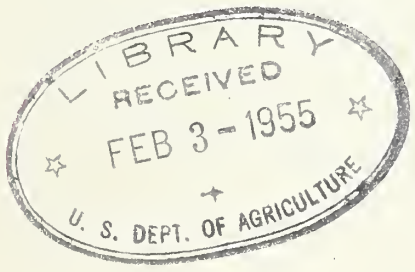
. . . instructions for building and operating a Two-Temperature Walk-in Farm Refrigerator

(U. S. D. A. Plan No. 7102)



Home Economics Research Branch and
Agricultural Engineering Research Branch
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INSTRUCTIONS FOR BUILDING AND OPERATING A TWO-TEMPERATURE WALK-IN FARM REFRIGERATOR

These instructions were prepared to accompany the working drawings for U.S.D.A. Plan No. 7102. They give information as to the construction and operation of the two-temperature walk-in refrigerator for the farm, designed by the Agricultural Research Service of the United States Department of Agriculture.

Description of Refrigerator

The refrigerator consists of a chillroom and freezer with the latter at the rear. See figure 1.

Capacity. The freezer has a capacity of about 100 cubic feet; 100 pounds of food can be frozen in 24 hours. The chillroom has a capacity of about 250 cubic feet with space for hanging 8 quarters of beef.

Dimensions. The outside dimensions of the refrigerator are: Height, 8 feet; width, 8-1/2 feet; and length, front to back, 10-1/2 feet. The

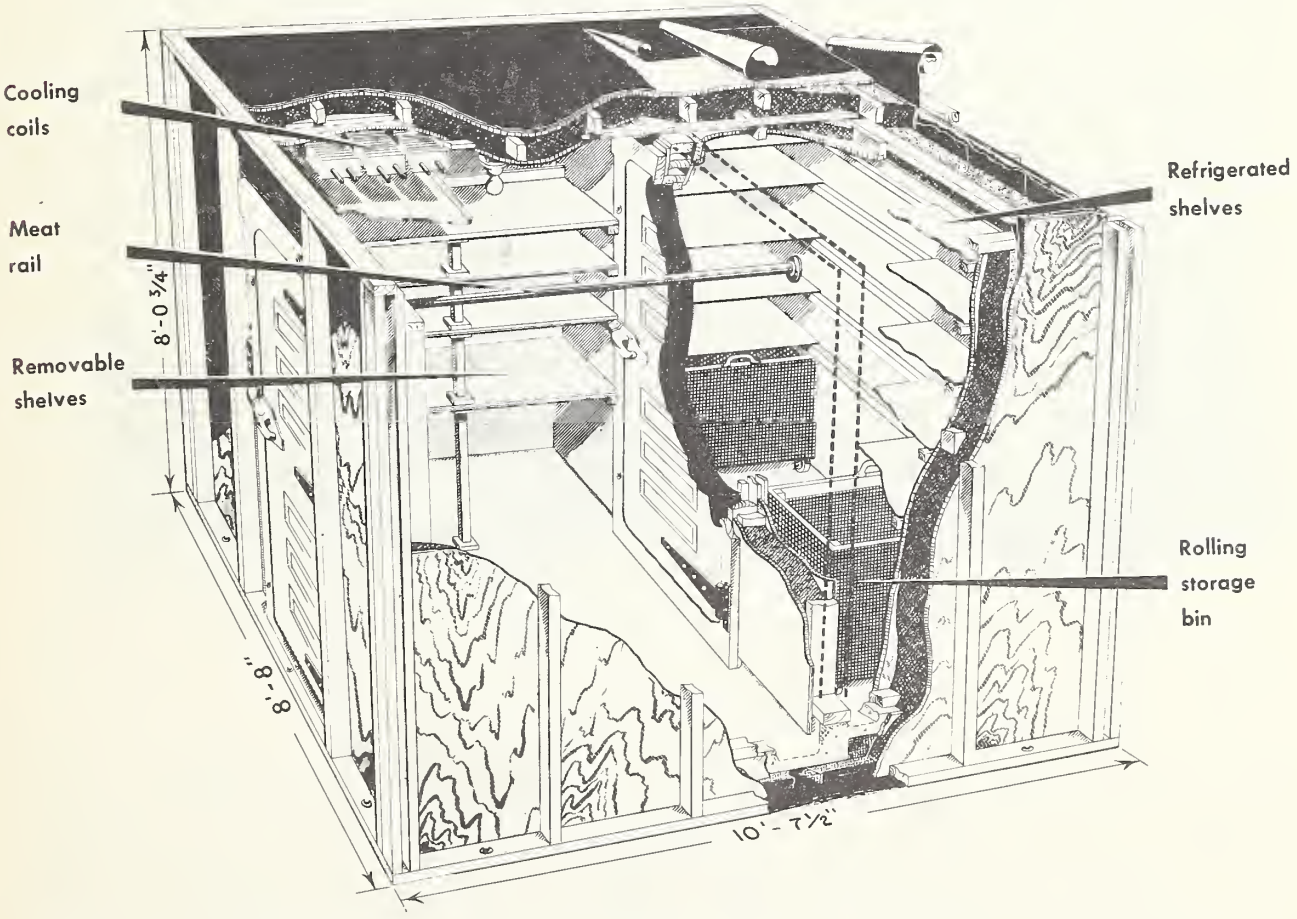

Figure 1.--Cutaway view of refrigerator; freezer compartment at right.

inside dimensions of the chillroom are: Height, 7 feet; width, 6-1/2 feet; and length, front to back, 5-1/2 feet. The inside dimensions of the freezer room are: Height, 6-1/2 feet; width, 6-1/2 feet; and length, front to back, 2-1/2 feet. A clearance of 3 inches above the refrigerator is required for construction.

Location. The refrigerator may be built in any dry, well-ventilated place. Because of dampness, a basement is, generally, not a suitable location. If such a location is chosen, however, a minimum of 6 inches should be left between the basement walls and refrigerator for ventilation.

If a new foundation is to be made for the refrigerator, make sure the site is well drained.

Future family needs should be considered in choosing the location. If the refrigerator is to be used chiefly for freezing and storing foods for the home, a location close to the kitchen would be convenient. If it is to be used chiefly for freezing and storing food to be sold, a location near where the food is to be prepared may be more desirable. Figure 2 shows an installation in an outbuilding.

Figure 2.--Installation in a garage; compressors in lean-to.

Building Construction

Study the following instructions (pp. 2 to 18) and the accompanying working drawings thoroughly. Examine the bill of material (pp. 21 to 29) and order all items which are not available locally and may have to come from a distance, such as door frames and doors, vapor-barrier paper, seam filler, asphalt paint, rigid-type insulation, and interior paint. Procure the materials available locally and store in a safe, dry place.

In the instructions that follow, note especially the details of installing vapor barriers on ceiling, wall, and floor. Correct installation of the vapor barrier is very important to prevent accumulation of water in the walls, which would destroy the effectiveness of the insulation.

Labor Required. Most of the construction can be done by one person. Help will be needed to lift the ceiling into place and to install the doors. The building construction will require about 375 man-hours. A refrigeration service man will be needed to purchase and install the refrigeration equipment. The installation will require about a week.

Foundation. Prepare the foundation. It must be level. If a new one is poured, insert the anchor bolts for the outside walls before the concrete has hardened. Determine their location from sheet 1 of the working drawings. If an old foundation is used, holes will have to be made for insertion of the bolts.

Outside Walls. Outline the space for the refrigerator on the foundation with a chalk line. Locate it no closer than 1 inch from an exterior wall (6 inches from a basement wall) in order to have room to plumb the walls. Cut the framing plates and paint them with asphalt paint. Put them in place on the foundation temporarily; measure top plates from them. Cut top plates and mark location of wall studs. Cut wall studs and nail in place. Nail wall corners together temporarily. Cut and nail panels to framing.

To assist in supporting the ceiling while it is being put in place, make a 2-inch ledge on the rear wall. For the ledge, nail a 6-foot 2-inch x 4-inch piece to the studding, the top side of the piece even with the top of the panel. Make similar ledges on the front wall, one on each side of the chillroom door opening; for each strip use a 2-foot 2-inch x 4-inch piece. (The ledges are not shown in the working drawings.)

Remove two adjacent walls and set aside to allow room for the ceiling construction.

Ceiling. Construct the ceiling, then lift it into place. Nail the nailing strips to the ceiling joists. Turn joists over so the nailing strips are underneath. Nail the plywood to the joists and apply a double layer of vapor-barrier paper. Along one side of the ceiling plywood panel apply odorless asphalt paint on a section slightly wider than the vapor-barrier paper. While the paint is still tacky, unroll a layer of the paper onto it leaving an overhang of 10 inches at the side and at both ends. Apply a ribbon of seam filler with a putty knife over the edge of the paper to be overlapped by the next strip. (The seam filler will need to be heated thoroughly to soften it.) Paint a second section. Unroll another strip of paper on the fresh asphalt paint, overlapping the first one 6 inches. After the whole surface has been covered (with a 10-inch overhang all around), apply asphalt paint to the first layer of paper and apply a second layer, staggering the seams. Experience has shown that nailing is not necessary to hold this paper in place.

