

except for footings and a low-cost roof supported by the cooler. This has been found to be an economical way to conserve interior space. A further advantage results from the high degree of engineering skill applied in the design and construction of the factory-built which is subject to close inspection of proper materials and vapor-sealing techniques.

Sizes

The size of the sectional walk-in cooler may be readily expanded in increments of standard wall sections, usually four feet. It has been found that coolers with 17 ft tops can be spanned successfully without posts. Sizes larger than this require top and bottom sections to be made in sections in length, supported on an I-beam in the center of the refrigerator. The height of the cooler depends on its use, and the type of the evaporator selected. A cooler with gravity coils is usually about 10 ft high; a cooler with forced convection coils is usually about 8 ft high.

Types

Sectional walk-in coolers are made under two main classifications: normal temperature, 32 to 45 F, and low temperature, 15 F and below. These refrigerators can be adapted through proper refrigeration application to store any commodity. Special care must be taken in the field erection of low temperature walk-in coolers to insure tight joints with no vapor leaks. Combination low and normal temperature coolers are available. Condensation problems that may arise on partitions between compartments are easily corrected by the application of low-wattage electric heaters. The normal temperature compartment acts as a vestibule for the low temperature compartment, and reduces frost build-up in the latter.

Normal temperature walk-in coolers are also used in combination self-service display and storage refrigerators. Usually one wall of the refrigerator is equipped with multi-light glass doors and is brilliantly illuminated. Commodities are displayed and dispensed through these doors and stored in the remainder of the refrigerator. These combination refrigerators are most commonly used with dairy products, bottle goods, and flowers. At the present time many low temperature walk-in refrigerators are being manufactured for display and storage of frozen foods. A recent innovation in walk-in cooler design is a self-service display-dispensing compartment in one wall, protected by an air curtain, thereby combining some of the open type display features with the storage advantages of the walk-in cooler. Sectional walk-in coolers are also being adapted for use in laboratories and industrial controlled-condition rooms in which, with proper equipment, high and low temperature and humidity conditions are maintained.

Doors

Because walk-in coolers usually receive heavy and rough usage, the doors and hardware must be able to stand up under this usage. The hinges should be heavy enough to allow the doors to swing with minimum effort. The fastener on the door must be easily openable from the inside or the outside, and is usually arranged so that it is impossible to lock the door without being able to open it from the inside.

Increased costs of handling the stored commodities encourage a greater use of conveyors and trucks. Walk-in coolers constructed with conveyor doors and overhead track doors enable items to be moved from the delivery truck to the

cooler at minimum cost. Solid or glazed reach-in service doors, opening onto shelves, tray racks, or meat racks make small items more accessible. Sliding or swinging multi-glazed doors are provided for self-service and display uses.

Freezer doors are usually of the overlapping type, fitted with sponge rubber gaskets, and closing on a non-conductive door frame. Low-wattage electric heaters around the door jambs on low temperature coolers are being employed by many manufacturers to prevent the accumulation of frost and ice. Breathers are sometimes installed on the inside of the freezer door face to insure the escape of any vapor that might infiltrate the door. Mechanical door openers are available to facilitate the use of power trucks when handling food loads in and out of the cooler.

Insulation

Three or four inches of insulation have been generally accepted for storage temperatures from 35 to 40 F. For low temperature applications such as frozen food storage, five inches or more of insulation should be used. Proper vapor seal should be provided. See Chapter 22, 1961 GUIDE AND DATA BOOK.

Installation of walk-in coolers of the sectional type without insulated floors is being used in some large chain store operations. This facilitates trucking into and out of the cooler. This will doubtless increase the refrigeration load on such coolers of the sizes being discussed here—whereas it might not make too much difference for a large cold storage warehouse room. The relation of the total floor area to the floor area immediately around the walls of the cooler apparently is the determining factor in this relation. Reliable data for calculation of refrigeration loads is not available based on experimental evidence. Heat gain factors varying from 0.045 to 2.0 Btu per (sq ft) (F deg) (hr) have been suggested. Ground temperature is assumed to be the average annual atmospheric temperature. One large storage warehouse has been built using this method and is reported as successful. The use of this method for low temperature coolers of the size being discussed in this chapter is questionable, however, for 35 F and up it is reported as satisfactory.

Considerable difficulty has been reported with low-temperature rooms having insulated floors built directly on the ground due to moisture in the ground freezing and causing the floor to heave and crack. Research is now under way on this problem. Good drainage, use of piping under the floor with a circulating warm non-freezing liquid, warmed enough to keep the ground above 32 F, has been tried. Electric heaters and tiling laid under the floor through which warm air can be circulated has also been suggested. This problem has been observed at room temperatures of 15 F and below. It should always be considered when designing rooms with floors on the ground and walls below ground.

Refrigerating Methods

Each cooler installation must be carefully engineered. Air circulation is of prime importance. If gravity circulation is used, cooling units, baffles and cooling unit decks must be so placed as to assure adequate air movement to or from all parts of the cooler. The trend in recent years has been for the use of forced-air circulating units, especially for low-ceiling coolers. When such units are employed, care must be exercised to see that air movement is not too rapid and that direct drafts from the cooling unit do not strike stored products if these are subject to dehydration. Plug-in assemblies are now available consisting of an evaporator mounted on one side of

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an insulated plug and a condensing unit mounted on the opposite side. This assembly is plugged into an opening in the side of the cooler.

