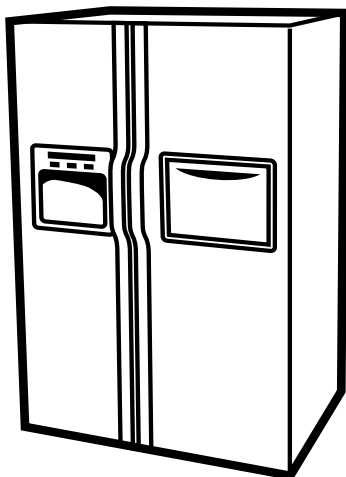




TECHNICAL SERVICE GUIDE

**Arctica Side-By-Side Refrigerator
Inverter Compressor
Low Noise - High Performance**



MODEL SERIES:

PSH23SGNAFBS





IMPORTANT SAFETY NOTICE

The information in this service guide is intended for use by individuals possessing adequate backgrounds of electrical, electronic, and mechanical experience. Any attempt to repair a major appliance may result in personal injury and property damage. The manufacturer or seller cannot be responsible for the interpretation of this information, nor can it assume any liability in connection with its use.

WARNING

To avoid personal injury, disconnect power before servicing this product. If electrical power is required for diagnosis or test purposes, disconnect the power immediately after performing the necessary checks.

RECONNECT ALL GROUNDING DEVICES

If grounding wires, screws, straps, clips, nuts, or washers used to complete a path to ground are removed for service, they must be returned to their original position and properly fastened.

GE Consumer Home Services Training
Technical Service Guide
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Introduction

This new Arctica refrigerator is similar to previous Arctica models with the following exceptions:

- Compressor type
- Compressor control
- 3-speed condenser fan
- 3-speed fresh food fan

The new inverter compressor has 3 speeds and is not controlled from the 120 VAC side of the main control board. The compressor is controlled by an inverter that receives input from the low voltage DC side of the main control board. The main control board still makes compressor decisions based on the input of 4 thermistors, door-open time, and input from the temperature control panel.

The other significant difference from previous models is that the main control board now operates the condenser fan and fresh food fan at three different speeds. Both fans are actually the same fans found on previous models.

The new Arctica with inverter compressor is also more efficient than previous models. The increased efficiency provided by the inverter compressor allows this refrigerator to receive an **Energy Star** rating. The **Energy Star** rating means the refrigerator consumes 10% less energy than the Department of Energy standard for the specific cabinet size.

This refrigerator is also 5 to 7 decibels quieter than previous models.

This technical service guide covers the new features of this new Arctica refrigerator. For information on features and components that are common to previous Arctica refrigerators, refer to pub #31-9072.



Specifications

DISCONNECT POWER CORD BEFORE SERVICING

IMPORTANT - RECONNECT ALL GROUNDING DEVICES

All parts of this appliance capable of conducting electrical current are grounded. If grounding wires, screws, straps, clips, nuts or washers used to complete a path to ground are removed for service, they must be returned to their original position and properly fastened.

ELECTRICAL SPECIFICATIONS

Temperature Control (Position 5) 7-(-11) °F
 Defrost Control 60hrs @ 45 min
 w/ no door openings
 Overtemperature Thermostat 140-110°F
 Defrost Thermistor 70°F
 Electrical Rating: 115V AC 60 Hz 11.6 Amp
 Maximum Current Leakage 0.75 mA
 Maximum Ground Path Resistance 0.14 Ohms
 Energy Consumption 51 KWH/mo

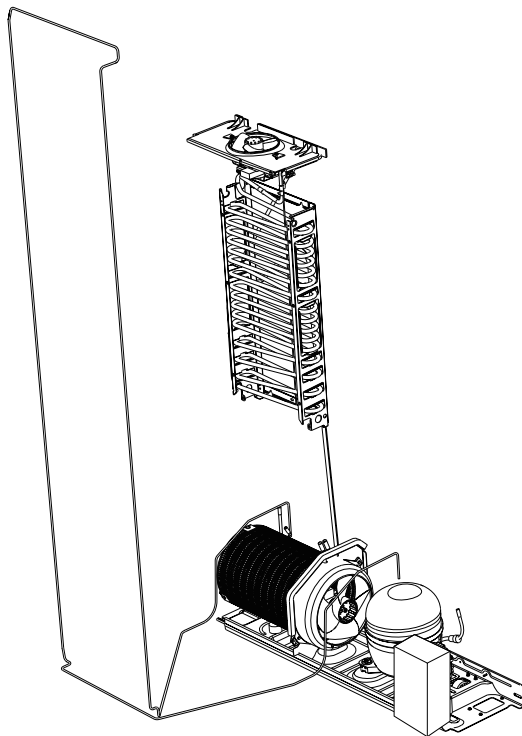
NO LOAD PERFORMANCE

Control Position MID/MID
 and Ambient of: 70°F 90°F

Fresh Food, °F 34-40 34-40
 Frozen Food, °F (-3) 3 (-3) 3
 Run Time, % <80 <100

REFRIGERATION SYSTEM

Refrigerant Charge (R134a) 6.0 ounces
 Compressor 833 BTU/hr @
 3000 RPM
 Minimum Compressor Capacity 22 inches
 Minimum Equalized Pressure
 @ 70°F 45 PSIG
 @ 90°F 57 PSIG



IMPORTANT SAFETY NOTICE

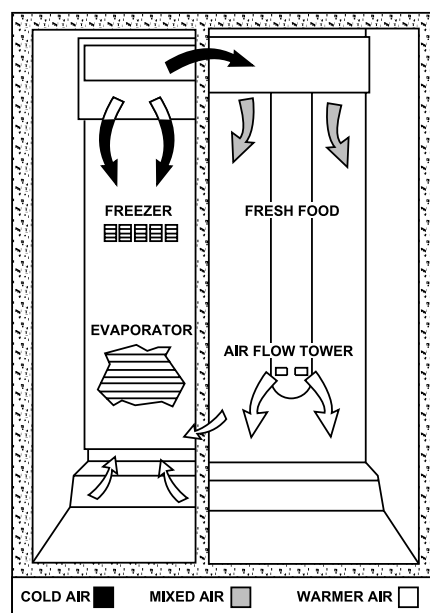
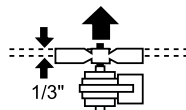
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INSTALLATION

Minimum clearance required for air circulation:

TOP 1"
 SIDES 0.125"
 REAR 0.5"

