

## 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.

**M2101.2 System drain down.** Hydronic piping systems shall be installed to permit draining the system. When the system drains to the plumbing drainage system, the installation shall conform to the requirements of the *Plumbing 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 Code*.

**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 be permitted only 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) (690 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), polybutylene, cross-linked polyethylene (PEX) tubing or polypropylene (PP) 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.
5. Polypropylene pipe and tubing joints shall be installed with socket-type heat-fused polypropylene fittings.
6. Cross-linked polyethylene (PEX) tubing shall be joined using cold expansion, insert or compression fittings.

**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.

**Exception:** Continuous loop systems using PEX or PP tubing are allowed to be tested with an air pressure test of 100 psi (690 kPa) for 30 minutes with no observed leaks.

**M2103.4 Pressurizing during installation.** Piping to be embedded in concrete shall be pressure tested prior to pouring concrete in accordance with Section M2103.3. During pouring, the piping shall be maintained at the proposed operating pressure.

### 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.

**HYDRONIC PIPING**

**TABLE M2101.1  
HYDRONIC PIPING MATERIALS**

<b>MATERIAL</b>	<b>USE CODE<sup>a</sup></b>	<b>STANDARD<sup>b</sup></b>	<b>JOINTS</b>	<b>NOTES</b>
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)	1, 2, 3	ASTM F 876, F 877	(See PEX fittings)	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.
PEX Fittings		ASTM F 1807 ASTM F 1960 ASTM F 2098	Copper-crimp/insert fittings, cold expansion fittings, stainless steel clamp, insert fittings	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	
Polypropylene (PP)	1, 2, 3	ISO 15874 ASTM F 2389	Heat-fusion joints, mechanical fittings, threaded adapters, compression joints	
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 systems.
3. Temperatures below 180°F only.
4. Low temperature (below 130°F) applications only.

b. Standards as listed in Chapter 43.

**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
PP < 1 inch pipe or tubing	2.67	4
PP > 1¼ inch	4	5
PVC	4	10
Steel pipe	12	15
Steel tubing	8	10

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

**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.
3. Polypropylene (PP) tubing shall be installed in accordance with the manufacturer's instructions.

**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.** 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.

