

Capacity Requirements

The average locker holds approximately six cu ft. Under average conditions, each cubic foot will hold a maximum of about 40 lb, therefore 240 lb per locker is a safe basic figure as to total capacity at any time. Assuming a yearly turnover of three customers each locker will accommodate about 720 lb per year. This is approximately 2 lb per day per locker which has been used in the past by many engineers as a base for product load calculations, but may need modification for today's operations due to the increased volume of processing for home freezers.

The National Electric Manufacturers Association standard for farm and home freezers is 35 lb per cu ft. However, 40 lb per cu ft is used here since the contents of a locker plant are relatively higher in meats such as beef and pork, which weigh somewhat more per cu ft than vegetables and fruits and other items of less weight per cu ft which constitute the principal contents of the average home or farm freezer.

The two lb per locker per day is not always a safe value, however, for all functions of the plant. The preparation and freezing of food is not a constant factor for each day of the year. Preparation and freezing, due to other work to be done, may take place only 4 to 6 days per week in the average plant. For this reason, it is often desirable to provide space and freezing capacity for 3 lb or more per day per locker, in order to avoid overloading of the freezer on busy days.

The incoming load in the chill room is also subject to considerable variation unless each customer is required to bring in foods to be processed on a regular predetermined daily schedule. Such a schedule may be carefully planned, but is rarely maintained. For this reason, it is best to figure a minimum of three lb per day per locker for the chill room load. This, too, should be increased if the chill room will be required to handle extra food products not scheduled for freezing and storage such as pork for curing and smoking only, meats to be sold fresh at retail, fruits and vegetables for temporary storage and other similar items. Some engineers have used a value as high as five lb per locker per day when sizing and planning the chill room. Good practice dictates that the chilling and aging be handled in separate rooms. Four to six square feet of floor space should be provided for aging a side of beef. One foot of rail for a 200 lb hog and 2½ ft for a 600 lb beef is common practice.

In some areas, a considerable amount of meat curing and smoking will be handled. The demand or requirement for this service is higher in areas such as the southern states where pork constitutes a rather high percentage of the meat used. Facilities for pork constitute as much as one-third or more of the plant capacity in many plants now in operation in Georgia, Alabama, Mississippi and nearby states.

Building Construction

Whether the building is a new one, or an old one, it should be planned or prepared in accordance with the needs of the plant. Most important is the foundation. Shifting and sagging floors will cause fissures in walls and insulation. Floor loads of 200 to 250 lb per sq ft should be provided, equivalent to some types of mill construction. Floors on grade levels should be supported at close intervals on piers. Floors over excavated areas or usable basement space should be supported by steel or reinforced concrete girders.

All floors of insulated rooms which are held at sub-freezing temperatures should be above ground or designed so as to pro-

vent upheavals caused by ice formation and expansion. (See Chapter 45.) Walls should be rigid and braced where necessary. Outside walls must be well protected against the weather. A good roof will pay dividends. (See Chapter 22 of the 1961 Guide And Data Book.)

Basements and second floors are sometimes considered for the location of all or part of a locker plant because of space limitations on the main or ground floor. Some plants have been installed with the locker room in the basement and with the chill and processing departments on the main floor. Others have been installed with the entire plant in the basement or on the second floor.

Because of the service demands and low temperatures needed in a frozen food locker plant, good insulation with a reliable vapor barrier on the warm side is highly important. Good insulation depends on both the material itself, and the method of application. The most expensive material, if poorly installed, will fail. On the other hand, it has been observed that many materials, if expertly applied, will often give satisfactory service for many years. Insulation materials are usually divided into the loose fill and batt-type and also the slab or block-type.

Insulation materials, interior finish and framing must be free from aromatic odors. The asphalt and paint must also be free from odors. Aromatic odors from walls built of wrong materials may find their way into improperly wrapped or packaged frozen foods in a few weeks or months. Such materials as cedar shavings for insulation, pine lumber for interior finish and common tar or street-type asphalt are the usual offenders.

Storage rooms and freezer rooms operating at temperatures of 0°F to -20°F require 6 to 12 in. insulation. Rooms for chilling, aging and curing which are operated at temperatures above freezing, require three to eight in. Common walls between refrigerated rooms should contain the minimum thickness required for the lower temperature room. If power rates are relatively high, thicker insulation should be used to compensate for these higher rates.

Small locker rooms are usually provided with doors approximately 2 × 6½ ft while larger plants are usually provided with a 2½ × 6½ ft door. All locker room and freezer room doors should be of the low temperature or freezer type. Utility doors approximately 18 × 18 in., or 18 × 24 in. of the same construction as doors for the locker room, are sometimes used for loading the freezer cabinet or freezer room. They are usually high enough from the floor to permit the unloading of baskets or trays from a table or truck into the freezer. Chill room or aging room doors may be of the standard cooler type with special provisions at the top for trackage, where needed. Minimum size chill room doors are 2½ × 6½ ft. If trackage is employed, wider and higher doors are required. Glazed windows (five thicknesses or more) are now in common use in both chill and locker rooms.

EQUIPMENT SELECTION

Lockers

The average size locker provides approximately six cu ft of storage space. The lower three or four lockers are usually of the drawer type, while the lockers in the upper part of a tier (a tier is usually five or six high) are provided with doors. Drawer lockers usually provide over six cu ft of storage, while the door type may provide a little less.

