

PHILCO



SERVICE

REFRIGERATION

HOME STUDY

ELECTRICAL SYSTEMS IN PHILCO REFRIGERATORS

**Testing Methods
Electrical Components
Electrical Systems**

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ELECTRICAL SYSTEMS IN PHILCO REFRIGERATORS

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INTRODUCTION

The purpose of this home-study booklet is to emphasize the importance of the electrical system when trouble-shooting Philco refrigerators.

This booklet shows the wiring diagrams of Philco refrigerators from prewar models to the 1953 automatic models. Wherever it was considered feasible, circuit break-downs are provided to simplify discussion of the circuits. When analyzing a group of models having the same electrical wiring and components, the original wiring diagram from the service manual is shown first, then a schematic diagram, followed by individual circuits if the system requires further explanation. Since a properly presented diagram tells a more complete story than can be put in words, a minimum of text is used in this booklet.

The table below shows the refrigerator lines that are covered, along with other pertinent data that are helpful in presenting the over-all picture.

PHILCO REFRIGERATORS

PREWAR MODELS

The diagrams in figures 13 to 17, inclusive, show the electrical hookups for most of the prewar models.

POSTWAR MODELS

Year	Line	Type of Motor-Compressor Spring Mounting	Relay	Overload Circuit Breaker	Wiring Harness
1946	A	External	Magnetic or hot-wire type with built-in circuit breaker	(See Relay)	Round cord with color-coded leads.
1947	B				
1948	C				
1949	D	Internal	Magnetic relay mounted on motor-compressor	Separate circuit breaker mounted on motor-compressor	Flat cord with wires identified by position in cord.
1950	E				
1951	F				
1952	G				
1953	H				

A definite understanding of the circuits involved is a great aid in locating trouble in the electrical system of a refrigerator. It is not necessary to memorize all of the circuits involved, but rather to make use of the wiring layouts and diagrams to obtain the required information. It is of the utmost importance to have a clear understanding of the nature of the various parts used in Philco refrigerator electrical systems and their operation within the system, in order to understand the system as a whole.

TESTING METHODS

USE OF A WIRE JUMPER

A wire jumper is a simple device that often aids in locating open circuits in electrical parts. Consider the case of a motor and circuit breaker connected as shown in A in figure 1. Power is applied as indicated, but the motor does not run. This indicates that the motor or circuit breaker may be defective—probably open-circuited.

To check the circuit breaker for an open circuit, connect a test lamp across its terminals, as shown in B of figure 1. If the circuit breaker was open-circuited, the test lamp will light when it is connected.

The wire jumper may be used in checking other parts for open circuits, provided caution is observed. Make sure that the jumper is never placed across the 115-volt circuit, as it would be if this check were applied to the COMMON and RUN terminals of the motor, for example.

THE OHMMETER

An ohmmeter may be used to test the continuity of a circuit and to measure its resistance in ohms.

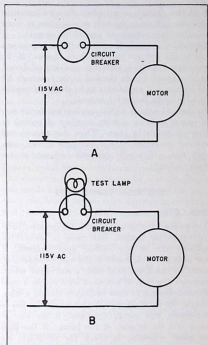
Many commercial ohmmeters also measure voltage, and are then called volt-ohmmeters.

An ohmmeter is simple to use, but there are certain precautions that must be observed. It is important to remember that resistance measurements must never be made on a circuit or appliance while it is connected to the power source. If this is done, the meter will be damaged. Be sure to read the proper scale, since most ohmmeters have two or more scales for measuring high or low resistance. If the needle (pointer) does not deflect when the meter test leads are connected across a circuit, the circuit is open. If the needle deflects all the way to zero on the scale, the circuit has practically no resistance. A reading of this type is obtained if the ohmmeter test leads are connected to the ends of a short piece of wire. Any reading obtained on the ohmmeter scale indicates continuity, i.e., that the circuit is continuous and has no breaks.

CONTINUITY TESTING

Continuity tests are usually made with a buzzer and battery, an ohmmeter, or, if the job is being done in the shop, a test light is usually the most convenient means.

There are only three electrical troubles that can



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Figure 1. Use of a Wire Jumper for Testing

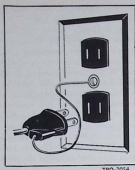


Figure 2. Ground Connection for Automatic-Defrost Refrigerators

occur in electrical devices: they can be open-circuited, grounded, or short-circuited.

1. An open circuit is one where the electrical path is broken completely or where its resistance is very high, as in the case of a corroded connection.

2. A grounded circuit is caused by contact of a live wire with the motor housing or other grounded object.

3. A short circuit occurs when the wire insulation is defective, allowing the bare copper wires to touch each other, thus cutting out part of the circuit.

Continuity testing will ordinarily locate opens and grounds, but will not indicate short circuits. If the appropriate diagram is available, an electrical device, such as a motor, can be checked at the terminals for open circuits, but would have to be checked from the terminals to the frame for grounds.

Mechanical failures within an electrical device may also occur, such as sticking together of points, or failure of points to close. When the normal and energized conditions of the part are known, continuity tests will usually determine whether or not the part is faulty.

