DOMESTIC PRODUCT MANUAL

GENERAL ELECTRIC
REFRIGERATING
MACHINES

GENERAL ELECTRIC COMPANY
ELECTRIC REFRIGERATION DEPARTMENT
NELA PARK
CLEVELAND, OHIO

DOMESTIC PRODUCT MANUAL

GENERAL ELECTRIC REFRIGERATING MACHINES

SECTION I

MODEL HT-47, HX-47
HT-70 and HX-70
REFRIGERATORS

GENERAL ELECTRIC COMPANY
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INTRODUCTION

Every General Electric Refrigeration Product is built as perfectly as possible, after which it is very carefully tested and inspected before it is shipped from the factory.

This manual is written to assist Product men in the installation and adjustment of domestic refrigeration equipment.

The proper functioning of all machinery depends ultimately on the human element. The following pages and your own experience will testify to this simple fact.

NOTE: This section is the first of several sections that will comprise the General Electric Domestic Refrigerator Product Manual. These sections will give in detail product information on General Electric domestic refrigeration equipment.

Section I, together with the subsequent sections which will be published from time to time, should be kept together in a suitable three-hole binder.

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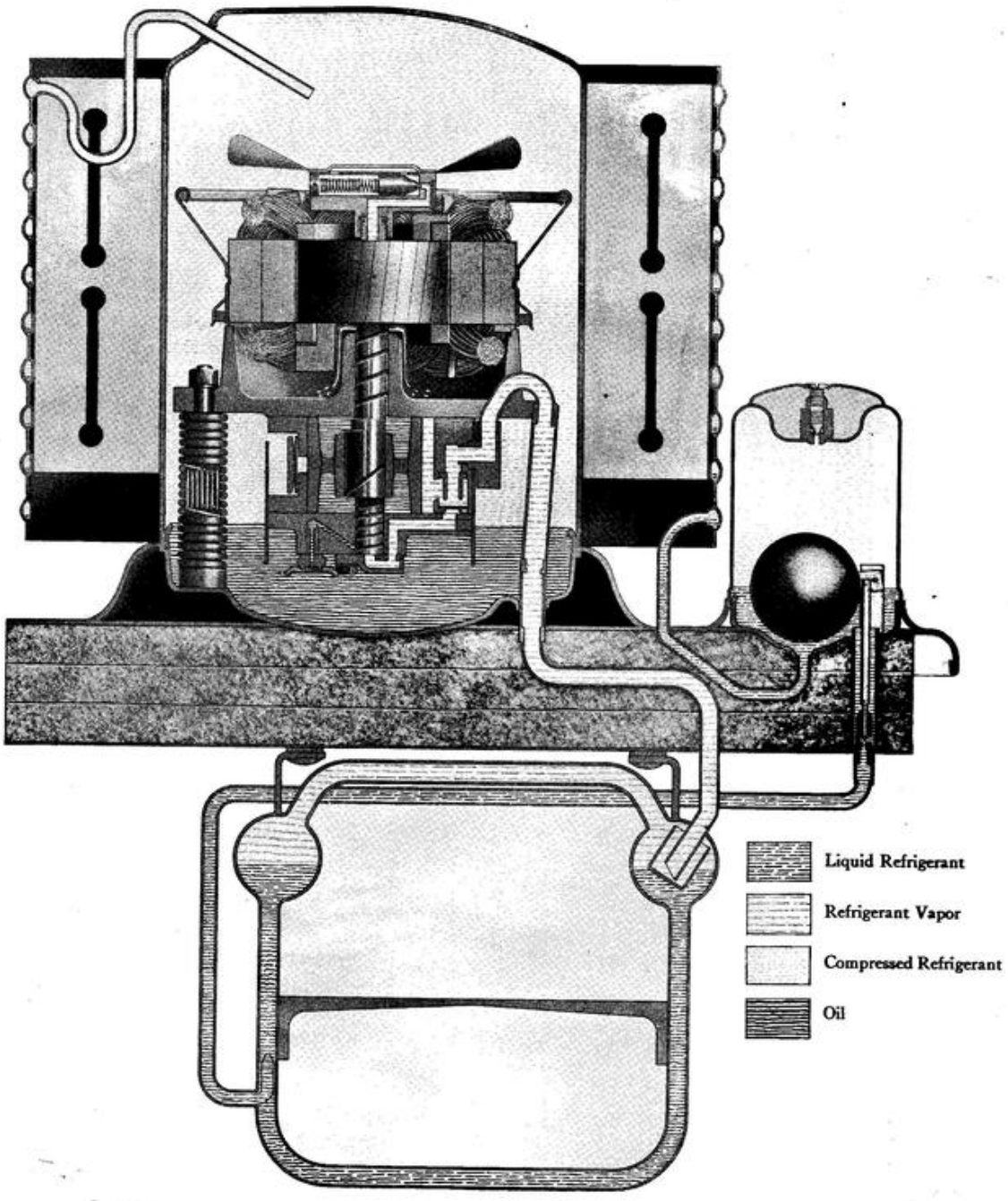
Chart Showing Operation of CA-2 Refrigerating Machine



General Electric Refrigerators

Models HT-47, HX-47, HT-70 and HX-70

DESCRIPTION

Refrigerating Machine (Models CA-1A and CA-2A)

This refrigerating machine is of Monitor Top design and construction. It is hermetically sealed. It is designed for efficient, quiet and trouble-free performance, and constructed for long life. A Glyptal-baked enamel, developed by the General Electric laboratories, offers a finish of unusual gloss and permanence.

Refrigerant

The refrigerant is methyl formate developed for this use by the General Electric laboratories. It is a low pressure refrigerant with a boiling point of 88° F. at atmospheric pressure.

Compressor

The compressor is located on the high pressure side of the system. It is of the oscillating type, developed especially to handle this new refrigerant. The movable element, the oscillator, is actuated by an eccentric on the vertical shaft. It oscillates rather than rotates, being keyed to the cylinder by a sliding blade. The compressor is spring mounted within the steel case and is carefully balanced so that no vibration is transmitted to the exterior. Oil under pressure lubricates every moving part.

Motor

The motor is mounted directly above the compressor on the vertical shaft. It operates as a resistance split-phase induction motor during starting and as a single-phase induction motor during normal running. The proper resistance is incorporated in the starting winding so that an external resistor is not needed.

Starting Relay

The starting relay used to make and break the starting winding circuit is located on the left-rear corner of the cabinet top. It is simple in construction and practically noiseless in operation.

Condenser

The condenser is of smooth construction made possible by the use of a low pressure refrigerant and new General Electric developments in the control of automatic electric line welding equipment.

Float Valve

A float valve, similar in construction to that used on previous General Electric refrigerating machines, is located on the high pressure side of the system.

Chilling Unit

The chilling unit is made of stainless steel. The CA-2A model has an aluminum freezing shelf. The surfaces are smooth, easy to clean and sanitary. The chilling unit is constructed to incorporate forced circulation of the refrigerant, thus assuring the highest cooling efficiency.

Control

The control is located on the front of the machine; easily accessible and readily replaceable if the occasion should demand. It is completely sealed. Included in the control are a manual switch for turning the machine on or off, an adjustable automatic mechanism for regulating the chilling unit and cabinet air temperatures, a device for protecting the motor from abnormal load or power conditions, and a semi-automatic arrangement for defrosting the chilling unit.

Cabinet

A. Model HT-47—Porcelain enamel paneled exterior.
Model HX-47—Glyptal-baked enamel exterior.

These cabinets are of all-steel construction with one-piece acid-resistant porcelain enamel interiors. New semi-concealed hinges and simple fingertip handle latches further enhance the appearance of the cabinets. Textolite door strips introduced by General Electric and proved for insulating quality and long life are used.

B. Model HT-70—Porcelain enamel paneled exterior.
Model HX-70—Glyptal-baked enamel exterior.

These cabinets are of all-steel construction with one-piece acid-resistant porcelain enamel interiors. New semi-concealed hinges and simple fingertip handle latches further enhance the appearance of the cabinets. Textolite door strips introduced by General Electric and proved for insulating quality and long life are used. Sliding shelves with the new feature of adjustable shelf spacing are introduced. The foot pedal door opener is an added convenience. Automatic lighting of the cabinet interiors occurs as soon as the cabinet doors are opened.

Accessories

A. For HT-47, HX-47 and HX-70 Refrigerators.

These models are completely equipped with enameled vegetable pan, glass chiller tray and aluminum ice freezing pans with the General Electric tapered dividers for faster freezing and easier removing of ice cubes. A unit cord with a special locking connector which prevents accidental pulling off, yet is easily detachable with a slight turning motion, is included.

B. For HT-70 Refrigerator.

This model is completely equipped with covered glass food containers, enameled vegetable pan, wire fruit basket, glass chiller tray, aluminum ice freezing pans with the General Electric tapered dividers for faster freezing and easier removing of ice cubes, and a rubber ice tray. A special cord with suitable connectors for the unit and cabinet is included. The connector to the unit is of new locking construction, preventing accidental pulling off, yet easily detachable with a slight turning motion.

Guarantee

These refrigerators carry a standard one-year warranty and a four-year replacement contract on the sealed mechanism.

Cycle of Operation

When the manual switch of the control is turned to the "on" position, an electric circuit is completed to the running winding of the motor. The current flowing is of such a value that as it passes through a coil in the starting relay in series with the running winding, an armature is raised and a pair of contacts are closed, putting the starting winding in parallel with the running winding. The motor starts immediately. As soon as it comes up to speed, the current decreases, and the armature drops, breaking the starting winding circuit. The motor continues to run as a single-phase induction motor.

The compressor is mounted directly below the motor on the vertical shaft. The cylinder is circular in form and is concentric with the center of the shaft. The oscillator of the compressor is cylindrical in form and is mounted on the eccentric of the shaft. The oscillator is keyed to the cylinder so that it oscillates but does not rotate, following around the cylinder wall as the shaft rotates.

On the suction side of the oscillator, gas refrigerant of low density is drawn into the compressor from the chilling unit. This gas is compressed and then expelled through the discharge valve. After passing through an acoustic muffler, it is discharged into the compressor case.

Gas refrigerant from the compressor case passes through the condenser where it is cooled and liquefied. The liquid refrigerant is collected in the float valve and returned to the chilling unit. It is introduced through specially designed nozzles near the bottom of the chilling unit so that forced circulation of the liquid refrigerant is secured.

The liquid refrigerant in the chilling unit evaporates because of the reduced pressure caused by the suction from the compressor. In so evaporating, heat is absorbed through the chilling unit walls from the air in contact with them and from water contained in the ice trays within the chilling unit. Thus refrigeration is obtained.

Unloading

In order to keep the load on the motor during the starting period as low as possible, it is desirable that the pressure of the refrigerant on the suction and discharge sides of the compressor be the same. The process of equalizing this pressure is known as unloading.

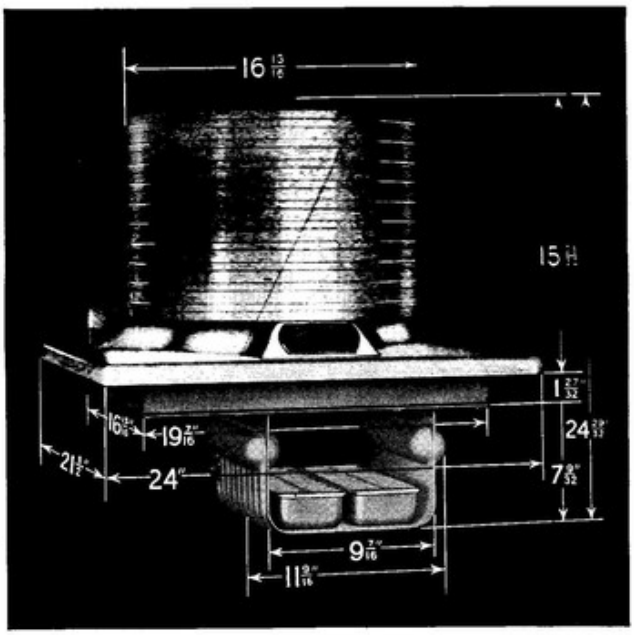
Although the pressure within the compressor should be equalized, it is imperative that the higher pressure and warmer gas refrigerant does not leak back into the chilling unit to warm the liquid refrigerant there and thus lose part of the refrigeration obtained during the operating period of the machine. The chilling unit is sealed off from the compressor by means of a check valve at the time of unloading.

The unloader valve on this model consists of a plunger in a housing mounted on top of the shaft. The centrifugal force on the plunger during normal running operation is such that it overcomes the tension of a spring; the plunger flies out and closes an opening in the housing, which is subject to the pressure of the gas refrigerant in the compressor case. When the electric circuit to the motor is opened, the motor slows down. As it does so, the centrifugal force on the plunger is reduced until the spring draws the plunger back, thus opening the hole in the housing.

When the unloader plunger opens, high pressure gas refrigerant flows through passages in the housing, down a hole drilled through the center of the shaft, through another hole in the bottom plate, and up into the check valve chamber in the cylinder wall. The pressure lifts and holds a small disc check valve against the check valve seat. Some of the gas refrigerant passes into the suction side of the compressor and thus accomplishes the unloading.

Since the unloading takes place early in the slowing up period, there is no vibration of the machine during stopping. Furthermore, the machine can be started again immediately after it is stopped.

Product Data on CA-1A Refrigerating Machines



CA-1A SPECIFICATIONS

Motor

Voltage	110
Cycles	60
Speed, R.P.M. (Full Load)	1755
Amperes (100° F. room, 20° F. brine)	2.35
Watts (100° F. room, 20° F. brine)	160
Starting current, amperes (Locked Rotor)	13.5
Horsepower	1/8

Compressor

Displacement, cu. in.	3.0
Head pressure, lbs. per sq. in. gauge (100° F. room, 20° F. brine)	17
Suction pressure, inches of mercury vacuum (100° F. room, 20° F. brine)	25

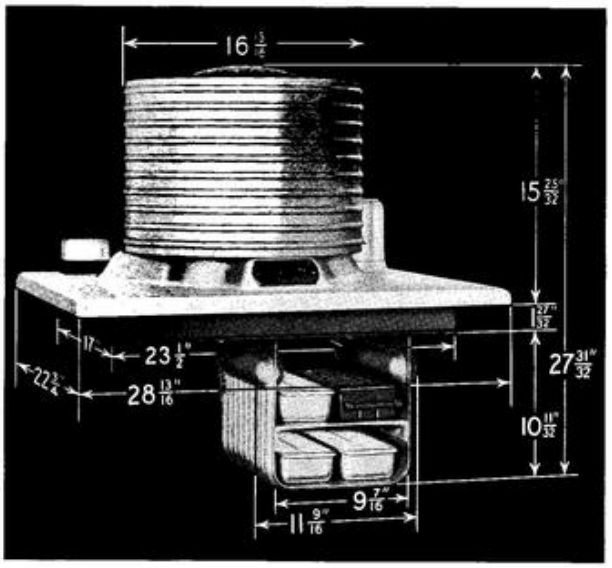
Machine

Capacity, B.t.u./hr. (100° F. room, 20° F. brine)	430
Equivalent ice melting, lbs. per 24 hours	72
Temperature range of chilling unit (80° F. room performance, thermometer on bottom of chilling unit):	
Temperature knob in position 1, °F. (warmest)	19–28
Temperature knob in position 5, °F. (normal)	10–20
Temperature knob in position 9, °F. (coldest)	2–13
Total number of ice cubes	42
Total weight of ice cubes, lbs.	4.5
Weight of methyl formate, lbs.	2.15
Volume of methyl formate, cc	975
Weight of machine, crated, lbs.	162
Weight of machine, uncrated, lbs.	130

CA-1A REPLACEMENT PARTS

Control (110-volt, 60-cycle A.C.)	58X25
Control (110-volt, 50-cycle A.C.)	58X58
Connecting cord	58X26
Escutcheon plate for control	NP-57756
Screw for attaching escutcheon plate	58X60
Float valve cap	58X138
Sealing plug and screw for 58X138	58X139
Locking connector for starting relay or control	58X15
Oil conditioner	11X100
Rubber plug to cover oil conditioner hole	58X35
Starting relay (110-volt, 60-cycle A.C.)	58X14
Starting relay (110-volt, 50-cycle A.C.)	58X59
Sealing screw for starting relay cover	58X206
Single hole bellows tube clamp (stainless steel)	58X33
Screw for 58X33 (stainless steel)	58X34
Two-hole bellows tube clamp (stainless steel)	58X46
Screw for 58X46 (stainless steel—2 required)	58X47
Nut for 58X47 screw	58X99

Product Data on CA-2A Refrigerating Machines



CA-2A SPECIFICATIONS

Motor

Voltage	110
Cycles	60
Speed, R.P.M. (Full Load)	1755
Amperes (100° F. room, 20° F. brine)	2.40
Watts (100° F. room, 20° F. brine)	175
Starting current, amperes (Locked Rotor)	13.5
Horsepower	1/8

Compressor

Displacement, cu. in.	3.0
Head pressure, lbs. per sq. in. gauge (100° F. room, 20° F. brine)	18
Suction pressure, inches of mercury vacuum (100° F. room, 20° F. brine)	25

Machine

Capacity, B.t.u./hr. (100° F. room, 20° F. brine)	470
Equivalent ice melting, lbs. per 24 hours	78
Temperature range of chilling unit (80° F. room performance, thermometer on bottom of chilling unit):	
Temperature knob in position 1, °F. (warmest)	19–27
Temperature knob in position 5, °F. (normal)	13.5–22
Temperature knob in position 9, °F. (coldest)	8.5–17
Total number of ice cubes	84
Total weight of ice cubes, lbs.	9
Weight of methyl formate, lbs.	2.75
Volume of methyl formate, cc	1250
Weight of machine, crated, lbs.	188
Weight of machine, uncrated, lbs.	143

CA-2A REPLACEMENT PARTS

Control (110-volt, 60-cycle A.C.)	58X25
Control (110-volt, 50-cycle A.C.)	58X58
Connecting cord	58X12
Escutcheon plate for control	NP-57756
Screw for attaching escutcheon plate	58X60
Float valve cap	58X138
Sealing plug and screw for 58X138	58X139
Locking connector for starting relay or control	58X15
Oil conditioner	11X100
Rubber plug to cover oil conditioner hole	58X35
Starting relay (110-volt, 60-cycle A.C.)	58X14
Starting relay (110-volt, 50-cycle A.C.)	58X59
Sealing screw for starting relay cover	58X206
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Screw for 58X46 (stainless steel—2 required)	58X47
Nut for 58X47 screw	58X99

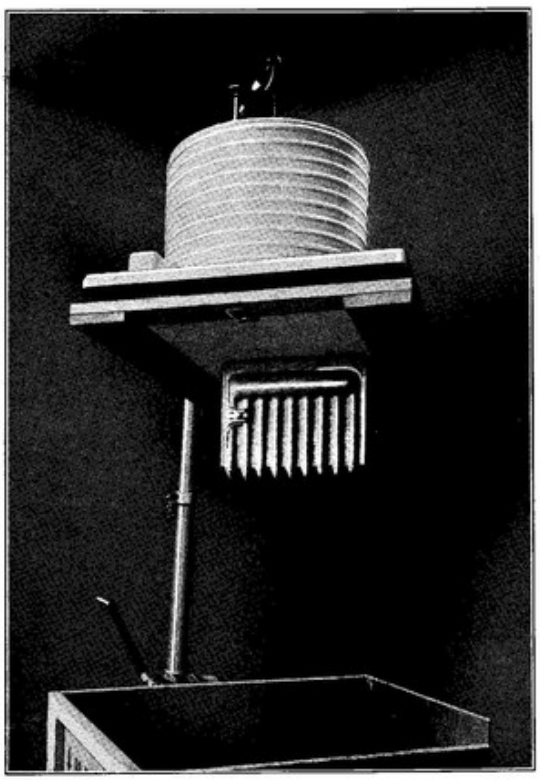
Uncrating, Inspection and Installation

Machine

Uncrating

Remove the cover of the shipping crate. Lift the machine from the crate.

Note: If collapsible lifter Cat. 11X384 is used, special long lifting hooks Cat. 58X32 must be substituted for the hooks originally supplied with the lifter.



Removing Unit from Crate.

The wooden rack comes out of the crate along with the machine, to protect the finish on the edges of the cabinet top as it is being removed. The rack is fastened to the bottom plate by two clips under two of the screw heads holding the bottom plate to the box top. See the above illustration.

To remove the rack, loosen the screws and turn the clips back under the rack. Be sure to tighten the screws again.

Note: Whenever one of these machines is shipped, the wooden rack must be properly assembled to it before placing it in the shipping crate.

Inspection

At the time the machine is uncrated, examine it carefully for possible damage during shipment. If damage is found, examine the crate and, as nearly as possible, ascertain the reason for the damage.

Also, inspect the machine as follows:

1. Make sure the finish is all right.
2. Make sure that the rubber plug properly seals the oil conditioner hole.

Cabinet

Uncrating

A reasonable amount of care should be used in removing cabinet from the crate. An examination of the crate will generally indicate the best method to use. Most of our crates are easily removable by pulling the nails in the rear of the crate. The cabinet will then slide out, after which the packing collars are removed.

Inspection

Examine the cabinet for the following points:

A. Fit and operation of the shelves.
B. Chips or mars on interior or exterior finish.
C. Operation of foot pedal door opener.
D. Operation of light.
E. Condition of seal around box top opening.
F. The two wood strips which protect the sponge rubber gasket from the shelves on some models during shipment are removed.

Installation

When the machine is being installed in a cabinet, care must be taken not to damage the liquid tube from the float valve to the chilling unit or any of the other pipes.

Before lowering the machine into the cabinet, examine the No-Ox-Id cloth around the box top opening of the cabinet. If it is loose at any point, iron the No-Ox-Id cloth down with a piece of wood.

After the machine is lowered into the cabinet, check the seal of *both* cabinet top gaskets. The seal of the outer (or upper) gasket is most important and must be made tight. If necessary, trim the gasket on the liner. The outer seal is required to prevent condensation of moisture between the cabinet walls.

The cabinet should be installed reasonably level and should set firmly on all four legs on the rubber gliders. It should not be set against the wall or against anything else.

In order to insure sufficient air circulation to the condenser, at least one side of the machine must be left exposed for the whole width of the cabinet. At least six inches of unrestricted space should be left above the machine top.

The control temperature knob should be set at position 5 for normal service.

Use and Care of the Refrigerator

The General Electric refrigerator is designed to satisfy all normal refrigeration requirements with a minimum amount of attention on the part of the user. A few instructions on the use and care of the refrigerator will assist the user in obtaining the most satisfactory service from it.

Cleaning the Interior

Directly after installation and previous to the time the machine is started, it is recommended that the user carefully clean the interior of the cabinet, the chilling unit, ice trays, chiller tray, and food containers.

For cleaning the interior of the cabinet and the chilling unit, a solution of baking soda in warm water should be used. A satisfactory solution can be made up of one tablespoonful of baking soda in four quarts of water.

Caution: Never clean the interior of the cabinet or the chilling unit with any cleaning agent which has an odor.

Caution: When washing the chiller tray, do not use hot water. Hot water may cause breakage.

It is suggested that the interior of the cabinet and the chilling unit be cleaned each time the chilling unit is defrosted.

Cleaning the Exterior

Ivory soap and warm water or General Electric Glyptal Cabinet Cleaner should be used in cleaning the Monitor Top and the exterior of the cabinet.

Caution: The use of any of the standard cleaning compounds which depend upon abrasive or alkaline action will remove the gloss from the finish on the Monitor Top or HX type cabinets.

Starting the Refrigerator

To start the refrigerator after it is installed, turn the left knob on the control on the front of the machine to the "on" position. The machine should start immediately.

If the machine does not start, make sure that the electrical cord is properly attached. Also, make sure that the house fuse on the circuit into which the refrigerator is plugged is all right.

During the first few hours after being started, the machine may be slightly noisy but as soon as it is within the normal operating condition, it will continue to operate quietly.

Cabinet Temperature

When the refrigerator is installed, the temperature knob at the right side of the control should be set at position 5. The control is set at the factory to automatically maintain a cabinet air temperature of between 38° F. and 42° F. in room temperatures between 70° F. and 80° F.

If the room temperature averages below 70° F., the cabinet air temperature may be slightly below 38° F. If this is too cold, the temperature knob can be turned counterclockwise to position 4 or 3, or even to 2 or 1.

If the room temperature averages above 80° F., the cabinet air temperature may be slightly above 42° F. If this seems too warm, the temperature knob can be turned clockwise to positions 6, 7, 8, or 9.

The temperature setting is made adjustable in order to satisfy the individual desires of the user. If it is desired to make the cabinet air temperature colder, the temperature knob can be turned clockwise; if warmer, the knob can be turned counterclockwise.

The use of a thermometer in the cabinet is not recommended unless it be of high quality. The user will find that the refrigerator is maintaining proper temperatures if the food is preserved satisfactorily and is cold enough for the individual taste.

Distribution of Food in the Cabinet

The coldest zone in the refrigerator is within the chilling unit where the temperature is below freezing. The next warmer zone is in the chiller tray where the temperature may be just below or just above freezing. The warmest zone is in the cabinet where the temperature should range between 38° F. and 45° F.

Air circulation is necessary to insure uniform temperature distribution within the cabinet. Therefore, do not restrict the circulation by excessive crowding of food into the cabinet or by placing coverings over the shelves.

The circulation of cold air in the cabinet is from the chilling unit, around the chiller tray, down the right side of the cabinet and up the left side. It is evident that foods with odors, which are not covered, should be placed on the left side of the cabinet near the top in order not to affect other foods.

For most satisfactory results, it is recommended that the following foods be kept in covered containers:

1. Those with strong or objectionable odors such as cantaloupes and onions.
2. Those which absorb odors readily such as butter.
3. Liquids such as milk or cream.
4. Moist foods such as mashed potatoes or creamed vegetables.
5. Fresh vegetables such as lettuce and celery. (Should be kept in the vegetable pan.)

Freezing Ice Cubes

To secure the most rapid freezing of ice cubes, be sure that the ice trays make good contact with the chilling unit freezing surfaces. A quarter cup of warm water spread evenly over the freezing surface will serve to level any unevenness in the frost covering the surface.

The ice freezing rate can be further improved by turning the temperature knob at the right of the control to position 9, the coldest setting. When the ice is frozen, the temperature knob must be returned to the normal position. Otherwise, the cabinet air temperature may be reduced to a point where freezing of food will result.

To remove an aluminum ice tray when frozen, use the tray lifter, or loosen with an upward push directed against the upper rim of the tray. Do not use an ice pick or other sharp instrument. The rubber ice tray can be loosened by lifting on the handle.

To remove ice cubes from an aluminum tray with a minimum loss of ice, allow cold water from the faucet to run on the bottom of the tray until the cubes fall out. An alternate method is to immerse the ice tray in a pan of cold water. Ice cubes are removed from the rubber tray by flexing the tray.

Defrosting

Frost will collect on the chilling unit at a rate depending on the humidity of the air entering the cabinet at times when the door is opened and on the amount of uncovered liquid or moist foods in the cabinet. It is recommended that the chilling unit be defrosted at a time when this accumulation is approximately one-half inch thick or when the accumulation interferes with the removal of ice trays. It is suggested that defrosting take place at least once a month at which time the interior of the cabinet and the chilling unit should be cleaned.

To defrost the refrigerator, the switch on the left side of the control should be turned counterclockwise to the position marked "defrost." The machine will automatically proceed to operate on a defrosting cycle, allowing the frost on the chilling unit to melt off into the chiller tray, yet not allowing the cabinet air temperature to rise more than a few degrees. When the defrosting is completed, the temperature knob should be returned to the "on" position.

The ice trays, and food stored in the chiller tray should be removed previous to defrosting. The water in the chiller tray after the defrosting is completed should be immediately emptied.

Caution: Do not use pans of hot water in the chilling unit to hasten the defrosting. If the machine is running at the time the hot water is put in, the hot water will cause it to continue to run until the water is frozen before it shuts off and allows the chilling unit to defrost.

Resetting the Motor Protective Device

A device is incorporated in the control to protect the motor in the machine in case of unusual load or power conditions. When this device operates, the motor is shut off and a red signal appears in the window on the front of the control.

To restart the machine, the switch on the left side of the control must be turned first to the "off" position and then to the "on" position. If the protective device trips immediately and will not remain set, wait a few minutes and try it again.

Changing the Spacing of the Cabinet Shelves

The new sliding shelves supplied with the HT-70 and HX-70 refrigerators can be inverted so that the shelf spacing can be altered to suit the convenience of the user.

Interchangeability

CA-1 and CA-2 units may be used on certain of the all-steel line of cabinets as follows:

I. CA-1 Units on S-44 Cabinets

Remove the $\frac{5}{8}$" x $\frac{11}{16}$" sponge rubber gasket and replace with special gasket $\frac{5}{8}$" x $1\frac{1}{8}$", replace the top shelf with special offset shelf and secure the regular CA-1 freezing trays, chiller tray, and the special connecting cord for CA-1A units. These parts are contained in Cat. No. A1R16 set of accessories used with this combination.

II. CA-2 Units on S-67 Cabinets

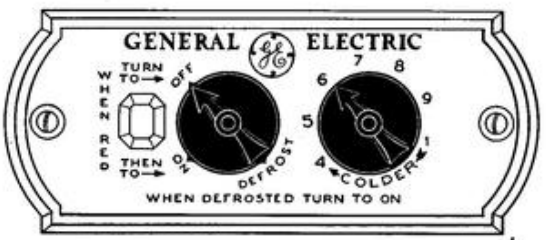
This combination requires only a special connecting cord and chiller tray which will be found in Cat. No. A1R13 accessories which will be shipped when this combination is ordered.

ADJUSTMENTS

Description of Control, and Instructions for Replacing

Control

The control is completely sealed. There are no internal adjustments that can be made. Directions for operating the control are engraved on the escutcheon plate covering the control. Further explanation of these directions and the details of what happens within the control follow.



Front View of Control and Escutcheon Plate.

The control, located in the front center of the cabinet top, contains the manual switch for turning the machine on or off, the adjustable automatic mechanism for regulating the chilling unit and cabinet temperatures, the motor protective device, and the semi-automatic defrosting device.

Left Knob

The left knob on the control serves as a manual switch to turn the machine on or off, to reset the motor protective device, and to defrost the chilling unit.

To Turn the Machine On or Off Manually

The machine is turned off when the knob points toward the upper left-hand position. The machine is turned on when the knob points to the lower left-hand position.

When the knob is turned to the "off" position, a cam on the knob moves an extension of the arm on which the movable main contact is mounted so that the contact is opened. When the knob is turned to the "on" position, the cam releases the same arm so that the contacts may be open or closed depending on the toggle switch location which is controlled by the thermostatic bellows.

To Reset the Motor Protective Device

In case of unusual load or power conditions on the motor which cause it to draw excessive current, a protective device trips the machine off. When this protective device operates, a red signal appears in the window on the front of the control. To turn the machine on again, the manual on and off switch must be turned first to the "off" and then to the "on" position.

This motor protective device is located in series with the main contacts in the common lead to the motor. All of the current to the motor passes through a small heater coil which is wound around a stationary, vertical shaft. On the lower end of the shaft is a ratchet wheel. A film of solder holds the ratchet wheel stationary on the shaft. When excessive current passes through the heating coil, the solder is melted and the ratchet wheel turns, releasing a dog. The dog springs out and strikes the extension of the arm on which is mounted the movable main contact, opening this contact as though the external manual knob were turned to the "off" position.

To reset the device and start the machine, the external knob must first be turned to the "off" position. This movement resets the dog on the ratchet wheel. The knob is then turned to the "on" position and the main contacts are closed.

To Defrost the Chilling Unit

Defrosting of the chilling unit is obtained by turning the knob to the lower right-hand position. Another cam on the knob releases a spring which acts in parallel with the main temperature spring against the bellows arm. The temperature range on the CA-2A chilling unit is changed from 13.5° – 22° F. to 13.5° – 46° F. It is evident that defrosting will take place since the chilling unit now operates on a defrosting cycle. After defrosting, the knob should be turned to the "on" position.

Right Knob

The right knob on the control allows adjustment of the temperature range of the chilling unit and the cabinet air to satisfy the desires of the user. The movement of the knob changes the compression of the main temperature spring acting against the bellows arm.

The normal setting of the temperature knob is at position 5. The chilling unit temperature range, as measured in the bottom of the chilling unit, is approximately 13.5° – 22° F. for CA-2A units and 10° – 20° F. for CA-1A units. The cabinet air temperature in a room varying between 70° F. and 80° F. with a normal amount of food in the cabinet will be in the vicinity of 38° F. to 42° F.

Directions for Removing and Installing a Control

To Remove the Control

1. Loosen the clamp holding the bellows tube to the left side of the chilling unit at the rear.
2. Remove and straighten the bellows tube.
3. Remove the two screws on the front of the control holding it to the cabinet top.
4. Pull the control directly forward, guiding the bellows tube through the rubber bushing in the bottom plate.
   The rubber bushing may cling to the bellows tube and pull up through the cabinet top. It should be replaced.

5. As soon as the control body is out of the cabinet top, the locking connector to the back of the control should be removed with a slight turning motion.

Caution: The locking connector to the back of the control is similar to that on the connecting cord to the relay. It cannot be removed by straight pulling. It must be turned slightly.

6. The control can now be completely removed.

To Install a Control

1. Insert the end of the control tube through the control opening in the cabinet top, push it through the box top insulation and start it through the rubber bushing in the bottom plate.
2. Guide the control tube through the rubber bushing.
3. Connect the locking connector to the prongs on the back of the control before the control enters the opening in the cabinet top.
4. Push the control into place and attach it with the two screws in the front.
5. Bend the control tube into place and clamp it to the chilling unit.

Caution: The control tube should not touch the chilling unit header. If it does, the temperature limits may vary somewhat from the proper ones.

6. The temperature knob should be set at position 5 if normal operating limits under normal operating conditions are desired.

Description of Starting Relay, and Instructions for Replacing

Starting Relay

The starting relay, located on the left-rear corner of the cabinet top, contains a coil in series with the running winding which, when the machine is started, lifts an armature and closes a pair of electrical contacts. Closing these contacts puts the starting winding of the motor in parallel with the running winding. The motor then starts. As soon as the motor is up to speed, the current in the running winding circuit drops to such a value that the armature drops and breaks the starting winding circuit. The motor continues to run single phase with current in the running winding only.

The lifting of the armature during starting is caused by the repelling force between the coil and the armature itself which forms a single short-circuited turn circuit above the coil. The armature is held steady in the upper position by the small steel bars under the short-circuited turn which tend to stay in the magnetic field between the pole pieces. When the current through the coil decreases to a predetermined value, the armature drops suddenly, giving the desired snap action to the electrical contacts.

Directions for Removing and Installing a Starting Relay

Caution: Do not disturb or adjust the starting armature.

The armature of the starting relay is carefully constructed and tested at the factory in order that its tension be just right to insure proper starting of the machine. Consequently, the starting relay is sealed and must not be opened unless absolutely necessary.

If it is found necessary to open a starting relay as a last resort before replacing a machine, great care must be used.

Never interchange any motor leads. The starting winding will burn in a short time if left continuously in the circuit.

In some instances, the color of the leads to the relay may not be easily distinguishable. If such is the case, mark them carefully when changing a starting relay.

To Remove the Relay

1. Remove the locking connector from the back of the relay, using a slight turning motion.

Caution: The connector locks itself to the prongs on the back of the relay. It cannot be removed by straight pulling. It must be turned slightly.

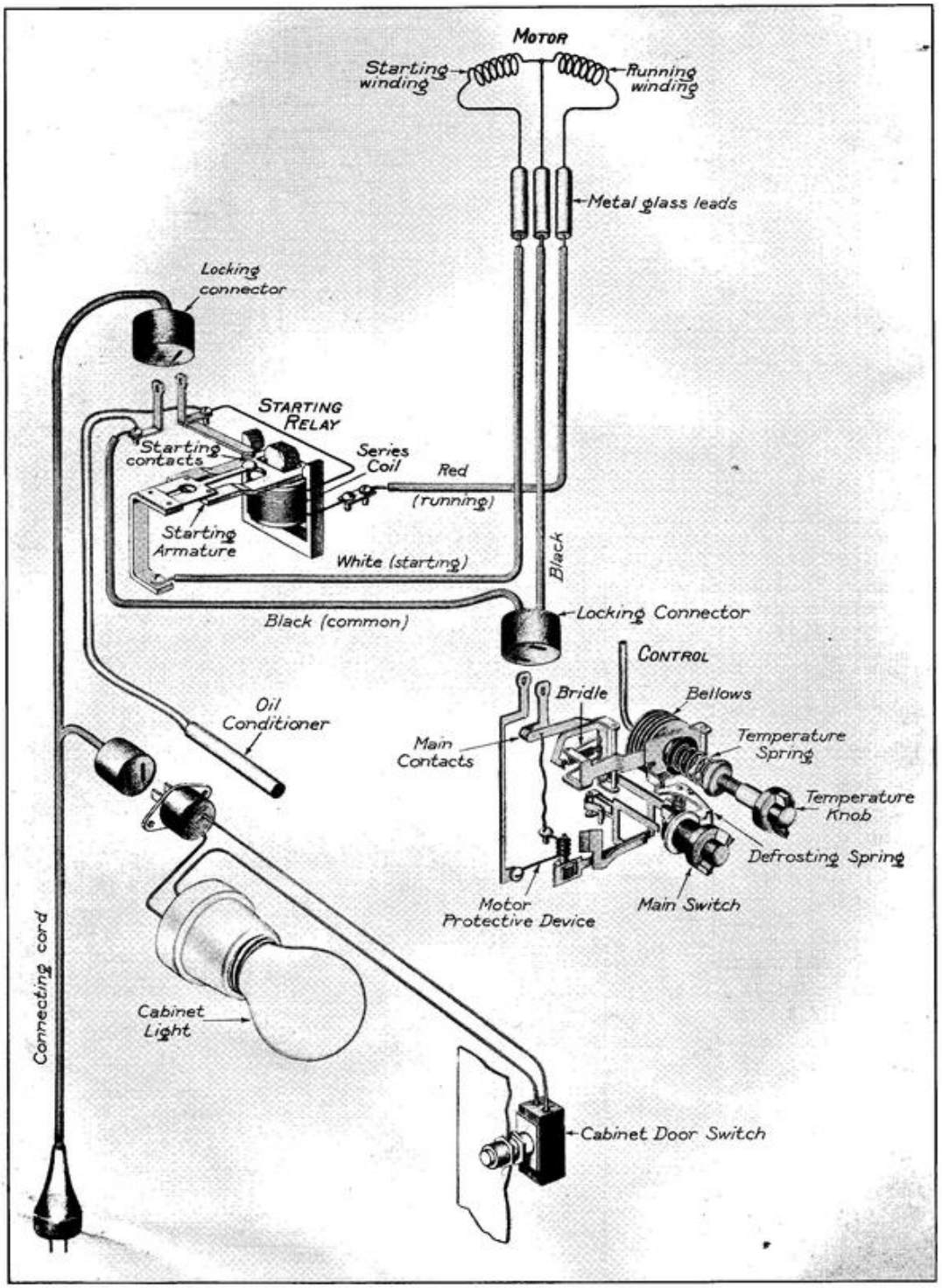
2. Break the seal on the back of the relay and remove the cover.
3. Disconnect the various motor and oil conditioner leads.
4. Remove the two screws holding the relay to the cabinet top.
5. Be sure to save the small washers when used under the corners of the relay and use them when the relay is replaced. These washers raise the corners of the relay and prevent warpage of the bakelite base.

To Install a Relay

1. Remove the cover from the relay.
2. Attach the relay to the cabinet top with the two screws.
3. Be sure to place the small fiber washers under the corners of the relay in order to prevent possible warpage of the bakelite base.
4. Connect the various motor and oil conditioner leads to the proper terminals as indicated in the wiring diagram of the relay on page 14. Be careful not to interchange the motor leads with the oil conditioner leads. The oil conditioner leads have metal terminals on them.

Caution: Make sure that the terminal on one of the oil conditioner leads does not touch the upright post which supports the relay armature. Should it touch, a serious short circuit would result.

5. Check the operation of the relay by connecting the cord and starting the machine.
6. Put on the relay cover and seal it.



Wiring Diagram of CA-2A Unit and HT-70 or HX-70 Cabinet. (Same for CA-1A Unit except for Cabinet Light and Plug.)

Machine Adjustments

I. Machine Does Not Run Properly

Symptoms

The refrigerating machine may have one or more of the following symptoms:

1. Stalled (will not start or run at all).
2. Starts and runs only with both windings in the circuit.
3. Burned motor.
4. Will not restart after shutting off.
5. Motor protective device trips off.
6. Runs all the time (does not shut off).

Adjustments

The source of trouble may be external to the machine or it may be in the machine itself. It is recommended that the external factors be checked first. These include such things as the location of the machine, the current and voltage to the machine, and the electrical circuit to the machine. In testing the machine, it is suggested that the parts be checked in the following order: control, starting relay, oil conditioner and finally the machine itself.

1. Stalled (Will not start or run at all)

If the machine will not start or run at all, the possible causes are:

A. Improper current or voltage.
B. Restricted air circulation to condenser.
C. Open circuit.
D. Grounded circuit.
E. Short circuit.
F. Non-condensable gas.
G. Stalled compressor.
H. Excessive load on compressor.

A. Improper Current or Voltage

The machine is designed for operation on 60-cycle alternating current. It will also operate satisfactorily on 50-cycle alternating current with control Cat. No. 58X58 and starting relay Cat. No. 58X59.

The machine will not operate on 25 or 40-cycle alternating current, or on direct current.

While the rated voltage on the machine is 110 volts, it will operate satisfactorily on any voltage between 100 and 135.

When the voltage at the machine at the time of starting is less than 100 volts and the machine is operating under heavy load conditions, it may not start and the motor protective device will trip off.

When the voltage is above 135 and the machine is operating under heavy load conditions, the current to the motor may be sufficient to trip the motor protective device.

B. Restricted Air Circulation to Condenser

If the circulation of air is restricted from the condenser, the head pressure may rise to such a point that the machine may trip off or the compressor may stall.

It is recommended that at least one side of the machine be left exposed. The space above the machine top should be at least six inches. If a machine is enclosed more than this amount, it may be necessary to provide forced air circulation in order to obtain satisfactory operation.

C. Open Circuit

a. Circuit to the refrigerator.

Check the electrical circuit to the refrigerating machine by placing a series test lamp across the terminals of the connecting cord connector and noting that it lights, or by observing that the house watt-hour-meter moves when the machine is connected to the circuit although turned off and all other appliances or lights are turned off, indicating a circuit through the oil conditioner. For CA-2A machines it is possible to observe whether the light in the cabinet comes on when the door is opened. If the cabinet light does not come on and the bulb tests all right in a socket on another electrical circuit, there is an open circuit in the supply line. If an open circuit is found, check the cord connections to the machine and to the wall receptacle, making sure that good electrical contact is obtained. Also, check the supply line fuses.

Check both of the locking connectors, the one on the connecting cord which attaches to the relay and the one which attaches to the control, for possible poor contact or open circuit.

One of the wires may have become disconnected in the connector.

The spring contacts in some connectors may not make contact, having lost their spring tension when the wires were soldered.

The small brass screws which hold the fiber disc over the end of the connector may project out far enough to prevent the prongs on the relay from making contact with the spring contacts in the connector. Make sure that the wires in the connector are properly located in the grooves so that they do not interfere with the seating of the disc.

b. Control.

If the circuit to the refrigerator is all right, remove the control as described on page 12. Replace it with a new control. If the machine starts and runs, it is evident that the original control may have had an open circuit.

Caution: Before replacing a control, make sure that the machine is not in the "off" cycle. The bellows tube can be warmed by holding the hand over it on the chilling unit.

A control can be tested for open circuit by placing a test lamp in series with the control in an electric circuit and observing whether the lamp lights when the main switch is turned to the "on" position. If the lamp does not light, there is an open circuit in the control.

An open circuit in a control may be caused by a weak bellows, open lead or connection, burned contacts, or defective toggle device. Since the control is sealed, it must be replaced as a whole. Part replacements cannot be made.

c. Starting relay.

Caution: Do not disturb or adjust the starting armature. The armature of the starting relay is carefully constructed and tested at the factory in order that its tension be just right to insure proper starting of the machine. Consequently, the starting relay is sealed and must not be opened unless absolutely necessary.

If it is found necessary to open a starting relay as a last resort before replacing a machine, great care must be used.

Never interchange any motor leads. The starting winding will burn in a short time if left continuously in the circuit.

In some instances, the color of the leads to the relay may not be easily distinguishable. If such is the case, mark them carefully when changing a starting relay.

If the circuit to the refrigerator and the control proves to be all right but still the machine does not start, the starting relay may be opened and inspected.

Check the electrical connections to the relay, making sure that all are tight and that the proper lead or leads come to each terminal. Refer to the electrical circuit diagram on page 14.

Raise the armature carefully, using a piece of insulating material such as wood or cardboard. The armature should operate freely.

Caution: When raised, the armature is at line voltage so should not be handled. If a person's body is grounded, a serious shock might result.

If the starting contacts do not spark when the armature is raised and lowered, there is an open circuit to the starting winding.

Note: The main switch of the control should be in the "on" position when this test and succeeding tests on the starting relay are made.

Disconnect the red (running) lead in the relay and see if it sparks when touched to its terminal. If it does not, there is an open circuit to the running winding. The open circuit may be in the series coil in the relay, in the running or common lead to the motor, or in the motor.

To test the series coil in the relay, short circuit it with a short piece of insulated wire between the terminal to which the single oil conditioner lead is connected and the terminal to which the red lead is connected. Again see if the red lead sparks when touched to its terminal. If it does but did not before the series coil was short circuited, there is an open circuit in the series coil. The relay must be replaced. Refer to page 13 for instructions for removing and replacing the relay.

If there is evidence of open circuits to both the starting and running windings, check the common lead circuit by disconnecting both the white (starting) and red (running) leads in the relay, placing a test lamp in series with them in an electrical circuit and observing if the lamp lights. If it does, the open circuit is in the common lead. If it does not, the open circuit may be in any two or all of the leads or in the motor.

d. Machine.

If, from the tests conducted on the starting relay, it is proved that there is an open circuit in the common, running or starting circuits or in the motor which cannot be repaired, the machine must be replaced.

D. Grounded Circuit

All electrical circuits and connections are insulated from the refrigerating machine itself. If one of the electrical circuits or connections should come in direct contact with a part of the refrigerating machine, it is considered grounded.

A ground in the circuit to the refrigerator, in the control, starting relay, oil conditioner, or machine may cause blowing of the house fuses, tripping off of the motor protective device, welding of the contacts or burning off of a lead.

A series test lamp will be found necessary to locate the ground.

Caution: The machine itself must not be grounded either through the cabinet or test rack while testing for a grounded circuit; otherwise, the line to the refrigerator may be short circuited to ground.

If the machine can not be conveniently insulated from ground, a series test lamp must be used in each lead from line to the machine.

a. Circuit to the refrigerator.

A ground in the circuit to the refrigerator will cause blowing of the house fuses after the refrigerator is disconnected from the circuit.

Make sure that the ground is not in the cord connector or plug. Look for evidence of arcing. Also, watch for indications of moisture and dirt.

b. Control, starting relay, oil conditioner and machine.

The control, starting relay, oil conditioner and machine can be tested as a group. Then, if a ground is found, each can be tested separately.

Refer to the above *"Caution."*

Plug one terminal of the cord connector onto one prong in the back of the starting relay. Put one terminal of the test lamp into the other terminal of the connector. With the knob of the control in the "on" position, touch the other terminal of the lamp to the other prong in the back of the relay. The lamp should light, indicating a circuit through the motor.

Then touch this second terminal of the lamp to some unpainted part of the machine such as the screw on the top of the float valve or one of the screws holding the nameplate to the cabinet top. If the lamp lights, there is a ground, in which case proceed to locate it.

c. Control.

Replace the control with a new one. If the machine starts and runs satisfactorily, there may have been a ground in the original control.

Caution: If the ground is in the starting relay, oil conditioner or machine, the motor protective device may trip off, the main contacts may weld or a lead may be burned off in the new control.

A ground in the control can be verified by plugging first one prong of the control and then the other into a terminal of the cord connector which ordinarily is attached to the starting relay. Put a test lamp in series between the other terminal of the cord connector and the bellows tube. If the lamp lights, there is a ground in the control.

Caution: The control or bellows tube must not be grounded while testing for a grounded circuit; otherwise, the line to the refrigerator may be short circuited to ground.

d. Starting relay.

Caution: Do not open the starting relay unless absolutely necessary. Refer to the "Caution" under "Starting relay" on page 13.

If the grounded circuit is apparently in the starting relay, oil conditioner or machine, it is permissible to open the starting relay and inspect it.

Make a visual inspection of all of the leads and connections. Watch for evidence of arcing.

Remove the two screws holding the relay to the cabinet top and lift the relay as far as the leads allow. Check to see that the leads do not chafe each other or the cabinet top. Look to see that there is no evidence of arcing between the screw heads under the relay and the cabinet top. Also, watch for indications of moisture and dirt under the relay.

If a grounded spot is found, eliminate it by taping or otherwise insulating it.

When replacing the relay, carefully follow the directions on page 13.

e. Oil conditioner.

Refer to the *"Caution"* under D on page 16.

Disconnect both oil conditioner leads in the starting relay. Put one lead into a terminal of the cord connector. Put one terminal of the test lamp in the other terminal of the cord connector. Touch the other terminal of the lamp to the second oil conditioner lead. The lamp should light, indicating a circuit through the oil conditioner.

Then touch the second terminal of the lamp to some unpainted part of the machine such as the screw on the top of the float valve or one of the screws holding the nameplate to the cabinet top. If the lamp lights, the oil conditioner is grounded and should be replaced.

f. Machine.

Refer to the *"Caution"* under D on page 16.

Disconnect the red and white leads in the relay. Attach the red lead to a terminal of the cord connector. Put one terminal of the test lamp in the other connector terminal. Touch the other terminal of the lamp to the white lead. The lamp should light, indicating a circuit through the motor.

Then touch the second terminal of the lamp to some unpainted part of the machine such as the screw on top of the float valve or one of the screws holding the nameplate to the cabinet top. If the lamp lights, the machine is grounded and should be replaced.

E. Short Circuit

All electrical circuits and connections are insulated from each other. If two of these circuits or connections should come in contact with each other, a short circuit results.

A short circuit in the circuit to the refrigerator or in the oil conditioner may cause blowing of the house fuses. A short circuit in the relay may cause blowing of the house fuses, tripping of the motor protective device, welding or burning of the starting contacts, or burning off of a lead. A short circuit in the control may cause the machine to run all the time. A short circuit in the machine may cause blowing of the house fuses, tripping off of the motor protective device, welding or burning of the main or starting contacts, or burning off of a lead.

a. Circuit to the refrigerator.

A short circuit in the circuit to the refrigerator will cause blowing of the house fuses after the refrigerator is disconnected.

Make sure that the short circuit is not in the cord connector or plug. Look for evidence of arcing; also, indications of moisture or dirt.

b. Control.

The machine will continue to run even when the main switch is turned to the "off" position if there is a short circuit in the control. Replace the control.

c. Starting relay.

Caution: Do not open the starting relay unless absolutely necessary. Refer to the "Caution" under "Starting relay" on page 13.

If the short circuit seems to be in the starting relay, oil conditioner or machine, it is permissible to open the starting relay and inspect it.

Make a visual inspection of all of the leads and connections, noting that the leads are properly connected and not touching. Look for evidence of arcing.

Observe particularly the terminals on the oil conditioner leads, making sure that the one attached to the terminal with the black (common) motor lead does not touch the upright post supporting the starting armature. Should this happen, there would be a short circuit as soon as the starting contacts close.

Check the other oil conditioner terminal to see that it does not touch the red motor lead or its terminal. If it does, the series coil will be left out of the circuit, the machine will not start and the motor protective device will trip off.

Remove the two screws holding the relay to the cabinet top and lift the relay as far as the leads allow. Check to see that the leads do not chafe each other or the cabinet top. Look for evidence of arcing. Inspect the under side of the relay. Watch for indications of moisture and dirt.

If a short-circuited spot is found, eliminate it by taping or otherwise insulating it.

When replacing the relay, carefully follow the directions on page 13.

d. Oil conditioner.

Disconnect one of the oil conditioner leads in the starting relay and put a series lamp in the circuit between the disconnected lead and its terminal. Turn the main switch to the "off" position. If the oil conditioner is short circuited, the lamp will burn with normal brilliancy. If the oil conditioner is all right, the lamp will glow at reduced brilliancy.

e. Machine.

If there is still a short circuit present after the preceding tests have been completed, it must be in the machine. In this case, the machine should be replaced.

F. Non-condensable Gas

The collection of non-condensable gas in the float valve may increase the head pressure sufficiently to cause the motor protective device to trip off or the compressor to stall. The temperature of the float valve and lower condenser turns is relatively cool to that of the upper condenser turns, and feels cooler to the hand.

Do not purge. The case pressure may be less than atmospheric pressure.

G. Stalled Compressor

The compressor may be stuck with corrosion, dirt or mechanical failure of a part. Jarring of the machine may free the compressor if the cause is of minor extent.

Apply 220 volts A.C. *momentarily* to the machine. The compressor may be broken loose with this treatment and then continue to run satisfactorily on normal voltage. Auto-transformer, 220-110 volts, Cat. No. 9AC26A, used backwards, is recommended for obtaining the higher voltage if 220 volt A.C. power is not available.

H. Excessive Load on Compressor

The compressor may stall because of an excessive load on it, particularly during the initial pull-down after the refrigerator is installed or after being shut off for a time. At such times, the evaporator temperature is high and a considerable amount of liquid refrigerant may be in the lubricating oil; both conditions tending to increase the compressor load.

It is recommended that the machine be shut off at the control main switch for a few minutes. The connector cord should be left attached to the relay and the house electrical outlet so that the oil conditioner will be in the circuit. The liquid refrigerant in the base will be boiled out of the lubricating oil.

It may be necessary to restart the machine more than once if it continues to trip off while pulling down. After it has reached normal operating temperatures it will continue to run all right.

2. Starts and Runs Only with Both Windings in the Circuit

The machine may start and run with both windings in the circuit until the motor protective device trips off. This condition is usually brought about by a defective electrical circuit or something that nearly stalls the compressor. With the exception of an open circuit, the possible causes are similar to those for a stalled machine:

A. Improper current or voltage.
B. Restricted air circulation to condenser.
C. Grounded circuit.
D. Short circuit.
E. Non-condensable gas.
F. Hard running compressor.
G. Excessive load on compressor.

Refer to the corresponding sections under "Stalled (will not start or run at all)" for the procedure for locating and taking care of the trouble.

3. Burned Motor

A burned motor will be indicated by a discoloration of the machine case top. If a machine with a burned motor is found, every effort should be made to determine the cause of burning and this information should be included on the report.

4. Will Not Restart After Shutting Off

The machine will not restart for a period of time after shutting off in a cycle or being shut off manually. The period of time may vary from a few seconds to several minutes. If this time is longer than the "off" cycle, the motor protective device will trip off when the machine tries to start. If the time is less than the "off" cycle, the motor protective device does not trip off and the refrigeration is not impaired, then the condition is not serious and does not need attention.

There are two possible sources of trouble when a machine will not restart after shutting off:

A. Unloader stuck shut.
B. Improper motor air gap.

A. Unloader Stuck Shut

If the unloader plunger is stuck shut, the machine will not unload, or restart again after shutting off. The motor protective device may trip off when the machine tries to start. The action of the unloader can be heard when the machine stops if it is operating properly.

Start and stop the machine a number of times in rapid succession. Jarring the machine might also loosen the plunger.

B. Improper Motor Air Gap

It is possible that the machine will not restart after shutting off, yet the unloader operates all right. This condition usually occurs only when the machine is operating in high temperature rooms, with heavy food or ice freezing loads, or with low voltage on the power supply. The motor protective device may trip off. The trouble may not occur under lighter loads or with higher voltage. The condition responsible for this is an improper motor air gap.

Check the machine by running it continuously under heavy load conditions by putting pans of hot water in the chilling unit and partly blanketing the

condenser. Observe whether the machine restarts immediately after shutting off and unloading properly.

Caution: Do not put a heater in the chilling unit.

Jarring of the machine may shift the stator the extremely small amount necessary to rectify the defect. Otherwise, if the machine trips off or stalls with this trouble, it should be replaced.

5. Motor Protective Device Trips Off

The motor protective device operates whenever the current to the motor is excessive. It will trip off under any of the following conditions:

A. Improper current or voltage.
B. Restricted air circulation to condenser.
C. Open circuit to starting winding.
D. Grounded circuit.
E. Short circuit.
F. Machine will not restart after shutting off.
G. Non-condensable gas.
H. Hard running or stalled compressor.
I. Excessive load on compressor.

Refer to the previous sections on "Stalled (will not run at all)" and "Will not restart after shutting off."

While the tripping off of the motor protective device will generally be an indication of trouble elsewhere, it is possible occasionally to find a control in which the motor protective device is faulty. If such is believed to be the case, it is recommended that the control be changed. If the new control operates satisfactorily, it is evident that the original one may have been defective.

If absolutely necessary, a motor protective device can be checked by opening the starting relay and holding the starting arm up with a piece of insulating material such as wood or cardboard. The machine should be running. The motor protective device should trip off within ¾ to 1¼ minutes.

Caution: When raised, the armature is at line voltage so should not be handled. If a person's body is grounded, a serious shock might result. Also, refer to the "Caution" under "Starting relay" on page 13.

6. Runs all the Time (Does not shut off)

When a machine runs all the time and fails to shut off, the cause is either unsatisfactory refrigeration or defective control operation. If it is the former, refer to Section II, "Unsatisfactory Refrigeration." If the machine continues to run when the main switch is turned to the "off" position, the fault is in the control.

The stationary main contact is mounted on the end of one of the prongs projecting through the back of the control. If the prong is sprung, the stationary main contact may be pushed inward until it touches the movable main contact even when this latter contact is in the open position. In some cases it will be possible to straighten the prong and return the stationary contact to its proper location. In other cases the control must be changed.

Other possible control defects which might cause continuous running of the machine include a weak bellows, defective bridle action and welded contacts. The control must be changed, since part replacements cannot be made.

