
SECTION 15710 - RADIANT FLOOR HEATING SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work covered by this Section of the specifications includes the design, calculations, documentation, and the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to provide the radiant floor heating systems indicated.

1.2 RELATED DOCUMENTS

- A. The drawings and the specifications referenced or included in the project manual are hereby made a part of the work of this section.

1.3 SUBMITTALS

- A. Substitutions: Your attention is directed to Section 15000-"Substitutions" relative to competition and the (ONLY) notation. Familiarity with this section should be achieved before reading the PRODUCTS section of this specification.
- B. The items for which the submittals paragraph in Section 15000, Supplemental General Mechanical Requirements, apply are as follows:
1. Temperature control system schematic including variables, flow diagrams, ladder diagrams, and point to point wiring diagrams, indicating set points, reset ranges, throttling ranges, differentials, operating ranges, normal positions, controller action, dial ranges, voltages, currents, mounting locations, indicators, and terminal strip points.
 2. Sequence of operation for each system and function.
 3. Generic, functional description of each control component indicated.
 4. Design calculations, tube layout drawings, electrical requirements.

1.4 SYSTEM DESIGN

- A. Design Calculations: Provide and submit calculations for heat loss, loop flow, pump head requirements, and balancing criteria for each heating system loop. The radiant floor heating system shall provide the heat output indicated as a minimum. The design shall provide a radiant floor slab of uniform surface temperature (maximum 85°F). Radiant floor calculations shall be adjusted to account for floor construction, depth of cover, type of floor material, and type of floor finish. The building heating system will provide reset water to each radiant floor zone based on the connected load indicated, a 40°F differential temperature on the heating system (boiler) side, and a linear reset water schedule of; 120°F water temperature at 60°F outside temperature, and 180°F water temperature at 0°F outside temperature. Maximum tube spacing shall be 12" O.C.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Polyethylene Radiant Floor Tubing: Crosslinked polyethylene (PEX), SDR 9, 5/8" O.D., 180°F at 100 psig, conforming to ASTM F-876. Degree of crosslinking shall be 65-89%. Tubing shall be

provided with additional oxygen diffusion barrier which limits oxygen diffusion to 0.1% of normal PEX tube without a barrier.

- B. PEX Kitec Composite Tubing: Cross-linked polyethylene as manufactured by IPEX. Tubing shall have crosslinked polyethylene inner and outer layers with a sonically welded and overlapped aluminum core. The aluminum core creates an oxygen barrier capable of limiting oxygen diffusion below 0.1 g/m³ per day at 104°F. Tubing shall be rated to handle 210°F water temperature at 115 psi. The tubing shall carry a thirty year warranty as standard.
- C. Bend Supports: 18 gage galvanized steel formed support for reduced radius tube bends. Support shall prevent tube collapse and flattening.

2.2 HYDRONIC SPECIALTIES

- A. Automatic Air Vents: Float type to vent air in hydronic systems. Vent shall be constructed of non-corrosive materials and shall have NPT male inlet and compression connector for 1/4 inch overflow to a drain receptor.
- B. Micro-bubble Air Separator: Spirovent inline type, brass body and internals, designed for elimination of air and micro bubbles in heating systems, to less than 3% entrained air at 100°F and 30 psig.
- C. Circulator (inline) for Radiant Floor Service: Pump(s) shall be cartridge-type with cast-iron body and bronze-fitted, 175 psig rated working pressure, selflubricated bearings, replaceable cartridge, UL listed motor.
- D. Valves:
 - 1. Injection Zone Valve: Bronze body, 125 psi max. working pressure, 240°F maximum operating temperature, 24V AC actuator, 5 year warranty on valve body, 3 year warranty on actuator.
 - 2. Four-Way Mixing Valve: Cast-iron body, bronze fitted, 125 psi, 250°F maximum temperature, with mounting assembly for valve actuator. Valve actuator shall be electronic, spring return, low voltage (24VAC), and properly selected for the valve body, temperature, and service.
- E. Piping Manifolds: Bronze construction, multi-port, extendable, specifically made to connect up to PEX tubing with compression type fittings or nitrile tubing with barbed fittings and clamps. Manifolds shall be provided with manual combination shut-off and balance valves for each tube circuit, vents, and drains. Manifolds shall be provided with thermostatic valves as indicated.

2.3 CONTROL

- A. Scope of Work: Furnish and install equipment, accessories and wiring required for a complete and functioning system. Materials and equipment shall be standard components, regularly manufactured for this and/or other systems and not custom designed especially for this project. Components shall have been thoroughly tested and proven in actual use.
- B. Wiring: The radiant floor control system shall be installed by licensed electricians and mechanics, who are trained for this work. Wiring shall be installed in accordance with the requirements of Division 16.
- C. Reset Controller: Mixing Reset Control shall reset supply temperature based on outside air temperature by modulating a 4-way valve. Controller shall be capable of shifting heating curve based on indoor temperature feedback from zone controller. Controller shall receive occupied/unoccupied signal from automatic temperature control system and setback occupied temperature 10°F during

unoccupied period. Controller shall shutdown loop circulator when outside air temperature exceeds 60°F.

- D. Zone Controller: Six Zone Control shall regulate the heat delivered to up to 6 zones by cycling zone valves at the radiant manifold. Shall regulate heat delivery based on feedback from room temperature units (RTU's). Shall produce a proportional output signal from the coldest room to reset controller.
- E. Temperature Sensors: Shall be provided and installed under Section 15900. Coordinate wiring and other components, as required.
- F. Outside Air Sensing Elements: Provide element with sun shade to minimize solar effects. Mount sun shade at least 3 inches from building outside wall. Sun shade shall not inhibit the flow of ambient air across the sensing element. Shade shall also protect sensing element from snow, ice and rain.
- G. Supply Water Sensor: Brass thermowell and sensor wired into controller.
- H. Telestat: 24VAC motorized actuator to open loop control valves.