ELECTRICAL COMPONENTS

POWER CORD

The power cord used in Philco refrigerators ordinarily gives no trouble, but there is always the possibility that it may become open-circuited. If there is no power delivered to the motor-compressor, be sure to check the cord with a continuity tester. Sometimes the ends of a broken wire within a cord will touch enough to show continuity during testing. Bending the cord along its length while the test is being made, will usually determine if the wire is broken and the location of the break. If the cord tests good, remember to check the receptacle for power and for contact with the prongs of the power-cord plug.

In all of the Philco refrigerators that include auto-

matic defrosting equipment, a three-wire power cord is required. This cord has a special grounding lead, shown in figure 2, that must be connected to the plate mounting screw, as shown. Of course, to make this ground effective, the metal outlet box where the refrigerator is connected must also be grounded. (These boxes are normally grounded by means of the armor on the electric cable or a special ground wire within the cable.) The other end of this third lead is connected to the refrigerator at the relay mounting screw.

OVERLOAD CIRCUIT BREAKERS

In the Philco refrigerators that were manufactured prior to the D-Line, the overload circuit breaker was built into the motor-starting relay. This assembly was used on units having an externally spring-mounted motor-compressor. The relay used was either of the magnetic type of the hot-wire type. Both types are fully discussed in this booklet, together with an explanation of the action of the circuit breaker for each type.

Beginning with the Philco D-Line, in refrigerators having internally spring-mounted motor-compressors, a new type of circuit breaker was used. It is an individual assembly that is mounted on the motor-compressor. This new circuit breaker has certain advantages in design when compared with the older type. Since it is mounted directly on the motor-compressor, it is acted upon by the heat developed in the motor winding (which causes an increase in temperature of the motor housing) as well as by the heat from an internal heater wire through which the

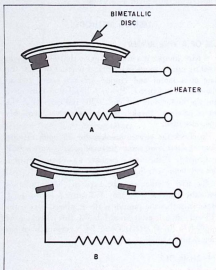


Figure 3. Action of the Later Type Overload Circuit Breaker

TP-1567

motor current passes. Because of this arrangement the circuit breaker will open as a result of excessive motor current, or an over-heated motor-compressor housing, or a combination of the two heat sources. The operation of the older type of circuit breaker that was an integral part of the relay was dependent on the motor current alone. After the circuit-breaker contacts have been open long enough for the unit to cool, the contacts again close, resulting in intermittent operation of the refrigerator.

The actuating element of the breaker is a bimetallic disc—a disc made up of two metals having different expansion rates under the influence of changing temperature. Figure 3 shows the action that occurs in circuit breakers of this type. At room temperature the disc is shaped as shown at A in the illustration. A rise in temperature produces equal expansion of the two metals in the disc, and, at some definite temperature, the strain becomes great enough to cause the disc to reverse its curvature, as shown at B in the illustration. This action produces the rapid breaking of the contacts which is required to prevent arcing and burning.

The overload circuit breaker must be matched to the compressor motor, since an incorrect circuit breaker either would not protect the motor from excessive currents, or would shut the motor down unnecessarily. Always make sure that a replacement circuit breaker has the same part number as the one it replaces.

Check the circuit breaker for continuity when it is at room temperature, because at that temperature the contacts should be closed.

MAGNETIC RELAYS WITH OVERLOAD CIRCUIT BREAKERS

In Philco refrigerators prior to the D-Line, the starting relay was combined with the overload circuit breaker, and mounted as shown in figure 4. The operation of the relay will be described with reference

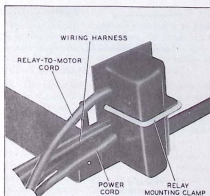


Figure 4. Starting Relay, Magnetic Type (Old Style)

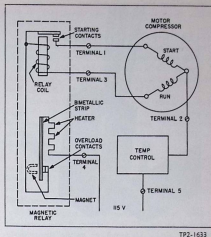


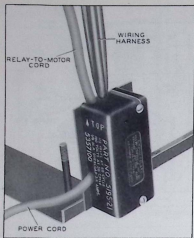
Figure 5. Schematic Diagram of Magnetic Relay

to the diagram in figure 5. It can be seen that all the current that passes through the RUN must pass through the relay coil. The relay contacts are normally held open by a spring (not shown); however, when the contacts of the temperature control close, the initial heavy current required to start the motor causes the relay contacts to close, and the motor START winding is energized. As the motor speed increases, less current is required, and just before the motor reaches full speed the current has dropped to such a value that the relay coil can no longer hold the starting contacts closed. The contacts then open and disconnect the starting winding. Since the speed of the motor is now such that it can lock into synchronism with the power frequency, it thereafter operates on the running winding alone.

In addition to the relay coil, the motor current passes through the circuit-breaker contacts and heater. The circuit breaker is actuated by a bimetallic strip that bends with increasing temperature of the heater. Since the heater temperature depends upon the current passing through it, excessive motor current causes it to bend enough to open the contacts. To ensure a quick break of the contacts so as to minimize arcing, a small permanent magnet is mounted as indicated in the illustration. When the contacts are about to open, the magnet supplies the energy necessary to achieve rapid separation.

The numbered terminals shown in the diagram follow the terminal markings on the magnetic relay, and thus circuits may easily be traced through the relay.

The magnetic relay must be mounted in the position indicated by the marking on the side of the housing. When replacing a relay, make sure that it has the same part number as the original. Note



TP-4899

Figure 6. Starting Relay, Hot-Wire Type

that the starting contacts of the magnetic relay are always open except during the motor starting period.