It is sometimes difficult to prevent the heavy paper from tearing or puncturing at the corners. The use of a flexible plastic material such as that used in wrapping foods for freezing will help in preventing this. As shown in figure 3, cut out a section of each of the overhanging layers at each corner and place a sheet of the plastic material over each cutout opening, lapping 2 or 3 inches over the vapor-barrier paper. Seal each of the sheets of the plastic to the layer of vapor-barrier paper under it with seam filler.

Fasten two walls together and to the floor, forming a permanent corner. Lift an end of the ceiling (with vapor-barrier paper up) on the wall ledge of the one wall with the vapor-barrier overhang inside the room. Lift the other end of the ceiling higher than the other walls and support it in this position. Move the two walls under the ceiling and bolt them into position on the floor. Nail the corners together, and lower the ceiling into place as shown in figure 4, with all the vapor-barrier overhang on the inside. (Note: With this method of construction, the vapor-barrier paper is on the exterior at the top. Because of the possibility of puncture or other damage to the paper, never put anything on top of the refrigerator.)

To apply vapor barrier to the walls, start by applying odorless asphalt paint to a lengthwise section slightly wider than the vapor-barrier paper; hold the ceiling overhang out of the way as you work. Smooth a strip of vapor-barrier paper over the paint; start at the top and bring the paper out from the bottom of the wall 10 inches along the floor. Overlap strip and use seam filler as was done in the ceiling construction. When applying the paper around the door opening, bring the paper out of the refrigerator at the sides and top of the opening and tack out of the way. Do not attach permanently at the top of the door opening until the panel above the door is in position after the freezer door is moved into the room.

Paint a strip 12 inches or so wide on the first layer of vapor-barrier paper around the top of the walls and press one layer of the ceiling overhang into position on the wall. Install a second layer of paper on the walls, staggering the seams with the first layer as was done on the ceiling, and complete the interlocking of wall and ceiling barrier by painting another strip around the top of the walls and pressing the second layer of the overhang into position.

Paint the floor with asphalt paint and put two layers of vapor-barrier paper in place as outlined for ceiling and walls, lapping and interlocking wall and floor strips at the bottom corners as was done for wall and ceiling. Press the paper well into the corners so the floor insulation will not puncture it.

Floor. Place a 2-inch layer of insulation on the vapor-barrier paper. Extend this to all four walls. Do not anchor the insulation to the floor. As indicated in Section A-A, sheet 1, of the working drawings, place three

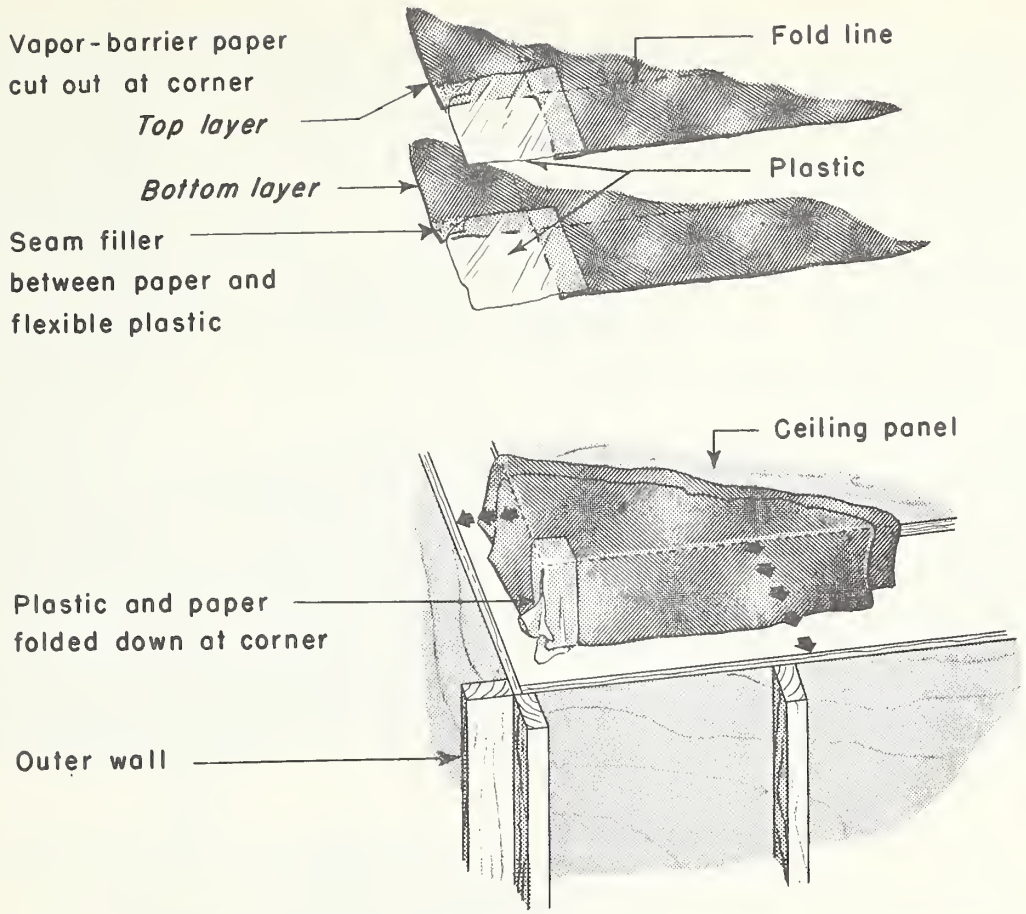

Figure 3.--Method of making vapor barriers at ceiling corners.

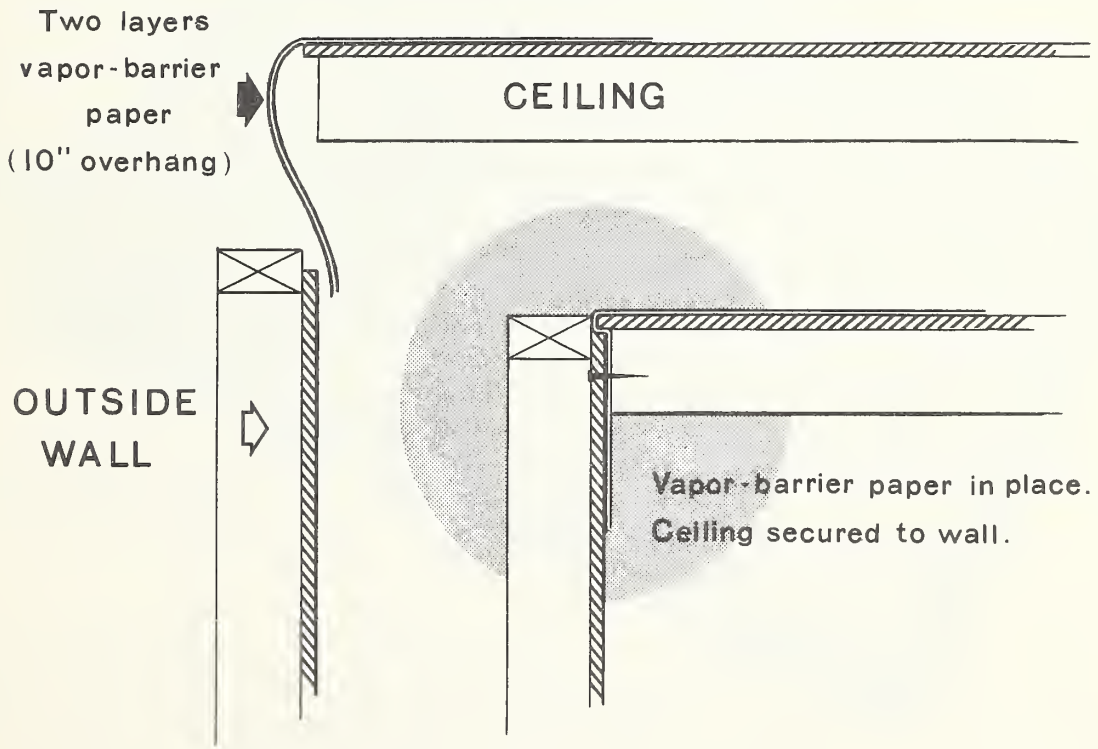

Figure 4.--Position of vapor barrier when lowering ceiling into place.

more layers on the part of the floor to become the freezer room, making a thickness of 8 inches. This extends from left to right wall and 3 feet 5 inches from the rear wall. Place waterproof paper (not necessarily vapor-barrier paper) on the insulation to prevent fresh concrete from running into it. Build pouring forms on the paper as shown in figure 5. Place wire mesh in the forms. Put the sheet-metal flashing along the partition side of the freezer-floor insulation. Pour the floors. Slope to center in both rooms. Set the anchor bolts for the inside walls and partitions where shown on sheet 1 of the working drawings. After the concrete has set overnight, remove only the pouring forms which would be inside the rooms and work additional concrete into the corners to form a cove around the base of the walls.

