

in the freezer immediately after packaging eliminates delays and saves a certain amount of handling. No facilities are provided in this layout for retail sales.

The refrigeration requirements for this plant are based on:

Plant capacity, 355 lockers
Peak ambient conditions, 95 F
Water for condensing unit, 70 F
Electric service, 1-phase and 3-phase 110-220 volt 60-cycle
Design temperatures:
Chill and aging rooms, 35 F
Cure room, 40 F
Locker room, 0 F
Insulation:
Chill and aging rooms, 6 in. fill type
Locker room, 9 in. fill type
Product loads:
Chill room, 4 lb per locker per day
Freezer, 2 lb per locker per day

In order to select the refrigeration equipment for this project, it is necessary to first prepare load calculations as follows:

REFRIGERATION LOAD

	Btu per day	Btu per hr
Chill and age room	129,646	7202
Cure room	63,357	3520
Freezer	89,637	3734
Locker room	251,561	10,481

Refrigeration Equipment Selection

Condensing units. One unit may be used for chill, age, and cure rooms combined ($7202 + 3520 = 10,722$ Btu per hr at a refrigerant temperature of 23 F).

A second unit may be selected for the locker room and freezer load combined ($10,481 + 3734 = 14,215$ Btu per hr).

Using water at 70 F which is available, refer to manufacturers' tables to select condensing units. A 1-hp condensing unit with a capacity of 12,072 Btu per hr at 23 F refrigerant and 70 F inlet water, might be used for the chill room and cure room load (10,722 Btu). Another condensing unit (3-hp) from the same tables has a capacity of 15,050 Btu per hr at -17 F refrigerant, and 70 F inlet water for the locker room and freezer load (14,215 Btu per hr). In this case, the condensing units required will have a total of 4 hp.

Evaporator selection. Forced-air units may be used in the chill and aging rooms. The required basic rating for both the age and chill room evaporators will be

$$\frac{7202}{10} = 720 \text{ Btu}$$

if 10 deg is selected as the temperature difference.

The load may be divided by 2, because approximately one-half of this load is for the age room and one-half for the chill room; this proportion may vary with different plants. The basic rating for each evaporator may then be $720/2 = 360$ Btu. A thermostatic expansion valve should be used with each evaporator.

A unit for the cure room may be selected in the same manner. The load will be

$$\frac{3520}{10} = 352 \text{ Btu}$$

One manufacturer's tables show a unit at 400 basic rating with 1/40 hp fan motor, and an hourly fan motor heat dissipation of 222 Btu per hr. One unit will be used in each of the chill, age, and cure rooms.

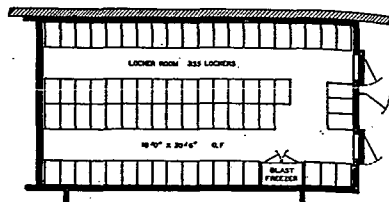


Fig. 4 . . . Locker Room with Blast Freezer (Plan B Alternate)

$$\frac{222 \times 24}{18} = 296 \text{ Btu per hr fan motor load.}$$

$$296 \times 3 = 888 \text{ Btu per hr.}$$

Adding this to the heat leak and product load $10,722 + 888 = 11,610$ Btu per hr. A condensing unit selected at 12,072 Btu per hr has ample capacity to handle this additional load due to fan motors. An evaporator regulating valve should be used on the cure and age room evaporators, due to the variable load on the chill room and to hold the cure room at about 38 to 40 F.

Plates for the cabinet freezer may be selected from standard sizes. Basing the number of square feet of surface for freezing on the rule of 5 lockers per sq ft, we have $355 \div 5 = 71$ sq ft one side only. A plate 22×72 provides 11 sq ft. Therefore, $71 \div 11 = 6.4$ plates. The selection, therefore, would be 7 plates 22×72 in. These would fit in the space provided. Two thermostatic expansion valves are needed.

Overhead plates for the locker room may also be selected from standard sizes. Using one manufacturer's data:

$$\frac{10,481}{2 \times 24 \times 25} = 14.6$$

Thus 16 plates will be satisfactory. These plates may be arranged in four banks of four plates per bank. Plates should be spaced about 2 ft from each end of each aisle, and attached to ceiling hangers. One thermostatic expansion valve is required for each bank.

PLAN B ALTERNATE

Reference has been made to the use of low temperature blast type freezers to handle the refrigeration load of freezing and holding the locker room at 0 F. As an example of how this may be handled see Fig. 4. This is the same locker room shown in Fig. 5 except that it is equipped with a blast freezer and locker room cooling unit as illustrated in Fig. 2. In this case, the locker room has been provided with two doors, one for the patron to use when going to his locker, and the other at a convenient point for the operator of the plant, since he will want to take as few steps as possible when placing food in the freezing unit and when removing it to his patrons' lockers.

It will be noted in Fig. 4 that the blast freezer is placed near the wall. This is to facilitate defrosting which may be either manual or automatic.

The blast freezer should be so located that good air distribution will be obtained to all parts of the room. Except in large locker rooms, ducts are usually unnecessary. The unit should be high enough to permit the air blast to pass between the tops

Locker and Freezer Provisioning Plants

of the lockers and the ceiling. A clear space of 12 to 18 in. is desirable for this purpose.

