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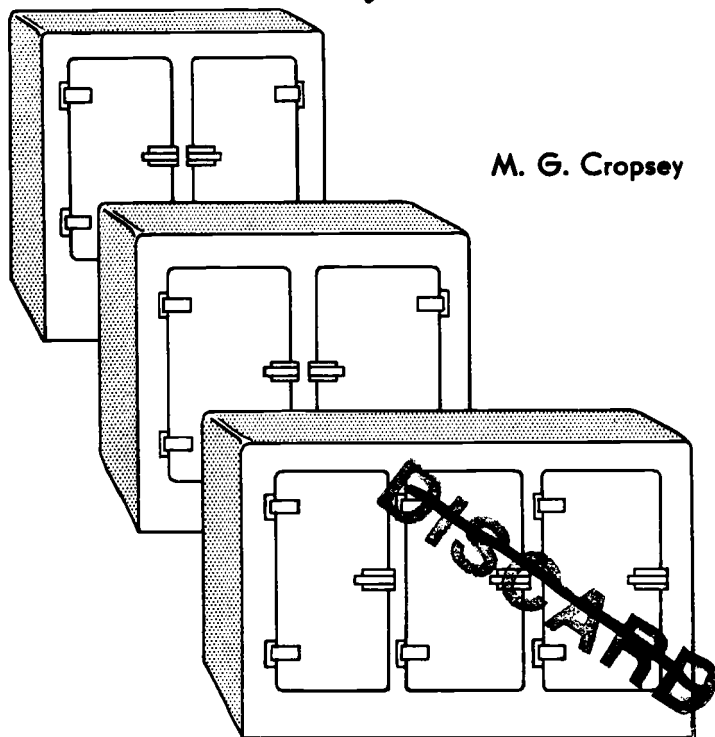
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# Three Large Reach-In Freezers *You Can Build*



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Agricultural Experiment Station  
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# Three Large Reach-In Freezers *You Can Build*

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The purpose of this bulletin is to explain how to build a 20-, 30-, or 40-cubic-foot front opening freezer from Plan Numbers 5.55, 5.56, and 5.57, obtainable from the Farm Building Plan Service, Oregon State College, Corvallis.

These freezers have many advantages. They are upright and front-opening, and therefore packages can be arranged neatly on shelves that are easily accessible. Adjustable shelves may be constructed in the freezers built with copper coils for evaporators. Minimum floor space is required for these freezers. The 20- and 30-cubic-foot freezers are portable. The large 40-cubic-foot freezer should be built in place. The 20- and 30-cubic-foot freezers can pass through a 30-inch door.

## Check Bill of Materials

Before attempting to build these freezers, look over the bill of materials listed on pages 8, 9, and 10. Be sure that the amount of copper tubing or freezer-plate shelves the right size are available before building. Also check Figure 1 to see if the floor space and ceiling height is right for your house, storeroom, or basement.

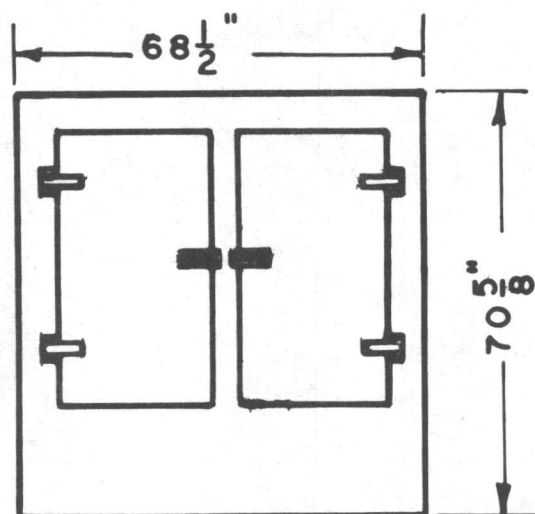
## Obtaining Plans

After deciding that you can obtain the necessary parts, then the plans for these freezers can be obtained by check or money order for \$1.35 from the Farm Building Plan Service, Oregon State College. Each of these plans consists of four sheets as follows: a general view of the outside, details of the inside construction, plans for mounting the evaporators—whether copper tubing or freezer shelves—and details for cutting the plywood to size. To construct the freezers you should have both the freezer plans and this circular.