HOT-WIRE RELAY

The hot-wire type of relay, shown in figure 6, operates on the principle that a metal wire expands (becomes longer) as its temperature rises, and contracts (becomes shorter) as it cools. The actuating thermal element in the hot-wire relay is a short length of wire through which the motor current passes. If the current through the motor changes, the length of the thermal element will change accordingly, causing the relay contacts to open or close.

At A in figure 7 the relay is shown connected to the compressor motor. When the temperature control closes the circuit, full voltage is applied to each motor winding through relay contacts S and M. The heavy starting current heats the thermal element, expands it lengthwise, and provides enough motion to open the starting contacts, as shown at B. After the starting circuit is disconnected, the motor continues to operate normally on the running winding. When the desired temperature is reached in the refrigerator, the temperature control opens and stops the motor. The thermal element in the relay now cools sufficiently to allow contact S to close in preparation for a new start.

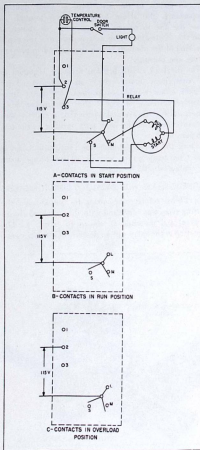
If the motor is under heavy load or if the motor winding is defective, more than normal current will flow through the actuating thermal element. If excessive current flows through the thermal element it becomes hotter than normal, and its further expansion causes both sets of contacts to open, as shown at C, thus disconnecting the motor completely. The hot-

wire relay thus combines the functions of starting relay and overload circuit breaker.

Like the magnetic relay, the hot-wire type must be matched with the motor with which it is used. Check the part numbers before installing a new relay. When checking the relay for continuity refer to the appropriate wiring diagram.

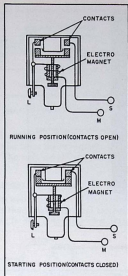
MAGNETIC RELAY USED IN THE D, E, F, G, AND H LINES

The magnetic relay shown in figure 8 consists of an electromagnet, a movable iron core, and a set of contacts. The weight of the iron core keeps the contacts open when the electromagnet is not energized. With the main winding starting current flowing through the magnet coil, the arm is raised and the contacts are closed. In operation, the coil is connected



TP3-1827

Figure 7. Diagram of Hot-Wire Relay, Showing Operation



TP1-3342

Figure 8. Wiring and Operation of Magnetic Relay (New Style)

in series with the motor running winding. When the motor circuit is closed by the temperature control, the starting current is heavy enough to cause the magnet to close the contacts and place the starting winding in the circuit. As the motor approaches full speed, the current required drops to such a value that the magnet can no longer hold the contacts closed. With the opening of the contacts, the motor starting winding is removed from the circuit until the next starting cycle.

MOTOR-COMPRESSORS

The function of the motor-compressor is to pump the low-pressure freon vapor from the evaporator, to increase its pressure and temperature, and to pass it on to the condenser. The compressor motors are designed to fulfill the following conditions.

1. The motor must be of the a-c induction type, to avoid the use of brushes or other electrical contacts inside the sealed housing. This eliminates the necessity for maintenance of brush equipment, and reduces the possibility of dirt and foreign particles finding their way into the refrigeration system.
2. A starting relay must be used to disconnect the starting winding as the motor approaches full speed. For reasons of maintenance and cleanliness in the refrigerating system, the relay must be mounted outside of the sealed motor-compressor housing.
3. The motor winding must not be affected adversely by the refrigerant or the lubricating oil, since

both of these agents are in contact with the motor windings.

From the standpoint of electrical circuits, the compressor motors used in the sealed units are quite similar in all models, although some types differ in appearance and in the positioning of the motor wiring terminals. The three types of motor-compressors used in Philco refrigerators are as follows:

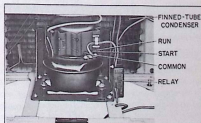
1. The externally spring-mounted type is shown in figure 9. This type was used in the prewar models and later in the A, B, and C lines. The electrical terminals for COMMON, START, and RUN are shown in the illustration.
2. An internally spring-mounted motor-compressor, as used in the D, E, F, G and H lines, is shown in figure 10. This type has the relay and circuit breaker mounted on the motor-compressor, as shown. The location of the terminals is also shown.
3. The compact type of motor-compressor used in the later 7-cu.-ft. models has the wiring terminal arrangement shown in figure 11. This type also mounts the relay and circuit breaker on the sealed housing.

MOTOR-COMPRESSOR CHECKS

Common troubles in all electric motors are (1) worn bearings caused by lack of proper lubrication, (2) dirt, moisture, or other foreign matter in the motor winding, and (3) overloading which causes the motor temperature to rise sufficiently to destroy the insulation.

Since the sealed compressor motor used in Philco refrigerators is always properly lubricated, and because the sealed-in motor winding is always free from dirt and moisture, the first two troubles are eliminated. Only overloading remains, and this may be caused by one or more of the following conditions:

1. The condenser cooling air is restricted, causing excessive pressure in the system.
2. The voltage furnished at the motor is not within the specified limits.
3. The refrigerator is improperly located—that is, it is operating in a room where temperature is too high.