AIR FLOW



REPLACEMENT PARTS

Temperature Control WR55x10023
 Inverter WR55x10155
 Overtemperature Thermostat WR50x10015
 Defrost Heater Harness & Thermostat WR23x10142
 Defrost Heater & Bracket WR51x10030
 Condenser Fan Motor WR60x10042
 Evaporator Fan Motor WR60x10043
 Main Board WR55x10156
 Dispenser Board WR55x10029
 Thermistor (EV) WR55x10025
 Thermistor (FZ) WR55x10026
 Thermistor (FF) WR55x10027
 Thermistor (FF) WR55x10028
 Thermistor (CC) WR55x10030
 Compressor WR87x10064
 FF Fan Motor WR60x10051
 Damper WR60x10052

Nomenclature

P S H 23 S G N A F BS

Brand/Product

G - GE
H - Hotpoint
P - Profile
E - Eterna
S - GE Select

Configuration

S - Side by Side
T - Top Mount

Depth/Power

H - Inverter Compressor
S - Standard Depth
T - Tropical
G - Global

Capacity

(cubic feet) AHAM Rated Volume

Interior Features/Shelves

A - Leader Wire
D - Deluxe Wire
I - Deluxe Glass
K - Spillproof/Slideout Glass F - 6 Month filter
S - Stainless Steel Doors
Q - Showcase Derivative
U - AVB Derivative
W - HPS Derivative
X - Regional Derivative

Exterior Color

BS - Black on Stainless
WW - White on White
AA - Almond on Almond
BB - Black on Black
CC - Bisque on Bisque
WH - White on Black

Door Type

F - Flat
R - Right
L - Left Door Swing

Engineering

A - Initial Design
B - 1st Revision

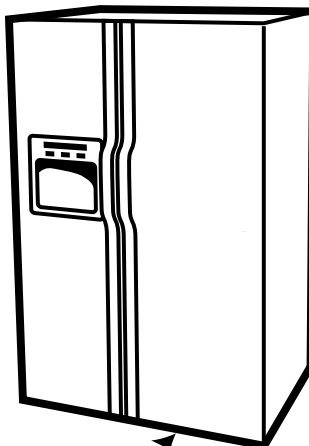
Model Year

N - 2002

Icemaker/Exterior

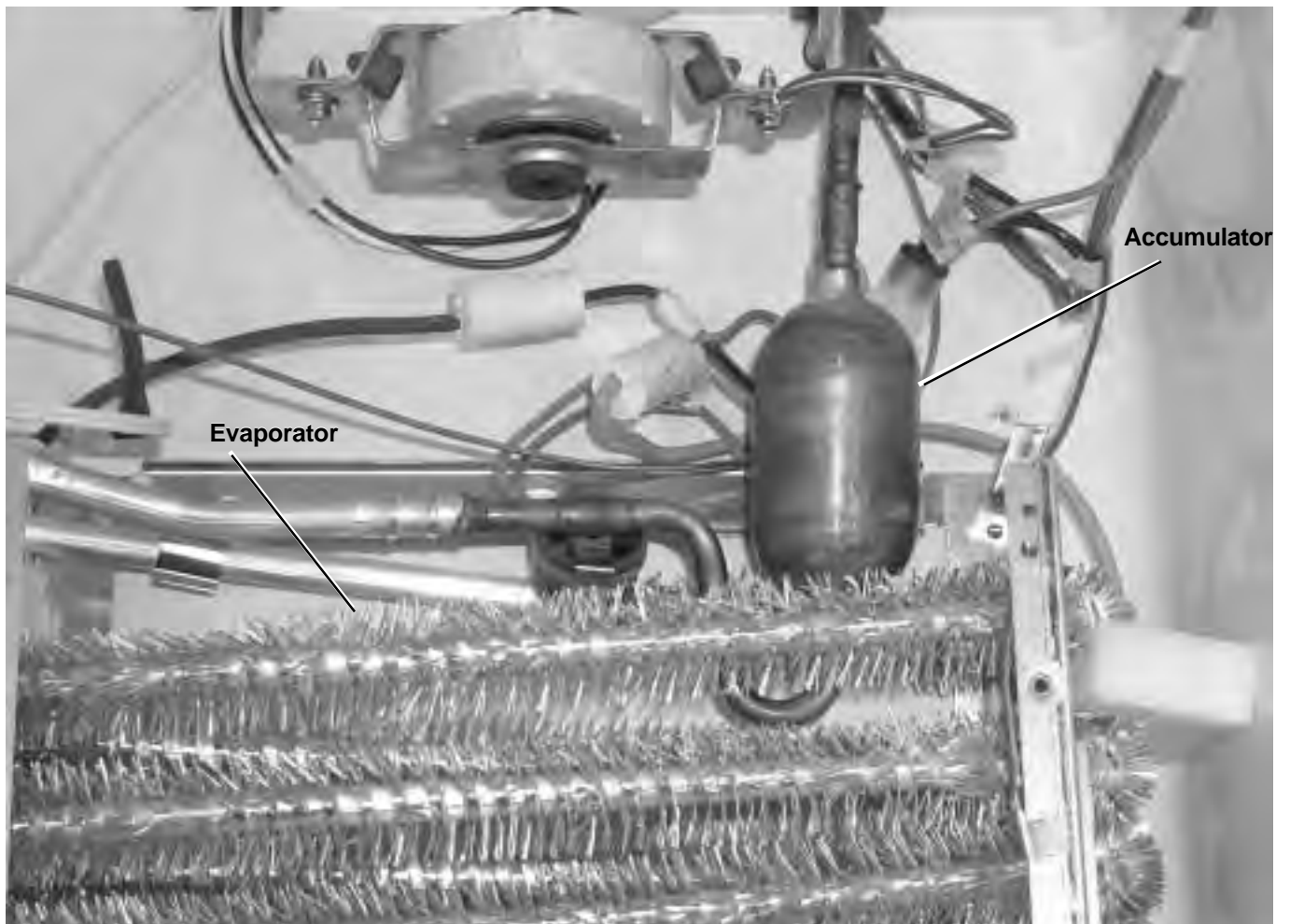
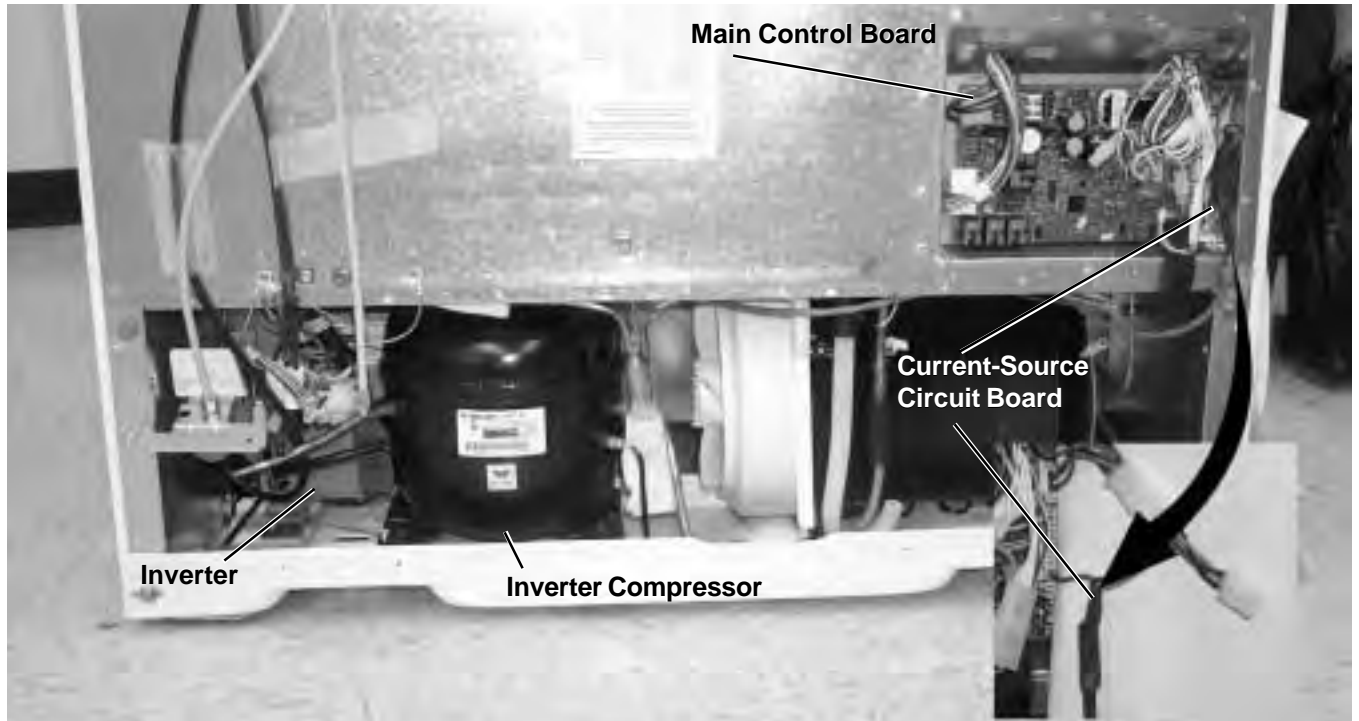
B - Non Dispenser
IM Ready
D - Cubed Ice/Water
E - Cubed/Crushed/Water
F - 6-Month Filter
Cubed/Crushed
G - 1-Year Filter
Cubed/Crushed
I - In-line Filter/Indicator
Cubed/Crushed/Water