II. Unsatisfactory Refrigeration (Machine runs all right)

Symptoms

The refrigerating machine may have one or more of the following symptoms:

1. No refrigeration (chilling unit does not cool).
2. Low refrigeration (chilling unit cools but frosts only partially or not at all).
3. Erratic refrigeration (chilling unit frosts at times, not at other times).
4. Cabinet temperature too high (chilling unit frosts satisfactorily).
5. Cabinet temperature too low (chilling unit frosts satisfactorily).
6. Unsatisfactory ice freezing (chilling unit frosts satisfactorily).
7. High per cent running time (chilling unit frosts satisfactorily).
8. High power consumption (chilling unit frosts satisfactorily).

Adjustments

Unsatisfactory refrigeration may result from factors external to the machine or from trouble within the machine. The machine is assumed to run all right; otherwise, it would be classed in Section I "Machine Does Not Run Properly." The frosting of the chilling unit is usually an indication of whether the fault is in the machine or elsewhere.

Caution: In checking a refrigerator for unsatisfactory refrigeration, make sure that the machine has operated for a period of time sufficient to bring normal operating conditions if the machine were operating properly.

1. No Refrigeration (Chilling unit does not cool)

If the chilling unit does not cool at all, yet the machine runs all right, the trouble is in the machine. Possible causes include:

A. All refrigerant in case.
B. No gas in machine.
C. Non-condensable gas.
D. Float valve stuck closed.
E. Float valve stuck open.
F. Unloader stuck open.
G. Check valve stuck closed.

A. All Refrigerant in Case

Directly after installation or after being shut off for a period of time, the machine may fail to refrigerate because all of the refrigerant has condensed in the case. The machine should be shut off at the main switch but left connected to the line so that the oil conditioner will be left in the circuit. In time the refrigerant will be returned to the chilling unit and the machine will refrigerate satisfactorily.

B. No Gas in Machine

If there is no gas in the machine, the upper three or four turns of condenser will not warm appreciably even after the machine has been run for fifteen min-

utes or more. The machine case top may be slightly warm from the heat radiated by the motor. When the machine is shut off, the unloader will operate normally.

Do not purge. The case pressure may be less than atmospheric pressure.

C. Non-condensable Gas

Non-condensable gas may stop the float valve operation so that refrigerant is not returned to the chilling unit. The refrigeration will drop off and eventually stop. The temperature of the float valve and lower condenser turns is relatively cool to that of the upper condenser turns, and feels cooler to the hand.

Do not purge. The case pressure may be less than atmospheric pressure.

D. Float Valve Stuck Closed

If the float valve is stuck closed, the circulation of refrigerant to the chilling unit will be stopped. Refrigeration will drop off and eventually stop. The possible reasons for the trouble include: corrosion, mechanical binding, plugged orifice and float bulb filled with liquid. In many cases, the trouble is of a minor nature and can be cured easily and permanently. In a few cases, the trouble is of a more serious nature and cannot be cured, or if cured, will remain so only temporarily.

The float valve temperature is relatively cool to that of the upper turns of the condenser, and feels cooler to the hand.

Use magnetic float valve lifter, Cat. No. 58X75, to free the float.

Caution:

(a) Be careful not to injure the finish on the float valve.

(b) Do not tap on the charging socket on the top of the float valve.

E. Float Valve Stuck Open

If the float valve is stuck open, gas refrigerant from the condenser is returned directly into the chilling unit. There will be little or no refrigeration in the chilling unit. The float valve temperature will be warm and equal to that of the condenser. A slight hissing noise may be heard as the gas passes through the float valve orifice.

Use the magnetic float valve lifter as outlined under Part D "Float valve stuck closed." Note the "*Cautions.*"

F. Unloader Stuck Open

If the unloader is stuck open, gas refrigerant from the case, instead of the chilling unit, will be drawn into the compressor. There will be little or no refrigeration in the chilling unit.

The action of the unloader can be heard when the machine starts or stops if the unloader is operating normally. If it cannot be heard, it is probably stuck.

The machine should be started and stopped a number of times in rapid succession to loosen the unloader plunger. Jarring the machine may also help.

G. Check Valve Stuck Closed

If the check valve is stuck closed, the chilling unit is closed off from the compressor. No refrigerant will pass through the compressor. The upper three or four turns of condenser will not warm up appreciably even after the machine has been run for fifteen minutes or more. The machine case top may be slightly warm from the heat radiated by the motor. When the machine is shut off, the unloader can be heard but not the check valve.

Run the machine with pans of hot water in the chilling unit to build up pressure which will tend to blow open the check valve.

Caution: Do not put a heater in the chilling unit.

2. Low Refrigeration (Chilling unit cools but frosts only partially or not at all)

Most of the causes listed under "no refrigeration" bring about "low refrigeration" when found in an earlier stage or when present in a lesser degree. Refer to the corresponding parts under "no refrigeration."

A. All refrigerant in case.
B. Low gas in machine.
C. Non-condensable gas.
D. Float valve stuck closed.
E. Float valve stuck open.
F. Unloader stuck open or leaks badly.

There are two other conditions which may cause "low refrigeration" but probably not "no refrigeration":

G. Check valve stuck open or leaks badly.
H. Partially weak bellows in control.

G. Check Valve Stuck Open or Leaks Badly

If the check valve is stuck open or if it leaks badly, warm gas refrigerant from the case flows back into the chilling unit when the machine shuts off. The liquid refrigerant in the chilling unit is warmed up and the machine starts up again in a shorter time than it normally would.

The "off" period will be abnormally short. The check valve will not be heard when the machine is shut off if it is stuck open. There will be a hissing noise after the unloader operates as the gas refrigerant from the case leaks back to the chilling unit.

Let the machine run continuously with pans of hot water in the chilling unit and with the condenser partly blanketed in order to increase the case pressure. Then shut off the machine. The higher pressure will tend to loosen the check valve if it is stuck open. The flushing through of the check valve with a large amount of refrigerant from the boiling in the chilling unit caused by the hot water will tend to flush out any small particles of dirt or other foreign matter.

Caution: Do not put a heater in the chilling unit.

Jarring the machine may dislodge the check valve, or the particle of dirt or foreign material holding it open.

H. Partially Weak Bellows in Control

A partially weak bellows in the control can cause a machine to operate on a defrosting cycle. Normally, the gas pressure within the bellows follows the pressure-temperature curve of a saturated vapor. Throughout the normal operating range there is some liquid present in the end of the bellows tube.

If there is a minute leak in the bellows or bellows tube, there will come a time when there will be liquid present at the lower end of the temperature range but

not at the upper end. The gas pressure will then follow the curve of a super-heated vapor. The pressure in the bellows for a given temperature will be less than it would be if the gas were a saturated vapor. Therefore, the chilling unit temperature must rise higher than it normally would to trip the machine on. The tripping-on temperature may be above 32° F. so that the chilling unit will defrost during the "off" part of the cycle. Replace the control.

3. Erratic Refrigeration (Chilling unit frosts at times, not at other times)

When a cause of no and low refrigeration appears and disappears at intervals, erratic refrigeration results. At one time the refrigeration will be normal, at another time there will be little or none. To check the machine when operating normally will reveal no trouble. It must be checked during the period when the refrigeration is low. Then refer to the causes listed under "No refrigeration" and "Low refrigeration."

4. Cabinet Temperature too High (Chilling unit frosts satisfactorily)

Since the chilling unit frosts all right, the trouble is probably not in the machine itself. Possible causes include:

A. Improper control temperature knob setting.
B. Weak bellows in control.
C. Restricted air circulation to condenser.
D. Restricted air circulation in cabinet.
E. Excessive door or cabinet top gasket leakage.
F. Excessively high room temperature.
G. Excessive loading of cabinet.
H. Excessive cabinet door opening.

A. Improper Control Temperature Knob Setting

The cabinet temperature depends to a certain extent on the control temperature knob setting. This setting is made adjustable in order to satisfy the individual desires of the user. If it is desired to make the cabinet air temperature colder, the knob is turned clockwise; if warmer, it is turned counter-clockwise.

To illustrate the point, the following table gives approximate chilling unit and cabinet temperatures for CA-2A machines during normal performance in an 80° F. room without food or ice freezing load:

Temperature knob position	Machine trips	Chill. unit bottom temp., ° F.	Cab. air temp., ° F.
1	on	27	41.0
	off	19	
5 (normal)	on	22	38.5
	off	13.5	
9	on	17.0	35.0
	off	8.5	

If the desirable temperature cannot be obtained with the amount of adjustment obtainable with the temperature knob, remove the bakelite seal in the center of the knob. The small screw under the seal can be removed and the knob reset. Be sure to replace the seal since the temperature knob screw is electrically alive.

Caution: Do not reset the knob more than two complete turns, or the stop against which the main temperature spring bears will run off the thread on the shaft and the control will have to be replaced.

B. Partially Weak Bellows in Control

A partially weak bellows in the control may raise the upper temperature limit of the chilling unit so that the average chilling unit temperature is considerably above normal. A higher cabinet air temperature will result. Refer to Part H "Partially weak bellows in control" under "Low refrigeration," page 20.

C. Restricted Air Circulation to Condenser

If the air circulation to the condenser is seriously restricted, the capacity of the machine will be reduced. If the machine is required to operate in a high room temperature with a heavy load, the reduction of capacity may be noticeable.

It is recommended that at least one side of the machine be left exposed when installed. The space above the machine top should be unrestricted for at least six inches. If a machine is enclosed more than this amount, it may be necessary to provide forced air circulation in order to obtain satisfactory operation.

D. Restricted Air Circulation in Cabinet

Air circulation is necessary to insure uniform temperature distribution in the cabinet. If the air circulation is restricted by excessive crowding of food or by placing coverings over the shelves, the cabinet air temperature in places will be higher than it should be.

E. Excessive Door or Cabinet Top Gasket Leakage

If the door or cabinet top gaskets do not seal properly, warm air will leak into the cabinet and increase the cabinet air temperature.

Test the door gasket seal by placing a piece of paper the thickness of a dollar bill (or else a .003 metal feeler) against the cabinet where the gasket seals, closing the door and then pulling out the paper. There should be tension on the paper at all points around the door. If there is not, adjust the door, hinges or latch to obtain a good seal.

Observe the inner and outer cabinet top gaskets to make sure they seal properly.

F. Excessively High Room Temperature

The capacity of a refrigerating machine depends on the room temperature in which it operates. With the same control temperature knob setting, the cabinet air temperature will increase with an increase in room temperature. The following approximate figures indicate the relationship of cabinet air temperature to room temperature with the control temperature knob set at position 5:

Room temp., ° F.	Cab. air temp., ° F.
60	34
80	38
100	42

G. Excessive Loading of Cabinet

The cabinet air temperature will rise when a large amount of relatively warm food is placed in the cabinet. The temperature will continue to be higher than normal until the food is cooled. If warm food is constantly being placed in the cabinet, the temperature will average somewhat above normal.

H. Excessive Cabinet Door Opening

Whenever the cabinet door is opened, warm air enters the cabinet and the temperature goes up a few degrees. If the door is left open or is opened excessively, the cabinet air temperature will stay above normal.

5. Cabinet Temperature too Low (Chilling unit frosts satisfactorily)

The machine is evidently refrigerating too much. If the machine runs all the time and fails to shut off, refer to Part 6, "Runs all the time," under Section I, "Machine Does Not Run Properly," page 19. Other possible causes include:

A. Improper control temperature knob setting.
B. Excessively low room temperature.
C. Poor bellows tube contact to chilling unit.

A. Improper Control Temperature Knob Setting

Refer to division A "Improper control temperature knob setting" under Part 4 "Cabinet temperature too high," page 21.

Note: In ***high altitudes*** *the lower barometric pressures will shift the temperature range of the control lower. This may necessitate resetting the temperature control knob warmer in order not to hold too low a cabinet temperature.*

B. Excessively Low Room Temperature

Refer to division F "Excessively high room temperature" under Part 4, "Cabinet temperature too high," page 21.

C. Poor Bellows Tube Contact to Chilling Unit

If the bellows tube contact to the chilling unit is poor, the chilling unit will run colder than it normally would. Adjust the clamp and bellows tube to improve the contact.

6. Unsatisfactory Ice Freezing (Chilling unit frosts satisfactorily)

If the refrigerating machine does not show low refrigeration as covered in Part 2 or if the cabinet temperature is not too high for any of the reasons listed in Part 4, the cause for slow freezing may be one of the following:

A. Improper control temperature knob setting.
B. Poor contact of ice tray with chilling unit surface.
   a. Tray not frozen in properly.
   b. Tray bottom surface not flat.
   c. Chilling unit needs defrosting.
C. Location of ice tray.
D. Rubber ice tray.
E. Freezing desserts.

A. Improper Control Temperature Knob Setting

For most rapid freezing, the control temperature knob setting should be turned to position 9, so that the machine will run continuously in normal room temperatures, until the freezing is completed. In this way the average chilling unit temperature will be several degrees lower than it would be if the machine operated in cycles.

Caution: When the freezing is completed, the knob should be returned to the normal position. Otherwise, the cabinet air temperature may be reduced to a point where freezing of food will result.

B. Poor Contact of Ice Tray with Chilling Unit Surface

The transfer of heat from the water to the chilling unit surface is accomplished largely through the contact of the ice tray with the chilling unit surface. The better the contact, the faster the freezing rate.

a. Tray Not Properly Frozen in.

If the ice tray is not frozen to the chilling unit surface, the freezing rate will be reduced. It is recommended that a small amount (quarter of a cupful) of water be spread over the chilling unit surface at the time the ice tray is put in.

b. Tray Bottom Surface Not Flat.

If the bottom surface of the ice tray is badly dented or warped, good contact cannot be obtained. The surface should be straightened or the tray replaced.

c. Chilling Unit Needs Defrosting.

If the surface of the frost on the chilling unit is uneven at the time the ice tray is put in, good contact cannot be secured. The chilling unit should be defrosted.

C. Location of Ice Tray

The freezing rate on the bottom shelf of the chilling unit is twice as fast as that on the upper shelf. Therefore, for rapid freezing, the ice tray should be placed on the lower shelf.

D. Rubber Ice Tray

The rubber ice tray is supplied for its ease in removing ice cubes where a few cubes are needed at a time. It is not a fast freezing tray. Generally it will require from two to three times as long to freeze cubes in the rubber tray as in an aluminum tray.

E. Freezing Desserts

The time required to freeze desserts depends on the constituents used. It is usually somewhat longer than the time to freeze water.

7. High Per Cent Running Time (Chilling unit frosts all right)

If the per cent running time of a machine seems abnormally high, the possible cause may be found in one of the following sections:

I. Machine does not run properly.
   6. Runs all the time, page 19.
II. Unsatisfactory refrigeration (Machine runs all right).
   4. Cabinet temperature too high, page 21.
   5. Cabinet temperature too low, (see above).

8. High Power Consumption (Chilling unit frosts satisfactorily)

If the power consumption of a machine seems abnormally high, refer to Part 7 "High per cent running time."

III. Noise (Machine runs and refrigerates satisfactorily)

The refrigerating machine is designed for quiet operation. However, like any piece of moving mechanism, it will have certain characteristic sounds which, though hardly noticeable, can be distinguished. Occasionally, because of abnormal operating conditions, improper adjustment of the starting relay, or a defect in the mechanism, the noise may be objectionable.

Symptoms

In order to classify the various sounds that can be distinguished, the following list will serve as a guide:

1. Relay starting noise.
2. Unloader starting noise.
3. Compressor noise.
4. Chilling unit thump.
5. Float valve discharge noise.
6. Relay hum.
7. Bumper or suction tube hitting case.
8. Radio interference.

Adjustments

1. Relay Starting Noise

This is a buzz or chattering sound coming from the starting relay only when the machine is starting. It is caused by faulty alignment of the armature.

Caution: Do not attempt to adjust the armature by bending or twisting it. The tension on this part is carefully regulated at the factory to insure proper starting of the machine.

Loosen or tighten the two screws holding the relay to the cabinet top. Notice whether the noise is still present when the machine is started. It is possible that the warping of the relay base, caused by tightening down the screws holding it to the cabinet top, was sufficient to change the alignment of the armature. The small washers under the two corners of the relay base are sometimes used to reduce this warpage. Add another small washer if necessary.

If the noise cannot be eliminated in this way, the starting relay must be replaced. Refer to page 13 for instructions.

2. Unloader Starting Noise

This is a vibrating hum or buzz coming from the unloader only when the machine is starting. It is due to the fact that the unloader is in the motor magnetic field which is especially strong during the starting period. It cannot be eliminated.

3. Compressor Noise

Compressor noises can be divided into three general classes as follows:

A. Flutter or clicky noise.

B. Gurgling or frog pond noise.

C. Rumble or groan noise.

A. Flutter or Clicky Noise

This noise varies considerably in quality depending on the cause and the conditions under which the machine is operating. It may have a fluttering or sputtering sound as though liquid were present, or it may have a dry clicky sound, or again it may resemble a light metallic vibration. In an extreme case, it may appear to be a heavy mechanical pounding. The noise may be steady throughout the cycle like the liquid pumping noise experienced in DR type refrigerating machines after defrosting, when requiring the monitor test, or when operating with a defective oil conditioner. The noise may be intermittent much like the vibrating burr found in some DR type machines.

The possible causes of the flutter or clicky noise include:

a. High chilling unit temperature.
b. Liquid refrigerant in the lubricating oil.
c. Pull-down after installation or after being shut off for a time.
d. Cold room temperature.
e. Changeable room temperature.
f. Defective oil conditioner.
g. Non-condensable gas.
h. Float valve stuck closed.

a. High Chilling Unit Temperature

The load on a machine depends on the chilling unit temperature; the higher the chilling unit temperature, the greater the load on the compressor and motor. The noise likewise follows the chilling unit temperature. When the chilling unit temperature is above the normal operating range, the machine may be somewhat noisier than normal.

b. Liquid Refrigerant in the Lubricating Oil

If liquid refrigerant collects in the base, a machine will be noisier than normal until the refrigerant is boiled out of the lubricating oil. The oil conditioner prevents the accumulation of refrigerant except under abnormal conditions.

c. Pull-down After Installation or After Being Shut off for a Time

Because of the high chilling unit temperature and the liquid refrigerant in the lubricating oil, a machine may be noisy during the pull-down period after installation or after being shut off for a time. If the cord connector is plugged into the relay so that the oil conditioner is placed in the circuit for a few minutes before the machine is turned on, the noise during the pull-down period will be considerably reduced.

d. Cold Room Temperature

If a machine operates in a cold room temperature (below 60° F.) for a period of time, some liquid refrigerant may collect in the base and the machine may be slightly more noisy than normal. If the room temperature goes below 60° F. at night, it is possible that the machine may be found slightly noisier than normal in the night or in the early morning although it will operate quietly at other times. Some machines may be found to be more sensitive to cooler room temperatures than others.

Another factor that tends to make a machine run slightly noisier in a cool room is that the temperature knob is frequently turned to a warmer position which raises the chilling unit temperature.

e. Changeable Room Temperature

If a machine is operating in a relatively cool room temperature and the room temperature rises rapidly several degrees, the condenser will warm more quickly than the base so that some liquid refrigerant may condense in the base. As soon as the base warms up, the refrigerant will be expelled and the machine will again sound normal.

f. Defective Oil Conditioner

An oil conditioner which is burned out or open circuited will allow the accumulation of liquid refrigerant in the base.

The oil conditioner can be checked by placing a series test lamp in the circuit between the house electrical outlet and the refrigerator connecting cord. Turn the machine off at the control main switch. If the oil conditioner is all right, the lamp will glow at reduced brilliancy. If the oil conditioner is open circuited, the lamp will not light. If the oil conditioner is short circuited, the lamp will burn at normal brilliancy.

Caution: Do not attempt to use ordinary electrical plugs, connectors or sockets with the special locking connector on the connecting cord or the prongs on the back of the relay.

If the oil conditioner is defective, it should be replaced.

g. Non-condensable Gas

Non-condensable gas in the float valve or condenser will raise the case pressure and consequently the load on the compressor, and will cause condensing of liquid refrigerant in the base. The float valve and lower condenser turns will be relatively cooler than the upper condenser turns and will feel cooler to the hand.

Do not purge. The case pressure will probably be less than atmospheric pressure.

h. Float Valve Stuck Closed

A float valve may stick closed long enough to cause condensing of liquid refrigerant in the base without stopping the refrigeration. The float valve will be relatively cooler than the upper turns of condenser, and will feel cool to the hand.

In many cases, the trouble is of a minor nature and can be cured easily and permanently. In a few cases, the trouble is of a more serious nature and cannot be cured, or if cured, will remain so only temporarily.

Use magnetic float valve lifter Cat. No. 58X75 to free the float.

Caution:

(a) Be careful not to injure the finish on the float valve.

(b) Do not tap on the charging socket on the top of the float valve.

B. Gurgling or Frog Pond Noise

This is a periodic bubbling noise coming from the compressor while the machine is running. It resembles the sound coming from a distant frog pond on a summer night. It is caused by refrigerant bubbling through the oil and can often be eliminated from the few machines where it will be found by changing the temperature setting of the control.

C. Rumble or Groan Noise

This is a pulsating hollow tone which frequently seems to be more objectionable outside the room than inside the room where the refrigerator is installed. Often the house construction (hollow walls, pipes, etc.) is such that the rumble is carried to other rooms. It is often possible to eliminate the trouble by changing the location of the refrigerator.

4. Chilling Unit Thump

In some machines there occurs a single thump from the chilling unit directly after the machine starts. This thump may not make its appearance for several months after the machine is installed. It is caused by a slug of refrigerant breaking through the oil film over the refrigerant in the chilling unit.

5. Float Valve Discharge Noise

This is a hissing noise coming from the float valve at times when the float opens. It arises from the liquid refrigerant discharging through the float valve orifice. It cannot be eliminated.

6. Relay Hum

This is a 60 cycle hum coming from the core of the starting relay while the machine is running. It is caused by loose laminations. Replace the relay, referring to instructions on page 13.

7. Bumper or Suction Tube Hitting Case

This is a rattle or vibrating noise, occasionally found during normal running of the machine but more likely found only when the machine starts or stops. It can be verified by shaking the machine gently and observing whether the noise is reproduced.

Check the level of the machine. It is possible that the noise can be eliminated by a slight change in the level of the refrigerator.

8. Radio Interference

There is no radio interference during the normal running of a machine. If radio interference should be traced to the refrigerator, there may be a ground or short circuit in the refrigerator. Refer to "Grounded circuit," page 16, and "Short circuit," page 17 under Section I "Machine Does Not Run Properly."

IV. Leaks

The refrigerating machine is of hermetically sealed Monitor Top design, carefully constructed and tested to insure against leaks. Should a leak occur after the machine has left the factory, it will seldom be recognized as such for two reasons: (1) the leak will probably be inward since the pressure within the machine is below atmospheric under most conditions; and (2) methyl formate is practically odorless even if it should leak outward. A leak will usually appear as non-condensable gas (air) collecting in the float valve.

A small amount of non-condensable gas in the float valve will not affect the operation of the machine. A larger amount may bring about a number of different complaints depending on the amount and the conditions under which the machine is operating:

1. Machine Does Not Run Properly

A. Stalled (Will not start or run at all).
B. Starts and runs only with both windings in the circuit.
C. Motor protective device trips off.

2. Unsatisfactory Refrigeration (Machine runs all right)

A. No refrigeration.
B. Low refrigeration.
C. Cabinet temperature too high.
D. Poor ice freezing.
E. High per cent running time.
F. High power consumption.

3. Noise (Machine runs and refrigerates all right)

A. Compressor flutter or clicky noise.

Symptoms

Non-condensable gas is indicated by the temperature of the float valve and lower turns of condenser. If, after the machine has run long enough to warm the case top and upper condenser turns, the float valve and lower condenser turns are relatively cool and feel cooler to the hand, either one of two conditions exists; non-condensable gas is present or the float valve is stuck closed.

Adjustments

Float Valve Stuck Closed

If the float valve is stuck closed, use magnetic float valve lifter, Cat. No. 58X75, to free it. In all cases, care must be taken not to injure the finish. Do not tap on the charging socket on top of the float valve.

Non-condensable Gas

If non-condensable gas is present, the machine must be replaced.

Do Not Purge. More harm than good will be done by purging. Methyl formate is a low pressure refrigerant. Its boiling point is 88° F. at atmospheric pressure. In other words, if the temperature of the gas is less than 88° F., the pressure will be less than atmospheric. Consequently, if a machine is purged at such a time, air will be drawn into the machine instead of gas being let out.

Pressure-Temperature Table for Methyl Formate

Temp. ° F.	Pressure, lbs. per sq. in., gauge	Temp. ° F.	Vacuum, in. of mercury
150	30.7	80	5.5
140	23.9	70	10.2
130	17.9	60	14.5
120	12.2	50	17.8
110	7.6	40	20.4
100	3.8	30	22.7
90	0.5	20	24.5
88	0	10	25.9
		0	27.0

V. Finish on CA-1A and CA-2A Units

The following instructions are for touch-up work on scratches, nicks, mars, etc., only, and are primarily for the inspector's use in the home. Units will rarely if ever need complete refinishing because of the inherent qualities of the Glyptal-baked enamel put on them at the factory. Complete refinishing, should it be necessary, should be done with the same materials and by the same methods as prescribed for cabinets on page 28 of the manual.

For Touch-up Work

Material

Use Cat. No. 58X69 special Glyptal Enamel Patching Kit. This kit includes the following:

One bottle of Glyptal Enamel.....Cat. No. 58X70
One bottle of Glyptal Thinner.....Cat. No. 58X71
One bottle of Cleaning Solution....Cat. No. 58X72
One ½ inch Fine Camels Hair Brush Cat. No. 58X73
Four small squares of Emery Paper.

Procedure

Small spots, scratches and nicks can best be repaired by spotting with unthinned material and smoothing over by a quick wiping operation with the thumb or one finger. Somewhat larger spots should be sanded to a feather edge and brushed in as smoothly as possible with the glyptal enamel thinned to a brushing consistency. If the job does not blend into the surrounding surface very well it may be improved by quickly flowing clear thinner over the patched and surrounding area with long fast strokes.

Cabinet Adjustments

Note: The adjustments given are to cover only those peculiar to the HT-47, HX-47, HT-70 and HX-70 cabinets.

I. Replacement of Porcelain Panels on Porcelain Finish Cabinets

Note: It is not necessary to remove the unit when replacing any of the exterior parts.

1. Top Front Crosspiece.

Remove nameplate, top door jamb corner pieces, and top door jamb insulating strip. Straighten out, with a screw driver, the holding tabs which clamp the nut strips, and pull the crosspiece down and out. The trim will come away with it and may be replaced on the new crosspiece which is installed by reversing this process.

2. Bottom Front Crosspiece.

The bottom crosspiece is removed in the same manner as the top crosspiece except that in place of the nameplate, there are holding tabs which are screwed to the bottom of the cabinet.

3. Side Panel Hinge Side.

Remove door leaving hinges attached to the door. Remove top and bottom crosspieces. Next loosen all inside screws and remove all outside screws on the jamb strip adjacent to the panel. The panel screws are now removed from the side and the panel may be slid down and forward and lifted free of the cabinet. Reverse the procedure to install new panel. Care should be taken to see that the sponge rubber seal is not wrinkled under the new panel.

4. Side Panel Latch Side.

It is not necessary to remove the door to replace this panel. Holding tabs are used which fit under the door jamb strip, and these must be lined up properly on the replacement panel, otherwise the procedure is identical with that for the hinge side panel.

II. Replacement of Inner Liner

The same procedure as at present for the all-steel models should be followed except:

1. Remove light socket by removing center screw under the contact tab.
2. Carefully remove and also carefully replace the greased cloth or rubber top insulation seal.

Note: Rubber stripping and cement for applying it will be shipped with each replacing liner from the factory.

III. Lighting Equipment

The lighting equipment consists of a receptacle, a switch and a socket, all easily replaceable. Refer to Wiring Diagram on page 14.

The socket is fastened to the liner with a screw concealed under the center contact tab, which threads into a speed nut clamped to the liner.

The receptable is standard and obviously replaceable on examination.

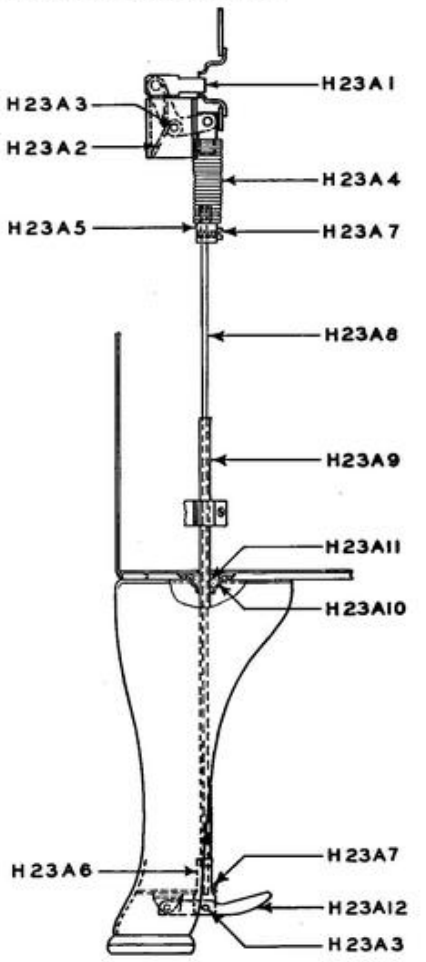
The switch is mounted on the jamb strip with a lock nut on either side. Replacement switches will be shipped with 3" leads. The old leads are cut and the new ones soldered on and wrapped with varnished cambric followed by friction tape.

The switch is adjusted at the factory so that the light goes out when the door is 1½" from closed. This is easily adjusted in the field if necessary.

IV. Foot Pedal Door Opener

There are four possible points which may require servicing on the foot pedal door opener.

1. If the spaghetti or tubing covering the operating wire becomes bent or kinked, the foot pedal will not return after being pressed down. When this trouble is experienced, the exposed part of the cable should be inspected for kinks and if none are found, the insulating strip should be removed and the loose insulation packed around the cable inspected to see that it is not crowding the cable.



Foot Pedal Door Opener Replacement Parts.

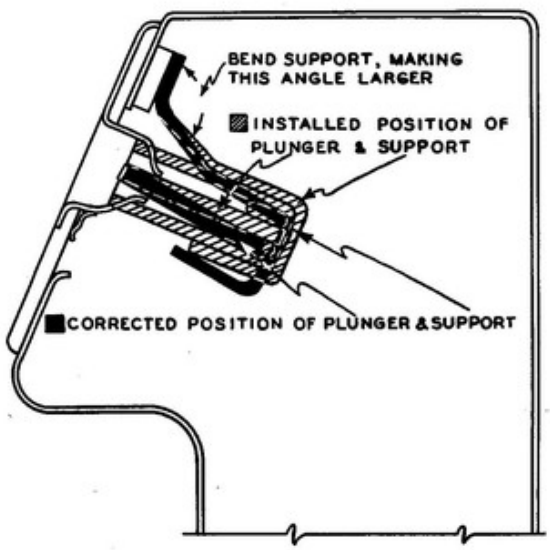
2. The second possible source of trouble is when the foot pedal touches the floor before the door opens. This may be caused by wear or by an uneven floor, and is remedied by loosening the set screw in the socket on the lower end of the operating wire, sliding the wire further into the socket and tightening the set screw. The door opener is so adjusted at the factory, that the pedal just barely touches the floor when the cabinet is not on the gliders. Therefore, the foot pedal door opener will not work properly if the cabinet is not up on the gliders as it is intended to be. Before making any adjustments of the foot pedal door opener, be sure that the cabinet is properly equipped with gliders.

3. On rare occasions the operating wire may break. This is replaced by removing the insulating strip, then loosening the set screws holding each end of the wire and pulling the wire out. A new wire is easily inserted in place of the broken one.

4. Occasionally when the door is shut just hard enough to catch, the foot pedal will be inoperative. This is because the end of the latch bolt just catches on the strike plate and does not quite slide into normal closed position. When this happens the plunger of the door opener strikes the bolt a glancing blow on the rounded edge only and fails to release it.

The existence of this condition is easily determined by chalking the end of the plunger and observing where it contacts the bolt.

This condition is easily remedied and positive operation in all bolt positions secured by changing the relative angle of the plunger, by bending the bracket, as shown on the following illustration.



To do this, remove the textolite strip and the kapok insulation packed loosely around the mechanism. Now remove the two flat headed machine screws which hold the mechanism to the case and take it out where it can be bent as illustrated.

V. Door Seal

Imperfect door seals may be located by the use of a .003 metal feeler. Locate the point of poor seal by inserting the feeler at various points around the door between the gasket and the cabinet front.

Proper door seal is obtained by springing the door or the cabinet front into proper position by using a rubber mallet, by tightening hinge screws, and replacing worn hinges as in other all-steel models. Strike adjustments are different.

The strike plate is in two pieces of which the strike bar is adjustable. By loosening the two screws in the plate this bar can be moved in or out. When the strike is properly adjusted there should be 1/8" free movement at the end of the latch handle when the door is closed. If the strike bar is too far out there will be no free movement. If it is too far in, the free movement will exceed 1/8".

VI. Shelf Frames on HT-70 and HX-70 Cabinets

The shelf frames in these models may be used either side up, giving considerable variation in shelf spacing.

Each set of sliding shelves is individually fitted to the cabinet with which it is shipped from the factory.

However, replacement of liners, replacement of shelves, and the mixing up of shelves, when installing or uncrating large orders may make readjustment necessary in some cases. We wish to caution that in adjusting the open type sliding shelf frames which we are now using, great care must be exercised not to bend them at the welds, or to install them by springing them in position, leaving the welded joints under a strain.

These shelves must be adjusted by bending the tangs back and forth the same as we did in the old close frame type and this bending must be done in a suitable clamping device to prevent applying a strain to the welded joints.

VII. Door Gaskets

It will be noted that the door gasket is one piece and is not interchangeable with any others in the line. To replace a gasket, pull the old gasket off and put the new gasket on the cabinet by forcing the lugs of the gasket into holes in exterior door pan with a blunt tool or pencil.

VIII. Installation of Six-Inch Legs

Standard six-inch legs may be used with the exception of the front leg with bracket for the foot pedal door opener. The wire for the foot pedal door opener will, of course, have to be shortened to the proper length.

Refinishing HX Cabinets and CA Units

Note: For touch-up work on **CA units** refer to instructions on page 25. Complete refinishing of **CA units** should be done, using the same materials and methods as prescribed in the following instructions for HX cabinets.

The material used for refinishing HX cabinets is DuPont RP-81970 Porcelain Tone Air Dry Dulux Refrigerator Finish Enamel. This material takes DuPont T-3810 special thinner.

The finish used on HX cabinets will be correctly known by our sales people as a Glyptal-baked enamel. However, for the purpose of brevity we will call this finish Dulux in the following instructions.

Please note that the finish put on CA type units at the factory is a variation of the finish put on the HX cabinets. However, when completely refinishing either units or cabinets, Air Dry Dulux will be satisfactory.

The following is a complete outline of the method of applying air drying Dulux material in the field under the various circumstances which may be encountered. The refinished jobs with Air Dry Dulux will fall into three general classifications, as follows:

I. Dulux cabinets with small spots less than $\frac{1}{16}$" in diameter.

II. Badly damaged Dulux cabinets which will require refinishing.

III. Dulux cabinets which have been subjected to exceptionally severe service conditions and are in such condition that they must be stripped and refinished.

Following are listed the details for refinishing under each of the above conditions:

I. Small nicks less than $\frac{1}{16}$" in diameter may be repaired by spotting with a pencil brush with unthinned Air Dry Dulux, RP-81970 and smoothing over with a quick motion of the thumb or forefinger. If necessary, the appearance may be improved by a light polish after the Dulux is dry. (At least 24 hours.) This method is similar to that now employed with lacquered boxes.

II. The method for refinishing badly damaged Dulux cabinets is as follows:

Sand all damaged places to a smooth feather edge, using No. 400 wet or dry sandpaper and water or oil-free naphtha. Give the entire surface a light sanding with the same paper, preferably using naphtha, to remove dirt, cleaner, wax, grease, etc. Wipe the whole surface clean with a rag and naphtha to remove any loose particles.

The surface is then ready for spraying with Air Dry Dulux RP-81970, which is the General Electric shade. Bare spots are first spotted with a flash coat of this material and allowed to dry about fifteen minutes. A full, even coat of the Air Dry Dulux is then sprayed over the entire surface of the cabinet or part to be refinished. The amount of thinning required for the Air Dry Dulux will vary slightly with the type of spray equipment used. Ten per cent reduction with T-3810 thinner is recommended for general use. Twenty-four to forty-eight hours drying time, depending upon weather conditions, is necessary before the Air Dry Dulux may be handled or packed.

Because of its slower drying time, Air Dry Dulux will have more tendency to pick up dirt and lint than the lacquers now being used. For this reason, every effort should be made to avoid dirt in the spray room. Field tests have indicated that a satisfactory job can be obtained by proper housekeeping.

III. It is believed that there will be very few cases in which the Dulux finish is in such condition that it will have to be stripped before refinishing. When this is necessary, the procedure is, in general, similar to that now used for lacquer boxes. The old finish should be removed with a wax-free paint remover. When the old finish is entirely removed, great care should be taken to remove all traces of paint remover by sanding and washing with oil-free naphtha or Dulux thinner. All rust spots should be sanded bright and clean. When the surface is thoroughly clean and free from all rust, grease, wax, or old finish, three coats of Air Dry Dulux reduced 10% with T-3810 thinner should be applied, allowing 24 hours between coats. The final coat should be allowed to dry 24 to 48 hours before handling or packing, depending upon drying conditions.

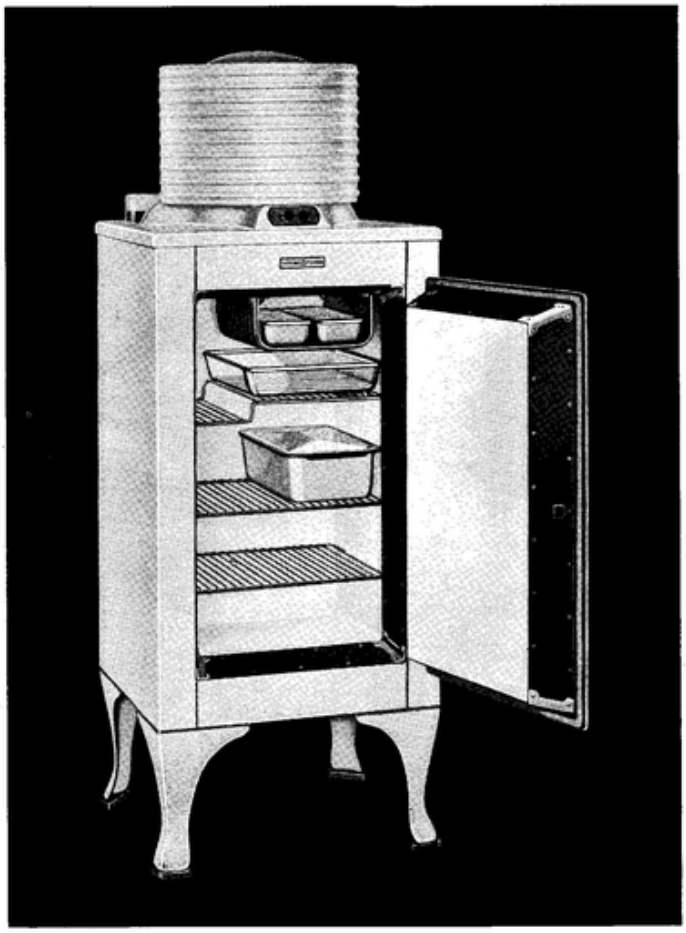
Note: Cleaning Dulux Finish.

We do not believe it will be necessary to use any polishing agent due to the inherent high gloss character of the finish. There will, however, probably be some demand for cleaners in the removal of finger marks and other dirt which will accumulate in delivery and in service.

Do not use anything other than Ivory Soap and water, or General Electric Glyptal Cabinet Cleaner as a cleaner on Dulux finish.

Most of the cleaners, and all of the polishes, recently approved for use on lacquer finish, have a certain amount of abrasive in them, and due to the high gloss of the Dulux finish, they scratch and dull rather than clean and polish, so please refrain from using anything other than the above on Dulux finish.

General Specifications



HT-47 (Open)

HT-47 (Closed)

GENERAL ELECTRIC REFRIGERATORS

Models HT-47 and HX-47

4.7 CUBIC FOOT SIZE

8.3 SQUARE FEET SHELF AREA
(N. E. M. A. Rating)

Porcelain or Glyptal-Baked Enamel Exterior, Porcelain Interior

Ice Making Capacity
2 trays, 4½ lbs. ice, 40 ice cubes.

Standard Accessory Equipment
Each cabinet is equipped with vegetable pan and glass chiller tray.

Hardware
The semi-concealed hardware is made of durable hard brass, modernistic in design with a highly polished chrome finish.

The hinges are securely held to the steel door and cabinet by machine screws.

The single action door latch makes opening of the doors easy. The self-sealing feature automatically insures a tight seal when the door is swung closed.

Gaskets
The door is fitted with a high grade especially developed General Electric one-piece moulded rubber gasket.

Air pockets, formed in the moulded rubber, result in a cushion-like gasket that insures an air tight seal when the door is closed. This type of gasket is exceptionally durable, sanitary, and easy to clean. It is so attached to the door as to permit easy removal.

General Specifications

All-Steel Construction

Both cabinets are of all-steel construction consisting of a one-piece outer steel shell, welded and sealed at all joints, and a one-piece steel inner liner. The inner liner has rounded corners, die-pressed shelf supports and is finished with white stain resistant porcelain enamel. The entire space between the inner and outer walls is completely filled with insulation.

This construction gives greater strength—prevents warping and sagging—increases efficiency and insures longer life.

Textolite Strips

The door openings and door edges are faced with black Textolite strips secured to the inner and outer panels with corrosion resistant screws. The Textolite strips will not warp, mold or cause odors and will withstand severe usage. Corners of the door and door jamb are fitted with stainless metal corner pieces.

Insulation

General Electric refrigerator cabinets are heavily insulated with the best grade material which is protected against entrance of moisture by the outer steel shell which is sealed and welded at all joints to make it moisture tight. The insulation is further protected by sealing in a water tight envelope.

Finish

The interiors of both cabinets are finished in white stain resistant porcelain.

The exterior of the HT-47 cabinet is finished with removable porcelain enameled steel panels which are secured to the main all-steel cabinet shell. The exterior of the HX-47 cabinet is finished in a high lustre Glyptal-baked enamel.

Shelves

Three shelves of the bar type, with steel wires running from front to rear, are used. Space for bottle storage is provided on the top shelf.

Legs

The cabinet is mounted on 11⅛" legs which are secured to the steel outer shell and bottom with heavy machine screws. Six-inch legs can be substituted if desired.

Four black composition gliders are supplied for placement under legs.

Refrigerating Unit

The refrigerating unit used is the G. E. Model CA-1. It is a self-contained, package type, which is installed by merely lowering into the cabinet.

All the working parts are sealed in a welded steel casing and are thereby effectively protected against the deteriorating effects of air, dirt, and moisture.

The unit never requires oiling, since a permanent supply is sealed in the casing.

Stainless Steel Cooling Unit

The cooling unit is of stainless steel, folded into shape and welded at all joints.

There are no hidden crevices or spaces and every portion of the cooling unit inside and out can be easily cleaned.

All ice trays are in direct contact with a freezing surface, assuring rapid freezing of ice cubes or desserts.

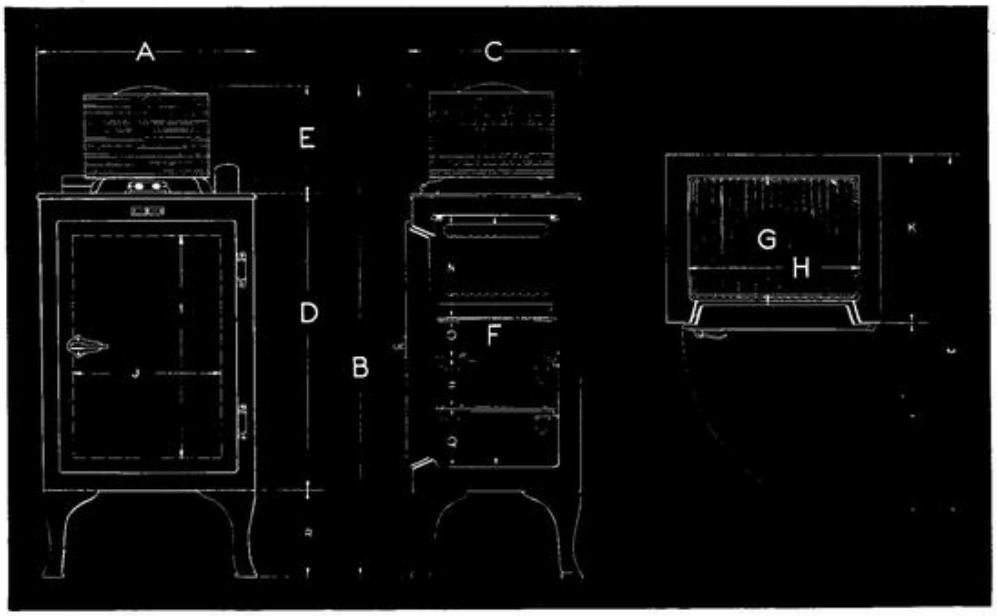
Temperature Control

The temperature control on the General Electric refrigerating unit automatically maintains a uniform cabinet temperature. An easily accessible adjustment dial is provided to permit the user to vary the temperature to meet individual requirements or special conditions.

The control is also equipped with a semi-automatic defrosting switch which permits defrosting of the cooling unit without interrupting refrigeration.

Weights

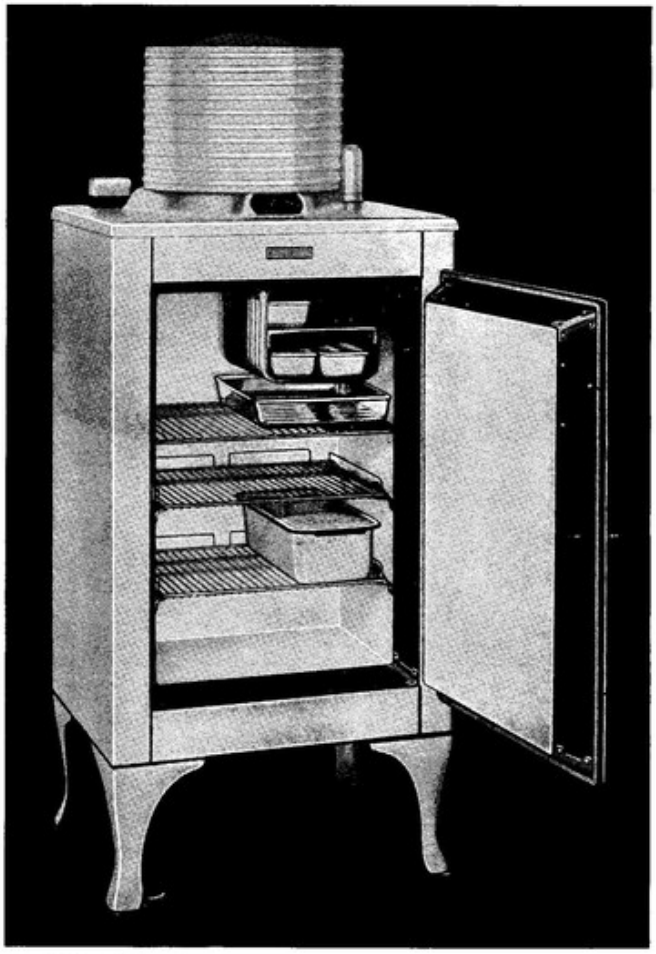
HT-47 Crated: Cabinet.....238 lbs. Unit.....162 lbs.
HX-47 Crated: Cabinet.....205 lbs. Unit.....162 lbs.



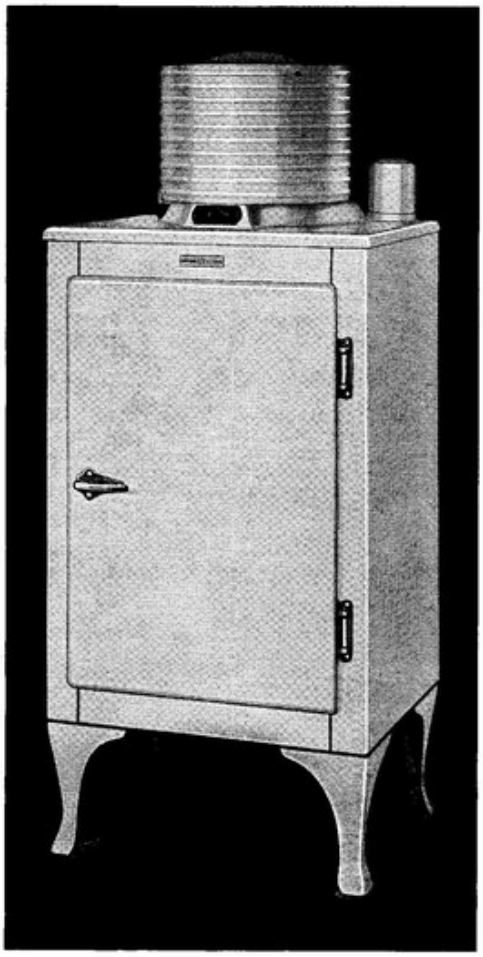
DIMENSION CHART

Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
HT-47	24"	64¾"	21½"	38 9/16"	14⅝"	32⅛"	15"	18"	28½"	15½"	21 1/16"	18⅞"	39 11/16"	12¼"	6¾"	5¾"	5 11/16"	11 3/16"
HX-47	24"	64 1/16"	21½"	38⅞"	14⅝"	32⅛"	15"	18"	28½"	15½"	20 11/16"	18⅞"	39 13/16"	12¼"	6¾"	5¾"	5 11/16"	11 3/16"

General Specifications



HT-70 (Open)



HT-70 (Closed)

GENERAL ELECTRIC
REFRIGERATORS

Models HT-70 and HX-70

7 CUBIC FOOT SIZE

12.3 SQUARE FEET SHELF AREA
(N. E. M. A. Rating)

Porcelain or Glyptal-Baked Enamel Exterior, Porcelain Interior

Ice Making Capacity

4 trays, 9 lbs. ice, 84 ice cubes.
One rubber DuFlex Tray.

Standard Accessory Equipment

The HT-70 accessories consist of a vegetable pan, wire fruit basket, glass chiller tray and a set of covered glass food containers. The HX-70 is equipped with vegetable pan and glass chiller tray.

Hardware

The semi-concealed hardware is made of durable hard brass, modernistic in design with a highly polished chrome finish.

The hinges are securely held to the steel door and cabinet by machine screws.

The single action door latch makes opening of the doors easy. The self-sealing feature automatically insures a tight seal when the door is swung closed.

Gaskets

The door is fitted with a high grade especially developed General Electric one-piece moulded rubber gasket.

Air pockets, formed in the moulded rubber, result in a cushion-like gasket that insures an air tight seal when the door is closed. This type of gasket is exceptionally durable, sanitary, and easy to clean. It is so attached to the door as to permit easy removal.

General Specifications

Foot Pedal Door Opener

The cabinet door may be opened by simply pressing against a foot pedal.

Automatic Interior Lighting

An interior electric light automatically turns on when the cabinet door is opened and turns off when the door is closed.

All-Steel Construction

Both cabinets are of all-steel construction consisting of a one-piece outer steel shell, welded and sealed at all joints, and a one-piece steel inner liner. The inner liner has rounded corners, die-pressed shelf supports and is finished with white stain resistant porcelain enamel. The entire space between the inner and outer walls is completely filled with insulation.

This construction gives greater strength—prevents warping and sagging—increases efficiency and insures longer life.

Textolite Strips

The door openings and door edges are faced with black Textolite strips secured to the inner and outer panels with corrosion resistant screws. The Textolite strips will not warp, mold or cause odors and will withstand severe usage. Corners of the door and door jamb are fitted with stainless metal corner pieces.

Insulation

General Electric refrigerator cabinets are heavily insulated with the best grade material. The insulation is protected against moisture by the outer steel shell which is sealed and welded at all joints. The insulation is further protected by sealing in a water tight envelope.

Finish

The interiors of both cabinets are finished in white stain resistant porcelain.

The exterior of the HT-70 cabinet is finished with removable porcelain enameled steel panels which are secured to the main all-steel cabinet shell. The exterior of the HX-70 cabinet is finished in a high lustre Glyptal-baked enamel.

Shelves

One shelf of the bar type, with steel wires running from front to rear, and two adjustable sliding shelves are used.

The sliding shelves are designed to permit easy adjustment of shelf spacing to provide the most convenient and usable arrangement. All shelves are especially finished to resist corrosion.

Legs

The cabinet is mounted on sturdy legs equipped with black composition gliders.

Refrigerating Unit

The refrigerating unit used is the G. E. Model CA-2. It is a self-contained, package type, which is installed by merely lowering into the cabinet.

All the working parts are sealed in a welded steel casing and are thereby effectively protected against the deteriorating effects of air, dirt, and moisture.

The unit never requires oiling, since a permanent supply is sealed in the casing.

Stainless Steel Cooling Unit

The cooling unit is of stainless steel, folded into shape and welded at all joints.

There are no hidden crevices or spaces and every portion of the cooling unit inside and out can be easily cleaned.

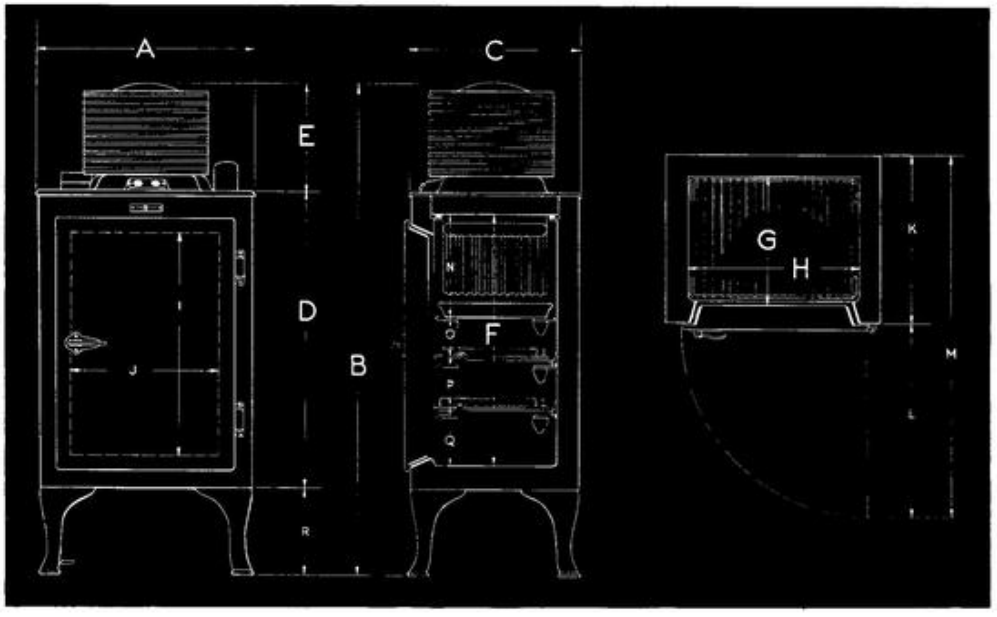
All ice trays are in direct contact with a freezing surface, assuring rapid freezing of ice cubes or desserts.

Temperature Control

The temperature control automatically maintains a uniform cabinet temperature. It is provided with a readily accessible temperature adjustment dial and with a defrosting switch which permits defrosting without interrupting refrigeration.

Weights

HT-70 Crated: Cabinet....318 lbs. Unit.....188 lbs.
HX-70 Crated: Cabinet....312 lbs. Unit.....188 lbs.



DIMENSION CHART

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
Model HT-70	28 1/2"	66 1/16"	22 3/4"	40 3/4"	14 5/8"	33 1/16"	17"	22 7/8"	29 7/8"	20"	22 3/16"	25 1/4"	47 1/16"	13 1/16"	5"	6 9/16"	7 9/16"	11 9/16"
Model HX-70	28 1/2"	66 3/16"	22 3/4"	40"	14 5/8"	33 1/16"	17"	22 7/8"	29 7/8"	19 7/8"	22 3/16"	25 1/4"	47 1/16"	13 1/16"	5"	6 9/16"	7 9/16"	11 9/16"

DOMESTIC PRODUCT MANUAL

GENERAL ELECTRIC

REFRIGERATING MACHINES

SECTION IA

CABINETS: MODELS X-5, T-7 AND X-7
MACHINES: CA-1B, CA-2B

GENERAL ELECTRIC COMPANY
ELECTRIC REFRIGERATION DEPARTMENT
NELA PARK
CLEVELAND, OHIO

Form P-496-1A

June 8, 1934

GENERAL ELECTRIC REFRIGERATORS
MODELS X-5, T-7, AND X-7

Description

Refrigerating Machine (models CA-1B and CA-2B)

These models are similar in design and construction to the preceding Monitor Top models, CA-1A and CA-2A, using the same refrigerant, compressor, motor and cooling unit. Improved features are found in the following details:

Location and setting of the starting relay.
Appearance of the condenser.
Appearance of the cabinet top.
Location and appearance of the float valve.
Location, appearance and operation of the control.
Location of the nameplate.

Starting Relay

The starting relay is mounted on the condenser, in the left rear side of the machine. It is similar to the starting relay used on CA-1A and CA-2A machines except that the setting of the armature is different due to the fact that it now operates horizontally instead of vertically.

Condenser and Cabinet Top

The condenser is of new appearance with pleasant, smooth lines. The cabinet top also is changed to present a graceful curve up to the condenser, unbroken by the starting relay and float valve.

Float Valve

The float valve is located in the rear of the machine, out of sight from the front.

Control

The control is located in the front center of the condenser, behind the condenser surface except for the two knobs which project through the condenser and escutcheon plate.

A white dot has been added to the pointer of each knob to make its position more readily apparent.

An additional feature has been incorporated in the control which automatically returns the machine to normal operation after the defrosting operation is completed.

The range of average temperatures between positions 1 and 9 has been considerably increased.

Nameplate

The nameplate is now placed on the cover of the starting relay in the back of the machine instead of on the cabinet top to the right of the float valve.

Control

Description and Instructions for Replacing

The control used on the CA Form B machine is quite similar to the one used on the CA Form A machine. Directions for operating the control are engraved on the escutcheon plate covering the control. For further information on how it operates and a diagram of its interior, refer to Section I of the Domestic Product Manual. The following points of difference deserve further explanation:

Front view of Control and Escutcheon Plate

Defrosting the Cooling Unit

The mechanism for defrosting the cooling unit operates in the same manner in the control for the CA form B machine as for the CA form A machine except that the CA form B machine is automatically returned to normal operation after a single defrosting cycle. The CA form A machine continues to operate through defrosting cycles until the knob is manually returned to the normal "on" position.

