

Internal Use Only

Installation Standard For WELDED COPPER AND COPPER ALLOY WATER TUBE

IAPMO IS 21-2006

1.0 SCOPE

This standard shall govern the installation of welded copper and copper alloy water tube in potable hot and cold water systems. Installation, material, and inspection shall comply with the current edition of the Uniform Plumbing Code [UPC]TM published by the International Association of Plumbing and Mechanical Officials and this standard.

Note: The following sections of the Uniform Plumbing Code apply to welded copper and copper alloy water tube.

811.1 Chemical or Industrial Waste

903.2 Use of Copper Tubing

Table 14-1 Standards

ANSI B 16.18 Cast Copper Alloy Solder Joint Pressure Fittings

ANSI B 16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

ASTM B 447 Welded Copper Tube

Appendix A Chart A-4 Friction Loss

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- 705.3.3 Ground Joint, Flared or Ferrule Connections

2.0 PRODUCT REQUIREMENTS

2.1 Minimum Standards

2.1.1 Materials. Materials shall comply with the appropriate standard in Table 14-1 of the UPC.

Note: The nominal or standard size of copper and copper alloy welded water tube is always 0.125 inch (3.8 mm) or 1/8 inch (3.8 mm) smaller than the actual outside diameter dimension of the tube. For example, 3 inch (76 mm) nominal size copper plumbing, tube measures 3-1/8 inch (79.2 mm) O.D., 1/2 inch (12.7 mm) nominal size copper plumbing tube measures 5/8 inch (15.9 mm) O.D., etc.

2.2 Use of Copper Tubing

2.2.1 Markings. Markings shall be visible for inspection.

2.2.1.1 Water tube shall bear the following incised marked at not over 18 inch (457 mm) intervals:

- (a) Manufacturer's name or trademark;
- (b) Tube type; and
- (c) Country of origin.

2.2.1.2 All hard drawn tube shall be identified throughout its entire length by a colored marking not less than 3/16 inch in height, including legend repeated at intervals not

greater than 3 feet (914 mm). The legend shall include the type of tube, welded, ASTM specification, name or trademark of the manufacturer or both, and the country of origin. [UPC 604.3]

- (a) Tube listed by IAPMO that is covered by this standard shall be labeled with the designated IAPMO certification mark to show compliance with this standard.

2.3 Joints

2.3.1 General Information. Copper tube and fittings may be joined in a number of ways, depending on the purpose of the system. Soldering and brazing with capillary fittings are the methods used most.

The American Welding Society defines soldering as a joining process which takes place below 840°F (449°C) and brazing as a similar process which occurs above 840°F (449°C) but below the melting point of the base metals. In actual practice for copper systems, most soldering is done at temperatures ranging from about 350°F to 550°F (177° to 288°C), while most brazing is done at temperatures ranging from 1100° F to 1500°F (593°C to 816°C). The choice between soldering or brazing will generally depend on operating conditions. Solder joints are generally used where the service temperature does not exceed 205°F (96°C), while brazed joints can be used where greater strength is required, or where system temperatures are as high as 400°F (204°C). [UPC 316.1]

2.3.2 Fittings for Soldered, Brazed, and Flared Joints. Fittings are available in all standard tube sizes and in a wide variety of types to cover needs for plumbing. They can be either soldered or brazed, although brazing cast fittings requires care. Wrought copper pressure fittings are also available over a wide range of sizes and types. These, too, can be joined by either soldering or brazing, and wrought fittings are preferred where brazing is the joining method. Otherwise, the choice between cast and wrought fittings is

largely a matter of the user's preference. Flared-tube fittings provide metal-to-metal contact similar to ground joint unions; both can be easily taken apart and reassembled. They are especially useful where residual water cannot be removed from the tube and soldering is difficult. Flared joints may be required where a fire hazard exists and the use of a torch to make soldered or brazed joints is not allowed.