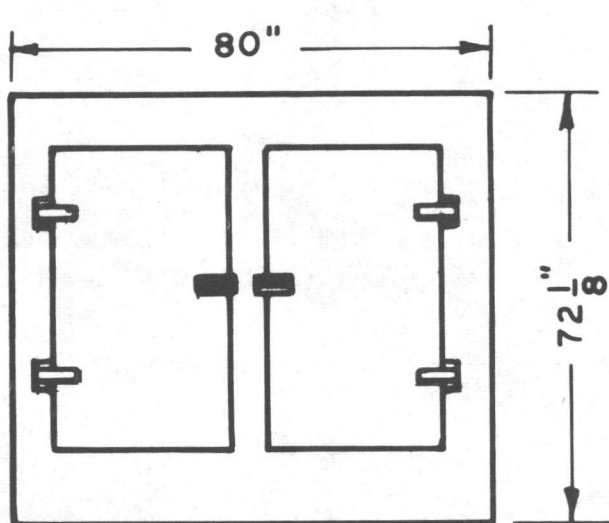
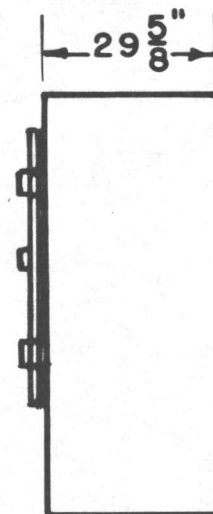
## Building the Freezer

Assemble all materials listed in the bill of materials to be sure that later time will not be taken in looking for odd parts. Cut all the material to size according to Sheet 4. Measure carefully to be sure that the pieces will fit together. Always allow for the thickness of saw cut.

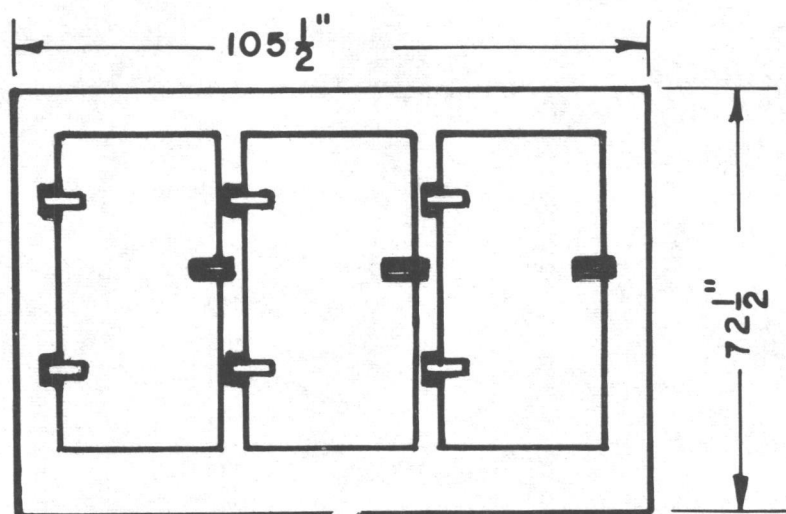
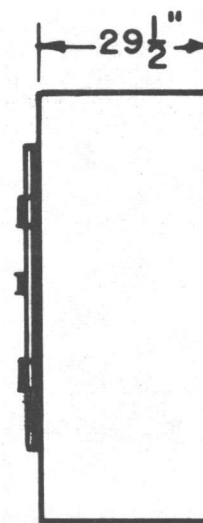
Assemble the framework sections at this time (see Figure 2). The joints of the framework are glued and held together with 16-penny galvanized nails. Holes 1/8-inch in diameter are drilled for the nails before driving them. These holes permit a much stronger bond for the nails and prevent the wood from splitting. Water-proof glue is placed between the wood joints to insure even greater strength. If freezer plates are used for evaporators, one of the braces (Piece C, Sheet 2 of the plan) is left off at this time to permit the entire group of freezer plates with supports to be slipped in the side.