The rating plate, located on the upper left wall of the fresh food compartment, contains the model and serial numbers. Additionally, the rating plate specifies the minimum installation clearances, electrical voltage, frequency, maximum amperage rating, and refrigerant charge, and type.



Location
Tech Data
Sheet

Component Locator Views



Principals of Refrigeration

Phases of Refrigeration

The compressor is the heart of any refrigeration system. It serves as a pump to circulate the refrigerant and create pressure within the system. When the compressor is operating, one side of the system is at high pressure and the other side is at low pressure. This difference in pressure creates a temperature difference that allows heat to be removed from inside the cabinet and transferred to the outside of the cabinet.

The 3 phases of the refrigeration system are:

- Compression
- Condensation – occurs on the “high side” of the system
- Evaporation – occurs on the “low side” of the system

Compression

While the compressor is operating, refrigerant vapor is discharged into the condenser. A capillary (small diameter tube) is connected to the outlet of the condenser. The capillary tube restricts the amount of refrigerant that leaves the condenser. As the compressor continues to pump refrigerant into the condenser, this restriction causes pressure to build in the condenser. Typical operating pressure in the condenser in the inverter compressor system is 85 to 90 psig in an ambient temperature of 75 °F.

Condensation

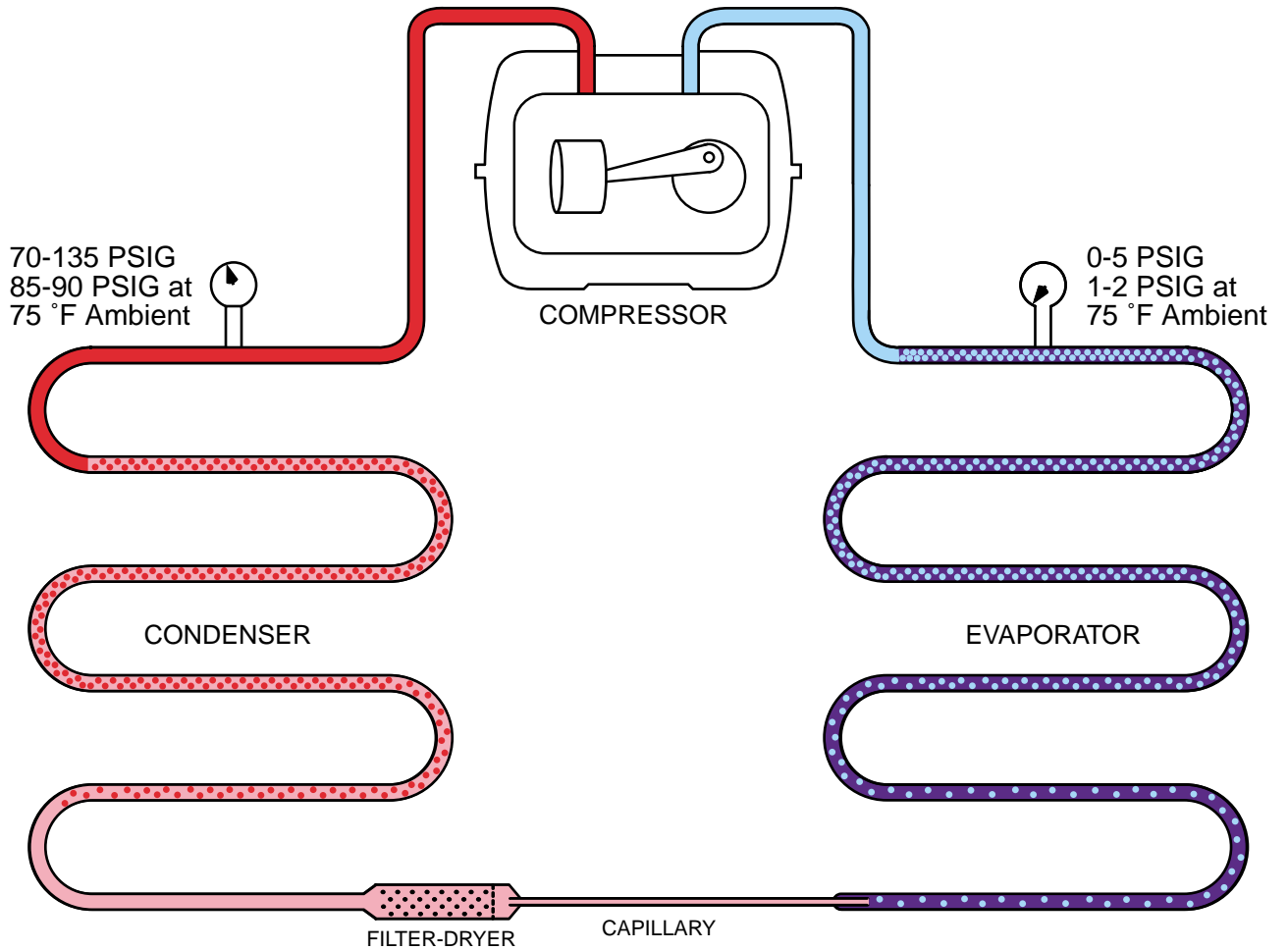
The compressed refrigerant vapor entering the condenser is warmer than the temperature of the room. As the refrigerant travels through the condenser, the heat from the high-pressure vapor is transferred to the condenser, which transfers heat to the surrounding air (by convection). As heat is removed from the high-pressure vapor, it begins to condense into a high-pressure liquid. This high-pressure liquid refrigerant flows to the end of the condenser and is forced into the capillary tube.