2.3.3

Solders

Note: *Users of the Uniform Plumbing Codes are reminded that provisions of the Federal Clean Drinking Act of 1986, which all must obey, forbid the use of solder which contains in excess of 0.2% of lead, by weight in potable water systems. The provisions of the act are incorporated in all ordinances, statutes, state and municipal regulations by reference and by operation of law.*

The selection of a solder depends on the operating pressure and temperature of the line. Consideration should also be given to the stresses on the joint caused by thermal expansion and contraction. However, stresses due to temperature changes should not be significant in two commonly encountered cases: when tube lengths are short, or when expansion loops are used in long tube runs.

Solder is generally used in wire form, but paste-type solders are also available. These are finely granulated solders in suspension in a paste flux. When using paste-type solders, observe these four rules:

1. Wire solder must be applied in addition to the paste to fill the voids and assist in displacing the flux, otherwise the surfaces may be well "tinned" and yet there may not be a good joint with a continuous bond.
2. The paste mixture must be thoroughly stirred if it has been standing in the can for more than a very short time, as the solder has a tendency to settle rapidly to the bottom.
3. The flux cannot be depended on to

clean the tube. Cleaning should be done manually as is recommended for any other flux and solder.

4. Remove any excess flux.

Solders are available containing small amounts of silver or other additives to impart special properties. Such solders may require special fluxes. The manufacturer's recommendations should be consulted regarding proper procedures and fluxes for such solders and about the expected properties.

2.3.4 Soldering Flux

The functions of the soldering flux are to remove residual traces of oxides, to promote wetting, and to protect the surfaces to be soldered from oxidation during heating. The flux should be applied to clean surfaces and only enough should be used to lightly coat the areas to be joined.

An oxide film may reform quickly on copper after it has been cleaned. Therefore, the flux should be applied as soon as possible after cleaning.

CAUTION

Careless workmanship, especially during flux applications, can result in corrosion of the tube long after the system has been installed. If excessive flux is used, the residue inside the tube can cause corrosion. In an extreme case, such residual flux can actually lead to perforation through the tube wall causing leakage. To guard against this danger, it is important (1) to choose a flux that is not too corrosive, and (2) to use only the minimum amount actually needed to make the joint.

2.3.5 Solder Joints

Soldering and brazing both involve basic steps, which must be executed with care and craftsmanship. The steps are:

- (1) Measuring
- (2) Cutting
- (3) Reaming
- (4) Cleaning
- (5) Fluxing
- (6) Assembly and support

- (7) Heating
- (8) Applying the filler metal
- (9) Cooling and cleaning

Each step contributes to a strong, dependable joint.

2.3.5.1 Measuring

Measuring the length of each tube segment must be accurate. Inaccuracy can compromise joint quality. If the tube is too short it will not reach all the way into the socket of the fitting and a proper joint cannot be made. If the tube segment is too long, there is danger of cocking the tube in the fitting and putting strain on the system which could affect service life.

2.3.5.2 Cutting

Once the tube is measured it can be cut. Cutting can be accomplished in a number of different ways to produce a satisfactory square end. The tube can be cut with a disc-type tube cutter, a hacksaw, an abrasive wheel, or with a stationary or portable bandsaw. Care must be taken that the tube is not deformed while being cut. Regardless of method, the cut must be square with the run of the tube so that the tube will seat properly in the fitting socket.

2.3.5.3 Reaming

All pipe and tube shall be reamed to the full I.D. of the pipe and tube.

Tools used to ream tube ends include the reaming blade on the tube cutter, half-round or round files, a pocket knife, and a suitable deburring tool. With annealed tube, care must be taken not to deform the tube end by applying too much pressure. Both the inside and the outside of the tube may require removal of the burr.

2.3.5.4 Cleaning

The removal of oxides and surface soil is crucial if filler metal is to flow properly into the joint. Unremoved oxide, surface soil, and oil can interfere with the strength of the joint and cause failure.

Mechanical cleaning is a simple operation. The end of the tube should be abraded lightly using sand cloth or nylon abrasive