PLAN 5.55 20 CUBIC FOOT FREEZER



PLAN 5.56 30 CUBIC FOOT FREEZER



PLAN 5.57 40 CUBIC FOOT FREEZER

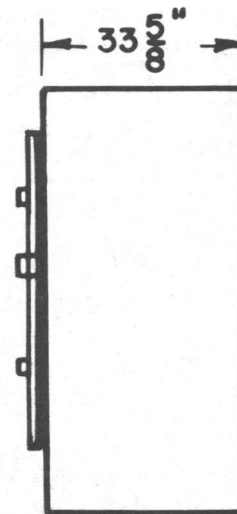


Figure 1. General view of freezers.

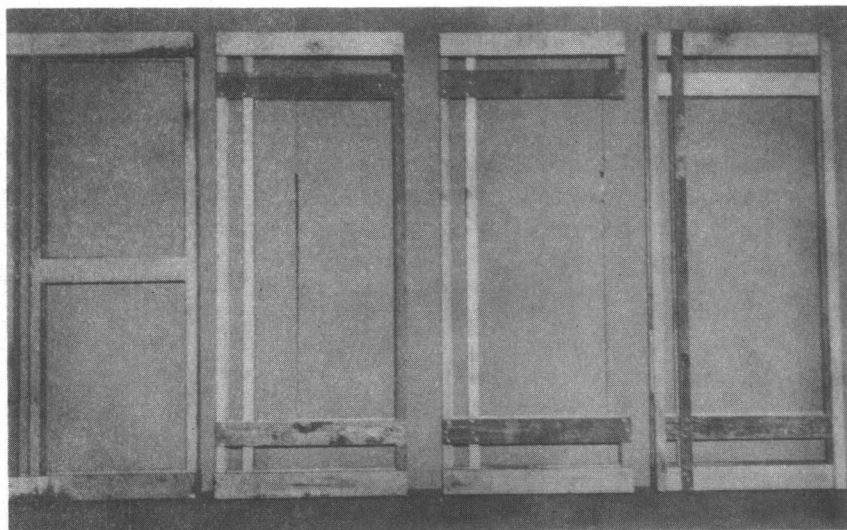


Figure 2. The frame-work sections.

The center piece, A, and the 2 x 6's, B, (see Sheet 2) both of which are cut to size, are fastened by gluing and 16d nails. Again drill 1/8-inch holes for the 16d nails. The inside plywood and the aluminum pan are now ready to be fastened. Use 2d galvanized nails for fastening the inside pieces of plywood. First, fasten the top and bottom inside pieces of plywood in position and then place the aluminum pan. Note that a U-shaped piece of plywood is placed around the center post (see Piece D, Sheet 3). This provides drainage away from the corners of the aluminum pan, as the pan is not soldered. A cocky corner is made for the outside corners of the aluminum pan. Nails are not required on the aluminum if the plywood is fastened in properly. Fasten one inside end piece of plywood if freezer plates are used and the two inside end pieces if copper tubing is used for evaporators. The inside back and middle pieces of plywood are now fastened in place.

