocking" or other misalignment of fixtures or trim is specifically prohibited.
* Set each fixture level and in continuous contact with floor or wall. Align fixtures in batteries and equally spaced to present a uniform appearance.
* Grout joint between fixture and walls or floor with Medusa Cement, forming a smooth, even, watertight joint. Porcelain plaster caps to be securely cemented into place over floor flange bolts, entirely covering washer and bolt hole.
* Seal waste outlet from water closets with asbestos or felt gasket furnished by the fixture manufacturer.
* Place exposed plated, polished or enameled connections from fixtures with special care, showing no tool marks or threads.

Domestic Water Piping:

Installation: Extend the water piping to fixtures, outlets and equipment. Wrap piping below floors or concrete with wrapping tape with 1/2 overlap. No fittings shall be allowed below concrete slabs-on-grade.

ACP installation shall conform to IAPMO Standard IS-15.

Provide all branch lines with shut-off valves as shown.

Install the water system with fall toward the drain valves. Cap or plug outlets as indicated, or as required, and leave ready for future connections. Provide connections between copper and steel pipe with non-metallic connectors to prevent electrolysis.

Install main, branches and runout piping as indicated. Cut pipe accurately to measurements established at the building and work into place without springing or forcing. Take care not to weaken the structural portions of the building. Run piping above ground parallel with the lines of the building unless otherwise shown or noted. Keep service pipe, valves, and fittings at a sufficient distance from the work to permit finished covering not less than 1/2" from other such work and not less than 1/2" between finished covering on the different services. Do not bury water piping in floors unless specifically indicated or approved. Make changes in pipe sizes with reducing fittings. The use of bushings shall not be permitted. Install additional drains at low points on the hot water and cold water piping, and grade piping toward drains.

Expansion and Contraction of Piping: Make allowance throughout for expansion and contraction or pipe. Make branch connections with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Anchor horizontal runs of pipe over 50 feet in length to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends, unless otherwise indicated.

Air Vents: Install as indicated or required to remove air from piping system.

Fixtures and equipment requiring water supplies shall be provided with stop valves.

Stop valves shall have wheel handles unless otherwise noted.

Sterilize the entire water distribution thoroughly with a solution containing not less than 50 parts per million of available chlorine. Allow the sterilizing solution to remain in the system for a period of eight hours, during which time valves and faucets shall be opened and closed several times. After sterilization, flush the solution from the system with clean water until the residual chlorine content is not greater than 0.2 parts per million, unless otherwise indicated.

Sterilization shall be under the supervision of a competent chemist or chemical engineer. The chemist shall make all analysis and shall deliver 6 copies of the analysis results to the Owner.

Pipe Insulation:

Apply insulation after piping has been installed, tested, approved, dry and in a clean condition. Cover fittings and valves (except unions) with insulation cement worked on in two applications to a smooth, hard surface, flush with pipe covering. Provide 8" long, 20 gauge galvanized iron insulation guards at locations of hanger rods and supports. Insulation wall thickness shall conform to the following schedule:

* Cold water piping outside of building insulation (not below ground) and hot water supply and return:
* Mains and horizontal branches: 1" thickness
* Drops in walls and partitions: 1/2" thickness
* Hot water piping: As indicated.

Piping:

Inspect each section of pipe, fittings, special traps, and valves; carefully and thoroughly clean inside before installing. Lay pipe according to the sizes specified or shown on the drawings and proceed up to grade. Cut special lengths of pipe accurately to measurements established at the site and work into place without forcing. Ream cut sections of pipe to remove all burrs. Run exposed pipe where practical parallel or at right angles with the line of the building or other exposed pipes, care being taken to avoid windows, doors or other openings and electric or other outlets, and not to weaken structural portions of the building.

Make changes in direction with fittings, as bending of pipe is prohibited. Use reducing fittings exclusively. Reducing bushings are prohibited. Take care to ensure unrestricted circulation and eliminate noise or vibration. Install unions at final connections to fixtures or equipment, the trimming of which does not permit their convenient removal.

* Screwed Joints:
    * Cut square; remove burrs.
* Soldered Joints:
    * Thoroughly clean outside of male fitting and slightly farther than depth of fitting to a bright finish.
* Use sandpaper, sandcloth, wire brush or steel wool for cleaning.
* Coat tubing and fitting with solder flux, applied with brush.
* Make joint per manufacturer's instructions for solder type required. Solder all joints.
* Remove the internal parts of solder valves prior to soldering. Cast iron mechanical joint piping installed in accordance with manufacturer's recommendations.

