

ITEM 11599.1202 M - REFRIGERANT PIPING

DESCRIPTION. This work shall consist of furnishing and installing refrigerant piping used for air-conditioning applications, as shown on the plans or as directed by the Engineer.

MATERIALS.

MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

Refrigerants:

Allied Signal, Inc./Fluorine Products; Genetron Refrigerants
P.O. Box 1053
Morriston, New Jersey
(800) 631-8138

DuPont Company; Fluorochemicals Division
1007 Market Street
Wilmington, Delaware
(800) 441-9450

Elf Atochem North America, Inc.; Fluorocarbon Division
2000 Market Street
Philadelphia, Pennsylvania
(215) 419-7000

Refrigerant Valves and Specialties:

Climate & Industrial Controls Group
2175 West Park Pl.
Stone Mtn., Georgia
(770) 939-4450

Danfoss Electronics, Inc.
7941 Corporate Dr.
Baltimore, Maryland
(410) 931-8250

Extol, Inc.
208 Republic
Norwalk, Ohio 44857
(800) 486-9865

COPPER TUBE AND FITTINGS

Drawn-Temper Copper Tube: ASTM B 88, Type L.

Annealed-Temper Copper Tube: ASTM B 88, Type L.

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Wrought-Copper Fittings: ASME B16.22.

Wrought-Copper Unions: ASME B16.22.

Brazing Filler Metals: AWS A5.8, Classification BAg-1 (Silver).

Flexible Connectors: 3450-kPa minimum operating pressure; seamless tin-bronze core, high-tensile bronze-braid covering, and solder-joint end connections; dehydrated, pressure tested, minimum 180mm long

VALVES

Diaphragm Packless Valves: 3450-kPa working pressure and 135 deg C working temperature; globe design with straight-through or angle pattern; forged-brass or bronze body and bonnet, phosphor bronze and stainless-steel diaphragms, rising stem and handwheel, stainless-steel spring, nylon seat disc, and with solder-end connections.

Packed-Angle Valves: 3450-kPa working pressure and 135 deg C working temperature; forged-brass or bronze body, forged-brass seal caps with copper gasket, back seating, rising stem and seat, molded stem packing, and with solder-end connections.

Check Valves Smaller Than DN 25: 2760-kPa operating pressure and 141 deg C operating temperature; cast-brass body, with removable piston, polytetrafluoroethylene seat, and stainless-steel spring; globe design. Valve shall be straight-through pattern, with solder-end connections.

Service Valves: 3450-kPa pressure rating; forged-brass body with copper stubs, brass caps, removable valve core, integral ball check valve, and with solder-end connections.

Solenoid Valves: Comply with ARI 760; 121 deg C temperature rating and 2760-kPa working pressure; forged brass, with polytetrafluoroethylene valve seat, 2-way, straight-through pattern, and solder-end connections; manual operator; fitted with suitable NEMA 250 enclosure of type required by location, with 16-GRC conduit adapter, and 24V, normally open holding coil.

Pressure-Regulating Valves: Comply with ARI 770; pilot operated, forged brass or cast bronze, stainless-steel bottom spring, pressure-gage tappings, 24-V dc standard coil, and wrought-copper fittings for solder-end connections; suitable for refrigerant specified.

Pressure-Regulating Valves: Comply with ARI 770; direct acting, brass; with pilot operator, stainless-steel diaphragm, standard coil, and solder-end connection; suitable for refrigerant specified.

Pressure Relief Valves: Straight-through or angle pattern, brass body and disc, neoprene seat, and factory sealed and ASME labeled for standard pressure setting.

Thermostatic Expansion Valves: Comply with ARI 750; brass body with stainless-steel parts; thermostatic-adjustable, modulating type; size and operating characteristics as recommended by manufacturer of evaporator, and factory set for superheat requirements; solder-end connections; with sensing bulb, distributor having side connection for hot-gas bypass line, and external equalizer line.

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Hot-Gas Bypass Valve: Pulsating-dampening design, stainless-steel bellows and polytetrafluoroethylene valve seat; adjustable; sized for capacity equal to last step of compressor unloading; with solder-end connections.

REFRIGERANT PIPING SPECIALITIES

Straight- or Angle-Type Strainers: 3450-kPa working pressure; forged-brass or steel body with stainless-steel wire or brass-reinforced Monel screen of 80 to 100 mesh in liquid lines up to 30 mm, 60 mesh in larger liquid lines, and 40 mesh in suction lines; with screwed cleanout plug and solder-end connections.

Moisture/Liquid Indicators: 3450-kPa maximum working pressure and 93 deg C operating temperature; all-brass body with replaceable, polished, optical viewing window with color-coded moisture indicator; with solder-end connections.