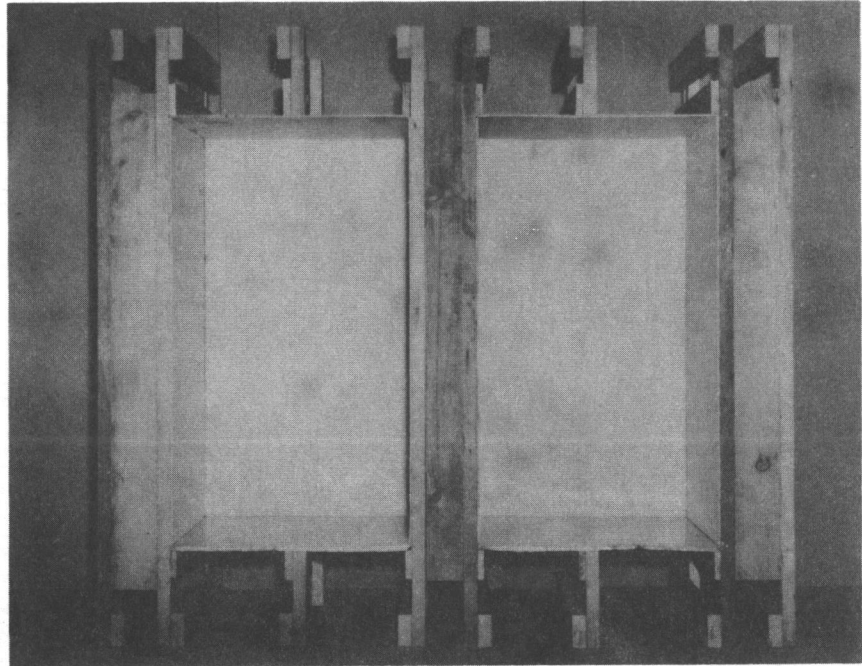
If freezer plates are used, they should be placed in at this time on the completed rack with all plates connected together with tubing satisfactorily brazed or soldered. Ordinarily the tubing joints are fastened together by a refrigeration man. This is important, as it is difficult to work on refrigeration tubing after it is in the freezer. The inside end piece on one side is left off until the freezer plate and racks are placed inside. Finally the 2 x 4 brace, C, and the one inside end piece of plywood are fastened in place for the freezer having plates as evaporators.

## The Vapor Barrier

It is necessary that the entire outside or warm side of the freezer beneath the plywood be covered with a vapor seal or barrier paper that is sealed at all points. This seal should be made continuous throughout the outside by sealing adjacent pieces together with emulsified asphalt and lapping the joints. Paint over roofing nails with odorless asphalt and nail plywood on with nails approximately in center of the studs. Mark with pencil the center of the stud line on the plywood to facilitate nailing.

Now the 2 x 4 foundation for the freezer and the 3/4-inch plywood base are fastened together with screws. Take the vapor-barrier paper at this time and place two thicknesses of it on the base consisting of the 2 x 4's and 3/4" pieces of plywood. Lap 2 inches over the front edges and allow enough paper to go over back, top, and down over the front. Now the framework (as shown in Figure 3) is placed on this base and squared up. Two thicknesses of vapor-barrier paper are placed on the ends, with enough left over to lap over the top edges and the corners. Plywood is fastened on the ends with 3d galvanized nails. Use extreme care when fastening the plywood to be sure the nails are driven in the approximate center of the stud to prevent splitting of the wood at the edges and breaking the vapor barrier.

Figure 3. The framework fastened together with plywood.



## Placing the Insulation

Insulation should be placed in firmly to fill all corners, but should not be packed in. Manufacturer's recommendations as to density of insulation and method of placing should be followed.

Insulation may be placed on the sides and bottom at this time. Then cover the back with the two thicknesses of vapor-barrier paper picked up from the bottom, which has been previously placed. Tack on with galvanized roofing nails. Where the edges of the vapor-barrier paper lap, paint with emulsified asphalt before tacking down with roofing nails. The plywood back may now be nailed on with 3d galvanized nails. Nail into the center of the stud as was done previously to prevent splitting of the wood at the edges and breaking the vapor barrier. Now fill insulation down the back and sides from the top of the freezer.

Cover the top with vapor-barrier paper, tacking in place with roofing nails and sealing all the edges by lapping the adjacent paper with emulsified asphalt. Now nail on the top plywood sections with 3d galvanized nails.



If possible, place the freezer down on its back, as work can be done more easily this way now. Fill the top with insulation at this time. Check to be sure all spaces are filled with insulation, and then bring the vapor-barrier paper up and over the front to the inside edge of the door frame. The front  $3/4$ -inch plywood can be put on at this time. Brass screws or some type of non-corroding metal should be used in countersunk holes. Afterwards the holes can be filled with plastic wood or a mixture of fine sawdust and glue. This same mixture can be used to fill any cracks. By using sandpaper when the glue is dry, a smooth surface is obtained. The front edges can be rounded also to improve the appearance of the box.