Dimensions of the lockers to be used in plans for the construction may be secured from the manufacturer. Three of the most popular sizes are shown in Table 4. Other sizes, both

Locker and Freezer Provisioning Plants

Table 4 . . . Locker Dimensions

	Door lockers		Drawer lockers as Match	
	Width, Ht., Depth, in.	Volume, Cu Ft	Width, Ht., Depth, in.	Volume,* Cu Ft
1.	18×18×30	5.62	18×22×30	6.25
2.	24×15×30	6.25	24×20×30	7.5
3.	20×17×30	5.90	20×20×30	6.25

* When calculating the approximate capacity of drawer-type lockers it is necessary to deduct about two in. from height for track and rollers to find the approximate inside depth.

larger and smaller, are available and some operators like to have a few of each to take care of special customers.

Special consideration must be given to the ceiling height of a locker room so that the lockers when installed will not conflict with ceiling installations of cooling units or interfere with air circulation.

Locker rooms with forced air type evaporators or coils should have at least 12 in. space above the lockers where the air throw is 15 to 20 ft. More clearance is needed if the air throw is greater. When plate type gravity coils are used the ceiling must be high enough to allow locker doors to be opened wide without striking coils or coil supports. When 12 in. plates are used the clearance should be approximately 17 in. to include space for air circulation and plate hangers. Lockers installed near outside walls should be placed so as to allow 4 to 6 in. of air space.

Processing Equipment

The layout of a locker plant should show the location of saws, grinders, work tables, cutting blocks, lard kettles, smoking cabinets, blanching kettles and other pieces of processing equipment. These items should be so arranged that a minimum number of steps is required by the operator. Their selection will depend upon the size of the plant, services rendered, individual preference of the operator, and space considerations. Dimensions and space requirements for these items should be obtained from the manufacturer.

The nature of this industry has changed in the past few years due to a rapidly growing volume of processing for home freezer owners. Available statistics show that the average firm has increased its meat processing volume about 28 percent, between 1954 and 1959. Hence the following information which has been more or less accepted practice for some years may still be used as a starting point—but serious consideration must be given to increasing chill room, aging room, and freezer room size and facilities above former practice, especially in a plant doing a sizable volume of processing for home freezer owners.

The amount of trackage needed in the chill aging and processing rooms will depend on the plant layout and the processing to be done. If processing is handled on a regular daily basis and not allowed to accumulate, the chill room space may be somewhat less than if it is handled in batches on certain days. A chill room may need from 3 to 6 ft or more of meat rail or track, for each 100 lockers, if an aging room is adjacent. The aging room will need from 12 to 20 ft of meat rail or track for each 100 lockers. If a considerable proportion of beef is processed in relation to other meats, and held approximately two weeks, more trackage is needed. If less beef and more pork is to be handled, less trackage is needed.

For a small plant with a capacity of 100 or 200 lockers having no separation between the aging and chilling space, 20 or 25 ft of hanging rail for carcass meats, and 10 or 12 ft of lower hanging rail for smaller cuts should be provided. The combined floor area for the average chill and aging room should be not less than one-third of the locker room floor area. If the meat to be handled is largely beef, freshly killed when received, the total chill and aging space should be increased to one-half that of the locker room.

Experience has shown that controlled ultra-violet radiation in the region of 2537 Angstrom units has a definite value for control of mold and bacteria growth when used in the chill, aging, and processing rooms of a frozen food locker plant (Chapter 52).

REFRIGERATION EQUIPMENT

Condensing Units

In determining the proper size and number of condensing units to be used, one of three general methods of selection is usually followed.

Method No. 1 provides one condensing unit of sufficient size to handle the entire plant. There are many plants now in operation equipped with one condensing unit. For the average job, this is not recommended because the unit must be selected to handle the entire load at the lowest and least efficient refrigerant temperature. The control problem also becomes more complicated as more control devices are needed. *Methods No. 2 and No. 3* which follow have so many advantages that *Method No. 1* should be considered only under special conditions.

Method No. 2 calls for a separate condensing unit for each room, that is, one for the locker room, one for the freezer room or cabinet, one for the chill room, and one for the cure room, if a cure room is used. Each condensing unit operates at the most efficient operating refrigerant temperature. There is no necessity for complicated controls.

Method No. 3 groups the temperature functions so that all low-temperature functions are handled by one condensing unit, and all high-temperature functions by another. This grouping usually includes the locker room, the freezer cabinet or room, and in some cases, a zero bulk storage room on one condensing unit. The higher-temperature rooms such as the chill room (age and cure rooms, if used) are included in a high-temperature group on another unit.

This method has the advantage of simplified control, and is also desirable because each condensing unit can operate at approximately its most efficient refrigerant temperature. From the standpoint of first cost, *Method No. 3* usually has some advantages over *Method No. 2*, and will, in many cases, compare favorably with the cost of *Method No. 1*. Since any of the above methods are practicable and more or less acceptable, the engineer should use the one which fits the project best, based on a study of conditions on the individual job.

There has been an important trend in the refrigeration industry to provide more and better water saving devices. This trend is of special importance to the engineer and the locker plant operator for either the building of new plants or the modernization of existing plants. Water cooling towers and evaporative condensers have been available for many years, and in many cases have provided a practical solution of the condensing problem for the locker plant which is located in an area where water is expensive, scarce, or of poor quality, or where sewer facilities are limited.

As a further step to provide suitable condensing service,