The automatic return to normal operation after defrosting the CA Form B machine is accomplished by having an arm trip the cam on the main switch which released the auxiliary defrosting spring when the bellows expands to the point corresponding to the upper defrosting temperature limit. There is a spring in the main switch which snaps it back to the "on" position.

Motor Protective Device Signal

The window in the front of the control on the CA Form B machine is not visible except when the escutcheon plate is removed. The escutcheon plate is held in place by two spring clips which are inserted through holes in the condenser. With the escutcheon plate removed, the lower end of the window will be visible just above the upper knob.

On later CA Form B machines the red signal has been left out. The tripping off of the motor protective device will be indicated by an excessively long "off" period during which the cooling unit will defrost.

Directions for Removing and Installing a Control

To remove a control:

(1) Remove the clamp holding the bellows tube to the left side of the cooling unit at the rear. In doing this, hold the screws stationary while removing the nuts. This will eliminate any possibility of jamming the threads.

(2) Remove and straighten the bellows tube.

(3) Remove the escutcheon plate. It is held in place by two spring clips which are inserted through holes in the condenser.

Caution: Be careful not to damage the finish on the condenser.

(4) Remove the control from the condenser by taking out the two screws which hold the control bracket to the condenser. Lift the control upward until the locking connector is accessible.

(5) Disconnect the locking connector from the back of the control with a slight turning motion.

Caution: The locking connector to the back of the control is similar to that on the connecting cord to the relay. It cannot be removed by straight pulling. It must be turned slightly.

(6) The control can now be completely removed by pulling it upward.

(7) Remove the bracket from the control by taking out the single screw.

To install a control:

Caution: Make sure that the proper control (Cat. No. 58X117 for 110 volt, 60 cycles, and Cat. No. 58X120 for 110 volt, 50 cycles) is used when installed on a CA Form B machine.

Before installing a new control, the bellows can be checked by turning the main switch to the "defrost" position and observing whether it snaps back to the "on" position. If the bellows is weak, the main switch will not snap back to the "on" position when the end of the bellows tube is at room temperature.

(1) Attach the bracket to the control with the single screw through the hole in the end of the control nearest the window.

(2) Insert the end of the control tube into the rubber bushing in the cabinet top behind the front of the condenser, push it through the box top insulation and start it through the rubber bushing in the bottom plate.

(3) Guide the control tube through the rubber bushing.

(4) Connect the locking connector to the prongs on the back of the control.

(5) Attach the control bracket to the condenser by means of the two screws.

(6) Put on the escutcheon plate, inserting the two spring clips through the holes in the condenser.

(7) Bend the control tube into place and clamp it to the cooling unit. The screws (Cat. No. 58X47) and nuts (Cat. No. 58X99) that hold the clamp to the cooling unit are 5/16" across the flats. Make sure that the end of the bellows tube fits into the depression made for it in the rear cooling unit channel. The upper end of the pinch-off of the bellows tube should project just below the clamp so that the liquid in the bellows tube will be right under the clamp. The bellows tube at this point should be right against the rear cooling unit channel.

The CA-1B machine requires a longer bellows tube than the CA-2B machine. Since the same control is used for both machines, it will be found that the bellows tube is too long when installed on a CA-2B machine. The extra length can be taken up by putting a bend in the tube just after it comes through the bottom plate. This bend should be made so that it will not interfere when putting things into the refrigerator.

Caution: The control tube should not touch the cooling unit header. If it does, the temperature limits may vary somewhat from the proper ones.

(8) The temperature knob should be set at position 5 if normal operating limits under normal operating conditions are desired.

Starting Relay

The starting relay used on CA Form B machines is similar to that used on CA Form A machines except that the setting of the armature is different due to the fact that the form B armature operates horizontally while the form A armature operates vertically.

Directions for Removing and Installing a Starting Relay

Caution: Make sure that the proper relay (Cat. No. 58X121 for 110 volt, 60 cycles and Cat. No. 58X122 for 110 volt 50 cycles) is used whenever one is installed on a CA Form B machine.

Do not disturb, adjust or bend the starting armature.

The armature of the starting relay is carefully constructed and tested at the factory in order that its tension be just right to insure proper starting of the machine. Consequently, the starting relay is sealed and must not be opened unless absolutely necessary.

If it is found necessary to open a starting relay as a last resort before replacing a machine, great care must be used.

To Remove a Starting Relay

(1) Remove the locking connector from the under side of the relay, using a slight turning motion.

Caution: The connector locks itself to the prongs projecting from the relay. It cannot be removed by straight pulling. It must be turned slightly.

(2) Break the seal on the back of the relay and remove the cover.

(3) Disconnect the various motor and oil conditioner leads.

Caution: In some instances, the color of the leads to the relay may not be easily distinguishable. If such is the case, mark them carefully when changing a starting relay.

(4) Remove the two screws holding the relay to the condenser.

To Install a Relay

(1) Remove the cover from the relay.

(2) Attach the relay to the condenser with the two screws.

(3) Connect the various motor and oil conditioner leads to the proper terminals as indicated in the wiring diagram on page 14 of Section I of the Domestic Product Manual.

Caution: Never interchange any motor leads. The starting winding will burn in a short time if left continuously in the circuit.

It will be observed that the oil conditioner leads have metal terminals on the ends.

(4) Check the operation of the relay by connecting the cord and starting the machine.

(5) Put on the relay cover and seal it.

MACHINE ADJUSTMENTS

Since the CA Form B machine is practically identical to the CA Form A machine with the exception of a few details which affect the appearance rather than the operation, the same adjustments apply. These adjustments will be found in Section I of the Domestic Product Manual.

A few additional adjustments have been discovered for the CA Form B machine:

Machine does not trip on again

This complaint may vary in frequency and degree. One machine may run through a single "on" cycle after being started, trip off normally at the lower temperature limit, but never trip on again unless the main switch or the machine is jarred. On another machine, this failure to trip on again may occur only occasionally; the machine operating normally the majority of the time.

The source of the trouble may be a partially weak bellows as described in the next adjustment but it also may be interference of the defrosting spring lever with the bellows tube arm at the upper temperature limit. This is a control defect which cannot be repaired in the field. The control must be replaced. Refer to page 5 for instructions.

Partially weak bellows in control

A partially weak bellows (one from which part of the gas charge has leaked out) may cause symptoms of low refrigeration. The cooling unit may operate on either a frosting or a defrosting cycle, depending on the amount of gas remaining. The "on" and "off" cycles will both be abnormally long.

Normally, the gas pressure within the bellows follows the pressure-temperature curve of a saturated vapor. Throughout the normal operating range there is some liquid present in the end of the bellows tube.

If there is a minute leak in the bellows or bellows tube, there will come a time when there will be liquid present at the lower end of the temperature range but not at the upper end. As soon as all of the liquid is evaporated, the gas pressure will follow the curve of a super-heated vapor. The pressure on the bellows for a given temperature will be less than it would be if the gas were a saturated vapor. Therefore, the cooling unit temperature must rise higher than it normally would to trip the machine on.

To test for a partially weak bellows, remove the bellows tube from the cooling unit and warm the end by holding it in the hand. After it is above 60° F., turn the main switch to the "defrost" position and observe if it snaps back to the "on" position. If the bellows is weak, the main switch will not snap back under these conditions. Replace the control. Refer to page 5 for instructions.

Creeping temperature knob

If the temperature knob creeps towards a colder setting from the position it was set, install a crimped spring washer (Cat. No. M15A3) under the temperature knob. To do this, remove the textolite sealing plug from the center of the temperature knob. Remove the small screw and then take off the knob. Install the spring washer under the knob and replace the knob, screw and sealing plug.

> Caution: Be sure to replace the textolite sealing plug because the small screw in the center of the knob is at line voltage.

Improper control temperature knob setting

The cabinet temperature depends to a certain extent on the control temperature knob setting. This setting is made adjustable in order to satisfy the individual desires of the user. If it is desired to make the cabinet air temperature colder, the knob is turned clockwise; if warmer, it is turned counter-clockwise.

For the majority of installations, sufficient temperature variation can be obtained by turning the temperature knob. Occasionally it may be found necessary to get additional range. To do this, remove the textolite sealing plug from the center of the temperature knob, using a pocketknife. The small screw under the plug can be removed and the knob reset. Replace the small screw and the sealing plug.

> Caution: Be sure to replace the textolite sealing plug since the screw in the center of the temperature knob is at line voltage.

The following table compares the control and cooling unit temperature limits on CA-2A and CA-2B machines during 80° F. performance (no food or ice freezing) test. These temperatures are carefully taken with thermocouples under closely controlled operating conditions. Thermometer readings in the field will vary slightly from these figures.

	Control knob position	Cooling unit bottom temp., °F	Average cabinet air temp., °F
CA-2A	1(warmest)	19-27	41.0
	5(normal)	13.5-22	38.5
	9(coldest)	8.5-17	35.0
CA-2B	1(warmest)	22-30.5	43.5
	5(normal)	13.5-22	38.5
	9(coldest)	4.0-13	31.5

It will be noted in the preceding table that the range of average cooling unit bottom temperatures between positions 1 and 9 on the CA-2B machine is 18° F. while on the CA-2A machine it is 10° F.

The temperature knob should never be reset just because a hasty check of the cabinet temperature shows it to be a few degrees colder or warmer than it should be. The cabinet temperature depends on a number of important factors in addition to the setting of the temperature knob. These factors include the room temperature, food load in the cabinet, ice freezing load, air circulation in the cabinet, air circulation to the condenser, door or cabinet top gasket leakage, and the frequency of door opening. All of these factors should be carefully checked before the temperature knob is reset.

Relay armature hits coil

The starting relay armature on the CA Form B machine operates in a horizontal plane. The rubber washer on the top of the coil was removed. It has been found in some instances, when the relay armature is not properly adjusted, that it hits the end of the coil when the contacts are broken open. Since the armature must not be adjusted in the field, it will be necessary to replace relays when this condition is found.

CABINET ADJUSTMENTS ON MODEL X-5, T-7, X-7 (and T-9) CABINETS

Note: The cabinet adjustments for the above cabinets are the same as those for the HT and HX cabinets which are given in Section I of the Domestic Product Manual with a few exceptions which are described following:

Foot Pedal 1934 Type

Adjustments on T and X

The foot pedal mechanism is not interchangeable with the 1933 type. The foot pedal is connected to the door opener with three rods, which are hooked together. The middle rod passes through a stuffing box attached to the cabinet bottom. This stuffing box is packed with wool packing and grease which does not allow air leakage and allows free movement of the rod. The lower rod hooks into the eye on the end of the middle rod which allows an easy disassembly. The lower end of the bottom rod is threaded and screws into a connector which has a ball end. The ball in turn fits into a socket in the foot pedal. For adjusting:

(1) Open the cabinet door.

(2) Pull down on the bottom rod and disengage the ball and socket joint.

(3) Loosen lock nut on top of connector piece and screw the connector in or out to shorten or lengthen the lower rod.

(4) Tighten lock nut and reassemble.

The door opener mechanism is permanently attached to the escutcheon plate which in turn is fastened to the textolite strip with two screws. The holes for these screws in the escutcheon plate are slightly oblong, as are the holes in the strike plate allowing for movement of the complete mechanism. Then when adjusting for door seal, the tongue of the door opener can be kept in the same position relative to the latch bolt.

Parts of the foot pedal itself and the bottom tread are obviously replaceable. The stuffing box and the door opener itself are also replaceable by removing the textolite strip which covers them and the screws which hold them in place.

Installation of Six-inch Legs

Standard six-inch legs may be used with the exception of the front leg with bracket for the foot pedal door opener. A short bottom link is available and will be shipped with the special six-inch leg.

Nameplate

The new nameplates are made up of two parts: (a) A concealed cadmium plated base strip which is attached to the outer case with two screws, and (b) the nameplate proper which snaps onto the base strip.

For removing nameplates use a small screw-driver with a bit approximately 5/16" in width.

(1) Open the cabinet door.

(2) Insert point of bit in slot of the nameplate shell. The slot is located in the right-hand end lower side.

(3) Twist screw-driver to unsnap the nameplate shell from its base plate, being careful not to mar the glyptal or the porcelain cabinet finish.

To reassemble, slide the left-hand end of the nameplate shell over the base plate and then snap the outer shell on the base plate.

Hardware

The hardware is obviously replaceable. The HT and HX hardware is interchangeable with the T and X hardware except for appearance. The white stripes are glyptal-baked enamel and are repairable in the field.

DOMESTIC PRODUCT MANUAL

GENERAL ELECTRIC REFRIGERATING MACHINES

SECTION II

MODEL HE-4, HE-5
HE-7 and E-5
REFRIGERATORS

GENERAL ELECTRIC COMPANY
SPECIALTY APPLIANCE SALES DEPARTMENT
NELA PARK
CLEVELAND, OHIO

INTRODUCTION

Every General Electric Refrigeration Product is built as perfectly as possible, after which it is very carefully tested and inspected before it is shipped from the factory.

This manual is written to assist Product men in the installation and adjustment of domestic refrigeration equipment.

The proper functioning of all machinery depends ultimately on the human element. The following pages and your own experience will testify to this simple fact.

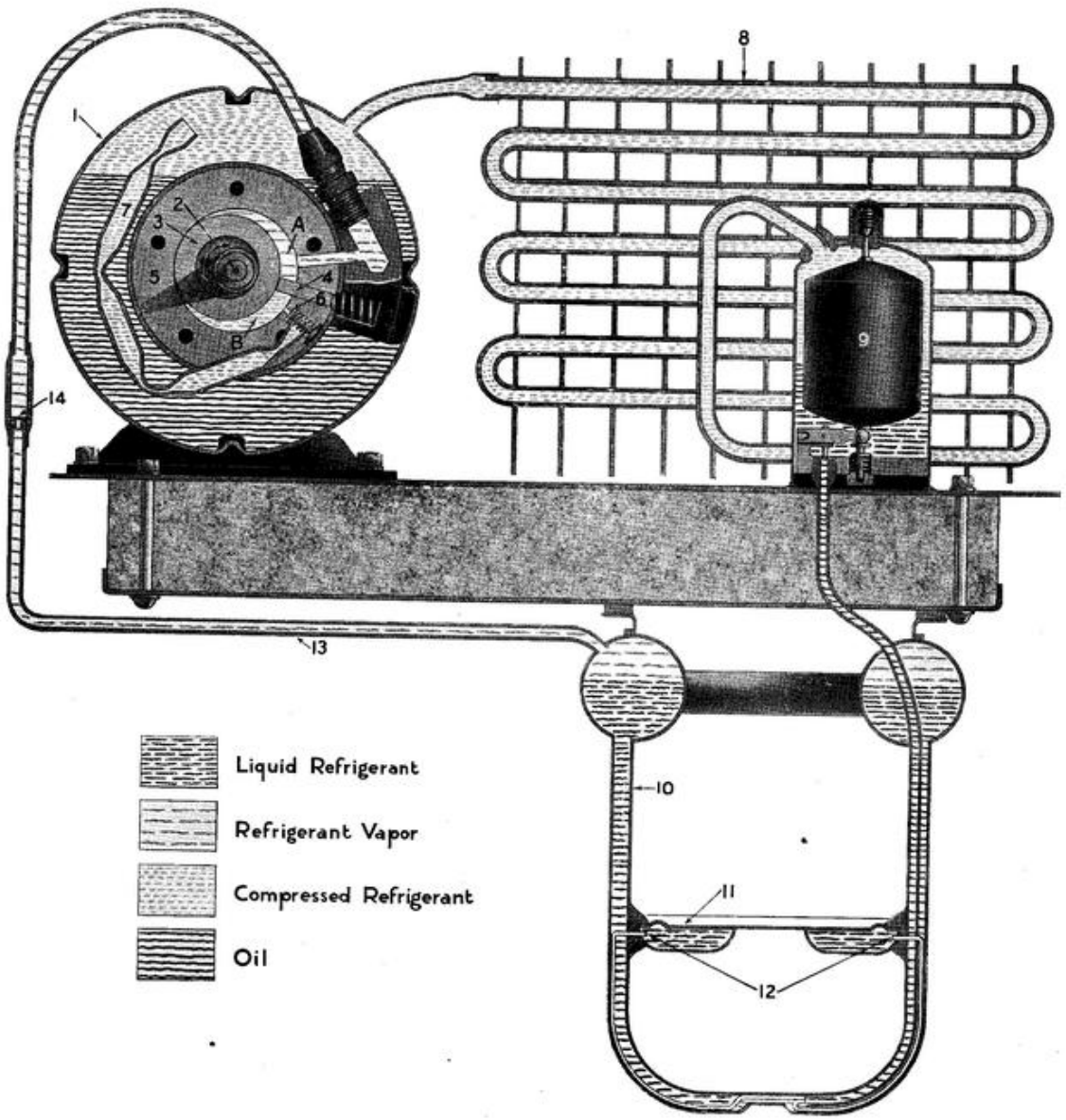
NOTE: This section is the second of several sections that will comprise the General Electric Domestic Refrigerator Product Manual. These sections will give in detail product information on General Electric domestic refrigeration equipment.

Sections I and II, together with the subsequent sections which will be published from time to time, should be kept together in a suitable three-hole binder.

Form P-496-2
Revised January 23, 1935

INDEX TO SECTION II

Chart Showing Operation of CB-1 Refrigerating Machine



1. Compressor
2. Compressor Shaft
3. Piston
4. Blade
5. Cylinder
6. Discharge Valve
7. Acoustic Filter
8. Finned Tube Condenser
9. Float
10. Chilling Unit
11. Freezing Shelf
12. Injectors
13. Suction Line
14. Check Valve

General Electric Refrigerators

Models HE-4B, HE-5A and HE-7A

DESCRIPTION

Refrigerating Machine (Models CB-1, CB-2, and CB-3)

The refrigerating machine is of conventional design having an external motor and a belt driven compressor. It is constructed of high quality materials with unusual precision in parts to insure efficient, quiet and trouble-free operation. The compressor and motor assembly is spring mounted to eliminate noise and vibration.

Refrigerant

Sulphur dioxide is used as a refrigerating medium.

Compressor

The compressor is located on the high pressure side of the system. It is of the rotary type, simple in construction and highly efficient. The piston (or rotor) is actuated by an eccentric on the horizontal shaft. The compressor assembly is mounted in a drawn steel case which is welded together to eliminate gaskets. Power is transmitted into the compressor through the shaft which extends through the end of the case and is driven by a pulley belted to the motor with a V belt. The rotating shaft is sealed from leakage of refrigerant by a bellows shaft seal which surrounds the shaft. The compressor mechanism and shaft seal is immersed in a permanent bath of oil to insure positive lubrication of all moving parts.

Motor

The motor used on alternating current models is of the trouble-proof highly efficient, capacitor type. It has no brushes to cause radio interference. The only attention it requires is oiling once a year. The motor used on direct current models necessarily has brushes but is provided with a wave filter to prevent any radio interference. The only attention this motor requires is inspection of brushes and oiling once a year.

Condenser

The condenser is of the radiator type and is constructed of copper fins and tubing, tin coated to insure good thermal contact between the fins and tubes. A McMahan type fan on the motor pulley insures positive air circulation through the condenser and efficient cooling.

Float Valve

Refrigerant is admitted into the chilling unit through a high side float valve.

Chilling Unit

The chilling unit is made of stainless steel and is provided with refrigerated freezing shelves. It is of welded construction providing surfaces which are smooth, easy to clean and sanitary. The construction of the chilling unit incorporates forced circulation of the refrigerant thus assuring the highest cooling efficiency.

Control

The control is mounted on the front of the unit enclosure; easily accessible and readily replaceable if the occasion should demand. It is completely sealed. The control incorporates a manual switch for turning the machine on and off; an adjustable mechanism for controlling the temperature of the cabinet and of the chilling unit; a motor protective device for protecting the motor from abnormal loads or power conditions and a semi-automatic arrangement for defrosting the chilling unit without appreciably affecting the cabinet temperature. First production of CB machines were equipped with a control which included all of these features with the exception of the semi-automatic defrosting device.

Cabinet (Models HE-4B, HE-5A, and HE-7A)

The cabinet is of all-steel construction with a one-piece acid-resistant porcelain enamel interior. The exterior of the cabinet is finished in white Glyptal-baked enamel. The neat semi-concealed hardware has a durable and attractive chrome finish. The unique and exclusive "push open" type latch makes it possible to open the refrigerator door with a slight push of the elbow or side. The door openings and door edges are faced with black Textolite strips secured to the inner and outer steel panels with rugged anodic treated aluminum machine screws. A ventilating duct is fastened to the back of the cabinet to direct the circulation of air around the refrigerating machine.

Accessories

These models are equipped with a glass chiller tray, aluminum ice freezing trays, with tapered dividers for faster freezing and easier removing of ice cubes, and a tray lifter for the ice trays.

Guarantee

These refrigerators carry a one-year guarantee.

Cycle of Operation

The rotary compressor used on CB type refrigerating machines is old in principle, yet new in design. It is efficient. It is simple. It is a contribution to simplified refrigeration.

The rotary compressor consists essentially of the few following parts:

Shaft
Piston
Blade
Cylinder
End flanges

The only valve in the compressor is an exhaust valve of the disc type. It is about the size of a dime and held in place by a small helical spring.

The intake port is an unrestricted hole in the cylinder wall. The cylinder and the end plates which carry the shaft bearings are stationary. It might be said that the cylinder and the end plates form the refrigerant compartment in the compressor. A piston is used to push the refrigerant from this compartment and the blade is a dividing member which helps the piston clear the compartment.

The assembly of the compressor is simple. The shaft, piston and blade are assembled in the cylinder and the end flanges bolted in place. This entire assembly is then slipped into a steel shell. The steel shell is then welded to the end cap, thus completely sealing the compressor except for the shaft seal.

Operation of CB Compressor

In order to visualize the operation of the CB compressor, refer to the schematic diagram on page 4. The pumping action is obtained by the piston moving along the cylinder wall, as indicated by the arrow.

As the piston moves away from the intake port, volume "A," which is between the blade, piston and cylinder, on the intake side of the pump, increases. Hence refrigerant vapor from the suction line is drawn into this increasing volume. Volume "B," which is located on the other side of the blade, is decreasing. Hence any refrigerant vapor which is trapped in this volume, is compressed. This vapor remains in the pump until the piston reaches a position where the vapor pressure on the exhaust side is great enough to overcome the spring tension on the valve. At this point the exhaust port opens and the piston pushes the compressed refrigerant vapor from the pump.

At the end of its stroke the piston completely clears the cylinder of its original refrigerant vapor charge, and at the same time it has already sucked in a new charge, ready to be compressed. The piston pushed in a rotary motion about the cylinder, causes refrigerant vapor to continually enter the suction side of the pump and at the same time discharges compressed refrigerant on the discharge side of the pump. The piston is effective for the full 360° of its stroke, which is one of the factors which largely contributes to the unusual efficiency of this design.

After the compressed vapor leaves the exhaust valve it is conducted above the oil level through the acoustic filter. The acoustic filter is a simple means of deadening noise. It consists of chambers of different sizes. The compressed vapor is then discharged directly into the case.

The compressor is three-fourths submerged in a bath of oil which insures positive lubrication of all moving parts.

Refrigerant Circuit

The refrigerant vapor from the chilling unit passes through the suction line to the check valve and thence directly to the suction port of the compressor. The check valve is of the disc type and is located in the suction line just outside the compressor case. The purpose of this valve is to prevent oil and refrigerant vapor from rushing back into the chilling unit as soon as the compressor stops.

In the compressor, the low pressure refrigerant vapor which is sucked from the chilling unit is compressed and pushed through the exhaust valve into the acoustic filter, which conducts the compressed vapor above the oil level and discharges it into the case. From the case the compressed vapor passes through the condenser, where it is cooled and liquefied. The liquefied refrigerant flows into the float chamber and raises the float valve after a certain liquid height is reached. This permits a small amount of liquid to pass through the injector and then into the chilling unit causing forced circulation of the liquid refrigerant. In the chilling unit the liquid refrigerant evaporates and absorbs heat due to the reduction in pressure caused by the suction of the pump. The repetition of this action gives a continuous cycle of refrigeration and thus cools the interior of the cabinet and freezes water in the ice freezing trays.

Note: Model ***HE-4A*** and ***E-5*** refrigerators use **CM-1** and **CM-2** refrigerating machines respectively. The compressor on these machines is of the Scotch Yoke reciprocating type. Model ***HE-4A*** and ***E-5*** refrigerators are not included in the foregoing description. However, full data and adjustments on the cabinets and refrigerating machines are given in this manual.

Product Data on CB-1 CB-2 and CB-3
Refrigerating machines

(Picture is missing)

Rotary
Belt-driven

sits on top
of machine

Specifications

USED IN REFRIGERATOR MODEL	CB-1 HE-4B	CB-2 HE-5A	CB-3 HE-7A
Motor			
Voltage	110	110	110
Cycles	60	60	60
Speed, R.P.M. (Full Load)	1725	1725	1725
Amperes (100° F. Room, 20° F. Brine)	3.0	3.0	3.0
Watts (100° F. Room, 20° F. Brine)	270	270	270
Starting current, amperes, (Locked Rotor)	15	15	15
Horsepower	⅛	⅛	⅛
Compressor			
Speed, R.P.M.	625	625	625
Displacement, cu. in.	1.93	1.93	1.93
Head pressure, lbs. per sq. in. gauge (100° F. Room, 20° F. Brine)	115	115	115
Suction pressure, lbs. per sq. in. gauge (100° F. Room, 20° F. Brine)	0	0	0
Machine			
Capacity, B.t.u./hr. (100° F. Room, 20° F. Brine)	600	600	600
Equivalent ice melting, lbs. per 24 hrs.	100	100	100
Air circulation, cu. ft. per min.	125	125	125
Temperature range of chilling unit (80° F. room performance, thermometer on bottom of chilling unit):			
Temperature knob in position 1, ° F. (warmest)	19–25	19–25	19–25
Temperature knob in position 5, ° F. (normal)	13–19	13–19	13–19
Temperature knob in position 9, ° F. (coldest)	7–13	7–13	7–13
Total number of ice cubes	40	60	60
Total weight of ice cubes, lbs.	4½	6¾	7½
Weight of sulphur dioxide, lbs.	2	2¼	2½
Weight of machine, crated, lbs.	136	141	151
Weight of machine, uncrated, lbs.	113	118	129

Replacement Parts for
CB-1 CB-2 and CB-3
Refrigerating machines

2	230	D.C.	5BC46A434	.....	—	4215344	C5A7	C5A6	C4A4	58X65 58X66	M1A48 M1A49

* Non-defrosting control. For replacement, order new (§) Cat. No. control and specify for CB machine.

▲ Also uses contactor CR-2800-1112 EV3.

† Use 5KC45AB52 for replacement. If motor end spring supports have 20 turns, replace same with spring supports, Cat. No. C20A58.

‡ Use 5KC49BB42 for replacement.

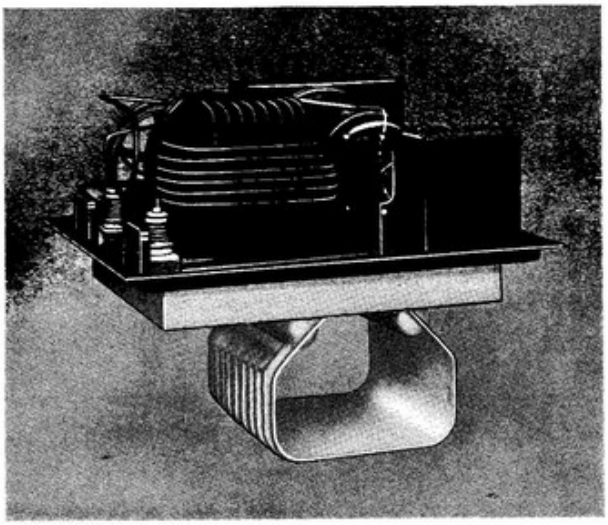
— Indicate that motor and capacitor, or motor and wave filter, are not separable.

§ New control which should be ordered for replacing a (□) control.

Part	Cat. No.	Part	Cat. No.
Bellows tube clamp	C20A54	Shaft seal oil retainer	C20A93
Screw for C20A54 (2 required)	C20A57	Shaft seal oil retainer cap	C20A94
Control temperature adjusting knob with screw and seal	58X142	Shaft seal oil retainer cap screw	223877
Textolite seal for 58X142 knob	58X192	*Elbow, compressor outlet, (required with C21A6 only)	C17A69
Metallic bellows for temperature control; with plate, nut and clamp	58X222	*Elbow, compressor inlet (required with C21A6 only)	C17A70
Compressor	C21A22	Nut for compressor pulley	281387
Connecting cable for control (32 V. DC only)	C20A63	Key for compressor pulley	168039
Connecting cable for contactor (32 V. DC only)	C20A64	Key for motor pulley	4218787
Escutcheon plate (defrost)	NP-57755	Set screw for motor pulley	58X203
Escutcheon plate (non-defrost)	NP-57712	Lockwasher for compressor pulley	63X865
Screw for escutcheon plate	11X909	Spring support (with stud and nuts) compressor end	C20A4
Locking connector for control	58X15	Spring support (with stud and nuts) motor end	C20A58
Overload heater, 4.2 amps. (110 V., 60 cycle)	4961092Pt21	Adapter for air duct (CB-3 machines only)	C13A44
*Shaft seal assembly for C21A6 and C21A22	C16A34	Tuned flywheel	C5A50
Shaft seal clamping plate, inner	C16A36	Tuned flywheel set, for 60 cycle and DC units (one C5A50, one C5A7 and two C20A58)	A1A23
Shaft seal clamping plate, outer	C16A35	Tuned flywheel set, for 50 and 25 cycle units (one C5A50, one C5A10 and two C20A58)	A1A24
Gasket for C16A34	C11A22		
*Screw for C16A34 (on C21A22 only)	C20A30		
*Screw for C16A34 (on C21A6 only)	C20A95		

* Note: Renewal compressor Cat. No. C21A22 should always be ordered; however, when this compressor is not available, compressor Cat. No. C21A6 with elbows, Cat. No. C17A69 and C17A70 may be furnished instead.

Product Data on CM-1 and CM-2 Refrigerating Machines



SPECIFICATIONS

REFRIGERATING MACHINE TYPE	CM-1	CM-2
USED IN REFRIGERATOR MODEL	HE-4A	E-5
Motor		
Voltage	110	110
Cycles	60	60
Speed, R.P.M. (Full Load)	1725	1725
Amperes (100° F. Room, 20° F. Brine)	2.5	2.5
Watts (100° F. Room, 20° F. Brine)	215	215
Starting current, amperes, (Locked Rotor)	18	18
Horsepower	⅙	⅙
Compressor		
Speed, R.P.M.	930	930
Displacement, cu. in.	1.15	1.15
Head pressure, lbs. per sq. in. gauge (100° F. Room, 20° F. Brine)	115	115
Suction pressure, lbs. per sq. in. gauge (100° F. Room, 20° F. Brine)	0	0
Machine		
Capacity, B.t.u./hr. (100° F. Room, 20° F. Brine)	450	450
Equivalent ice melting, lbs. per 24 hrs.	75	75
Air circulation, cu. ft. per min.	85	85
Temperature range of chilling unit (80° F. room performance, thermometer on bottom of chilling unit):		
Temperature knob in position 1, ° F. (warmest)	19–25	19–25
Temperature knob in position 5, ° F. (normal)	13–19	13–19
Temperature knob in position 9, ° F. (coldest)	7–13	7–13
Total number of ice cubes	40	40
Total weight of ice cubes, lbs.	4½	4½
Weight of sulphur dioxide, lbs.	2½	2½
Weight of machine, crated, lbs.	160	170
Weight of machine, uncrated, lbs.	132	140

Replacement Parts for CM-1 and CM-2 Refrigerating Machines

Note: CM-1—Model A
CM-2—Models A, B and C (inclusive)

Form No.	Power Supply V	F	Motor Complete	Capacitor	Motor Only	Motor Brush	Motor Pulley	Compressor Pulley	Belt	*Control □	▲
16	110	60	5KC45AA542	9AC250N	C2A2	.....	C5A1	C5A2	C4A1	11X988	M1A55
			5KC45AA617	9AC250Q	C2A2	.....	C5A1	C5A2	C4A1	11X988	M1A55
15	110	50	5KC45AA615	9AC249M	C2B4	.....	C5A1	C5A5	C4A2	11X988	M1A55
14	110	40	5KC47AA114	9AC174E	C2A3	.....	C5A4	C5A3	C4A3	11X988	M1A55
12	110	25	†5KC49BA392	9AC253E	C2A8	.....	C5A1	C5A5	C4A2	11X988	M1A55
1	115	D.C.	§‡5BC46A391	.....	C2A4	4215344	C5A1	C5A2	C4A1	58X3	M1A42
2	230	D.C.	§5BC46A381	.....	C2A7	4215344	C5A1	C5A2	C4A1	58X4	M1A43

* Note: Controls are non-defrosting. For replacement, order new (▲) Cat. No. control and specify for CM machine.

† Use 5KC49BB42 for replacement.

‡ First fifty CM-2-C1 machines were built with motor 5BC46A379 with separately mounted wave filter 9CY20A.

§ Uses separable wave filter 9CY20B.

▲ New control which should be ordered for replacing a (□) control.

Part	Cat. No.	Part	Cat. No.
Bellows tube clamp	C20A55	Escutcheon plate (non-defrost)	NP-56927
Bellows tube clamp screw (2 required)	C20A56	Locking connector for control	58X15
Control temperature adjusting knob with screw and seal	58X142	Overload heater, 4.2 Amps. for 11X988 control	4961092Pt21
Textolite seal for 58X142 knob	58X192	Screw for escutcheon plate	11X909
Metallic bellows for control; with plate, nut, and clamp	58X222	Spring support assembly (complete with stud, nut and rubber bushing)	C15A31
Compressor pulley, grooved, for 60 cycle and D.C. units	C5A560		

Uncrating, Inspection and Installation

MACHINE

Uncrating

Remove the cover from the shipping crate. Lift the machine from the crate using the handles provided at either end of the top section. (Cat. No. C20A3 lifting eyebolts are used in handling CM-1 machines.)

Inspection

After the machine is uncrated examine it carefully for damage during shipment. If damage is found, examine the crate and as nearly as possible ascertain the reason for the damage and note it on the report. Check to see that the movable parts do not strike other parts.

All machines have their motors well oiled at the factory before shipment. However, a careful service man will protect against the remote chance of having an insufficient supply of oil by adding a few drops of a good grade of medium lubricating oil to each motor bearing before installing the machine.

CABINET

Uncrating

A reasonable amount of care should be used in removing the cabinet from the crate. An examination of the crate will generally indicate the best method to use. The cabinet will usually be easily removable by pulling the nails in the rear of the crate. The cabinet will then slide out, after which the packing collars are removed. After the cabinet is uncrated remove the accessory carton from the interior of the cabinet.

Inspection

Examine the cabinet for the following:

1. Fit of shelves.
2. Chips or mars on interior or exterior finish.
3. Condition of seal around box top opening.
4. Operation of door latch.

INSTALLATION

Prepare the cabinet for assembling with the machine as follows:

1. Remove lid.
2. Remove rear top angle.
3. Remove four self-tapping screws from rear of cabinet.
4. Remove escutcheon plate and screws from front of cabinet.
5. See that the sponge rubber gaskets are in place adjacent to the unit opening of the inner liner and top of the cabinet. Examine the No-Ox-Id cloth seal around the box top opening of the cabinet. If the cloth is loose at any point, iron it down with a piece of wood.

Prepare the machine for assembly to the cabinet as follows:

1. Remove two screws holding control panel to support.
2. Remove two cap screws holding mounting brackets to top section. Cat. No. A18X6 special ½-inch foot wrench will be found very useful in removing these screws.
3. Remove the wooden spacing blocks from between the motor supporting angles and the top section, on the motor end, on those machines shipped with such supports.

Assemble the machine to cabinet from rear using the handles on either end of the top section. If it is more convenient, Cat. No. 11X384 portable lifter with special hooks to engage the handles on the top section may be used for installing the machine. Locate the box top of the machine centrally in the box top opening. *Check the seal of both sponge rubber gaskets.* The upper gasket is most important and must be made tight.

Assemble the temperature control to the front of the cabinet by passing the two knobs through the opening. Secure the escutcheon plate to the cabinet and in correct position, using the two screws which have been previously removed. *The plate should not bind against the control knobs.*

The sound absorbing material should now be inspected to see that it is held against the sides of the machine enclosure.

Assembly may now be completed as follows:

1. On CB-3 machines, assemble air duct adapter to condenser. This adapter will be found in the shipping crate of the type CB-3 but not in the type CB-1 and CB-2 crates. Assemble by using the self-tapping screws which will be found in the side panels of the CB-3 condenser.
2. Assemble rear ventilating duct by using the four self-tapping screws previously removed from rear of cabinet. The motor cord should be threaded through the intake side of the duct. Make sure that the duct is properly assembled to the cabinet.
3. Inspect incoming air path to insure all air passing through the condenser will be drawn into the bottom of the ventilating duct.
4. Be sure that tubes and moving parts do not strike stationary parts while the machine is starting, running or stopping. On machines not shipped with wooden spacing blocks between the motor supporting angles and the top section on the motor end, adjust the mounting springs before the unit is started so that there is ⅜-inch clearance between the mounting angles and the top section.
5. Assemble cabinet top.

Accessories which are found in the accessory carton should now be installed and the refrigerator cabinet placed in location, making sure that the cabinet is level and that the load is equally distributed on all four legs. The cabinet should not be set against a wall or anything else.

Caution: There should be a clearance of at least 2 inches on all sides and over the top of the cabinet in order to insure proper ventilation of the refrigerating machine.

Electrical connections should be made to an adjacent convenience outlet using the cord attached to the motor and which has been previously threaded through the incoming air duct. The power supply voltage and frequency must agree with that which is stamped on the nameplate of the machine.

Start the machine by turning the temperature control switch to the "on" position. Check to see that the unit operates normally. Set the temperature control knob at position 5 for normal service.

Instruct the user as to the use and care of his refrigerator as discussed on page 13.

Use and Care of the Refrigerator

The General Electric refrigerator is designed to satisfy all normal refrigeration requirements with a minimum amount of attention on the part of the user. A few instructions on the use and care of the refrigerator will assist the user in obtaining the most satisfactory service from it. The user should be instructed regarding these points at the time the refrigerator is installed.

Cleaning the Interior

Directly after installation and previous to the time the machine is started, it is recommended that the user carefully clean the interior of the cabinet, the chilling unit, ice trays, chiller tray, and food containers.

For cleaning the interior of the cabinet and the chilling unit, a solution of baking soda in warm water should be used. A satisfactory solution can be made up of one tablespoonful of baking soda in four quarts of water.

Caution: Never clean the interior of the cabinet or the chilling unit with any cleaning agent which has an odor.

Caution: When washing the chiller tray, do not use hot water. Hot water may cause breakage.

It is suggested that the interior of the cabinet and the chilling unit be cleaned each time the chilling unit is defrosted.

Cleaning the Exterior

Use only Ivory soap and warm water or General Electric Liquid Wax (pint can Cat. No. A20R1; gallon can Cat. No. A20R3), for cleaning the Glyptal-baked enamel exterior of the cabinet.

Caution: The use of any of the standard cleaning compounds which depend upon abrasive or alkaline action will remove the gloss from the finish on the HE type cabinets.

Cleaning the Condenser and Condensing Unit Compartment

The condenser must be inspected regularly and cleaned of dirt and lint which may restrict the flow of cooling air through it. If this is not done trouble may result due to high power consumption, low capacity or tripping out of the overload. The condenser may be made accessible by removing the ventilating duct on the back of the cabinet. Use a small, stiff bristle brush for cleaning.

Normally it should only be necessary to clean the condenser once a year, and this should be done at the time of the yearly oiling of the motor. However, if the refrigerator is located where accumulation of dust and lint builds up on the condenser rather quickly, it must be cleaned at more frequent intervals. The condensing unit compartment should also be cleaned out at the time the condenser is cleaned. Wipe off the various parts with a clean rag to remove lint and dust.

Starting the Refrigerator

To start the refrigerator after it is installed, turn the left knob on the control on the front of the machine to the "on" position. The machine should start immediately.

If the machine does not start, make sure that the electrical cord is properly attached. Also, make sure that the house fuse on the circuit into which the refrigerator is plugged is all right.

During the first few minutes after being started, the machine may be slightly noisy but as soon as it is within the normal operating condition, it will continue to operate quietly.

Stopping the Refrigerator

To stop the refrigerator, turn the left control knob to "off." If the refrigerator is to be out of service for several days or longer, remove all foods and all water from freezing trays and chiller. Leave the cabinet door ajar. Clean the interior before putting the refrigerator back into service.

Cabinet Temperature

When the refrigerator is installed, the temperature knob at the right of the control should be set at position 5. The control is set at the factory to automatically maintain a cabinet air temperature of between 38° F. and 42° F. in room temperatures between 70° F. and 80° F.

If the room temperature averages below 70° F., the cabinet air temperature may be slightly below 38° F. If this is too cold, the temperature knob can be turned counterclockwise to position 4 or 3, or even to 2 or 1.

If the room temperature averages above 80° F., the cabinet air temperature may be slightly above 42° F. If this seems too warm, the temperature knob can be turned clockwise to positions 6, 7, 8, or 9.

The temperature setting is made adjustable in order to satisfy the individual desires of the user. If it is desired to make the cabinet air colder, the temperature knob can be turned clockwise; if warmer, the knob can be turned counterclockwise.

The use of a thermometer in the cabinet is not recommended unless it be of high quality. The user will find that the refrigerator is maintaining proper temperatures if the food is preserved satisfactorily and is cold enough for the individual taste.

Distribution of Food in the Cabinet

The coldest zone in the refrigerator is within the chilling unit where the temperature is below freezing. The next warmer zone is in the chiller tray where the temperature may be just below or just above freezing. The warmest zone is in the cabinet where the temperature should range between 38° F. and 45° F.

Air circulation is necessary to insure uniform temperature distribution within the cabinet. Therefore, do not restrict the circulation by excessive crowding of food into the cabinet or by placing coverings over the shelves.

The circulation of cold air in the cabinet is from the chilling unit, around the chiller tray, down the right side of the cabinet and up the left side. It is

evident that foods with odors, which are not covered, should be placed on the left side of the cabinet near the top in order not to affect other foods.

For most satisfactory results, it is recommended that the following foods be kept in covered containers:

1. Those with strong or objectionable odors such as cantaloupes and onions.
2. Those which absorb odors readily such as butter.
3. Liquids such as milk or cream.
4. Moist foods such as mashed potatoes or creamed vegetables.
5. Fresh vegetables such as lettuce and celery.

Freezing Ice Cubes

To secure the most rapid freezing of ice cubes, be sure that the ice trays make good contact with the chilling unit freezing surfaces. A quarter cup of warm water spread evenly over the freezing surface will serve to level any unevenness in the frost covering the surface.

Fast freezing can be obtained by turning the temperature knob at the right of the control to position 9, the coldest setting. When the ice is frozen, the temperature knob must be returned to the normal position. Otherwise, the cabinet air temperature may be reduced to a point where freezing of food will result.

To remove an aluminum ice tray when frozen use the tray lifter, or loosen with an upward push directed against the upper rim of the tray. Do not use an ice pick or other sharp instrument.

Note: If difficulty is experienced in removing freezing trays from the lower shelf of an HE-5 chilling unit, replace with trays Cat. No. A5A1.

To remove ice cubes from an aluminum tray with a minimum loss of ice, allow cold water from the faucet to run on the bottom of the tray until the cubes fall out. An alternate method is to immerse the ice tray in a pan of cold water.

Defrosting

Frost will collect on the chilling unit at a rate depending on the humidity of the air entering the cabinet at times when the door is opened and on the amount of uncovered liquid or moist foods in the cabinet. It is recommended that the chilling unit be defrosted at a time when this accumulation is approximately one-half inch thick or when the accumulation interferes with the removal of ice trays. It is suggested that defrosting take place at least once a month at which time the interior of the cabinet and the chilling unit should be cleaned.

1. Machines Equipped with Defrosting Controls

To defrost the refrigerator, the control knob on the left of the control should be turned counterclockwise to the position marked "defrost." The machine will automatically proceed to operate on a defrosting cycle, allowing the frost on the chilling unit to melt off into the chiller tray, yet not allowing the cabinet air temperature to rise more than a few degrees if the cabinet door is kept closed. When the defrosting is completed, the control knob should be returned to the "on" position.

Food stored in the chiller tray should be removed previous to defrosting. Also before defrosting, the freezing trays should be removed or else covered with the lids provided. The water in the chiller tray after the defrosting is completed should be immediately emptied.

Caution: Do not use pans of hot water in the chilling unit to hasten the defrosting. If the machine is running at the time the hot water is put in, the hot water will cause it to continue to run until the water is frozen before it shuts off and allows the chilling unit to defrost.

2. Machines Equipped with Non-defrosting Controls

Turn the control knob to "off" at night and under ordinary conditions the frost will be melted off by morning. When defrosting is completed turn the control knob to "on." This process may be speeded up if desired by filling the freezing trays with hot water.

Resetting the Motor Protective Device

A device is incorporated in the control to protect the motor in the machine in case of unusual load or power conditions. When this device operates, the motor is shut off and a red signal appears in the window on the front of the control.

To restart the machine, the control knob on the left of the control must be turned first to the "off" position and then to the "on" position. If the protective device trips immediately and will not remain set, wait a few minutes and try it again.

Lubrication

The motor bearings should be lubricated once each year with a good grade of medium lubricating oil. If the motor runs hotter than normal, due to operation in very high room temperatures or due to operation at high altitudes, it is safer although not absolutely necessary to oil the motor at more frequent intervals than once a year. In this case, semi-annual oilings are recommended. Before attempting to oil the motor bearings the control knob should be turned to the "off" position.

At the time of oiling inspect the belt for excessive wear and proper tension. Refer to "Replacement and adjustment of belt," page 28.

Also inspect and clean the condenser, inspect the door gaskets, tighten the hardware screws and check the operation of the door latch, at this time.

Motor Brushes and Commutator

The motor brushes on **DC motors** should be inspected at yearly intervals. This is best done at the time of oiling.

Any brush worn down to 3/8 inch or less in length should be replaced.

To insure proper contact between the brush and the commutator, make sure that each brush, after inspection, is replaced in its original holder in the same

position it had before removal. The brush should slide freely in the holder and there must be good contact between the brush and holder.

When new brushes are installed they must be sanded to fit the curvature of the commutator, with grade 00 sandpaper. Never use emery cloth or emery paper on brushes or commutator, as fine particles of emery will become imbedded between the commutator bars and short circuit them. When fitting brushes, either wrap a strip of sandpaper entirely around the commutator, under the brushes, and turn the armature and sandpaper by hand in the direction of rotation; or place a short strip on the commutator under a brush and rock the armature and sandpaper back and forth until the brush is properly fitted. The sandpaper must fit close to the commutator and must have the rough side in contact with the brush. The belt should be removed when turning the armature by hand.

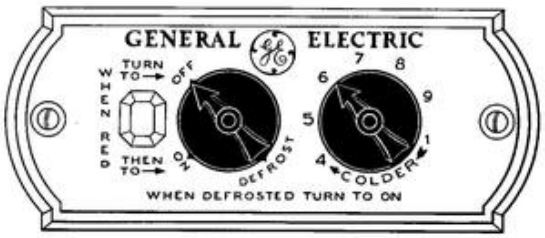
The commutator should be inspected to see that it is smooth and clean. Use a clean cloth to clean the commutator or, when necessary to remove slightly uneven or rough spots, sand it slightly, using a fine grade of sandpaper.

ADJUSTMENTS

Description of Control, and Instructions for Replacing

Control

The control is completely sealed. There are no internal adjustments that can be made. Directions for operating the control are engraved on the escutcheon plate covering the control. Further explanation of these directions and the details of what happens within the control follow.



Front View of Control and Escutcheon Plate.

The control, located in the top front center of the cabinet, contains the manual switch for turning the machine on or off, the adjustable automatic mechanism for regulating the chilling unit and cabinet temperatures, the motor protective device, and the semi-automatic defrosting device.

Note: CM machines and also first production of CB machines were equipped with controls which have all of the above features except the defrosting device.

Left Knob

The left knob on the control serves as a manual switch to turn the machine on or off, to reset the motor protective device, and to defrost the chilling unit.

Note: This knob is the top knob on controls installed vertically on HE-4A and E-5 refrigerators.

To Turn the Machine On or Off Manually

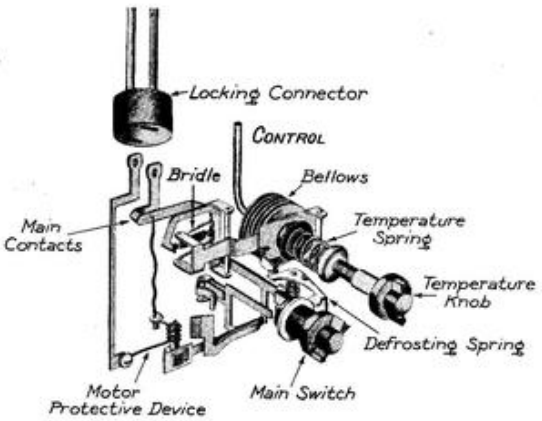
The machine is turned off when the knob points to the "off" position. The machine is turned on when the knob points to the "on" position.

When the knob is turned to the "off" position, a cam on the knob moves an extension of the arm on which the movable main contact is mounted so that the contact is opened. When the knob is turned to the "on" position, the cam releases the same arm so that the contacts may be open or closed depending on the toggle switch location which is controlled by the thermostatic bellows.

To Reset the Motor Protective Device

In case of unusual load or power conditions on the motor which cause it to draw excessive current, a protective device trips the machine off. When this protective device operates, a red signal appears in the window on the front of the control. To turn the machine on again, the manual on and off switch must be turned first to the "off" and then to the "on" position.

This motor protective device is located in series with the main contacts in the common lead to the motor. All of the current to the motor passes through a small heater coil which is wound around a stationary shaft. On the lower end of the shaft is a ratchet wheel. A film of solder holds the ratchet wheel stationary on the shaft. When excessive current passes through the heating coil, the solder is melted and the ratchet wheel turns, releasing a dog. The dog springs out and strikes the extension of the arm on which is mounted the movable main contact, opening this contact as though the external manual knob were turned to the "off" position.



View of Internal Mechanism of Control.

To reset the device and start the machine, the external knob must first be turned to the "off" position. This movement resets the dog on the ratchet wheel. The knob is then turned to the "on" position and the main contacts are closed.

To Defrost the Chilling Unit

Defrosting of the chilling unit is obtained by turning the knob to the "defrost" position. Another cam on the knob releases a spring which acts in parallel with the main temperature spring against the bellows arm. The temperature range on the chilling unit is changed from 13°–19° F. to 13°–48° F. It is evident that defrosting will take place since the chilling unit now operates on a defrosting cycle. After defrosting, the knob should be turned to the "on" position. Refer to "*Caution*" on page 14.

Note: On machines equipped with early controls of the non-defrosting type it is necessary to turn the control to "off" until the frost melts from the chilling unit. This process can be hastened by filling the freezing trays with hot water.

Right Knob

The right knob on the control allows adjustment of the temperature range of the chilling unit and the cabinet air to satisfy the desires of the user. The movement of the knob changes the compression of the main temperature spring acting against the bellows arm.

Note: This knob is the bottom knob on controls installed vertically on HE-4A and E-5 refrigerators.

The normal setting of the temperature knob is at position 5. The chilling unit temperature range, as measured in the bottom of the chilling unit, is approximately 13°–19° F. The cabinet air temperature in a room varying between 70° F. and 80° F. with a normal amount of food in the cabinet will be in the vicinity of 38° F. to 42° F.

Directions for Removing and Installing a Control

To Remove the Control

1. Loosen the screws in the clamp which holds the control tube to the chilling unit.
2. Remove and straighten the control tube under the box top.
3. Remove the locking connector to the back of the control with a slight turning motion.

   Caution: The locking connector to the back of the control cannot be removed by straight pulling. It must be turned slightly.

   Note: If the control has no locking connector, remove the cover which encloses the cord connections at the rear of the control by lifting it backward and upward. Loosen screws, remove cord from control, tighten screws and replace cover.
4. Remove screws which hold escutcheon plate and control to cabinet front.
5. Move the control toward the rear until it clears the acoustic pads and the upper edge of the enclosure.

   Remove the control by grasping it and the tube near the box top and lifting upward.

   Watch the rubber bushing in the box top bottom plate to see that it remains in its proper position.

To Install a Control

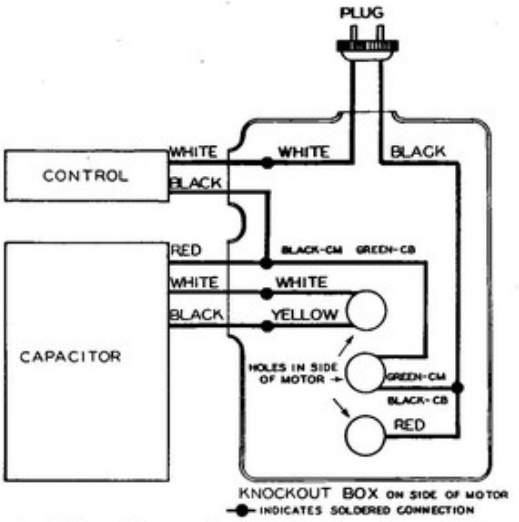
1. Reverse the foregoing procedure, making sure that the control tube is properly clamped against the chilling unit and that the rubber bushing is in place in the bottom plate.

   On some of the type CB refrigerating machines the control tube has been wrapped with tape where it passes through the top section rubber bushing. When controls are replaced on these machines the tape should be removed from the defective control tube and placed on the new control tube. This is to properly seal the hole through which the tube passes.

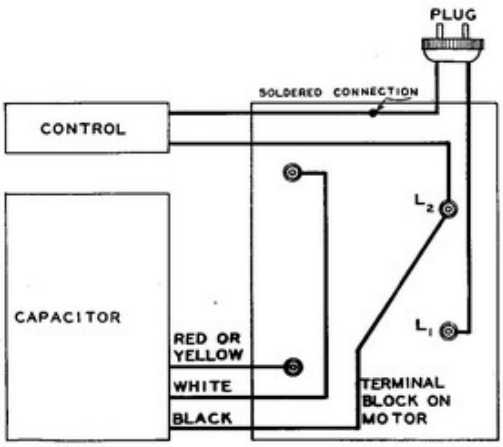
   Caution: Check to see that the control tube does not come in contact with any metal or moving parts on the refrigerating machine.
2. Check the control adjustments as directed under division A, "Improper control temperature knob setting," under Part 4, "Cabinet temperature too high," page 23.

Directions for Replacing Control Bellows

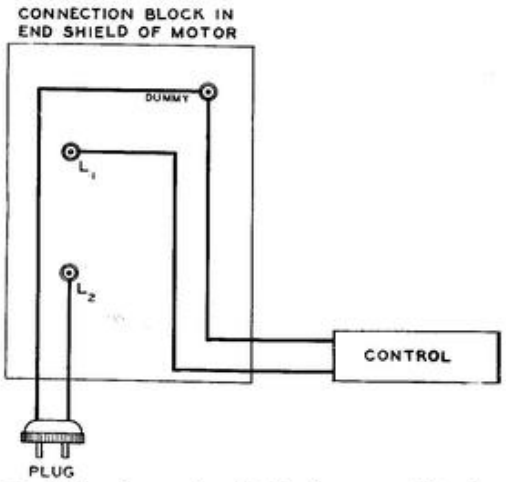
Refer to page 30 for complete directions.



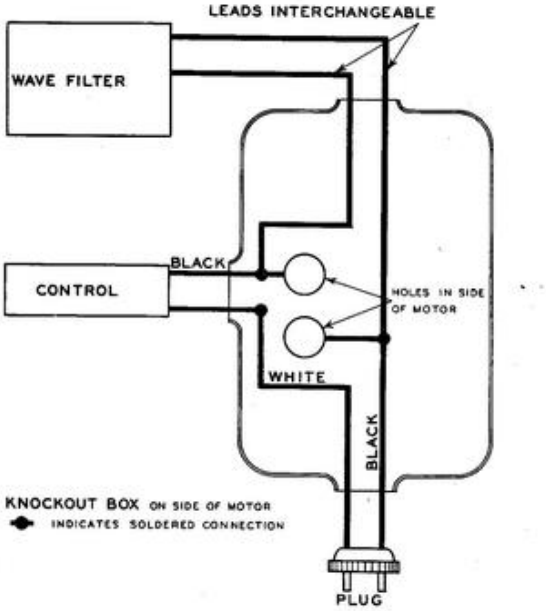
1. Wiring Diagram for AC Machines, Type CB or CM. Capacitor separately mounted—knockout box on motor. Rotation of motor CCW, pulley end for CB. Rotation of motor CW, pulley end for CM. Note that black and green leads are connected differently for CB and CM.



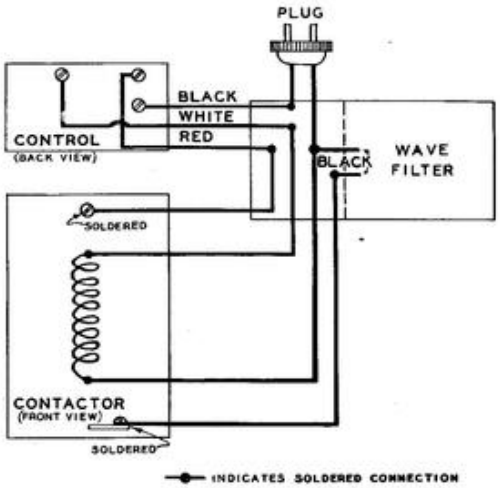
2. Wiring Diagram for AC Machines, Type CB only. Capacitor separately mounted—terminal block on motor. Rotation of motor CCW, pulley end. To reverse rotation, reverse the two leads that come from the inside of the motor and are connected to L_1 and L_2.