Load calculations are the same as for Plan B but the equipment selections may be made at a smaller temperature difference, a satisfactory value being 10 deg which is used by most engineers. One manufacturer provides a unit with a capacity of 14,000 Btu at 10 F temperature difference. This will handle the load under consideration providing the compressor selected will deliver the necessary capacity at -10 F (refrigerant temp at freezer) and approximately 2 F allowance for line loss. The compressor may be selected at -12 F refrigerant temp and 70 F water for condensing.

PLAN C—1008 LOCKERS

The plant layout shown in Fig. 5 provides a locker room for 1008 lockers, a chill room, an aging room, a cure room, a freezer room as well as rooms for utility kitchen, processing

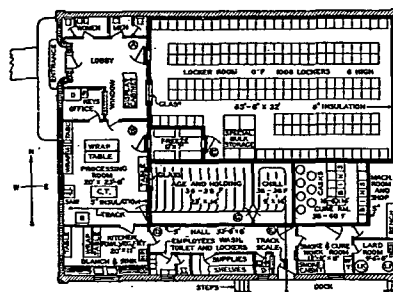


Fig. 5 . . . Frozen Food Locker Plant (Plan C)

room, lobby, office, cure and smoke work room, lard grinding and rendering room, supply room and shop. Employees toilets and wash rooms are provided in the hall, and for customers, just off the lobby. If a heating plant is needed, it may be located in a small basement, or space may be provided in the rear by a rearrangement of the shop and lard room.

A plant of this size will require more floor space than ordinarily found in a store room and, consequently, a special building may be required. Parking space may be provided on the north side or in the rear. A driveway is needed on the south side and in the front, so that all incoming carcass meats and other foods can be brought to the dock on the south side where they are weighed, checked and passed on to the proper department for processing.

The building may be a one-story structure with under-roof ventilation (to reduce heat load on room ceilings). Cement block, brick or other type of masonry construction is suggested. This plan may be easily altered to provide for either less or greater capacity by changing the length of the building and the principal rooms to correspond.

Patrons may enter the front lobby for the transaction of business or to visit the locker room. A display cabinet may

be provided here to show special commercial frozen foods which may be for sale, or to show patrons how they may package some of their own foods.

The processing room where most of the work is done is in the front where the operator may keep most of the plant under observation and near the office where records may be readily available. Carcass meats are brought in on the track from the aging and holding room for processing and placing in the freezer room nearby. Packaged foods from the kitchen can be conveniently and quickly transferred to the freezer.

The utility kitchen is large enough to accommodate blanching, cleaning, and packaging of various items such as fowl, small game, fruits, vegetables and fish. Some operators like to schedule work in the kitchen so that different products are handled on different days.

The aging and holding room where carcasses may be aged or held for the required length of time is convenient to the chill room and the processing room. An observation window is shown in the west wall of the aging and holding room.

The smoking and curing department, as well as the lard rendering room, is in the back of the plant so as to keep odors from filtering through to the other rooms. The refrigerated room for cured meats is shown with both bins and casks. This room should be provided with the kind of equipment needed for the type of curing to be done, such as wet or dry, salt or sugar cure.

The freezer room is convenient for loading from the processing room and is provided with doors at each end. The freezer room is equipped with low temperature shelf plates for contact freezing, and with ceiling plates to handle the heat leakage into the room. All plates are operated at approximately -15 F.

The locker room is arranged for efficient refrigeration. All insulated walls are shielded from sun effect. Heavy insulation of 8 in. thickness is specified. All aisles are 36 in. wide and are open at both ends to allow patrons free access to lockers. Lockers are six high in each tier. Sizes for lower drawer lockers are $24 \times 20 \times 30$ in., second and third drawers $24 \times 18 \times 30$ in. and the upper door lockers are $24 \times 15 \times 30$ in. This provides a selection of three sizes which should accommodate practically all needs. An observation window is provided in the locker room wall next to the lobby. This window will provide light in the locker room in an emergency and will be looked upon with favor by most patrons.

As a basis for load calculations, the following conditions are assumed:

BASIS FOR LOAD CALCULATION

Insulation, 5 in. corkboard, or equal, on age and holding room, chill room and cure room, and 8 in. on locker room and freezer.
Peak ambient, 95 F except that floor is 75 F.
Ceiling height, 9½ ft except in freezer which is 7½ ft inside.
Chill room is to handle 4 lb per locker per day.
Age and holding room has no product load.
Cure room will handle 1 lb per locker per day.
Freezer will handle 2 lb per locker per day.
Locker room will have no product load.
Design temperatures are: Chill room, age and holding room 34 to 36 F (average 35 F) cure room 38 to 40 F with thermostatic control and solenoid or evaporator regulating valve on cure room to provide for adjustment to 38 to 40 F.
Freezer plates operate at -15 F and in locker room at 0 F.
Water-cooled condensing units will be used as follows:
1 on chill, cure, and age and holding rooms
1 on freezer
1 on locker room.
Water for condensing units at 70 F.
Electric service, 60-cycle, 110-220-volt, single-phase, and 220-volt, 3-phase.