Evaporation

High-pressure liquid refrigerant travels through the capillary and exits at a very high rate of speed into the much-larger tubing of the evaporator. Low pressure in the evaporator, caused by the suction of the compressor (typically 0 to 5 psig in the inverter compressor) causes the liquid refrigerant to vaporize. Approximately 30% of the refrigerant will vaporize immediately upon exiting the capillary. The remaining refrigerant will vaporize as it travels through the evaporator. As the refrigerant vaporizes, it absorbs heat. Heat inside the cabinet is transferred (by convection) to the evaporator because the evaporator temperature is lower than the cabinet air temperature. Refrigerant exiting the evaporator should have completely vaporized so that only vapor is returned to the compressor through the suction line. However, under certain conditions some refrigerant may remain in liquid form as it exits the evaporator.

The mixture of refrigerant (vapor and liquid) is known as “refrigerant quality.” Refrigerant that has a higher ratio of vapor to liquid has a higher quality. Completely vaporized refrigerant has a quality rating of 100%. Refrigerant that is completely liquid has a quality rating of 0%. Refrigerant that is exiting the evaporator should have a quality rating of 100%. Refrigerant that is exiting the condenser should have a quality rating of 0%. Refrigerant quality is an important part of refrigeration system efficiency.

SINGLE-SPEED COMPRESSOR



HIGH PRESSURE VAPOR



LOW PRESSURE LIQUID



MIX OF LIQUID AND VAPOR



MIX OF LIQUID AND VAPOR



HIGH PRESSURE LIQUID

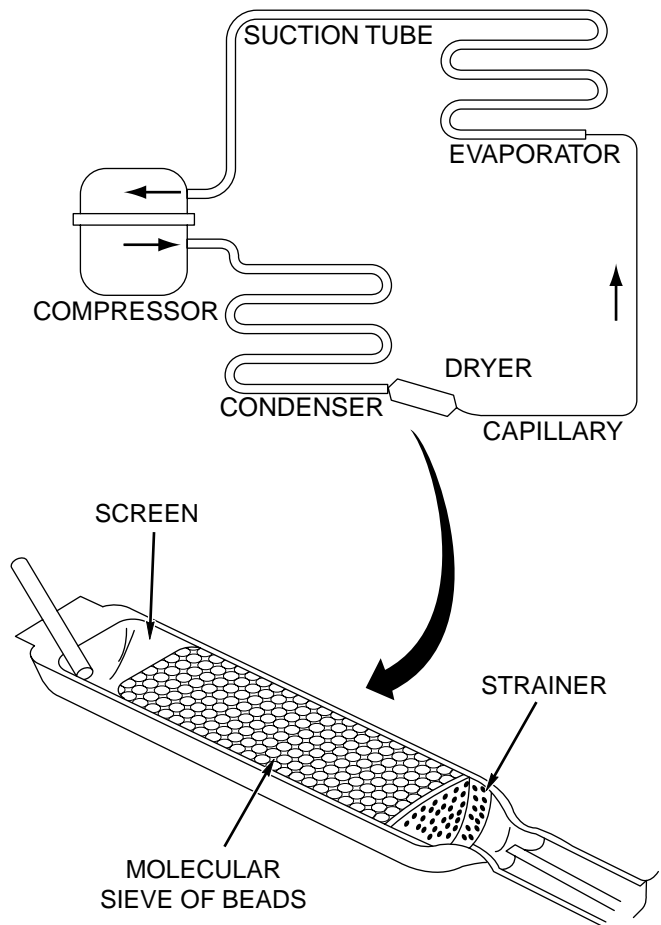


LOW PRESSURE VAPOR

GEA01261

Dryer

The refrigeration system must be free from dirt and moisture. A single particle of dirt, or one drop of water, can cause the system to fail. For this reason, a dryer is a necessary component of the refrigeration system. The dryer consists of a strainer at the inlet, a molecular sieve of beads, and a screen at the outlet. The beads have the ability to attract and absorb molecules of water but reject the molecules of refrigerant, oil, nitrogen, and most other substances. The strainer prevents the beads from spilling into the inlet. The fine mesh screen prevents particles (including crushed beads) from plugging the capillary tube. The dryer is normally located between the outlet of the condenser and the inlet of the capillary.