TP-3704

Figure 9. Externally Spring-Mounted Motor-Compressor

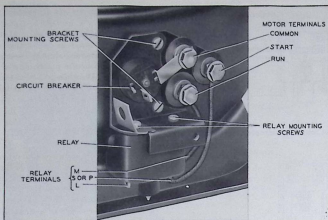


Figure 10. Terminal Arrangement on Internally Spring-Mounted Motor-Compressor TP-6552C

4. A defective temperature control or a poor door seal causes the motor to run for too long periods during hot weather.

5. A defect in the motor winding, such as a ground or a short circuit, causes the motor to draw too much current.

A simple method of checking the motor-compressor is by using the special test leads shown in figure 12. Power is first applied to both motor windings; then the starting winding is disconnected from the circuit according to the following procedures:

1. Remove the leads from the three motor-compressor terminals.

2. Attach the test clips to the motor terminals, as indicated in the diagram.

3. Connect the test leads to the power outlet, close the single-pole switch, and depress the momentary contact push button for not longer than 3 seconds. *If the starting winding is left in the circuit for more than 3 seconds, the winding may be damaged.*

If the motor runs normally when power is supplied by the special leads but will not run with the regular connections, the trouble is not in the motor. It may be in the wiring, the circuit breaker, the relay, or the temperature control. Test each part separately to determine which is defective.

TEMPERATURE CONTROL

The temperature control is an automatic switch that stops the unit when the temperature in the refrigerator is sufficiently low and starts it at some slightly higher temperature. A temperature control should be checked against the OFF and ON temperatures given in the appropriate service manual. If it does not start and stop the unit within the required limits, it should be replaced. To determine if the



Figure 11. Compact Type Motor-Compressor

TPS-1454

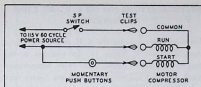


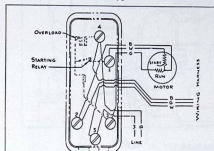
Figure 12. Motor Test-Lead Assembly

TP-7887

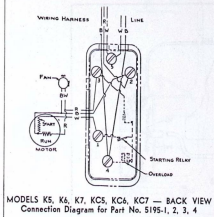
temperature control contacts are operating, unclamp the feeler tube from the evaporator and warm it in the hand. The unit should start as the feeler tube warms up.

WIRING HARNESS

The wiring harness consists of the assembly of leads that connect the various electrical components in the refrigerator. In the older type that was used with



ALL L, M, and R MODELS — BACK VIEW
Connection Diagram for Part No. 5195-5, 6, 7, 8, 9

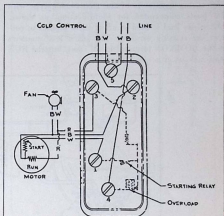


MODELS K5, K6, K7, KC5, KC6, KC7 — BACK VIEW
Connection Diagram for Part No. 5195-1, 2, 3, 4

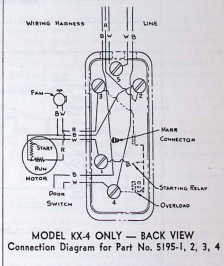
TP3-1459

Figure 13. Connection Diagram for Prewar Models, Back View of Relay

the prewar and A, B, and C lines the main cable is a round cord with the leads color-coded for identification. In the later type, used with the internally spring-mounted motor-compressor, the main cable is flat, with the leads identified by their positions in the cable. The wiring harness having the round cord is shown in figure 18, while all the late models use the flat-type cables indicated in figure 21.



MODEL KX-6 ONLY — BACK VIEW
Connection Diagram for Part No. 5195-1, 2, 3, 4



MODEL KX-4 ONLY — BACK VIEW
Connection Diagram for Part No. 5195-1, 2, 3, 4

TP3-1459

Figure 14. Connection Diagram for Prewar Models, Back View of Relay

ELECTRICAL SYSTEMS FOR THE A, B, AND C LINE REFRIGERATORS

The wiring diagram for the A, B, and C line refrigerators is shown in figure 18. In addition to the wiring harness which connects the relay, temperature control, and lighting circuit, a separate 3-wire cord connects the relay to the motor. As the diagram shows, either of two types of relays is used—the hot-wire or the magnetic type.

Because the cabled leads in figure 18 are not easy to follow in tracing circuits, a schematic diagram showing all connections for the magnetic relay is given in figure 19. It should be noted that terminals

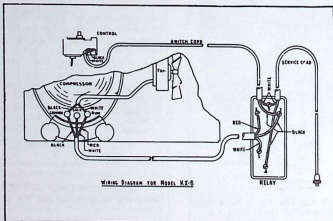
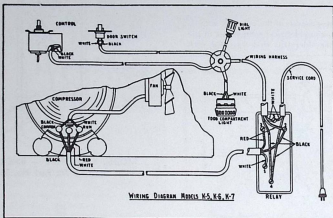


Figure 15. Wiring Diagram for Prewar Models, Back View of Relay

TP3-1458

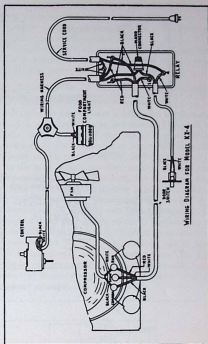
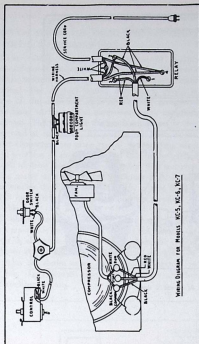