Drainage Pipes and Vent Piping: Grade horizontal soil, waste and roof drain pipes at 1/4" per foot where possible, but in no case less than 1/8" per foot. Where an end or circuit vent pipe from any fixture or line of fixtures is connected to a vent line serving other fixtures, locate the connection at least 4 feet above the floor on which the fixtures are located.

Installation of AC shall conform to IAPMO Standard IS-6.

Fittings: Make changes in pipe size on soil, waste and drain lines with reducing fittings or recessed reducers. Make changes in direction with appropriate use of 45 degrees WYES, Half WYES, long sweep 1/4 bends, 1/6,

1/8 or 1/16 bends, except that sanitary tees may be used in soil and waste lines where the change in direction of low is from the horizontal to the vertical, and on the discharge from water closets. Where is becomes necessary because of space conditions to use short radius fittings in any other locations, obtain written authority therefor from Architect or Engineer.

Clean-Outs:

* Make clean-outs accessible by one of the following means:
* Extending to floor or grade above.
* Location in wall with removable plate.
* Size to be same as pipe on which clean-out is installed.
* Covers shall be set flush with finish wall, floor or grade and to be securely anchored by means of integral lugs or bolts. Where surfacing materials, such as resilient floor covering or ceramic tile is used, verify thickness being used. Install clean-out with top so that finished surface will be smooth and flush.

Fixture Supports:

Hang fixtures and supports or set with 1/4" bolts or screws of sufficient length to securely fasten the fixture to the backing, wall or closet ring.

Secure fixture hangerset against concrete or masonry walls with 5/16" bolts into "Tamp-In" type anchors, or 2 unit cinch anchors.

Wood plugs are prohibited.

For fixture hangers set against metal stud walls secure to a metal backing plate at the time the rough piping is installed. Use a steel plate 1/4" thick and not less than 4" wide. Attach the plate to a stud at each end of the plate by bolting with two 1/4" U- Bolts per stud. Fit the bolts through the plate and around the flange of the stud. (Alternate system: use a 1/8" fillet weld across the full width of the flange at top and bottom of the plate.)

Equipment Connections:

Cold water make-ups and gas supply lines, where required, shall be brought to equipment locations and valved off. Make final water and gas extension and connection to all equipment requiring same.

Valves installed on project shall be appropriately tagged. Valve tag shall be secured to piping adjacent to the valve with 12 gauge copper wire. Provide index of valves showing valve number, location and purpose. Index shall be included as a part of the operating and maintenance manual for the project.

Flashing:
Refer to Section 07600 for flashings for piping passing through roof for installation with the roofing.

Pipe Hangers and Supports:
Support vertical pipes more than 10 feet long at the bottom by means of a hanger on the horizontal branch within 3" of the fitting at the base or by means of a base fitting adequately supported or by a suitable riser clamp. Fit hangers on insulated lines around outside of insulation and allow for sheet metal shield.

Wiring: In accordance with Section 16000.

Include mounting of control apparatus with connections to the equipment being controlled. Relays, electric controls, control switches, and related items together with identification and complete instructions shall be furnished. Wiring shall be performed under the Electrical Section of the Specifications. Provide required conductors, conduit, wiring devices and hook-up, whether or not ALL conditions are indicated or specified.

Adjusting and Cleaning

Check out and test operate equipment installed.

Test work and verify that controls are in good working order and properly adjusted. After the equipment has been properly checked and adjusted, start up and operate the equipment to determine controls and equipment are operating properly and the installation is complete and satisfactorily installed.

Pipe lines shall be filled, flushed, drained and then refilled with clear water.

When the tests or inspections show that the work is in any way defective or at variance with the Specification requirements, the Contractor shall immediately make changes necessary to correct the work and remedy the defects to the satisfaction of the Architect. Defective material or equipment shall be removed front he premises.

At the completion of the work, exposed plumbing fixtures, and other equipment, piping, apparatus, walls, floors, ceilings, and material shall be thoroughly cleaned of oil, grease, dirt, rust, cement and plaster. Exposed surfaces shall be cleaned of oil and grease spots and left smooth and clean. Cracks and corners shall be scraped out clean. Finished surface shall be cleaned of oil and grease spots and left smooth an clean.

Damage to glass, finish, or structure of adjacent work shall be properly repaired or replaced. Unused construction materials in or about the building and construction area and dirt and rubbish caused by the work shall be removed. The premises shall be left neat, clean, and usable by the Owner without special effort or knowledge.

END OF SECTION 15400

SECTION 15550 - FIRE PROTECTION SPRINKLER SYSTEM

GENERAL

General Description: This section describes labor, materials and installation requirements necessary to install automatic fire sprinkler system as specified. Work in this section includes, but is not limited to, the following principal items:

The layout and installation of a complete automatic fire sprinkler system as required by national and local codes that meets the requirements of the authority having jurisdiction.