## Freezers with Copper Tubing for Evaporators

The evaporator coil supports should be made now. Only annealed copper tubing should be used, as it is too difficult to bend hard copper tubing without kinking. A better type of evaporator is made with  $3/8$ -inch copper tubing wound over galvanized iron, but for larger size tubing better results are obtained without a metal lining.

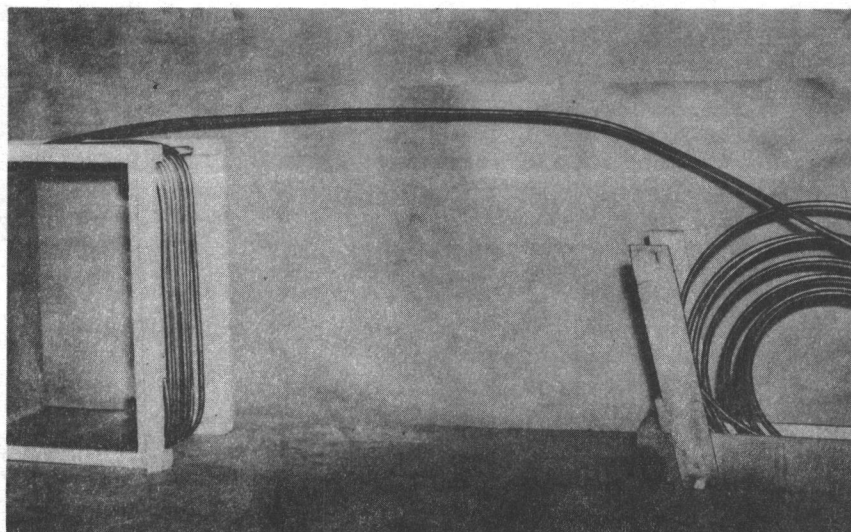


Figure 4. Making the evaporator with copper tubing.

If more than one piece of copper tubing is required, the ends should be soldered or brazed together with a sweat fitting. After finishing both freezer coil supports and winding them with copper, place them in the freezer. In order to fit them in place, first put them in the bottom of the freezer with the two long ends vertical. Turn them to their correct position and push up in place. The coils are secured with screws. The small plywood doors can be fastened in at this time.

## Making the Doors

For best results, the doors should be both glued and held together with screws. The beveled inside edge should be left off at this time. Place inside the vapor-barrier paper as shown in Figure 4. Insulation is built up in alternate layers of  $1/2$ -inch wood strips, aluminum foil, and  $1/2$ -inch rigid insulation board tacked in

place. Fasten the beveled side in place with screws. Finally, cover this insulation with aluminum or 1/4-inch plywood. Around the inside edge of the door, a strip of 3/8- or 1/2-inch weather stripping is used to make the door gasket.

Use good substantial refrigerator door hinges and latches. Rust-resistant screws should be used here to prevent rust. Check latches and hinges to be sure they are the type that will make the doors shut tight on the gasket you have selected. It is important that the door fit snugly to the surface of the freezer to prevent air leakage.

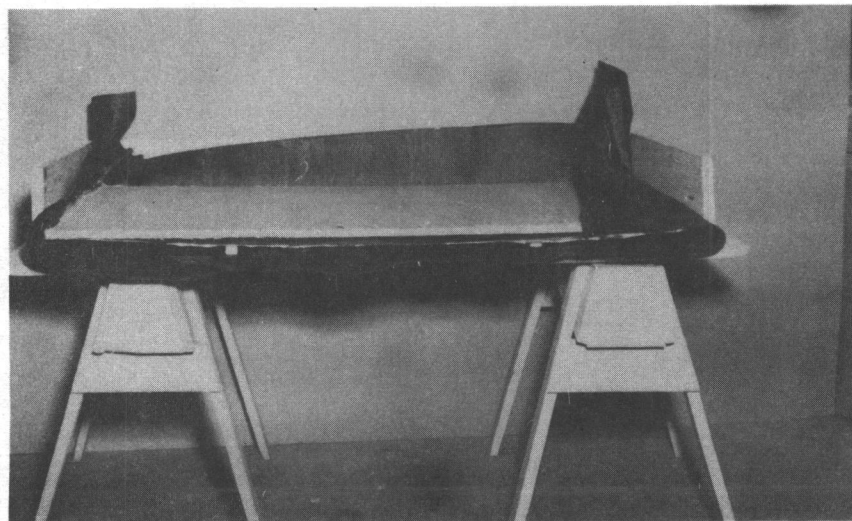


Figure 5. Making the doors.