Figure 16. Wiring Diagram for Prewar Models, Back View of Relay

TP3-1458

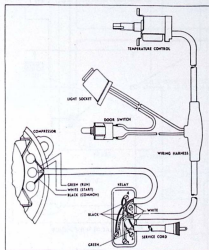


Figure 17. Wiring Diagram for all L, M, and R Models, Back View of Relay

TP3-1458

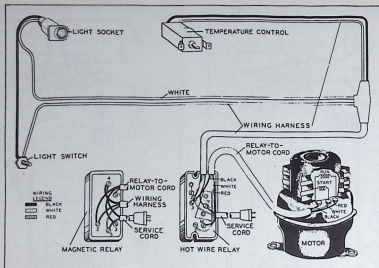
2 and 5 on the rear of the relay are merely binding posts, and are not a part of the relay circuit.

Figure 20 shows the connections in the electrical system of these refrigerators when the hot-wire relay is used. Again it should be noted that terminals 1, 2, and 3 are merely binding posts, and are not a part of the relay operating circuit.

D, E, F, G, AND H LINES

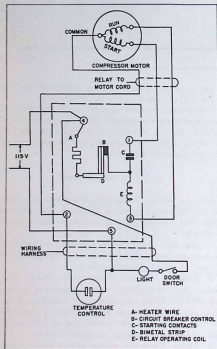
For convenience in discussing the electrical systems of the Philco refrigerators produced from 1949 to 1953, they may be divided into three classifications as follows:

1. Standard refrigerators.—Those refrigerators that do not have automatic defrosting equipment and are not of the Philco Automatic type.
2. Automatic-defrost refrigerators.—Those refrigerators that are equipped with an automatic defrosting device. (When considering the electrical system, these refrigerators may be divided into two types: the earlier two-door (duplex) models and the later single-door refrigerators having automatic defrost.)
3. Philco Automatic refrigerators.—Those refrigerators that automatically maintain correct inde-



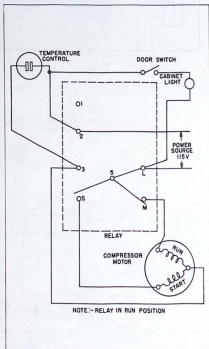
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Figure 18. Wiring Diagram, A, B, and C Lines



TP3-1802

Figure 19. Schematic Diagram, A, B, and C Lines, Using a Magnetic Relay



TP3-1803

Figure 20. Schematic Diagram, A, B, and C Lines, Using a Hot-Wire Relay

pendent temperatures in the freezer and in the food compartment.

ELECTRICAL SYSTEMS FOR PHILCO STANDARD REFRIGERATORS, D, E, F, G, AND H LINES

These models employed the internally spring-mounted motor-compressor with the relay and circuit breaker mounted directly on the motor-compressor housing. The original wiring diagram is given in figure 21. In all except some of the early models of these lines, wiring-harness connectors were installed, as shown. The three-wire flat cord can be easily disconnected at this point, by pulling the leads apart. These connectors are often useful in localizing electrical troubles. It should be noted that in the earlier models of these lines the relay terminal that connects to the motor starting winding was marked P. In the later models the P was changed to S, so that both P and S have been used to designate this terminal of the relay.

To obtain a clearer concept of what happens when the temperature control closes to start the compressor motor, a schematic diagram of the electrical system is shown at A in figure 22. The terminal markings on the relay are shown as an aid in tracing circuits on the job. The diagram shows the complete starting and running circuits.

When the motor-compressor approaches full speed, the starting contacts in the relay open and leave only the motor running winding and the series relay coil in the circuit, as shown at B.

The cabinet lighting circuit, shown at C in figure 22, is an independent circuit connected directly across the 115-volt power source at all times.

ELECTRICAL SYSTEM OF THE TWO-DOOR AUTOMATIC-DEFROST REFRIGERATORS

All two-door models have a dew-point compensator, which is a low-wattage heater mounted behind the center rail and around the upper portion of the cabinet shell. Its purpose is to retard the formation of sweat on this portion of the cabinet.

In the early, F-line, two-door models the dew-point compensator was connected with three leads, as shown in figure 24. With the circuits arranged as shown, the part of the heater (compensator) marked A is connected across the 115-volt power source, and is energized at all times when power is furnished to the refrigerator. The other half (marked B) is connected in parallel with the compressor motor, and is therefore energized only when the motor runs. The later G-model refrigerators use a single compensator heater connected across the power line in series with the heater thermostat. See figure 26.