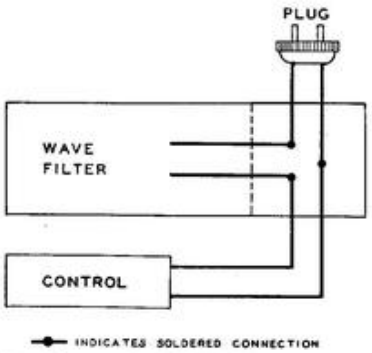
3. Wiring diagram for AC Machines, type CB only. Capacitor mounted on motor—not separable. Connection block in motor end shield. Rotation of motor CCW, pulley end. To reverse rotation, reverse the two black leads that come from the inside of the motor and are connected to L_1 and L_2.



4. Wiring Diagram for DC Machines, Type CM only. Wave filter separable—mounted separately or on motor —knockout box on motor. Rotation of motor CW, pulley end.



5. Wiring Diagram for 32V. DC Machines, Type CB only. Wave filter not separable from motor. Note: In connecting control and contactor use special connecting cables C20A63 and C20A64 respectively. Rotation of motor CCW, pulley end.



6. Wiring Diagram for DC Machines, Type CB only. Wave filter not separable from motor. Rotation of motor CCW, pulley end.

Machine Adjustments

Note: The cord plug should be removed from the convenience outlet when making electrical connections or mechanical adjustments. If power is essential for some particular test, then use adequate precautions to avoid an electrical shock.

All electrical and mechanical connections that have been loosened in the process of adjustment should be thoroughly tightened again to insure satisfactory performance.

I. Machine Will Not Start

Causes

If the machine will not start, the overload protective device in the control may, or may not, trip off when the machine is turned on.

The possible causes for the machine not starting are:

1. Improper current or voltage.
2. Open circuit.
3. Grounded circuit.
4. Short circuit.
5. Defective motor.
6. Defective capacitor.
7. Stalled compressor.

Adjustments

The source of trouble may be external to the machine or it may be in the machine itself. It is recommended that the external factors be checked first.

1. Improper Current or Voltage

The power supply voltage and frequency must agree with that which is stamped on the nameplate of the machine.

The motor is designed for operation over a voltage range of from 85% to 110% of the normal voltage rating stamped on the machine nameplate.

When the voltage at the machine at the time of starting is less than 85% of the nameplate voltage then the motor may not start and the motor protective device in the control may trip off.

When the voltage is above 110% nameplate voltage and the machine is operating under heavy load conditions, the current to the motor may be sufficient to trip the motor protective device.

Line voltage can be checked with a voltmeter or by noting a light on the same circuit for excessive dimness or brightness. If the voltage is constantly low or drops excessively during starting, notify the power company.

2. Open Circuit

A. Circuit to the Refrigerator

Check the electrical circuit to the convenience outlet by placing a series test lamp across the terminals of the outlet. If the lamp will not light, check the line fuses to see that one is not blown and needs replacing. If a line fuse is blown, check the circuit to which the machine is connected to see that the circuit is not overloaded.

Check the cord connections to the convenience outlet and to the machine to make sure that good electrical contact is obtained.

Check the connections to the control. If a locking connector is used on the control, check the connector for possible poor contact or open circuit.

One of the wires may have become disconnected in the connector.

The spring contacts in some connectors may not make contact, having lost their spring tension.

The small brass screws which hold the fiber disc over the end of the connector may project out far enough to prevent the prongs on the control from making contact with the spring contacts in the connector. Make sure that the wires in the connector are properly located in the grooves so that they do not interfere with the seating of the disc.

B. Control

If the circuit to the refrigerator is found to be all right, try a jumper wire across the control locking connector terminals or twist the control leads together. If the machine starts and runs when the machine cord is plugged into the convenience outlet, then it is evident that the control may have an open circuit. If open circuited, the control should be replaced.

Caution: Before replacing a control, make sure that the machine is not in the "off" cycle. The bellows tube can be warmed by holding the hand over it on the chilling unit.

An alternative method for testing a control for open circuit is by means of a test lamp. Place the test lamp in series with the control in an electric circuit and note whether the lamp lights when the main switch is turned to the "on" position. If the lamp does not light, there is an open circuit in the control.

An open circuit in a control may be caused by a weak bellows, open lead or connection, burned contacts, or defective toggle device. Since part replacements which disturb the operation of the control should not be made, the control must be replaced.

3. Grounded Circuit

All electrical circuits and connections are insulated from the refrigerating machine itself. If one of the electrical circuits or connections should come in direct contact with a part of the refrigerating machine, it is considered grounded.

A ground in the circuit to the refrigerator, in the control, motor or capacitor may cause blowing of the house fuses, tripping off of the motor protective device, welding of the contacts or burning off of a lead.

A series test lamp will be found necessary to locate the ground.

Caution: The machine itself must not be grounded either through the cabinet or test rack while testing for a grounded circuit; otherwise, the line to the refrigerator may be short circuited to ground.

If the machine can not be conveniently insulated from ground, a series test lamp must be used in each lead from line to the machine.

A. Circuit to the Refrigerator

A ground in the circuit to the refrigerator will cause blowing of the house fuses after the refrigerator is disconnected from the circuit.

Make sure that the ground is not in the cord connector or plug. Look for evidence of arcing. Also, watch for indications of moisture and dirt.

B. Control

Replace the control with a new one. If the machine starts and runs satisfactorily, there may have been a ground in the original control.

Caution: If the ground is in the motor or capacitor, the motor protective device may trip off, the main contacts may weld or a lead may be burned off in the new control.

A grounded control can be very easily checked with an electric circuit and a series test lamp. First turn the control to "on." Then connect one side of the electric circuit to one terminal of the control. Connect one lead from the series test lamp to the other side of the electric circuit. Touch the other lead of the test lamp to the bellows tube. If the lamp lights, there is a ground in the control.

Caution: The control or bellows tube must not be grounded while testing for a grounded circuit; otherwise, the testing voltage may be short circuited to ground.

C. Motor or Capacitor

Examine the connections at the motor terminal block for evidences of arcing. Also look for indications of moisture and dirt.

Test motor and capacitor for grounds by disconnecting and checking with a series test lamp. Observe the "*Caution*" immediately after Part 3, "Grounded circuit" on page 19.

4. Short Circuit

A short circuit occurs when two circuits or connections come in contact with each other. All electrical circuits or connections are insulated from each other in the machine.

A short in the circuit to the refrigerator may cause blowing of the house fuses.

A short circuit in the motor or capacitor may cause blowing of the house fuses, tripping of the motor protective device, welding or burning the control contacts, or burning off of a lead.

Make sure that the short is not in the connector to the control. Examine all connections for evidence of arcing; also, indications of moisture and dirt.

If a short-circuited spot is found, eliminate it if possible by taping or otherwise insulating it.

A short circuit in the control will cause the machine to run all the time even when the switch is turned to the "off" position.

Replace the control.

5. Defective Motor

If the motor does not run with the belt removed from the pulley, although the connections are in good condition and the voltage is correct, a check should be made to determine whether the motor or capacitor (if separately mounted) is at fault. Where the capacitor is not separately mounted but is mounted on the motor frame as shown in wiring diagram 3, page 18, the motor and capacitor are not separable. In this case the complete motor must be replaced, if it will not run.

If the motor has a separately mounted capacitor, the motor may be checked by disconnecting the capacitor from the motor and connecting a capacitor which is known to be good.

If the motor will not run with the new capacitor, then the motor is defective and should be replaced. Refer to wiring diagrams 1 and 2 on page 17.

6. Defective Capacitor

The capacitor, if separately mounted and therefore separable from the motor, may be checked, using the same procedure as in Part 5, "Defective Motor."

If the motor runs satisfactorily with the new capacitor, then the old capacitor is defective and should be replaced.

7. Stalled Compressor

Possibly a rare case may be encountered where the compressor is completely or partially stalled. The motor is overloaded and as a result, the overload device in the control trips off in order to protect the motor.

Remove the belt from the compressor pulley and try turning the pulley by hand. If it turns excessively hard, then the compressor is defective. In case of doubt, compare the compressor with one which is known to be good.

The compressor may, in certain cases, be replaced as outlined under "Replacement of compressor," on page 28. Otherwise it will be necessary to replace the refrigerating machine.

II. Machine Will Not Run

Causes

The machine will start but will not continue to run and will trip off on account of the following causes:

1. Improper current or voltage.
2. Defective motor.
3. Defective capacitor.
4. Partially stalled compressor.
5. Belt too tight.
6. Non-condensable gas.
7. Improper control overload.
8. Improper ventilation.

Adjustments

The first four sources of trouble listed above were covered under Section I, "Machine Will Not Start."

5. Belt Too Tight

If the belt is too tight, an excessive load will be thrown on the motor.

Check the belt tension. A force of about ten pounds exerted midway between the compressor and motor pulleys should depress the belt about ½".

If the belt is too tight, correct it by loosening the compressor on CB machines, or the motor on CM machines, to obtain the proper belt tension. Tighten down the compressor or motor again. Make sure that the motor and compressor pulleys are properly lined up by checking with a straightedge.

6. Non-Condensable Gas

The collection of non-condensable gas (or air) in the float valve may increase the head pressure sufficiently to overload the motor and cause the motor protective device to trip off. The temperature of the float valve is relatively cool to that of the upper part of the condenser, and feels cooler to the hand.

The remedy for this condition is to purge the machine at the float valve using Cat. No. 11X122 purging wrench. Before purging, run the machine long enough to warm it up. Then merely crack the purging screw in the float valve a few seconds until the odor of SO_2 is detected. After purging, securely tighten the purging screw and test it for an SO_2 leak.

One method of testing for an SO_2 leak at the purging screw is to hold an open bottle of ammonium hydroxide (28% solution) near the purging screw. A leak will be indicated by a cloudy white vapor.

Another method is to put a few drops of oil over the screw and look for bubbles of gas escaping through the oil.

7. Improper Control Overload

On first CB-1, 2 and 3, 110-volt, 60-cycle machines a 3.8 ampere overload heater coil was used in the control to furnish exceptional overload protection for the motor. It has been found that under high ambient temperatures and somewhat restricted ventilation conditions the 3.8 ampere heater furnishes too fine an overload protection for the motor and causes tripping of the overload device in the control.

Later production machines of this type are equipped with a 4.2 ampere heater in the control. The ampere rating of the overload heater is plainly stamped on the control. Except where the cabinet is located so that ventilation is badly restricted, overload tripping should not occur.

Where tripping is encountered with 3.8 ampere heaters, they should be replaced with 4.2 ampere heaters. To do this, remove the small round seal at practically the center of the long side of the control, using a sharp instrument such as a knife, awl or chisel to gouge out the seal. Remove the screw under the seal and lift off the control cover. Remove the heater coil found at the front left corner by first removing the top holding screw and holding the upper end of the coil with small pliers while the bottom screw is removed. The coil and bottom screw may now be easily lifted out. Install the 4.2 heater by reversing the above operations and put the cover in place.

In order to comply with underwriters' requirements when the heavier size overload heater coil is substituted, it is necessary to change the heater ampere rating stamped on the exterior of the control. This can be done by scratching off the original rating with a sharp instrument, and scratching in the new rating directly under the location of the old rating.

If the cabinet is located in a corner and is not supplied with the latest type ventilating duct on which the top of the duct is open on the exhaust side, then it is also necessary to open the top of the ventilating duct as described under "Improper Ventilation."

8. Improper Ventilation

The refrigerator should be located so that there is a clearance of at least 2 inches on all sides and over the top of the cabinet in order to insure proper ventilation of the refrigerating machine. If the cabinet is located in a corner and has the early type of ventilating duct where the exhaust air is blown downward, trouble may be had from overheating and tripping off of the machine.

In such cases it is advisable to open the top of the ventilating duct on the exhaust side. On cabinets used with CB type refrigerating machines, the exhaust side is on the right-hand side looking at the front of the cabinet. A hack saw may be used in making the opening. Remove the duct from the cabinet and saw into the upper right-hand corner until the acoustic insulation is encountered. Also saw into this duct near and on the right-hand side of the partition. Bend the sawed out portions outward in a straight line and saw off, after which the edge should be bent inward. Mount the duct on the cabinet.

Where tripping is encountered with a 4.2 ampere heater originally furnished with a 110-volt 60-cycle machine, correction of the ventilating duct as described should be resorted to. Present cabinet production now employs the use of the top opened exhaust duct.

Remove the ventilating duct and check the condenser to see that it is not clogged up with dirt and lint. Clean the condenser with a small, stiff bristle brush.

III. Unsatisfactory Refrigeration (Machine runs all right)

Symptoms

The refrigerating machine may have one or more of the following symptoms:

1. No refrigeration (chilling unit does not cool).
2. Low refrigeration (chilling unit cools only partially or not at all).
3. Erratic refrigeration (chilling unit frosts at times, not at other times).
4. Cabinet temperature too high (chilling unit frosts satisfactorily).
5. Cabinet temperature too low (chilling unit frosts satisfactorily).
6. Unsatisfactory ice freezing (chilling unit frosts satisfactorily).
7. High per cent running time.
8. High power consumption.

Adjustments

Unsatisfactory refrigeration may result from factors external to the machine or from trouble within the machine. The machine is assumed to run all right, otherwise it would be classified in Section I, "Machine Will Not Start," or in Section II, "Machine Will Not Run." The frosting of the chilling unit is usually an indication of whether the fault is in the machine or elsewhere.

Caution: In checking a refrigerator for unsatisfactory refrigeration, make sure that the machine has operated for a period of time sufficient to bring normal operating conditions, if the machine were operating properly.

1. No Refrigeration (Chilling unit does not cool)

If the chilling unit does not cool at all, yet the machine runs all right, the trouble is in the machine. Possible causes include:

A. No refrigerant in machine.
B. Non-condensable gas.
C. Float valve stuck closed.
D. Float valve stuck open.
E. Belt slipping or off pulleys.
F. Check valve stuck closed.
G. Defective compressor.

A. No Refrigerant in Machine

If there is no refrigerant in the machine, the condenser will not warm up even after the machine has been run fifteen minutes or more. The compressor case may be slightly warm. The machine runs continuously. If the purging screw in the float valve is cracked slightly open with Cat. No. 11X122 purging wrench, there will be no indication of high pressure SO_2 gas escaping.

Examine the machine for a gas leak and correct it if possible. Refer to Section V, "Leaks" on page 26.

If the gas leak can be corrected, than add gas to the machine by means of the Monitor Test equipment as described under "Adding Refrigerant," on page 30.

Note: If there is a low charge of refrigerant in a machine, unequal frosting of the lower sides of the chilling unit will occur.

B. Non-Condensable Gas

Non-condensable gas may stop the float valve operation so that refrigerant is not returned to the chilling unit. The refrigeration will drop off and eventually stop. The temperature of the float valve is relatively cool to that of the upper part of the condenser, and feels cooler to the hand.

Rid the machine of non-condensable gas by purging as described in Section II, Part 6, "Non-condensable gas," page 21.

C. Float Valve Stuck Closed

If the float valve is stuck closed, the circulation of refrigerant to the chilling unit will be stopped. Refrigeration will drop off and eventually stop. The possible reasons for the trouble include: corrosion, mechanical binding, plugged orifice and float bulb filled with liquid. In many cases, the trouble is of a minor nature and can be cured easily and permanently. In a few cases, the trouble is of a more serious nature and cannot be cured, or if cured, will remain so only temporarily.

The float valve temperature is relatively cool to that of the upper part of the condenser, and feels cooler to the hand.

Use magnetic float valve lifter, Cat. No. 58X36, to free the float. Tapping the float valve shell with a rubber mallet may also be effective in freeing the float.

D. Float Valve Stuck Open

If the float valve is stuck open, gas refrigerant from the condenser is returned directly into the chilling unit. There will be little or no refrigeration in the chilling unit. The float valve temperature will be warm and equal to that of the condenser. A slight hissing noise may be heard as the refrigerant passes through the float valve orifice.

Use the magnetic float valve lifter or try tapping on the float valve shell with a rubber mallet.

E. Belt Slipping or off Pulleys

Check the performance of the belt. If the belt is running off the pulleys, align the pulleys. If the belt is slipping, adjust it to obtain proper tension. Refer to "Replacement and adjustment of belt," page 28.

F. Check Valve Stuck Closed

If the check valve is stuck closed, the chilling unit is closed off from the compressor. No refrigerant will pass through the compressor. The condenser will not warm up appreciably even after the machine has been run for fifteen minutes or more. The compressor case may be slightly warm.

Run the machine with pans of hot water in the chilling unit to build up pressure which will tend to blow open the check valve.

Caution: Do not put a heater in the chilling unit.

Jarring the check valve with the hand may free it.

G. Defective Compressor

By the process of elimination the compressor is probably defective if no refrigeration is not found to be due to the preceding causes.

If the compressor is defective, either replace the machine or replace the compressor, using the pinch-off tools. Refer to "Replacement of compressor," page 28.

2. Low Refrigeration (Chilling unit cools only partially or not at all)

Most of the causes listed under "no refrigeration" bring about "low refrigeration" when found in an earlier stage or when present in a lesser degree. Refer to the corresponding parts under "no refrigeration."

A. Low refrigerant charge in machine.
B. Non-condensable gas.
C. Float valve stuck closed.
D. Float valve stuck open.
E. Belt slipping.
F. Defective compressor.

In addition there are three other conditions which may cause "low refrigeration":

H. Check valve stuck open or leaks badly.
I. Improper ventilation.
J. Partially weak bellows in control.

H. Check Valve Stuck Open or Leaks Badly

If the check valve is stuck open or if it leaks badly, some refrigerant vapor and oil from the compressor flows back into the chilling unit when the machine shuts off. The liquid refrigerant in the chilling unit is warmed up and the machine starts up again in a shorter time than it normally would.

The "off" period will be abnormally short. Let the machine run continuously with pans of hot water in the chilling unit and with the exhaust duct partly blocked in order to increase the head pressure. Then shut off the machine. The higher pressure will tend to loosen the check valve if it is stuck open. The flushing through of the check valve with a large amount of refrigerant from the boiling in the chilling unit caused by placing pans of hot water in the chilling unit will tend to force out any small particles of dirt or other foreign matter.

Caution: Do not put a heater in the chilling unit.

Jarring the check valve with the hand may dislodge the valve or the particle of dirt or foreign material holding it open.

I. Improper Ventilation

Improper ventilation will cause the machine to run hotter and consequently will reduce the efficiency and capacity of the machine. Refer to Part 8 "Improper ventilation" under "Machine will not run," page 21.

J. Partially Weak Bellows in Control

A partially weak bellows in the control can cause a machine to operate on a defrosting cycle. Normally, the gas pressure within the bellows follows the pressure-temperature curve of a saturated vapor. Throughout the normal operating range there is some liquid present in the end of the bellows tube.

If there is a minute leak in the bellows or bellows tube, there will come a time when there will be liquid present at the lower end of the temperature range but not at the upper end. The gas pressure will then follow the curve of a super-heated vapor. The pressure in the bellows for a given temperature will be less than it would be if the gas were a saturated vapor. Therefore, the chilling unit temperature must rise higher than it normally would to trip the machine on. The tripping-on temperature may be above 32° F. so that the chilling unit will defrost during the "off" part of the cycle. Replace the control or control bellows. See pages 17 and 30. Be sure that the trouble was not due to the old control being turned to the defrost position.

3. Erratic Refrigeration (Chilling unit frosts at times, not at other times)

When a cause of no and low refrigeration appears and disappears at intervals, erratic refrigeration results. At one time the refrigeration will be normal, at another time there will be little or none. To check the machine when operating normally will reveal no trouble. It must be checked during the period when the refrigeration is low. Then refer to the causes listed under "No refrigeration" and "Low refrigeration."

4. Cabinet Temperature too High (Chilling unit frosts satisfactorily)

Since the chilling unit frosts all right, the trouble is probably not in the machine itself. Possible causes include:

A. Improper control temperature knob setting.
B. Partially weak bellows in control.
C. Improper ventilation.
D. Restricted air circulation in cabinet.
E. Excessive door or cabinet top gasket leakage.
F. Excessively high room temperature.
G. Excessive loading of cabinet.
H. Excessive cabinet door opening.

A. Improper Control Temperature Knob Setting

The cabinet temperature depends to a certain extent on the control temperature knob setting. This setting is made adjustable in order to satisfy the individual desires of the user. If it is desired to make the cabinet air colder, the knob is turned clockwise; if warmer, it is turned counterclockwise.

To illustrate the point, the following table gives approximate chilling unit and cabinet temperatures during normal performance in an 80° F. room without food or ice freezing load:

Temperature knob position	Machine trips	Chill. unit bottom temp., °F.	Cab. air temp., °F.
1	on	25	42
	off	19	
5 (normal)	on	19	38
	off	13	
9	on	13	34
	off	7	

If the desirable temperature cannot be obtained with the amount of adjustment obtainable with the temperature knob, remove the Textolite seal in the center of the knob. The small screw under the seal can be removed and the knob reset. Shift the knob clockwise for warmer and counterclockwise for colder. Be sure to replace the seal since the temperature knob screw is electrically alive.

Caution: Do not reset the knob more than two complete turns warmer, or the stop against which the main temperature spring bears will run off the thread on the shaft and the control will have to be replaced. Also do not push inward on the spindle to which the knob is attached. If the spindle is pushed inward when the knob is loosened or removed from it, a small horseshoe-shaped bearing piece may fall out and ruin the temperature adjusting mechanism.

The temperature setting of the control can be checked by running the machine and observing the cut-off and cut-on temperatures as registered by a thermometer lying on the bottom of the chilling unit. With the control knob in position 5, the temperature range should be about 13°–19° F.

B. Partially Weak Bellows in Control

A partially weak bellows in the control may raise the upper temperature limit of the chilling unit so that the average chilling unit temperature is considerably above normal. A higher cabinet air temperature will result. Refer to division J "Partially weak bellows in control" under "Low refrigeration."

C. Improper Ventilation

Improper ventilation will cause the machine to run hotter and will consequently reduce the efficiency and capacity of the machine. Refer to Part 8 "Improper ventilation" under "Machine will not run," page 21.

D. Restricted Air Circulation in Cabinet

Air circulation is necessary to insure uniform temperature distribution in the cabinet. If the air circulation is restricted by excessive crowding of food or by placing coverings over the shelves, the cabinet air temperature in places will be higher than it should be.

E. Excessive Door or Cabinet Top Gasket Leakage

If the door or cabinet top gaskets do not seal properly, warm air will leak into the cabinet and increase the cabinet air temperature.

Test the door gasket seal by placing a piece of paper the thickness of a dollar bill (or else a .003 metal feeler) against the cabinet where the gasket seals, closing the door and then pulling out the paper. There should be tension on the paper at all points around the door. If there is not, refer to "Door seal" on page 31.

Observe the upper and lower cabinet top sponge rubber gaskets to make sure they seal properly.

F. Excessively High Room Temperature

The capacity of a refrigerating machine depends on the room temperature in which it operates. With the same control temperature knob setting, the cabinet air temperature will increase with an increase in room temperature. The following approximate figures indicate the relationship of cabinet air temperature to room temperature with the control temperature knob set at position 5, for normal operating conditions:

Room temp. °F.	Cab. air temp. °F.
60	34
80	40
100	44

G. Excessive Loading of Cabinet

The cabinet air temperature will rise when a large amount of relatively warm food is placed in the cabinet. The temperature will continue to be higher than normal until the food is cooled. If warm food is constantly being placed in the cabinet, the temperature will average somewhat above normal.

H. Excessive Cabinet Door Opening

Whenever the cabinet door is opened, warm air enters the cabinet and the temperature goes up a few degrees. If the door is left open or is opened excessively, the cabinet air temperature will stay above normal.

5. Cabinet Temperature too Low (Chilling unit frosts satisfactorily)

The machine is evidently refrigerating too much. Possible causes are:

A. Improper control temperature knob setting.
B. Excessively low room temperature.
C. Poor bellows tube contact to chilling unit.
D. Machine does not shut off.

A. Improper Control Temperature Knob Setting

Refer to division A "Improper control temperature knob setting" under Part 4 "Cabinet temperature too high," page 23.

Note: In ***high altitudes*** *the lower barometric pressures will shift the temperature range of the control lower. This may necessitate resetting the temperature control knob warmer in order not to hold too low a cabinet temperature.*

B. Excessively Low Room Temperature

Refer to division F "Excessively high room temperature" under Part 4, "Cabinet temperature too high," this page.

C. Poor Bellows Tube Contact to Chilling Unit

If the bellows tube contact to the chilling unit is poor, the chilling unit will run colder than it normally would. Adjust the clamp and bellows tube to improve the contact.

Note: A poor bellows tube contact increases the range of the control and may cause defrosting on the "off" part of the cycle.

D. Machine Does Not Shut Off

When a machine runs all the time and fails to shut off, the cause is either low refrigeration or defective control operation. In this case the fault must be in the control, since the machine is refrigerating well.

The stationary main contact in the control is mounted on the end of one of the prongs projecting through the back of the control. If the prong is sprung, the stationary main contact may be pushed inward until it touches the movable main contact even when this latter contact is in the open position. In some cases it will be possible to straighten the prong and return the stationary contact to its proper location. In other cases the control must be changed.

Other possible control defects which might cause continuous running of the machine include a weak bellows, defective bridle action and welded contacts. The control must be changed, since part replacements cannot be made.

6. Unsatisfactory Ice Freezing (Chilling unit frosts satisfactorily)

If the refrigerating machine does not show low refrigeration as covered in Part 2 or if the cabinet temperature is not too high for any of the reasons listed in Part 4, the cause for slow freezing may be one of the following:

A. Improper control temperature knob setting.
B. Poor contact of ice tray with chilling unit surface.
   a. Tray not frozen in properly.
   b. Tray bottom surface not flat.
   c. Chilling unit needs defrosting.
C. Freezing desserts.

A. Improper Control Temperature Knob Setting

For most rapid freezing, the control temperature knob setting should be turned to position 9, so that the machine will run continuously in normal room temperatures, until the freezing is completed. In this way the average chilling unit temperature will be several degrees lower than it would be if the machine operated in cycles.

Caution: When the freezing is completed, the knob should be returned to the normal position. Otherwise, the cabinet air temperature may be reduced to a point where freezing of food will result.

If the temperature range of the control doesn't seem right, check the control temperature limits as described in Part 4, division A, "Improper control knob setting." If necessary, reset the control temperature knob.

B. Poor Contact of Ice Tray with Chilling Unit Surface

The transfer of heat from the water to the chilling unit surface is accomplished largely through the contact of the ice tray with the chilling unit surface. The better the contact, the faster the freezing rate.

a. Tray Not Frozen in Properly.

If the ice tray is not frozen to the chilling unit surface, the freezing rate will be reduced. It is recommended that a small amount (quarter of a cupful) of water be spread over the chilling unit surface at the time the ice tray is put in.

b. Tray Bottom Surface Not Flat.

If the bottom surface of the ice tray is badly dented or warped, good contact cannot be obtained. The surface should be straightened or the tray replaced.

c. Chilling Unit Needs Defrosting.

If the surface of the frost on the chilling unit is uneven at the time the ice tray is put in, good contact cannot be secured. The chilling unit should be defrosted.

C. Freezing Desserts

The time required to freeze desserts depends on the constituents used. It is usually somewhat longer than the time to freeze water.

7. High Per Cent Running Time

If the per cent running time of a machine seems abnormally high and the chilling unit frosts satisfactorily, the probable cause may be found in Part 4, "Cabinet temperature too high," or Part 5, "Cabinet temperature too low."

If the per cent running time is abnormally high and the chilling unit does not frost satisfactorily, the probable cause may be found in Part 1, "No refrigeration," or Part 2, "Low refrigeration."

Be sure to inspect the condenser to see that it is not clogged with dirt and lint.

8. High Power Consumption

If the power consumption of a machine seems abnormally high, refer to Part 7, "High per cent running time."

IV. Noise

Noise may be caused by defects in the machine itself or by improper adjustment of the machine parts. If noise is encountered on a machine, examine the machine for the following:

1. Loose fan blades or pulleys.
2. Belt squeak.
3. Loose ventilating duct.
4. Vibration of machine mounting.
5. Shaft seal squeak.
6. Noisy compressor.
7. Noisy motor.
8. Radio interference.
9. Mounting spring squeak.

1. Loose Fan Blades or Pulleys

Noise may be caused by either of these conditions. Loose fan blades may be easily found by stopping the machine and checking the blades of both pulleys for tightness on their hubs. If a pulley has a loose blade, the pulley should be replaced. If a pulley is loose on its shaft, it should be corrected by tightening the nut or screw which holds it in place. For tightening the motor pulley set screw, Cat. No. A18X7 1/8" Allen set screw wrench should be used.

2. Belt Squeak

If the belt is too loose, tighten it. If the belt is properly adjusted, apply some ordinary work soap to the V surfaces of the belt by holding a bar of soap against belt when the machine is running. For CM-1 or 2 60-cycle or DC machines, the flat C5A2 compressor pulley can be replaced with a grooved C5A560 compressor pulley.

3. Loose Ventilating Duct

Noise caused by a loose ventilating duct can be corrected by tightening of the four screws which hold the duct in place. Also check the fan duct on the condenser to see that it is not loose and is in proper position so that the fan does not strike it. If the fan duct is held by only one bolt on each side, it is recommended that an additional short stove bolt and lock washer be placed on each side to keep the duct from pivoting.

4. Vibration of Machine Mounting

First check the machine mounting to see that the shipping bolts and blocks have been removed.

Vibration of the machine mounting may result in a chattering noise caused by improper adjustment of the mounting springs. Check the mounting to see that it floats freely on its four spring supports. If it does not, the nuts on the spring studs may be loosened and the springs adjusted. The tubes connecting to the compressor may be bent, thus holding the machine mounting out of position.

If the motor pulley fan strikes the condenser air duct it may be necessary to try several combinations of adjustment until the mounting plate is adjusted correctly. Also check to see that the duct is in place and not loose.

After the springs are adjusted they may be staked in place by hitting the threaded portion of the adjusting studs with a prick punch several times above the adjusting nut. On CB machines be sure that both adjusting nuts on each stud are securely tightened.

If the mounting is vibrating excessively the machine might be operating under a very heavy load or there might be non-condensable gas in the machine. Refer to Section II, Part 6, "Non-condensable gas," page 21.

An excessively tight belt might cause this trouble. Refer to "Replacement and adjustment of belt," page 28. Check the motor and compressor pulleys with a straightedge to see that they are in alignment. Run the machine to see if these pulleys run true.

On CM-2 machines only, below serial number 1553950, check to see that the strip of metal (or vibration arrestor) which is fastened to the rear of

the motor and which has an adjusting screw at other end, makes good contact with the CM compressor. Such a vibration arrestor is not used on any other models due to spring mounting the motors.

5. Shaft Seal Squeak

Shaft seal squeaking is due to an abnormal condition between the seal assembly and the compressor shaft. In most cases the condition will correct itself, especially if lubrication is applied between the seal assembly and the shaft.

The following is a method of lubricating shaft seals on CB machines only, below approximately serial number 3300000:

Turn the control to "off," remove the cabinet lid and allow the machine to cool for at least five minutes. Stand in front of the cabinet, grasp the outer edge of the compressor flywheel on opposite sides using both hands and resting the thumbs back of the elbow connections at the seal end of the compressor. Pull on the flywheel until a slight hiss is heard at the seal and a slight amount of foam is observed coming out of the seal. Wipe the oil and foam off the outside of the seal plate, shaft and box top thoroughly. The machine may then be placed in operation.

Caution: Do not pound the compressor flywheel in to lubricate the shaft seal. This may damage the compressor flywheel or shaft.

The machine should be checked after two to three days' operation. If two seal lubrications and six days of operation have not corrected the squeaking, the machine should be replaced or the compressor replaced, using the pinch-off tools.

Note: On all CM-1 and CM-2 machines, and on CB-1, CB-2, and CB-3 machines above approximately serial number 3300000 it is impossible to lubricate the shaft seal using the above method of pulling in on the compressor flywheel. If on these machines the shaft seal continues to squeak after six days of operation, either the entire machine or the compressor must be replaced. The compressor may be replaced by using the pinch-off tools. Refer to "Replacement of compressor," page 28.

6. Noisy Compressor

The compressor may be slightly noisy when it is first started up. If the compressor has a heavy pumping noise after it has been run long enough to pull down the chilling unit to normal operating temperatures, check for non-condensable gas. Refer to Section II, Part 6, "Non-condensable gas," page 21.

If the compressor continues to be excessively noisy, replace the entire machine or the compressor. Refer to "Replacement of compressor," page 28.

7. Noisy Motor

Excessive end play of the motor rotor may cause excessive vibration and thus cause noise. The rotor end play should not exceed 1/64 inch.

Replace the motor if it has noisy bearings. Refer to "Replacement of motor," page 27. Before replacing motor for this condition be sure to check the bearings to see that they are properly lubricated by adding a few drops of oil to each bearing.

8. Radio Interference

There is no radio interference during the normal running of a machine. If radio interference is traced to the refrigerator, there may be a ground or short circuit in the machine. Refer to "Grounded circuit," page 19 and "Short circuit," page 20 under Section I, "Machine will not start." Also check all connections to see that they are tight.

9. Mounting Spring Squeak

If a mounting spring squeaks, drop some oil on it.

V. Leaks

Gas leaks may be detected with a bottle of ammonium hydroxide (28% solution). The bottle should be held near the suspected location or the location may be painted with the solution. The leak will be indicated by a cloudy white vapor.

If possible, a gas leak should be corrected. After correction, check the machine for low or no refrigerant. Refer to division A, "No refrigerant," page 22.

If a gas leak is suspected, check the silver solder joints, flared joints, compressor case flange (on CM compressors), shaft seal, and float valve purging screw.

1. Silver Solder Joints

No attempt should be made to repair leaks at these joints in the field. The machine should be replaced.

2. Flared Joints and Compressor Case Flange

If leaks are encountered at these locations an attempt should be made to stop the leak by tightening the flare nut or bolts, care being used not to force them. If this does not stop the leak, replace the machine or the compressor.

3. Shaft Seal

If tightening the shaft seal screws will not correct the leak, either replace the machine or, by using the pinch-off tools, replace the compressor.

The shaft seal on an original type CB compressor cannot be replaced or repaired in the field. The entire compressor must be replaced if the seal leaks, or is noisy.

If the shaft seal leaks on a Cat. No. C21A6 or C21A22 replacement compressor, it is possible to remove the shaft seal assembly and lap the nose piece and shaft shoulder, or replace the seal assembly. Refer to "Replacement of shaft seal," page 29, for information on lapping.

It should be particularly noted that shaft seal Cat. No. C16A34 can be used only on Cat. No. C21A6 or C21A22 type CB replacement compressors. This seal will not work if it is put into one of the original type CB compressors.

Since the oil level in the compressor is above the shaft seal, the seal will probably leak oil before a gas leak at a defective seal will be noted.

A slight amount of oil at the shaft seal flange or on the box top should not be taken as a sign that the shaft seal is necessarily leaking oil. The shaft seal is lubricated on the inside of the bellows with a light grease at the factory. When first operated, a little of this grease may leak out along the compressor shaft when the machine warms up.

Also on CB machines, below approximately serial number 3300000 the compressor shaft may have been accidentally pushed in during installation of the machine, thus allowing a little oil to leak out between the sealing surfaces. It is not possible to push in the

compressor shaft on CB machines above this serial number, or on any CM machines.

If a shaft seal oil leak is suspected, the oil should be carefully wiped away from the seal flange and from the box top where it may have dripped. Then the unit should be operated over a long enough period of time to determine whether or not the shaft seal is actually leaking oil.

VI. Light Flicker

In installations where lead in wire or building wiring is of comparatively high resistance (small wire) operation of a refrigerating machine may cause flickering of lights connected to the same circuit. The flicker is produced by pulsating current originating from the frequency of machine compression impulses.

A set of pulleys is available for use on CB-1, CB-2 and CB-3 machines which will eliminate light flicker in connection with these machines. The compressor pulley is known as tuned flywheel Cat. No. C5A50 and must be used with motor pulley Cat. No. C5A7 on 60-cycle units and motor pulley C5A10 on 50-cycle units. Cat. Nos. A1A23 and A1A24 cover tuned flywheels and accessories for 60-cycle and 50-cycle units respectively.

In replacing the compressor pulley it may be necessary to use a small wheel puller. However, it will not be necessary to loosen either the compressor or the motor to change pulleys. A Cat. No. A18X7 ⅛-inch Allen set screw wrench is necessary in replacing the motor pulley. Mount the tuned flywheel on the compressor shaft with the key in place. Then tighten the nut and lock washer in place. Put on the belt and adjust its tension if necessary by shifting the compressor.

Note that C5A7 motor pulley is now used as standard on all 60-cycle and DC machines above approximately serial number 3370000. Originally this pulley was used only on CB-3 machines. Smaller pulleys were used on CB-1 and CB-2 machines below approximately serial number 3370000. Therefore only on CB-1 and CB-2 machines below approximately serial number 3370000 will it be necessary to change the motor pulley when the C5A50 tuned flywheel is installed.

If the machine has 20 turn mounting springs at the motor end, replace them with spring supports Cat. No. C20A58.

With the C5A50 tuned flywheel and the C5A7 motor pulley any trouble from light flickering caused by the operation of the machine should be eliminated. This holds true for even extreme installations where the house wiring is very poor. In case the difficulty is not corrected a careful check should be made to determine that the C5A7 motor pulley is used.

Note: If light flicker trouble is had on 50-cycle CB machines try the use of tuned flywheel C5A50 with C5A10 motor pulley.

VII. Machine and Part Replacements

With the proper tools it is not difficult to make replacement of the various parts on General Electric refrigerators. Cat. No. A18X1 tool kit contains several tools which are necessary in making part replacements. For CM-1 and CM-2 machines all of the tools in this kit are necessary.

For CB-1, CB-2 and CB-3 machines, the kit is not required. The special ½-inch foot wrench Cat. No. A18X6, the ⅛-inch Allen set screw wrench Cat. No. A18X7 and the Cat. No. 11X122 purging wrench are essential. Two pinch-off tools, obtained from the Imperial Brass Co., 1200 West Harrison St., Chicago, Illinois, their Cat. No. 106F, will be needed if compressors are to be changed. Also lapping tool Cat. No. A18A31, glass plates Cat. No. A18A8 and a quantity of 600 mesh alundum will be required for lapping shaft shoulders and shaft seal nose pieces of replacement compressors.

The following replacements are covered:

1. Replacement of machine.
2. Replacement of motor.
3. Replacement of capacitor.
4. Replacement of motor pulley.
5. Replacement of compressor pulley.
6. Replacement and adjustment of belt.
7. Replacement of compressor.
8. Replacement of shaft seal.
9. Adding refrigerant.
10. Power change-over.
11. Replacement of control bellows.

1. Replacement of Machine

Remove the machine by reversing the procedure used in installing the machine given on page 11. Immediately after the machine has been taken out of the cabinet, a holding down screw should be placed and tightened in the hole in each end of the machine mounting. This is necessary to prevent damage to the machine during transportation. Install the new machine. The holding down screws from the new machine may be used in returning the replaced machine.

2. Replacement of Motor

In removing the motor it is first necessary to disconnect the connections made to the motor. Remove the four screws from the motor base with Cat. No. A18X6 foot wrench, take off the belt and lift the motor out. Take off the pulley by loosening the set screw with Cat. No. A18X7 set screw wrench, being careful not to lose the shaft key, as this will have to be used on the replacing motor.

Before installing the new motor examine it for damage during shipment and check the voltage and frequency rating on the nameplate. Turn the motor rotor by hand to be sure that it revolves freely in the bearings. Also see that there is no undue friction in the compressor.

Place the pulley on the shaft and lightly tighten the set screw. Place the motor on the mounting supports, insert screws in motor base and place belt on motor pulley.

Locate the motor so that its shaft is parallel with the compressor shaft, the faces of the pulleys are in alignment and the belt has proper tension. Then tighten the holding screws and the set screw.

Check to see that the bearings have sufficient oil. This can be done by adding a few drops of medium machine oil of a good grade to each bearing.

After connecting the motor, start it several times to see that it comes up to speed promptly under load. Then operate the machine for approximately ½ hour, observing if the motor runs quietly and without over-

heating. If the motor does not operate satisfactorily, too tight a belt may be the cause.

3. Replacement of Capacitor

Disconnect the capacitor from the motor. Take out the four screws which hold the capacitor to the box top and lift it out.

Note: If the capacitor is mounted on the motor, it is not separable from the motor.

Install a new capacitor by reversing the above procedure, being careful to connect the leads according to the proper wiring diagram.

4. Replacement of Motor Pulley

The motor pulley may be removed and replaced without removing the motor. A slight amount of difficulty may be experienced in removing the pulley but this operation can be done by pressing the floating base away from the fan duct. Use Cat. No. A18X7 set screw wrench to loosen the motor pulley.

When replacing a motor pulley be sure to check the alignment of the pulleys and the belt tension.

5. Replacement of Compressor Pulley

The compressor pulley is removed by removing the nut and lock washer which hold it in place. In removing the pulley it may be necessary to use a small wheel puller. It will not be necessary to remove the compressor.

In replacing the compressor pulley be sure to check the alignment of the pulleys and the belt tension.

Note: A heavy cast compressor pulley is used on CB machines above approximately serial number 3292700. This heavy cast pulley will be furnished for replacement instead of the earlier type of stamped pulley. When the cast pulley is installed on machines having 20 turn motor end spring supports, it will be necessary to replace these spring supports with Cat. No. C20A58 spring supports.

6. Replacement and Adjustment of Belt

If the belt is excessively worn it should be replaced. Improper adjustment may have caused the belt to wear out sooner than it should.

To replace the belt, loosen the motor on CM-1 and CM-2 machines, or the compressor on CB-1, CB-2 and CB-3 machines. Use Cat. No. A18X6 foot wrench.

Take the belt off the pulleys and replace it. Place the motor or compressor that has been loosened, in position so that the motor and compressor shafts are parallel, the pulleys line up, and the belt has proper tension. Next tighten the holding down cap screws. Check the alignment of the pulleys with a straightedge.

Proper belt tension is obtained when a force of about ten pounds exerted midway between the pulleys will depress the belt about ½ inch.

Caution: Do not tighten the belt excessively as this will overload the motor and may cause tripping off. Also a tight belt may cause excessive vibration of the machine mounting.

If the belt is running off the pulleys, align the pulleys as outlined above. Check the pulleys to see that they run true.

A slipping belt should be corrected by increasing the belt tension to the proper amount.

7. Replacement of Compressor

The compressor may need replacing because it runs hard or sticks, will not pump, is noisy internally or has a leaky or noisy shaft seal. If the compressor is to be replaced, proceed as follows:

A. Pinch off the suction line about 2 inches back from the suction line flare nut, using one of the pinch-off tools. Place the tool so that the wing nuts are accessible and so that they will also be accessible with the tool rotated 90°. Tighten the wing nuts evenly until the two bars are together.

B. Start up the machine and run it for approximately ten minutes to warm up the oil.

Pinch-Off Tool

C. Shut off the machine and immediately pinch off the discharge line in the same manner as the suction line, making the pinch midway between the first and second bends in the tubing from the compressor. Remove the suction and discharge refrigerant lines from the compressor by slowly loosening the flare nuts. The discharge line flare nut should be loosened first. Assemble flare nuts with bonnets to the flare fittings of the end cap as quickly as possible to prevent oil from being thrown out. Remove the machine to the outside air and wear goggles while performing these operations. Have an SO_2 gas mask handy.

Remove the compressor from the mounting supports by removing the four bolts. Remove the compressor pulley using a small wheel puller to prevent damage to pulley or compressor.

D. Assemble the compressor pulley to the replacement compressor. Assemble the replacement compressor on the mounting support. See that the compressor shaft and motor shaft are parallel and that the belt is in proper tension. Adjust belt tension as described in Part 6, "Replacement and adjustment of belt," this page.

The replacement compressor should be immediately connected into the refrigerant system.

E. Connect the suction and the discharge lines to the replacement compressor. If Cat. No. C21A22 replacement compressor is used it will only be necessary to remove the caps from the elbows in order to connect these lines. However, if Cat. No. C21A6 replacement compressor is used, it will be necessary to remove the plates and gaskets from the pads on the end cap, and screw elbows Cat. No. C17A69 and C17A70 into the tapped inlet and outlet holes, using litharge and glycerine on the threads. Tighten the suction line flare nut but leave the discharge

line flare nut loose. Remove the clamp from the suction line and as soon as a considerable amount of escaping refrigerant may be detected at the discharge line flare nut, tighten this nut. Remove the clamp from the discharge line. Rotate both clamps 90° and place the tubing in the hole in the clamp corresponding to the outside diameter of the tube. The discharge line is ¼ inch in diameter and the suction line is 5/16 inch in diameter. Tighten the wing nuts evenly until the bars are together. This will properly open the tubing. Test for leaks at the flare nuts and in the tubing.

F. Add approximately ¼ lb. of SO_2 through the top of the float valve. See "Adding refrigerant," page 30. Unless some of the oil in the compressor has been drained out or lost it should not be necessary to add oil as replacement compressors are shipped with the proper oil supply.

G. Run the machine for 24 hours. During this run and at its conclusion check the machine for signs of gas or oil leaks, and see if the machine is refrigerating properly. If the unit shows signs of a low refrigerant charge, additional refrigerant should be added until proper refrigeration is obtained. See "Adding refrigerant," page 30.

8. Replacement of Shaft Seal

A shaft seal may be defective because it leaks oil and gas or because it is noisy. If it is impossible to correct the defect by using the remedies given under Section IV, "Noise," page 25, and Section V, "Leaks," page 26, then it will be necessary to either replace the machine, compressor or shaft seal, depending on whether the compressor is an original or a replacement compressor and on the type of defect.

If the compressor having the defective seal is the original compressor it will be necessary to either replace the compressor, using the pinch-off tools, or else replace the entire machine. If the compressor giving the trouble is a replacement compressor, the shaft seal may be replaced. However, since this compressor is not supplied with service valves it will be necessary to return either the compressor or the entire machine to the shop for the seal to be changed. The work should be done with the refrigerating machine resting on a test rack. The service man should wear goggles and have a good SO_2 gas mask handy.

The shaft seal may be replaced as follows:

A. Follow the procedure given under items A to C inclusive in Part 7, "Replacement of compressor."

B. Remove the compressor to the outside air, take off the caps covering the inlet and outlet elbows and permit the refrigerant to escape from the compressor. Considerable oil will bubble out with the escaping refrigerant, and this must be replaced later. Refer to item G following.

C. Place the compressor with the shaft horizontal and fasten it down so it will not fall over. Remove the six cap screws, the clamping plates, the oil retainer assembly and the shaft seal assembly from the compressor. Allow the small amount of oil in the seal compartment to drain out.

D. Examine the shoulder on the crankshaft to see that it is smooth and free from cuts or scratches. The crankshaft shoulder may be lapped, if necessary, by using shaft lapping tool Cat. No. A18A31, with a small quantity of 600 mesh alundum. Mix the alundum with enough kerosene to make a stiff paste and apply a small quantity to the lapping surface of the lapping tool.

Plug the hole in the compressor housing to prevent abrasive from getting into the inside of the compressor case. Slip the tool over the shaft and lap the shoulder as in grinding automobile valves. Continue this operation until a continuous dull gray surface is produced. When the operation is completed remove all of the abrasive from the shaft and from the seal housing, using a clean cloth moistened with naphtha. Remove the cloth from the hole in the compressor housing.

E. The shaft seal nose piece may be lapped by using one of the pieces of prepared plate glass Cat. No. A18A8. These plates have been ground on one side to a flat surface at the factory. However, before using the plates for the first time and always thereafter before using them, lap them together. This is to insure that the lapped surfaces will always be perfectly flat.

To lap the plates, mix some No. 600 mesh alundum with enough kerosene to form a thin paste. Then wash the plates thoroughly in naphtha or carbon tetrachloride and apply a thin layer of the alundum paste to one of the plates. Then proceed to lap the plates together using a circular motion.

Continue this process until the ground surfaces of all plates make tight fits together after they have been washed in naphtha or carbon tetrachloride and dried, thus indicating that the surfaces are flat. Be sure that all of the alundum is washed off the plates before they are used for lapping the shaft seal nose piece.

To lap the nose piece, first wash the glass plate with naphtha and then apply kerosene to the etched side of the plate. With the plate resting on a flat surface, lap the shaft seal nose on the etched surface, grasping the sealing ring between the thumb and middle finger and using a circular motion. Be very careful to keep the shaft seal nose in firm contact with the plate and use plenty of kerosene. Continue lapping until a continuous dull flat surface is obtained. Then wash the seal thoroughly in naphtha.

Do not use alundum or any other abrasive for this operation as the soft material of the nose piece will become imbedded with the abrasive and be ruined.

F. Assemble the shaft seal in place, first placing a small quantity of petrolatum or vaseline on the nose piece. Use a new gasket with the new or replaced seal assembly. Pull up the cap screws evenly but do not tighten them until the seal has been purged.

G. Add sufficient oil to replace that lost or drained

out during the preceding operations. A minimum of 40 fluid ounces will be required to replace the oil lost when the refrigerant was released and when the seal was removed as described in items B and C preceding. If in doubt as to the amount of oil lost, drain all the oil from the compressor, through the outlet elbow, and replace 70 fluid ounces.

Connect the vessel holding the oil to the inlet elbow of the compressor with a piece of 5/16-inch tubing. Place the pulley on the shaft and turn it counterclockwise by hand until the proper amount of oil has been added. Use only refrigerating machine oil Cat. No. C16A24. Be sure that no air is drawn into the compressor during this process.

H. Re-assemble the compressor to the unit, proceeding as described in items D to G under "Replacement of compressor," except that the shaft seal chamber will be purged out at the same time the compressor is purged. Tighten the cap screws holding the seal plates as soon as escaping refrigerant is detected at this point.

9. Adding Refrigerant

To add refrigerant assemble the 11X762 bomb of SO_2 refrigerant to the connection at the float valve by means of the 11X765 monitor test adapter which is contained in the 11X764 monitor tester kit.

Before using the monitor adapter inspect it to see that it has a single good 11X768 lead washer in place on each side and the purging screw in its side is closed.

Loosen the bottle valve screw with the 11X122 purging wrench and assemble the bottle to the adapter. Place the valve stem into the bottle valve screw and tighten the valve stem nut.

Place the bottle and adapter just assembled over the float connection after first loosening the float purging screw with the purging wrench. Then tighten the monitor adapter nut.

Crack the purging screw in the float valve, and then crack the purging screw in the adapter until the odor of SO_2 is detected and tighten this screw. Check for leaks with ammonia. Open the bottle valve screw three complete turns and pull out valve stem. Assemble the 11X766 heater to the bottle and plug it into a 110-volt outlet for a few minutes.

Control amount of refrigerant added to machine by opening and closing the float valve screw with the monitor valve stem.

Before adding refrigerant, the unit should have been running and the chilling unit pulled down. Stop the machine and add a little refrigerant. Then run the machine again. Very carefully add just enough refrigerant, a little at a time, until the suction tube feels cold near the top of the box top. If too much refrigerant is added, the suction tube will frost up and the excess refrigerant will have to be purged out of the machine.

After enough refrigerant is added, tighten both float and bottle valve screws. Purge refrigerant trapped in the adapter out the purging screw in the adapter. Absorb this gas with a rag saturated with concentrated ammonia held over the purging screw. If so desired the refrigerant can be driven out of the adapter back into the bottle by heating up the adapter with the heater, with the float screw closed and the bottle screw open. Then close bottle screw and purge out the slight amount of gas left in adapter.

Remove adapter and bottle, and tighten float and bottle valve screws with the purging wrench.

Check the float screw for an SO_2 leak with ammonia. Replace caps on float valve and bottle.

10. Power Change-Over

It is possible to convert the refrigerator to operate on other types of power supplies by changing the proper parts of the refrigerating machine.

In order to know what parts must be changed, refer to the list of replacement parts for the machines and carefully compare the parts used for different power supplies.

When it is necessary to mount a separate capacitor or the 32 V. DC contactor, use the holes already drilled in the top section on machines originally having separately mounted capacitors. Otherwise it is necessary to drill holes in the top section. The holes should be of the proper size so that self-tapping screws can be used to hold down the part.

Extreme care should be taken to make good connections. On 32 V. DC machines special connecting cables C20A63 and C20A64 respectively are used for connecting the control and contactor.

Refer to the proper wiring diagram for the connections that should be made. Be sure to solder all connections so indicated on the wiring diagram.

11. Replacement of Control Bellows

1. Remove the control from the refrigerator.
2. Lay the control on a flat working surface with the sealed cover uppermost. Remove the two brass screws which hold the bellows cover plate to the control and withdraw the bellows from the control.

Caution: After these two screws are loosened, and until the new bellows is tightened into place, the control should not be moved violently, or changed from the position specified, otherwise, one of the taps which receive the attaching screws may slip out of the slot, and may be lost inside of the mechanism, after which it would be difficult to recover.

3. Place the new bellows tube into a salty ice bath. The end of the tube must be kept quite cold while inserting the bellows in place. Remove the clamp which holds bellows during shipment, only after the bellows has been contracted.

Caution: Be sure not to loosen the nut which locks the cover plate to the bellows. In straightening or bending the bellows tube, avoid bending the section near the silver soldered joint where it joins the bellows. A strain at this point may crack the tubing.

4. Insert the bellows, carefully observing the *"Caution"* under item 3, being careful to keep

the bellows tube cold until the attaching screws are firmly tightened.

Caution: Be sure that the cupped fiber washer is properly in place between the bellows and bellows arm. The bellows arm is an electrically live point, and must be insulated from the bellows to avoid grounding the motor circuit to the machine.

Note: No attempt should be made to replace any of the parts inside the control cover. Controls having defective internal parts must be returned to the factory with the seal unbroken.

Cabinet Adjustments

Foreword: Cabinet adjustments for the most part do not require technical knowledge but rather lend themselves to simple solutions which are apparent upon examination. We believe however, that the following suggestions may be of considerable help to the Service man.

I. Replacement of Inner Liner

The one-piece acid-resistant inner liner is easily changed. First remove the Textolite door jamb strips. The metal unit supporting frame will now be found to be held in place only by a row of machine screws across the back of the cabinet. Remove these screws and lift out the frame with its greased cloth seal. The liner will now easily lift out.

The new liner is installed by reversing the above process. The unit supporting frame is held in place on the sides by metal clips welded to the outer case of the cabinet, on the front by the outer row of Textolite strip screws, and on the rear by the previously mentioned row of machine screws.

Care should be exercised in replacing the No-Ox-Id or greased cloth top seal. Carefully iron the cloth into its original position to prevent moisture from getting into the insulation and to assure economical operation.

II. Replacement of Door

Doors are obviously replaceable by removal of the hardware and its subsequent re-assembly to the new door.

Whenever possible this work should be done with the cabinet on its back. Carefully center the door in the opening and draw the hinge screws tight in rotation so that unequal pressure of the screws will not throw the door out of line with resultant poor door seal.

III. Door Seal

Poor door seal usually results in complaints of cabinet sweating inside, excessive frosting of chilling unit, high per cent running time, high power consumption, slow ice freezing and high cabinet air temperature.

Imperfect door seals may be located by the use of a .003 metal feeler. Locate the point of poor seal by inserting the feeler at various points around the door between the gasket and the cabinet front.

If a poor seal is located, first check the gasket to see that it is not excessively worn. Check the hardware to see that it is not sprung or worn and that the screws are tight.

Often a poor door seal can be corrected by rehanging the door as described above under "Replacement of door"; by replacing the gasket, or by properly adjusting or replacing the hardware.

If, however, the poor seal is caused by the door being sprung out of line, or by the front of the cabinet being out of line, it can be corrected as follows:

(The operator should be provided with a straightedge approximately 2 inches longer than the long side of the door, a rubber mallet, a metal feeler approximately 1/32" in thickness and a screw driver.)

1. With the straightedge check the cabinet front on all four sides, approximately where the door gasket seats, to see if the front is straight. If it is possible to insert the 1/32" feeler between the straightedge and the face of the cabinet such points should be corrected.

If an unevenness does exist, it is very likely that the cabinet front will be bulged outwardly, generally at the center of the Textolite strip.

2. When the front is bulged outwardly, loosen the Textolite strip screws approximately 1½ turns on all four sides of the door opening, front side only, not on the liner side.

3. Pound the high point of the cabinet front and keep checking with the straightedge until a comparatively even, flat surface is obtained. If done properly this will not in any way injure the finish. When the front is straight, tighten up all the screws.

4. If the cabinet front is found to be bulged inwardly, it will probably be found necessary to remove the Textolite strip at that point and pull the front of the cabinet out so that it makes a bulge outward.

Replace the Textolite strip, thoroughly tightening the screws on the liner side but leaving the outer screws loosened 1½ turns. Proceed in the same manner as for high points on the cabinet front.

5. Now firmly close the door and check the door seal by inserting the .003 metal feeler at various points around the perimeter of the door under the gasket.

If the gasket is not properly seated at all points, loosen all Textolite strip screws around the outer door panel side of door. Slam the door once or twice rather severely to let it take the shape of the cabinet front. Check the seal again and if found satisfactory tighten the strip screws thoroughly to hold the outer door panel in place.

If not found satisfactory, repeat the process and try springing the door further with the hands.

If the door is still out, straighten it by striking the rolled edge at the open places sharply with the rubber mallet. Care should be taken to strike the

radius only. Never hit the flat face of the door, as it will dent.

When the correct seal is obtained, make certain that all the Textolite strip screws are tight.

IV. Replacement of Door Panel

1. Outer Door Panel.

If it is necessary to replace the outer door panel, remove the door from the cabinet by removing the hardware.

Remove the Textolite strip screws from around the outer door panel only. Replace the old panel with the new one.

Re-hang the door and check the door seal.

2. Inner Door Panel.

If the inner door panel is to be replaced, remove the door.

Next take out all the Textolite strip screws. Then assemble the Textolite strips to the new inner door panel. Place in position on the rest of the door and replace the Textolite strip screws around the outer door panel.

Re-hang the door and check the door seal.

