

secured from various sources and represent approximate value indexes which must be tempered by judgment and experience for specific job conditions. The values are relative costs, not dollar costs. The installed cost of 2½-in. Type K copper and Schedule 40 steel pipe has been assigned a value of 1.0. Material costs are generally higher for copper than for steel, but the installation costs are less.

From Table 21, it is apparent that, for nominal sizes up to 2½ in., the use of copper tube is usually more economical, but for sizes over 3 in., the use of steel pipe is usually more economical. However, job conditions, the experience of the men actually installing the piping, design limitations such as corrosion, ambient temperature, availability of materials, and other factors may supersede simple cost considerations.

REFERENCES

¹ American Standard Code for Pressure Piping (American Standards Association, ASA B-31.1, 1955, and Addenda B31.1a,

1963). *Refrigeration Piping* (American Standards Association, ASA B31.5, 1962, and Addenda B31.5a, 1963).

² API Specification 6L for Line Pipe (American Petroleum Institute).

³ Standard Manual on Pipe Welding (Heating, Piping and Air Conditioning Contractors National Association, 1951, 2nd ed.). *Welding Handbook* (American Welding Society, 1942).

⁴ ASME Power Boiler Code (American Society of Mechanical Engineers).

⁵ Marine Engineering Regulations of the Coast Guard (American Bureau of Shipping). *Welding (General Specifications for Inspection of Material, Appendix VII, U. S. Navy)*. General—*for vessels of the U. S. Navy (Specifications for Welding, Appendix 5, Part 1, Bureau of Ships, April 1940)*.

⁶ The Barco "Off-Set" Method (Barco Manufacturing Company, Barrington, Illinois).

⁷ Sabin Crocker: *Piping Handbook* (McGraw-Hill Book Co., New York). E. A. Wert, S. Smith, and E. T. Cope: *A Manual for the Design of Piping for Flexibility by the Use of Graphs* (The Detroit Edison Company).

⁸ American Standard Safety Code for Mechanical Refrigeration (American Standards Association, ASA B9.1, 1964).

CHAPTER 59

COMMERCIAL REFRIGERATORS AND DISPENSING CABINETS

Walk-In Storage Coolers, Reach-In Cabinets, Normal and Low Temperature Display Cases, Cabinet Construction, Insulation, Evaporators, Defrosting, Controls, Condensers and Cooling Towers

COMMERCIAL refrigeration cabinets can be divided into three general classifications: (1) merchandising display equipment, (2) storage equipment, and (3) processing equipment. A further division of each of these classifications can be made according to temperatures: (1) for temperatures above freezing, and (2) for temperatures below freezing. In each of the three general types of cabinets, the products to be stored determines, to a great extent, the general design of the cabinet and its refrigeration system. However, in each design, consideration must be given to temperature, air circulation, and air moisture content.

Table 1 lists the recommended temperatures for retail storage.

STORAGE CABINETS

Walk-In Coolers

The unitary walk-in storage cooler is of sectional construction, with wall, ceiling and floor sections which must be joined and fastened at the time of installation.

The material used in the construction of the cooler sections may be wood or metal. However, the trend in supermarket installations seems to favor metal, both exterior and interior. In many coolers, both exterior and interior surfaces are covered with enamel finish.

Wood used on the interior of a cooler must be an odorless type, such as spruce, maple, fir, etc. Interior wood panels are usually given a shellac finish.

Many walk-in coolers constructed to maintain 35 to 40 F temperatures are being installed without insulated floor sections. In some instances, an insulated floor is built into the market floor at the time of the floor construction, while in other installations, the cooler is erected upon the uninsulated slab. In computing the refrigeration load for a cooler installed upon an uninsulated floor, an allowance must be made for the extra heat leakage.

Walk-in coolers which serve a dual purpose of storage and display are equipped with either sliding or hinged glass doors on the front. These door sections often are a prefabricated assembly which is set into a door opening within the front of the cooler. Allowances must be made in computing the refrigeration load for the extra service load through these glass doors.

Evaporators commonly used in normal temperature

coolers are the forced-air and natural convection (gravity) types. Some market operators want meat cooler temperatures of 28 to 32 F. In such coolers, an automatic defrost system is usually required.

Reach-In Cabinets

The reach-in refrigerator, equipped with hinged or sliding glazed doors, may be used as a self-service cabinet for dairy products or beverages. Solid door models provide additional storage space.

The range of sizes of commercial reach-in cabinets is from approximately 16 cu ft to 100 cu ft capacity or more. Some models are self-contained while others are installed with remote condensing units.

Evaporators used in these cabinets are forced-air, natural convection, or ice-cube maker types, depending upon the application or use for which the cabinets are intended.

Table 1 Recommended Temperatures for Retail Storage

Type of Fixture	Average Temp. F	
	Minimum	Maximum
Walk-In Cooler (Unfrozen Food)	35	42
Walk-In Cooler (Frozen Food)	-10	0
Reach-In Refrigerator	35	45
Single-Duty Meat Case (Closed)	35	42
Single-Duty Meat Case (Open)	28	42
Double-Duty Meat Display Case (Closed)	35	42
Double-Duty Meat Display Case (Open)	28	42
Vegetable Refrigerator or Case (Closed)	35	45
Vegetable Refrigerator or Case (Open)	35	55
Dairy Refrigerator (Closed)	35	42
Dairy Refrigerator (Open)	35	45
Baker's Dough Retarder	35	40
Florist's Display Refrigerator	40	50
Florist's Storage Cooler	38	45
Frozen Food Cabinet (Closed)	-5	0
Frozen Food Cabinet (Open)	-10	5
Candy Case	65	70
Candy Case (Frozen)	0	10
Ice Cream Cabinet or Case (Closed)	-5	0
Ice Cream Cabinet or Case (Open)	-20	42
Bottled Beverage Cooler	35	42

The general responsibility for this chapter is assigned to TC 5.A, Commercial Food Storage and Dispensing Equipment.