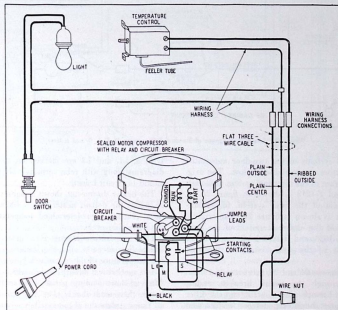


Figure 21. Wiring Diagram of Standard Refrigerators, D, E, F, G, and H Lines

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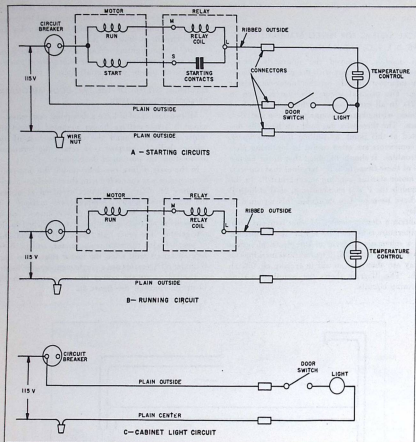


Figure 22. Schematic Diagrams of Standard Refrigerators, D, E, F, G, and H Lines

TP3-1804

The electrical systems of the two-door automatic-defrost refrigerators are explained below. The original service diagram of the electrical system of models F-818, F-1018 and F-1218 is shown in figure 23. A schematic diagram of the same system, for circuit-tracing purposes, is shown in figure 24. The original service diagram of the electrical system of the later models G-828, G-1028, and G-1228 is shown in figure 25. A schematic of the same system is shown in figure 26.

As shown in figures 24 and 26, there are two main circuits—one through the circuit breaker, motor, starting relay, and temperature control, and the other through the heater thermostat, defrost heaters, and current limiter. Both circuits lead to the clock-driven timer switch which connects one or the other of the circuits to the 115-volt line. Wiring-panel terminals

1, 2, 3, L1, and L2 are marked on the schematic diagrams along with relay terminals M, S, and L, as an aid to circuit tracing.

The heater thermostat, shown in figures 23 through 26, opens the defrost heater circuit when the evaporator reaches a predetermined temperature during the defrosting cycle.

The temperature limiter is a protective device which also serves to open the heater circuit in case the temperature of the evaporator becomes excessive. It is a mechanical circuit breaker which resets itself. After a short cooling period, the contacts of the heater thermostat should close and remain closed at all times, unless the evaporator temperature becomes excessive (above 80° F.).

The diagram in figure 24 is correct for all F models except F-1218. In addition to the electrical equip-

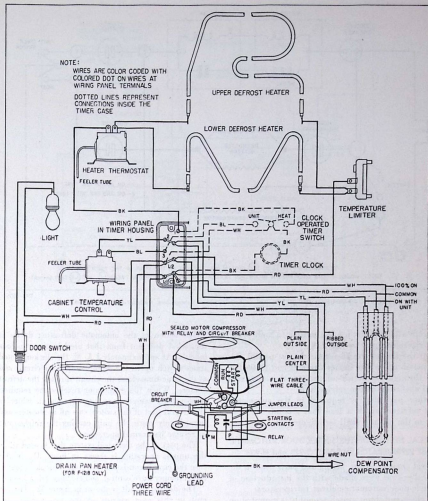


Figure 23. Wiring Diagram of Two-Door Automatic-Defrost Refrigerator, Models F-818, F-1018, and F-1218

TP0-2280

ment shown, this model contains a drain-pan heater that is connected between terminals L1 and L2 on the wiring panel (see figure 23). In this model provision is made for the automatic disposal of the defrost water by draining it through a tube to a drain pan located beneath the food compartment. The function of the drain-pan heater is to heat the defrost water sufficiently to dispose of it by evaporation.

The clock which drives the switching mechanism for the defrosting cycle is located in the evaporator at the rear. The indicator is used to set the clock

for the correct time, as shown in figure 27. If the current goes off because of power failure or for other reasons such as a defective wall plug, the clock should be reset to the correct time.

The action of the defrost heaters may be explained in three steps:

1. At approximately 2 A. M. each night, the clock-driven timer switch opens the motor-compressor circuit and, at the same time, closes the heater circuit.
2. When a predetermined evaporator temperature is reached, the heater thermostat cuts the defrost

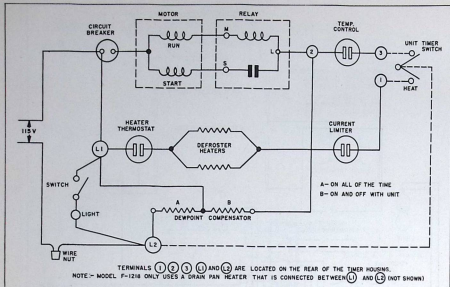


Figure 24. Schematic Diagram of Two-Door Automatic-Defrost Refrigerators, Models F-818, F-1018, and F-1218

TP3-1805

heater off, allowing the ice to continue to melt, since the refrigerating unit is still idle.

3. At the end of the 25-minute defrost period, the timer switch opens the heater contacts and closes the circuit through the motor-compressor, thus restoring normal operation of the refrigerator.

Another part that is required in the automatic-defrost refrigerators is a lead that grounds the condenser to the cabinet shell (see figure 28).

ELECTRICAL SYSTEM OF THE SINGLE-DOOR AUTOMATIC DEFROST REFRIGERATOR, MODELS G-928 and H-938

Several changes in the wiring and parts used in the electrical system were made with the introduction of the single-door automatic-defrost refrigerators.

The clock-and-timer switch assembly is mounted on the top breaker strip instead of on the evaporator, as in the former two-door models. The heater thermostat is not included as a separate part, but is built into the clock-and-switch mechanism.

The original diagram, taken from the service manual, is shown in figure 29, and a schematic diagram showing the same circuit is shown in figure 30.