V. Replacement of Shelves

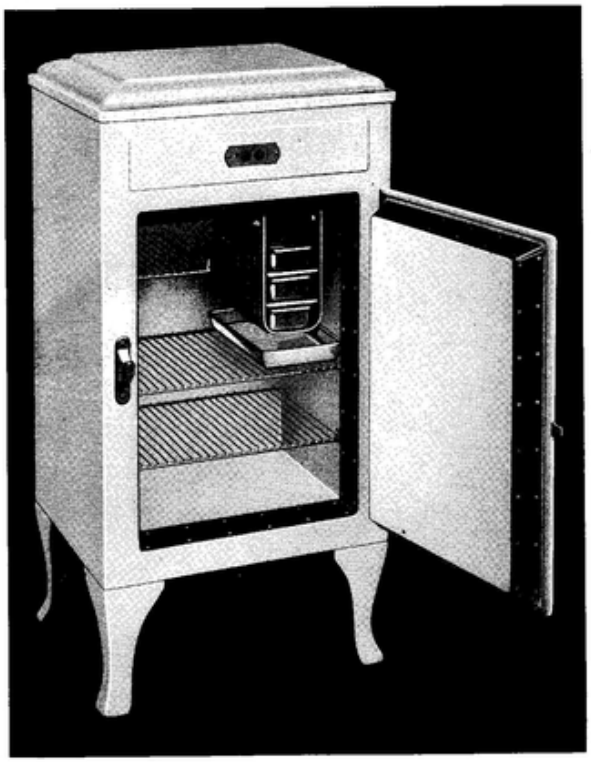
Original shelves are properly adjusted at the factory to conform with the cabinet liner.

It may be necessary to adjust replacement shelves to the particular cabinet by bending the supporting tangs in or out in a suitable clamping device to make a snug fitting shelf. Care must be exercised not to bend the tangs at the welds or to spring the shelves into position, leaving the welded points under a strain. Loose shelves will rattle and shelves should never be so tight that they have to be forced into place, as they are apt to chip the porcelain on the liner.

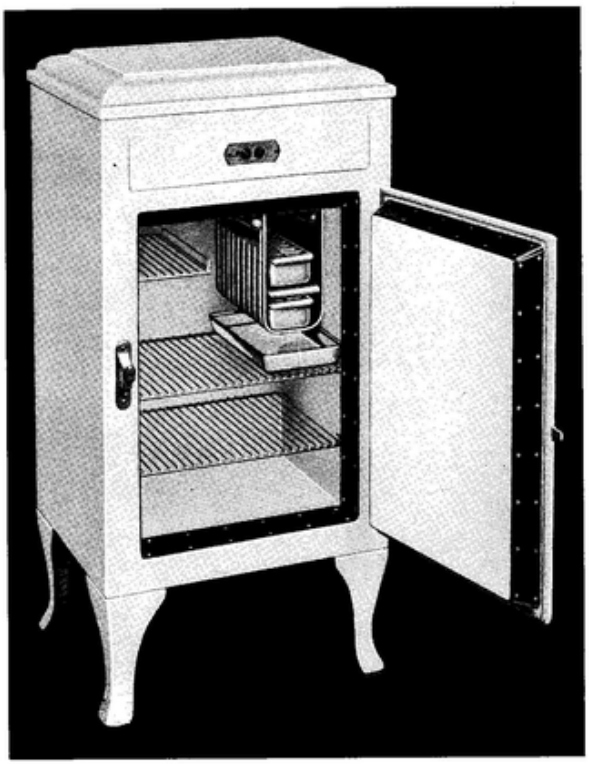
VI. Replacement of Door Gaskets

To replace a gasket, pull the old gasket off and put the new gasket on the cabinet by forcing the lugs of the gasket into holes in the outer door panel with a blunt tool or pencil.

General Specifications



HE-5A (Open)



HE-4B (Open)

GENERAL ELECTRIC REFRIGERATORS

Models HE-4B, HE-5A and HE-7A

Cubic Capacity

HE-4B	4.0 cu. ft.
HE-5A	5.0 cu. ft.
HE-7A	7.0 cu. ft.

Shelf Area

HE-4B	7.9 sq. ft.
HE-5A	9.5 sq. ft.
HE-7A	12.0 sq. ft.

Ice Freezing

	HE-4B	HE-5A	HE-7A
Number of ice freezing trays	2	3	3
Total weight of ice	4½ lbs.	6¾ lbs.	7½ lbs.
Number of ice cubes	40	60	60

Hardware

Hardware on each model is modernistic in design, made of hard brass with chrome finish.

The single action door latch makes opening of the doors easy. The self-sealing feature automatically insures a tight seal when the door is swung closed.

Gaskets

Doors are fitted with a high grade, specially designed moulded rubber gasket which is exceptionally durable and is sanitary and easy to clean. The gaskets are designed so that they can be easily replaced.

All-Steel Construction

Each model has an "All-Steel" cabinet, exceptionally strong and rugged in design. The outer heavy steel shell is essentially a one-piece construction, welded or lock seamed at all joints. No wooden frame is used either in the cabinet or the door. The one-piece steel inner liner has rounded corners to facilitate cleaning.

General Specifications

The entire space between the inner and outer walls is completely filled with insulation.
This construction gives greater strength—prevents warping and sagging—increases efficiency and insures longer life.

Textolite Strips

The door openings and door edges are faced with black Textolite strips secured to the inner and outer panels with corrosion resistant screws. The Textolite strips will not warp, mold or cause odors and will withstand severe usage. Corners of the door and door jamb are fitted with stainless metal corner pieces.

Insulation

Cabinets are heavily insulated to make them efficient. The insulation used is "Thermocraft." It is especially efficient and is protected against entrance of moisture by the outer steel shell which is lock seamed or welded at all joints to make it moisture tight. The insulation is further protected by sealing in a water tight envelope.

Finish

Interiors of the cabinets are finished in white stain resisting porcelain applied in three coats and fused to the steel inner liner. Note that the corners are rounded and that the entire interior permits easy and thorough cleaning.
The exterior finish of the cabinets is high lustre Glyptal-baked enamel.

Shelves

Three shelves of the bar type, with steel wires running from front to rear are used in each cabinet.
All shelves are heavily tinned to prevent corrosion.
The arrangement of the top shelf in the cabinet allows ample space for storage of tall bottles.

Legs

Cabinets are mounted on 11⅛" legs which are secured to the steel outer shell and bottom with heavy machine screws. Four black composition gliders are supplied for placement under the legs.

Refrigerating Unit

Refrigerating units used in Models HE-4, HE-5 and HE-7 refrigerators are Models CB-1, CB-2 and CB-3. Compressors used in these units are extremely simple in design, dependable in operation and exceptionally efficient in performance.

The motor used with each unit is external, and is a ⅙ H.P. General Electric capacitor type. (For operation on direct current a D.C. motor is used.)

The use of the capacitor type motor gives increased efficiency and eliminates radio interference.

The motor is belted to the compressor.

A fan mounted on the motor shaft provides positive forced cooling of the condenser, motor, and compressor.

Stainless Steel Cooling Unit

The cooling unit is of stainless steel, folded into shape and welded at all joints.

There are no hidden crevices or spaces and every portion of the cooling unit inside and out can be easily cleaned.

All ice trays are in direct contact with a freezing surface assuring rapid freezing of ice cubes and desserts.

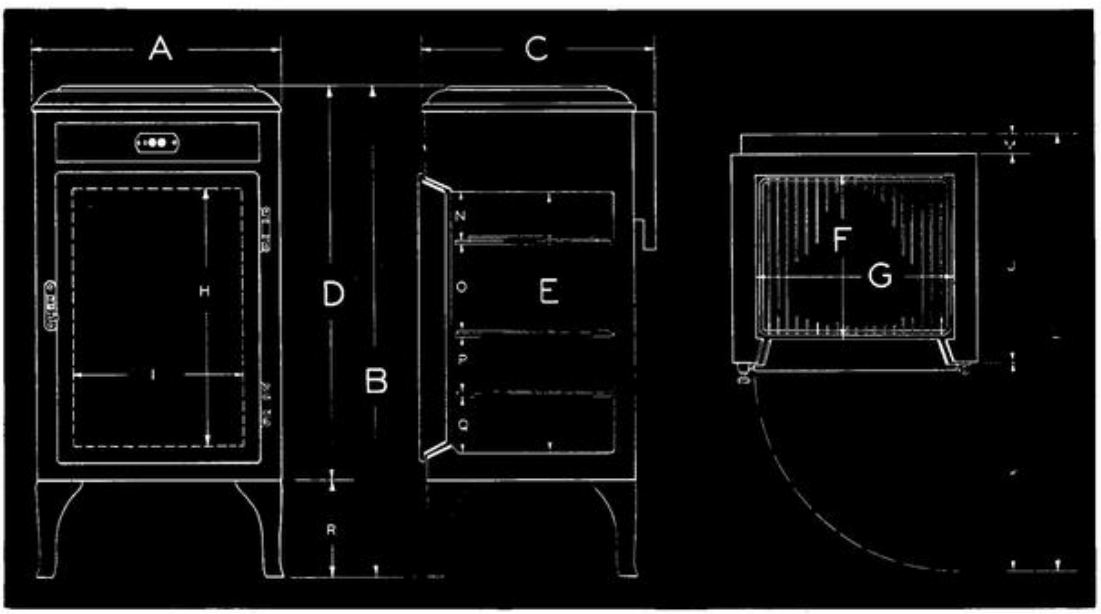
Temperature Control

The temperature control on the refrigerating unit automatically maintains a uniform cabinet temperature. An easily accessible adjustment dial is provided to permit the user to vary the temperature to meet individual requirements or special conditions.

The control is also equipped with a semi-automatic defrosting switch which permits defrosting of the cooling unit without interrupting refrigeration.

Weights

HE-4B Crated:	Cabinet....205 lbs.	Unit.....136 lbs
HE-5A Crated:	Cabinet....222 lbs.	Unit.....141 lbs
HE-7A Crated:	Cabinet....300 lbs.	Unit.....151 lbs



DIMENSION CHART

Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
HE-4B	24"	51⅝"	23¾"	40¼"	25⅜"	16 5/16"	18½"	24 5/16"	15 11/32"	21"	18⅞"	42⅝"	2½"	4 3/32"	8"	5 31/32"	6"	11⅜"
HE-5A	26½"	53⅜"	23¾"	42"	27 13/32"	16 5/16"	21"	26 1/16"	18 13/32"	21"	21⅜"	45⅛"	2½"	4 3/32"	9 1/32"	6"	6"	11⅜"
HE-7A	28¾"	57⅛"	26¾"	45¾"	30 23/32"	19⅛"	23¼"	29⅜"	19½"	24"	23¾"	50½"	2½"	5 3/16"	10¼"	6 1/16"	6½"	11⅜"

DOMESTIC PRODUCT MANUAL

GENERAL ELECTRIC REFRIGERATING MACHINES

SECTION III

MODEL F-4, F-5 AND F-7
REFRIGERATORS

GENERAL ELECTRIC COMPANY
ELECTRIC REFRIGERATION DEPARTMENT
NELA PARK
CLEVELAND, OHIO

INTRODUCTION

Every General Electric Refrigeration Product is built as perfectly as possible, after which it is very carefully tested and inspected before it is shipped from the factory.

This manual is written to assist Product men in the installation and adjustment of domestic refrigeration equipment.

The proper functioning of all machinery depends ultimately on the human element. The following pages and your own experience will testify to this simple fact.

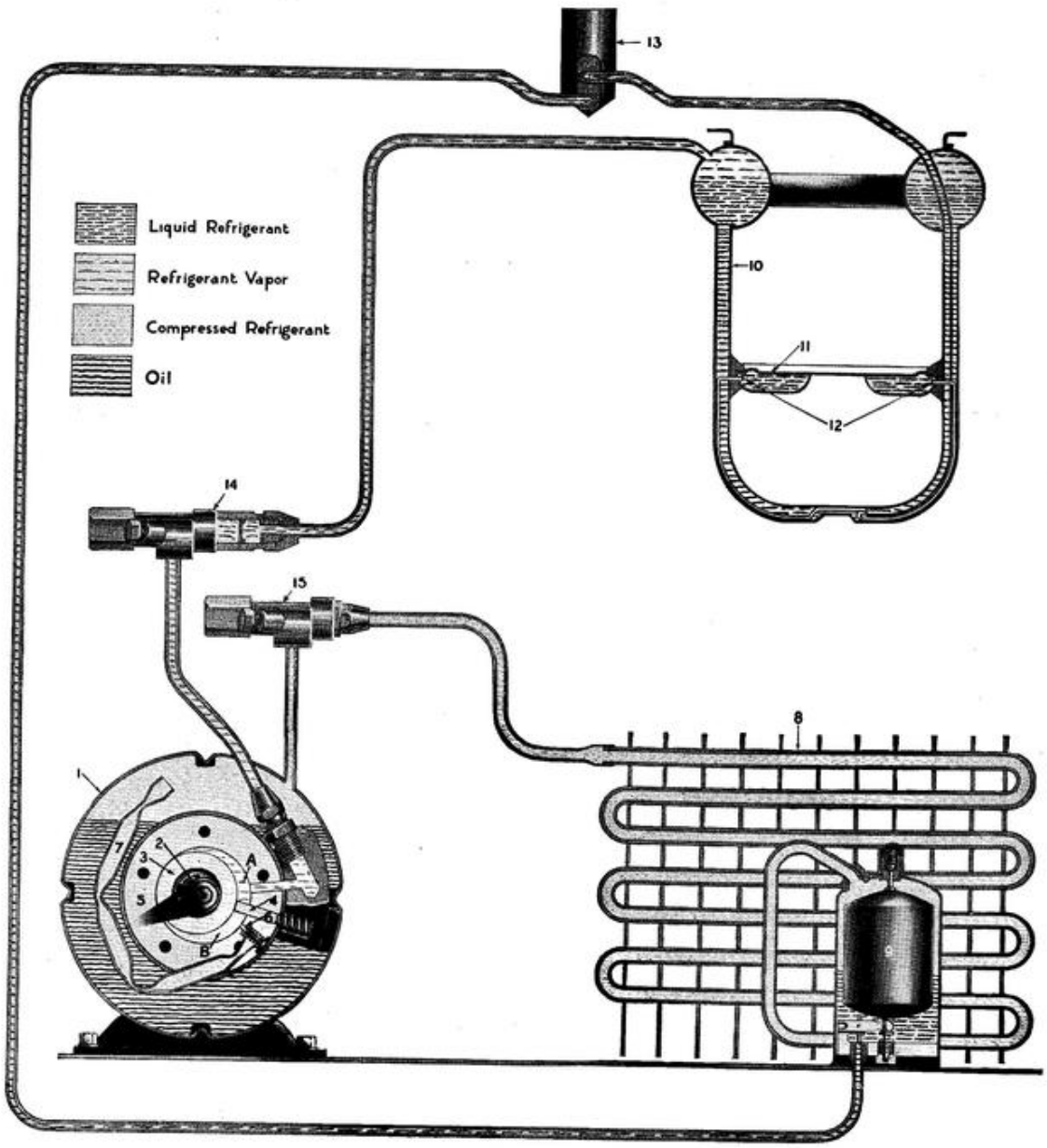
NOTE: This section is one of several sections that will comprise the General Electric Domestic Refrigerator Product Manual. These sections will give in detail product information on General Electric domestic refrigeration equipment.

The published sections, together with the subsequent sections which will be published from time to time, should be kept together in a suitable three-hole binder.

Form P-496-3
Issued May 8, 1934

INDEX

Chart Showing Operation of CD Type Refrigerating Machine



1. Compressor
2. Compressor Shaft
3. Piston
4. Blade
5. Cylinder
6. Discharge Valve
7. Acoustic Filter
8. Finned Tube Condenser
9. Float
10. Cooling Unit
11. Freezing Shelf
12. Injectors
13. Throttling Valve
14. Suction Service and Check Valve Assembly
15. Discharge Service Valve

General Electric Refrigerators

Models F-4A, F-5A, F-7A

DESCRIPTION

Refrigerating Machines (Models CD-1, CD-2 and CD-3)

The type CD refrigerating machine consists of the condensing unit and the connected cooling unit. The principal parts of the condensing unit are the compressor, the condenser, the external motor and the float valve. These parts are mounted on a rigid angle-iron mounting plate which is supported by a special spring and rubber mounting to eliminate noise and vibration. The condenser is cooled by forced air and the location of the condensing unit in the bottom of the refrigerator is made practical by the development of a special and unique ventilating system. The condensing unit is compact and occupies a minimum amount of space.

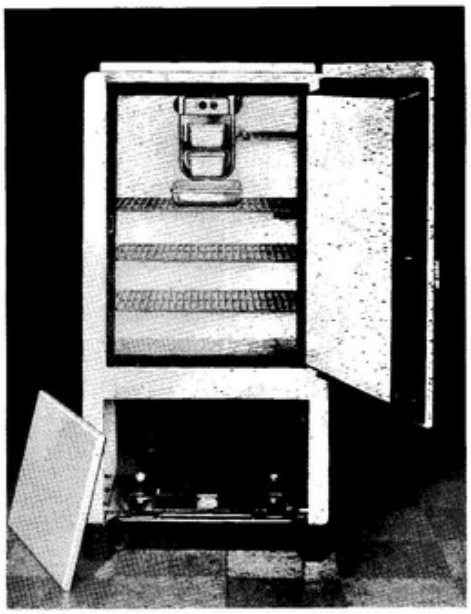


Fig. 1

The cooling unit is located in the top of the refrigerator and the connecting refrigerant lines are covered by a tough, flexible, moulded rubber protecting casing. These rubber covered lines are led from the condensing unit to the cooling unit through a metal enclosing channel at the rear of the cabinet. The control is mounted inside the cabinet, on the front of the cooling unit and the control wiring is carried through the rubber casing with the refrigerant lines to the condensing unit.

The complete refrigerating machine assembly may be easily removed from the cabinet without breaking any refrigerant connections.

All parts of the refrigerating machine are constructed of high quality materials with careful attention to design and unusual precision of manufacture to insure efficient, quiet and trouble-free operation.

Compressor

The compressor is of the belt driven, rotary type, simple and sturdy in construction and highly efficient. It is supplied with removable service valves, making it possible to replace the compressor in the field.

The main internal parts of the compressor are the piston, blade, cylinder, shaft and end flanges. The piston (or rotor) and the blade are held in place inside the cylinder by the end flanges. The end flanges contain the bearings and are bolted tightly to the cylinder. Adequate clearances between the piston and cylinder and between the ends of the piston and the end flanges permit rotation of the piston but prevent leakage of refrigerant from the cylinder.

The internal mechanism assembly is mounted in a drawn steel case which is welded to a drop forged steel end cap containing the shaft seal housing and the service valve connections. A drawn steel base is welded to the bottom of the compressor case. This welded construction completely seals the compressor except for the shaft seal and the service valve connections.

The cylinder and end flanges are held stationary in the case, while the piston is actuated by an eccentric on the horizontal shaft. The shaft extends through the end cap and is driven by a pulley connected to the motor by a V belt. The piston does not rotate at the speed of the shaft but rolls slowly around the eccentric portion of the shaft. The blade maintains contact with the piston at all times, moving in and out of a slot in the cylinder as the piston rotates.

The compressor mechanism is immersed in a permanent bath of oil under pressure to insure positive lubrication of all moving parts.

The only valve in the compressor is an exhaust valve of the disc type which is about the size of a dime and is held in place in the cylinder wall by a small helical spring. The intake port is an unrestricted hole in the cylinder wall.

The type CD compressor is supplied with a specially developed low side shaft seal of the stationary bellows type. This seal consists of a nose piece made of a special metal, a bellows, a spring, a spring retainer and a seal flange. This assembly cannot be taken apart for repair in the field but must be replaced as a unit. When assembled in the compressor, the nose piece of the seal presses against the hardened and ground shoulder of the crankshaft, forming a gas and oil-tight joint at that point. The bellows provides a flexible, gas-tight connection between the nose piece and the seal flange, while the flange is clamped against a lead gasket around an opening in the end cap of the compressor case.

A hole is drilled directly from the shaft seal compartment through the compressor end flange to register with a hole through the cylinder to the suction line passage in the cylinder wall. Thus, during the time the compressor operates, the shaft seal is under suction pressure, since the shaft seal compartment is connected to the suction line passage in the cylinder. Consequently the shaft seal is not subjected to the high head pressure developed during the operation of the compressor. As a result the wear on the seal and the possibility of a leak at this point is greatly reduced.

An oil retainer, consisting of a large felt washer held in place between the shaft and the outer shaft seal clamping plate by a steel cap fastened to the outer plate, serves to catch any small amount of grease or oil which may be forced out through the seal in normal operation.

Refrigerant

Sulphur dioxide is used as the refrigerating medium.

Oil

Special refrigerating machine oil, developed for General Electric refrigerating machines, is used in the compressor. This oil should be ordered by Cat. No. C16A24 and no other oil should be used. Containers holding this oil must be kept sealed when not in use to prevent the oil from absorbing moisture.

Motor

The motor used on alternating current models is of the trouble-proof, highly efficient, capacitor type.

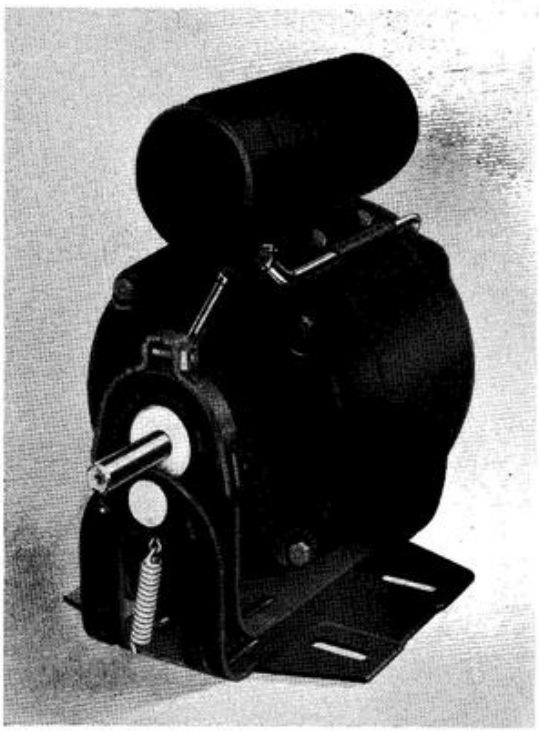


Fig. 2

It has no brushes to cause radio interference. The only attention it requires is oiling once a year. The motor used on direct current models necessarily has brushes, but is provided with a wave filter to prevent any radio interference. The only attention this motor requires is inspection of brushes and oiling once a year.

The motor is rubber mounted in a pivoted cradle which has been specially designed for refrigerating machine use. The oil-impervious, live rubber mountings give smooth, cushioned power with new quietness, yet maintain good shaft alignment. The cradle is pivoted in such manner that the proper belt tension is automatically maintained. This new and different belt tightener depends on the motor torque and not on springs for its action. It maintains just sufficient belt tension to prevent slippage because the tension is proportional to the load. It eliminates service calls for belt tightening or premature belt replacement.

The live rubber mountings are clamped to the cradle in such manner that motor and rubber mountings may be easily removed from the cradle.

Condenser

The condenser is of the radiator type and is constructed of copper fins and tubing, tin coated to insure good thermal contact between the fins and tubes. The condenser is located at the front of the condensing unit at the base of the refrigerator where it is readily accessible for cleaning. The condenser is cooled by forced air. The extremely efficient McMahan fan, mounted on the motor pulley, assures positive air circulation. Cool room air is drawn in at the front of the refrigerator from the floor level and is passed through the condenser and then across the compressor and motor. It is then exhausted out of the rear of the cabinet.

This uni-directional air flow prevents recirculation of air in the condensing unit compartment and is a very important feature in the cooling of the unit.

Float Valve

Refrigerant is admitted into the cooling unit through a high side float valve mounted on the condensing unit mounting plate. The float valve is held to the mounting plate with screws, and is connected to the liquid line to the cooling unit with a flare connection.

Throttling Valve

A throttling valve is located in the liquid line at the cooling unit header. This valve is a vertical, weighted valve. It consists of a shell containing a weighted plunger attached to a hardened steel needle. The valve seat is located at the bottom of the shell, and a screen is supplied between the valve inlet and the seat. See Fig. 14, page 25, for a cross-sectional view of the throttling valve.

This valve serves to prevent frosting of the liquid line between the condensing unit and the cooling unit which would otherwise occur due to expansion of the liquefied refrigerant at the float valve. The weighted plunger holds the valve closed and prevents the flow of refrigerant into the cooling unit until the difference in pressure between the cooling unit

and the liquid line builds up to the point where the needle is forced up off the seat. Liquid then flows until this pressure difference decreases to the point where the weighted plunger will close the valve.

This action maintains sufficient pressure in the liquid line to prevent excessive expansion at the float valve and consequent frosting or sweating of the liquid line, but at the same time admits liquid refrigerant into the cooling unit, as required.

Service Valves

The compressor is supplied with two service valves so that it may be isolated from the rest of the refrigerant system for repair or replacement. These service valves are bolted to valve pads on the compressor end cap and are so located that the valve stems are easily accessible. Copper and lead gaskets are used between the valve pad and the valve. One valve is connected to the suction line and the other to the discharge line.

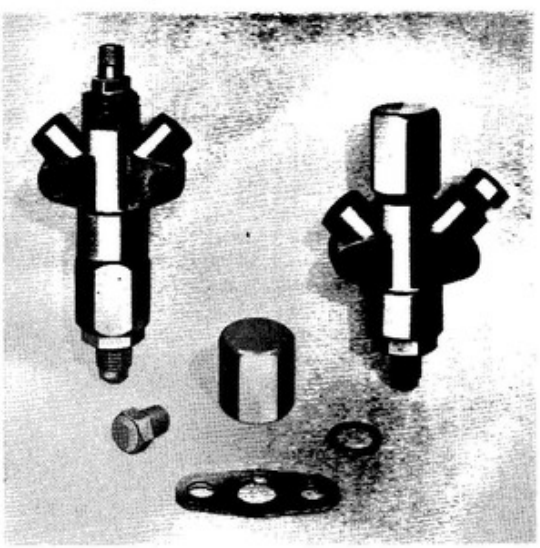


Fig. 3

A check valve is permanently assembled to the end of the suction service valve, and these parts cannot be separated in the field.

These service valves are two-way valves and are provided with both front and back seats. Each valve is provided with a ⅛-in. pipe thread gauge connection.

Cooling Unit

The cooling unit is made of stainless steel and is provided with a refrigerated freezing shelf on the CD-2 and CD-3 models. It is of welded construction, providing surfaces which are smooth, easy to clean and sanitary. The construction of the cooling unit incorporates forced circulation of the refrigerant by means of injectors, thus assuring the highest cooling efficiency. A throttling valve is provided in the liquid line near the header to prevent frosting of the liquid line between the float valve and the cooling unit.

Control

The control is mounted inside the cabinet on the top front of the cooling unit, easily accessible and readily replaceable if occasion should demand. It is sealed against moisture and must not be taken apart for repair in the field.

The control incorporates a manual switch for turning the machine on and off, an adjustable mechanism for controlling the temperature of the cabinet and of the cooling unit, a motor protective device for protecting the motor from abnormal loads or power conditions and a semi-automatic arrangement for defrosting the cooling unit without appreciably affecting the cabinet temperature.

A locking type connector on the back of the control provides the electrical connections.

Cabinet (Models F-4A, F-5A and F-7A)

The cabinet is of all-steel construction with a one-piece, acid-resistant, porcelain enamel interior. The exterior of the cabinet is furnished in white Glyptal-baked enamel. The neat and modern semi-concealed hardware has a durable and attractive chrome and enamel finish. The cabinet fittings are exceptionally easy to operate.

The door openings and door edges are faced with black Textolite strips secured to the inner and outer steel panels with rugged anodic treated aluminum machine screws. Long life, extruded type rubber door gaskets are used to seal the cabinet around the door opening.

The pressed steel strip around the cabinet legs is easily removable for cleaning under the cabinet.

An automatic cabinet light and a foot operated door latch with a rubber tread is supplied with the F-5A and F-7A cabinets.

A removable panel is located at the front bottom of the cabinet. This permits easy access to the condensing unit compartment for oiling of the motor and cleaning of the condenser.

Accessories

All models are supplied with a glass chiller tray and with aluminum ice freezing trays. One ice freezing tray in each unit is supplied with rubber dividers, the rest of the trays having aluminum dividers. Ice tray removers are included with all models.

Guarantee

These refrigerators carry a one year guarantee.

CYCLE OF OPERATION

Operation of CD Compressor

In order to visualize the operation of the CD compressor, refer to the schematic diagram on page 4. The pumping action is obtained by the piston moving along the cylinder wall, as indicated by the arrow.

As the piston moves away from the intake port, volume "A", which is between the blade, piston and cylinder, on the intake side of the pump, increases. Hence, refrigerant vapor from the suction line is drawn into this increasing volume. Vol-

ume "B", which is located on the other side of the blade, is decreasing. Hence, any refrigerant vapor which is trapped in this volume, is compressed. This vapor remains in the pump until the piston reaches a position where the pressure on the exhaust side is great enough to overcome the spring tension on the exhaust valve. At this point the exhaust valve opens and the piston pushes the compressed vapor from the pump.

At the end of its stroke the piston completely clears the cylinder of the original refrigerant charge, and at the same time it has already drawn in a new charge, ready to be compressed. The piston, pushed in a rotary motion about the cylinder, causes refrigerant vapor to continually enter the suction side of the pump and at the same time discharges compressed refrigerant vapor on the discharge side of the pump. The piston is effective for the full 360° of its stroke, which is one of the factors which largely contributes to the unusual efficiency of this design.

After the refrigerant leaves the exhaust valve it is conducted above the oil level through the acoustic filter and is discharged directly into the case. The acoustic filter is a simple means of deadening noise. It consists of several chambers of different sizes.

Refrigerant Circuit

The refrigerant vapor from the cooling unit is drawn through the suction line to the check valve, then through the suction service valve, and then directly to the suction port of the compressor. The check valve is of the disc type and is located in the suction line at the suction service valve. The purpose of this valve is to prevent oil and refrigerant from rushing back into the cooling unit as soon as the compressor stops.

In the compressor, the low pressure vapor which is drawn from the cooling unit is compressed and pushed through the exhaust valve into the acoustic filter, which conducts the compressed vapor above the oil level and discharges it into the compressor case. From the case the compressed vapor passes through the discharge service valve to the condenser where it is cooled and liquefied. The liquefied refrigerant flows into the float chamber and raises the float valve after a certain liquid height is reached. This permits a small amount of liquid to pass into the liquid line and increases the pressure underneath the weighted plunger in the throttling valve at the cooling unit. This valve opens, when the proper pressure difference has been obtained, and admits liquid into the cooling unit through the injectors, which causes forced circulation of the liquid refrigerant in the cooling unit. The liquid refrigerant evaporates and absorbs heat in the cooling unit due to the reduction in pressure caused by the suction of the pump.

The repetition of the action described above gives a continuous cycle of refrigeration and thus cools the interior of the cabinet and freezes water in the ice freezing trays.

PERFORMANCE

The criterion by which a refrigerator is judged is its performance. For, after all, the customer is interested in the cost of operation, its ability to make ice quickly, and ability to maintain proper cabinet air temperatures. This Flat Top line of refrigerators was designed to give the customer performance second only to that of our Monitor Top machines.

The type CD machine incorporates many refinements tending to improve performance such as the automatic belt tightener, the low side shaft seal, the uni-directional air flow making use of the cool air from the floor level, and the silent, stable condensing unit mounting in the base of the cabinet.

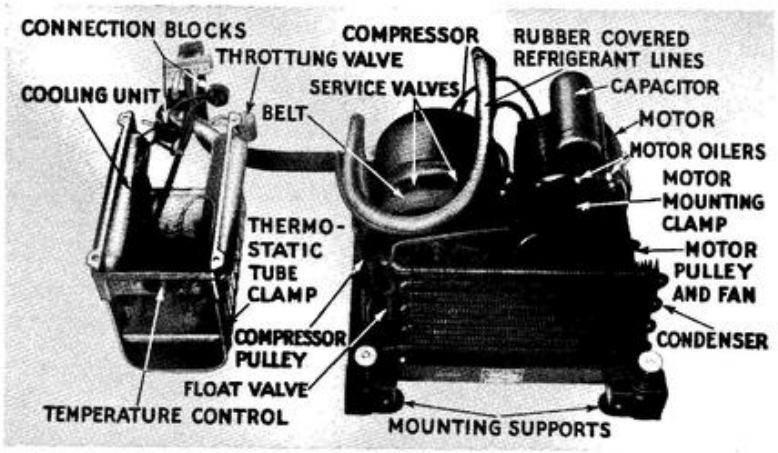
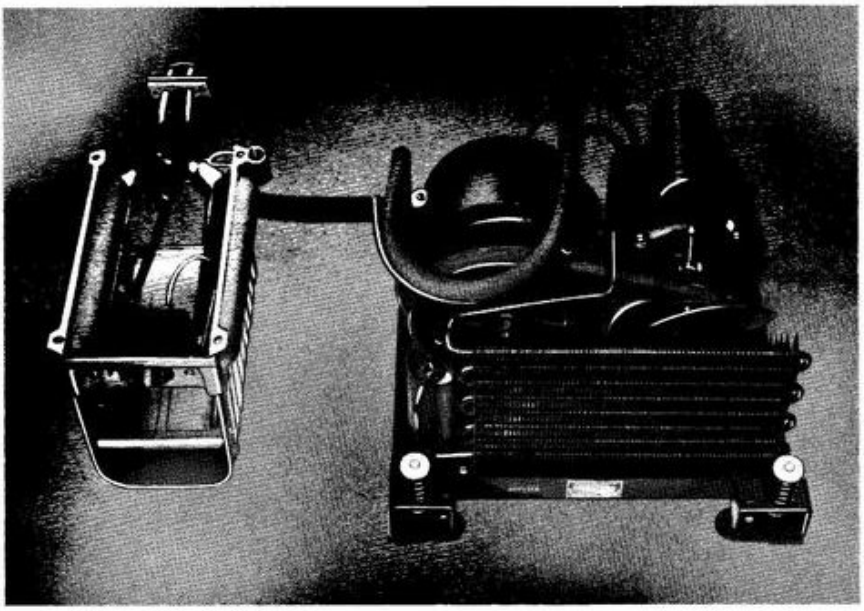


Fig. 4

Product Data on CD-1, CD-2 and CD-3 Refrigerating Machines



SPECIFICATIONS

REFRIGERATING MACHINE TYPE	CD-1	CD-2	CD-3
USED IN REFRIGERATOR MODEL	F-3 F-4	F-5	F-7
Motor			
Voltage	110	110	110
Cycles	60	60	60
Speed, R.P.M. (Full Load)	1725	1725	1725
Amperes (100° F. Room, 20° F. Cooling Unit)	3.0	3.0	3.0
Watts (100° F. Room, 20° F. Cooling Unit)	250	250	260
Starting current amperes, (Locked Rotor)	15	15	15
Horsepower	⅙	⅙	⅙
Compressor			
Speed, R.P.M.	625	625	625
Displacement, cu. in.	1.93	1.93	1.93
Head pressure, lbs. per sq. in. gauge (100° F. Room, 20° F. Cooling Unit)	115	115	110
Suction pressure, lbs. per sq. in. gauge (100° F. Room, 20° F. Cooling Unit)	0	0	0
Machine			
Capacity, B.t.u./hr. (100° F. Room, 20° F. Cooling Unit)	600	600	625
Equivalent ice melting, lbs. per 24 hours	100	100	104
Air circulation, cu. ft. per min.	100	100	100
Temperature range of cooling unit (80° F. room performance, thermometer on bottom of cooling unit)			
Temperature knob in position 1, ° F. (warmest)	18–28	18–28	20–30
Temperature knob in position 5, ° F. (normal)	12–22	12–22	15–25
Temperature knob in position 9, ° F. (coldest)	8–18	8–18	10–20
Total number of ice cubes	40	40	80
Total weight of ice cubes, lbs.	4½	4½	9
Weight of sulphur dioxide, lbs.	2	2½	2¾
Weight of machine, crated, lbs.	118	120	124
Weight of machine, uncrated, lbs.	100	102	106

Replacement Parts for CD-1, CD-2, and CD-3 Refrigerating Machines

Form No.	Power Supply V	F	Motor Complete with Capacitor and base	Motor with Capacitor, minus base	Capacitor	Motor Brush	Motor Pulley	Compressor Pulley	Belt	*Control
16	110	60	5KC45AB251	C2A13	9CG101R3	...	C5B24	C5B26	C4A4	M1A13
15	110	50	5KC45AB301	C2A14	—	...	C5B25	C5B26	C4A11	M1A34
14	110	40	5KC49AB7	C2A16	—	...	C5B25	C5B5	C4A57	M1A35
12	110	25	5KC49BB146	C2A15	—	...	C5B25	C5B26	C4A11	M1A36
1	115	DC	5BC42AB95	C2A11	—	4218692	C5B24	C5B26	C4A4	M1A51
2	230	DC	5BC42AB96	C2A12	—	4218692	C5B24	C5B26	C4A4	M1A52

— Indicates motor and capacitor, or motor and wave filter are not separable.

*Early models of CD refrigerating machines were supplied with controls having the 58X series catalog numbers. Use controls listed here for all replacements.

Part	Cat. No.	Part	Cat. No.
Bellows tube clamp	C20A54	Service valve cap washer	C20A14
Screw for C20A54 (2 required)	C20A57	Service valve gasket	C11A36
Compressor	C21A6	Screw for service valve	58X185
Escutcheon plate, CD-1 and CD-2	NP-60532	Service valve plug	C17A9
Escutcheon plate, CD-3	NP-60264	Mounting spring assembly	C15A95
Screw and nut for escutcheon plate	C20A97	Hold-down screw (for motor and compressor)	58X184
Locking connector for control	58X15	Lock washer for 58X184	58X189
Shaft seal assembly	C16A34	Nut for compressor pulley	281387
Gasket for C16A34	C11A22	Lock washer for 281387	63X865
Shaft seal clamping plate (inner)	C16A36	Key for compressor pulley	168039
Shaft seal clamping plate (outer)	C16A35	Motor cushion base assembly	3582952 G.2
Screw for C16A34	C20A95	Motor base spring	5020752
Shaft seal oil retainer	C20A93	Cushion ring for motor base, terminal box end	5007624 G.1
Shaft seal oil retainer cap	C20A94	Cushion ring for motor base, pulley end	5007624 G.2
Screw for C20A94	223877	Tuned flywheel	C5A50
Service valve cap	C17A72	Shipping bolt, lock washer and wood block (4 required)	A20A23

Uncrating, Inspection and Installation

UNCRATING

The model F refrigerator is shipped with the type CD refrigerating machine assembled in the cabinet. The shipping crate is padded to prevent damage to the cabinet and is marked to indicate the position in which it should be transported. The refrigerating machine is shipped with the service valves open, consequently the crate and cabinet should be kept upright at all times to reduce the possibility of oil being drained from the compressor.

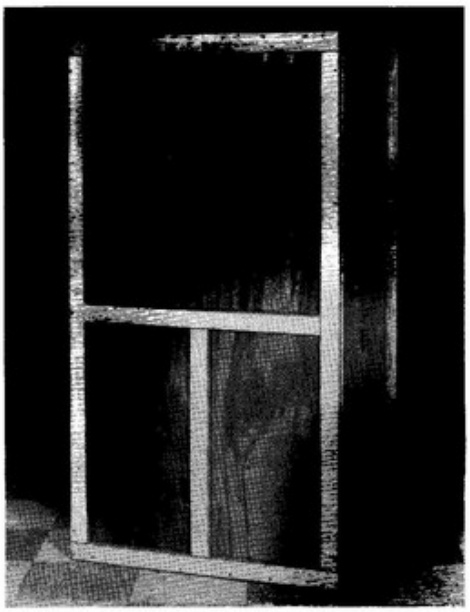


Fig. 5

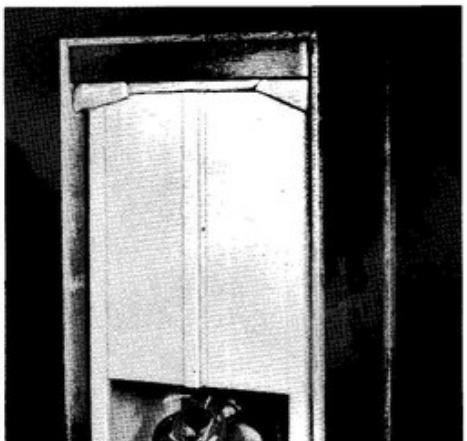


Fig. 6

To uncrate the refrigerator, proceed as follows:

A. With the crate in an upright position, remove the nails from the *back* of the crate. Do not attempt to pry the back off. Lift off the back of the crate.

B. Carefully slide the cabinet out of the crate as shown in Fig. 7. The cabinet legs are bolted to skids which are held in slots in the sides of the crate. Do not remove the padding until the cabinet is out of the crate. Do not remove the skids until the cabinet is moved to near the final location.

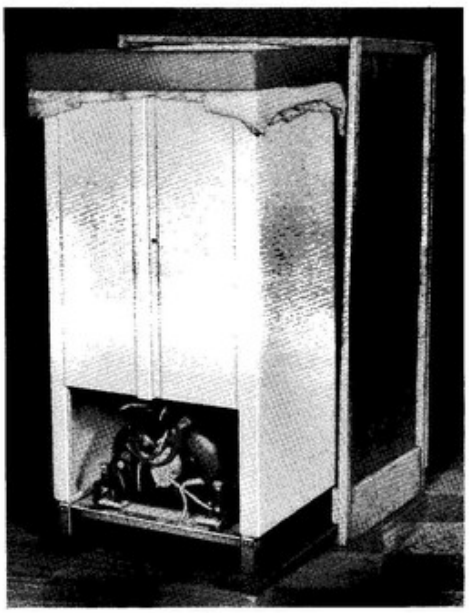


Fig. 7

INSPECTION

Inspect the refrigerator for damage, which may have occurred during shipment, to the cabinet or to the refrigerating machine. Remove the accessory carton from the interior of the cabinet.

Examine the cabinet for the following:

1. Fit of shelves.
2. Chips or mars on interior or exterior finish.
3. Operation of door latch and foot pedal.

The condensing unit should be checked to see that the tubing is not bent or broken and that the shipping bolts and blocks are in place. See that the motor is tied to the compressor. Damage to the parts may have occurred if the condensing unit was not bolted down and also the motor prevented from moving during shipment.

The motor nameplate should be checked to see that

it is of the proper voltage and frequency, and the operation of the condensing unit should be observed at the time the refrigerator is installed.

INSTALLATION

Place the cabinet near the final location with the front and back accessible until the operation of the machine has been checked. Remove the skirt from the base of the cabinet and take off the skids by removing the nuts from the four bolts in the feet and lifting the cabinet up off the skids.

Remove the rubber spacer from the accessory carton and assemble it to the channel on the rear of the cabinet, using the screw provided.

Remove the front panel of the machine compartment, so the compartment will be accessible, by opening the cabinet door and pressing down, then pulling out on the panel. Remove the four shipping bolts and the wooden shipping blocks from the condensing unit, and remove the cord and shipping pad used in holding the motor against the compressor during shipment.

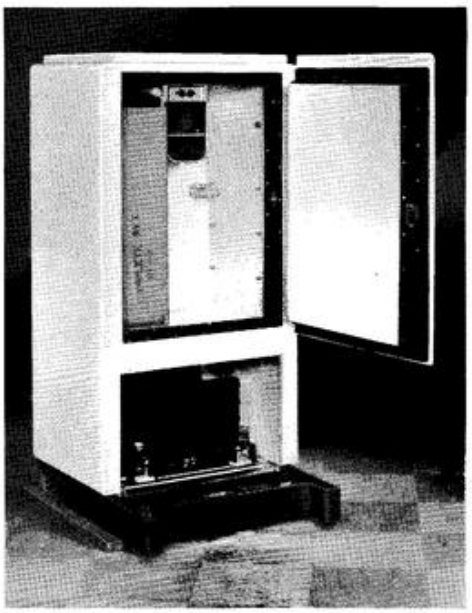


Fig. 8

All machines have their motors well oiled at the factory. However, a careful service man will protect against the remote chance of having an insufficient oil supply by adding a few drops of a good grade of medium lubricating oil to each motor bearing before starting the machine.

See that the "on" and "off" knob on the temperature control is turned to the "off" position. Check the voltage and frequency of the power supply with that stamped on the motor nameplate. Check to see that the belt is on the pulleys and that nothing interferes with the belt, pulleys or fan. See that the motor pulley and fan are tight on the shaft and that the fan does not strike the condenser.

Connect the cord to a convenience outlet and start the unit by turning the control knob to "on." See that the machine runs freely and that tubes and moving parts do not strike stationary parts while the machine is starting, running or stopping.

Check the operation of the belt tension device by observing the position of the motor while the machine is running. With the motor in the operating position the center of the capacitor or wave filter should be directly above the center of the motor shaft. If the capacitor is more than ¼ in. off center, the motor base is not located properly on the mounting plate and it must be adjusted as described in "Replacement and adjustment of belt," page 34.

Check the adjustment of the mounting springs by noting the distance between the angles on the mounting plate and the mounting supports. See Fig. 15. This distance should be approximately ⅜ in. The spring can be adjusted by turning the nut in the proper direction on the bolt running through the center of the spring.

Check the cabinet light and the operation of the switch by opening the door and observing if the light goes on. As soon as it is apparent that the machine is refrigerating properly, turn the control knob to "off" and move the cabinet to the final location. Do not move the cabinet along the floor with the skirt in place as it will scratch the floor.

It is important to properly locate the refrigerator so that with normal usage the proper ventilation of the condensing unit and satisfactory performance will be obtained.

The room in which one of these refrigerators is located should be of at least 250 cu. ft. content, unless special means of ventilation are provided. Where the room is less than 250 cu. ft. content, there should be an air intake opening into the room of not less

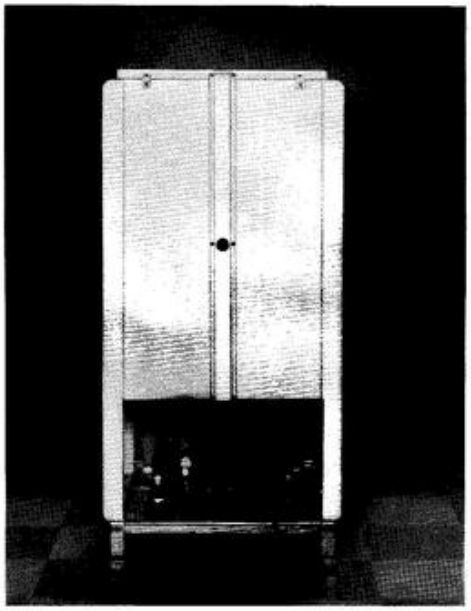


Fig. 9

than 70 sq. in. near the bottom and toward the front of the cabinet. There should also be an air outlet at or above the top of the cabinet which should have an opening of at least 140 sq. in. for the F-4, 160 sq. in. for the F-5 and 180 sq. in. for the F-7.

In locating one of these refrigerators in a room or in a nook there should be not less than 2 in. clearance between the back of the cabinet and the wall, and not less than 6 in. clearance above the entire top of the cabinet, including the 2 in. spacing from the back of the cabinet to the wall.

The toe space to the cabinet must be open at all times, so that the intake air to the machine will not be restricted. Under these conditions the cabinet may be located so that there will be no clearance at either side.

The 2 in. minimum spacing at the rear of the cabinet is assured by the use of the rubber spacer on the back of the cabinet. Note the rubber spacer shown on the back of the cabinet in Fig. 9.

Make sure that the cabinet is setting level and replace the skirt at the base. Remove the accessories from the carton and assemble them in the cabinet.

To take care of installations where the floor is not level, a set of shims is shipped with the accessories of each cabinet. This set consists of a small brass cup and a series of fiber shims of varying thicknesses. See Fig. 10. The proper number of fiber shims or washers can be determined by placing one or two of them over the knob of the brass cup or shim support. Then push this assembly up to the leg which does not touch the floor and add or remove shims until the proper thickness is obtained. Then raise the cabinet and insert the brass shim support as shown in the illustration. These items will be found in a paper envelope, packed in the accessory carton.

Set the temperature control knob at position number 5 for normal operation, and start the machine by turning the control switch to "on."

Instruct the user as to the use and care of the refrigerator as discussed on page 14.

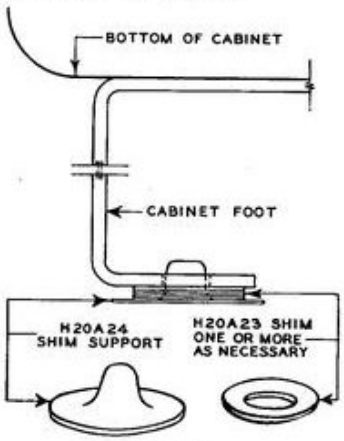


Fig. 10

Use and Care of the Refrigerator

The General Electric refrigerator is designed to satisfy all normal refrigeration requirements with a minimum amount of attention on the part of the user. A few instructions on the use and care of the refrigerator will assist the user in obtaining the most satisfactory service from it. The user should be instructed regarding the following points at the time the refrigerator is installed.

1. Operation of control "on" and "off" switch.
2. Operation of control overload device.
3. Operation of control defrost.
4. Use of control temperature knob.
5. Cleaning cabinet.
6. Oiling motor.
7. Cleaning condenser.
8. Moving refrigerator.

Cleaning the Interior

Directly after installation and previous to the time the machine is started, it is recommended that the user carefully clean the interior of the cabinet, the cooling unit, ice trays, chiller tray, and food containers.

For cleaning the interior of the cabinet and the cooling unit, a solution of baking soda in warm water should be used. A satisfactory solution can be made up of one tablespoonful of baking soda in four quarts of water.

Caution: Never clean the interior of the cabinet or the cooling unit with any cleaning agent which has an odor.

Caution: When washing the chiller tray, do not use hot water. Hot water may cause breakage.

It is suggested that the interior of the cabinet and the cooling unit be cleaned each time the cooling unit is defrosted.

For removing deposits on the cooling unit caused by fruit acids, etc., use a good kitchen cleanser such as Bon-Ami, Old Dutch Cleanser, etc.

Cleaning the Exterior

Use only Ivory soap and warm water or Cabinet Cleaner Cat. No. A20R1 for cleaning the Glyptal-baked enamel exterior of the cabinet.

Caution: The use of any of the standard cleaning compounds which depend upon abrasive or alkaline action will remove the gloss from the finish on the Glyptal finished cabinets.

Cleaning the Condenser and Condensing Unit Compartment

The condenser must be inspected regularly and cleaned of dirt and lint which may restrict the flow of cooling air through it. If this is not done trouble may result due to high power consumption, low capacity or tripping out of the overload. The condenser may be made accessible by removing the machine compartment panel from the front of the cabinet. Use a small, stiff bristle brush for cleaning the condenser.

Normally it should only be necessary to clean the condenser once a year, and this should be done at the time of the yearly oiling of the motor. However, if the refrigerator is located where accumulation of dust and lint builds up on the condenser rather quickly, it must be cleaned at more frequent intervals. The condensing unit compartment should also be cleaned out at the time the condenser is cleaned. Wipe off the various parts with a clean rag to remove lint and dust. Be sure to turn the control to the "off" position when oiling or cleaning in the machine compartment.

Cleaning under the Cabinet

The porcelain pressed steel base strip or skirt is easily removed for cleaning the floor under the cabinet by pulling it out.

Starting the Refrigerator

To start the refrigerator after it is installed, turn the left knob on the control located at the top of the cooling unit to the "on" position. The machine should start immediately.

If the machine does not start, make sure that the electrical cord is properly attached. Also, make sure that the house fuse on the circuit into which the refrigerator is plugged is all right.

During the first few minutes after being started, the machine may be slightly noisy but as soon as it is within the normal operating condition, it will continue to operate quietly.

Stopping the Refrigerator

To stop the refrigerator, turn the left control knob to "off." If the refrigerator is to be out of service for several days or longer, remove all foods and all water from freezing trays and chiller tray. Leave the cabinet door ajar. Clean the interior before putting the refrigerator back into service.

Cabinet Temperature

When the refrigerator is installed, the temperature knob at the right of the control should be set at position 5. The control is set at the factory to automatically maintain a cabinet air temperature of between 38° F. and 42° F. in room temperatures between 70° F. and 80° F.

If the room temperature averages below 70° F., the cabinet air temperature may be slightly below 38° F. If this is too cold, the temperature knob can be turned counterclockwise to position 4 or 3, or even to 2 or 1.

If the room temperature averages above 80° F., the cabinet air temperature may be slightly above 42° F. If this seems too warm, the temperature knob can be turned clockwise to positions 6, 7, 8 or 9.

The temperature setting is made adjustable in order to satisfy the individual desires of the user. If it is desired to make the cabinet air colder, the temperature knob can be turned clockwise; if warmer, the knob can be turned counterclockwise.

The use of a thermometer in the cabinet is not recommended unless it be of high quality. The user

will find that the refrigerator is maintaining proper temperatures if the food is preserved satisfactorily and is cold enough for the individual taste.

Distribution of Food in the Cabinet

The coldest zone in the refrigerator is within the cooling unit where the temperature is below freezing. The next warmer zone is in the chiller tray where the temperature may be just below or just above freezing. The warmest zone is in the cabinet where the temperature should range between 38° F. and 45° F.

Air circulation is necessary to insure uniform temperature distribution within the cabinet. Therefore, do not restrict the circulation by excessive crowding of food into the cabinet or by placing coverings over the shelves.

The circulation of cold air in the cabinet is from the cooling unit, around the chiller tray, down the center of the cabinet and up the sides. It is evident that foods with odors, which are not covered, should be placed on the sides of the cabinet near the top in order not to affect other foods.

For most satisfactory results, it is recommended that the following foods be kept in covered containers:

1. Those with strong or objectionable odors such as cantaloupes and onions.
2. Those which absorb odors readily such as butter.
3. Liquids such as milk or cream.
4. Moist foods such as mashed potatoes or creamed vegetables.
5. Fresh vegetables such as lettuce and celery.

Freezing Ice Cubes

To secure the most rapid freezing of ice cubes, be sure that the ice trays make good contact with the cooling unit freezing surfaces. A quarter cup of water spread evenly over the freezing surface will serve to level any unevenness in the frost covering the surface.

Fast freezing can be obtained by turning the temperature knob at the right of the control to position 9, the coldest setting. When the ice is frozen, the temperature knob must be returned to the normal position. Otherwise, the cabinet air temperature may be reduced to a point where freezing of food will result.

To remove an aluminum ice tray when frozen use the tray lifter, or loosen with an upward push directed against the upper rim of the tray. Do not use an ice pick or other sharp instrument.

To remove ice cubes from an aluminum tray with a minimum loss of ice, allow cold water from the faucet to run on the bottom of the tray until the cubes fall out. An alternate method is to immerse the ice tray in a pan of cold water.

Defrosting

Frost will collect on the cooling unit at a rate depending on the humidity of the air entering the cabinet at times when the door is opened and on the amount of uncovered liquid or moist foods in the cabinet. It is recommended that the cooling unit be defrosted at a time when this accumulation is approximately one-half inch thick or when the accumulation interferes with the removal of ice trays. It is suggested that defrosting take place at least once a month, at which time the interior of the cabinet and the cooling unit should be cleaned.

To defrost the refrigerator, the control knob on the left of the control should be turned counterclockwise to the position marked "defrost." The machine will automatically proceed to operate on a defrosting cycle, allowing the frost on the cooling unit to melt off into the cooler tray, yet not allowing the cabinet air temperature to rise more than a few degrees if the cabinet door is kept closed. When the defrosting is completed, the control knob should be returned to the "on" position.

Food stored in the chiller tray should be removed previous to defrosting. Also before defrosting, the freezing trays should be removed. The water in the chiller tray, after the defrosting is completed, should be immediately emptied.

Caution: Do not use pans of hot water in the cooling unit to hasten the defrosting. If the machine is running at the time the hot water is put in, the hot water will cause it to continue to run until the water is frozen before it shuts off and allows the cooling unit to defrost.

Resetting the Motor Protective Device

A device is incorporated in the control to protect the motor in the machine in case of unusual load or power conditions. When this device operates, the motor is shut off and a red signal appears in the window on the front of the control.

To restart the machine, the control knob on the left of the control must be turned first to the "off" position and then to the "on" position. If the protective device trips immediately and will not remain set, wait a few minutes and try it again.

Lubrication

The motor bearings should be lubricated once each year with a good grade of medium lubricating oil. If the motor runs hotter than normal, due to operation in very high room temperatures or due to operation at high altitudes, it is safer although not absolutely necessary to oil the motor at more frequent intervals than once a year. In this case, semi-annual oilings are recommended. Before attempting to oil the motor bearings the control knob should be turned to the "off" position.

To oil the motor, first remove the front panel from the machine compartment. The oilers are located just back of the top of the condenser (see Fig. 2, page 6). At the time of oiling inspect the belt and the operation of the belt tension device. See "Replacement and adjustment of belt," page 34.

Also inspect and clean the condenser, inspect the door gaskets, tighten the hardware screws and check the operation of the door latch at the time the motor is oiled.

Motor Brushes and Commutator

The motor brushes on **DC motors** should be inspected at yearly intervals. This is best done at the time of oiling.

Any brush worn down to 3/8 in. or less in length should be replaced.

To insure proper contact between the brush and the commutator, make sure that each brush, after inspection, is replaced in its original holder in the same position it had before removal. The brush should slide freely in the holder and there must be good contact between the brush and holder.

When new brushes are installed they must be sanded to fit the curvature of the commutator, with grade 00 sandpaper. Never use emery cloth or emery paper on brushes or commutator, as fine particles of emery will become imbedded between the commutator bars and short circuit them. When fitting brushes, either wrap a strip of sandpaper entirely around the commutator, under the brushes, and turn the armature and sandpaper by hand in the direction of rotation, or place a short strip on the commutator under a brush and rock the armature and sandpaper back and forth until the brush is properly fitted. The sandpaper must fit close to the commutator and must have the rough side in contact with the brush. The belt should be removed when turning the armature by hand.

The commutator should be inspected to see that it is smooth and clean. Use a clean cloth to clean the commutator or, when necessary to remove slightly uneven or rough spots, sand it slightly, using a fine grade of sandpaper.

Moving the Refrigerator

The user should be instructed regarding the proper procedure for moving the refrigerator. If possible he should notify the dealer and have a service man prepare the machine for moving.

Disconnect the cord plug from the convenience outlet and move the refrigerator away from the wall. Remove the unit compartment panel and install the shipping bolts and shipping blocks. Place several thicknesses of corrugated paper between the motor and compressor and tie the motor firmly against the compressor with heavy twine so it can not move. Remove the chiller tray and shelves.

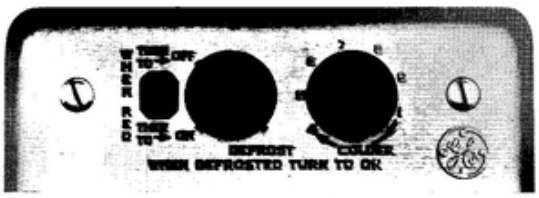
When the refrigerator is re-installed be sure that the rubber spacer is in place on the channel on the back of the cabinet. Refer to "Installation," page 12.