## Mechanical Installation

The refrigeration man should now be called to make the hookup as outlined on Sheet 4. Silver-soldered joints are best if properly made, but 50-50 solder and special refrigeration welding rods have given excellent service and are more easily made. Note on Sheet 2 that the tubing makes a vapor-tight joint at the outside surface of the freezer. Note that the 3/4-inch plywood block must be slipped over the tubing and then fastened with screws after emulsified asphalt is forced into the augered hole. This makes a vapor seal where the tubing enters the box and prevents moisture from creeping along this line.

The inside of the freezer should be painted with a refrigeration enamel. Any other type of paint tends to give an odor to the food. The outside can be painted first with a single coat of flat paint, followed by two coats of enamel.

The freezer with copper tubing can have adjustable shelves. These shelves are made from scraps of 3/4-inch plywood. To permit the shelves to move up or down and be adjustable, shelf supports are fastened on 1 x 2's on the inside corners. The manner of fastening these is left up to the individual, but a suggested method is illustrated in Sheet 2 of all plans. For best results, shelves below the evaporator should be separated approximately 3 inches at the middle section to permit a proper distribution of air.

A bottom-slatted floor improves air circulation.

## Operating the Freezer

The operation of the freezer requires very little care. The motor on the compressor should be oiled according to the manufacturer's instructions.

Defrosting will be required about once a year, and it is necessary whenever there is a large accumulation of frost. Remove all the food packages and shelves. A small fan will increase the rate of defrosting. Place the fan on a chair in front of the open doors. The fan will force warm air through the freezer in this manner. When all of the ice has fallen from the shelves, the water and ice is wiped into a container. Wipe the shelves dry before placing packages back in freezer to prevent their freezing to the shelves. The freezer may now be started again.

Keep an extra belt available for the compressor. About once a year, stop the compressor and clean out the fins on the condensor coils with a vacuum cleaner. This will improve the efficiency of the condensor unit.

An accumulation of oil at any joint in the tubing generally is a sign of a leak and should be corrected by the service man.

If the compressor runs all the time, generally the refrigerant has leaked and should be replenished.

With proper care and good workmanship, anyone building one of these freezers should have a satisfactory, economical, and efficient freezer.

Table 1. Specifications of the Freezer

Plan number	Cubic foot capacity	Floor space required	Estimated building cost	Ceiling height required
5.55 . . . .	20	2'5 5/8" X 5'5 1/2"	\$350.00	5'10 5/8"
5.56 . . . .	30	2'5 5/8" X 6'8"	420.00	6' 1/8"
5.57 . . . .	40	2'9 5/8" X 9'9 1/2"	540.00	6' 1/2"



## ► 20-cubic-foot freezers

- 5 pieces of plywood  $\frac{1}{4}$ " exterior grade - 4' x 8'
- 3 pieces of plywood  $\frac{3}{4}$ " exterior grade - 4' x 8'
- 2 x 2 - 23 pieces 6 feet long, No. 1 or better
- 1 x 4 - 3 pieces 10 feet long, No. 1 or better
- 2 x 4 - 4 pieces 10 feet long, No. 1 or better
- 2 x 4 - 2 pieces 5 feet long, No. 1 or better
- 2 x 4 - 2 pieces 6 feet long, No. 1 or better
- 2 x 6 - 1 piece 8 feet long, No. 1 or better
- Aluminum - 1 piece 26" x 55" - .019" thick or better
- Insulation - 50 cubic feet of fill insulation
- 3 pieces of common insulation board  $\frac{1}{2}$ " x 48" x 96"
- 1 roll of vapor-barrier paper (Brownskin Vapor-seal paper, Bird's Neponset 50 pound, Rubberoid's Giant Sheathing 50 pound black, or equivalent)
- 1 gallon of emulsified asphalt (odorless)
- 2 pair refrigerator door hinges
- 2 refrigerator door latches
- 25 feet of  $\frac{1}{2}$ " or  $\frac{3}{8}$ " rubber gasket material (check type of latches and hinges before buying gasket material to be sure that doors will close tightly)
- 1 pound of waterproof glue
- 1 pound 2d galvanized nails
- 1 pound 3d galvanized nails
- 2 pounds 16d galvanized nails
- 1 pound 1" roofing nails, galvanized (used on vapor-barrier paper)
- 6 dozen  $1\frac{1}{2}$ " flathead screws #10 (stainless steel, brass, or galvanized)
- 1 quart of plywood size (Rez or equivalent)
- 2 quarts of refrigerator enamel (to be used inside of freezer only)
- 1 gallon enamel (to be used on outside of freezer only)