Note that in the schematic diagram the relay terminals, L, M, and S, the terminal-board wiring connections, Y, W, B, and R, and the numbered terminals on the clock-and-switch assembly are given to assist in tracing circuits.

The dotted lines at the switch indicate that the connections are made inside the timer-clock assembly.

The action of the automatic defrosting device is somewhat different from that used in the two-door models. At approximately 1 A. M. the clock-operated timer switch opens the motor-compressor circuit and at the same time closes the circuit through the defrost heaters. When the evaporator reaches the required frost-melting temperature, the thermostat, which is an integral part of the switch, cuts off the heaters and immediately starts the unit, causing the refrigerator to resume its normal operation.

The part of the electrical system that is used while the unit is operating is shown in figure 31. In this case the circuit consists of the circuit breaker, motor, relay, temperature control, and clock-switch assembly.

The defrost circuit is shown in figure 32. The circuit in this case consists of the two heaters, the current limiter, and the clock-switch, which opens automatically when the predetermined evaporator temperature is reached.

The timer clock is energized at all times when the refrigerator cord is plugged into the power receptacle. Figure 33 shows the clock circuit and the wiring-panel terminals through which it is connected. It should be noted that the circuit breaker protects the motor circuit only, and that the auxiliary equipment, such as the heaters, clock, and cabinet lights are connected directly to the 115-volt source.

Figure 34 shows the cabinet-light and door-switch circuit connected to wiring-panel terminals R and W.

The thermal damper, shown in figure 35, is a low-

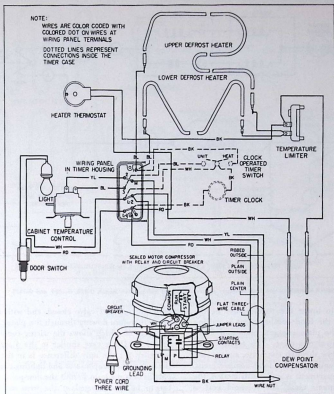


Figure 25. Wiring Diagram of Two-Door Automatic-Defrost Refrigerator, Models G-828, G-1028, and G-1228

wattage heater. Its purpose is to aid the mechanical damper and to make it more effective. The thermal-damper heater wire is taped to the outer side of the food-compartment rear panel immediately below the rear cutout, and it is connected in parallel with the temperature control, as shown. As a result of this connection the damper is energized only while the unit is not operating. When the unit is operating, the temperature-control contacts are closed and the damper is shorted out. When the damper is energized it sets up an air block which makes possible a greater temperature differential between the freezer and the food compartment, and thus the freezer may be operated at a lower temperature without the possibility of freezing foods in the food compartment.

ELECTRICAL SYSTEMS OF THE PHILCO AUTOMATIC REFRIGERATORS, MODELS H-1137, H-1138, and H-1238

The original wiring layout for the Philco automatic refrigerators is shown in figure 36. These refrigerators

are considerably different, and far superior in performance to those previously discussed.

Two separate heat-absorbing devices are employed—the conventional evaporator in the completely isolated freezer, and a cooling plate to maintain the correct temperature in the food compartment. The automatic refrigerators contain no defrosting equipment, because with this arrangement the freezer is practically frost free. It therefore requires frost removal only at infrequent intervals. Figure 37 shows the schematic diagram for models H-1137 and H-1138, the two single-door models of this type. Relay terminals M, S, and C and wiring-panel terminals Y, R, and W are shown in the schematic, as an aid to circuit tracing.

As shown in the block diagrams in figure 38, the compressor motor circuit and the plate thermal-regulator circuit are in parallel, and both circuits are controlled by the freezer thermal regulator. Whenever the freezer thermal-regulator contacts are closed,

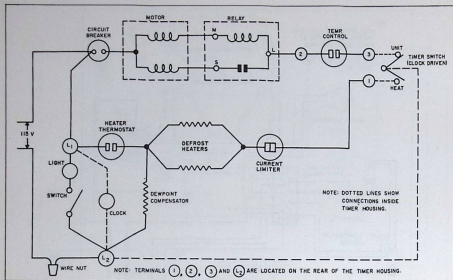


Figure 26. Schematic Diagram of Two-Door Automatic-Defrost Refrigerator, Models G-828, G-1028, and G-1238

TP3-1806

the unit operates to lower the temperature of the freezer section. If the food compartment is calling for refrigeration, the plate contacts open and allow the solenoid bypass valve to close. This action causes the refrigerant to flow through the plate, and to produce the desired cooling in the food compartment. When the food compartment is sufficiently cooled, the plate regulator contacts close, the solenoid coil is energized, the valve opens, and the refrigerant bypasses the plate. The plate regulator contacts then remain closed until the food compartment again requires cooling. Figure 39 shows the system layout

with the solenoid valve closed, and with the refrigerant therefore flowing through the plate.

Figure 40 which shows the wiring connections for model H-1238 is very similar to the diagram shown in figure 37; the only difference is in the wiring of the dew-point compensator and lighting circuits. This change was made to permit the dew-point compensator to be disconnected at the wire nut when the refrigerator is on display. The wire nut is located in back of the lamp housing.