ADJUSTMENTS

Description of Control, and Instructions for Replacing

CONTROL

The control is moisture-proof and is sealed. There are no internal adjustments that can be made. Directions for operating the control are engraved on the escutcheon plate covering the control. Further explanation of these directions and the details of what happens within the control follow.



Front View of Control and Escutcheon Plate
Fig. 11

The control, located on the top front of the cooling unit, inside the cabinet, contains the manual switch for turning the machine on or off, the adjustable automatic mechanism for regulating the cooling unit and cabinet temperatures, the motor protective device, and the semi-automatic defrosting device.

LEFT KNOB

The left knob on the control serves as a manual switch to turn the machine on or off, to reset the motor protective device, and to defrost the cooling unit.

To Turn the Machine On or Off Manually

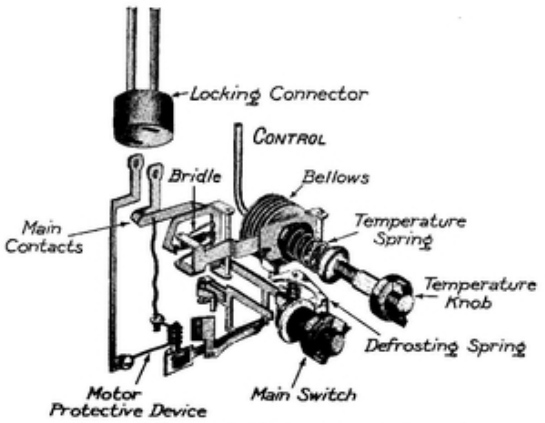
The machine is turned off when the knob points to the "off" position. The machine is turned on when the knob points to the "on" position.

When the knob is turned to the "off" position, a cam on the knob moves an extension of the arm on which the movable main contact is mounted so that the contact is opened. When the knob is turned to the "on" position, the cam releases the same arm so that the contacts may be open or closed depending on the toggle switch location which is controlled by the thermostatic bellows.

To Reset the Motor Protective Device

In case of unusual load or power conditions on the motor which cause it to draw excessive current, a protective device trips the machine off. When this protective device operates, a red signal appears in the window on the front of the control. To turn the machine on again, the manual on and off switch must be turned first to the "off" and then to the "on" position.

This motor protective device is located in series with the main contacts in the common lead to the motor. All of the current to the motor passes through a small heater coil which is wound around a stationary shaft. On the lower end of the shaft is a ratchet wheel. A film of solder holds the ratchet wheel stationary on the shaft. When excessive current passes through the heating coil, the solder is melted and the ratchet wheel turns, releasing a dog. The dog springs out and strikes the extension of the arm on which is mounted the movable main contact, opening this contact as though the external manual knob were turned to the "off" position.



View of Internal Mechanism of Control
Fig. 12

To reset the device and start the machine, the external knob must first be turned to the "off" position. This movement resets the dog on the ratchet wheel. The knob is then turned to the "on" position and the main contacts are closed.

To Defrost the Cooling Unit

Defrosting of the cooling unit is obtained by turning the knob to the "defrost" position. Another cam on the knob releases a spring which acts in parallel with the main temperature spring against the bellows arm. The temperature range on the cooling unit is changed from 12° – 22° F. to 12° – 48° F. on the CD-1 and CD-2; and from 15° – 25° F. to 15° – 48° F. on the CD-3. It is evident that defrosting will take place since the cooling unit now operates on a defrosting cycle. After defrosting, the knob should be turned to the "on" position. Refer to "*Caution*" on page 15.

RIGHT KNOB

The right knob on the control allows adjustment of the temperature range of the cooling unit and the cabinet air to satisfy the desires of the user. The movement of the knob changes the compression of the main temperature spring acting against the bellows arm.

The normal setting of the temperature knob is at position 5. The cooling unit temperature range, as measured in the bottom of the cooling unit, is ap-

proximately 12° – 22° F. for the CD-1 and CD-2 and 15° – 25° F. for the CD-3. The cabinet air temperature in a room varying between 70° F. and 80° F. with a normal amount of food in the cabinet will be in the vicinity of 38° F. to 42° F.

DIRECTIONS FOR REMOVING AND INSTALLING A CONTROL

To Remove the Control

1. Loosen the screws in the clamp which holds the control tube to the cooling unit.
2. Remove the tube from under the clamp.
3. Remove the locking connector to the back of the control with a slight turning and pulling motion.

Caution: The locking connector to the back of the control cannot be removed by straight pulling. It must be turned slightly.

If this locking connector becomes stuck or fused to the control and cannot be disconnected by turning, it will be necessary to remove the top of the cabinet, take out the insulation and disconnect the control leads from the connection block in the top of the cabinet. Pull the disconnected wires through the liner gasket into the inside of the cabinet.

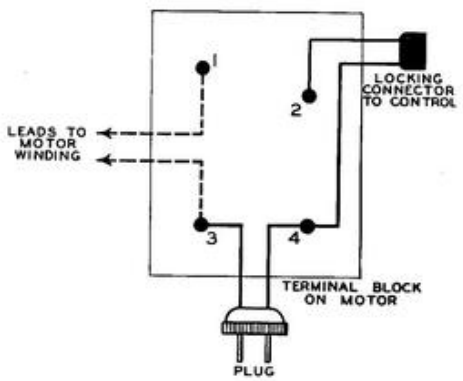
4. Remove the two screws which hold the escutcheon plate and the control to the cooling unit.
5. Lift out the escutcheon plate and the control. The control tube slides out of a slot in the front edge of the cooling unit.

To Install a Control

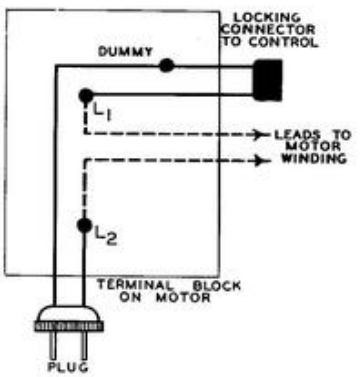
1. Reverse the foregoing procedure, first bending the control tube so it will loop around from the back of the control and fit into the slot and down along the front edge of the cooling unit. Do not make any sharp bends in the tube. The tube must fit tightly under the clamp with the top edge of the pinched off portion even with the bottom edge of the clamp.

***Caution:** That portion of the control tube located between the control and the slot in the cooling unit must not come in contact with the cooling unit.*

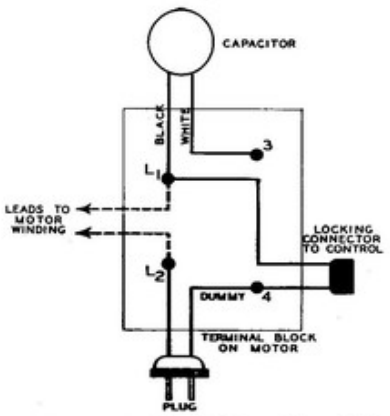
2. Check the control adjustments as directed under A "Improper control temperature knob setting," page 27.



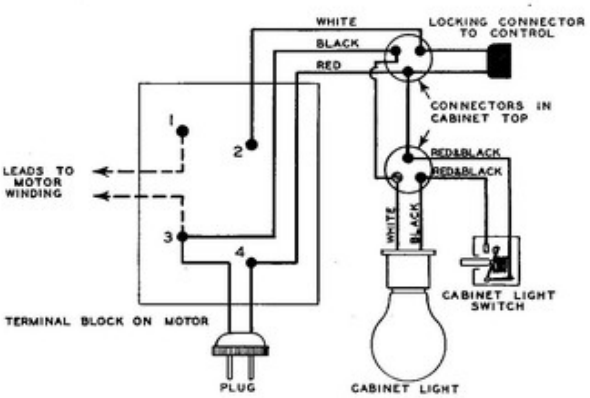
Wiring diagram for DC Machines, Type CD-1 only. Wave filter not separable from motor. Rotation of motor CCW, pulley end. To reverse rotation interchange the two leads that come from the inside of the motor and connect to 1 and 3.



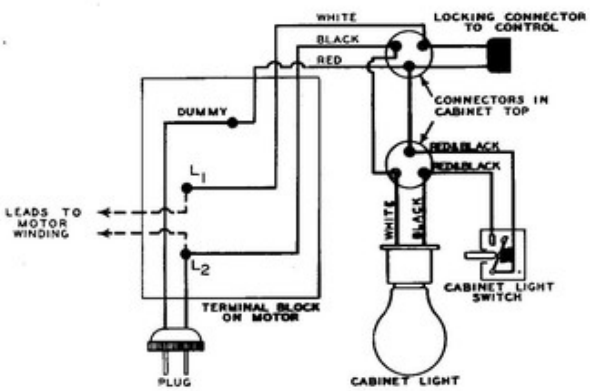
***Wiring** diagram for AC Machines, Type CD-1 only. **Capacitor not separable** from motor. Rotation of **motor CCW**, pulley end. To reverse **rotation interchange** the two leads that come from the inside of **the** motor and connect to L_1 and L_2.*



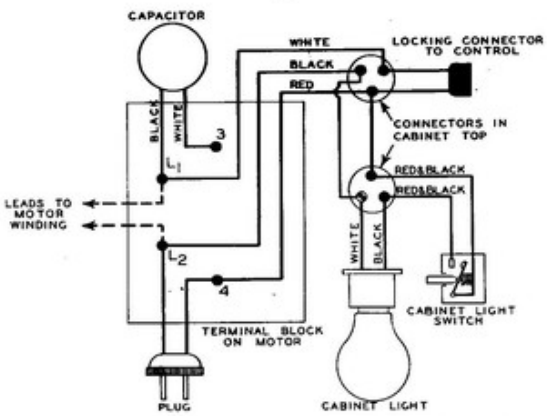
*Wiring diagram for AC Machines, Type CD-1 only. Capacitor **separable from motor**. Rotation of motor CCW, **pulley end. To reverse rotation** interchange the two leads that come from the inside of the motor and connect to L_1 and L_2.*



Wiring diagram for DC Machines, Type CD-2 and CD-3 only. Wave filter not separable from motor. Rotation of motor CCW, pulley end. To reverse rotation interchange the two leads that come from the inside of the motor and connect to 1 and 3.



*Wiring diagram for AC Machines, Type CD-2 and CD-3 only. Capacitor **not separable** from motor. Rotation of motor CCW, pulley end. To reverse rotation interchange the two leads that come from the inside of the motor and connect to L_1 and L_2.*



*Wiring diagram for AC Machines, Type CD-2 and CD-3 only. Capacitor **separable** from motor. Motor rotation CCW, pulley end. To **reverse rotation** interchange the two leads that come **from the** inside of the motor and connect **to L_1 and L_2.***

Machine Adjustments

Before attempting to make adjustments to the refrigerating machine, the service man should become thoroughly familiar with the operation of the various parts of the machine, as described in the preceding pages of this Manual. He should be supplied with the necessary tools and be familiar with their use.

TOOLS

Tools required to make ordinary repairs and adjustments to the type CD refrigerating machine are as follows:

1. 8-in. Crescent wrench, Cat. No. A18X26.
2. Valve packing nut wrench, Cat. No. C19A3.
3. 1/8-in. Allen set screw wrench, Cat. No. A18X7.
4. Special 1/2-in. foot wrench, Cat. No. A18X6.
5. Ratchet wrench for valve stem, Cat. No. A18X27.
6. Extension for A18X27, Cat. No. A18X35.
7. Two screwdrivers, one with 3/8 x 6 in. bit, and one small screwdriver.
8. Bristo purging wrench, Cat. No. 11X122.
9. Compound gauge, Cat. No. C19X2 and pressure gauge, Cat. No. C19X1.
10. Pocket thermometer, Cat. No. 11X67.

Note: Items 1 to 6, inclusive, of the above are contained in the Cat. No. A18A36 tool kit for type CD refrigerating machines.

Additional tools will also be needed if it is necessary to change compressors or shaft seals. These are as follows:

1. Small wheel puller for compressor flywheel. A small gear puller that can be purchased locally is satisfactory.
2. Set of flare tools. Flare block Cat. No. C19A6, and flare yoke Cat. No. A18A29.
3. Lapping plates, Cat. No. A18A8, for shaft seal nose-piece.
4. Lapping tool, Cat. No. A18A31, for shaft shoulder.
5. Alundum, Cat. Nos. A18A20, A18A21 and A18A22.

PRESSURE GAUGES

Pressure gauge Cat. No. C19X2 reading from 30-in. vacuum to 50-lbs. pressure is used for measuring pressure in the low pressure side and Cat. No. C19X1 reading from 0-lbs. to 300-lbs. pressure is used in the high pressure side. Both gauges are supplied with 1/8-in. male pipe connections to fit the gauge connections on the suction and discharge service valves. Back, or suction pressure is measured at the compressor suction service valve and head pressure at the discharge service valve.

To install a pressure gauge proceed as follows:

A. Disconnect the cord plug from the convenience outlet and remove the unit compartment panel.

B. Back-seat the valve on which the gauge is to be placed.

C. Remove the plug from the gauge connection in the valve.

D. Install the gauge by screwing the gauge fitting into the valve connection.

E. To read pressure, the valve stem must be turned approximately 1/4 turn away from the back-seat position, to open up the passage to the gauge. Refer to Fig. 13, which shows a sectional view of the service valve. When reading pressure on the back pressure gauge turn the valve stem slowly to see that the pressure is not too high to read on the gauge. When the valve stem is between front and back seat, the gauge passage is open to the pressure of the refrigerant flowing through the valve. If it is desired to read the pressure on one side of the valve only, the valve must be front-seated, and the gauge is then open to the pressure inside the compressor only.

F. To remove the gauge, back-seat the valve and reverse the above operations.

Caution: Always seal the valve connection plug threads with litharge and glycerine paste. Put the paste on the male plug threads only in order to assure that none will get into the refrigerant system.

Both pressure gauges should be used when checking trouble in the refrigerant system and when making adjustments.

In order to serve as a guide for checking the operating pressures, Table I is given here, showing the temperatures and corresponding pressures for the evaporation or condensation of sulphur dioxide (SO_2) refrigerant.

Table I

Temperatures and corresponding pressures for the evaporation or condensation of sulphur dioxide (SO_2).

Refrigerant Temperature Degrees F.	SO_2 Gauge Pressure
−40	23.5 in.
−35	22.5 in.
−30	21.0 in.
−25	19.5 in.
−20	18.0 in.
−15	16.0 in.
−10	14.0 in.
−5	11.5 in.
0	9.0 in.
5	6.0 in.
10	2.5 in.
15	0.5 lbs.
20	2.5 lbs.
25	4.5 lbs.
30	7.0 lbs.
35	9.5 lbs.
40	12.5 lbs.
45	15.5 lbs.
50	19.0 lbs.
55	22.5 lbs.
60	26.0 lbs.

Refrigerant Temperature Degrees F.	SO_2 Gauge Pressure
65	30.5 lbs.
70	35.0 lbs.
75	40.0 lbs.
80	45.0 lbs.
85	50.5 lbs.
90	56.5 lbs.
95	63.0 lbs.
100	70.0 lbs.
105	77.0 lbs.
110	85.0 lbs.
120	106.0 lbs.
130	122.0 lbs.
140	144.0 lbs.

The temperature of the compressed vapor which is being liquefied in the condenser is always higher than that of the room air drawn through the condenser by the fan since the heat absorbed by the compressed vapor must be transferred to the room air. Consequently, when the machine is operating the condenser or head pressure will always be higher than the pressures given in Table I for the corresponding temperature of the air in front of the machine compartment.

When the machine is operating and the cooling unit is pulled down, the head pressure should not be more than approximately 15 lbs. higher than the pressure shown in Table I for the corresponding temperature of the air in front of the machine compartment.

Higher than normal head pressures may be caused by non-condensable gas or air in the system; a restriction in the high side such as a bent liquid line or a stuck-closed float or throttling valve; improper ventilation due to dirt clogging the condenser or a blocked intake duct or improperly located refrigerator; or an overcharge of refrigerant by an inexperienced service man.

A low suction pressure and a warm cooling unit might result from a restriction in the suction line; a stuck-closed check valve; a stuck-closed float or throttling valve; or a low charge of refrigerant. When reading suction pressures allow for fact that the temperature of the refrigerant in the cooling unit is several degrees lower than the temperature of the cooling unit.

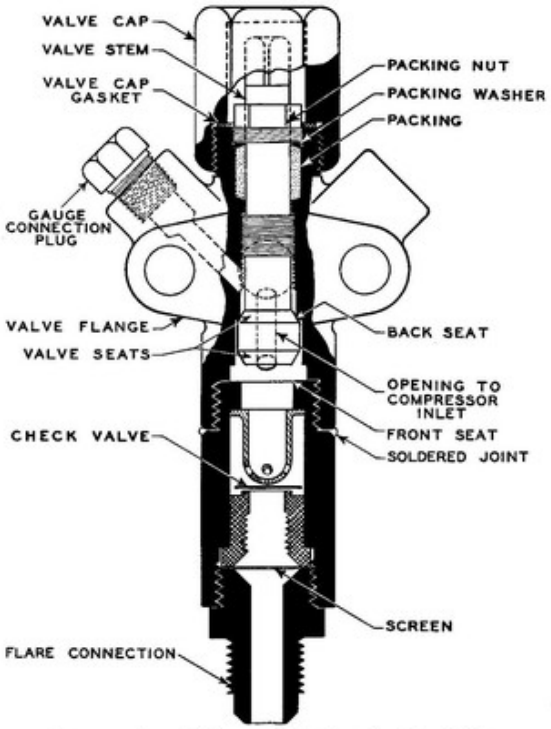
SERVICE VALVES

The type CD compressor is supplied with service valves to permit removal of the compressor, if necessary, from the refrigerant system. These valves are located in the suction and discharge lines, and are alike in construction, except that the suction service valve has the check valve permanently assembled to it. They are three-way valves, provided with front and back seats and with outlet connections for gauges.

The service valve is front-seated when the valve stem is turned to the right as far as possible. It is back-seated when the valve stem is turned to the left as far as possible. When the valve is back-seated the gauge connection is closed off from the main passageway through the valve.

When the service valve is between front seat and back seat, the gauge outlet is open to the pressure of the refrigerant as it passes through the valve.

Referring to Fig. 13, it may be seen that the valve stem is enclosed by a packing to prevent the escape of gas. A packing nut is provided to increase the pressure on the packing and prevent leaking. Valves are provided with caps and gaskets which serve as a secondary seal in case the packing around the valve stems should leak slightly. The valve cap and gasket should always be tightened into place to be absolutely certain that leakage is prevented.



Cross-sectional View of Suction Service Valve and Check Valve
Fig. 13

Excessive tightening is unnecessary and undesirable for either the front-seating or back-seating of the valve. The valve may be injured or freeze to the seat so that the valve stem is twisted off when an attempt is made to turn it. For this reason the valves should be turned ¼ turn from back seat when the machine is left in operation. This will prevent possible freezing of the valve stem to the seat over a period of time.

The use of service valves on the compressor facilitates adjustments and by providing pressure gauge connections assists in diagnosing troubles.

Machine adjustments are discussed under the following headings:

I. Machine will not start.
II. Machine will not run.
III. Unsatisfactory refrigeration.
IV. Noise.
V. Leaks.
VI. Light flicker.
VII. Machine and parts replacement.

Note: The cord plug should be removed from the convenience outlet when making electrical connections or mechanical adjustments. If power is essential for some particular test, then use adequate precautions to avoid an electrical shock.

All electrical and mechanical connections that have been loosened in the process of adjustment should be thoroughly tightened again to insure satisfactory performance.

I. MACHINE WILL NOT START

Causes

If the machine will not start, the overload protective device in the control may, or may not, trip off when the machine is turned on.

The possible causes for the machine not starting are:

1. Improper current or voltage.
2. Open circuit.
3. Grounded circuit.
4. Short circuit.
5. Defective motor.
6. Defective capacitor.
7. Stalled compressor.
8. Broken belt.

Adjustments

The source of trouble may be external to the machine or it may be in the machine itself. It is recommended that the external factors be checked first.

1. IMPROPER CURRENT OR VOLTAGE

The power supply voltage and frequency must agree with that which is stamped on the nameplate of the machine.

The motor is designed for operation over a voltage range of from 85% to 110% of the normal voltage rating stamped on the machine nameplate.

When the voltage at the machine at the time of starting is less than 85% of the nameplate voltage then the motor may not start and the motor protective device in the control may trip off.

When the voltage is above 110% nameplate voltage and the machine is operating under heavy load conditions, the current to the motor may be sufficient to trip the motor protective device.

Line voltage can be checked with a voltmeter or by noting a light on the same circuit for excessive dimness or brightness. If the voltage is constantly low or drops excessively during starting, notify the power company.

2. OPEN CIRCUIT

A. Circuit to the Refrigerator

Check the electrical circuit to the convenience outlet by placing a series test lamp across the terminals of the outlet. If the lamp will not light, check the line fuses to see that one is not blown and needs replacing. If a line fuse is blown, check the circuit to which the machine is connected to see that the circuit is not overloaded.

Check the cord connections to the convenience outlet and to the machine to make sure that good electrical contact is obtained.

Check the connections to the control. Check the control locking connector for possible poor contact or open circuit.

One of the wires may have become disconnected in the connector.

The spring contacts in some connectors may not make contact, having lost their spring tension.

The small brass screws which hold the fiber disc over the end of the connector may project out far enough to prevent the prongs on the control from making contact with the spring contacts in the connector. Make sure that the wires in the connector are properly located in the grooves so that they do not interfere with the seating of the disc.

B. Control

If the circuit to the refrigerator is found to be all right, place a jumper wire across the control locking connector terminals or twist the control leads together. If the machine then starts and runs when the machine cord is plugged into the convenience outlet, it is evident that the control may have an open circuit. If open circuited, the control should be replaced.

Caution: Before replacing a control, make sure that the machine is not in the "off" cycle. The bellows tube can be warmed by holding the hand over it on the cooling unit.

An alternative method for testing a control for open circuit is by means of a test lamp. Place the test lamp in series with the control in an electric circuit and note whether the lamp lights when the main switch is turned to the "on" position. If the lamp does not light, there is an open circuit in the control.

An open circuit in a control may be caused by a weak bellows, open lead or connection, burned contacts, or defective toggle device. Since part replacements which disturb the operation of the control should not be made, the control must be replaced.

C. Motor or Capacitor

If there is an open circuit in the motor or capacitor the motor will not start even with the proper voltage applied to the motor terminals. See "Defective motor," page 23.

3. GROUNDED CIRCUIT

All electrical circuits and connections are insulated from the refrigerating machine itself. If one of the electrical circuits or connections should come in direct contact with a part of the refrigerating machine, it is considered grounded.

A ground in the circuit to the refrigerator, in the control, motor or capacitor may cause blowing of the house fuses, tripping off of the motor protective device, welding of the contacts or burning off of a lead.

A series test lamp will be found necessary to locate the ground.

Caution: The machine itself must not be grounded either through the cabinet or test rack while testing for a grounded circuit; otherwise, the line to the refrigerator may be short circuited to ground. If the machine can not be conveniently insulated from ground, a series test lamp must be used in each lead from line to the machine.

A. Circuit to the Refrigerator

A ground in the circuit to the refrigerator will cause blowing of the house fuses after the refrigerator is disconnected from the circuit.

Make sure that the ground is not in the cord connector or plug. Look for evidence of arcing. Also, watch for indications of moisture and dirt.

B. Control

Replace the control with a new one. If the machine starts and runs satisfactorily, there may have been a ground in the original control.

Caution: If the ground is in the motor or capacitor, the motor protective device may trip off, the main contacts may weld or a lead may be burned off in the new control.

A grounded control can be very easily checked with an electric circuit and a series test lamp. First turn the control to "on." Then connect one side of the electric circuit to one terminal of the control. Connect one lead from the series test lamp to the other side of the electric circuit. Touch the other lead of the test lamp to the bellows tube. If the lamp lights, there is a ground in the control.

Caution: The control or bellows tube must not be grounded while testing for a grounded circuit; otherwise, the testing voltage may be short circuited to ground.

C. Motor or Capacitor

Examine the connections at the motor terminal block for evidences of arcing. Also look for indications of moisture and dirt.

Test motor and capacitor for grounds by disconnecting and checking with a series test lamp. Observe the "*Caution*" immediately after "Grounded circuit" on this page.

4. SHORT CIRCUIT

A short circuit occurs when two circuits or connections come in contact with each other. All electrical circuits or connections are insulated from each other in the machine.

A short in the circuit to the refrigerator may cause blowing of the house fuses.

A short circuit in the motor or capacitor may cause blowing of the house fuses, tripping of the motor protective device, welding or burning the control contacts, or burning off of a lead.

Make sure that the short is not in the connector to the control. Examine all connections for evidence of arcing; also, indications of moisture and dirt.

If a short-circuited spot is found, eliminate it if possible by taping or otherwise insulating it.

A short circuit in the control will cause the machine to run all the time even when the switch is turned to the "off" position. See "Machine does not shut off," page 28.

Replace the control.

5. DEFECTIVE MOTOR

If the motor does not run with the belt removed from the pulley, although the connections are in good condition and the voltage is correct, a check should be made to determine whether the motor or capacitor (if removable) is at fault.

Capacitors are removable from motors on which the capacitor connections are made to the terminal blocks on the motors. Capacitors are not removable where the connections are made inside the motors.

If the capacitor is removable, the motor may be checked by disconnecting the capacitor and replacing it with one which is known to be good. If the motor will not run with the new capacitor it is defective and should be replaced. Refer to wiring diagrams on page 19. If the capacitor is not removable both motor and capacitor must be replaced.

6. DEFECTIVE CAPACITOR

The capacitor, if separable from the motor, may be checked using the same procedure as given under "Defective motor." If the motor runs satisfactorily with the new capacitor, then the old capacitor is defective and should be replaced. If the capacitor is not separable both motor and capacitor must be replaced.

7. STALLED COMPRESSOR

Possibly a rare case may be encountered where the compressor is completely or partially stalled. The motor may stall causing the overload device in the control to trip out or the belt may slip. Shut off the machine, remove the belt from the compressor pulley and try turning the pulley by hand, in the operating direction. All compressors normally turn hard in the reverse direction. If it will not turn, or turns excessively hard, the compressor is defective. In case of doubt, compare it with a compressor which is known to be good.

If the compressor is stalled, either the compressor or the machine must be replaced. See "Replacement of compressor," page 34.

8. BROKEN BELT

If the motor starts and runs satisfactorily but the compressor does not start, the belt must be broken or off the pulleys. Refer to "Replacement and adjustment of belt," page 34.

II. MACHINE WILL NOT RUN

Causes

If the machine starts but does not continue to run because of the overload device tripping out, the trouble will be due to one of the following causes:

1. Improper current or voltage.

2. Defective motor.
3. Defective capacitor.
4. Partially stalled compressor.
5. Non-condensable gas.
6. Improper control.
7. Improper ventilation.
8. Stuck float or throttling valve.

Adjustments

The first four sources of trouble listed above were discussed under Section I "Machine will not start."

5. NON-CONDENSABLE GAS

The presence of non-condensable gas (or air) in the refrigerant system may increase the head pressure sufficiently to overload the motor and cause the motor protective device to trip out. When trouble is due to non-condensable gas the temperature of the float is relatively cool to that of the upper part of the condenser, and feels cooler to the hand. Check the head pressure, with the proper gauge, at the discharge service valve.

To remedy this condition, purge the machine at the discharge service valve gauge connection. First run the machine long enough to warm it up, then shut it off, back-seat the discharge service valve and remove the gauge from the gauge connection. Turn the valve stem approximately ¼ turn away from the back seat and purge out the non-condensable gas. Return it to back seat as soon as the odor of SO_2 is noticed. Replace the gauge, and check the operation of the machine. If the head pressure has returned to normal, the machine will operate satisfactorily; if not, it will be necessary to purge it again.

6. IMPROPER CONTROL

Different overload heaters are used in the different controls, and if the current overload is tripping out for no apparent cause, check to see that the proper control is used. The catalog number of the control is stamped on the side of the control case. The control case must not be opened. Replace the entire control with one of the proper catalog number.

7. IMPROPER VENTILATION

The refrigerator should be located so that there is at least 2 inches unrestricted air space between the back of the cabinet and the wall and at least 6 inches above the entire top of the cabinet including the 2 inch space between the cabinet and wall. The air inlet to the condenser is along the bottom front of the cabinet and *this space must not be blocked off* with boxes, etc.

Check the head pressure with a gauge at the discharge service valve. If trouble is due to improper ventilation the head pressure will be excessively high.

Remove the front panel of the unit compartment and see that the condenser is not clogged with dirt or lint.

See that the rubber spacer is on the channel on the rear of the cabinet.

8. STUCK FLOAT OR THROTTLING VALVE

If the float valve or the throttling valve on the cooling unit is stuck shut the unit may stall. The condenser will gradually fill with liquid refrigerant, reducing its effectiveness and raising the head pressure. The motor overload will trip out.

Loosen the stuck valve by bumping it with a wood block until refrigerant can be heard flowing through the valve or until the stalling is eliminated.

III. UNSATISFACTORY REFRIGERATION (MACHINE RUNS ALL RIGHT)

Symptoms

If the refrigerating machine will start and run but will not refrigerate properly, it will probably have one or more of the symptoms listed below. If it will not start or run refer to "Machine will not start" or "Machine will not run," pages 22 and 23.

Symtoms of unsatisfactory refrigeration may be listed as follows:

1. No refrigeration (cooling unit remains warm).
2. Low refrigeration (cooling unit cools only partially).
3. Erratic refrigeration (cooling unit frosts at times, not at other times).
4. Cabinet temperature too high (cooling unit frosts satisfactorily).
5. Cabinet temperature too low (cooling unit frosts satisfactorily).
6. Unsatisfactory ice or dessert freezing (cooling unit frosts satisfactorily).
7. High per cent running time.
8. High power consumption.

Adjustments

Unsatisfactory refrigeration may result from factors external to the machine or from trouble within the machine. The frosting of the cooling unit is usually an indication of whether the fault is in the machine or elsewhere. A check of the head and back pressures at the service valves will give an indication of the cause of the trouble.

Caution: *In checking a refrigerator for unsatisfactory refrigeration, first make sure that the machine has operated long enough that normal operating conditions should have been obtained if it were operating properly.*

1. NO REFRIGERATION (COOLING UNIT REMAINS WARM)

If the cooling unit does not cool at all, yet the machine runs all right, the trouble is in the machine. Possible causes include:

A. Closed service valves.
B. No refrigerant in the machine.
C. Non-condensable gas.
D. Float valve stuck closed.
E. Float valve stuck open.
F. Check valve stuck closed.

G. Throttling valve stuck closed.

H. Defective compressor.

A. Closed Service Valves

Check to see that the service valves have not been left closed, thus isolating the compressor from the rest of the system.

B. No Refrigerant in the Machine

If there is no refrigerant in the machine the condenser will not warm up, even after the machine has been run fifteen minutes or more. The compressor case may be slightly warm. The back pressure will be low and the head pressure low. The machine runs continuously. If the purging screw in the float valve is opened slightly with the Cat. No. 11X122 purging wrench, or if the machine is purged at the discharge service valve, there will be no indication of high pressure refrigerant escaping.

Examine the machine for a gas leak and correct it if possible. Refer to "Leaks," page 30.

If the leak can be repaired, add refrigerant to the machine as described under "Adding refrigerant," page 37.

C. Non-Condensable Gas

Non-condensable gas may stop the float valve operation so that refrigerant is not returned to the cooling unit. The refrigeration will drop off and eventually stop. The temperature of the float valve is relatively cool to that of the upper part of the condenser, and feels cooler to the hand. The head pressure will be high.

Rid the machine of non-condensable gas by purging as described under "Non-condensable gas," page 24.

D. Float Valve Stuck Closed

If the float valve is stuck closed, the circulation of refrigerant to the cooling unit will be stopped. Refrigeration will drop off and eventually stop. The possible reasons for the trouble include: corrosion, mechanical binding, plugged orifice and float bulb filled with liquid. In many cases, the trouble is of a minor nature and can be cured easily and permanently. In a few cases, the trouble is of a more serious nature and cannot be cured, or if cured, will remain so only temporarily.

The float valve temperature is relatively cool to that of the upper part of the condenser, and feels cooler to the hand. The head pressure will be high and the back pressure low. Bump the float valve shell with a piece of wood or a rubber mallet to free the float.

If the trouble cannot be overcome, replace the machine.

E. Float Valve Stuck Open

If the float valve is stuck open, gas refrigerant from the condenser is returned directly into the cooling unit. There will be little or no refrigeration in the cooling unit. The float valve temperature will be warm and equal to that of the condenser. A slight hissing noise may be heard as the refrigerant passes through the float valve orifice.

The back pressure will probably be high and the head pressure low.

To remedy the trouble, try tapping the float valve shell with a block of wood or a rubber mallet. If the trouble cannot be remedied, replace the machine.

F. Check Valve Stuck Closed

If the check valve is stuck closed, the cooling unit is closed off from the compressor. No refrigerant will pass through the compressor. The condenser will not warm up appreciably even after the machine has been run for fifteen minutes or more. The compressor case may be slightly warm. The back pressure will be very low.

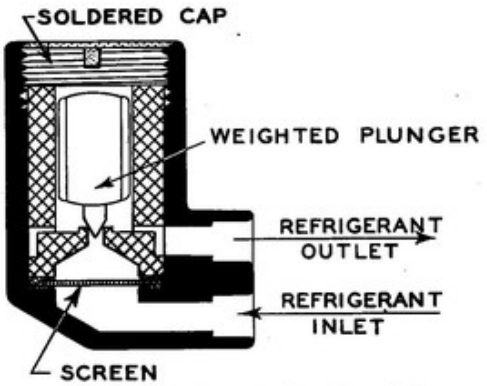
Run the machine with pans of hot water in the cooling unit to build up pressure which will tend to blow open the check valve.

Caution: Do not put a heater in the cooling unit.

Jarring the check valve with a wood block may free it.

G. Throttling Valve Stuck Closed

If the throttling valve is stuck closed the symptoms will be similar to those found when the float valve is stuck closed, since no refrigerant will pass into the cooling unit. Trouble may be due to corrosion or mechanical binding of the weighted plunger. The construction of the throttling valve is shown in Fig. 14.



Cross-sectional View of Throttling Valve
Fig. 14

To correct the trouble, tap the bottom of the valve body lightly with a piece of wood or a rubber mallet to jar the plunger upward off of the seat. Do not strike the valve hard enough to break it loose from the cooling unit. If the valve sticks again, repeat this treatment. Do not replace the machine until this process has been repeated several times.

H. Defective Compressor

If it is found that the lack of refrigeration is not due to any of the preceding causes, by the process of elimination it is probable that the compressor is defective.

The operation of the compressor should be checked by means of the set of pressure gauges as follows:

First remove the cord from the convenience outlet and then remove the condensing unit from the bottom of the cabinet as described under "Replacement of machine," page 31.

Check both service valves to see that they are back-seated and then remove their gauge plugs. Install the compound gauge in the back-seat of the suction service valve and the pressure gauge in the back-seat of the discharge service valve.

Before making the compressor gauge tests, run the machine long enough to warm up the oil in the compressor. This will usually require at least five to ten minutes. Be sure that the gauges used are accurate and reliable.

First give the compressor a vacuum test by completely front-seating the suction service valve and then running the machine. The compressor is defective if it will not pull a 20-inch vacuum on the compound gauge.

If the compressor passes the vacuum test, then the ability of the compressor to pump up a head pressure should be tested. First make sure that the suction service valve is back-seated. Then carefully and slowly front-seat the discharge service valve until the pressure gauge registers 175 lbs. pressure. If the compressor will not pump a head pressure of at least 175 lbs. it is defective.

If the compressor is defective either the machine or compressor body must be replaced. Refer to "Replacement of machine," page 31, and "Replacement of compressor," page 34.

2. LOW REFRIGERATION (CABINET TEMPERATURE HIGH, COOLING UNIT COOLS ONLY PARTIALLY)

Most of the causes listed under "No refrigeration" bring about low refrigeration when discovered in an early stage or when the trouble is present in a lesser degree. The following causes of both no and low refrigeration are discussed under "No refrigeration," page 24.

Closed service valves.

Non-condensable gas.

Float valve stuck closed.

Float valve stuck open.

Throttling valve stuck closed.

Defective compressor.

In addition to the above, there are several other conditions which may cause low refrigeration:

A. Low refrigerant charge.

B. Check valve stuck open or leaking badly.

C. Improper ventilation.

D. Partially weak bellows in control.

A. Low Refrigerant Charge

If there is a low refrigerant charge in the machine, the frost line will be low and probably uneven. (This condition should not be confused with that which may occur if the temperature control is set for too high a temperature.) The head and back pressures may be low. The cabinet temperature may be high and the ice freezing time unduly long.

To correct the trouble, add refrigerant as described under "Adding refrigerant," page 37.

B. Check Valve Stuck Open or Leaks Badly

If the check valve is stuck open or if it leaks badly, some gas refrigerant and oil from the compressor flows back into the cooling unit when the machine shuts off. The liquid refrigerant in the cooling unit is warmed up and the machine starts up again in a shorter time than it normally would.

The "off" period will be abnormally short. Let the machine run continuously with pans of hot water in the cooling unit and with the air intake partly blocked in order to increase the head pressure. Then shut off the machine. The higher pressure will tend to loosen the check valve if it is stuck open. The flushing through of the check valve with a large amount of refrigerant from the boiling in the cooling unit caused by placing pans of hot water in the cooling unit will tend to force out any small particles of dirt or other foreign matter.

Caution: Do not put a heater in the cooling unit.

Jarring the check valve with a wood block may dislodge the valve or the particle of dirt or foreign material holding it open.

C. Improper Ventilation

Improper ventilation will cause the machine to run hotter and consequently will reduce the efficiency and capacity of the machine. Refer to "Improper ventilation," page 24.

D. Partially Weak Bellows in Control

A partially weak bellows in the control can cause a machine to operate on a defrosting cycle. Normally, the gas pressure within the bellows follows the pressure-temperature curve of a saturated vapor. Throughout the normal operating range there is some liquid present in the end of the bellows tube.

If there is a minute leak in the bellows or bellows tube, there will come a time when there will be liquid present at the lower end of the temperature range but not at the upper end. The gas pressure will then follow the curve of a super-heated vapor. The pressure in the bellows for a given temperature will be less than it would be if the gas were a saturated vapor. Therefore, the cooling unit temperature must rise higher than it normally would to trip the machine on. The tripping-on temperature may be above 32° F. so that the cooling unit will defrost during the "off" part of the cycle. The "on" and "off" parts of the cycle will be longer than normal. Replace the control.

Be sure that the trouble was not due to the old control being turned to the defrost position or that the control is set too high.

3. ERRATIC REFRIGERATION (COOLING UNIT FROSTS AT TIMES, NOT AT OTHER TIMES)

When a cause of no and low refrigeration appears and disappears at intervals, erratic refrigeration results. At one time the refrigeration will be normal, at another time there will be little or none. To check the machine when operating normally will reveal no trouble. It must be checked during the period when the refrigeration is low. Then refer to the causes

listed under "No refrigeration" and "Low refrigeration."

4. CABINET TEMPERATURE TOO HIGH (COOLING UNIT FROSTS SATISFACTORILY)

If the cooling unit frosts all right, the trouble is probably not in the machine itself. If the cabinet temperature is too high and the cooling unit does not appear to be frosting satisfactorily refer to "Low refrigeration," page 26. Possible causes of high cabinet temperature include:

A. Improper control temperature knob setting.
B. Partially weak bellows in control.
C. Improper ventilation.
D. Restricted air circulation in cabinet.
E. Excessive heat leakage into cabinet.
F. Excessively high room temperature.
G. Excessive loading of cabinet.
H. Excessive cabinet door opening.

A. Improper Control Temperature Knob Setting

The cabinet temperature depends to a certain extent on the control temperature knob setting. This setting is made adjustable in order to satisfy the individual desires of the user. If it is desired to make the cabinet air temperature colder, the knob is turned clockwise; if warmer, it is turned counterclockwise.

To illustrate the point, the following table gives approximate cooling unit and cabinet temperatures for a CD-1 or CD-2, during normal performance in an 80° F. room without food or ice freezing load:

Temperature knob position	Machine trips	Cool. unit bottom temp., °F.	Cab. air temp., °F.
1	on	28	42
	off	18	
5 (normal)	on	22	38
	off	12	
9	on	18	34
	off	8	

If the desirable temperature cannot be obtained with the amount of adjustment obtainable with the temperature knob, remove the textolite seal in the center of the knob. The small screw under the seal can be removed and the knob reset. Shift the knob clockwise for warmer and counterclockwise for colder.

Caution: Do not reset the knob more than two complete turns warmer, or the stop against which the main temperature spring bears will run off the thread on the shaft and the control will have to be replaced.

The temperature setting of the control can be checked by running the machine and observing the cut-off and cut-on temperatures as registered by a thermometer lying on the bottom of the cooling unit. With the control knob in position 5, the temperature range should be about 12° – 22° F. for the CD-1 or CD-2 and 15° – 25° F. for the CD-3.

B. Partially Weak Bellows in Control

A partially weak bellows in the control may raise the upper temperature limit of the cooling unit so that the average cooling unit temperature is considerably above normal. A higher cabinet air temperature will result. Refer to "Partially weak bellows in control" under "Low refrigeration," page 26.

C. Improper Ventilation

Improper ventilation will cause the machine to run hotter and will consequently reduce the efficiency and capacity of the machine. The head pressure will be high. Refer to "Improper ventilation" under "Machine will not run," page 24.

D. Restricted Air Circulation in Cabinet

Air circulation is necessary to insure uniform temperature distribution in the cabinet. If the air circulation is restricted by excessive crowding of food or by placing coverings over the shelves, the cabinet air temperature in places will be higher than it should be.

E. Excessive Heat Leakage Into the Cabinet

If there is excessive heat leakage into the cabinet the cabinet air temperature will increase.

Test the door gasket seal by inserting a .003 in. metal feeler between the cabinet and the gasket. There should be tension on the feeler at all points around the door seal. Refer to "Door seal," page 39.

Check the rubber gasket, through which the refrigerant lines pass, in the cooling unit mounting plate to see that it is properly located and is sealing the opening in the plate. See that the sponge rubber seal in the clamp holding the refrigerant lines in the back of the cabinet is tightly clamped in place, sealing up this opening into the top of the cabinet.

Remove the cabinet top and see that the insulation between the cooling unit mounting plate and the cabinet top is in place. Check the No-Ox-Id or greased cloth seal around the top of the inner liner to see that it is in place.

F. Excessively High Room Temperature

The capacity of a refrigerating machine depends on the room temperature in which it operates. With the same control temperature knob setting, the cabinet air temperature will increase with an increase in room temperature. If the room temperature is exceptionally high, the proper cooling of the condenser will not take place, and the head pressure will increase. The overload protective device may cut out.

The following approximate figures indicate the relationship of cabinet air temperature to room temperature with the control temperature knob set at position 5, for normal operating conditions:

Room temp. °F.	Cab. air temp. °F.
60	34
80	40
100	44

G. Excessive Loading of Cabinet

The cabinet air temperature will rise when a large

amount of relatively warm food is placed in the cabinet. The temperature will continue to be higher than normal until the food is cooled. If warm food is constantly being placed in the cabinet, the temperature will average somewhat above normal.

H. Excessive Cabinet Door Opening

Whenever the cabinet door is opened, warm air enters the cabinet and the temperature goes up a few degrees. If the door is left open or is opened excessively, the cabinet air temperature will stay above normal.

5. CABINET TEMPERATURE TOO LOW (COOLING UNIT FROSTS SATISFACTORILY)

When this condition occurs the machine is evidently running too much.

Possible causes are:

A. Improper control temperature knob setting.
B. Excessively low room temperature.
C. Poor bellows tube contact to cooling unit.
D. Machine does not shut off.

A. Improper Control Temperature Knob Setting

Refer to "Improper control temperature knob setting" under "Cabinet temperature too high," page 27.

Note: In high altitudes the lower barometric pressures will shift the temperature range of the control lower. This may necessitate resetting the temperature control knob warmer in order not to hold too low a cabinet temperature.

B. Excessively Low Room Temperature

Refer to "Excessively high room temperature" under "Cabinet temperature too high," page 27.

C. Poor Bellows Tube Contact to Cooling Unit

If the bellows tube contact to the cooling unit is poor, the cooling unit will run colder than it normally would. Adjust the clamp and bellows tube to improve the contact.

Note: A poor bellows tube contact increases the range of the control and may cause defrosting on the "off" part of the cycle.

D. Machine Does Not Shut Off

When a machine runs all the time and fails to shut off, the cause is either low refrigeration or defective control operation. In this case the fault must be in the control, since the machine is refrigerating properly.

The stationary main contact in the control is mounted on the end of one of the prongs projecting through the back of the control. If the prong is sprung, the stationary main contact may be pushed inward until it touches the movable main contact even when this latter contact is in the open position. In some cases it will be possible to straighten the prong and return the stationary contact to its proper location. In other cases the control must be changed.

Other possible control defects which might cause continuous running of the machine include a weak bellows, defective bridle action and any short circuit in the control, such as welded contacts. The control must be changed, since part replacements cannot be made, if it is defective.

6. UNSATISFACTORY ICE OR DESSERT FREEZING (COOLING UNIT FROSTS SATISFACTORILY)

If the refrigerating machine does not show low refrigeration as covered on page 26, or if the cabinet temperature is not too high for any of the reasons listed on page 27, the cause for slow freezing may be one of the following:

A. Improper control temperature knob setting.
B. Poor contact of ice tray with cooling unit surface.
   a. Tray not frozen in properly.
   b. Tray bottom surface not flat.
   c. Cooling unit needs defrosting.

A. Improper Control Temperature Knob Setting

For most rapid freezing, the control temperature knob setting should be turned to position 9, so that the machine will run continuously in normal room temperatures, until the freezing is completed. In this way the average cooling unit temperature will be several degrees lower than it would be if the machine operated in cycles.

Caution: When the freezing is completed, the knob should be returned to the normal position. Otherwise, the cabinet air temperature may be reduced to a point where freezing of food will result.

If the temperature range of the control doesn't seem right, check the control temperature limits as described under "Improper control knob setting," on page 27. If necessary, reset the control temperature knob.

B. Poor Contact of Ice Tray with Cooling Unit Surface

The transfer of heat from the water to the cooling unit surface is accomplished largely through the contact of the ice tray with the cooling unit surface. The better the contact, the faster the freezing rate.

a. Tray Not Frozen in Properly.

If the ice tray is not frozen to the cooling unit surface, the freezing rate will be reduced. It is recommended that a small amount (quarter of a cupful) of water be spread over the cooling unit surface at the time the ice tray is put in.

b. Tray Bottom Surface Not Flat.

If the bottom surface of the ice tray is badly dented or warped, good contact cannot be obtained. The surface should be straightened or the tray replaced.

c. Cooling Unit Needs Defrosting.

If the surface of the frost on the cooling unit is uneven at the time the ice tray is put in, good contact cannot be secured. The cooling unit should be defrosted.

Note: The time required to freeze desserts depends on the constituents used. It is usually somewhat longer than the time to freeze water. If the machine

will freeze water satisfactorily it will likewise freeze desserts.

7. HIGH PER CENT RUNNING TIME

If the per cent runing time of a machine seems abnormally high and the cooling unit frosts satisfactorily, the probable cause may be found under "Cabinet temperature too high," or "Cabinet temperature too low," pages 27 and 28.

If the per cent running time is abnormally high and the cooling unit does not frost satisfactorily, the probable cause may be found in "No refrigeration," or "Low refrigeration," pages 24 and 26.

Be sure to inspect the condenser to see that it is not clogged with dirt and lint.

8. HIGH POWER CONSUMPTION

If the power consumption of a machine seems abnormally high, refer to "High per cent running time."

IV. NOISE

Noise may be caused by defects in the machine itself or by improper adjustment of the machine parts. If a machine is noisy, examine it for the following:

1. Loose fan blades or pulleys.
2. Belt squeak or slap.
3. Noisy condensing unit mounting.
4. Shaft seal squeak.
5. Noisy compressor.
6. Noisy motor.
7. Radio interference.

1. LOOSE FAN BLADES OR PULLEYS

Noise may be caused by either of these conditions. Loose fan blades may be found by stopping the machine and checking the blades for tightness on the pulley.

The motor pulley and fan assembly may possibly be noisy without the blades feeling loose. To check for this, remove the belt and run the motor. If the noise continues it is in either the motor or the pulley and fan assembly. Replace the pulley and fan with one which is known to be quiet. If the noise has disappeared, the old fan and pulley assembly was noisy and should be replaced.

Check the motor and compressor pulleys for tightness on the shafts. Use the Allen set screw wrench Catalog No. A18X7 for tightening the motor pulley set screw.

2. BELT SQUEAK OR SLAP

If the belt squeaks, first check the operation of the belt tension device. See that it is in proper adjustment. Refer to "Replacement and adjustment of belt," page 34.

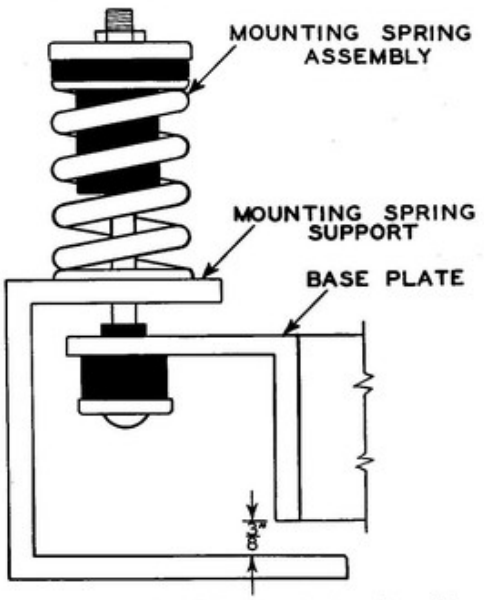
If the belt is in proper adjustment when running, but still squeaks, apply some ordinary work soap to the V surfaces by holding a bar of soap against the belt when the machine is running.

Belt slap is caused by improper adjustment of the motor with respect to the compressor, or the motor has rotated in the motor mounting clamps. If the clamps will not hold the motor from rotating in them the clamps should be removed and the ends filed off so that the clamps can be drawn tight.

3. NOISY CONDENSING UNIT MOUNTING

If the condensing unit mounting is noisy, first see that the shipping bolts and blocks have been removed. See that the four bolts holding the mounting spring supports to the cabinet are tight, and are holding the mounting securely to the cabinet.

Vibration of the machine mounting may result in a chattering noise caused by improper adjustment of the mounting springs. Check the mounting to see that it floats freely on its four spring supports. See that the mounting springs are properly located on the mounting spring supports. There should be approximately 3/8 in. clearance between the angle of the condensing unit mounting plate and the spring mounting supports. See Fig. 15. This clearance may be adjusted by adjusting the nuts on the spring studs.



Condensing Unit Mounting Spring Assembly
Fig. 15

See that the motor pulley fan does not strike the condenser and that the tubes connecting to the machine are not bent out of shape, thus holding the machine mounting out of position.

If the condensing unit mounting is vibrating excessively, it may be because the machine is operating under a very heavy load or that there is non-condensable gas in the machine.

See that the motor and compressor pulleys are in line and are running true. Use a straightedge to check the pulley alignment.

4. SHAFT SEAL SQUEAK

Shaft seal squeaking is due to an abnormal condition between the nose-piece of the seal assembly and

the compressor shaft. In most cases the condition will correct itself providing the machine is allowed to run for two or three days. If, after the machine has run for this length of time, the seal continues to be noisy, either the refrigerating machine, compressor, or the shaft seal should be replaced. Refer to "Replacement of shaft seal," page 35.

5. NOISY COMPRESSOR

The compressor may be slightly noisy when it is first started up. This noise will stop after the machine has run a few minutes. If the compressor has a heavy pumping noise after it has been run long enough to pull down the cooling unit to normal operating temperature, check for non-condensable gas. Refer to "Non-condensable gas," page 24.

If the compressor continues to be noisy after purging, either replace the refrigerating machine or the compressor. Refer to "Replacement of compressor," page 34.

6. NOISY MOTOR

If the motor appears to be noisy, check to see that the bearings are properly oiled. The motor should be oiled once a year, using a good grade of medium lubricating oil.

Excessive end play of the motor rotor may cause excessive vibration or noise or both. The rotor end play should not exceed 1/64 in.

Replace the motor if it has noisy bearings. Refer to "Replacement of motor," page 32.

See that the motor is properly secured in the pivoted cradle and that the rubber mountings are tight. If the mounting clamps will not hold the motor from turning, when they are tightened up because the ends of the clamps touch, remove the clamps and file off the ends so they can be tightened an additional amount.

7. RADIO INTERFERENCE

There will be no radio interference during the normal running of a refrigerating machine. If radio interference is traced to the refrigerator, there may be a ground or short circuit in the machine. Refer to "Grounded circuit," page 22, and "Short circuit," page 23. Check all connections to see that they are tight. On DC motors check to see that brushes are not sparking excessively due to worn brushes or a rough commutator. See page 16, "Motor brushes and commutator."

V. LEAKS

Gas leaks may be detected with ammonium hydroxide (28% solution). Hold either the open bottle or a saturated rag near the suspected location. The leak will be indicated by a cloudy white vapor.

If a considerable amount of the refrigerant has leaked out of a machine the head pressure will be low and the machine will be low in refrigeration.

If possible a gas leak should be corrected and refrigerant added, if required, as described under "Adding refrigerant," page 37.

If a gas leak is suspected, check all soldered and flare joints, the service valves, the shaft seal and the float valve purging screw.

1. SILVER SOLDERED JOINTS

Silver soldered joints should not be repaired in the field. Replace the machine.

2. FLARED JOINTS

Check the flared joints at the service valves and at the float valve outlet connection. If any of these joints leak, endeavor to tighten the flare nut, being careful not to force it.

3. COMPRESSOR SERVICE VALVES

Check all joints and connections at the service valves. If the leak is at the valve flange tighten the screws or replace the gasket if necessary. Refer to "Replacement of compressor," page 34, for information on removing the service valve from the compressor.

Check the gauge connection plug. Litharge and glycerine should be used to seal the plug threads.

If a leak develops at the valve stem tighten the packing nut. In addition, see that the valve stem cap is tight and replace the cap gasket if necessary.

The soft soldered joints on the service valves, and between the suction service valve and the check valve may leak in rare cases. These joints cannot be repaired without releasing the refrigerant from the machine.

4. SHAFT SEAL

If a leak is found at the shaft seal, first tighten the screws holding the clamping plates to the compressor end cap. If this does not correct the trouble the machine, the compressor, or the shaft seal may be replaced. If the shaft seal is changed, see that the leak is not in the bellows or at the gasket before attempting to repair the nose-piece or replacing the seal. Refer to "Replacement of shaft seal," page 35.

The shaft seal will probably leak oil before it will leak gas. However, a slight amount of oil at the shaft seal flange may not be an indication of leak, as a very slight amount of oil or grease may be forced out of the seal in normal operation, particularly on a new machine. This should be retained, however, by the oil retainer on the clamping plate and should not be enough to leak onto the mounting plate.

VI. LIGHT FLICKER

In installations where lead in wires or building wiring is of comparatively high resistance (small wire), operation of a refrigerating machine may cause flickering of lights connected to the same circuit. The flicker is produced by pulsating current originating from the frequency of the machine compression impulses.

For particularly bad cases of light flicker, a tuned flywheel, Cat. No. C5A50 for the compressor, may be installed in place of the regular pulley. This will correct the flicker even in very extreme installations where the house wiring is very poor.

To install the tuned flywheel, remove the condensing unit from the cabinet as described under "Replacement of machine," this page, and take off the compressor pulley, using a small wheel puller. Place the tuned flywheel on the shaft with the key in place and tighten the nut and lock washer in place. It will not be necessary to loosen the motor or compressor to make this change.

VII. MACHINE AND PART REPLACEMENTS

The replacement of the refrigerating machine or of any of its parts, in the field, is an operation which requires special care and attention on the part of the service man. The use of service valves on the type CD compressor permits the easy replacement of the compressor or the shaft seal.

If, in replacing parts, the service man will carefully follow the instructions given, no difficulty will be encountered and a good serviceable job will be done. Tools required to make replacements are listed on page 20.

Handling Refrigerant

In combination with moisture, sulphur dioxide (SO_2) forms an acid which attacks metal and which would stick up a compressor and float valve if present inside the refrigerant system of a machine. Consequently, every precaution must be taken to keep moisture from coming in contact with the sulphur dioxide that is used. Only sulphur dioxide which is obtained from an approved source must be used. Only our special dehydrated and filtered oil which is supplied in sealed containers must be used. This oil must never be left to stand around in an unsealed container because it will absorb moisture from the air. If the refrigerant system on a machine is opened in order to replace a part, every precaution must be taken to keep air (which contains moisture) out of the opened parts. After a part is replaced the opened parts must be purged to remove any air that may have gotten into them.

Always wear goggles and have a gas mask handy when working on parts from which refrigerant may be released. When handling SO_2 refrigerant the service man should keep in mind the possibility of injury if the refrigerant is not handled properly.

Never release any SO_2 refrigerant around household plants or pet birds as they are strongly affected by it.

Liquid SO_2 may produce a serious "burn" if it comes in contact with the skin. If this occurs, the injury should be treated as if the skin were frost bitten or frozen. In addition wash the skin with a liberal quantity of running water and apply sweet oil or olive oil, or if these are not available, apply clean machine oil.

Particular care must be taken that liquid refrigerant does not get into the eyes. SO_2 will unite with moisture to form an acid which may cause an acid burn. If liquid refrigerant gets into the eyes do not rub or irriate them. The following first aid treatment should be used:

First, wash out the eye with clean running water. Second, place drops of sweet oil or prime castor oil in the eye.

Machine and parts replacements are described under the following headings:

1. Replacement of machine.
2. Replacement of motor.
3. Replacement of capacitor.
4. Replacement of motor pulley.
5. Replacement of compressor pulley.
6. Replacement and adjustment of belt.
7. Replacement of motor cushion base.
8. Replacement of rubber cushion rings.
9. Replacement of compressor.
10. Replacement of shaft seal.
11. Adding refrigerant.
12. Power change-over.

1. REPLACEMENT OF MACHINE

The complete refrigerating machine can be removed from the cabinet and replaced by one man. Be sure that the temperature control knob is turned to "off" and that the plug is pulled from the outlet before any work is done on the machine.