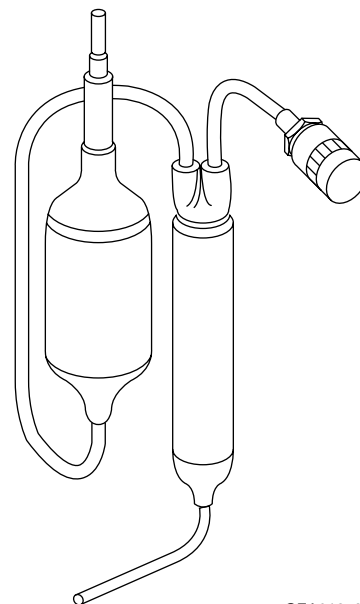


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Filter

A filter is provided in some refrigeration systems and furnished with some replacement compressors. The filter has the appearance of a large diameter dryer. It has a very fine mesh screen located at the outlet and a solid core, made of a special porous material, that is capable of chemically removing contaminants from the system. An arrow, stamped on the body of the filter, indicates the proper direction of flow.

A filter/dryer combination is furnished with replacement compressors for systems using R134a refrigerant. A new filter/dryer must be installed any time an R134a system is repaired. An additional 0.5 oz of refrigerant is required when a filter/dryer is added to the high side of the system.



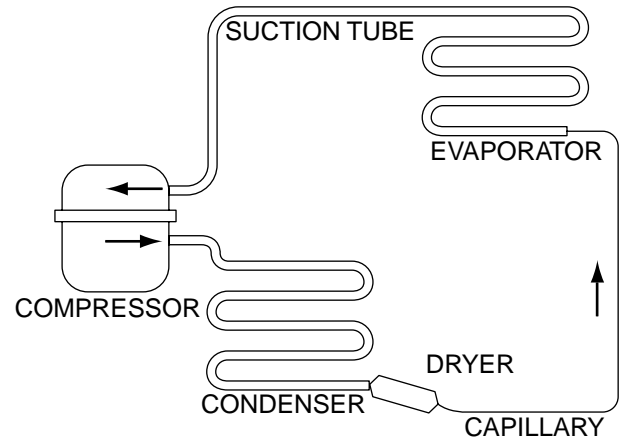
GEA01258

Capillary

The capillary is a very small diameter tube that is about 6 to 8 feet long. Its primary function is to control the flow of refrigerant into the evaporator. The flow rate of a capillary is determined by its diameter and is critical to the proper operation of the refrigeration system. If a capillary is shortened, the flow rate will increase. Likewise, if it is lengthened the flow rate will decrease. Therefore, when repairing a refrigeration system it is very important to cut the capillary as close as possible to the outlet of the dryer. The capillary is not replaceable separately.

Heat Exchanger

The function of the heat exchanger is to transfer heat from the warm liquid flowing through the capillary to the cool vapor flowing through the suction tube. The heat exchange occurs where the capillary is soldered to the outside of the suction tube. This arrangement improves the efficiency of the system. By reducing the heat of the capillary, the boiling point of the liquid entering the evaporator is lowered. Increasing the heat of the suction tube increases the density of the vapor entering the compressor and also helps to prevent the suction tube from sweating.



GEA01256

Refrigeration System

The refrigeration system has several new components as well as several familiar ones. New components include:

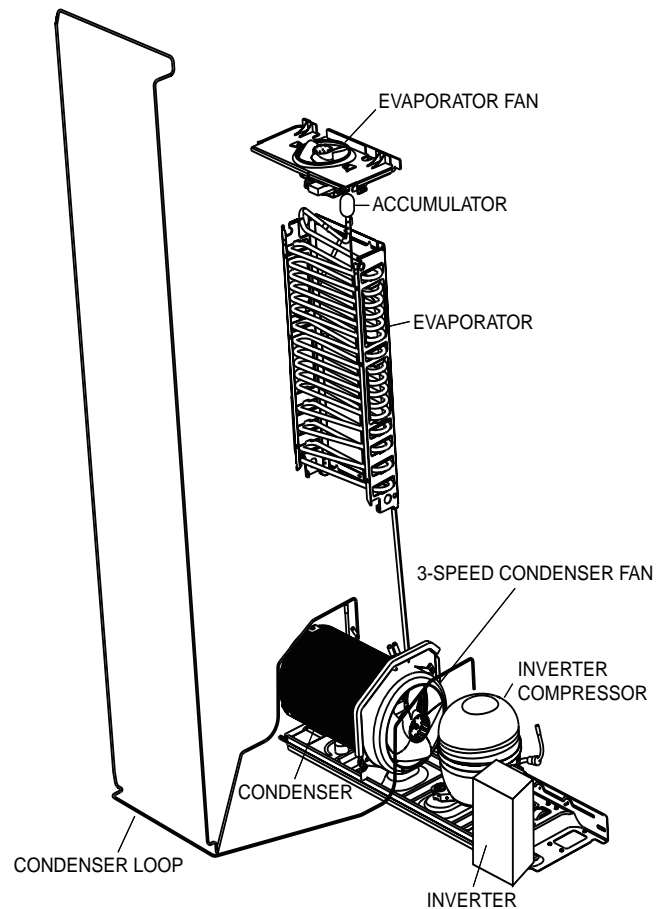
- Inverter compressor
- Inverter
- 3-speed condenser fan
- Accumulator at the outlet of the evaporator

Familiar components include:

