

CHAPTER 21

HYDRONIC PIPING

SECTION M2101 HYDRONIC PIPING SYSTEMS INSTALLATION

M2101.1 General. Hydronic piping shall conform to Table M2101.1. Approved piping, valves, fittings and connections

shall be installed in accordance with the manufacturer's installation instructions. Pipe and fittings shall be rated for use at the operating temperature and pressure of the hydronic system. Used pipe, fittings, valves or other materials shall be free of foreign materials.

**TABLE M2101.1
HYDRONIC PIPING MATERIALS**

| MATERIAL | USE CODE ^a | STANDARD ^b | JOINTS | NOTES |
|---|-----------------------|--|---|--|
| Brass pipe | 1 | ASTM B 43 | Brazed, welded, threaded, mechanical and flanged fittings | |
| Brass tubing | 1 | ASTM B 135 | Brazed, soldered and mechanical fittings | |
| Chlorinated poly (vinyl chloride) (CPVC) pipe and tubing | 1, 2, 3 | ASTM D 2846 | Solvent cement joints, compression joints and threaded adapters | |
| Copper pipe | 1 | ASTM B 42, B 302 | Brazed, soldered and mechanical fittings threaded, welded and flanged | |
| Copper tubing (type K, L or M) | 1, 2 | ASTM B 75, B 88, B 251, B 306 | Brazed, soldered and flared mechanical fittings | Joints embedded in concrete |
| Cross-linked polyethylene (PEX) tubing | 2, 3 | ASTM F 876, F 877 | Mechanical compression | Install in accordance with manufacturer's instructions. |
| Cross-linked polyethylene/aluminum/cross-linked polyethylene-(PEX-AL-PEX) pressure pipe | 1, 2 | ASTM F 1281 or CAN/ CSA B137.10 | Mechanical, crimp/insert | Install in accordance with manufacturer's instructions. |
| Plastic fittings PEX | | ASTM F 1807 | | |
| Polybutylene (PB) pipe and tubing | 1, 2, 3 | ASTM D 3309 | Heat-fusion, crimp/insert and compression | Joints in concrete shall be heat-fused. |
| Polyethylene (PE) pipe, tubing and fittings (for ground source heat pump loop systems) | 1, 2, 4 | ASTM D 2513; ASTM D 3350; ASTM D 2513; ASTM D 3035; ASTM D 2447; ASTM D 2683; ASTM F 1055; ASTM D 2837; ASTM D 3350; ASTM D 1693 | Heat-fusion | |
| Soldering fluxes | 1 | ASTM B 813 | Copper tube joints | |
| Steel pipe | 1, 2 | ASTM A 53; A 106 | Brazed, welded, threaded, flanged and mechanical fittings | Joints in concrete shall be welded. Galvanized pipe shall not be welded or brazed. |
| Steel tubing | 1 | ASTM A 254 | Mechanical fittings, welded | |

For SI: °C = [(°F)-32]/1.8.

a. Use code:

1. Above ground.
2. Embedded in radiant system.
3. Temperatures below 180°F only.
4. Low temperature (below 130°F) applications only.

b. Standards as listed in Chapter 43.

HYDRONIC PIPING

M2101.2 System drain down. Hydronic piping systems shall be installed to permit the system to be drained. When the system drains to the plumbing drainage system, the installation shall conform to the requirements of Chapters 25 through 32 of this code.

M2101.3 Protection of potable water. The potable water system shall be protected from backflow in accordance with the provisions listed in the plumbing chapters.

M2101.4 Pipe penetrations. Openings through concrete or masonry building elements shall be sleeved.

M2101.5 Contact with building material. A hydronic piping system shall not be in direct contact with any building material that causes the piping material to degrade or corrode.

M2101.6 Drilling and notching. Wood-framed structural members shall be drilled, notched or altered in accordance with the provisions of Sections R502.6, R602.6, R602.6.1 and R802.6. Holes in cold-formed, steel-framed, load-bearing members shall only be permitted in accordance with Sections R506.2, R603.2 and R804.2. In accordance with the provisions of Sections R505.3.5, R603.3.4 and R804.3.5, cutting and notching of flanges and lips of cold-formed, steel-framed, load-bearing members shall not be permitted.

M2101.7 Prohibited tee applications. Fluid in the supply side of a hydronic system shall not enter a tee fitting through the branch opening.

M2101.8 Expansion, contraction and settlement. Piping shall be installed so that piping, connections and equipment shall not be subjected to excessive strains or stresses. Provisions shall be made to compensate for expansion, contraction, shrinkage and structural settlement.

M2101.9 Piping support. Hangers and supports shall be of material of sufficient strength to support the piping, and shall be fabricated from materials compatible with the piping material. Piping shall be supported at intervals not exceeding the spacing specified in Table M2101.9.