Make the change as follows:

A. Remove the skirt from the bottom of the cabinet and move the cabinet away from the wall. Take off the front panel by pushing down and then pulling out on it.

B. Take out the screws holding the channel to the back of the cabinet and remove the channel. Remove the cabinet top by taking out the screws holding the two short braces at the rear and

Fig. 16

then tipping the top up at the back and sliding it forward.

Remove the insulation from the top of the cabinet and loosen the tubing clamp at the back.

Caution: Be very careful not to scratch the cabinet finish when removing or replacing parts. Handle the cabinet top carefully so the finish will not be scratched or marred.

C. Assemble the shipping blocks and shipping bolts in place on the condensing unit. This must be done before the condensing unit mounting is loosened from the cabinet or the mounting supports will not remain in place while the unit is being moved.

D. Remove the four cap screws holding the unit to the cabinet frame.

E. Place the skid or crate bottom on a strong box approximately 6 or 8 inches high, which must be placed close to the back of the cabinet. Slide the condensing unit out the back of the cabinet and lift it onto the skid on the box. Be sure the box is not so low or so far away from the cabinet that the tubing will not reach. See Fig. 16.

Bolt the condensing unit to the skid. Put several thicknesses of corrugated paper between the motor and compressor and tie the motor against the compressor, using a heavy cord to hold it in place.

F. Disconnect the cabinet light and door switch wiring from the connection block in the top of the cabinet.

G. Remove the 8 nuts holding the cooling unit mounting plate or top inner liner to the cabinet. Remove the shelves and chiller tray. Push upward on the bottom of the cooling unit until the top liner is loosened from the cabinet. Lift the cooling unit and liner out of the top of the cabinet. Support the cooling unit with one hand and carefully bend the tubing with the other until the cooling unit may be rested in place beside the condensing unit, on the skid. See Fig. 17. Secure the cooling unit in place with the wood strap and screws, and remove the liner from the top of the cooling unit.

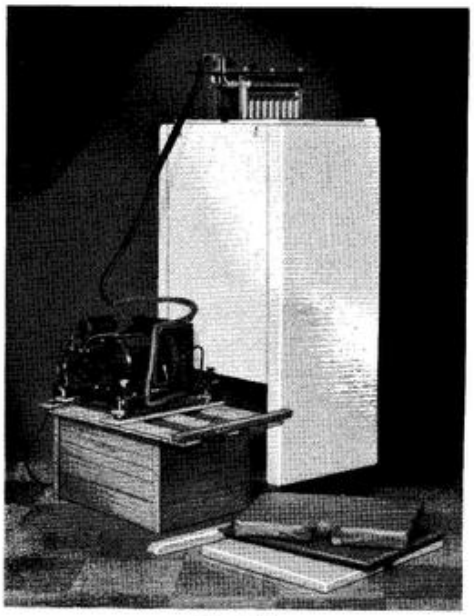


Fig. 17

H. Place the replacement refrigerating machine on the box at the back of the cabinet. Fasten the inner liner to the four supports on the cooling unit and install the new machine by reversing the foregoing operations.

Caution: Do not draw up the nuts too tight on the top inner liner or the porcelain will be chipped under the bolt heads inside the cabinet. Be sure the fibre washers are in place under these nuts.

Be sure that the No-Ox-Id or greased cloth seal is in place around the cabinet top and that the top inner liner is tight against the cloth all the way around the edge. See that the rubber gasket through which the refrigerant lines pass is in place in the top liner. Consult the wiring diagrams on page 19 when re-connecting the wiring in the cabinet top. Note that the white lead from the cabinet light connects to the white screw post in the small circular connection block in the cabinet top.

After the replacement is completed, check the new condensing unit as described under "Installation," page 12.

I. To uncrate the replacement machine, first straighten the ends of the wires which brace the sides of the crate as shown in Fig. 18. Pull out the nails holding the sides of the crate to the top, remove the top and then remove the sides as shown in Fig. 19. Remove the packing paper and inspect the refrigerating machine to see that all parts are in place and that parts or tubing are not damaged. Check the voltage and frequency stamped on the motor nameplate with that of the power supply.

J. When returning a replaced machine use the crate in which the replacement machine was received. Be sure to tie the proper return papers to the machine.

Caution: In returning a machine be sure that the condensing unit floating base is securely bolted down with the shipping bolts and blocks, the condensing unit is securely bolted to the bottom of the crate, the motor is properly tied against the compressor, and the cooling unit is securely fastened down. See Fig. 20. Otherwise damage to the machine parts may occur in transit.

2. REPLACEMENT OF MOTOR

A. Remove the condensing unit from the bottom of the cabinet and set it on a box as described under "Replacement of machine," page 31. It will, of course, be unnecessary to place it on the

skid. Disconnect the motor leads (after first making sure that the cord plug is pulled from the outlet) and remove the belt by tilting the motor toward the compressor. Loosen the two screws in the clamps of the motor mounting, remove the clamps and lift the motor up out of the cradle. See Fig. 21.

B. Remove the pulley and fan assembly and place it on the replacement motor. Check the voltage and frequency on the replacement motor nameplate.

C. The replacement motor will be supplied with the rubber cushion rings in place. Put the motor in the cradle and clamp it in place. Tighten the clamp screws so the mounting is held firmly in place but do not tighten them enough to squeeze the rubber cushion rings out of shape.

When clamping the motor in the mounting, care must be taken to get it in the correct position. With the motor properly mounted, the vertical centerline of the motor will pass through the centerline of the capacitor, or wave filter,

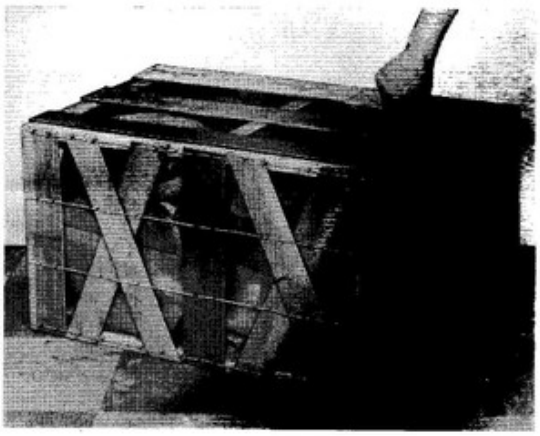


Fig. 18

and also through the vertical centerline of the cradle pivot. An easy way to check this is to see that the center of the hole in the rear end flange of the motor, into which the oiler tube fits, lines up with the slot between the tops of the mounting clamps. See Fig. 22.

D. Re-align the motor and compressor pulleys and replace the belt. Add a few drops of medium lubricating oil to the bearings. See that the pulley is tight on the shaft. When connecting the motor wiring, refer to the proper wiring diagram, pages 18 and 19.

E. Replace the condensing unit in the cabinet and check the operation of the motor by starting it several times to see that it will come up to speed promptly under load. Operate the machine for approximately one-half hour to observe if the motor runs quietly and without overheating. Check the operation of the belt tension device. See "Replacement and adjustment of belt," page 34.

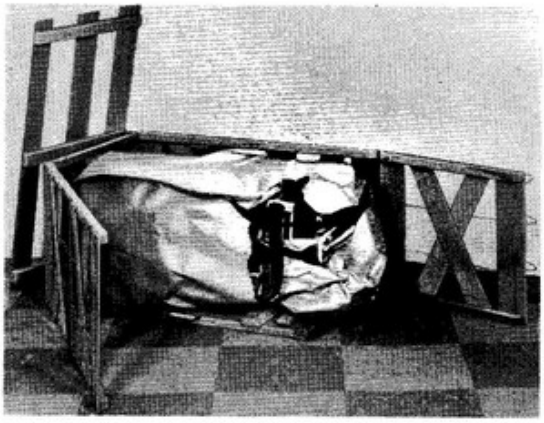


Fig. 19

Note: It should not be necessary to re-align the motor and compressor shafts in changing a motor. However, the alignment should be checked. If it is ever necessary to re-align the motor shaft, the motor base must be loosened on the mounting plate. Refer to "Replacement and adjustment of belt," page 34.

3. REPLACEMENT OF CAPACITOR

If the capacitor leads are connected at the motor terminal box the capacitor may be removed from the motor. Disconnect the leads and remove the screws holding the capacitor clamp to the motor and lift out the capacitor.

Install the new capacitor by reversing the above operations. Consult the proper wiring diagram for connections.

4. REPLACEMENT OF MOTOR PULLEY

To replace the motor pulley, first remove the condensing unit from the cabinet as described on page 31. under "Replacement of machine." Remove the pulley, using the Cat. No. A18X7 set screw wrench to loosen the set screw. Be careful not to misplace the motor pulley key. Be sure to re-align the pulleys after the new pulley is installed.

5. REPLACEMENT OF COMPRESSOR PULLEY

Remove the condensing unit from the cabinet and

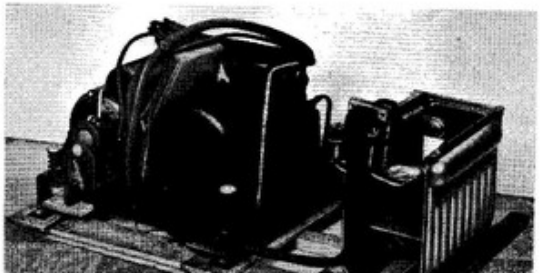


Fig. 20

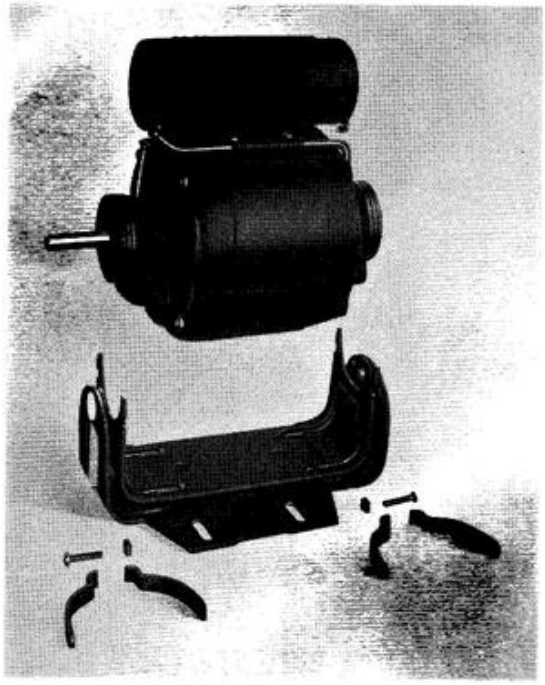


Fig. 21

take off the compressor pulley nut and lock washer. Remove the pulley with a small wheel puller. It will not be necessary to remove the compressor.

To replace the pulley, place it on the shaft with the key in place and tighten the nut and lock washer.

In replacing the pulley, be sure to check the alignment of the motor and compressor pulleys.

6. REPLACEMENT AND ADJUSTMENT OF BELT

If the belt is excessively worn it should be replaced. To replace the belt, shut off the unit, and move the cabinet away from the wall. Tip the motor over against the compressor to loosen and replace the belt.

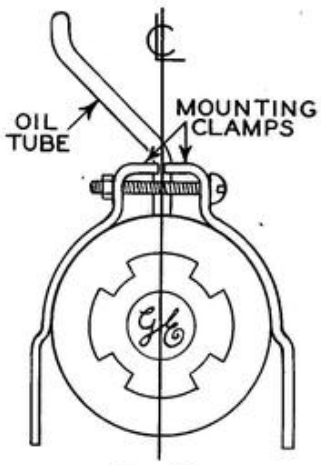


Fig. 22

If the motor base is in the proper position on the mounting plate, the belt tension device will operate to keep the belt in proper tension. The tension device is operating properly when the center of the capacitor or wave filter is not more than ¼ in. off the vertical centerline through the motor shaft with the unit running. This is only true if the motor is mounted properly in the cradle as shown in Fig. 22 and described in part C under "Replacement of motor."

If the capacitor or wave filter is more than ¼ in. off the motor vertical centerline, the motor base should be shifted on the mounting plate in the proper direction to bring the motor back into the correct running position. To move the motor base, loosen the four cap screws holding the base to the mounting plate.

Re-align the motor shaft and the pulleys before tightening down the motor base. See that the springs at each end of the motor base are in position.

If the belt tension device is operating as described in the foregoing, there should be no trouble with the belt slipping or being too tight. If the belt jumps off the pulleys check to see that the shafts and pulleys are properly aligned.

7. REPLACEMENT OF MOTOR CUSHION BASE

It should seldom be necessary to replace a motor base, since the base need not be changed even when the motor is replaced. If it is necessary to replace a base, remove the four cap screws holding it to the mounting plate. Be sure to re-align the motor shaft and the pulleys, if the base is changed.

8. REPLACEMENT OF RUBBER CUSHION RINGS

If it should become necessary to replace the rubber cushion rings, remove the motor from the base as described under "Replacement of motor." Pry the cushion rings off the end flanges and replace them, being careful not to damage the new rings when placing them on the flanges.

9. REPLACEMENT OF COMPRESSOR

The compressor may need replacing because it runs hard or sticks, will not pump, is noisy internally or has a leaky or noisy shaft seal. If the compressor is to be replaced, the refrigerating machine should be removed from the cabinet as described under "Replacement of machine," page 31, and taken to the shop where the work may be done conveniently. The work can be done on the user's premises if necessary but this is not recommended. Never release any sulphur dioxide around any plants or pet birds on the user's premises as they are strongly affected by it.

Since the compressor case of the type CD machine is in the high pressure side of the system and since the seal compartment is subjected to this pressure when the machine is idle, it is not practical to pump down the compressor or seal compartment to atmospheric pressure. Therefore, it is necessary to release the gas from the compressor case before opening the compressor case or seal compartment. If this is done in the user's home, extreme care must be used to prevent damage, by oil or refrigerant, to the floor or furnishings. It will be necessary to use a length of copper tubing or a rubber hose, with the proper fit-

tings to connect to the gauge connection of the discharge service valve, to remove the escaping refrigerant to the outside air. A good discharge tube can be made out of a length of ¼-in. copper tubing and a globe valve. Use the set of flare tools to make the necessary flares for the tubing flare connections. Connection to the service valve gauge connection is made by means of a ⅛-in. M. P. T. to ¼-in. S. A. E. union, Cat. No. A19X35.

If it is not possible to release the refrigerant to the outside air, it must be purged into a lye solution, containing approximately 1¼ lbs. lye in 1 gallon of water for each pound of SO_2 to be absorbed. If a lye solution is used, extreme care must be taken to prevent damage to rugs, furnishings, etc., as lye is extremely harmful to such articles. Also do not put the lye solution in any good utensil as the lye will attack the metal. An old pail or a crockery jug should be used to hold the lye solution.

To replace the compressor proceed as follows:

A. Front-seat the suction service valve.

B. Back-seat the discharge service valve, remove the gauge connection plug and connect a discharge tube with a shut-off valve in it, to the gauge connection.

C. Start up the machine and run it for approximately ten minutes to warm up the oil.

D. While the machine is running, front-seat the discharge service valve. Shut off the machine, slowly open the shut off valve in the discharge tube and allow the gas in the compressor to escape through the discharge line into the outside air or into a lye solution. Do not allow the gas to escape too fast since this will result in syphoning an excess amount of oil out of the compressor. A half can of lye in half a gallon of water will be ample for absorbing the gas in the compressor.

Caution: Do not leave the compressor while the gas is being purged out. The discharge tube must immediately be withdrawn from the lye solution at the end of the purging operation. Otherwise gas in the purging tube will continue to dissolve in the lye solution, produce a vacuum in the tube and cause lye solution to be drawn up the tube into the compressor and permanently ruin it.

If it is not practical to use a discharge tube, the machine may be moved to the outside air and the refrigerant permitted to escape by slowly removing the discharge service valve gauge connection plug after the discharge service valve has been front-seated.

Wear goggles and have an SO_2 gas mask handy while performing the above operations.

E. Remove the suction and discharge service valves from the compressor end cap by removing the cap screws. Do not attempt to remove the service valves from the refrigerant lines or all of the refrigerant in the system will escape. Install plates and gaskets over the valve pads on the compressor end cap.

Remove the compressor from the mounting plate by removing the four cap screws. Take off the compressor pulley, using a small wheel puller to prevent damage to pulley or compressor.

F. Assemble the compressor pulley to the replacement compressor. Assemble the replacement compressor on the mounting plate. See that the compressor and motor shafts are parallel and that the pulleys are in line.

G. Remove the plates and gaskets from the valve pads on the replacement compressor end cap and immediately assemble the service valves, using new gaskets. Purge the compressor by slowly opening the suction service valve about one-quarter turn and purging through the gauge connection at the discharge service valve. As soon as a strong odor of SO_2 is detected, at the discharge valve gauge connection, replace the plug using litharge and glycerine on the threads.

Test for leaks at the valve pad gaskets and then back-seat both service valves.

H. Add approximately ¼ lb. of SO_2 to the machine. See "Adding refrigerant," page 37. Unless some of the oil in the compressor has been drained out or lost, it should not be necessary to add oil, as replacement compressors are shipped with the proper oil supply. If necessary to add oil proceed as described under F on page 36.

I. Run the machine for 24 hours. During this run and at its conclusion check the machine for signs of gas or oil leaks and see if the machine is refrigerating properly. If it shows signs of a low refrigerant charge, additional refrigerant should be added until proper refrigeration is obtained.

10. REPLACEMENT OF SHAFT SEAL

A shaft seal may be defective because it leaks oil or gas, or because it is noisy. If it is impossible to correct the defect by using the remedies given under "Leaks," page 30, then it will be necessary to replace the machine or else replace the compressor or shaft seal.

If the compressor is to be replaced, the refrigerating machine should be removed from the cabinet, and the work done at the shop, as described under "Replacement of compressor," page 34. This should also be done, if possible, when the shaft seal is to be repaired or replaced.

When replacing the shaft seal, it will be necessary to purge the gas from the compressor as described under "Replacement of compressor."

Replace or repair the shaft seal as follows:

A. Follow the procedure given under items A to D, inclusive, under "Replacement of compressor," page 34. If it is found necessary to replace the seal in the user's home, it will of course not be necessary to remove the entire machine from the cabinet. Instead, remove the condensing unit only. See Fig. 16.

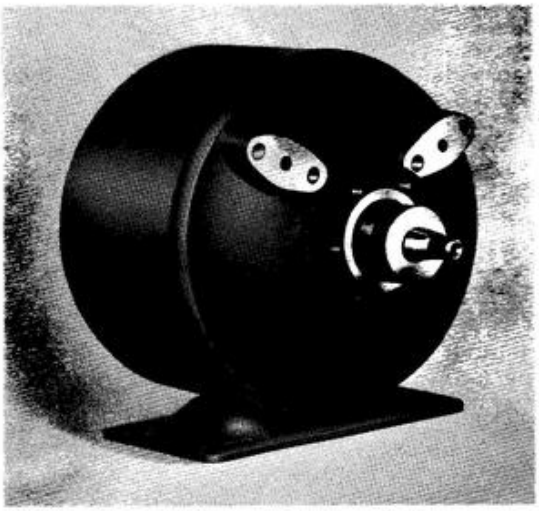
In replacing the seal, it is not necessary that the service valves be removed from the com-

pressor, or that the compressor be removed from the mounting plate. However, if the work is done in the shop, it may be found more convenient to do this. If the service valves are removed from the compressor, they must be replaced with plates and gaskets, to seal the compressor from the air while the work is being done.

B. While working on the shaft seal the compressor should be placed with the shaft horizontal and fastened down so that it will not fall over. Remove the six cap screws, the clamping plates, the oil retainer assembly and the shaft seal assembly from the compressor. Allow the small amount of oil in the seal compartment to drain out. This oil, together with that lost when the refrigerant was released from the compressor, must be replaced later. Refer to item "F" following.

C. Examine the shoulder on the crankshaft to see that it is smooth and free from cuts or scratches. The crankshaft shoulder may be lapped, if necessary, by using shaft lapping tool Cat. No. A18A31. A paste made of alundum and kerosene is used to lap the shaft shoulder. Only a small quantity of this paste should be applied at a time to the lapping surface of the lapping tool. Alundum is supplied in three grades for this purpose. Cat. No. A18A22 and Cat. No. A18A21 are the coarse and medium grades and should be used first to remove any corrosion or rough places on the shoulder. Cat. No. A18A20 is the fine grade and should be used for finishing.

Plug the hole in the compressor housing to prevent abrasive from getting into the inside of the compressor case. Slip the tool over the shaft and lap the shoulder as in grinding automobile valves. Continue this operation until a continuous dull gray surface is produced. When the operation is completed remove all of the abrasive from the shaft and from the seal housing, using a clean cloth moistened with naphtha. Remove the cloth from the hole in the compressor housing.



Lapping the Crankshaft Shoulder
Fig. 23

D. The shaft seal nose piece may be lapped by using one of the pieces of prepared plate glass Cat. No. A18A8. These plates have been ground on one side to a flat surface at the factory. However, before using the plates for the first time and always thereafter before using them. lap them together. This is to insure that the lapped surfaces will always be perfectly flat.

To lap the plates, mix some Cat. No. A18A20 alundum with enough kerosene to form a thin paste. Then wash the plates thoroughly in naphtha or carbon tetrachloride and apply a thin layer of the alundum paste to one of the plates. Then proceed to lap the three plates together using a circular motion.

Continue this process until the ground surfaces of all plates make tight fits together after they have been washed in naphtha or carbon tetrachloride and dried, thus indicating that the surfaces are flat. Be sure that all of the alundum is washed off the plates before they are used for lapping the shaft seal nose piece.

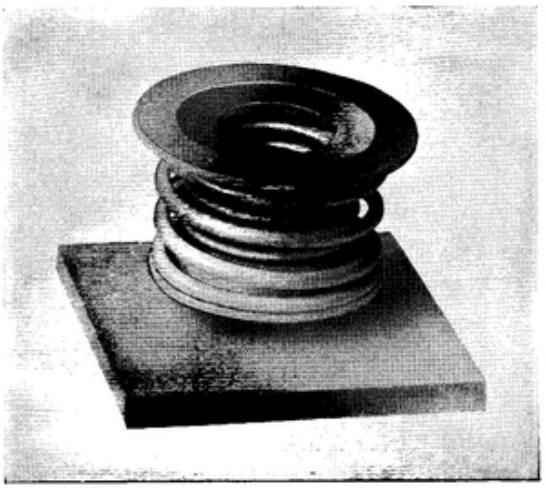
To lap the nose piece, first wash the glass plate with naphtha and then apply kerosene to the etched side of the plate. With the plate resting on a flat surface, lap the shaft seal nose on the etched surface, grasping the sealing ring between the thumb and middle finger and using a circular motion. Be very careful to keep the shaft seal nose in firm contact with the plate and use plenty of kerosene. Continue lapping until a continuous dull flat surface is obtained. Then wash the seal thoroughly in naphtha.

Do not use alundum or any other abrasive for this operation as the soft material of the nose piece will become imbedded with the abrasive and be ruined.

E. Assemble the shaft seal in place, first placing a small quantity of petrolatum or vaseline on the nose piece. Use a new gasket with the new or replaced seal assembly. Pull up the cap screws evenly but do not tighten them until the seal has been purged. Be sure to replace the oil retainer on the clamping plate.

If the compressor was removed from the condensing unit, re-assemble it to the unit, being careful to line up the pulleys and shafts. Use new gaskets under the service valves.

F. Add sufficient oil to replace that lost or drained out during the preceding operations. A minimum of 40 fluid ounces will be required to replace the oil lost when the refrigerant was released and when the seal was removed as described in items A and B preceding. If in doubt as to the amount of oil lost, drain all the oil from the compressor through the connection for the discharge service valve on the end cap by inverting the compressor, and add 70 fluid ounces.



Lapping the Shaft Seal Nose Piece
Fig. 24

To add oil, connect the vessel holding the oil to the gauge connection on the suction service valve, with a ¼-inch copper tube with the necessary union and flare to attach to the connection. Be careful to leave the suction service valve front-seated during this operation. Place the pulley on the shaft and turn it counterclockwise by hand, until the proper amount of oil has been added. Use only refrigerating machine oil Cat. No. C16A24. *Be sure that no air is drawn into the compressor during this process. Be sure to use only oil that has been kept in a tightly closed container. If left in an unsealed container the oil will absorb moisture from the air and cause the compressor to stick up due to the corrosion that will result from the combining of the moisture with SO_2 to form an acid.*

After the oil is added, remove the tube and replace the gauge connection plug, using litharge and glycerine on the threads.

G. Purge the shaft seal compartment by slowly opening the suction service valve. When a strong odor of SO_2 is detected at the shaft seal flange, tighten the cap screws. Also purge the compressor case at the same time, at the discharge valve gauge connection.

Test for leaks and then back-seat both service valves.

H. Add approximately ¼ lb. of SO_2 to the refrigerating machine. See "Adding refrigerant," this page.

I. Run the machine for 24 hours. Check the operation of the shaft seal and at the end of the run check for gas or oil leaks and see if the machine is refrigerating properly. If the unit shows signs of a low refrigerant charge, additional refrigerant should be added until proper refrigeration is obtained.

11. ADDING REFRIGERANT

Refrigerant may be added to the condensing unit at either the float valve, using the Cat. No. 11X764 monitor test kit, or at the suction service valve.

Before adding refrigerant, the unit should have been running and the cooling unit pulled down, if possible. Stop the machine and add a little refrigerant. Then run the machine again. Very carefully add just enough refrigerant, a little at a time, until the machine is refrigerating properly. Do not add so much refrigerant that the suction line becomes cold outside of the cabinet, or frosts back; or until the compressor becomes noisy.

The condensing unit should be removed from the cabinet as described under "Replacement of machine," page 31, if refrigerant is to be added.

Adding Refrigerant With Monitor Test Kit

If the monitor test kit is to be used, proceed as follows:

A. Inspect the Cat. No. 11X765 monitor test adapter to see that it has a single good Cat. No. 11X768 lead washer in place on each side, and that the purging screw in its side is closed. Loosen the bottle valve screw with the 11X122 purging wrench and assemble the bottle to the adapter. Place the valve stem into the bottle valve screw and tighten the valve stem nut.

Place the bottle and adapter just assembled over the float connection after first loosening the float purging screw with the purging wrench. Then tighten the monitor adapter nut.

B. Crack the purging screw in the float valve, and then crack the purging screw in the adapter until the odor of SO_2 is detected and tighten this screw. Check for leaks with ammonia. Open the bottle valve screw three complete turns and pull out valve stem. Assemble the 11X766 heater to the bottle and plug it into a 110-volt outlet for a few minutes.

Control amount of refrigerant added to machine by opening and closing the float valve screw with a monitor valve stem.

C. After enough refrigerant is added, tighten both float and bottle valve screws. Purge refrigerant trapped in the adapter out the purging screw in the adapter. Absorb this gas with a rag saturated with ammonium hydroxide held over the purging screw. If so desired the refrigerant can be driven out of the adapter into the machine by heating up the adapter with the heater, with the float screw opened and the bottle screw closed. Then close float valve screw and purge out the slight amount of gas left in adapter.

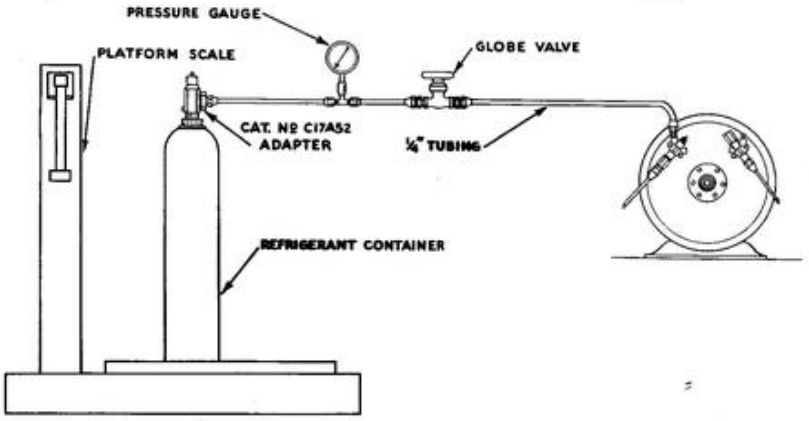
Remove adapter and bottle, and tighten float and bottle valve screws with the purging wrench. Check the float screw for an SO_2 leak with ammonium hydroxide. Replace caps on float valve and bottle.

Adding Refrigerant at Suction Service Valve

If refrigerant is to be added at the suction service valve, a short length of ¼-in. copper tubing must be provided to connect the refrig-

erant container to the compressor. This tubing should be supplied with a globe valve and a tee for connecting a pressure gauge. A ⅛-in. M. P. T. to ¼-in. S. A. E. union is used to connect one end of the tube to the gauge connection on the suction service valve. An adapter, Cat. No. C17A52 may be used to connect the other end of the tube to the refrigerant container.

The pressure gauge should be located between the globe valve and the refrigerant container. See Fig. 25.



Adding Refrigerant to CD Type Compressor
Fig. 25

A. Place the refrigerant container on a suitable scale and connect it to the gauge connection on the suction service valve. The suction service valve must be back-seated before the plug is removed from the gauge connection.

The refrigerant container must be placed on the scale with the valve end up, otherwise liquid refrigerant may be pumped into the compressor and damage the parts.

B. Purge out the connecting tubing by cracking the valve on the refrigerant container and loosening the flare nut at the gauge connection on the compressor until refrigerant escapes. Carefully check for refrigerant leaks at all connections.

C. Set the suction service valve stem in mid position, so the compressor will be connected to both cooling unit and refrigerant container.

D. Partially open the valve in the refrigerant container. Open the globe valve in the connecting supply line.

E. Start the compressor and throttle the valve at the container so that a suction pressure of not over 5 to 10 lbs. will be maintained in the supply line. Higher pressures may allow too much liquid to be pumped into the compressor with the gas.

F. When the desired amount of refrigerant has been added back-seat the suction service valve and close the valve on the refrigerant container.

The machine may then be checked for refrigeration before disconnecting the tubing. Then if more refrigerant is required it may be added as described.

G. After sufficient refrigerant has been added, disconnect the supply line from the union at the gauge connection on the compressor by slowly loosening the flare nut and permitting the refrigerant in the line to escape. The suction service valve must be back-seated and the valve on the refrigerant container closed before this is done. The escaping refrigerant may be absorbed by wrapping a rag soaked in ammonium hydroxide around the joint. Remove the union from the gauge connection in the service valve and replace the plug, using litharge and glycerine on the threads. Test gauge connection for leaks. Wipe any refrigerant stains off of the connections with a moist rag.

12. POWER CHANGE-OVER

It is possible to convert the refrigerator to operate on other types of power supplies by changing the proper parts of the refrigerating machine. In order to determine what parts to change, refer to the list of replacement parts for refrigerating machines, and carefully compare the parts used for different power supplies.

Refer to the proper wiring diagrams when making these changes.

Cabinet Adjustments

Foreword: Cabinet adjustments for the most part do not require technical knowledge but rather lend themselves to simple solutions which are apparent upon examination. We believe, however, that the following suggestions may be of considerable help to the service man.

I. Replacement of Inner Liner

The one-piece acid-resistant inner liner is easily changed. The refrigerating machine must of course be removed as described on page 31, under "Replacement of machine." Next, remove all Textolite door jamb strips. The four leads running to the light switch and the lamp socket must be disconnected from the small circular connection block. The greased cloth top seal may now be removed. The liner will now easily lift out.

The light socket may next be attached to the replacing liner which is inserted by reversing the above procedure.

II. Lighting Circuit

The lighting equipment consists of a switch and a socket which are connected to a small circular connection block located in the cabinet top.

In reconnecting leads to the connection block note that the white lamp lead is connected to the white screw post in the connection block. Refer to the wiring diagrams on page 19.

The light switch and socket are easily replaceable. Since the connections to them are molded in, these parts will be shipped with sufficient length of wire to make the necessary connections. These parts can be replaced without removing the cabinet liner by pulling the part out, cutting the wires, and splicing the new part in. There is sufficient extra length to all connections to do this. The spliced connections should be soldered together and wrapped with varnished cambric followed by friction tape.

The light socket is fastened to the liner with a screw concealed under the center contact tab, which threads into a speed nut clamped to the liner.

The light switch is held onto the Textolite door jamb strip by a small hex nut on either side. The switch is adjusted at the factory so that the light goes out when the door is 1½ in. from closed. This is easily adjusted in the field if necessary.

III. Adjustment of Spring for Opening Door

Mounted in the door jamb strip on the hinge side will be found an ingenious coil spring and plunger device which pushes the door open when the foot pedal mechanism has disengaged the latch. This mechanism is held in place by two screws, and on removing these it can be taken out for adjustment of the spring tension if necessary. By inserting a lead pencil in the spring support, the tension can be increased or decreased by steps as desired.

IV. Replacement of Door

Doors are obviously replaceable by removal of the hardware and its subsequent re-assembly to the new door.

Whenever possible this work should be done with the cabinet on its back. Be sure that the condensing unit is clamped down with the shipping bolts if this is done. Carefully center the door in the opening and draw the hinge screws tight in rotation so that unequal pressure of the screws will not throw the door out of line with resultant poor door seal.

V. Door Seal

Poor door seal usually results in complaints of cabinet sweating inside, excessive frosting of cooling unit, high per cent running time, high power consumption, slow ice freezing and high cabinet air temperature.

Imperfect door seals may be located by the use of a .003 metal feeler. Locate the point of poor seal by inserting the feeler at various points around the door between the gasket and the cabinet front.

If a poor seal is located, first check the gasket to see that it is not excessively worn. Check the hardware to see that it is not sprung or worn and that the screws are tight.

Often a poor door seal can be corrected by rehanging the door as described above under "Replacement of door"; by replacing the gasket; or by properly adjusting or replacing the hardware.

If, however, the poor seal is caused by the door being sprung out of line, or by the front of the cabinet being out of line, it can be corrected as follows:

(The operator should be provided with a straight-edge approximately 2 inches longer than the long side of the door, a rubber mallet, a metal feeler approximately 1/32-in. thick and a screw driver.)

1. With the straightedge check the cabinet front on all four sides, approximately where the door gasket seats, to see if the front is straight. If it is possible to insert the 1/32-in. feeler between the straight-edge and the face of the cabinet such points should be corrected.

   If an unevenness does exist, it is very likely that the cabinet front will be bulged outwardly, generally at the center of the Textolite strip.
2. When the front is bulged outwardly, loosen the Textolite strip screws approximately 1½ turns on all four sides of the door opening, front side only, not on the liner side.
3. Pound the high point of the cabinet front and keep checking with the straightedge until a comparatively even, flat surface is obtained. If done properly this will not in any way injure the finish. When the front is straight, tighten up all the screws.
4. If the cabinet front is found to be bulged inwardly, it will probably be found necessary to remove the Textolite strip at that point and pull the front of the cabinet out so that it makes a bulge forward.

Replace the Textolite strip, thoroughly tightening the screws on the liner side but leaving the outer screws loosened 1½ turns. Proceed in the same manner as for high points on the cabinet front.

5. Now firmly close the door and check the door seal by inserting the .003 metal feeler at various points around the perimeter of the door under the gasket.

If the gasket is not properly seated at all points, loosen all Textolite strip screws around the outer door panel side of door. Slam the door once or twice rather severely to let it take the shape of the cabinet front. Check the seal again and if found satisfactory tighten the strip screws thoroughly to hold the outer door panel in place.

If not found satisfactory, repeat the process and try springing the door further with the hands.

If the door is still out, straighten it by striking the rolled edge at the open places sharply with the rubber mallet. Care should be taken to strike the radius only. Never hit the flat face of the door, as it will dent.

When the correct seal is obtained, make certain that all the Textolite strip screws are tight.

VI. Replacement of Hinges

The covers on the hinges which conceal the screws are stainless steel finished with Glyptal-baked enamel. To remove these, insert a knife blade in the slot and pry out. The screws are now exposed and may be removed and the hinge replaced. It may be desirable to slightly pinch the cover when snapping it over the butt of the hinge when replacing it.

VII. Replacement of Latch

First remove the casing that encloses the top of the handle, by inserting a small screw driver in the slot under the handle at the bottom of the casing and prying it off.

Second, with a ¾-in. open end wrench, unscrew the hex nut that clamps the latch body and the handle to the outer door.

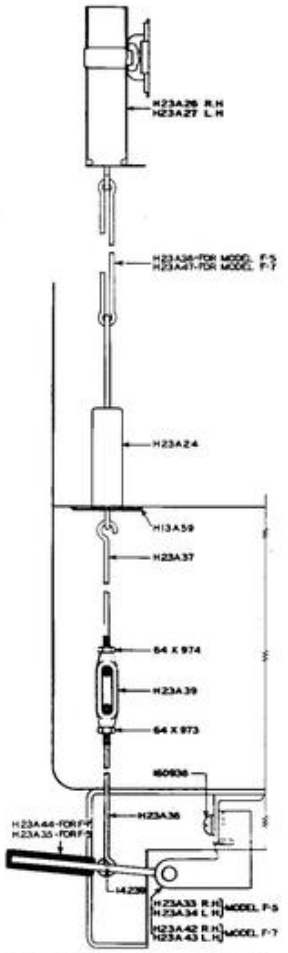
Third, remove the three screws which hold the escutcheon plate which surrounds the latch bolt and slide the entire latch mechanism out through this opening.

VIII. Foot Pedal Door Opener

The complete mechanism with its parts catalogued is shown in Fig. 26.

The Cat. No. H23H26 door opener mechanism is permanently attached to the escutcheon plate which holds the strike plate. This is held to the Textolite door strip by two screws which go through slightly oblong holes so that the whole head of the mechanism can be moved in or out in relation to the front of the cabinet. In addition to this the strike plate may be adjusted in or out in the same manner to take up for variations in gasket thickness in order to secure good door seal, and proper latching action.

In addition to these adjustments, turnbuckle



Foot Pedal Door Opener Mechanism
Fig. 26

H23A39 may be used to shorten the connection between pedal and door opener to secure proper pedal action. The door should open when the pedal is approximately ⅛ in. from the floor.

IX. Replacement of Door Panel

1. OUTER DOOR PANEL

If it is necessary to replace the outer door panel, remove the door from the cabinet by removing the hardware.

Remove the Textolite strip screws from around the outer door panel only. Replace the old panel with the new one.

Re-hang the door and check the door seal.

2. INNER DOOR PANEL

If the inner door panel is to be replaced, remove the door.

Next take out all the Textolite strip screws. Then assemble the Textolite strips to the new inner door panel. Place in position on the rest of the door and

replace the Textolite strip screws around the outer door panel.

Re-hang the door and check the door seal.

X. Replacement of Cabinet Top

Remove the cabinet top by taking out the screws holding the two short braces at the rear and then tipping the top up at the back and sliding it forward.

Install the new top by reversing this procedure.

XI. Replacement of Shelves

Original shelves are properly adjusted at the factory to conform with the cabinet liner.

It may be necessary to adjust replacement shelves to the particular cabinet by bending the supporting tangs in or out in a suitable clamping device to make a snug fitting shelf. Care must be exercised not to bend the tangs at the welds or to spring the shelves into position, leaving the welded points under a strain. Loose shelves will rattle and shelves should never be so tight that they have to be forced into place, as they are apt to chip the porcelain on the liner.

XII. Replacement of Door Gaskets

The black rubber, extruded type door gasket may be replaced by loosening the row of Textolite strip screws along the outer door panel and peeling the gasket off. The replacing gasket may be cut out at the corners, using the old gasket as a pattern and inserting the toe of the gasket skirt in the channel under the Textolite strip, and following around the door pressing it into place with a screw driver. Then tighten down the Textolite strip screws.

XIII. Repairing Chipped Porcelain

Small chips on porcelain parts may be patched by means of the Cat. No. 58X85 porcelain patching kit. Follow the directions given with the kit.

XIV. Shaking of Cabinet

If the floor is not level, one of the cabinet legs may not rest on the floor. As a result the cabinet may shake when the door is slammed.

To remedy this condition install a Cat. No. H20A24 shim support with the proper number of Cat. No. H20A23 shims under the leg where the floor is low. Refer to page 13 for more details on using these parts.

Refinishing Glyptal-Baked Enamel Cabinets

The material used for refinishing Glyptal-baked enamel cabinets in the field is DuPont RP-81970 Porcelain Tone Air Dry Dulux Refrigerator Finish Enamel. This material takes DuPont T-3810 special thinner.

The following is a complete outline of the method of applying air drying Dulux material in the field under the various circumstances which may be encountered. The refinished jobs with Air Dry Dulux will fall into three general classifications as follows:

1. Glyptal cabinets with small spots less than 1/16″ in diameter.
2. Badly damaged Glyptal cabinets which will require refinishing.
3. Glyptal cabinets which have been subjected to exceptionally severe service conditions and are in such condition that they must be stripped and refinished.

Following are listed the details for refinishing under each of the above conditions:

1. Small nicks less than 1/16″ in diameter may be repaired by spotting with a pencil brush with unthinned Air Dry Dulux, RP-81970 and smoothing over with a quick motion of the thumb or forefinger. If necessary, the appearance may be improved by a light polish after the Dulux is dry (at least 24 hours).

Note: *Glyptal touch-up kit Cat. No. 58X69 is available for touch-up work on Glyptal cabinets.*

2. The method for refinishing badly damaged Glyptal cabinets is as follows: Sand all damaged places to a smooth feather edge, using No. 400 sandpaper and oil-free naphtha. Give the entire surface or part to be refinished a light sanding with the same paper, using naphtha to remove the dirt, cleaner, wax, grease, etc. Wipe the whole surface clean with a rag and naphtha to remove any loose particles.

The surface is then ready for spraying with Air Dry Dulux RP-81970, which is the correct shade. Bare spots are first spotted with a flash coat of this material and allowed to dry about fifteen minutes. A full, even coat of the Air Dry Dulux is then sprayed over the entire surface of the cabinet or part to be refinished. The amount of thinning required for the Air Dry Dulux will vary slightly with the type of spray equipment used. Ten per cent reduction with T-3810 thinner is recommended for general use. Twenty-four to forty-eight hours drying time, depending upon weather conditions, is necessary before the Air Dry Dulux may be handled or packed.

Because of its slower drying time, Air Dry Dulux will have more tendency to pick up dirt and lint than the lacquers now being used. For this reason, every effort should be made to avoid dirt in the spray room. Field tests have indicated that a satisfactory job can be obtained by proper housekeeping.

3. There may be a very few cases in which the Glyptal finish is in such condition that it will have to be stripped before refinishing. When this is necessary, the procedure is, in general, similar to that now used for lacquer cabinets. The old finish should be removed with a wax-free paint remover. When the old finish is entirely removed, great care should be taken to remove all traces of paint remover by sanding and washing with oil-free naphtha or Dulux thinner. All rust spots should be sanded bright and clean. When the surface is thoroughly clean and

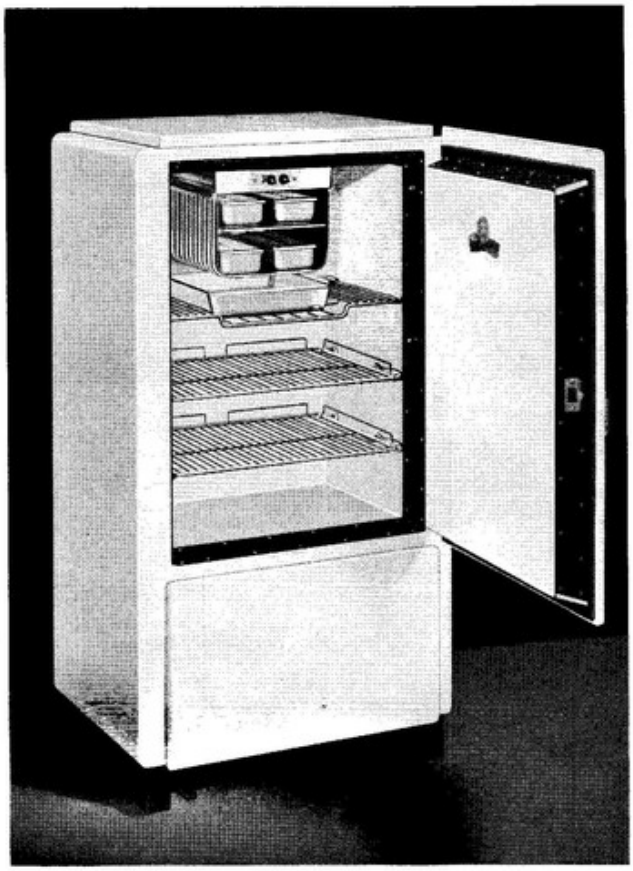
free from all rust, grease, wax, or old finish, three coats of Air Dry Dulux reduced 10% with T-3810 thinner should be applied, allowing 24 hours between coats. The final coat should be allowed to dry 24 to 48 hours before handling or packing, depending upon drying conditions.

Cleaning Glyptal-Baked Enamel Cabinets

We do not believe it will be necessary to use any polishing agent, due to the inherent high gloss character of the finish. There will, however, probably be some demand for cleaners in the removal of finger marks and other dirt which will accumulate in delivery and in service.

In these cases we recommend the use of Glyptal Cabinet Cleaner Cat. No. A20R1. Most cleaners have a certain amount of abrasive in them, and due to the high gloss of the Glyptal finish, they scratch and dull rather than clean and polish. Accordingly please refrain from using anything other than the above on Glyptal finish.

F-5 (Open)



F-7 (Open)

GENERAL ELECTRIC REFRIGERATOR

Models F-4A, F-5A and F-7A

Model	Cubic Capacity	Shelf Area
F-4	4.3 cu. ft.	9.1 sq. ft.
F-5	5.3 cu. ft.	10.9 sq. ft.
F-7	7.2 cu. ft.	13.1 sq. ft.

Ice Making Capacity

	Trays	Lbs. of ice	Ice cubes
F-4	2	4½	40
F-5	2	4½	40
F-7	4	9	80

Finish

Exterior finish of all cabinets—Glyptal-baked Enamel. **Interior finish** of all cabinets—Porcelain.

Automatic Interior Lighting

The F-5 and F-7 refrigerators are equipped with an **interior electric** light which automatically turns on when **the cabinet door** is opened and turns off when the door **is closed. This** light is protected by a steel wire guard.

Hardware

The semi-concealed hardware is made of durable hard **brass,** modernistic in design with a highly polished chrome **finish.**

The hinges are securely held to the steel door and cabinet by machine screws.

The single action door latch makes opening of the door easy. The self-sealing feature automatically insures a tight seal when the door is swung closed.

Foot Pedal Door Opener

With the F-5 and F-7 models the cabinet door may be opened by simply pressing against a rubber tread foot pedal protruding from the cabinet base. Pressing against this foot pedal releases the door latch and allows a spring in the Textolite door strip to push the door open.

All-Steel Construction

Cabinets are of all-steel construction for strength, durability and long life. The construction consists of a one-piece outer steel shell, welded and sealed at all joints, and a one-piece steel inner liner. No wood frame is used either in the cabinet or the door.

The entire space between the inner and outer walls is completely filled with insulation. This construction gives greater strength—prevents warping and sagging—increases efficiency and insures longer life.

General Specifications

Textolite Strips

The door openings and door edges are faced with black Textolite strips secured to the inner and outer panels with corrosion resistant screws. No wood is used in the door construction. The Textolite strips will not warp, mold, or cause odors and will withstand severe usage. Corners of the door and door jamb are fitted with stainless metal corner pieces.

Insulation

General Electric refrigerator cabinets are heavily insulated to make them efficient. The insulation is of the best grade and is protected against entrance of moisture by the outer steel shell which is sealed and welded at all joints to make it moisture tight. The insulation is further protected by sealing in a water tight envelope.

Gaskets

The doors are fitted with a high grade, specially designed extruded type rubber door gasket. This gasket is exceptionally durable and sanitary and is easy to clean. It is designed so that it can be easily replaced.

Shelves

The F-4 and F-5 refrigerators are equipped with three full shelves and one half shelf of the bar type with steel wires running from front to rear. Flat bars are used on F-5 shelves. The F-7 is equipped with three full shelves, two of which are of the sliding type. Flat bars are also used on these shelves.

Cabinet Base

A pressed steel strip finished in black, covers the 4" cabinet legs and forms a base, in keeping with the modernistic design of the cabinet. The steel base strip is easily removable to allow cleaning under the cabinet.

Condensing Units

Condensing units used in Models F-4, F-5 and F-7 are the General Electric Models CD-1, CD-2 and CD-3. The compressors of these units are simple in design, dependable in operation and exceptionally efficient in performance.

The motor used with each unit is of the external 1/6 H.P., General Electric capacitor type. Motors are belted to the compressor and are equipped with automatic belt tighteners. Compressors are charged with 2 lbs. of Sulphur Dioxide (SO_2) in the CD-1 unit, 2½ lbs. in the CD-2, and 2¾ lbs. in the CD-3.

Condensing units are spring mounted in the bottom of the cabinet with the condenser located in the front. A specially developed ventilating system permits the cooling air to be definitely directed. Cool air from near the floor is drawn through the condenser, across the compressor and motor and exhausted through the rear of the cabinet. The warm air exhausted is not permitted to recirculate in the condensing unit compartment.

Stainless Steel Cooling Unit

Cooling units are of stainless steel, folded into shape and welded at all joints. There are no hidden crevices or spaces and every portion of the cooling unit inside and out can be easily cleaned. All ice trays are in direct contact with a freezing surface assuring rapid freezing of ice cubes and desserts.

Temperature Control

The temperature control located on the front of the cooling unit automatically regulates the operation of the refrigerating unit to hold a uniform cabinet temperature. An easily accessible adjustment dial is provided to permit the user to vary the temperature to meet individual requirements or special conditions.

The control is also equipped with a semi-automatic defrosting switch which permits defrosting of the cooling unit without interrupting refrigeration.

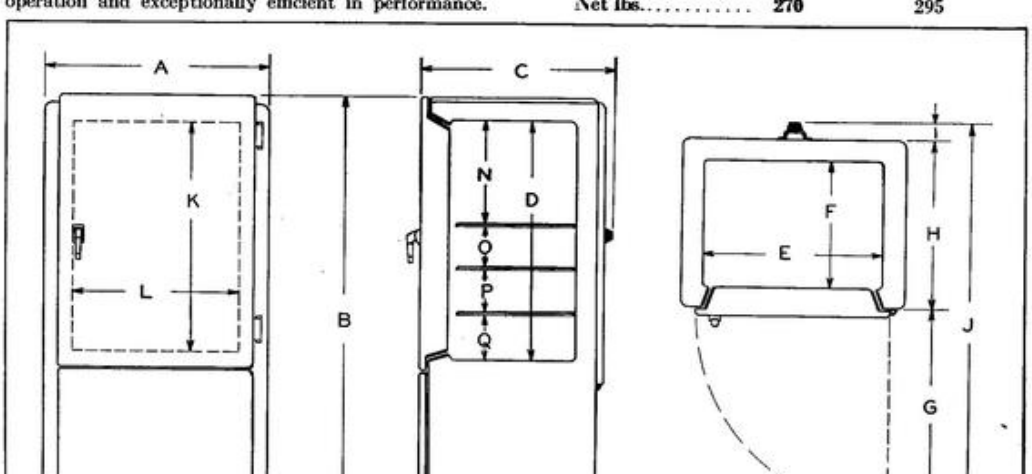
Oiling

The compressor itself is permanently oiled from a liberal supply contained within the compressor casing.

A simple yet positive forced feed oiling system supplies oil under pressure to each bearing surface.

The external motor bearings require oiling annually.

Weights	F-4	F-5	F-7
Crated lbs.....	320	340	415
Net lbs.....	270	295	350



DIMENSION CHART

Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
F-4...	23"	52¾"	22 15/16"	29"	18"	15 5/16"	20½"	20"	2"	42½"	27 13/32"	16¼"	4"	12½"	5 1/16"	5 1/16"	5⅜"
F-5...	26¾"	52¾"	22 15/16"	29"	21¾"	15 5/16"	24¼"	20"	2"	46¼"	27 13/32"	20"	4"	12½"	5 1/16"	5 1/16"	5⅜"
F-7...	29½"	56¾"	25⅛"	33"	24"	17"	26½"	22 3/16"	2 1/32"	50 23/32"	31 13/32"	22¼"	4"	13½"	5"	6"	7 1/16"

CLEARANCES REQUIRED: 2" between back of cabinet and wall for all installations. 6" above cabinet when built in at sides. The toe space at front of cabinet must be open at all times.

DOMESTIC PRODUCT MANUAL

GENERAL ELECTRIC REFRIGERATING MACHINES

SECTION IV

CK-30B and CK-35B
REFRIGERATING MACHINES

GENERAL ELECTRIC COMPANY
ELECTRIC REFRIGERATION DEPARTMENT
NELA PARK
CLEVELAND, OHIO

INDEX TO SECTION IV

Form P-496-4
June 15, 1934

General Electric Refrigerators

Model T-9 with CK-30B Refrigerating Machine

Models S-107, P-110, P-134 and S-146 with CK-35B Refrigerating Machine

DESCRIPTION

Refrigerating Machines (Models CK-30B and CK-35B)

These models are hermetically-sealed Monitor Top refrigerating machines, designed and manufactured to give many years of efficient, quiet and trouble-free operation. Incorporated in this design and in the intricate processes involved in its manufacture, are the results of General Electric's many years experience in producing hermetically-sealed refrigerating machines which, through the satisfactory experience of almost two million users over a period of eight years, has proved the fundamental soundness of the design.

These machines are finished with the Glyptal-baked enamel developed by the General Electric laboratories and proved by field tests on preceding models to be the outstanding finish in the industry.

Refrigerant

Sulphur dioxide (SO_2) is the refrigerant used.

Compressor

A compressor of the reciprocating type is mounted on three coil supporting springs within the drawn steel case. All moving parts are lubricated with special refrigerator oil under pressure from a permanent supply contained in the hermetically-sealed machine case.

Condenser

The condenser encircles the case in the manner of previous Monitor Top models. It is made up of two circular sections of tubes pressed into pairs of line-welded steel sheets. These sections are separated from each other and from the case by vertical fins.

Float Valve

The float valve is located on the high-pressure side of the system. Around the liquid chamber in the bottom there are several turns of suction tube, forming a heat interchanger which increases the capacity and efficiency of the machine.

Cooling Unit

CK-30B—The cooling unit, which has two large refrigerated freezing surfaces, is made of stainless steel and is located below the center of the cabinet top. The surfaces are smooth, easy to clean and sanitary.

CK-35B—This model has two identical cooling units made of stainless steel and mounted side by side. Each cooling unit has three refrigerated freezing surfaces.

Motor

The motor operates as a capacitor split-phase induction motor during starting, and as a single-phase induction motor during normal running. A series capacitor is placed in the starting circuit. This capacitor is located in the cabinet top. There are no brushes or moving contacts on the motor to cause sparking or radio interference.

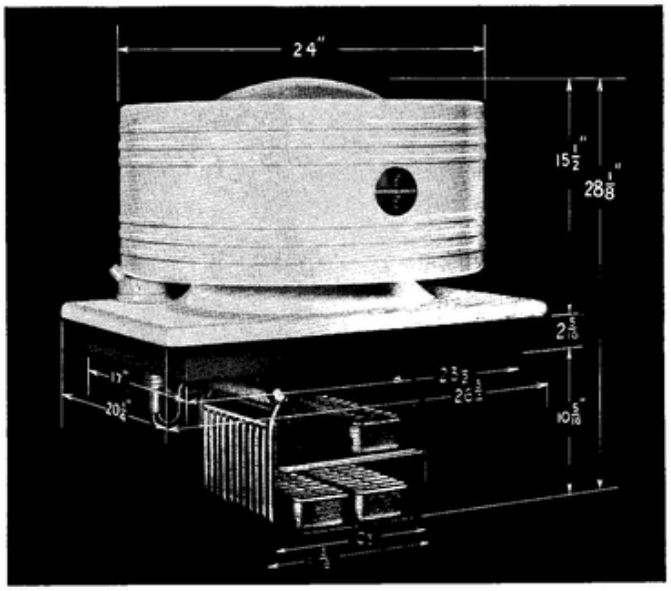
Control

The control has been placed in the front center of the condenser assembly. It is completely sealed. Included in it are the manual switch for turning the machine on or off, the adjustable automatic mechanism for regulating the cooling unit and cabinet temperatures, the motor protective device, and the automatic reset defrosting mechanism.

Starting Relay

The starting relay, a simple but effective device for making and breaking the starting winding circuit during the starting period, will be found on the right rear side of the condenser assembly.