### Mechanical equipment

- 1 each Condensor Unit (freon, air-cooled)
- 1,300 BTU per hour at 20° F. suction temperature in 90° F. ambient (about  $\frac{1}{3}$  hp)
- 1 Thermal Expansion Valve -  $\frac{1}{3}$ - to  $\frac{1}{2}$ -ton capacity
- 1 Drier Strainer Combination -  $\frac{1}{2}$ -ton capacity

### With freezer plates

- 3 each freezer plates 16" x 48" (these can be either plain or vacuum)
- 1 x 2 - 6 each 8 feet long
- 1 x 2 - 1 each 14 feet long

### Alternate plan (copper tubing)

- 250 feet  $\frac{3}{8}$ " O.D. annealed copper tubing (2 pieces of thin gaged (22) galvanized iron 15  $\frac{3}{8}$ " x 55" can be used with advantage with  $\frac{3}{8}$ " copper tubing)
- or
- 200 feet  $\frac{1}{2}$ " O.D. annealed copper tubing
- 2 x 2 - 1 each 14 feet long
- 1 x 2 - 2 each 10 feet long
- $\frac{3}{4}$ " plywood secured from scraps

► 30-cubic-foot freezers

- 6 pieces of plywood  $\frac{1}{4}$ " exterior grade - 4' x 8'
- 4 pieces of plywood  $\frac{3}{4}$ " exterior grade - 4' x 8'
- 2 x 2 - 23 pieces 6 feet long, No. 1 or better
- 1 x 4 - 3 pieces 10 feet long, No. 1 or better
- 2 x 4 - 6 pieces 10 feet long, No. 1 or better
- 2 x 6 - 1 piece 14 feet long, No. 1 or better
- Aluminum - 1 piece 26" x 66  $\frac{3}{4}$ " - .019" thick or better
- Insulation - 60 cubic feet of fill insulation
- 3 pieces of common insulation board  $\frac{1}{2}$ " x 48" x 96"
- 1 roll of vapor-barrier paper (Brownskin Vapor-seal paper, Bird's Neponset 50 pound, Rubberoid's Giant Sheathing 50 pound black, or equivalent)
- 1 gallon of emulsified asphalt (odorless)
- 2 pair refrigerator door hinges
- 2 refrigerator door latches
- 28 feet of  $\frac{1}{2}$ " or  $\frac{3}{8}$ " rubber gasket material (check type of latches and hinges before buying gasket material to be sure that doors will close tightly)
- 1 pound of waterproof glue
- 1 pound 2d galvanized nails
- 1 pound 3d galvanized nails
- 2 pounds 16d galvanized nails
- 1 pound 1" roofing nails, galvanized (to be used on vapor-barrier paper)
- 7 dozen  $1\frac{1}{2}$ " flathead screws #10 (stainless steel, brass, or galvanized)
- 1 quart of plywood size (Rez or equivalent)
- 2 quarts of refrigerator enamel (to be used inside only)
- 1 gallon enamel (to be used on the outside only)