For fixture temperatures of 35 F and above, finned gravity or forced-air evaporators may be used with low-pressure controlled temperature and off-cycle defrosting. For fixture temperatures below 35 F, plates, finned gravity or forced-air evaporators may be used. These must be designed for low temperature application with heated drain pans. Applications of forced air units must also be made at higher refrigerant temperatures than those used with gravity circulation. Below 35 F, provisions for positive defrosting must be also made. With plate coils, manual scraping, complete shutdowns, or hot-gas, defrost is commonly used to remove frost. Properly designed forced-air units are usually defrosted with hot gas, electric heaters, or water.

Since most low temperature walk-in refrigerators are installed where an operating engineer is not always present, it is suggested that two complete refrigeration systems be used in large low-temperature walk-in coolers, so that if one fails, the other will continue to operate, thus preventing a major loss of the products stored. Many installations are made where a variety of products are stored in the same refrigerated space. Compromised selections of evaporators and operating conditions will then be required.

Bottled beverages and keg beer are usually stored in walk-in coolers equipped with large capacity forced-air coils for quick cooling. Since air velocity, direction of circulation and humidity are not factors, forced-air coils blowing directly on the bottles or kegs are quite effective. If keg beer, delivered cold, is kept in a cooler, normal heat load requirements are satisfactory unless the turnover is high. However, if bottled beer or other beverages are stored in the cooler, the additional heat load of the number of bottles loaded per day must be considered.

Frozen food low-temperature walk-in coolers may be equipped with overhead plate-coil banks, plates or coils on the side walls, (if the plates and coils are on the side walls only, a circulating fan must be installed in the refrigerator to prevent heavy condensation on the ceiling) or blower coils equipped with water, electric or hot gas defrost. Blower coils are usually specified at not more than a 10 F temperature differential in order to provide for quick defrost and rapid pull-down after defrost. The condensing unit should be specified to have sufficient capacity at these suction pressures. If there is to be a freezing load, this should be added to the heat load of the refrigerator when specifying the cooling unit and condensing unit. If food is to be frozen, contact freezing on plates or by blast from forced-air units, or a combination of the two, produce the best results. *Frozen food should never be stored in contact with floors or walls of storage rooms.* Allow at least 3 in. from the floors by using floor racks, and 12 in. from the outside walls, except in small coolers, where not less than 4 in. is recommended.

Walk-in coolers are used for many other refrigerated space requirements than those outlined here. The nature of the product to be stored, the range to which the product is to be cooled, if product cooling is involved, the moisture conditions required, the size of the cooler, the thickness of insulation and the differential between ambient and interior cooling temperatures are factors in the selection of equipment required.

SPECIAL-PURPOSE REFRIGERATORS

This title is perhaps a misnomer because any given refrigerated enclosure which is capable of performing a particular

function more suitably than it would a less exacting requirement, belongs in this category, which obviously is much broader than the items to be enumerated here indicate. However, the purpose is to invite attention to a variety of adaptations of the basic principle of the commercial refrigerator as applied in meeting specific needs that are less frequently encountered in the field than, for example, a refrigerated display case. It is possible, of course, to cover only some of the more familiar types in this classification.

Florist Refrigerators

Basically, a florist is a dealer in flowers and plants. More specifically, the florist is an arranger and designer of floral pieces for various and special occasions. A sale for the retail floral shop may range from a single blossom corsage to an elaborate funeral piece, or from a table decoration for a home to a complete floral setting for a wedding. Flowers are living plants, and after being cut must be refrigerated the same as other perishable items. Experience has taught that flowers keep best at a moderate refrigerated temperature with a high relative humidity. Ferns or foliage used in floral background decoration must also be held at a cool temperature.

Flowers maturing in the fall and those grown in cooler climates can stand more cold than others. For the general range of flowers in their refrigerator, most retail florists have found that best results are obtained at temperatures from 40 to 45 F. Many wholesalers operate their storage coolers at 33 to 38 F. Refrigerators for the display and storage of flowers are required by the retail florist while large walk-in storage coolers are required by the wholesale florist. The display refrigerator located in the sales area at the front of the shop usually includes a picture window display front, and is provided with one or more display-type access doors, either swinging or sliding. Usually these refrigerators are the step-in type. In the backroom work area of the retail shop, a walk-in cooler is used for storage and to supply make-up. In smaller shops, a combination of display and storage can be worked out in one refrigerator.

Although there are a few floral refrigerator designs considered conventional in the trade, the majority are custom-built to the operator's needs and wishes. The exterior of the refrigerator is usually steel with baked enamel finish, stainless steel or wood. In the latter, the interior decor of the shop may be continued on the front of refrigerator, so that it becomes a part of the walls of the room. Interiors are usually done in black satin enamel on steel or wood. Display windows and doors are glazed with two- or three-light sealed glass panels. Illumination in display refrigerators is usually obtained by means of warm white fluorescent tubes to bring out the color of the flowers. Colored spotlights are added in some instances to complement certain flowers, such as a pink spotlight to enhance the beauty of red roses. To aid preservation, florists sometimes use a small motor-driven charcoal air purifier in their refrigerators.

In floral cases and coolers, high relative humidity is desirable and, therefore, the refrigeration coil and condensing unit should be selected to accomplish this. Some florists favor a gravity type cooling coil because of low velocity of air circulation, but many are now choosing forced-air cooling coils which set up a positive but gentle air flow through the refrigerator. The forced-air coil has an advantage in the display refrigerator in which the in-and-out service is especially heavy, as it provides quick temperature recovery during these peak local conditions.

The refrigeration system for floral refrigerators may be