features not obtainable with the coil and bunker method. Higher suction temperature operation, more uniform temperatures, higher relative humidities with the defrosting cycle, moderate first cost, and a minimum of installation expense are likewise factors in their development.

New uses have appeared for unit air cooler application in industrial and commercial processes involving both the raw materials and finished product, where the maintenance of low temperatures is a necessary part of these processes. Of particular interest is the new field of extreme low temperature application, where many new uses for refrigeration are being found.

Types of Units. The two standard types are the suspended or ceiling type, and the vertical or floor mounted type. There are variations of these such as the panel type, which is wall mounted and arranged to take in air from the lower section, and discharge it from the upper section.

The ceiling type has the appearance of a unit heater, with its propeller type fan blowing air through a bank of coils. Singly or in combination, they are easily installed and occupy little or no useful space. Alterations may be accomplished with little cost by relocating units or adding additional ones for increased capacity.

The floor mounted types employ blower type fans, as their air deliveries are higher and their locations may be remote from the space to be refrigerated. Air velocities and volumes must be designed for the individual application. Due to the small temperature difference between coil and air, the air volumes handled are many times greater than in comfort air conditioning work. Where a defrosting cycle is not practicable, this type of unit may employ a pump to spray a eutectic solution over the coils for the purpose of avoiding frosting.

Ratings. In order to rate and test equipment of this kind which normally operates below the frost temperature, a proposed code, Standard Methods of Rating and Testing Forced-Circulation and Natural Convection Air Coolers for Refrigeration,[3] has been issued. In this standard, the gross cooling effects are taken since the motor power input equivalent is to be computed as part of the load.

REFERENCES

[1] Prepared by a Joint Committee of the *American Society of Refrigerating Engineers*, American Society of Heating and Ventilating Engineers, *Refrigerating Machinery Association, National Electrical Manufacturers' Association*, and *Air Conditioning Manufacturers' Association* (*A.S.R.E. Circular* No. 13-42).

[2] Standard Method of Rating and Testing Self-Contained Air Conditioning Units for Comfort Cooling prepared by a Joint Committee of the *American Society of Refrigerating Engineers*, American Society of Heating and Ventilating Engineers, *Refrigerating Machinery Association, National Electrical Manufacturers' Association*, and *Air Conditioning Manufacturers' Association* (*A.S.R.E. Circular* No. 16).

[3] Proposed A.S.R.E. Standard Methods of Rating and Testing Forced-Circulation and Natural Convection Air Coolers for Refrigeration (*A.S.R.E. Circular* No. 25-44).

CHAPTER 26

PIPE, FITTINGS, WELDING

Pipe Materials, Types of Pipe, Commercial Pipe Dimensions, Expansion and Flexibility of Pipe, Pipe Threads and Hangers, Types of Fittings, Flange Facings and Gaskets, Welding in Erection of Piping, Valves

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 and irons, wrought-iron, copper, and brass, has increased considerably during the past few years. The recent development of copper, brass, and bronze fittings which can be assembled by soldering or sweating, permits the use of thin-wall pipe and thereby has reduced the initial cost of such installations. The following brief discussion indicates the variety of pipe materials and the types of pipe available.

Wrought-Steel Pipe. Because of its low price, 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-bessemer, 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.

Seamless steel pipe is frequently used for high pressure work or where pipe is desired for close coiling, cold bending, or other forming operations. Its advantages are its somewhat 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 is claimed to be more corrosion-resisting than ordinary steel pipe, and therefore its somewhat higher first cost is said to be justified on the basis of longer life expectancy. 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 the difference.

Cast-Ferrous Pipe. There are now available several types of cast-ferrous