Product Data on CK-30B Refrigerating Machines



CK-30B16 SPECIFICATIONS

Motor

Voltage	115
Cycles	60 (or 50)
Speed, R.P.M. (Full Load)	1740
Amperes (100° F. room, 20° F. Cooling Unit)	3.4
Watts (100° F. room, 20° F. Cooling Unit)	240
Starting current, amperes (Locked Rotor)	13
Horsepower	⅙

Compressor

Displacement, cu. in.	1.04
Head pressure, lbs. per sq. in. gauge (100° F. room, 20° F. Cooling Unit)	120
Suction pressure, lbs. per sq. in. gauge (100° F. room, 20° F. Cooling Unit)	0

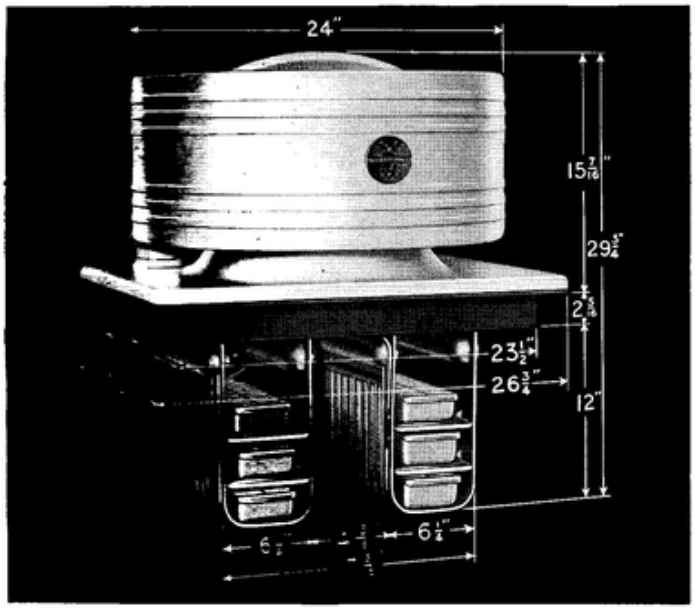
Machine

Capacity, B.t.u. per hr. (100° F. room, 20° F. Cooling Unit)	730
Equivalent ice melting, lbs. per 24 hrs.	122
Temperature range of cooling unit (80° F. room performance, bottom of cooling unit):	
Temperature knob in position 1, °F. (warmest)	23.5–33.5
Temperature knob in position 5, °F. (normal)	15–25
Temperature knob in position 9, °F. (coldest)	5.5–16
Total number of ice cubes	84
Total weight of ice cubes, lbs.	9
Weight of sulphur dioxide, lbs.	3¾
Weight of machine, crated, lbs.	244
Weight of machine, uncrated, lbs.	179

CK-30B16 REPLACEMENT PARTS

Capacitor	9CF1A6
Control complete (110-volt, 50–60 cycle, AC)	M1A10
Clamp and screws for fastening control to condenser	58X141
Bellows tube clamp	MC20A54
Screw for MC20A54 (2 required)	58X47
Nut for 58X47 screw	58X99
Temperature adjusting knob with screw and seal for control	58X191
Seal for temperature adjusting knob	58X192
Escutcheon plate	NP–59190
Gasket for edge of cabinet top	58X196
Locking connector for starting relay or control	58X15
Screw with fiber washer for holding bottom plate to cabinet top	58X195
Starting relay (110-volt, 50–60 cycle, AC)	M1A11
Top cap for float valve chamber	11X326

Product Data on CK-35B Refrigerating Machines



CK-35B16 SPECIFICATIONS

Motor	
Voltage	115
Cycles	60 (or 50)
Speed, R.P.M. (Full Load)	1740
Amperes (100° F. room, 20° F. Cooling Unit)	3.4
Watts (100° F. room, 20° F. Cooling Unit)	250
Starting current, amperes (Locked Rotor)	13
Horsepower	1/6
Compressor	
Displacement, cu. in.	1.04
Head pressure, lbs. per sq. in. gauge (110° F. room, 20° F. Cooling Unit)	125
Suction pressure, lbs. per sq. in. gauge (100° F. room, 20° F. Cooling Unit)	0
Machine	
Capacity, B.t.u. per hr. (100° F. room, 20° F. Cooling Unit)	780
Equivalent ice melting, lbs. per 24 hrs.	130
Temperature range of cooling unit (80° F. room performance, bottom of cooling unit):	
Temperature knob in position 1, °F. (warmest)	23.5–33.5
Temperature knob in position 5, °F. (normal)	15–25
Temperature knob in position 9, °F. (coldest)	5.5–16
Total number of ice cubes	120
Total weight of ice cubes, lbs.	12¼
Weight of sulphur dioxide, lbs.	7¾
Weight of machine, crated, lbs.	260
Weight of machine, uncrated, lbs.	195

CK-35B16 REPLACEMENT PARTS

Capacitor	9CF1A6
Control complete (110-volt, 50–60 cycle, AC)	M1A10
Clamp and screws for fastening control to condenser	58X141
Bellows tube clamp	MC20A54
Screw for MC20A54 (2 required)	58X47
Nut for 58X47 screw	58X99
Temperature adjusting knob with screw and seal for control	58X191
Seal for temperature adjusting knob	58X192
Escutcheon plate	NP–59190
Gasket for edge of cabinet top	58X196
Locking connector for starting relay or control	58X15
Screw with fiber washer for holding bottom plate to cabinet top	58X195
Starting relay (110-volt, 50–60 cycle, AC)	M1A11
Top cap for float valve chamber	11X326

Uncrating, Inspection and Installation

MACHINE

Uncrating

Remove the cover of the shipping crate. Lift the machine from the crate.

Note: If collapsible lifter Cat. 11X384 is used, special long lifting hooks Cat. 58X32 must be substituted for the hooks originally supplied with the lifter.

The wooden rack comes out of the crate along with the machine, to protect the finish on the edges of the cabinet top as it is being removed. The rack is fastened to the bottom plate by two clips under two of the screw heads holding the bottom plate to the box top.

To remove the rack, loosen the screws and turn the clips back under the rack. Be sure to tighten the screws again.

Note: Whenever one of these machines is shipped, the wooden rack must be properly assembled to it before placing it in the shipping crate.

Inspection

At the time the machine is uncrated, examine it carefully for possible damage during shipment. If damage is found, examine the crate and, as nearly as possible, ascertain the reason for the damage.

Also, inspect the machine to make sure that the finish is all right.

CABINET

Uncrating

A reasonable amount of care should be used in removing the cabinet from the crate. An examination of the crate will generally indicate the best method to use. Most of the crates are easily removable by pulling the nails in the rear of the crate. The cabinet will then slide out, after which the packing collars are removed.

Inspection

Examine the cabinet for the following points:

A. Fit and operation of the shelves.

B. Chips or mars on interior or exterior finish.

C. Operation of foot pedal door opener (T-9).

D. Operation of light (T-9).

E. Condition of seal around cabinet top opening.

INSTALLATION

When the machine is being installed in a cabinet, care must be taken not to damage the liquid tube from the float valve to the cooling unit or any of the other pipes.

Before lowering the machine into the cabinet, examine the No-Ox-Id cloth around the box top opening of the cabinet. If it is loose at any point, iron the No-Ox-Id cloth down with a piece of wood.

Assemble the black molded rubber gasket around the outer edge of the machine cabinet top. The easiest way to assemble it is as follows: Start one end of the gasket in the center of the rear cabinet top edge by pulling the two sides of the gasket apart and slipping it onto the cabinet top edge. Then, holding this end in place with the left hand, bend the gasket at a right angle at the point it is going onto the cabinet top edge. Use the forefinger of the right hand to make the bend and the thumb to follow the gasket along. Move the left hand along the gasket as it goes on so as to hold it in place.

Care must be taken at the corners in order not to stretch the gasket. The bottom of the gasket should be square at the corners as well as along the edge. If the gasket is stretched at the corners, it is apt to come off.

If the gasket is found to be too long when assembled, it should be cut off so that a neat, tight joint is made where the ends meet. Before cutting the gasket, make sure that it is not stretched at the corners. Never leave a gap between the ends of the gasket to allow air and moisture to leak in.

After the machine is lowered into the cabinet, check the seal of *both* cabinet top gaskets. The seal of the outer (or upper) gasket is most important and must be made tight. If necessary, trim the gasket on the liner. The outer seal is required to prevent condensation of moisture between the cabinet walls.

The cabinet should be installed reasonably level and should set firmly on all four legs on the rubber gliders. It should not be set against the wall or against anything else.

In order to insure sufficient air circulation to the condenser, at least one side of the machine must be left exposed for the whole width of the cabinet. At least six inches of unrestricted space should be left above the machine top.

The control temperature knob should be set at position 5 for normal service.

Use and Care of the Refrigerator

The General Electric refrigerator is designed to satisfy all normal refrigeration requirements with a minimum amount of attention on the part of the user. A few instructions on the use and care of the refrigerator will assist the user in obtaining the most satisfactory service from it.

Cleaning the Interior

Directly after installation and previous to the time the machine is started, it is recommended that the user carefully clean the interior of the cabinet, the cooling unit, ice trays, chiller tray, and food containers.

For cleaning the interior of the cabinet and the cooling unit, a solution of baking soda in warm water should be used. A satisfactory solution can be made up of one tablespoonful of baking soda in four quarts of water.

Caution: Never clean the interior of the cabinet or the cooling unit with any cleaning agent which has an odor.

Caution: When washing the chiller tray, do not use hot water. Hot water may cause breakage.

It is suggested that the interior of the cabinet and the cooling unit be cleaned each time the cooling unit is defrosted.

For cleaning deposits or stains on the cooling unit, use a good kitchen cleanser such as Bon Ami or Old Dutch Cleanser.

Cleaning the Exterior

Ivory soap and warm water or Glyptal Cabinet Cleaner Cat. No. A20R1 should be used in cleaning the Monitor Top and the exterior of the cabinet.

Caution: The use of any of the standard cleaning compounds which depend upon abrasive or alkaline action will remove the gloss from the finish on the Monitor Top or Glyptal finished cabinets.

Starting the Refrigerator

To start the refrigerator after it is installed, turn the upper knob on the control on the front of the machine to the "on" position. The machine should start immediately.

If the machine does not start, make sure that the electrical cord is properly attached. Also, make sure that the house fuse on the circuit into which the refrigerator is plugged is all right.

During the first few hours after being started, the machine may be slightly noisy but as soon as it is within the normal operating condition, it will continue to operate quietly.

Stopping the Refrigerator

To stop the refrigerator, turn the upper control knob to "off."

If the refrigerator is to be out of service for several days or longer, remove all foods and all water from the freezing trays and chiller. Leave the cabinet door ajar. Clean the interior before putting the refrigerator back into service.

Cabinet Temperature

When the refrigerator is installed, the temperature knob at the bottom of the control should be set at position 5. The control is set at the factory to automatically maintain a cabinet air temperature of between 38° F. and 42° F. in room temperatures between 70° F. and 80° F.

If the room temperature averages below 70° F., the cabinet air temperature may be slightly below 38° F. If this is too cold, the temperature knob can be turned counterclockwise to position 4 or 3, or even to 2 or 1.

If the room temperature averages above 80° F., the cabinet air temperature may be slightly above 42° F. If this seems too warm, the temperature knob can be turned clockwise to positions 6, 7, 8 or 9.

The temperature setting is made adjustable in order to satisfy the individual desires of the user. If it is desired to make the cabinet air temperature lower, the temperature knob can be turned clockwise; if higher, the knob can be turned counterclockwise.

The use of a thermometer in the cabinet is not recommended unless it be of high quality. The user will find that the refrigerator is maintaining proper temperatures if the food is preserved satisfactorily and is cold enough for the individual taste.

Distribution of Food in the Cabinet

The coldest zone in the refrigerator is within the cooling unit where the temperature is below freezing. The next warmer zone is in the chiller tray where the temperature may be just below or just above freezing. The warmest zone is in the cabinet where the temperature should range between 38° F. and 42° F.

Air circulation is necessary to insure uniform temperature distribution within the cabinet. Therefore, do not restrict the circulation by excessive crowding of food into the cabinet or by placing coverings over the shelves.

The circulation of cold air in the cabinet is from the cooling unit, down around the chiller tray, and then up the sides of the cabinet. It is evident that foods with odors, which are not covered, should be placed near the top of the cabinet at the sides, in order not to affect other foods.

For most satisfactory results, it is recommended that the following foods be kept in covered containers:

1. Those with strong or objectionable odors such as cantaloupes and onions.
2. Those which absorb odors readily such as butter.
3. Liquids such as milk or cream.
4. Moist foods such as mashed potatoes or creamed vegetables.
5. Fresh vegetables such as lettuce and celery. (Should be kept in the vegetable pan.)

Freezing Ice Cubes

To secure the most rapid freezing of ice cubes, be sure that the ice trays make good contact with the cooling unit freezing surfaces. A quarter-cup of warm water spread evenly over the freezing surface will serve to level any unevenness in the frost covering the surface.

The ice freezing rate can be further improved by turning the temperature knob at the bottom of the control to position 9, the coldest setting. When the ice is frozen, the temperature knob must be returned to the normal position. Otherwise, the cabinet air temperature may be reduced to a point where freezing of food will result.

To remove an aluminum ice tray when frozen, use the tray lifter, or loosen with an upward push directed against the upper rim of the tray. Do not use an ice pick or other sharp instrument. The rubber ice tray can be loosened by lifting on the handle.

To remove ice cubes from an aluminum tray with a minimum loss of ice, allow cold water from the faucet to run on the bottom of the tray until the cubes fall out. An alternate method is to immerse the ice tray in a pan of cold water. Ice cubes are removed from the rubber tray by flexing the tray.

Defrosting

Frost will collect on the cooling unit at a rate depending on the humidity of the air entering the cabinet at times when the door is opened and on the amount of uncovered liquid or moist foods in the cabinet. It is recommended that the cooling unit be defrosted at a time when this accumulation is approximately one-fourth to one-half inch thick or when the accumulation interferes with the removal of ice trays. It is suggested that defrosting take place at least once a month, at which time the interior of the cabinet and the cooling unit should be cleaned.

To defrost the refrigerator, the switch at the top of the control should be turned counterclockwise to the position marked "defrost." The machine will automatically proceed to operate through a single defrosting cycle, allowing the frost on the cooling unit to melt off into the chiller tray, yet not allowing the cabinet air temperature to rise more than a few degrees. When the defrosting is completed, the temperature knob will automatically return to the "on" position and the machine will continue to operate with normal temperature limits on the cooling unit.

The ice trays, and food stored in the chiller tray should be removed previous to defrosting. The water in the chiller tray after the defrosting is completed should be immediately emptied.

Caution: Do not use pans of hot water in the cooling unit to hasten the defrosting. If the machine is running at the time the hot water is put in, the hot water will cause it to continue to run until the water is frozen before it shuts off and allows the cooling unit to defrost.

Resetting the Motor Protective Device

A device is incorporated in the control to protect the motor in the machine in case of unusual load or power conditions. When this device operates, the motor is shut off. The shutting down of the machine due to overload will be indicated by an unusually long time off.

To restart the machine, the switch at the top of the control must be turned first to the "off" position and then to the "on" position. If the protective device trips immediately and will not remain set, wait a few minutes and try it again.

ADJUSTMENTS

Control

DESCRIPTION AND EXPLANATION OF OPERATION

The control, located in the front center of the condenser, contains the manual switch for turning the machine on or off, the adjustable automatic mechanism for regulating the cooling unit and cabinet temperatures, the motor protective device, and the automatic reset defrosting device.

The control is completely sealed. There are no internal adjustments that can be made. Directions for operating the control are engraved on the escutcheon plate covering the control. Further explanation of these directions and the details of what happens within the control follow.

Front View of Control and Escutcheon Plate

UPPER KNOB

The upper knob on the control serves as a manual switch to turn the machine on or off, to reset the motor protective device, and to defrost the cooling unit.

To Turn the Machine On or Off Manually

The machine is turned off when the knob points toward the upper right-hand position. The machine is turned on when the knob points to the upper left-hand position.

When the knob is turned to the "off" position, a cam on the knob moves an extension of the arm on which the movable main contact is mounted so that the contact is opened. When the knob is turned to the "on" position, the cam releases the same arm so that the contacts may be open or closed depending on the toggle switch location which is controlled by the thermostatic bellows.

To Reset the Motor Protective Device

In case of unusual load or power conditions on the motor which cause it to draw excessive current, a protective device trips the machine off. To turn the machine on again, the manual on and off switch must be turned first to the "off" and then to the "on" position.

The motor protective device is located in series with the main contacts in the common lead to the motor. All of the current to the motor passes through a small heater coil which is wound around a stationary, vertical shaft. On the lower end of the shaft is a ratchet wheel. A film of solder holds the ratchet wheel stationary on the shaft. When excessive current passes through the heating coil, the solder is melted and the ratchet wheel turns, releasing a dog. The dog springs out and strikes the extension of the arm on which is mounted the movable main contact, opening this contact as though the external manual knob were turned to the "off" position.

To reset the device and start the machine, the external knob must first be turned to the "off" position. This movement resets the dog on the ratchet wheel. The knob is then turned to the "on" position and the main contacts are closed.

To Defrost the Cooling Unit

Defrosting of the cooling unit is obtained by turning the knob to the lower left-hand position. Another cam on the knob releases a spring which acts in parallel with the main temperature spring against the bellows arm. The temperature range on the bottom of the cooling unit is changed from 15°–25° F. to 15°–46° F. It is evident that defrosting will take place since the cooling unit warms up above 32° F.

After defrosting, the knob is automatically returned to the "on" position and the machine resumes operation with normal temperature limits on the cooling unit. This is accomplished by having an arm trip the cam on the main switch which released the auxiliary defrosting spring when the bellows expands to the point corresponding to the upper defrosting temperature limit. There is a spring in the main switch which snaps it back to the "on" position.

LOWER KNOB

The lower knob on the control allows adjustment of the temperature range of the cooling unit and the cabinet air to satisfy the desires of the user. The movement of the knob changes the compression of the main temperature spring acting against the bellows arm.

The normal setting of the temperature knob is at position 5. The cooling unit temperature range, as measured in the bottom of the cooling unit, is approximately 15°–25° F. The cabinet air temperature in a room varying between 70° F. and 80° F. with a normal amount of food in the cabinet will be in the vicinity of 38° F. to 42° F.

DIRECTIONS FOR REMOVING AND INSTALLING A CONTROL

To remove a control:

(1) Remove the clamp holding the bellows tube to the cooling unit.

(2) Remove and straighten the bellows tube.

(3) Remove the escutcheon plate. It is held in place by two spring clips which are inserted through holes in the condenser.

(4) Remove the control from the condenser by taking out the two screws which hold the control bracket to the condenser. Lift the control upward until the locking connector is accessible.

(5) Disconnect the locking connector from the back of the control with a slight turning motion.

Caution: The locking connector to the back of the control is similar to that on the connecting cord to the relay. It cannot be removed by straight pulling. It must be turned slightly.

(6) The control can now be completely removed by pulling it upward.

(7) Remove the bracket from the control by taking out the single screw.

To install a control:

Caution: Make sure that the proper control (Cat. No. M1A10) is used when installed on CK-30B16 and CK-35B16 machines.

Before installing a new control, the bellows may be checked by turning the main switch to the "defrost" position and observing whether it snaps back to the "on" position. If the bellows in this control is weak, the main switch will not snap back to the "on" position when the end of the bellows tube is at room temperature.

(1) Attach the bracket to the control with the single screw through the hole in the end of the control nearest the window.

(2) Insert the end of the control tube into the rubber bushing in the cabinet top behind the front of the condenser, push it through the box top insulation and start it through the rubber bushing in the bottom plate.

(3) Guide the control tube through the rubber bushing.

(4) Connect the locking connector to the prongs on the back of the control.

(5) Attach the control bracket to the condenser by means of the two screws.

(6) Put on the escutcheon plate, inserting the two spring clips through the holes in the condenser.

(7) Bend the control tube into place and clamp it to the cooling unit. Two screws (Cat. No. 58X47) with nuts (Cat. No. 58X99) hold the clamp to the cooling unit. Make sure that the end of the bellows tube lies against the front cooling unit channel. The upper end of the pinch-off of the bellows tube should project just below the clamp so that the liquid in the tube will be directly under the clamp.

Caution: The control tube should not touch the cooling unit header. If it does, the temperature limits may vary somewhat from the proper ones.

(8) The temperature knob should be set at position 5 if normal operating limits under normal operating conditions are desired.

Starting Relay

DESCRIPTION AND EXPLANATION OF OPERATION

The starting relay, located on the right rear side of the condenser, contains a coil in series with the running winding which, when the machine is started, moves an armature outward and closes a pair of electrical contacts. Closing these contacts puts the starting winding of the motor in parallel with the running winding. The motor then starts. As soon as the motor is up to speed, the current in the running winding circuit drops to such a value that the armature returns to its normal position and breaks the starting winding circuit. The motor continues to run single phase with current in the running winding only.

The moving of the armature during starting is caused by the repelling force between the coil and the armature itself which forms a single short-circuited turn circuit above the coil. The armature is held steady in the outer position by the small steel bars under the short-circuited turn which tend to stay in the magnetic field between the pole pieces. When the current through the coil decreases to a predetermined value, the armature returns suddenly, giving the desired snap action to the electrical contacts.

DIRECTIONS FOR REMOVING AND INSTALLING A STARTING RELAY

Caution: Make sure that the proper relay (Cat. No. M1A11) is used whenever one is installed on CK-30B16 and CK-35B16 machines.

Do not disturb, adjust or bend the starting armature.

The armature of the starting relay is carefully constructed and tested at the factory in order that

its tension be just right to insure proper starting of the machine. Consequently, the starting relay is sealed and must not be opened unless absolutely necessary.

If it is found necessary to open a starting relay as a last resort before replacing a machine, great care must be used.

To Remove a Starting Relay

(1) **Remove the locking** connector from the under **side of the relay,** using a slight turning motion.

Caution: *The connector locks itself to the **prongs** projecting from the relay. It **cannot be** removed by straight pulling. It **must be** turned slightly.*

(2) **Break** the seal on the back of the relay and **remove** the cover.

(3) **Disconnect** the motor leads.

Caution: *In some instances, the color of **the leads to the** relay may not be easily distinguishable. If such is the case, mark them carefully when changing a starting relay.*

(4) Remove the two screws holding the relay to the condenser.

To Install a Relay

(1) Remove the cover from the relay.

(2) Attach the relay to the condenser with the two screws.

(3) Connect the motor leads to the proper terminals as indicated in the wiring diagram on page 12 of this section of the Domestic Product Manual.

Caution: Never interchange any motor leads. The starting winding will be injured in a short time if left continuously in the circuit.

(4) Check the operaton of the relay by connecting the cord and starting the machine.

(5) Put on the relay cover and seal it.

Capacitor

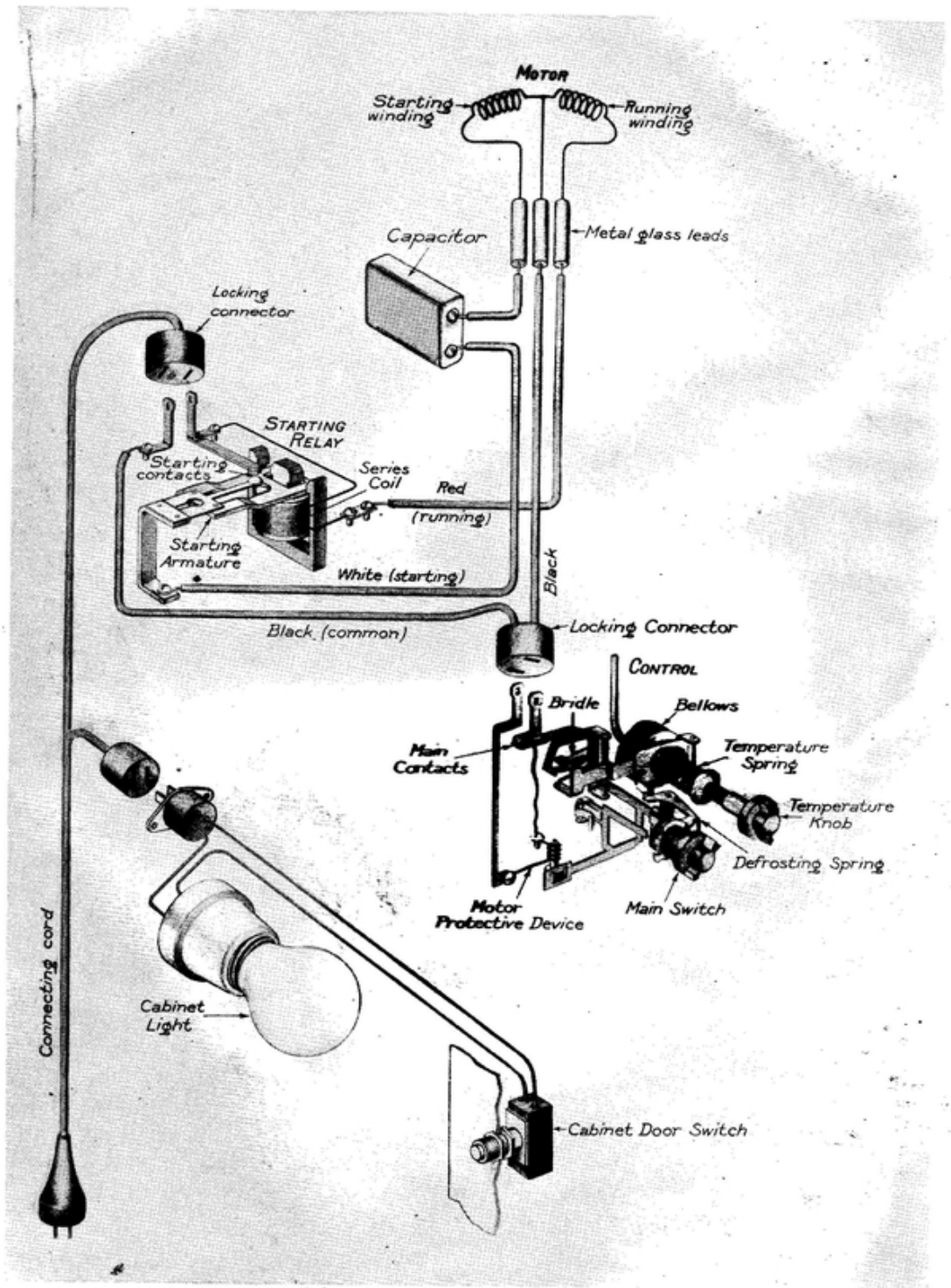
In order to give proper starting **torque to the motor** and, at the same time, to **limit the** starting current, a capacitor is used in **series with the** starting winding of the motor. This capacitor **is rated** at 50 microfarads (mf). It is located under **the cabinet** top, in a pocket on the right side of the **machine between** the cabinet top and the bottom plate. **The flap** over the pocket is sealed to keep out **moisture.**

DIRECTIONS FOR REMOVING AND INSTALLING A CAPACITOR

1. The machine must be lifted out of the cabinet far enough to expose the pocket under the cabinet top.
2. Remove the seal over the pocket.
3. Unsolder the two leads to the capacitor.
4. Remove the capacitor.

To install a capacitor, the above steps are performed in the reverse order.

*Caution: **The pocket** must be properly sealed in order to keep out moisture.*



Wiring Diagram of CK-30B or CK-35B Unit on Cabinet Equipped With a Light

Machine Adjustments

I. MACHINE DOES NOT RUN PROPERLY

Symptoms

The refrigerating machine may have one or more of the following symptoms:

1. Stalled (will not start or run at all).
2. Starts and runs only with both windings in the circuit.
3. Burned motor.
4. Motor protective device trips off.
5. Runs all the time (does not shut off).

Adjustments

The source of trouble may be external to the machine or it may be in the machine itself. It is recommended that the external factors be checked first. These include such things as the location of the machine, the current and voltage to the machine, and the electrical circuit to the machine. In testing the machine, it is suggested that the parts be checked in the following order: control, starting relay, capacitor and finally the machine itself.

1. STALLED (WILL NOT START OR RUN AT ALL)

If the machine will not start or run at all, the possible causes are:

A. Improper current or voltage.
B. Restricted air circulation to condenser.
C. Open circuit.
D. Grounded circuit.
E. Short circuit.
F. Stalled compressor.
G. Excessive load on compressor.

A. Improper Current or Voltage

The machine is designed for operation on 60-cycle or 50-cycle alternating current.

The machine will not operate on 25-cycle or 40-cycle alternating current, or on direct current.

While the rated voltage on the machine is 110 volts, it will operate satisfactorily on any voltage between 100 and 135.

When the voltage at the machine at the time of starting is less than 100 volts and the machine is operating under heavy load conditions, it may not start and the motor protective device will trip off.

When the voltage is above 135 and the machine is operating under heavy load conditions, the current to the motor may be sufficient to trip the motor protective device.

B. Restricted Air Circulation to Condenser

If the circulation of air is restricted from the condenser, the head pressure may rise to such a point that the machine may trip off or the compressor may stall.

It is recommended that at least one side of the machine be left exposed. The space above the machine top should be at least six inches. If a machine is enclosed more than this amount, it may be necessary to provide forced air circulation in order to obtain satisfactory operation.

C. Open Circuit

a. Circuit to the refrigerator.

Check the electrical circuit to the refrigerating machine by placing a series test lamp across the terminals of the connecting cord connector and noting that it lights.

If the cabinet has a light, observe whether the light comes on when the door is opened. If the cabinet light does not come on and the bulb tests all right in a socket on another electrical circuit, there is an open circuit in the supply line. If an open circuit is found, check the cord connections to the machine and to the service outlet, making sure that good electrical contact is obtained. Also, check the supply line fuses.

Check both of the locking connectors, the one on the connecting cord which attaches to the relay and the one which attaches to the control, for possible poor contact or open circuit.

One of the wires may have become disconnected in the connector.

The spring contacts in some connectors may not make contact, having lost their spring tension when the wires were soldered.

The small brass screws which hold the fiber disc over the end of the connector may project out far enough to prevent the prongs on the relay from making contact with the spring contacts in the connector. Make sure that the wires in the connector are properly located in the grooves so that they do not interfere with the seating of the disc.

b. Control.

If the circuit to the refrigerator is all right, remove the control as described on page 10. Replace it with a new control. If the machine starts and runs, it is evident that the original control may have had an open circuit.

Caution: Before replacing a control, make sure that the machine is not in the "off" cycle. The bellows tube can be warmed by holding the hand over it on the cooling unit.

A control can be tested for open circuit by placing a test lamp in series with the control in an electric circuit and observing whether the lamp lights when the main switch is turned to the "on" position. If the lamp does not light, there is an open circuit in the control.

An open circuit in a control may be caused by a weak bellows, open lead or connection, burned contacts, or defective toggle device. Since the control is sealed, it must be replaced as a whole. Part replacements cannot be made.

To test for a weak bellows, remove the bellows tube from the cooling unit and warm the end by holding it in the hand. After it is above 60° F., turn the main switch to the "defrost" position and observe if it snaps back to the "on" position. If the bellows is weak, the main switch will not snap back under these conditions.

c. Starting relay.

Caution: Do not disturb or adjust the starting armature. The armature of the starting relay is carefully constructed and tested at the factory in order that its tension be just right to insure proper starting of the machine. Consequently, the starting relay is sealed and must not be opened unless absolutely necessary.

If it is found necessary to open a starting relay as a last resort before replacing a machine, great care must be used.

Never interchange any motor leads. The starting winding will be injured in a short time if left continuously in the circuit.

In some instances, the color of the leads to the relay may not be easily distinguishable. If such is the case, mark them carefully when changing a starting relay.

If the circuit to the refrigerator and the control proves to be all right but still the machine does not start, the starting relay may be opened and inspected.

Check the electrical connections to the relay, making sure that all are tight and that the proper lead comes to each terminal. Refer to the wiring diagram on page 12.

Move the armature carefully, using a piece of insulating material such as wood or cardboard. The armature should operate freely.

Caution: When the starting contacts are closed, the armature is at line voltage so should not be handled. If a person's body is grounded, a serious shock might result.

Do not hold the starting contacts closed for more than a few seconds at a time.

Note: The main switch of the control should be in the "on" position when the following tests on the starting relay are made.

If the starting contacts do not spark when opened and closed, there is an open circuit to the starting winding. The open circuit may be at the capacitor, at the metal glass leads through the base or in the starting winding.

Disconnect the red (running) lead in the relay and see if it sparks when touched to its terminal. If it does not, there is an open circuit to the running winding. The open circuit may be in the series coil in the relay, at the metal glass leads through the base or in the running winding.

To test the series coil in the relay, short circuit it with a short piece of insulated wire between the terminal to which no lead is connected and the terminal to which the red lead is connected. Again see if the red lead sparks when touched to its terminal. If it does, but did not before the series coil was short circuited, there is an open circuit in the series coil. The relay must be replaced. Refer to page 10 for instructions for removing and replacing the relay.

If there is evidence of open circuits to both the starting and running windings, check the common lead circuit by disconnecting both the white (starting) and red (running) leads in the relay, placing a test lamp in series with them in an electrical circuit and observing if the lamp lights. If it does, the open circuit is in the common lead. If it does not, the open circuit may be in any two or all of the leads or in the motor.

d. Capacitor.

If the preceding tests on the starting relay indicate that there is an open circuit to the starting winding, first check the soldered connections to the capacitor. Make sure that they are tight.

To check the capacitor, it is necessary to raise the machine out of the cabinet far enough to open the flap over the pocket in the right side of the cabinet top.

Caution: Before replacing the machine in the cabinet, the pocket must be properly sealed with some material, such as adhesive paper to keep out moisture.

e. Machine.

If, from the tests conducted on the starting relay, it is proved that there is an open circuit in the common, running or starting circuits or in the motor which cannot be repaired, the machine must be replaced.

D. Grounded Circuit

All electrical circuits and connections are insulated from the refrigerating machine itself. If one of the electrical circuits or connections should come in direct contact with a part of the refrigerating machine, it is considered grounded.

A ground in the circuit to the refrigerator, in the control, starting relay, or machine may cause blowing of the house fuses, tripping off of the motor protective device, welding of the contacts or burning off of a lead.

A series test lamp will be found necessary to locate the ground.

Caution: The machine itself must not be grounded either through the cabinet or test rack while testing for a grounded circuit; otherwise, the line to the refrigerator may be short circuited to ground.

If the machine cannot be conveniently insulated from ground, a series test lamp must be used in each lead from line to the machine.

a. Circuit to the refrigerator.

A ground in the circuit to the refrigerator will cause blowing of the house fuses after the refrigerator is disconnected from the circuit.

Make sure that the ground is not in the cord connector or plug. Look for evidence of arcing. Also, watch for indications of moisture and dirt.

b. Control, starting relay and machine.

The control, starting relay and machine can be tested as a group. Then, if a ground is found, each can be tested separately.

Refer to the above *"Caution."*

Plug one terminal of the cord connector onto one prong in the back of the starting relay. Put one terminal of the test lamp into the other terminal of the connector. With the knob of the control in the "on" position, touch the other terminal of the lamp to the other prong in the back of the relay. The lamp should light, indicating a circuit through the motor.

Then touch this second terminal of the lamp to some unpainted part of the machine, such as the bracket on the control or the cooling unit. If the lamp lights, there is a ground, in which case proceed to locate it.

c. Control.

Replace the control with a new one. If the machine starts and runs satisfactorily, there may have been a ground in the original control.

Caution: If the ground is in the starting relay or machine, the motor protective device may trip off, the main contacts may weld or a lead may be burned off in the new control.

A ground in the control can be verified by plugging first one prong of the control and then the other into a terminal of the cord connector which ordinarily is attached to the starting relay. Put a test lamp in series between the other terminal of the cord connector and the bellows tube. If the lamp lights, there is a ground in the control.

Caution: The control or bellows tube must not be grounded while testing for a grounded circuit; otherwise, the line to the refrigerator may be short circuited to ground.

d. Starting relay.

Caution: Do not open the starting relay unless absolutely necessary. Refer to the "Caution" under "Starting relay," on page 10.

If the grounded circuit is apparently in the starting relay or machine, it is permissible to open the starting relay and inspect it.

Make a visual inspection of all of the leads and connections. Watch for evidence of arcing.

Remove the two screws holding the relay to the condenser and lift the relay as far as the leads allow. Check to see that the leads do not chafe each other or the condenser. Look to see that there is no evidence of arcing between the screw heads under the relay and the condenser. Also, watch for indications of moisture and dirt under the relay.

If a grounded spot is found, eliminate it by taping or otherwise insulating it.

When replacing the relay, carefully follow the directions on page 10.

e. Machine.

Refer to the *"Caution"* under D on page 14.

Disconnect the red and white leads in the relay. Attach the red lead to a terminal of the cord connector. Put one terminal of the test lamp in the other connector terminal. Touch the other terminal of the lamp to the white lead. The lamp should light, indicating a circuit through the motor.

Then touch the second terminal of the lamp to some unpainted part of the machine, such as the screws which hold the relay on the condenser, the bracket on the control, or the cooling unit. If the lamp lights, the machine is grounded and should be replaced.

E. Short Circuit

All electrical circuits and connections are insulated from each other. If two of these circuits or connections should come in contact with each other, a short circuit results.

A short circuit in the circuit to the refrigerator may cause blowing of the house fuses. A short circuit in the relay may cause blowing of the house fuses, tripping of the motor protective device, welding or burning of the starting contacts, or burning off of a lead. A short circuit in the control may cause the machine to run all the time. A short circuit in the capacitor may cause tripping of the motor protective device.

A short circuit in the machine may cause blowing of the house fuses, tripping off of the motor protective device, welding or burning of the main or starting contacts, or burning off of a lead.

a. Circuit to the refrigerator.

A short circuit in the circuit to the refrigerator will cause blowing of the house fuses after the refrigerator is disconnected.

Make sure that the short circuit is not in the cord connector or plug. Look for evidence of arcing; also, indications of moisture or dirt.

b. Control.

The machine will continue to run even when the main switch is turned to the "off" position if there is a short circuit in the control. Replace the control.

c. Starting relay.

Caution: Do not open the starting relay unless absolutely necessary. Refer to the "Caution" under "Starting relay," on page 10.

If the short circuit seems to be in the starting relay, capacitor or machine, it is permissible to open the starting relay and inspect it.

Make a visual inspection of all of the leads and connections, noting that the leads are properly connected and not touching. Look for evidence of arcing.

Remove the two screws holding the relay to the condenser and lift the relay as far as the leads allow. Check to see that the leads do not chafe each other or the condenser. Look for evidence of arcing. Inspect the under side of the relay. Watch for indications of moisture and dirt.

If a short-circuited spot is found, eliminate it by taping or otherwise insulating it.

When replacing the relay, carefully follow the directions on page 10.

d. Capacitor.

A short circuit in the capacitor will cause the motor to draw excessive current so that the motor protective device may trip. The only way to check this remotely possible trouble is to replace the capacitor and prove that the machine operates all right with the new one. Refer to page 11 for instructions on replacing a capacitor.

e. Machine.

If there is still a short circuit present after the preceding tests have been completed, it must be in the machine. In this case, the machine should be replaced.

F. Stalled Compressor

The compressor may be stuck with corrosion, dirt or mechanical failure of a part. Jarring of the ma-

chine may free the compressor if the cause is of minor extent.

Apply 220 volts A.C. *momentarily* to the machine. The compressor may be broken loose with this treatment and then continue to run satisfactorily on normal voltage. Auto-transformer, 220-110 volts, Cat. No. 9AC26A, used backwards, is recommended for obtaining the higher voltage if 220-volt A.C. power is not available.

G. Excessive Load on Compressor

The compressor may stall because of an excessive load on it, particularly during the initial pull-down after the refrigerator is installed or after being shut off for a time. At such times, the evaporator temperature is high and a considerable amount of liquid refrigerant may be in the lubricating oil; both conditions tending to increase the compressor load.

It may be necessary to restart the machine more than once if it continues to trip off while pulling down. After it has reached normal operating temperatures it will continue to run all right.

2. STARTS AND RUNS ONLY WITH BOTH WINDINGS IN THE CIRCUIT

The machine may start and run with both windings in the circuit until the motor protective device trips off. This condition is usually brought about by a defective electrical circuit or something that nearly stalls the compressor. With the exception of an open circuit, the possible causes are similar to those for a stalled machine:

A. Improper current or voltage.
B. Restricted air circulation to condenser.
C. Grounded circuit.
D. Short circuit.
E. Hard running compressor.
F. Excessive load on compressor.

Refer to the corresponding sections under "Stalled (will not start or run at all)" for the procedure for locating and taking care of the trouble.

3. BURNED MOTOR

A burned motor may be indicated by a discoloration of the machine case top. If a machine with a burned motor is found, every effort should be made to determine the cause of burning and this information should be included on the report.

4. MOTOR PROTECTIVE DEVICE TRIPS OFF

The motor protective device operates whenever the current to the motor is excessive. It may trip off under any of the following conditions:

A. Improper current or voltage.
B. Restricted air circulation to condenser.
C. Open circuit to starting winding.
D. Grounded circuit.
E. Short circuit.
F. Hard running or stalled compressor.
G. Excessive load on compressor.

Refer to the previous section on "Stalled (will not run at all)."

There are two additional conditions which may cause tripping of the motor protective device:

H. Float valve stuck closed.
I. Non-condensable gas (air).

Refer to page 17, Part B, "Float valve stuck closed," and Part C, "Non-condensable gas (air)."

While the tripping off of the motor protective device will generally be an indication of trouble elsewhere, it is possible occasionally to find a control in which the motor protective device is faulty. If such is believed to be the case, it is recommended that the control be changed. If the new control operates satisfactorily, it is evident that the original one may have been defective.

Caution: Do not attempt to check the motor protective device setting by holding the starting contacts in. The starting winding may be injured.

5. RUNS ALL THE TIME (DOES NOT SHUT OFF)

When a machine runs all the time and fails to shut off, the cause is either unsatisfactory refrigeration or defective control operation. If it is the former, refer to Section II, "Unsatisfactory refrigeration." If the machine continues to run when the main switch is turned to the "off" position, the fault is in the control.

Possible control defects which might cause continuous running of the machine include a weak bellows, defective bridle action and welded contacts. The control must be changed, since part replacements cannnot be made.

II. UNSATISFACTORY REFRIGERATION (MACHINE RUNS ALL RIGHT)

Symptoms

The refrigerating machine may have one or more of the following symptoms:

1. No refrigeration (cooling unit does not cool).
2. Low refrigeration (cooling unit cools but frosts only partially or not at all).
3. Erratic refrigeration (cooling unit frosts at times, not at other times).
4. Cabinet temperature too high (cooling unit frosts satisfactorily).
5. Cabinet temperature too low (cooling unit frosts satisfactorily).
6. Unsatisfactory ice freezing (cooling unit frosts satisfactorily).
7. High per cent running time (cooling unit frosts satisfactorily).
8. High power consumption (cooling unit frosts satisfactorily).

Adjustments

Unsatisfactory refrigeration may result from factors external to the machine or from trouble within the machine. The machine is assumed to run all right; otherwise, it would be classed in Section I "Machine does not run properly." The frosting of the cooling unit is usually an indication of whether the fault is in the machine or elsewhere.

Caution: In checking a refrigerator for unsatisfactory refrigeration, make sure that the machine has operated for a period of time sufficient to bring normal operating conditions if the machine were operating properly.

1. NO REFRIGERATION (COOLING UNIT DOES NOT COOL)

If the cooling unit does not cool at all, yet the machine runs all right, the trouble is in the machine. Possible causes include:

A. No refrigerant in machine.
B. Float valve stuck closed.
C. Non-condensable gas (air).
D. Float valve stuck open.
E. Leaky intake valve.
F. Leaky discharge valve.

A. No Refrigerant in Machine

If there is no refrigerant in the machine, the upper condenser coils will not warm appreciably even after the machine has been run for fifteen minutes or more. The case top may be slightly warm from the heat radiated by the motor.

Open the purging screw just a crack to determine if there is refrigerant pressure in the machine. Refer to "Instructions for purging" under Part B which follows.

B. Float Valve Stuck Closed

The float valve temperature during normal operation is almost equal to that of the upper set of turns on the outer condenser assembly. If the float valve temperature is appreciably lower so that the difference can be easily detected by placing corresponding parts of one's two hands on the float valve and upper condenser turns, then the float valve is not operating properly. The trouble may be partial or complete sticking of the float mechanism due to non-condensable gas (air), corrosion, mechanical binding, plugged orifice or a leak in the float bulb.

If the float valve is completely stuck closed, the return of refrigerant to the cooling unit will be stopped. The pressure in the condenser will gradually increase until the pressure release valve releases, thereby opening the cylinder to the case (low) pressure. At this time, the refrigeration will drop off and stop. A loud sputtering noise will accompany the releasing of the pressure release valve. The machine will probably shake violently due to the unusual pressure condition. The starting contacts will flutter as the starting winding is drawn into the circuit because of the heavy current passing through the running winding. In a short time, the motor protective device will trip the machine off.

Caution: Do not run a machine which has the symptoms of a completely stuck float valve. If run under such heavy load conditions, the motor may be damaged.

The first step is to purge the machine at the float valve purging screw.

INSTRUCTIONS FOR PURGING

1. Remove the cap from the purging screw socket.
   Caution: In order not to injure the finish on the float valve, cut through the finish at the base of the cap with a pocket-knife.
2. Using a standard purging wrench (Cat. No. 11X122), open the purging screw just a crack (possibly 1/10 turn or less).

If liquid refrigerant comes out (the purging screw being open only a crack), close it immediately. The trouble then is not non-condensable gas (air), so purging will probably not help.

3. Leave the purging screw open a crack until the non-condensable gas is purged off. This will be indicated by a strong odor of sulphur dioxide from the escaping gas and the rising of the float valve temperature to the point where it will feel equal to that of the upper condenser turns.
4. Tighten the purging screw with the purging wrench.
5. Fill the purging screw socket with light oil and observe very carefully to make sure that there is no leak.
6. Replace the cap.

If it is found that the float valve is stuck by something other than non-condensable gas (air), the float valve shell should be tapped either with a rubber or leather mallet, or with an ordinary hammer on a block of wood placed against the shell.

Caution: Be careful not to injure the finish on the float valve shell while tapping on it.

C. Non-condensable Gas (Air)

The effects of non-condensable gas (air) in the machine are similar to those produced by a partially or completely stuck float valve. Therefore, refer to the preceding section on "Float valve stuck closed."

If there should be a very small leak on the low pressure side of the machine and the cooling unit is operating below 14° F., air may be drawn in. Thus, it will collect again at the float valve after the machine has once been purged. Such a machine should be shut off, the cooling unit warmed and then a careful check made with ammonia in order to locate the leak. Refer to page 20, Section IV, "Leaks."

D. Float Valve Stuck Open

If the float valve is stuck open, gas refrigerant from the condenser is returned directly into the cooling unit. There will be little or no refrigeration in the cooling unit. The float valve temperature will be warm and equal to that of the condenser. A slight hissing noise may be heard as the gas passes through the float valve orifice.

Tap the float valve shell with a rubber or leather mallet, or with an ordinary hammer on a block of wood placed against the shell.

Caution: Be careful not to injure the finish on the float valve shell while tapping on it.

E. Leaky Intake Valve

If the flapper intake valve is held off its seat by something lodged under it, such as corrosion or dirt, or by the unloader being stuck in the inward position, the cylinder will remain open to the case (low) pressure and there will be no refrigeration. If such is the case, the condenser will not warm up and the watts input to the motor will be low.

F. Leaky Discharge Valve

If the discharge valve is held off its seat by something lodged under it, such as corrosion or dirt, the cylinder will remain open to the condenser (high) side and there will be no refrigeration.

The discharge valve acts also as a check valve. If it leaks slightly, the effects will be the same as from a leaky check valve; that is, there will be a slight hissing noise within the case when the machine shuts off, and the warm compressed refrigerant leaking back will cause defrosting of the headers and possibly more of the cooling unit.

It will be observed that the right cooling unit will defrost more quickly than the left on a CK-35B16 machine when the discharge valve leaks, since the suction tube comes from the right cooling unit. The right cooling unit may defrost nearly completely while the left one may lose the frost only from the headers. This unequal defrosting must not be mistaken for an improper control setting even though the bellows tube is attached only to the left cooling unit.

Shut the machine off; heat up the cooling units, particularly the right one, with pans of hot water; then start the machine again. In this way the obstruction under the discharge valve may be flushed out.

2. LOW REFRIGERATION (COOLING UNIT COOLS BUT FROSTS ONLY PARTIALLY OR NOT AT ALL)

Most of the causes listed under "No refrigeration" bring about "low refrigeration" when found in an earlier stage or when present in a lesser degree. Refer to the corresponding parts under "No refrigeration."

A. Low refrigerant in machine.
B. Float valve stuck closed.
C. Non-condensable gas (air).
D. Float valve stuck open.
E. Leaky intake valve.
F. Leaky discharge valve.

There is another condition which may cause "low refrigeration" but probably not "no refrigeration":

G. Partially Weak Bellows in Control

A partially weak bellows (one from which part of the gas charge has leaked out) may cause symptoms of low refrigeration. The cooling unit may operate on either a frosting or a defrosting cycle, depending on the amount of gas remaining. The "on" and "off" cycles will both be abnormally long.

Normally, the gas pressure within the bellows follows the pressure-temperature curve of a saturated vapor. Throughout the normal operating range there is some liquid present in the end of the bellows tube.

If there is a minute leak in the bellows or bellows tube, there will come a time when there will be liquid present at the lower end of the temperature range but not at the upper end. As soon as all of the liquid is evaporated, the gas pressure will follow the curve of a super-heated vapor. The pressure on the bellows for a given temperature will be less than it would be if the gas were a saturated vapor. Therefore, the cooling unit temperature must rise higher than it normally would to trip the machine on.

To test for a partially weak bellows, remove the bellows tube from the cooling unit and warm the end by holding it in the hand. After it is above 60° F., turn the main switch to the "defrost" position and observe if it snaps back to the "on" position. If the bellows is weak, the main switch will not snap back under these conditions. Replace the control. Refer to page 10 for instructions.

3. ERRATIC REFRIGERATION (COOLING UNIT FROSTS AT TIMES, NOT AT OTHER TIMES)

When a cause of no and low refrigeration appears and disappears at intervals, erratic refrigeration results. At one time the refrigeration will be normal, at another time there will be little or none. To check the machine when operating normally will reveal no trouble. It must be checked during the period when the refrigeration is low. Then refer to the causes listed under "No refrigeration" and "Low refrigeration."

4. CABINET TEMPERATURE TOO HIGH (COOLING UNIT FROSTS SATISFACTORILY)

Since the cooling unit frosts all right, the trouble is probably not in the machine itself. Possible causes include:

A. Improper control temperature knob setting.
B. Partially weak bellows in control.
C. Restricted air circulation to condenser.
D. Restricted air circulation in cabinet.
E. Excessive door or cabinet top gasket leakage.
F. Excessively high room temperature.
G. Excessive loading of cabinet.
H. Excessive cabinet door opening.

A. Improper Control Temperature Knob Setting

The cabinet temperature depends to a certain extent on the control temperature knob setting. This setting is made adjustable in order to satisfy the individual desires of the user. If it is desired to make the cabinet air temperature lower, the knob is turned clockwise; if higher, it is turned counterclockwise.

To illustrate the point, the following table gives approximate cooling unit and cabinet temperatures for a CK-30B16 machine in a T-9 cabinet without food or ice freezing load in an 80°F. room:

Temperature knob position	Machine trips	Cool. unit bott'm temp., °F.	Av. cab. air temp., °F.
1 (warmest)	on	33.5	44
	off	23.5	
5 (normal)	on	25	38
	off	15	
9 (coldest)	on	16	32
	off	5.5	

For the majority of installations, sufficient temperature variation can be obtained by turning the temperature knob. Occasionally it may be found necessary to get additional range. To do this, remove the textolite sealing plug from the center of the temperature knob, using a pocket-knife. The small screw under the plug can be removed and the knob reset. It will be noted in the preceding table that the range of average temperatures between positions 1 and 9 is about 18° F.

Caution: Be sure to replace the textolite sealing plug since the screw in the center of the temperature knob is at line voltage.

The temperature knob should never be reset just because a hasty check of the cabinet temperature shows it to be a few degrees lower or higher than it should be. The cabinet temperature depends on a number of important factors in addition to the setting of the temperature knob. These factors include the room temperature, food load in the cabinet, ice freezing load, air circulation in the cabinet, air circulation to the condenser, door or cabinet top gasket leakage, and the frequency of door opening. All of these factors should be carefully checked before the temperature knob is reset.

B. Partially Weak Bellows in Control

A partially weak bellows in the control may raise the upper temperature limit of the cooling unit so that the average cooling unit temperature is considerably above normal. A higher cabinet air temperature will result. Refer to Part G, "Partially weak bellows in control" under "Low refrigeration," page 18.

C. Restricted Air Circulation to Condenser

If the air circulation to the condenser is seriously restricted, the capacity of the machine will be reduced. If the machine is required to operate in a high room temperature with a heavy load, the reduction of capacity may be noticeable.

It is recommended that at least one side of the machine be left exposed when installed. The space above the machine top should be unrestricted for at least six inches. If a machine is enclosed more than this amount, it may be necessary to provide forced air circulation in order to obtain satisfactory operation.

D. Restricted Air Circulation in Cabinet

Air circulation is necessary to insure uniform temperature distribution in the cabinet. If the air circulation is restricted by excessive crowding of food or by placing coverings over the shelves, the cabinet air temperature in places will be higher than it should be.

E. Excessive Door or Cabinet Top Gasket Leakage

If the door or cabinet top gaskets do not seal properly, warm air will leak into the cabinet and increase the cabinet air temperature.

Imperfect door seals may be located by the use of a .003 metal feeler. Locate the point of poor seal by inserting the feeler at various points around the door between the gasket and the cabinet front.

Observe the inner and outer cabinet top gaskets to make sure they seal properly.

F. Excessively High Room Temperature

The capacity of a refrigerating machine depends on the room temperature in which it operates. With the same control temperature knob setting, the cabinet air temperature will increase with an increase in room temperature. The following approximate figures indicate the relationship of cabinet air temperature to room temperature with the control temperature knob set at position 5:

Room temp., °F.	Cab. air temp., °F.
60	34
80	38
100	42

G. Excessive Loading of Cabinet

The cabinet air temperature will rise when a large amount of relatively warm food is placed in the cabinet. The temperature will continue to be higher than normal until the food is cooled. If warm food is constantly being placed in the cabinet, the temperature will average somewhat above normal.

H. Excessive Cabinet Door Opening

Whenever the cabinet door is opened, warm air enters the cabinet and the temperature goes up a few degrees. If the door is left open or is opened excessively, the cabinet air temperature will stay above normal.

5. CABINET TEMPERATURE TOO LOW (COOLING UNIT FROSTS SATISFACTORILY)

The machine is evidently refrigerating too much. If the machine runs all the time and fails to shut off, refer to Part 5, "Runs all the time," under Section I, "Machine does not run properly," page 16. Other possible causes include:

A. Improper control temperature knob setting.
B. Creeping temperature knob.
C. Excessively low room temperature.
D. Poor bellows tube contact to cooling unit.

A. Improper Control Temperature Knob Setting

Refer to division A "Improper control temperature knob setting" under Part 4, "Cabinet temperature too high," page 18.

Note: In ***high altitudes*** *the lower barometric pressures will shift the temperature range of the control lower. This may necessitate resetting the temperature control knob warmer in order not to hold too low a cabinet temperature.*

B. Creeping Temperature Knob

If the temperature knob creeps towards a colder setting from the position it was set, install a crimped spring washer (Cat. No. M15A3) under the temperature knob. To do this, remove the textolite sealing plug from the center of the temperature knob. Remove the small screw and then take off the knob. Install the spring washer under the knob and replace the knob, screw and sealing plug.

Caution: Be sure to replace the textolite sealing plug because the small screw in the center of the knob is at line voltage.

C. Excessively Low Room Temperature

Refer to division F "Excessively high room temperature" under Part 4, "Cabinet temperature too high," this page.

D. Poor Bellows Tube Contact to Cooling Unit

If the bellows tube contact to the cooling unit is poor, the cooling unit will run colder than it normally would. Adjust the clamp and bellows tube to improve the contact.

6. UNSATISFACTORY ICE FREEZING (COOLING UNIT FROSTS SATISFACTORILY)

If the refrigerating machine does not show low refrigeration as covered in Part 2 or if the cabinet temperature is not too high for any of the reasons listed in Part 4, the cause for slow freezing may be one of the following:

A. Improper control temperature knob setting.
B. Poor contact of ice tray with cooling unit surface.
   a. Tray not frozen in properly.
   b. Tray bottom surface not flat.
   c. Cooling unit needs defrosting.
C. Rubber ice tray.
D. Freezing desserts.

A. Improper Control Temperature Knob Setting

For most rapid freezing, the control temperature knob setting should be turned to position 9, so that the machine will run continuously in normal room temperatures, until the freezing is completed. In this way the average cooling unit temperature will be several degrees lower than it would be if the machine operated in cycles.

Caution: When the freezing is completed, the knob should be returned to the normal position. Otherwise, the cabinet air temperature may be reduced to a point where freezing of food will result.

B. Poor Contact of Ice Tray with Cooling Unit Surface

The transfer of heat from the water to the cooling unit surface is accomplished largely through the contact of the ice tray with the cooling unit surface. The better the contact, the faster the freezing rate.

a. Tray Not Properly Frozen in.

If the ice tray is not frozen to the cooling unit surface, the freezing rate will be reduced. It is recommended that a small amount (quarter of a cupful) of water be spread over the cooling unit surface at the time the ice tray is put in.

b. Tray Bottom Surface Not Flat.

If the bottom surface of the ice tray is badly dented or warped, good contact cannot be obtained. The surface should be straightened or the tray replaced.

c. Cooling Unit Needs Defrosting.

If the surface of the frost on the cooling unit is uneven at the time the ice tray is put in, good contact cannot be secured. The cooling unit should be defrosted.

C. Rubber Ice Tray

The rubber ice tray is supplied for its ease in removing ice cubes where a few cubes are needed at a time. It is not a fast freezing tray. Generally it will require from two to three times as long to freeze cubes in the rubber tray as in an aluminum tray.

D. Freezing Desserts

The time required to freeze desserts depends on the constituents used. It is usually somewhat longer than the time to freeze water.

7. HIGH PER CENT RUNNING TIME (COOLING UNIT FROSTS SATISFACTORILY)

If the per cent running time of machine seems abnormally high, the possible cause may be found in one of the following sections:

I. Machine does not run properly.
   5. Runs all the time, page 16.
II. Unsatisfactory refrigeration (Machine runs all right).
   4. Cabinet temperature too high, page 18.
   5. Cabinet temperature too low, page 19.

8. HIGH POWER CONSUMPTION (COOLING UNIT FROSTS SATISFACTORILY)

If the power consumption of a machine seems abnormally high, refer to Part 7, "High per cent running time."

III. NOISE (MACHINE RUNS AND REFRIGERATES SATISFACTORILY)

Under normal operating conditions, these machines will be found to be even quieter than previous Monitor Top models. More or less distinguishable, but not objectionable, will be found the characteristic oil flowing sound within the case.

There is no radio interference during the normal running of a machine. If radio interference should be traced to the refrigerator, there may be a ground or short circuit in the refrigerator. Refer to "Grounded circuit," page 14, and "Short circuit," page 15 under Section I "Machine does not run properly."

IV. LEAKS

A leak is usually readily detected since the odor of sulphur dioxide (SO_2) makes itself apparent even when present in very small quantities.

To locate a leak, use an uncorked bottle of concentrated ammonia or a swab saturated with it. The reaction of sulphur dioxide gas and ammonia fumes produces a white vapor which is easily recognized.

If there should be a very small leak on the low pressure side of the machine, and the cooling unit operates below 14° F., air will be drawn into the machine and will collect at the float valve. Refer to page 17, Part C, "Non-condensable gas (air)." To locate such a leak, defrost and warm the cooling unit using pans of hot water or an electric heater. Then bring the fumes of concentrated ammonia into the vicinity.

V. FINISH ON UNITS

For repairing scratches, nicks and mars on units in the home, use Cat. No. 58X69 Glyptal Enamel Patching Kit. Follow the directions given with the kit.

Units will rarely if ever need complete refinishing because of the inherent qualities of the Glyptal-baked enamel put on them at the factory. Complete refinishing, should it be necessary, should be done with the same materials and by the same methods as prescribed for Glyptal finished cabinets.