Prepare Working Plans and Shop Drawings: Show all piping, sprinklers, hangers, earthquake bracing, roof construction and occupancy of each area, including ceiling and roof heights as required by NFPA 13, Section 1-9. Indicated the sections to be shop welded and the type of weld fittings to be used. Submit Shop Drawings to the office having jurisdiction for certification. Certified Shop Drawings shall then be submitted to the Architect for review.

Securing and payment for all necessary permits and inspections.

Field verification of all dimensions. No extra charges or compensation will be allowed for any differences between actual dimensions and measurements indicated.

Install outside yard piping as indicated on the drawings complete, including connection to fire line.

Provide a letter of acceptance from the Owner's fire protection insurer and complete printed instructions on operation of system to the Owner.

Provide six complete sets of approved shop drawings stamped by the fire protection authority submitted to the Architect prior to fabrication or installed of sprinkler systems.

Furnishing miscellaneous materials such as brackets, hangers, steel supports for equipment, expansion joints, inspector's test connection, etc.

Provide alarm valves, zone valves, fire department pumper connection, alarm gong, and miscellaneous equipment as required.

QUALITY ASSURANCE:

Provide a Contractor's material and test certificate to the Architect stating that the system has been designed and installed according to national standards, state and local codes.

Prior to connecting the overhead sprinkler piping, flush underground main in the presence of representatives of the regulatory agencies and Owner and meet with their approval.

After completion of the installation, test entire system for acceptance by the authority having jurisdiction.

SUBMITTALS:

Conformance Certificate: Submit a letter of conformance for fire sprinkler system in accordance with National Fire Codes published by National Fire Protection Association (NFPA).

Design Reference Standards: Provide automatic sprinkler system in accordance with the following NFPA Standards.

* NFPA, Chapter 13, entitled, "Sprinkler Systems, Installation."
* NFPA, Chapter 13A, entitled, "Sprinkler Systems, Care and Maintenance."
* NFPA, Chapter 1963, entitled, "Fire Hose Connections."

* NFPA, Chapter 14, entitled, "Standpipe and Hose Systems."
* NFPA, Chapter 24, entitled, "Private Fire Service Mains."

Refer to other chapters of the NFPA that are applicable.

PRODUCTS

Supply Connections: Sprinkler Contractor shall coordinate with Plumbing Contractor on final locations and connection to water mains serving sprinkler system.

Outside Piping: Install outside yard piping as indicated on the drawings complete.

Underground Piping: Shall conform with NFPA Standard 24 (Standard for Installation of Private Fire Mains). Every pipe and all fittings shall be cleaned of all debris, stone and dirt and inspected for cracks and holes before being laid. All underground piping shall be thoroughly flushed in accordance with the requirements of NFPA 13 and 24. The test must be witnessed by a proper authority.

Interior Piping: Shall be pipe conforming to NFPA 13 standards.

Sprinkler Heads: Provide sprinkler heads using approved upright, pendent, spray type, regular bronze, of proper degree ratings as required, installed where indicated and in conformity to NFPA. Pendent sprinkler heads shall be chrome-plated with plated escutcheons. Where flush sprinkler heads are specified, use Grunau Liquidator LD or equal by Grinell, Automatic, Reliable, Viking, or Star, temperature ratings in accordance with NFPA 13.

Fire Department Connection: Provide polished chrome-plated, exposed wall Siamese complete including double clapper checks, plugs and chains. Provide chrome-plated rough brass wall plate lettered, "Auto Spkr.".

Provide floor, wall and ceiling escutcheon flanges on all exposed places where pipe runs through walls, ceiling or floor. Use metal flanges at sprinkler heads, painted to match ceiling.

EXECUTION

Install sprinklers in accordance with above referenced standards, latest edition. After completion of the installation the entire system shall be tested for acceptance by the authority having jurisdiction. Provide suitable receptacle cabinet with extra sprinkler heads with same rating as those installed and one sprinkler wrench, all of which shall be installed at location approved by authority having jurisdiction.

Provide excavation and backfilling necessary for installation of underground piping in conformance with Division 2.

After work has been installed, carefully fit around, close up, repair, patch and paint all chases, holes or openings as directed, to the entire satisfaction of the Owner and Architect.

Acceptance: Provide letter of guarantee stating compliance with the required national standards, state and local codes.

Owners Instructions:

Provide next to the sprinkler rise main a printed sheet, protected by glass or transparent plastic cover, giving brief instructions regarding control, emergency procedures and other data as deemed necessary.

After completion of installation and tests and prior to the building's final acceptance, instruct the Owner or is designated representative in the operation of the sprinkler system.

END OF SECTION 15550