Mechanical equipment

- 1 each Condensor Unit (freon, air-cooled)
- 1,500 BTU per hour at 20° F. suction temperature at 90° F. ambient (about 1/3-1/2 hp unit)
- 1 Thermal Expansion Valve - 1/2-ton capacity or better
- 1 Drier Strainer Combination - 1/2-ton capacity or better

With freezer plates

- 4 each freezer plates 12" x 60" (these can be either plain or vacuum)
- 2 x 2 - 2 each 8 feet long, No. 1 or better
- 2 x 4 - 4 each 10 feet long, No. 1 or better
- 1 x 2 - 2 each 10 feet long, No. 1 or better

Alternate plan (copper tubing)

- 360 feet  $\frac{3}{8}$ " O.D. annealed copper tubing (2 pieces 15  $\frac{7}{8}$ " x 67" of thin gaged (22) galvanized iron can be used with advantage with  $\frac{3}{8}$ " copper tubing)
- 300 feet  $\frac{1}{2}$ " O.D. annealed copper tubing
- 2 x 2 - 2 each 8 feet long
- 1 x 2 - 2 each 14 feet long
- $\frac{3}{4}$ " plywood secured from scraps

► 40-cubic-foot freezers

9 pieces of plywood  $\frac{1}{4}$ " exterior grade - 4' x 8'  
 4 pieces of plywood  $\frac{3}{4}$ " exterior grade - 4' x 8'  
 2 x 2 - 33 pieces 6 feet long, No. 1 or better  
 1 x 4 - 5 pieces 12 feet long, No. 1 or better  
 2 x 4 - 6 pieces 12 feet long, No. 1 or better  
 2 x 4 - 2 pieces 10 feet long, No. 1 or better  
 1 x 2 - 1 piece 8 feet long, No. 1 or better  
 Aluminum - 1 piece 26" x  $91\frac{1}{4}$ " - .019" thick or better  
 Insulation - 80 cubic feet of fill insulation  
 5 pieces of common insulation board  $\frac{1}{2}$ " x 48" x 96"  
 1 roll of vapor-barrier paper (Brownskin Vapor-seal paper, Bird's Neponset  
 50 pound, Rubberoid's Giant Sheathing 50 pound black, or equivalent)  
 1 gallon of emulsified asphalt (odorless)  
 3 pair refrigerator door hinges  
 3 refrigerator door latches  
 42 feet of  $\frac{1}{2}$ " or  $\frac{3}{8}$ " rubber gasket material (check type of latches and  
 hinges before buying gasket material to be sure that doors will close  
 tightly)  
 1 pound of waterproof glue  
 1 pound 2d galvanized nails  
 1 pound 3d galvanized nails  
 3 pounds 16d galvanized nails  
 2 pounds 1" roofing nails, galvanized (to be used on vapor-barrier paper)  
 9 dozen  $1\frac{1}{2}$ " flathead screws #10 (stainless steel, brass, or galvanized)  
 2 quarts of plywood size (Rez or equivalent)  
 3 quarts of refrigerator enamel (to be used inside only)  
 1 gallon enamel (to be used on the outside only)

Mechanical equipment

1 each Condensor Unit (freon, air-cooled)  
 1,900 BTU per hour at 20° F. suction temperature at 90° F. ambient (about  
 1/2 hp unit)  
 1 Thermal Expansion Valve - 1/2-ton capacity or better  
 1 Drier Strainer - 1/2-ton capacity or better

With freezer plates

4 each freezer plates 12" x 84" (these can be either plain or vacuum)  
 2 x 4 - 4 each 14 feet long  
 2 x 2 - 2 each 8 feet long  
 1 x 2 - 4 each 8 feet long

Alternate plan (copper tubing)

460 feet  $\frac{3}{8}$ " O.D. annealed copper tubing (3 pieces 15  $\frac{7}{8}$ " x  $66\frac{1}{4}$ " of  
 thin gaged iron can be used to advantage on coil support if  $\frac{3}{8}$ "  
 tubing is used)

or

360 feet  $\frac{1}{2}$ " O.D. annealed copper tubing  
 1 x 2 - 3 pieces 14 feet long  
 2 x 2 - 3 pieces 8 feet long  
 $\frac{3}{4}$ " plywood obtained from scraps