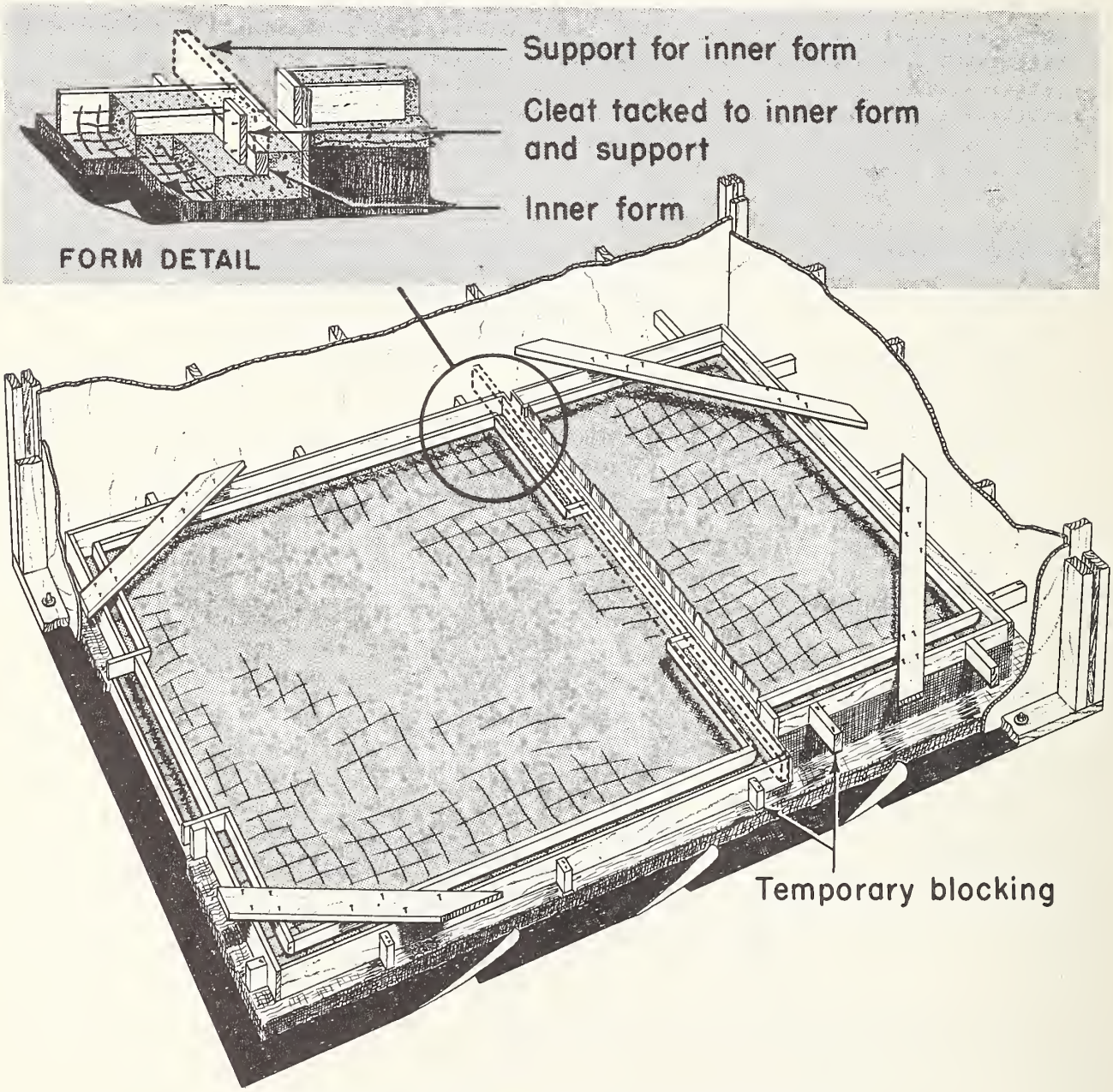

Figure 5.--Forms for concrete floor.

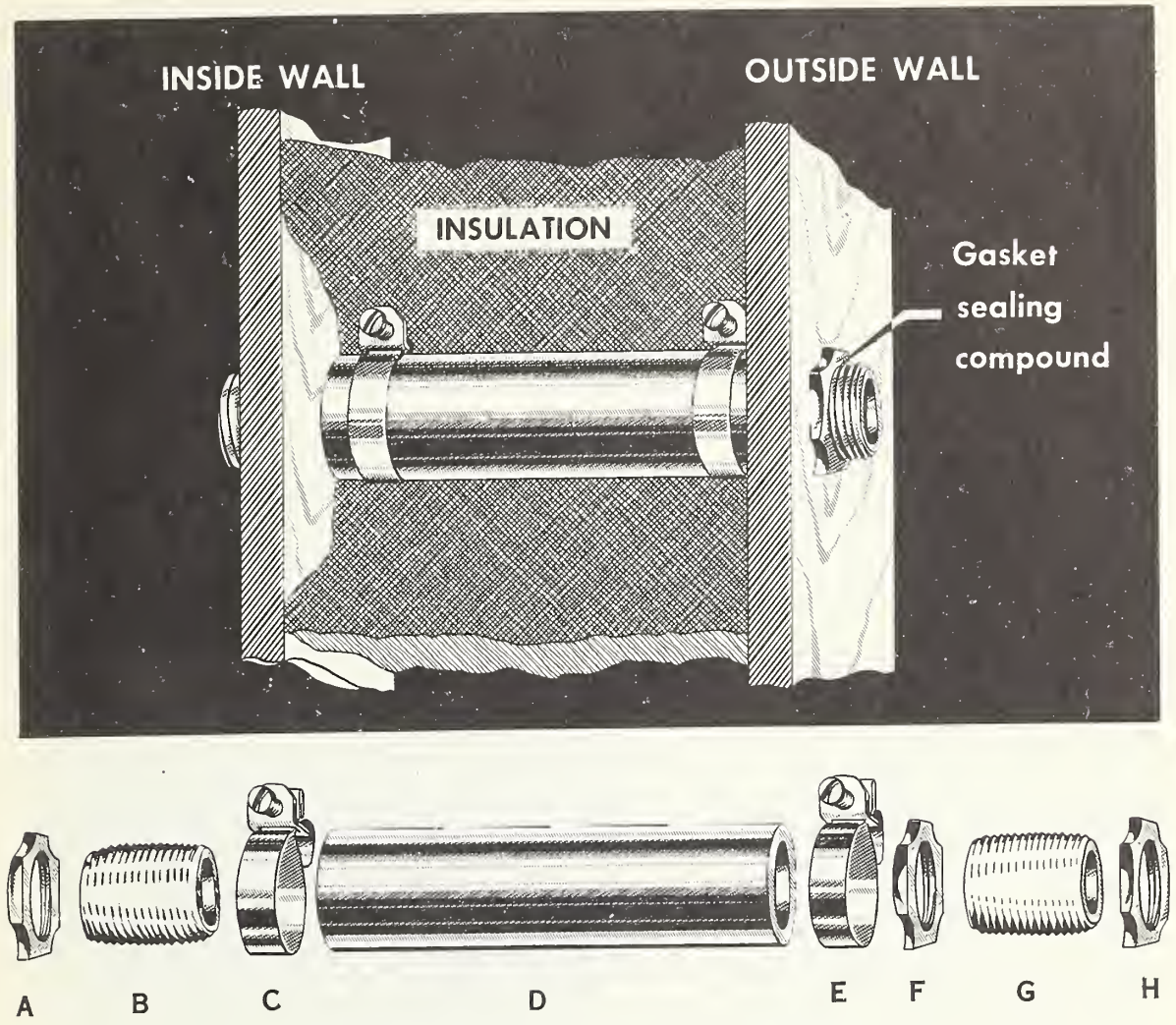

Figure 6.--Details of wall duct.

Outside-Wall Ducts. To install the outside-wall ducts, bore a hole for the larger pipe nipple 5 feet above the floor and 5-1/2 feet from the rear of the refrigerator. Bore another hole for the smaller pipe nipple (which will contain the wiring) 4-1/2 feet above the floor and 1-1/2 inches from the stud on the left of the chillroom door, as in the front view on sheet 2 of the working drawings.

Referring to figure 6, turn a locknut (F) as far as possible on one end of the pipe nipple (G). Put gasket cement (calking compound) on the threads of the nipple over which the locknut has passed and on one end of the other nipple (B). Force the cement-covered ends into the ends of a 6-inch hose (D) and clamp in position with hose clamps (C) and (E).

Insert the pipe nipple (G) with the inner locknut (F) outward through the hole in the wall until the locknut touches the vapor-barrier paper. Place gasket sealing (calking) compound around the nipple extending beyond the outside wall. Tighten another locknut (H) through the compound and against the wall. After the insulation is in place and the inner walls are erected, screw a locknut (A) on the inside pipe nipple to hold the hose more firmly in place.

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Inside Walls. Cut and bolt the 2-inch x 4-inch sill plates onto the concrete ledges provided for them. Nail three 2-inch x 4-inch blocking strips on the freezer ceiling as shown in section A-A, sheet 1, of the working drawings. Nail the head plate to the blocking strips. Toenail the studding between the head and sill plates. Place 1-inch x 6-inch bridging about halfway up between the studs completely around the room and in the partition to prevent settling of the insulation. Put the freezer-door header between the studs.

Insulation. Insulate the walls (except above the chillroom door) and the ceiling. If you use a rigid-type insulation, take care not to nail the outer layer into the vapor-barrier paper. Toenail the top layer into the ceiling joists.

If you use a fill-type insulation, tack screen wire across studs; start at the bottom and stop every few inches to pour insulation and to press it lightly into position, as in figure 7. Look for and fill any voids in the insulation. Use the same method in the ceiling insulation, working from side to side of the room between the joists. Insulate from the freezer side of the partition after the plywood has been nailed on the chillroom side.

Figure 7.--Placing fill-type insulation in wall.

