Food
FREEZERS

BUY?
BUILD?
RENT?

EXTENSION SERVICE
INSTITUTE OF AGRICULTURAL SCIENCES
STATE COLLEGE OF WASHINGTON
PULLMAN, WASHINGTON
What kind of refrigeration do you need? How much do you need? How will you get it?
The answers to these questions have an important bearing whether you buy, build, or rent refrigeration facilities, both for freezing and for above-freezing storage.
Your frozen food storage requirements may be met by...
1. The locker plant.
2. The locker plant and a home food freezer.
3. A commercially built food freezer.
4. A home-built freezer.

How much space you need for frozen storage is one of the main considerations in selecting the freezer. Decide for what you will use the space and how much you will use it.

**Meat** . . . How much will you store? How often will you replenish the supply—every 3 months? 6 months? 1 year?

**Baked goods** . . . Do you like to freeze pies, cakes, breads and other baked goods? Many homemakers with freezers prefer to keep some baked goods on hand for emergencies and to bake large quantities of pies and cakes at one time. If you plan to do this, allow extra space, since most of these items are irregular and bulky.

**Vegetables** Do you freeze vegetables? Do you buy and store frozen vegetables? How many months supply would you store?

**Other foods** . . . Do you want to store items such as prepared dishes, soups, juice concentrates, and ice cream? You will be surprised how many things you will want to put in your freezer when it is convenient.

**Fruits and berries** . . . Do you freeze fruits and berries? Almost everyone likes frozen berries. If you can fruit, you may want to freeze a portion of it.

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1 This publication was prepared by M. Conner Ahrens, Associate Agricultural Engineer, Agricultural Engineering Branch, Agricultural Research Service (USDA). The author wishes to acknowledge the help of: Inez M. Eckblad, Extension Food Specialist; E. Arlean Pattison, Extension Home Management Specialist; and Paul K. Fanning, Extension Agricultural Engineering Specialist, Agricultural Extension Service, State College of Washington.
Freezer Capacity for Storing Various Amounts of Fruits and Vegetables and Meat and Poultry for 1 to 12 Months by Families of Different Sizes*

<table>
<thead>
<tr>
<th>No. months of storage</th>
<th>Fruits, vegetables</th>
<th>Meat, poultry</th>
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<tbody>
<tr>
<td></td>
<td>All (cu. ft.)</td>
<td>Three-fourths (cu. ft.)</td>
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* Figures are based on the needs of very active adults.
† From "How Large Should a Farm Freezer Be?" by Elizabeth Beveridge, "Refrigerating Engineering," September, 1950.
Other questions you need to consider are:
How many people are now in your household? How many will there be in the future?
By applying your answers to the chart on page 3 you may get an idea of how much storage you need.

The chart on page 3 is based on research by the former Bureau of Human Nutrition and Home Economics, USDA. In the chart a maximum of 2.3 cubic feet per person per month is set. This figure allows for a liberal diet for farm men and women with large food requirements. It is assumed that all food that can be frozen will be frozen. The figure also allows for maximum food requirements which might be anticipated in planning a freezer, including 2½ guest meals per week in a family of four.

Not all foods freeze well. Enough of them may be frozen, however, to provide a well-varied diet and to make it possible to meet most of the family food needs from the freezer.

If you do not plan to freeze fruit, your required capacity will be reduced considerably. In this case, one method of estimating capacity would be to allow ½ cubic foot per person per month for leafy, green, and yellow vegetables; ½ cubic foot per person per month for meat, poultry, and fish; and a reasonable allowance for less frequently used foods. These should include berries, ice cream and other dairy products, baked goods, juice concentrates, and anything else you might want to freeze. Remember that more and more items are coming into use as frozen products.

An example using this estimate might be:
A family of four wants to store a 6-month supply of meat and 9-month supply of leafy, green, and yellow vegetables.

\[ 4 \times 6 \times \frac{3}{2} = 16 \text{ cubic feet and} \]
\[ 4 \times 9 \times \frac{1}{2} = 18 \text{ cubic feet plus an allowance of 6 cubic feet for miscellaneous items.} \]
This family's total frozen storage requirements then would be \( 16 + 18 + 6 = 40 \) cubic feet. These would be the estimated requirements under the conditions cited.

The 16 cubic feet allowed for a 6-month supply of meat will allow storage for about 480 pounds. If your requirements are different from this, adjust by allowing 30 pounds of meat per cubic foot of storage.

Sizes and Types of Freezers

If you decide you want freezer capacity less than 50 cubic feet, it is doubtful that you will gain in the long run by building it yourself. Even the skilled worker at home cannot duplicate the quality of work performed in the factory under controlled conditions with modern equipment and techniques.

You may want instead to meet the home freezing and storage problem something like this:

- If you want less than 50 cubic feet, you probably should consider commercial freezers, the locker plant, or a combination of the two.
- If your needs fall in the range between 50 and 100 cubic feet, you may want to build your own unit.
- If you want 100 cubic feet or more, detailed plans for building are available in USDA Plan No. 7102. If you do not wish to build the 35°F room shown in the plans, you may modify the plans easily to omit the 35°F room or build it separately. The advantages of building are that you can place the unit where you want it and make use of existing walls.