- Condenser
- Condenser loop
- Dryer
- Evaporator
- Evaporator fan

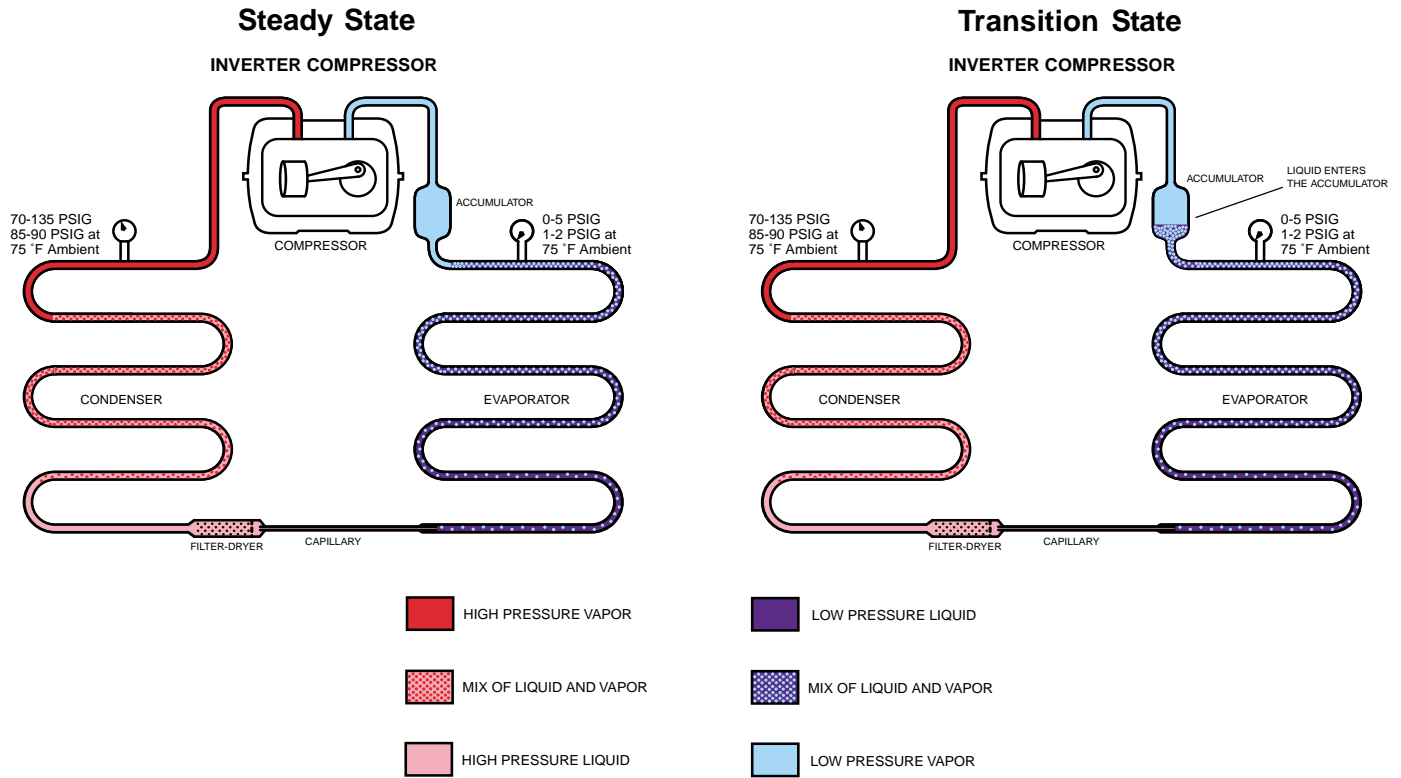
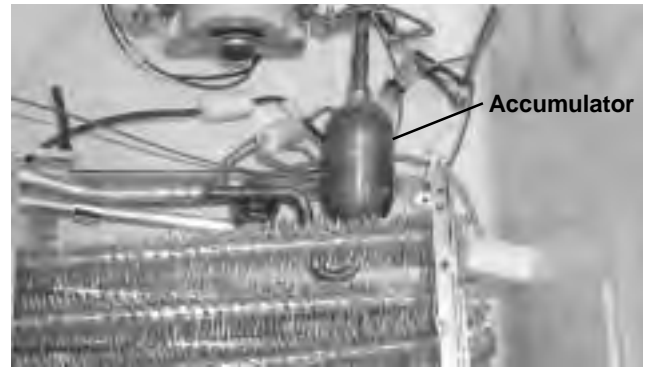
The refrigeration system operates with optimum efficiency and economy by changing the speed of the compressor (and condenser fan) to meet demand. During times of high usage, or in extremely warm ambient conditions, the 3-speed, inverter compressor will increase speed to meet greater refrigeration requirements. When usage is low, the compressor will operate at a slower speed, reducing its energy requirement.

In the new system with the inverter compressor, the flow of refrigerant through the components in the system is the same as previous models with the following exception: an accumulator has been added to the outlet side of the evaporator.



GEA01262

An accumulator has been installed at the outlet of the evaporator to prevent liquid refrigerant (low quality) from entering the suction line. Changes in compressor speed (transition state) can temporarily reduce refrigerant quality. The accumulator compensates for this by collecting and holding up to 2 oz of liquid while allowing vapor to pass. Within minutes after the compressor speed change, the system attains a steady state (becomes stabilized), the liquid refrigerant in the accumulator vaporizes, and refrigerant quality returns to normal.



GEA01263

System Pressure

The refrigeration system should maintain a consistent pressure regardless of compressor speed. Pressure variations, due to changing compressor speed, are minimized by matching the condenser fan speed and evaporator fan speed to the compressor speed. The condenser and evaporator fans will always operate at the same speed (low, medium, or high) as the compressor.

Low side system pressure should be between 0 and 5 psig dependant on ambient temperature. System pressures in an ambient temperature of 75 °F should be:

- **High Side – 85 to 90 psig**
- **Low Side – 1 to 2 psig**

Refrigerant Charge

The refrigerant used in the sealed system is R134a. Proper system charge is 6 oz; however, an additional 0.5 oz is required when adding a filter/dryer. Proper system charge is critical to the operation of this unit.

Inverter Compressor

The new inverter compressor is not controlled by 120 VAC output from the main control board, as in previous models. The compressor is controlled by the inverter.

Warning: Disconnecting the 6-pin connector does not disconnect power (120 VAC) from the inverter. The refrigerator must be unplugged before servicing the inverter or compressor.

Caution: Do not attempt to direct-start the compressor. The compressor operates on a 3-phase power supply. Applying 120 VAC to the compressor will permanently damage the unit. It is not possible to start the compressor without an inverter.

The compressor is a reciprocating, variable speed, 4-pole type. It operates on 3-phase, 80 to 230 VAC within a range of 57 to 104 Hz. Compressor speed is controlled by voltage frequency and pulse width modulation. Increasing frequency from the inverter will produce an increase in compressor speed.

- Frequency of 57 Hz will produce low speed operation at 1710 rpm.
- Frequency of 70 Hz will produce medium speed at 2100 rpm.
- Frequency of 104 Hz will produce 3120 rpm.

Note: Certain voltmeters will not be able to read voltage output or frequency from the inverter.