2.4 SEQUENCE OF CONTROLS

- A. The occupied/unoccupied signal shall be provided from the BAS. The BAS shall provide an "on-off" signal to the radiant floor reset controllers.
- B. The radiant floor system controller shall be a direct digital controller with a proportional-integral-differential (P.I.D.) control scheme to proportion the 4-way valve. The radiant loop supply water temperature shall be reset in response to room temperature and outside air temperature. Room temperature setpoint shall be 70°F for normally occupied areas. The spaces shall be setback 10°F during the unoccupied periods.
- C. The radiant floor zone reset controller shall start-stop the zone circulating pumps.
- D. Room or deck sensors shall open/close associated zone telestats to control room temperature at setpoint.

2.5 EQUIPMENT IDENTIFICATION

- A. Provide laminated plastic nameplates for control valves, pumps, and controls. Laminated plastic shall be 0.125-inch thick melamine plastic conforming to Fed. Spec. L-P-387, black with white center core. Surface shall be a matte finish, corners shall be square. Accurately align lettering and engrave into the white core. Minimum size of nameplates shall be 1.0 inch by 2.5 inches. Lettering shall be minimum of 0.25-inch high normal block lettering.
- B. Radiant Floor Circuit Tags:
 - 1. Attach to each end of each heating circuit at each manifold, a 1-1/2" round or octagonal brass tag with 1/2" indented numerals filled with a durable black compound. In addition to the circuit numbers, manifold tags shall identify the rooms served.
 - 2. Tags shall be securely attached to the piping with copper or brass "S" hooks, or chains.
 - 3. Circuit charts shall be provided for each system and shall consist of schematic drawings or piping layouts, showing and identifying each circuit, manifold, and location. Upon completion of the work, one(1) copy of each chart shall be bound into the O&M manual. Two (2) additional unbound copies shall be delivered to the Resident.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:

1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.
2. Verify that the heating system may be installed in accordance with pertinent codes and regulations and the reviewed Submittals.

3.2 INSTALLATION OF PIPING

- A. Install radiant floor heating system per manufacturer's installation drawings and instructions. Provide services of tubing manufacturer's technical representative to supervise and test the installation.
- B. Tubing shall be laid as indicated, shall be supported and tied to the floor slab reinforcing to maintain alignment, spacing, and elevation. Minimum tube bend radius shall be 10 times the tube diameter. Minimum tube bend radius may be reduced to 7 times the tube diameter when mechanical bend supports are used. Concealed tube runs shall be continuous, no joints shall be concealed in the slab.
- C. Hydronic specialties provided under this section shall be installed per Section 15700.
- D. Provide 2" PVC sleeves at each underfloor feeder penetration of a footing or foundation wall. Provide polyolefin unicellular insulation sleeves at building expansion joints in slab.
- E. Provide tube bend supports at locations where tube bends must be made with a shorter radius bend than that recommended by the manufacturer for un-guided bends.
- F. Provide polyolefin unicellular insulation on tubing which runs below slab, and where tubing density would cause excessive floor surface temperatures (above 88°F).
- G. Maximum tube spacing shall be 12" O.C.

3.3 CLOSING IN WORK

- A. Cover up or enclose work after it has been properly and completely tested and reviewed.
- B. No additional cost to the Owner will be allowed for uncovering and recovering any work that is covered or enclosed prior to required test and review.

3.4 TEST AND ADJUST

- A. Test radiant slab tubing with water to a pressure of 100 psi and hold for a period of two hours. Repair leaks and retest the piping system; repeat process until systems are leak-free. Maintain water pressure during pouring of concrete floors.
- B. Before connecting underfloor tubing to its supply and return manifold, flush the piping to remove foreign materials. Prior to connecting any above slab manifold interconnecting piping to the supply and return manifolds, remove pumps, control valves, and other accessories which might collect dirt. Flush the piping to remove oil and foreign materials. After flushing procedures are complete, reinstall pumps and control valves, make final connections to supply and return manifolds. Protect cleaned tube runs by capping ends until tubes are connected to the manifolds.

- C. After the installation is complete and ready for operation, test the system under normal operating conditions in the presence of the Resident and demonstrate that the system functions as designed.
- D. Demonstrate that the radiant slab heating systems have free and noiseless circulation of water and that parts are watertight.
- E. Correct defects which develop in operational testing, conduct additional tests until defect free operation is achieved.
- F. System Turn-Over and Service: Upon completion of the installation, start up the system and perform necessary testing and run diagnostics to ensure proper operation. An acceptance test in the presence of the Owner's Representative and the Resident shall be performed. When the system performance is deemed satisfactory by these observers, the system parts will be accepted for beneficial use and placed under warranty.

3.5 CLEANUP AND CORROSION PREVENTION

- A. Thoroughly clean piping and equipment. Remove dirt, dust, and debris and leave the premises in a clean and neat condition.

3.6 INSTRUCTIONS

- A. On completion of the project, instruct the Owner's representative in the care and operation of the system. The total period of instruction shall not exceed four (4) hours. The time of instruction shall be arranged with the Owner. In addition to the prime Mechanical Contractor, the control system Contractor, Balancing Contractor, and Owner's representative shall be present and participate in the Owner's instruction.

3.7 GUARANTEE

- A. Provide guarantee per Section 15000, and the General Conditions.
- B. Provide 25 year limited warranty against manufacturing defects on radiant floor tubing.

END OF SECTION