The Locker Plant

If you rent freezer storage at a local locker plant, your initial expense is lower than if you buy or build a freezer. For year-around use the locker plant is fairly satisfactory for many
people. Most families make two or three trips to town each week on business. They must plan carefully, however, in order to have the products they need on hand at the right time.

In terms of dollars and cents spent per pound of food, it is difficult to arrange for freezer storage less expensively than at the locker plant. However, most people consider the convenience of a freezer at home worth the difference in cost.

Freezer Plus Locker Box

Probably the next most economical solution is to buy a small freezer for the home and rent additional locker space. The freezer at home should be large enough to store several kinds and cuts of meat, various vegetables, berries, juices, baked goods, leftovers, and miscellaneous items. It also should have enough room for freezing products to be taken to the locker on the next trip to town. A freezer for this purpose might be from 5 to 10 cubic feet. This purpose might be from 5 to 10 cubic feet, possibly in combination with the household refrigerator.

A Commercially Built Food Freezer

If you want to keep all of your frozen food at home, you will probably need one or more large freezers. The available floor space will probably determine whether you obtain an upright or a chest-type freezer. An upright may be more convenient to use and allow more storage for a given floor space than the chest-type. If floor space is available, the chest-type may be slightly less expensive than the upright. If you can use either, check cost per cubic foot when buying.

Chest and Upright Freezers—How They Compare

**UPRIGHT**
1. Food may be easier to reach. Varies with size.
2. Occupies less floor space but places greater weight per square foot of floor area. Operating costs may be greater.
3. May make more conveniences possible (such as door storage or drawers).
4. May be located more conveniently.
5. Requires more frequent defrosting.

**CHEST**
1. Holds more food for same volume.
2. Does not lose as much cold air with each door opening.†
3. Tends to sweat less.
4. Does not need as perfect a door seal.
5. Original cost is smaller.

*Because the weight of an upright is heavily concentrated, use care in placing it in a house with conventional flooring. Any upright except the smallest should be located next to an outside wall or over a floor joist support. The combined weight of a freezer and food may weigh well over the safe load for the floor.

† More cold air may be lost from the upright when an upright door and a chest freezer door are opened for an equal time.

The door of a conveniently located freezer will usually be opened considerably more often than one on a freezer in a more remote location. The upright uses more electricity per door opening, but power consumption is not usually a major consideration.

For further information on selection, use, operating, and packaging costs refer to USDA Home and Garden Bulletin 48, "Home Freezers—Their Selection and Use."
Should You Build Your Own Freezer?

If you have the necessary room, you may be able to build your own large freezer. The advantages are that you can—
1. Build your unit to fit a particular place.
2. Build it to fit your needs.
3. Use more insulation (8 to 10 inches) than commercial units and save operating cost.
4. Use a relatively smaller compressor than commercial units (because of added insulation) and reduce initial cost.
5. Do part or all of the work yourself.

You may choose to have one built by a refrigeration man; if so, be sure he has experience and is competent. Talk with more than one serviceman and with someone who has a home-built freezer. You may want to build the box yourself and have a refrigeration serviceman install the refrigeration equipment. Get estimates from several refrigeration men for constructing the complete unit or get equipment estimates, in case you want to construct the box yourself. Estimates have little value unless the size of the refrigeration equipment components is specified.

Unless you are fairly well skilled in the use of hand tools and are willing to follow directions closely, you may be ahead to hire experts.

If you make a sketch of the unit you want and its dimensions, you should be able to estimate the bill of material for the box. This will give you an idea of what it will cost if you choose to do your own construction.

If You Decide to Build . . .

If you decide to build an upright freezer of about 75 to 100 cubic feet, you can get some pointers from USDA publication "Instructions for Building and Operating a Two-Temperature Walk-In Farm Refrigerator." These plans are for 100 cubic feet but many of the details and techniques of construction are the same for 75 feet.

Because of the height and depth limitations on a chest freezer, a 50-cubic-foot capacity freezer would be extremely long and in most cases impractical. You may find it advisable to build an upright freezer.

An important item to consider in building an upright freezer is that it will be more economical, both in construction and operation, to build one in which you can reach all the shelves from a large door. A walk-in freezer wastes space if not properly designed because of the necessary walkway or standing room inside it. You can, however, use this space by putting in removable shelves when the permanent shelves are full, although the removable shelves make most of the food on the regular shelves inaccessible. In view of this, consider the space in which you intend to build your freezer. If possible proportion it so that with a large door you can reach all of the shelves. If it is more than 75 cubic feet, you probably will not be able to do this. If you
cannot work out an arrangement, you may want to follow USDA Plan No. 7102.

Because a large amount of electrical and refrigeration equipment must be assembled "on the spot," labor is an expensive part of home constructed refrigeration systems. Quality of work cannot be expected to be as good as work done in the shop or factory. In cases of failure, service calls to remote installations are costly.