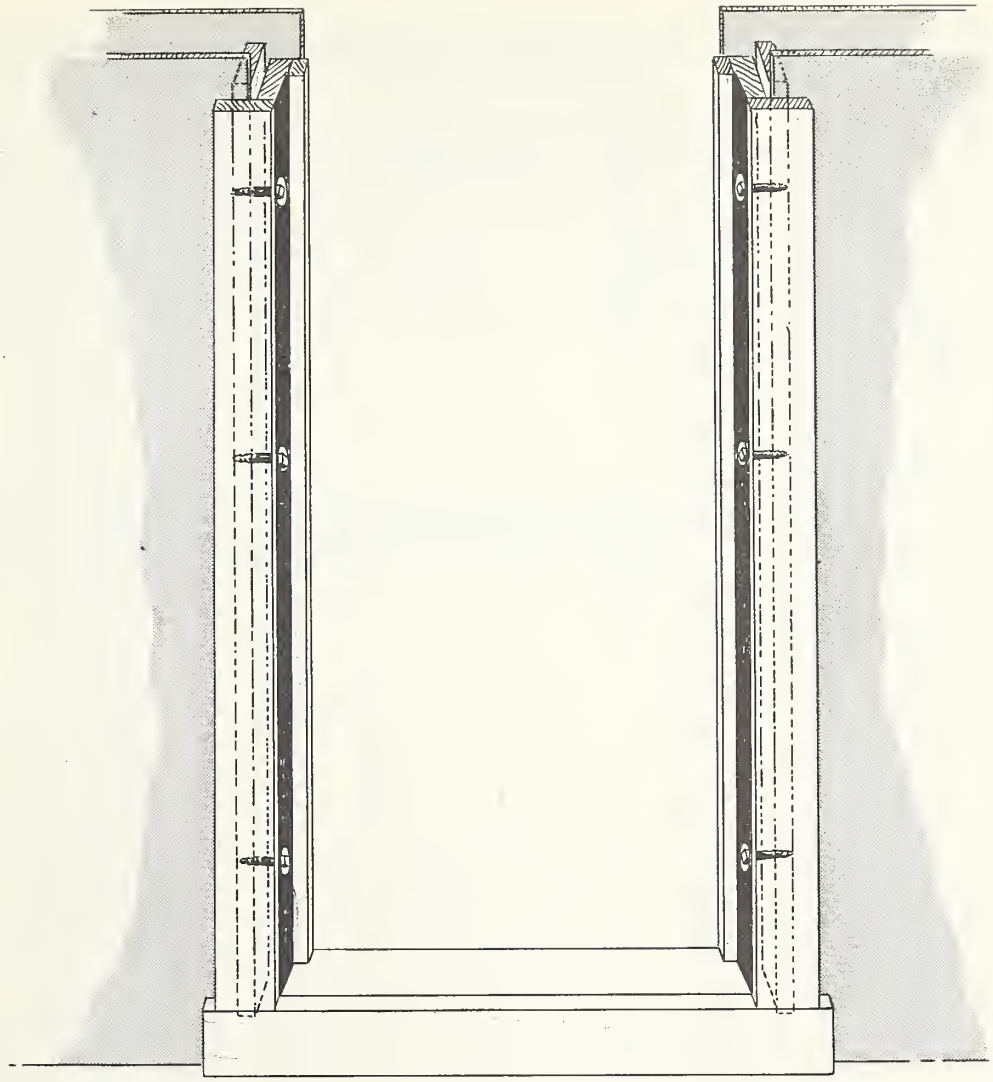

Figure 8.--Position of lag screws in freezer-door frame.

Partition Ducts. Install wall duct through the partition for the light wiring and cut opening for the heat exchanger.

Paneling and Doors. Nail plywood on the ceiling of both rooms. Use corrosion-resistant nails. Leave the screen wire under the plywood. Finish paneling the walls of both rooms (except above the chillroom door). Start these panels 2 inches above the floor. Place quarter round in all corners desired.

The doors and door frames will come as one unit from the factory. Remove them from the crates. Take the door off the frame by removing the hinge pins. Leave the crossbraces on the door frames until after the frames are installed, as they keep the frames square. Remove the threshold pouring forms. Paint both door frames and around the entire door openings with asphalt paint. Bring the freezer-door frame through the chillroom. Plumb and level it into position with wedges. Fasten it with three lag screws on each side as shown in figure 8. Install the door in the frame.

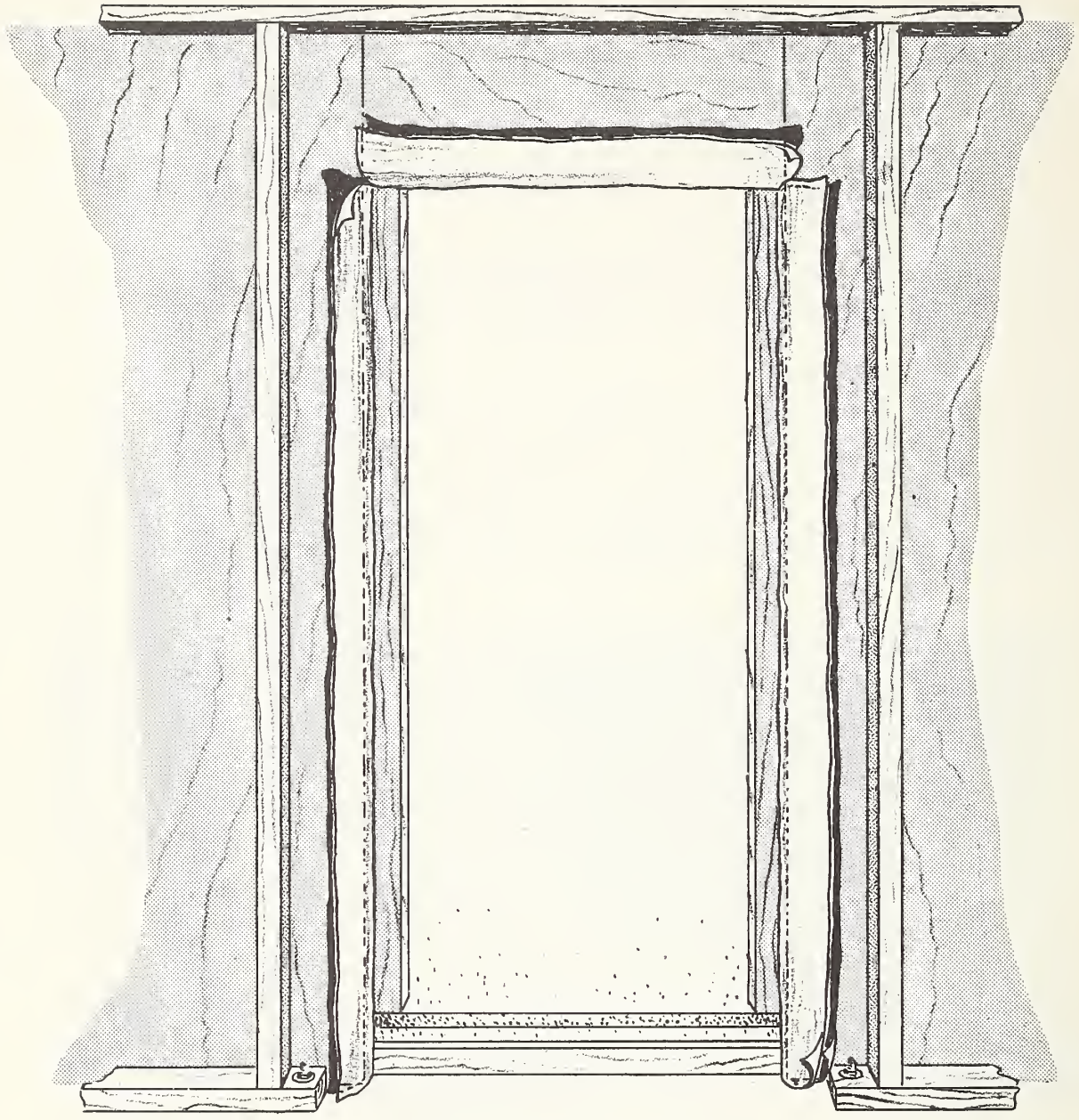

Figure 9.--Method of applying vapor barrier around chillroom door.

Toenail in a header above the chillroom-door opening. Nail panel on the outside above the chillroom door. Apply the vapor barrier bringing it outside the room as shown in figure 9. Place the insulation and install panel on the inside above the door. Install chillroom-door frame and door as with the freezer.

Press a bead of calking completely around both door frames where they join the wall panels.

Tack 12-inch flashing against the base of the partition on the chillroom side.