M2101.10 Tests. Hydronic piping shall be tested hydrostatically at a pressure of not less than 100 pounds per square inch (psi) (689 kPa) for a duration of not less than 15 minutes.

**SECTION M2102
 BASEBOARD CONVECTORS**

M2102.1 General. Baseboard convectors shall be installed in accordance with the manufacturer's installation instructions. Convectors shall be supported independently of the hydronic piping.

**SECTION M2103
 FLOOR HEATING SYSTEMS**

M2103.1 Piping materials. Piping for embedment in concrete or gypsum materials shall be standard-weight steel pipe, copper tubing, cross-linked polyethylene/aluminum/cross-linked polyethylene (PEX-AL-PEX) pressure pipe, chlorinated polyvinyl chloride (CPVC) or polybutylene with a minimum rating of 100 psi at 180°F (690 kPa at 82°C).

M2103.2 Piping joints. Piping joints that are embedded shall be installed in accordance with the following requirements:

1. Steel pipe joints shall be welded.
2. Copper tubing shall be joined with brazing material having a melting point exceeding 1,000°F (538°C).
3. Polybutylene pipe and tubing joints shall be installed with socket-type, heat-fused polybutylene fittings.
4. CPVC tubing shall be joined using solvent cement joints.

M2103.3 Testing. Piping or tubing to be embedded shall be tested by applying a hydrostatic pressure of not less than 100 psi (690 kPa). The pressure shall be maintained for 15 minutes, during which all joints shall be visually inspected for leaks.

**TABLE M2101.9
 HANGER SPACING INTERNALS**

| PIPING MATERIAL | MAXIMUM HORIZONTAL SPACING (feet) | MAXIMUM VERTICAL SPACING (feet) |
|-------------------------------|--------------------------------------|------------------------------------|
| ABS | 4 | 10 |
| CPVC ≤ 1 inch pipe or tubing | 3 | 5 |
| CPVC ≥ 1¼ inch | 4 | 10 |
| Copper or copper alloy pipe | 12 | 10 |
| Copper or copper alloy tubing | 6 | 10 |
| PB pipe or tubing | 2.67 | 4 |
| PE pipe or tubing | 2.67 | 4 |
| PEX tubing | 2.67 | 4 |
| PVC | 4 | 10 |
| Steel pipe | 12 | 15 |
| Steel tubing | 8 | 10 |

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

SECTION M2104 LOW TEMPERATURE PIPING

M2104.1 Piping materials. Low temperature piping for embedment in concrete or gypsum materials shall be as indicated in Table M2101.1.

M2104.2 Piping joints. Piping joints (other than those in Section M2103.2) that are embedded shall comply with the following requirements:

1. Cross-linked polyethylene (PEX) tubing shall be installed in accordance with the manufacturer's instructions.
2. Polyethylene tubing shall be installed with heat fusion joints.

M2104.2.1 Polyethylene plastic pipe and tubing for ground source heat pump loop systems. Joints between polyethylene plastic pipe and tubing or fittings for ground source heat pump loop systems shall be heat fusion joints conforming to Section M2104.2.1.1, electrofusion joints conforming to Section M2104.2.1.2 or stab-type insertion joints conforming to Section M2104.2.1.3.

M2104.2.1.1 Heat-fusion joints. Joints shall be of the socket-fusion, saddle-fusion or butt-fusion type, fabricated in accordance with the piping manufacturer's instructions. Joint surfaces shall be clean and free of moisture. Joint surfaces shall be heated to melt temperatures and joined. The joint shall be undisturbed until cool. Fittings shall be manufactured in accordance with ASTM D 2683.

M2104.2.1.2 Electrofusion joints. Joints shall be of the electrofusion type. Joint surfaces shall be clean and free of moisture, and scoured to expose virgin resin. Joint surfaces shall be heated to melt temperatures for the period of time specified by the manufacturer. The joint shall be undisturbed until cool. Fittings shall be manufactured in accordance with ASTM F 1055.

M2104.2.1.3 Stab-type insert fittings. Joint surfaces shall be clean and free of moisture. Pipe ends shall be chamfered and inserted into the fitting to full depth. Fittings shall be manufactured in accordance with ASTM D 2513.

SECTION M2105 GROUND SOURCE HEAT PUMP SYSTEM LOOP PIPING

M2105.1 Testing. The assembled loop system shall be pressure tested with water at 100 psi (690 kPa) for 30 minutes with no observed leaks before connection (header) trenches are backfilled. Flow rates and pressure drops shall be compared to calculated values. If actual flow rate or pressure drop figures differ from calculated values by more than 10 percent, the problem shall be identified and corrected.