In order to reduce some of the expense of home constructed refrigeration systems a "package unit" for freezers was developed.

A Package Unit for Freezers

The package unit with hot gas defrost shown in the photograph below has been completely satisfactory. A package unit is one in which all the refrigeration equipment is preassembled and may be installed easily. It is similar to a window air conditioner. Package units may be taken to service personnel for repair. This eliminates the expense of rural service calls.

The units contain an insulated panel between the evaporator and the condensing unit. Refrigerant connections are not necessary since the refrigerant system is charged, sealed, and tested when the package unit is assembled. Usually the only connections necessary are the electrical and the condensate drain from the evaporator.

An automatic control on the package unit, set for once-a-day defrost, has been adequate. More frequent defrosting is possible should it become necessary. This unit has an insulated panel approximately 17 x 22 inches which is sealed with a strip of conventional door gasket. Be sure the unit fits the opening in the freezer.

A ½ horsepower unit such as this will operate a 0°F freezer of 50 or 75 cubic feet with 8 or 10 inches of insulation under normal use and operating conditions.

At present there are no known manufacturers of preassembled package units for freezers.

Only experienced refrigeration men should attempt to assemble packaged units. They may obtain plans from County Extension Agents. Ask for Extension Circular 263. The plans were developed by the USDA at the State College of Washington.

A package unit must be designed for the temperature for which it is used. Do not use window air conditioners as refrigerators.

Many of the package-unit refrigeration systems on the market today employ a capillary tube expansion device in place of the expansion valve. Units such as this are designed for a particular application and temperature. Window air conditioners are an example—they cannot be depended upon to operate satisfactorily at temperatures below approximately 60°F.
Operation at temperatures below approximately 60° F. will reduce capacity, cause the evaporator to frost, and result in completely unsatisfactory operation.

Units using expansion valves may be unsatisfactory, too. Evaporator and other component sizing may make a unit unsatisfactory for a particular use, for instance window air-conditioners are not satisfactory as egg room coolers.

Some Construction Details
Builders Often Neglect

Your construction depends on the materials you choose and the space and shape you decide upon. You will probably want to build your freezer into some particular location and make use of some of the existing walls. Sometimes it's easier to prepare existing walls than new walls for a vapor barrier. Concrete walls should receive a coat of asphalt emulsion and two layers of vapor-barrier paper, with a coat of asphalt emulsion between the layers of paper. If the existing walls have open studding, apply some sheathing to the studs to make a smooth surface on which to apply the paper.

For the new walls and frame for the freezer and if you have the space, make an 8- or 10-inch wall and stagger the studs. On the outside wall it is convenient to apply ¼-inch plywood. The vapor barrier then can be applied easily and smoothly over the plywood. Another layer of ¼-inch, exterior-type plywood may be used over the paper. Use a layer of asphalt emulsion between the layers of paper. Apply the emulsion generously where it is necessary to nail through the paper. Allow a few inches of paper to lap on the corners. Fold the paper carefully or it will become too bulky.

THE DOOR

The patch or overlap-type door may be constructed easily and is quite satisfactory.

Three inches overlap and a properly adjusted gasket will give good service. Use heavy refrigerator hardware for the door. Under the hinges, use 3 or 4 large washers. Notch them so you can slip them over the bolts which hold the hinges in place without removing the bolt or hinge. This will facilitate adjusting the door gasket.

For a good fit, the face of the door opening should be true in a vertical plane. Test and adjust by closing the door on a dollar bill. If you can pull the bill out easily and gasket pressure is uniform around your door, it is satisfactorily adjusted. In making the door, work on a flat surface to get the frame true; then glue it and brace it well. Don't forget the vapor barrier on the door; cover the edges as well as the door.

INSULATION

Effectiveness of most commercial insulations does not vary much. The insulation you choose should be easy to install for the particular type of construction you use. Fill insulation should be packed in place enough to give you the density recommended by the manufacturer. Be sure the insulation is uniformly packed around corners, framing members, and the door. Place a support at the 4-foot wall level to prevent an air space from forming at the top as the insulation settles.

If it is not convenient to fill the walls from the top, use a wire screen on the inside, tacking it on as you fill. The interior wall surface material can be put on afterward. It will be to your advantage if you can use an insulation that is moisture-, fire-, and vermin-resistant. Do not use sawdust because of transfer of flavor to food.

35° Storage

Fresh meat, vegetables, fruits, eggs, and other foods will keep fresh longer in refrigerated (35° F.) storage.

Humidity in storage for fresh produce should be relatively high, about 90 per cent for most foods. To insure high relative humidity, proper construction and design are necessary. The evaporator must be large enough and have proper controls. Construction must be sound, with adequate insulation and a good vapor barrier.

Either unit blower evaporators (cooling coil) or gravity-type fin evaporators may be used in the 35° F. room. Some package units have been available for 35° F. to 40° F. operation, and more may be available in the future.