Compressor wattages at various speeds are:

- LOW - 65 watts
- MED - 100 watts
- HIGH - 150 watts

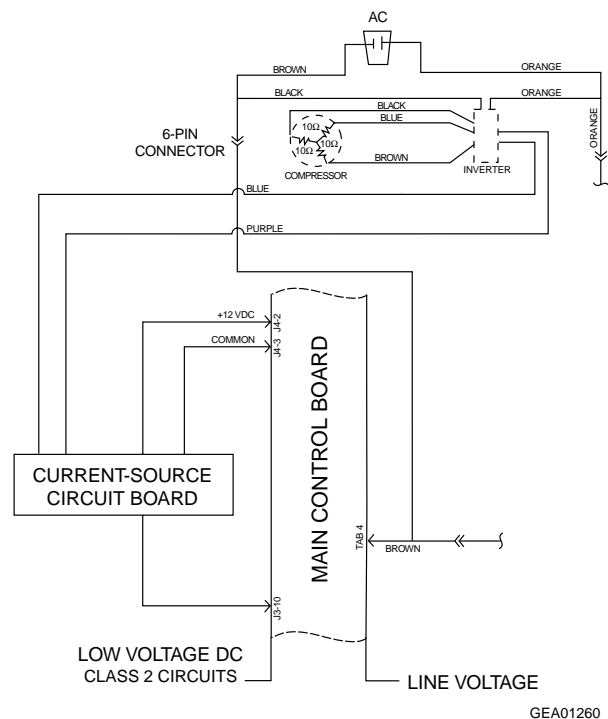
BTU rating also varies according to operating speed.

Compressor speed is based on the temperature setpoint in conjunction with the cabinet temperature. Speeds are selected according to the following cabinet temperatures:

- 8 °F to 19.5 °F above setpoint = high speed
- 3.5 °F to 7.5 °F above setpoint = medium speed
- 1 °F to 3 °F above setpoint = low speed

Note: The compressor will run at medium speed if the cabinet temperature is 20 °F or more above the setpoint.

The use of 3-phase power eliminates the need for the PTCR relay, capacitor, and individual start and run windings; therefore the start, run, and common pins found on conventional compressors are not applicable on this 3-phase model. Compressor pin functions are identical and compressor lead wire configuration is of no importance. A resistance of 9 to 11Ω should be read between any 2 of the 3 pins. Should an open occur in the compressor winding or should one of the compressor lead wires become open or disconnected, the inverter will stop voltage output to the compressor.



High compressor torque enables the compressor to start against high pressure in the sealed system. When power has been disconnected from an operating unit, the high torque will enable the compressor to start immediately upon power restoration.

Compressor and sealed system operation is extremely smooth and cool. The compressor exterior may be room temperature while operating; therefore a running unit may be difficult to detect.

To verify that the compressor is running:

Disconnect power from the unit and place a hand on the compressor. Reconnect power and feel for a vibration when the compressor tries to start. It may take up to 8 seconds before the compressor attempts to start.

To determine motor rpm:

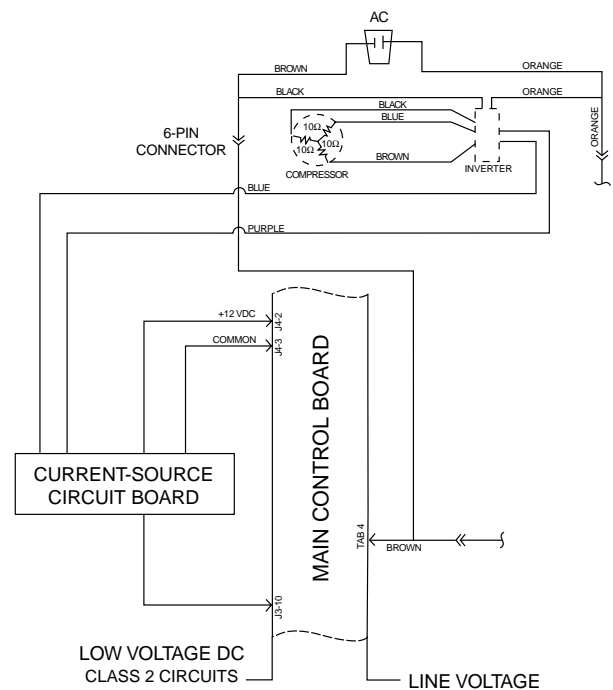
Measure the frequency of the voltage being applied to the compressor and multiply this number by 30. For example, a frequency measurement of 70 Hz would show a compressor speed of 2100 rpm (30 x 70 = 2100).

Note: If the compressor fails to start, the inverter will briefly stop voltage output. The inverter will make 12 consecutive attempts to start the compressor (once every 12 seconds). If, after 12 attempts, the compressor has not started, an 8-minute count will occur. After 8 minutes, the inverter will attempt to start the compressor again. If the compressor starts, normal operation will resume. If the compressor fails to start, the process will be repeated.

Removing power from the unit will reset the inverter count. When power is restored, the inverter will attempt to start the compressor within 8 seconds.

Note:

- When ordering a replacement compressor, order both the compressor and inverter. Replace the compressor first. If, after compressor installation, the compressor fails to start, replace the inverter.
- When servicing the compressor, it is important to dress the wiring to keep low voltage DC wiring and 120 VAC wiring separate.



GEA01260

Inverter

Warning: Disconnecting the 6-pin connector does not disconnect power (120 VAC) from the inverter. The refrigerator must be unplugged before servicing the inverter.

Note: Certain voltmeters will not be able to read voltage output from the inverter. If no voltage or erratic voltage is measured, it does not necessarily indicate a faulty inverter.

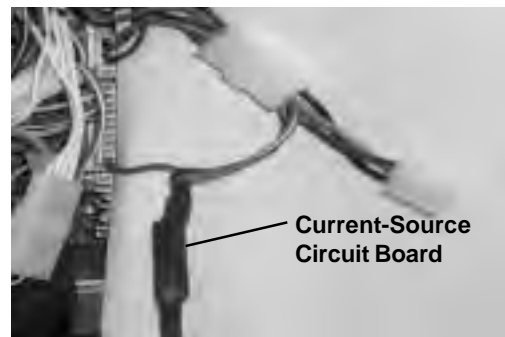
The inverter receives 120 VAC line-in from the power supply. The inverter converts this single-phase, 60 Hz, 120 VAC into 3-phase, 230 VAC, with frequency variations between 57 Hz and 104 Hz. This voltage is delivered to the compressor through 3 lead wires. Each wire will carry identical voltage and frequency. When checking inverter voltage output, connect the test-meter leads to any 2 of the 3 compressor lead wires. The same reading should be measured between any 2 of the 3 wires.

Note: The compressor leads must be connected to measure voltage output. If the compressor wires are not connected, or if an open occurs in one of the 3 lead wires or in the compressor, the inverter will stop voltage output.

