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PIPE, FITTINGS, WELDING

Pipe Materials, Types of Pipe, Commercial Pipe Dimensions, Threading Practice, Pipe Fittings, Flange Facings and Gaskets, Valves, Welding, Expansion and Flexibility, Hangers and Supports

IMPORTANT considerations in the selection and installation of pipe and fittings for heating, ventilating, and air conditioning are dealt with in this chapter.

PIPE MATERIALS

Use of corrosion-resistant materials for pipe, including special alloy steels, copper, and red brass, has increased considerably during the past few years. The following brief discussion indicates the variety of pipe materials and the types of pipe available.

Wrought-Steel Pipe. Because of its lower cost, the great bulk of wrought pipe used for heating and ventilating work at the present time is of wrought steel. The material used for steel pipe is a mild steel made by the acid-bessmer, the open-hearth, or the electric-furnace process. Ordinary wrought-steel pipe is made either by shaping sheets of metal into cylindrical form and welding the edges together, or by forming or drawing from a solid billet. The former is known as *welded pipe*, the latter as *seamless pipe*.

Many types of welded pipe are available, although the smaller sizes most frequently used in heating and ventilating work are made by the lap-weld, resistance-weld, or butt-weld process. While the lap-weld and resistance-weld processes produce a better weld than the butt type, lap-weld and resistance-weld pipe are seldom manufactured in nominal pipe sizes less than 2 in. Seamless pipe can be obtained in the small sizes at a somewhat higher cost, and is listed as pressure tubing below 2 in.

Seamless steel pipe is frequently used for high-pressure work or where pipe is desired for close coiling, cold bending, or other severe forming operations. Its advantages are its greater strength which permits use of a thinner wall and, in the small sizes, its freedom from the occasional tendency of welded pipe to split at the weld when bent.

Wrought-Iron Pipe. Wrought-iron pipe may be identified by the spiral line marked into each length, either knurled into the metal or painted on it in red or other bright color. Otherwise, there is little difference in the appearance of wrought-iron and steel pipe, although microscopic examination of polished and etched specimens will readily disclose different grain structures.

Cast-Ferrous Pipe. There are now available several types of cast-ferrous metal pipe made of a good grade of cast-iron with or without additions of nickel, chromium, or other alloy. This pipe is available in sizes from 1½ in. to 6 in., and in standard lengths of 5 or 6 ft, with external and internal diameters closely approximating those of extra strong wrought pipe. Cast-ferrous pipe may be obtained coupled, beveled for welding, or with ends plain or grooved for the several types of couplings. It is easily cut and threaded as well as welded. The fact that it is readily welded enables the

manufacturers to supply the pipe in any lengths practicable for handling.

Alloy Metal Pipe. Both iron and steel pipe are available in the alloy class. In the case of iron pipe when copper and molybdenum are added, the material is known as alloy wrought-iron pipe.

By common custom steel is considered to be an alloy when the maximum range of alloying elements exceed certain limits such as 1.65 percent manganese, 0.60 silicon, or 0.60 copper. Also, a steel is an alloy if any of the following elements are specified in minimal quantities or within limits: Al, B, Cr (up to 3.99), Co, Cu, Mo, Ni, Ti, W, V, Zr, or any other element added to obtain a certain alloying effect. Small quantities of certain elements are present in alloy steels and are considered as incidental and may be present to the following maximum amounts: copper—0.35 percent, nickel—0.25 percent, chromium—0.20 percent, and molybdenum—0.08 percent.

Commercially, steel is considered stainless when chromium exceeds 3.99 percent regardless of the inclusion of other alloying elements. With tubing, however, an alloy becomes stainless when it contains a minimum of 10.5 percent chromium.

The alloy and stainless steels are used for high temperature piping and for highly corrosive fluids and gases.

Copper Pipe and Fittings. Owing to inherent resistance to corrosion, copper and red brass pipe have always been used in heating, ventilating, and water supply installations, but the cost with standard dimensions for threaded connections has been high. The introduction of fittings which permit erection by soldering or sweating, allows the use of tube with thinner walls than would be possible with threaded connections, thereby reducing the cost of installations.

COMMERCIAL PIPE DIMENSIONS

Commercial pipe dimensions are covered in the following specifications of the American Society for Testing Materials: (1) steel—ASTM A-120 and A-53, (2) wrought iron—ASTM A-72, and (3) copper tube—ASTM A-88.

Tables 1 and 2 are based on these specifications.

In addition to the specifications for these three materials, there are standards for copper or red brass IPS, clay or concrete, and cast-iron pipe. Copies of the following specifications may be obtained from the American Society for Testing Materials: (1) steel, wrought-iron, and cast-iron—Series A, (2) copper and red brass—Series B, and (3) clay and concrete—Series C.

Table 3 lists the sizes available in each of the specifications and classes of steel pipe. Note that butt-weld is not available above 4-in. size and that lap-weld, electric-resistance-weld, and seamless are not available below 2-in. size.