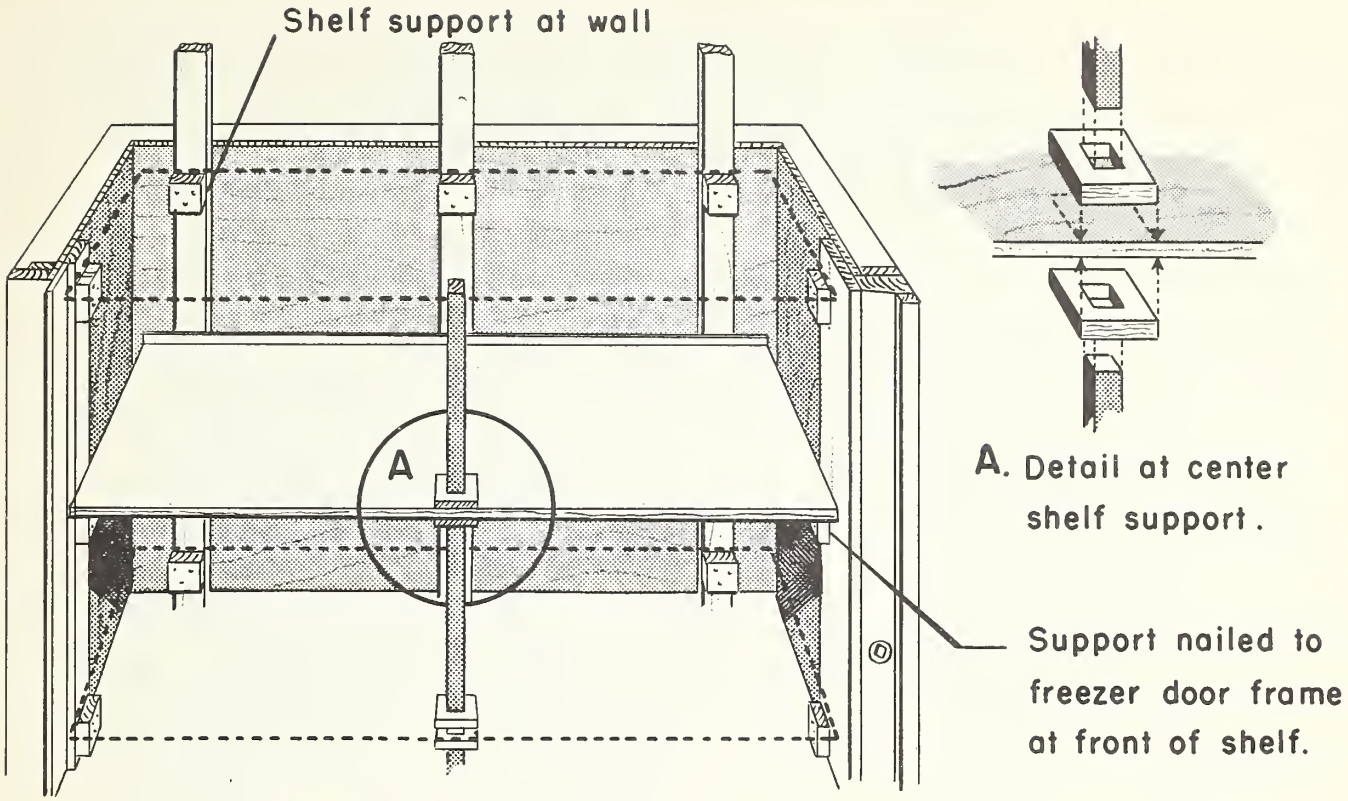

Figure 10.--Shelf supports in chillroom.

Shelves. Install the shelf supports in the chillroom as shown in figure 10. The distance between shelves may be varied to meet requirements. Cut and fit the shelves and remove from the room for painting.

Paint and Painting. Paint all interior walls and ceiling with two coats of boiled linseed oil. Paint the entire freezer door and the inside of the chillroom door with boiled linseed oil. Wipe off immediately any oil getting onto the rubber door gaskets. Paint the chillroom shelves and drip baffle outside the room, using rubber-base paint. Avoid all oil-base paints and phenolic varnishes as the odor will taint the food. Rubber-base paints are comparatively odorless. Paint surfaces only when warm. If the temperature is lower than 60° F., the paint will not flow well. After painting, leave the shelves and drip baffle outside the room several days until completely dry and odorless. Paint the wiremold, lamp receptacles, wall conductors, meat rail and drip-baffle supports. Leave the doors open with a fan blowing into the room for at least a week after painting. Give the outside of the chillroom door two coats of varnish.

Lights. Install a light fixture at the center of the freezer ceiling and another midway between the right and left chillroom walls and as close as possible to the opened freezer door. Fasten the light switch beside the chillroom door below the wall duct. Avoid puncturing the vapor barrier. Have the lights wired so they will both go on when the switch is thrown. Seal the wiring ducts by forcing calking compound around them and in them (around the wires). Do this on the outside of the wall duct and on the chillroom side of the partition duct.

An experienced refrigeration service man should be employed to install the refrigeration systems for freezer and chillroom. The following information is for such a person and includes suggestions to assist him in the general installation as well as specific directions for construction details to meet the requirements of the plan.

Drier. Start the construction by making a drier loop as shown on sheet 4 of the working drawings. Solder together 8 feet of 10-foot lengths of 1/2-inch and 1/4-inch tubing. Leave 1 foot unsoldered at each end. Silver solder the drier loop into the heat exchanger. Make sure these joints do not leak because they will be inaccessible when in place. Use reducing bushings in the heat exchanger fittings. Solder a 2-foot length of 1/4-inch tubing into the liquid line of the other end of the heat exchanger. Solder a 2-inch and a 2-foot length of 1/2-inch tubing into the ends of an ell fitting. Solder the short end of the resulting ell into the suction line of the exchanger. Slit a length of car radiator hose and lay it around the heat exchanger. Tape the hose together. Bore a hole through the partition the size of the hose diameter and locate as shown in Section B-B, on sheet 1, of the working drawings. Shove the 8-foot drier through the partition from the chillroom side and form the loop in the freezer.

Plate Assembly. Install five temporary supports for holding the front ends of the freezer plates as shown in figure 11 for one of the pairs of plates. The supports should be level with the permanent supports at the rear and sides of the room and in at least 6 inches from the front of the room. Lay five plates at the door opening on the rear-wall shelf supports and the temporary supports with the sealed tubing ends extending toward the chillroom.

With a tube cutter, cut off the sealed ends of the tubing far enough back to allow the plates to be slid into position. Warning: Do not remove the sealed tube ends by unsoldering them at the plates as these joints are difficult to remake.

Connect the plates as shown on sheet 4 of the working drawings. The return tubing from the middle plate should be connected through the tee to the drier loop.

Move the assembled plates into position at one side of the freezer. Connect the other five plates in similar manner and slide them into position at the other side. (Note: It is not advisable to install the permanent supports at the front of the plates at this time. It is better to wait until the systems have been checked for leaks.) Connect the top plates to a tee which is connected to the expansion valve through a short length of tubing. Fasten a liquid indicator (optional) to the other end of the expansion valve. Place a 6-inch length of 1/4-inch tubing with a flare nut on each end between the liquid indicator and the liquid line of the drier loop. This will be replaced by a drier-strainer after dehydration.

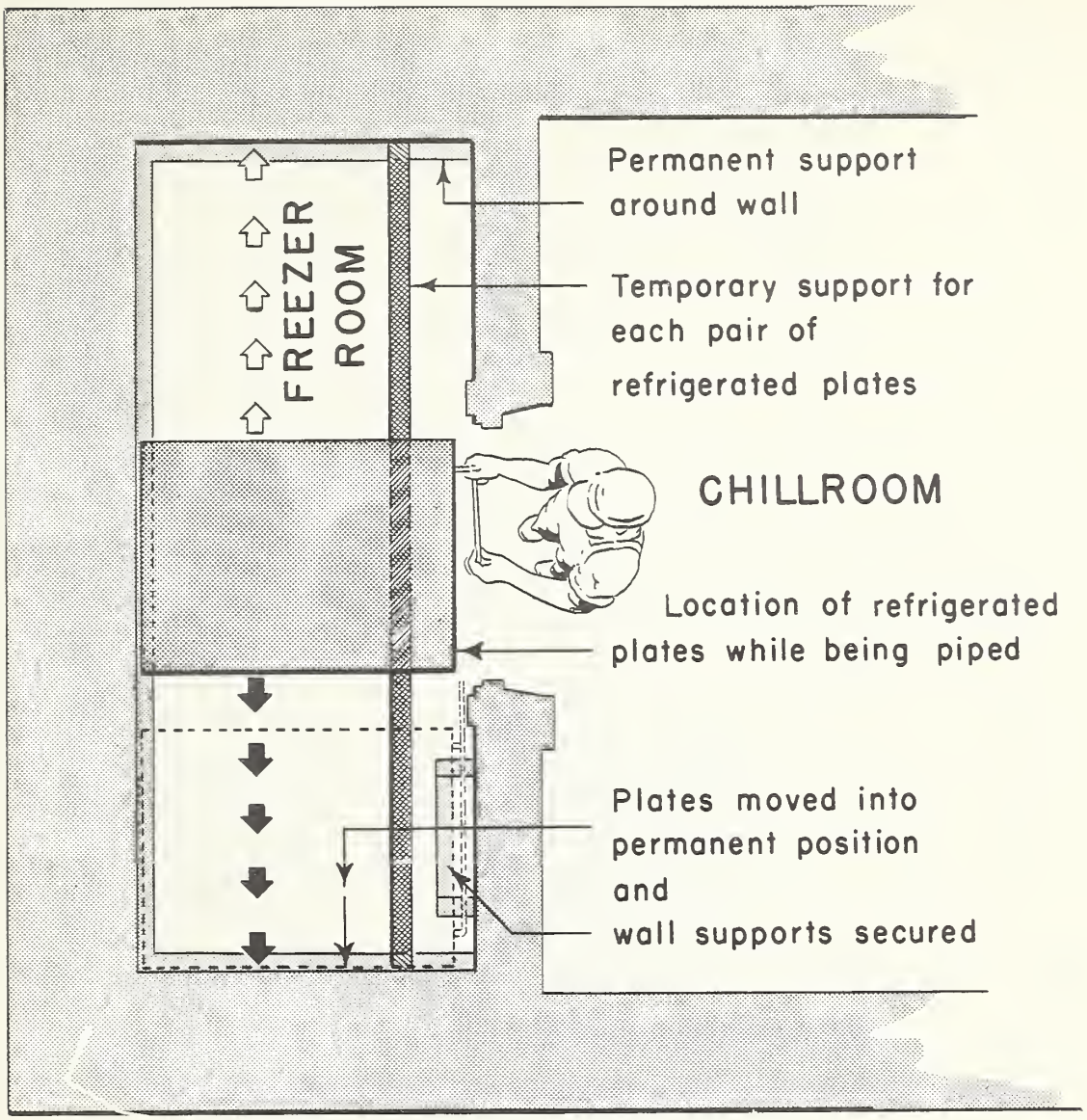

Figure 11.--Location of supports for plate assembly.