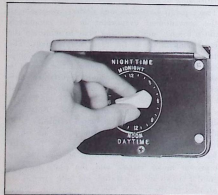


Figure 27. Setting Timer Clock

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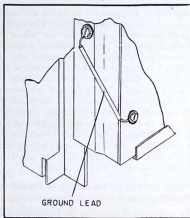
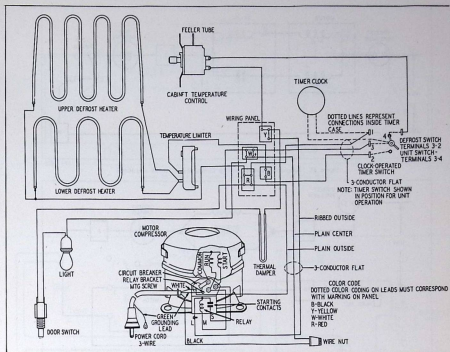


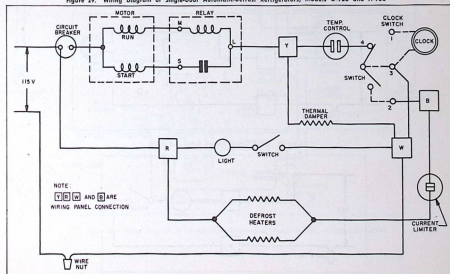
Figure 28. Ground Lead to Condenser

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TP2-1110

Figure 29. Wiring Diagram of Single-Door Automatic-Defrost Refrigerators, Models G-928 and H-928



TP3-1807

Figure 30. Schematic Diagram of Single-Door Automatic-Defrost Refrigerators, Models G-928 and H-928

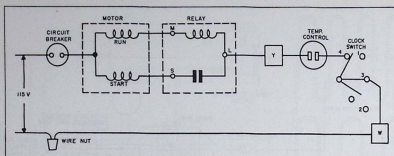


Figure 31. Diagram Showing Running Circuit, Models G-928 and H-938

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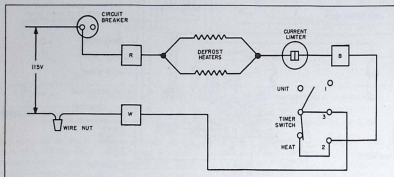


Figure 32. Diagram Showing Defrost Heater Circuit, Models G-928 and H-938

TP3-1809

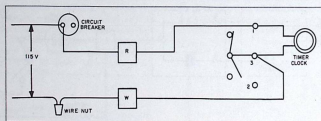


Figure 33. Clock Circuit, Models G-928 and H-938

TP3-1810

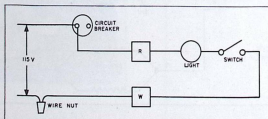


Figure 34. Cabinet Light Circuit, Models G-928 and H-938

TP3-1811

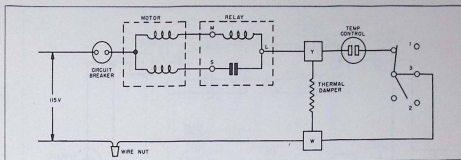


Figure 35. Thermal-Damper Circuit, Models G-928 and H-938

TP3-1912

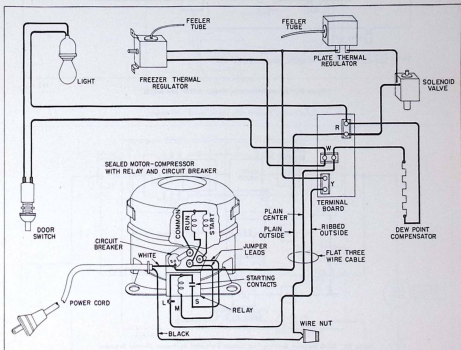


Figure 36. Wiring Diagram, Philco Automatic Refrigerator, Models H-1137, H-1138, and H-1238

TP2-2692

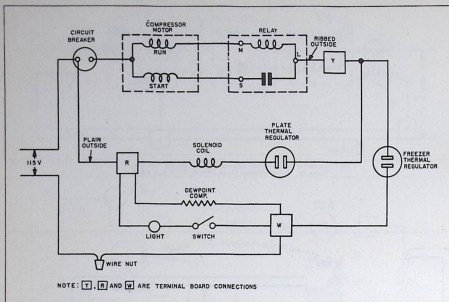
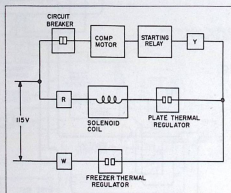


Figure 37. Schematic Diagram, Models H-1137 and H-1138

TP3-1813



TP3-1814

Figure 38. Block Diagram Showing Two Circuits Controlled by Freezer Thermal Regulator

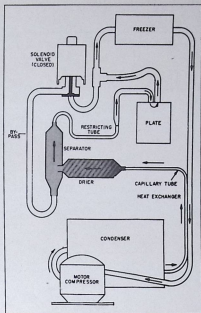


Figure 39. From Circuits with Solenoid Valve Closed TP2-2633

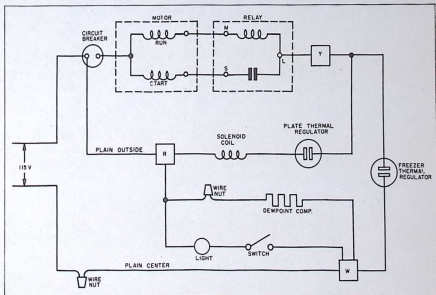


Figure 40. Schematic Diagram, Model H-1238 TP3-1913