Replaceable-Core Filter-Dryers: 3450-kPa maximum working pressure; heavy gage protected with corrosion-resistant-painted steel shell, flanged ring and spring, ductile-iron cover plate with steel cap screws; wrought-copper fittings for solder-end connections; with replaceable-core kit, including gaskets and the following:

Filter Cartridge: Pleated media with integral end rings, stainless-steel support, ARI 730 rated for capacity.

Filter-Dryer Cartridge: Pleated media with solid-core sieve with activated alumina, ARI 730 rated for capacity.

Wax Removal Cartridge: Molded, bonded core of activated charcoal and desiccant with integral gaskets.

Permanent Filter-Dryer: 2410-kPa maximum operating pressure and 107 deg C maximum operating temperature; steel shell and wrought-copper fittings for solder-end connections; molded-felt core surrounded by desiccant.

Mufflers: 3450-kPa operating pressure, welded-steel construction with fusible plug; sized for refrigeration capacity.

REFRIGERANTS

ASHRAE 34, R-134a: Tetrafluoroethane.
Puron (R-140A)

CONSTRUCTION DETAILS.

SUBMITTALS

Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for thermostatic expansion valves, solenoid valves, and pressure-regulating valves.

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Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationship between piping and equipment.

Refrigerant piping indicated is schematic only. Size piping and design the actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes, to ensure proper operation and compliance with warranties of connected equipment.

Welding Certificates: Copies of certificates for welding procedures and personnel.

Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

QUALITY ASSURANCE

Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX; "Welding and Brazing Qualifications."

American Society of Heating, Refrigerating and Air-Conditioning (ASHRAE) Standard: Comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

American Society of Mechanical Engineers (ASME) Standard: Comply with ASME B31.5, "Refrigeration Piping."

Underwriters Laboratories, Inc, (UL) Standard: Provide products complying with UL 207, "Refrigerant-Containing Components and Accessories, Nonelectrical"; or UL 429, "Electrically Operated Valves."

COORDINATION

Coordinate layout and installation of refrigerant piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

Coordinate pipe fitting pressure classes with products specified in related Sections.

EXTRA MATERIALS

Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Refrigeration Oil Test Kits: Two each, containing everything required to conduct one test.

Refrigerant: Two containers each, with 9 kg of refrigerant.

Filter-Dryer Cartridges: Three of each type.

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PIPING APPLICATIONS

Aboveground, within Building: Type ACR drawn-copper tubing.

VALVE APPLICATIONS

Install diaphragm packless or packed-angle valves in suction and discharge lines of compressor, for gage taps at hot-gas bypass regulators, on each side of strainers.

Install check valves in compressor discharge lines and in condenser liquid lines on multiple condenser systems.

Install packed-angle valve in liquid line between receiver shutoff valve and thermostatic expansion valve for system charging.

Install diaphragm packless or packed-angle valves on each side of strainers and dryers, in liquid and suction lines at evaporators, and elsewhere as indicated.

Install a full-sized, three-valve bypass around each dryer.

Install solenoid valves upstream from each expansion valve and hot-gas bypass valve.

Install solenoid valves in horizontal lines with coil at top.

Coordinate electrical requirements and connections.

Install thermostatic expansion valves as close as possible to evaporator.

If refrigerant distributors are used, install them directly on expansion-valve outlet.

Install valve so diaphragm case is warmer than bulb.

Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.

If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

Install pressure-regulating and pressure relief valves as required by ASHRAE 15. Pipe pressure relief valve discharge to outside.

SPECIALTY APPLICATIONS

Install liquid indicators in liquid line leaving condenser, in liquid line leaving receiver, and on leaving side of liquid solenoid valves.

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Install strainers immediately upstream from each automatic valve, including expansion valves, solenoid valves, hot-gas bypass valves, and compressor suction valves.

Install strainers in main liquid line where multiple expansion valves with integral strainers are used.

Install strainers in suction line of steel pipe.

Install moisture-liquid indicators in liquid lines between filter-dryers and thermostatic expansion valves and in liquid line to receiver.

Install pressure relief valves on ASME receivers; pipe discharge to outdoors.

Install replaceable-core filter-dryers in vertical liquid line adjacent to receivers and before each solenoid valve.

Install permanent filter-dryers in low-temperature systems, in systems using hermetic compressors, and before each solenoid valve.

Install solenoid valves in liquid line of systems operating with single pump-out or pump-down compressor control, in liquid line of single or multiple evaporator systems, and in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into suction line when system shuts down.

Install flexible connectors at or near compressors.

PIPING INSTALLATION

Install refrigerant piping according to ASHRAE 15.

Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

Arrange piping to allow inspection and service of compressor and other equipment. Install valves and specialties in accessible locations to allow for service and inspection.

Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

Slope refrigerant piping as follows:

Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.

Install horizontal suction lines with a uniform slope downward to compressor.

Install traps and double risers to entrain oil in vertical runs.

Liquid lines may be installed level.

Install unions to allow removal of solenoid valves, pressure-regulating valves, and expansion valves and at connections to compressors and evaporators.

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When brazing, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion valve bulb.

Hanger, support, and anchor products are specified in "Hangers and Supports."

Install the following pipe attachments:

Adjustable steel clevis hangers for individual horizontal runs less than 6.0 m long.

Roller hangers and spring hangers for individual horizontal runs 6.0 m or longer.

Pipe rollers for multiple horizontal runs 6.0 m or longer, supported by a trapeze.

Spring hangers to support vertical runs.

Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

DN 15: Maximum span, 1500 mm; minimum rod size, 6.4 mm.

DN 18: Maximum span, 1500 mm; minimum rod size, 6.4 mm.

DN 25: Maximum span, 1800 mm; minimum rod size, 6.4 mm.

Support vertical runs at each floor.

PIPE JOINT CONSTRUCTION

Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide) during brazing to prevent scale formation.

FIELD QUALITY CONTROL

Test and inspect refrigerant piping according to ASME B31.5, Chapter VI.

Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure.

ADJUSTING

Adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.

Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

Adjust set-point temperature of the conditioned air controllers to the system design temperature.

Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

Open shutoff valves in condenser water circuit.

Check compressor oil level above center of sight glass.

Open compressor suction and discharge valves.

Open refrigerant valves, except bypass valves that are used for other purposes.

Check compressor-motor alignment, and lubricate motors and bearings.

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CLEANING

Before installing copper tubing other than Type ACR, clean tubing and fittings with trichloroethylene. Replace core of filter-dryer after system has been adjusted and design flow rates and pressures are established.

SYSTEM CHARGING

Charge system using the following procedures:

Install core in filter-dryer after leak test but before evacuation.

Evacuate entire refrigerant system with a vacuum pump to a vacuum of 67 Pa. If vacuum holds for 12 hours, system is ready for charging.

Break vacuum with refrigerant gas, allowing pressure to build up to 14 kPa.

Charge system with a new filter-dryer core in charging line. Provide full-operating charge.

OPERATION AND MAINTENANCE

This work shall consist of a training program for the operations and maintenance (O&M) personnel. The objective of the O&M training program is to provide qualified technicians with the knowledge to operate and maintain the equipment and system in accordance with design intent, manufacturers' recommendations, and procedures contained in the Systems Manual.

The program shall be detailed such that it can be repeated for new and replacement personnel. Thorough documentation must be supplied for future training activities.

Training Programs shall be developed and executed, for specified equipment, using the Manufacturer's qualified representative. Contractor shall furnish all training materials, tools and equipment to conduct training session(s) for Owner's O&M personnel.

Contractor shall videotape each type of training session on DVD, to be given as specified in individual system manual, to serve as a future reference and review resource. Where multiple training sessions, of the same level, are required for a particular piece of equipment, at least two of the training sessions shall be video taped to produce the training documentation tape. It is not the intent to have every training session for a particular type of equipment or level of training, video taped. However, the Contractor is responsible for providing an informative videotape covering all pertinent training topics which may require video taping of more than one session.

METHOD OF MEASUREMENT. The work will be measured for payment on a lump sum basis for the work completed in accordance with the Contract Documents and as directed by the Engineer.

BASIS OF PAYMENT.

The lump sum price bid for refrigerant piping shall include the cost of all labor, materials, equipment, accessories, and appliances necessary to complete the work as shown on the contract drawings, and as specified in the referenced section.

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Monthly payment will be made for this item in proportion to the total amount of work completed up to a limit of 50% of the lump sum price bid. The remaining 50% of the lump sum price bid shall be paid after all systems in the Refrigerant Piping have been tested and accepted by the Owner, and the O&M training program is completed and accepted by the Owner.

Before the first payment estimate is issued for work under this item, the Contractor shall furnish to the Engineer a detailed estimate of quantities and prices for all materials and labor included under this item, which shall aggregate the contract lump sum price bid for this item. This estimate shall be made out in such form as required and, if requested, supported by such evidence of its correctness as the Engineer may direct. This evidence shall include certified copies of subcontracts.

The Contractor agrees that this detailed estimate shall not become effective until it has been approved by the Engineer, who shall have the right to revise the estimate as, in his/her judgment, may be required to make the various subdivisions of work conform to their value. The approved detail estimate shall be used as a basis for monthly payment for work completed under this item. The proportionate share for bond premiums for this item shall not be listed as a separate item but its cost shall be distributed pro rate throughout the estimate for this item.