Connect the liquid line to the condensing unit and the suction line to a 6-inch-diameter loop as shown on sheet 2 of the working drawings. If the units are in a dwelling, add vibration absorbers in both lines to reduce the noise.

Leak Testing and Dehydration. The system may be tested for leaks in the following manner: Connect the center hose of a testing unit to a Freon drum. Connect the left and right gages of the unit to the high side and low side of the refrigeration system. Crack the drum valve allowing pressure to build up on both high and low sides. Close the valve and listen for leaks at all joints. Recheck for leaks by going around each joint slowly with a halide leak detector. A minimum of 60-pounds pressure should be in the high and low sides during this test. Close the Freon-drum valve and remove the drum from the charging line. Let the

Freon in the high and low sides blow out the air. Connect a vacuum pump on the charging line. Evacuate both high and low sides as well as the condensing unit to remove moisture and air from the system. The evacuation times at various system temperatures are given below:

System temperature:	Hours
50° F.	4
60° F.	2-1/2
70° F.	1-1/2
80° F.	1/2
90° F.	1/2

Stop the vacuum pump and allow Freon or air to enter the system. Evacuate again for one-half hour. Heat the entire system to about 90° F. during the evacuation. After the second evacuation, shut off the testing unit valves and substitute the Freon drum for the vacuum pump. Build up about 2 pounds pressure in the high and low sides of the system and shut off the Freon-drum valve. Remove the short length of tubing ahead of the liquid indicator and replace it with a drier-strainer. Open all valves on the condensing unit and start it operating. Crack the Freon-drum valve and slowly charge the system by weighing in 2 pounds of Freon-12 gas through the suction valve. Throttle the suction pressure below 30 pounds during this charging operation to prevent overloading the compressor. Let the system refrigerate an hour, then leave it off overnight. The next day carefully examine around all joints for oil which indicates a leak. Put the unit in operation. After the suction pressure has fallen to 3 pounds, add refrigerant slowly until the suction line starts to get cold. The suction line outside the room should be about 65° F.

Controls. Fasten the freezer pressure-control where it will not vibrate. Connect it to the high and low sides of the condensing unit. Set the high-pressure control to cut out at 180 pounds for Freon-12 and 300 pounds for Freon-22. Set the low-side control at a minimum differential and to cut out at 3 pounds for Freon-12 and 15 pounds for Freon-22.

Chillroom Refrigeration Installation

Assembly. Install the chillroom equipment in the following order: Hang the cooling coils 3 inches below the ceiling with hooks furnished with the coils. Make sure the freezer door does not hit the coils. Make a heat exchanger by soldering together 8 feet of 14-foot lengths of 3/8-inch and 1/4-inch tubing. (Note: The working drawings call for a minimum of 4 feet. Later study has shown that 8 feet gives best results.) Leave 3 feet unsoldered at each end. Seal the ends so dirt will not get in during handling. Shove the heat exchanger through the wall duct, as shown in sheet 4 of the working drawings.

As shown in figure 12, connect the suction line through an elbow to the cooling coil end at the front of the room and the liquid line through a liquid indicator (optional) and expansion valve to the other end of the

coils. Include a 6-inch length of 1/4-inch tubing with a flare nut on each end just ahead of the liquid indicator. This will be replaced by a drier-strainer after dehydration. If a capillary tube is used instead of an expansion valve, connect the suction line to the coil in the same way. Be sure to insert the line through the capillary coil before soldering the ell in place. Solder a 3-inch length of 1/4-inch tubing to the short extension of the capillary tube and a 3-inch length of 1/2-inch tubing to the other. See figure 12A for the method of attaching capillary tubing to larger tubing. Put a flare nut on each short length. Attach the 1/2-inch flare nut to the cooling coil and the 1/4-inch flare nut to liquid indicator (optional). Place a 6-inch length of tubing just ahead of the liquid indicator, as described for the installation of an expansion valve.

Connect the suction line to a 6-inch-diameter loop as shown in sheet 2 of the working drawings. If sponge-rubber tubing is used in place of tape, pull it over the liquid and suction lines to the wall. Connect the liquid line to the condenser. Put a tee in this line for a pressure gage. Disconnect the receiver if a capillary tube is used. If the fusible safety plug is located in the disconnected receiver, install a high-pressure cutout.

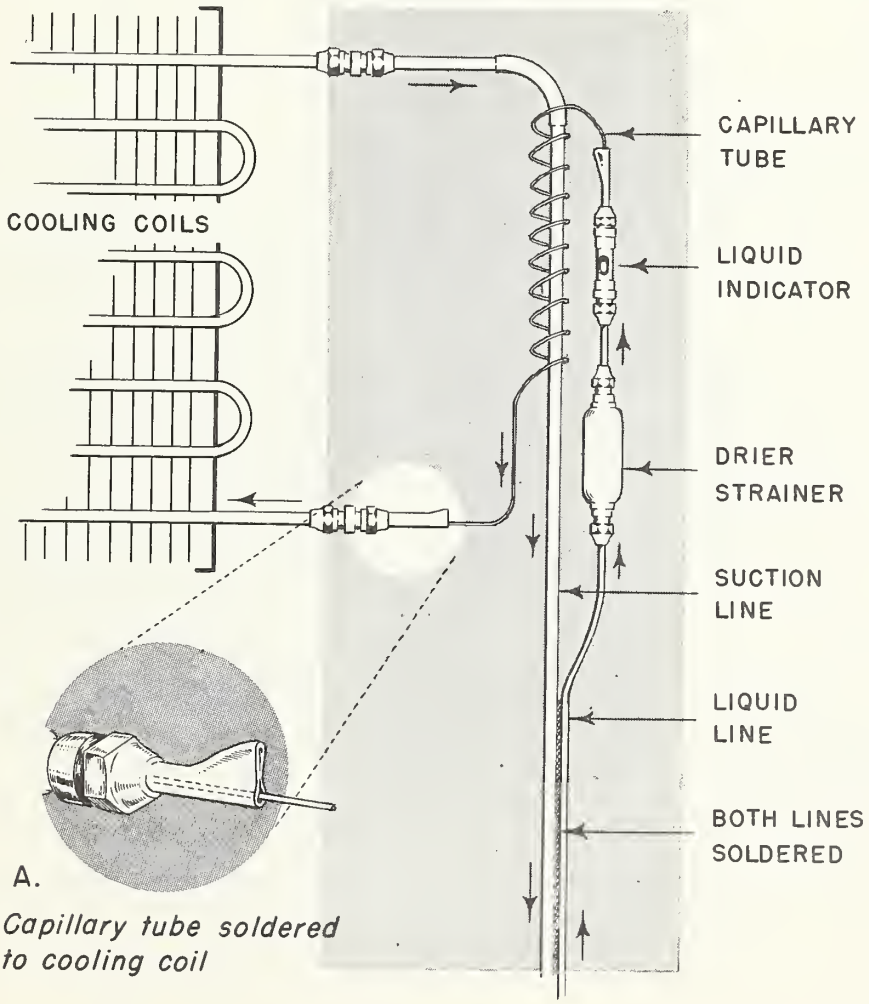

Figure 12.--Detail of connections to cooling coils in chillroom.

Leak Testing and Dehydrating. Test the chillroom system for leaks by building pressure in both the high- and low-pressure sides, listening and using a leak detector at the joints as was done with the freezer. Dehydrate the unit as was done with the freezer. Build up about 2 pounds pressure in the high and low sides and replace the 6-inch length of tubing with a drier-strainer. Open all valves on the condensing unit and start the unit operating. Connect a Freon drum to the compressor suction valve and slowly charge the system with 2 pounds Freon gas. Keep the suction pressure below 30 pounds during this charging operation. Let the system operate an hour then leave it off overnight. The next day examine around all joints carefully for oil which indicates a leak. Wrap cork tape around the tubing outside the room. Force calking compound around the tubing and wires in the warmer end of the duct.

Charging the System. If possible, a two-pound charge of Freon-12 should be weighed into the chillroom unit. In case scales are not available, charge the system until the suction line is about 65° F. when the evaporator pressure is 10 pounds or when the unit turns off. If the system has a receiver and expansion valve, charge with 4 pounds of Freon-12.

Controls. Fasten the thermostat 5 feet from the floor on the inside of the chillroom-door frame. Uncoil the capillary power element and clamp the feeler bulb to the first bend of the chiller coil as shown on sheet 4 of the working drawings. If a high-pressure cutout is used, set it at 190 pounds cutout pressure. Set the thermostat at a maximum differential and with a cutout temperature of 37° F. Install the drip baffle and connect to a drain leading out of the room.

Switchboard

Nail a 2-foot x 2-foot panel of 3/8-inch plywood on the wall studs out of the reach of children and beside the refrigerator equipment. Fasten the switch boxes and switches on as shown on sheet 2 of the working drawings. Connect a 220-volt circuit to one box for the freezer unit. This box should contain 2 fuses, one for each side of the circuit. Connect 110-volt circuits to the other two boxes. Wire the chillroom unit to one box and the room lights to the other. Ground the fuse boxes with No. 14 wire or larger. Connect the chillroom thermostat and freezer pressure-control in one conductor of each pair leading to the condensing units. Install toggle-type bypass switches in parallel with these automatic controls as shown in figure 13. Wire the switches so that, when they are turned "off", the automatic controls operate the units. When they are "on", the automatic controls will be bypassed and the units will run continuously.

Figure 14 shows one installation of the bypass switches. It is advisable, however, to install the thermostat in the chillroom rather than on the outside panel.

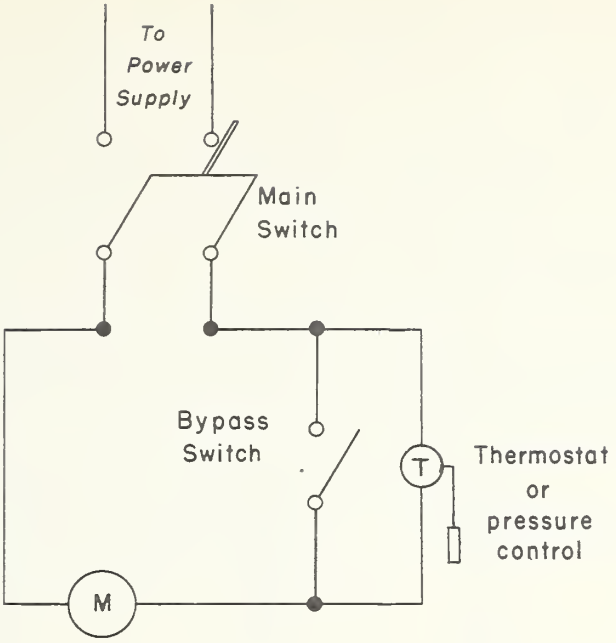

Figure 13.--Bypass wiring diagram.

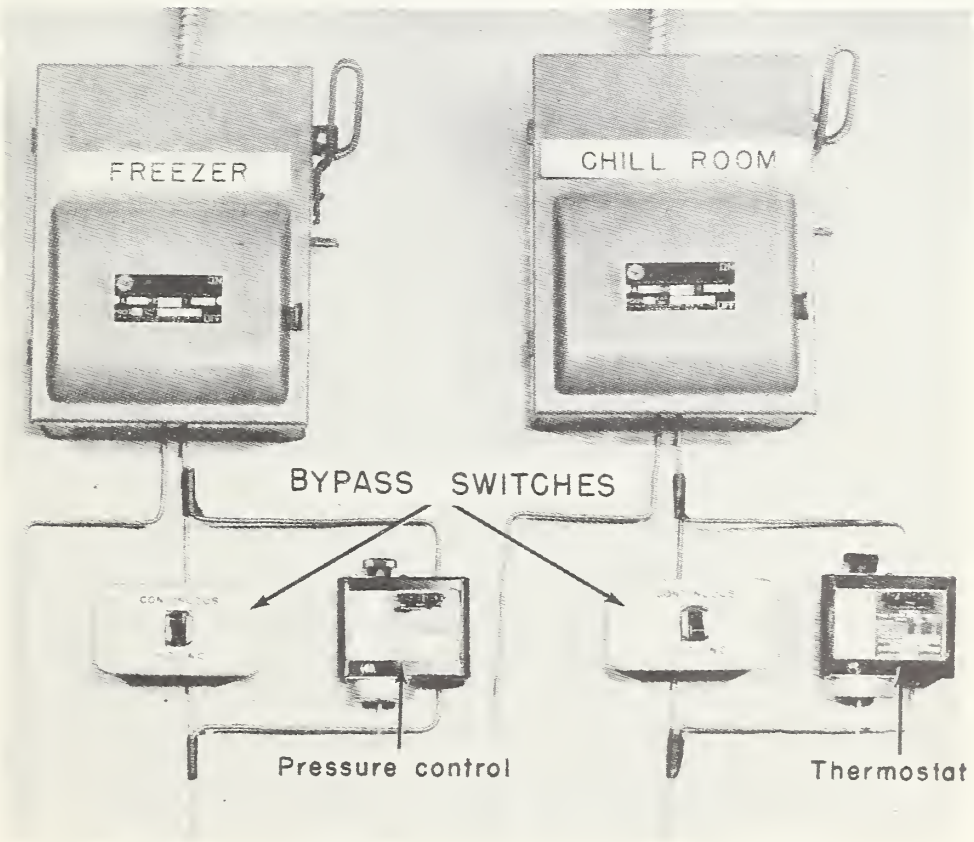

Figure 14.--Bypass switch installation.

Initial Check

In order to find the operating conditions, fasten thermometers onto the chillroom and freezer walls about 5 feet above the floor. Turn the completed units on and let them operate overnight on the automatic controls. The freezer thermometer should then read between 5° and 7° F. The chillroom thermometer should read 35° to 40° F. Check the Freon-12 head pressures with the values in table 1.

Table 1.--Approximate head pressures of Freon-12 air-cooled units at various condenser temperatures and suction pressures

Suction pressure (pounds)	Head pressure at condenser temperature of--			
	60° F.	70° F.	80° F.	90° F.
	Lb.	Lb.	Lb.	Lb.
3.....	87	94	112	132
10.....	101	113	127	143
20.....	119	132	145	161

If the pressure is too high, turn the unit off and let it cool for 15 minutes. Purge slowly by loosening flare nut of the compressor discharge line. Repeat until the head pressure is normal. Observe the suction lines for "sweating-back" at the time the units go off. Cold suction lines of capillary tube systems may be warmed in the following manner: Let the unit operate until it shuts off. Turn it on again with the continuous operation switch. Let out refrigerant vapor slowly through the suction valve until the suction line becomes warm. Cold suction lines of expansion valve systems may be warmed by soldering the liquid and suction lines together outside the room or increasing the superheat of the valve. Caution: Confine the refrigerant in the receiver and loosen flare nuts on both the liquid line and suction line before soldering the lines together.

Use of Refrigerator

The entire unit may be used as a chillroom by turning off the freezer and leaving the freezer door open. The entire walk-in may be used as a freezer by turning the chillroom unit on continuous operation and leaving the freezer door open. Leave the freezer on normal setting. Under these conditions, ice will accumulate on the chillroom coils. Defrost them when they become covered to a depth of 1 inch. If allowed to accumulate further, the load on the supporting screws may become too great. In case of freezer failure, the chillroom unit may be relied on to prevent thawing until the freezer is repaired. Set the chillroom unit on continuous operation and leave the freezer door open.

If a load greater than 100 pounds is to be frozen, run the freezer continuously overnight before placing the load in the freezer. This will

lower the temperature of the stored food so there will be less danger of thawing while the load is being frozen. Distribute foods to be frozen evenly on shelves. Restrict loads to 100 pounds per day when freezing on consecutive days.

Annual Checkup

Proper maintenance is relatively simple and inexpensive. An annual checkup will result in lasting and efficient operation. Neglect or delay will result in sticking doors, expensive repairs, and short life. Make the checkup in the late spring or early summer. Remove frozen food from the freezer and protect from thawing by wrapping with blankets or other insulating material. Turn both units off and defrost. Place absorbent material, such as turkish towels, on the floor of the freezer to soak up the defrost water. Leave both chillroom and freezer doors open. Set a fan in the chillroom doorway so that it will blow into the freezer. Remove the defrost water from the floor.

Check the refrigerator in the following manner:

1. Examine the top for holes in the vapor-barrier paper. Patch any found. Pay particular attention to the corners to see that they have not pulled apart. Pour asphalt paint in any opening and fill with seam filler.

2. Examine the floor around the refrigerator for moisture. Take steps, if necessary, to prevent storm water from standing around the base.

3. Make sure doors fit snugly and evenly against the door frames. The door may be made to close more tightly by adjusting the catch on the door frame. Replace hard, torn, or worn gaskets.

4. Grease all moving parts of the catch and hinges with petroleum jelly. Take care to keep it off the gasket.

5. Repaint door frames and the wall below the sills with boiled linseed oil. Paint the electrical conductors, meat rails, and tubing conductors in the chillroom. If the inside of the drip baffle shows signs of rusting, paint it with a rubber-base paint.

6. Calk any holes that may have developed around the tubing and wiring in the ducts through the walls.

7. Clean the inside of the fuse boxes with a whisk broom or vacuum cleaner brush. Replenish the spare-fuse supply.

8. Clean the refrigeration units with a clean cloth. Clean the finned coils with a vacuum cleaner. Find the cause of any unusual rattling and correct it. Make sure copper tubing does not rub or vibrate against other objects; such rubbing or vibration will wear holes in the tubing.

Bill of Material for Walk-in Refrigerator

This list is prepared for estimating purposes. If used for the purchase of construction materials, the quantities should be verified by the builder. Reasonable allowances have been made for waste in items where this is a factor.

The door models listed are of the type necessary for the construction. It is impracticable to provide a complete list of manufacturers of doors of this type. The partial listing is furnished for your information, with the understanding that no discrimination is intended, and no guarantee of reliability is implied.

Description of Item	Unit	Quantity	Unit Cost	Cost of Item
BUILDING MATERIALS (All framing No. 1 common lumber)				
Outside walls				
Plates 4 pcs. 2" x 4" x 12'	bd. ft.	32		
4 pcs. 2" x 4" x 10'	bd. ft.	27		
Studdings and joists 37 pcs. 2" x 4" x 8'	bd. ft.	197		
Exterior plywood 12 pcs. 48" x 96" x 3/8"	sq. ft.	384		
OR				
T & G lumber 36 pcs. 1" x 6" x 8'	bd. ft.	144		
54 pcs. 1" x 6" x 10'	bd. ft.	270		
Inside walls and shelves				
Plates 4 pcs. 2" x 4" x 8'	bd. ft.	22		
4 pcs. 2" x 4" x 10'	bd. ft.	27		
Studding (to be cut to 7 feet) 14 pcs. 2" x 4" x 14'	bd. ft.	131		
Nailing strips for ceiling 6 pcs. 1" x 2" x 10'	bd. ft.	10		
Exterior plywood or equal 13 pcs. 48" x 96" x 3/8"	sq. ft.	416		
Framing (partition and doors) 9 pcs. 2" x 6" x 8'	bd. ft.	72		
Doors (with frames)				
Cooler door	each	1		
Jamison high sill 2' x 6', 4" GC (Jamison Cold Storage Company Hagerstown, Maryland)				
OR				
Butcher Boy high sill cooler door CF-5 2' x 6', 4" loose fill (Butcher Boy Cold Storage Door Co. 170 N. Sangamon Street Chicago 7, Illinois)				

Bill of Material for Walk-in Refrigerator

Description of Item	Unit	Quantity	Unit Cost	Cost of Item
Doors (continued) OR Birkenwald raised wood-sill cooler door 1-2060 4, 2' x 6', 4" loose fill (S. Birkenwald Co. 310 N.W. Fifth Avenue Portland 9, Oregon				
Freezer door (metal clad)	each	1		
Jamison high sill low-temperature door 2' x 6', 6" BF OR				
Butcher Boy high-sill sharp-freezer door 2' x 6', 6" BF OR				
Birkenwald raised wood-sill freezer door F-2060 6, 2' x 6', 6" loose fill				
Insulation				
Floor - Rigid type - 2" thickness	sq. ft.	164		
Walls and Ceiling				
Rigid type - 2" thickness OR	sq. ft.	1200 (includes floor)		
Fill type 40-lb sacks	sack	45		
*Common screen wire 100 ft. roll, 4 feet wide	roll	1		
*To be used on inner studding and rafters to retain fill-type insulation if used.				
Concrete				
Refrigerator floor (ready mixed)	cu. yd.	1		
OR				
Material for concrete				
Portland cement	sack	7		
Sharp sand	cu. yd.	.52		
Crushed stone	cu. yd.	.78		
Plastic sheet 18" x 18"	each	8		
Vapor-barrier paper 3' wide 100' long	roll	3		
Asphalt paint, odorless (sole plates and inside walls)	gal.	5		
Seam filler	gal.	5		
Rubber-base paint (for interior)	qt.	1		
Calking compound	lb. or pt.	2-1/2 or 1		
Linseed oil (interior walls)	gal.	1		
Spar varnish (doors)	gal.	1		
Wire mesh (floor concrete) #6 wire 4" x 4" mesh, 4' wide	ft.	18		

Bill of Material for Walk-in Refrigerator

Description of Item	Unit	Quantity	Unit Cost	Cost of Item
Nails				
16d common	lb.	10		
12d common	lb.	5		
6d common galvanized (for interior)	lb.	5		
Roofing 1/2"	lb.	1/2		
Tacks (for screen wire)	lb.	1/2		
Anchor bolts 3/8" x 5" (washers and nuts)	each	32		
Meat rails - 1 or 2 optional				
Pipe, galvanized 1½" diameter, ends threaded, length cut to fit room	ft.	each approx. 5'6"		
Floor-support fittings and screws	each	2 or 4		
Sheet metal (drip baffle)				
20-gage galvanized 3' x 6'6"	each	1		
Copper flashing 12" width	lb.	14		
Condensing-unit stand				
Angle-iron 1-1/4" x 1-1/4" x 1/8"	ft.	32		
Bolts (washers, nuts)				
Stove bolts 1/4" x 1"	each	24		
Wall ducts				
1/Car radiator hose 1-1/2"-diameter, 18" long	each	1		
Outer wall				
Hose 6" long (cut from 1/)				
Clamps	each	2		
Pipe nipples	each	2		
Locking nuts	each	3		
Partition-wall heat-exchanger cover				
Hose 7" long (cut from 1/)				
2/Garden hose 1/2"-diameter 12" long	each	1		
Wall and partition wiring				
Hose 6" each (cut from 2/)				
Clamps	each	4		
Pipe nipples	each	4		
Locking nuts	each	6		

Bill of Material for Walk-in Refrigerator

Description of Item	Unit	Quantity	Unit Cost	Cost of Item
REFRIGERATION EQUIPMENT				
Condensing unit				
Freezer - 220-volt 1/2-h.p. low temperature	each	1		
Chillroom - 110-volt 1/4-h.p. medium temperature	each	1		
Thermostatic expansion valve				
Freezer 1-ton, 10-lb limit, 1/4" liquid, 1/2" suction	each	1		
*Chillroom 1/2-ton, 25-30 lb. limit, 1/4" liquid, 1/2" suction	each	1		
Capillary tube				
*Chillroom 1/4-h.p., commercial, 1/4" liquid, 1/2" suction	each	1		
*If a capillary tube is used in place of the expansion valve in the chillroom system the condensing-unit receiver should be disconnected and a 2-pound charge of Freon 12 used.				
Finned coil (chillroom)				
Approximately 3" x 28" x 63" finned length-	each	1		
Freezing plates 22" x 30"	each	10		
Drier-strainer approximately 12 cu.in. with 1/4" SAE fittings	each	2		
Heat exchanger (for freezer) approximately 3500 BTU capacity at 0° F with 3/8" and 5/8" sweat fittings	each	1		
Liquid indicators (optional) with 1/4" SAE fittings	each	2		
Temperature control for chillroom range approximately 0° to 55° F	each	1		
Pressure control with high-pressure cutout for freezer, range approximately 12" to 50 lb.	each	1		
Solder tees 1/4" for pressure cutout	each	2		
Solder elbows (3/8" tubing)	each	3		
Solder elbows (1/2" tubing)	each	30		
Solder tees (1/2" tubing)	each	2		
Reducing elbow (chillroom coil) 1/2" to 3/8" male SAE	each	1		
Reducing bushings (heat exchanger) 5/8" to 1/2"	each	2		
Flare nuts 1/4" SAE	each	14		
Flare nuts 3/8" SAE	each	2		
Flare nuts 1/2" SAE	each	6		

Bill of Material for Walk-in Refrigerator

Description of Item	Unit	Quantity	Unit Cost	Cost of Item
Union 1/2" SAE flare	each	1		
Half-union 1/4" SAE flare to 1/8" male pipe thread for pressure control on freezer	each	1		
Half-union 3/8" SAE flare to 1/2" male pipe thread for drip baffle	each	1		
Copper refrigerator tubing				
1/4" for liquid lines	ft.	50		
3/8" for chillroom suction line	ft.	50		
1/2" for freezer suction line	ft.	50		
Freon-F12	lb.	12		
Silver solder 1/8" x .050" x 20"	pc.	20		
Flux (silver solder)	oz.	4		
Wire solder (chillroom heat exchanger)	lb.	1		
Permagum (calking around tubing)	lb.	2-1/2		
Cork insulating tape 2" x 1/8" (freezer heat exchanger and suction lines)	roll	2		
OR				
Sponge-rubber tubing 1/2" inside diameter	ft.	9		
Wall thermometer	each	2		
Pressure gage (Optional)	each	1		
Compound gage (Optional)	each	1		
ELECTRICAL EQUIPMENT				
Combination toggle switch and light	each	1		
Utility box, 2-3/4" wide (combination toggle switch and light and control-by-passing switches)	each	3		
Raceway - metal molding	ft.	20		
Supporting clips for metal molding	each	6		
Adjustable internal elbows - for metal molding	each	3		
Corner box - for metal molding	each	3		
Keyless receptacle - for metal molding	each	2		
Toggle switches (for bypassing controls)	each	2		
Plates (for toggle switches)	each	2		
Switch box for 1/2-h.p. 220-volt motor 2 pole, 2 fuse	each	1		
Switch box for 1/4-h.p. 110-volt motor and lights, 1 pole, 1 fuse	each	2		
Fuse (delayed action) 6-1/4 amp.	each	6		
Wire - Copper #14 RW or TW	ft.	50		
Connectors	each	6		
Light bulb 100W	each	2		

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