The inverter controls compressor speed by frequency variation and by pulse width modulation (PWM). Changing frequency and PWM will cause an effective voltage between 80 and 230 VAC to be received at the compressor.

- Low speed (1710 rpm) - 57 Hz
- Medium speed (2100 rpm) - 70 Hz
- High Speed (3120 rpm) - 104 Hz

The inverter receives commands from the main control board. The main control board will send a (PWM) run signal between 1.5 and 3.5 VDC effective voltage to the inverter. In the circuit between the main control board and the inverter, a current-source circuit board is used to amplify the pulse width modulated voltage. The signal voltage at the inverter should be higher than the signal voltage sent by the main control board. The inverter will select compressor speed (voltage output) based on this signal. A signal voltage from the main control board (J3-10 to J2-3) lower than 1.5 VDC or greater than 3.5 VDC indicates a faulty main control board. The main control board will only send a run signal to the inverter when the compressor should be on.



Note: When measuring signal voltage (from the main control board) at the inverter, disconnect the wire harness connector at the inverter and measure the voltage at the connector.

The inverter will monitor compressor operation and if the compressor fails to start or excessive current draw (4 amps maximum) is detected, the inverter will briefly stop voltage output. The inverter will then make 12 consecutive compressor start attempts (once every 12 seconds). If after 12 attempts the compressor has not started, an 8-minute count will initiate. After the 8-minute count, the inverter will attempt to start the compressor again. If the compressor starts, normal operation will resume. If the compressor fails to start, this process will be repeated. Removing power to the unit will reset the inverter count. When power is restored, the inverter will attempt to start the compressor within 8 seconds.

The inverter has a built-in circuit protection to guard against damage from a failed or shorted compressor. However, if a failed compressor is diagnosed, order a new compressor and inverter. If the compressor fails to start after replacement, replace the inverter.

Note: When servicing the inverter, it is important to dress the wiring to keep low-voltage DC wiring and 120 VAC wiring separate.

To remove the inverter:

1. Unplug the unit.
2. Remove the rear access cover.
3. Remove the screw securing the water valve and position to access the inverter.
4. Remove 1 screw (1/4 in) securing the inverter. Slide the inverter forward to release the back tab from the machine compartment bottom.

Note: It may be necessary to bend the process tube in order to remove the inverter. If it is necessary to bend the process tube, use extreme care.

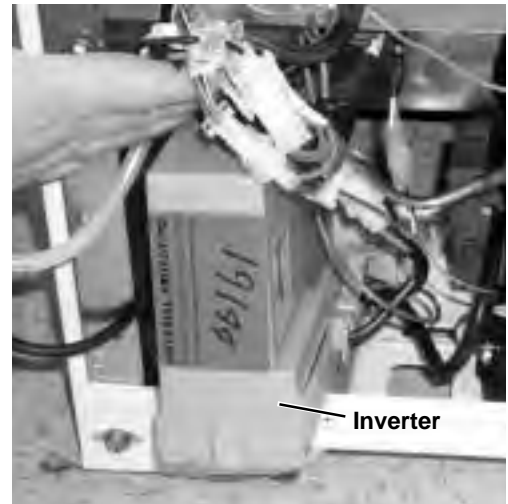
5. Turn the inverter horizontally and slide out of the machine compartment.

To remove the inverter cover:

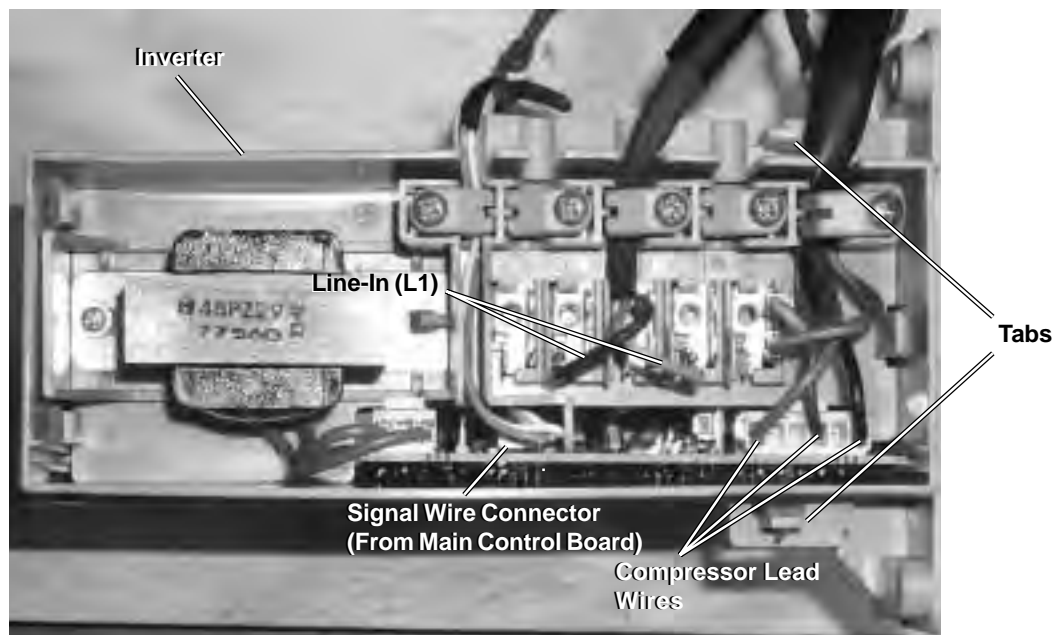
Use a small screwdriver to release the two small tabs and carefully remove the inverter cover.



Water Valve



Inverter



Adaptive Defrost

Adaptive Defrost

Adaptive Defrost can be described as a defrost system that adapts to a refrigerator's surrounding environment and household usage.

Unlike conventional defrost systems that use electromechanical timers with a fixed defrost cycle time, Adaptive Defrost utilizes an intelligent, electronic control to determine when the defrost cycle is necessary. In order to accomplish the correct defrost cycle time, the main control board monitors the following refrigerator operations:

- Length of time the refrigerator doors were open since the last defrost cycle
- Length of time the compressor has run since the last defrost cycle
- Amount of time the defrost heaters were on in the last defrost cycle

Adaptive Defrost is divided into 5 separate cycles. Those operations are:

- Cooling Operation
- Pre-Chill Operation
- Defrost Heater Operation
- Dwell Period
- Post Dwell

(See Pub. #31-9062 for more information on Adaptive Defrost.)

Adaptive Defrost (Cooling Operation)

During the cooling operation, the main control board monitors door opening (fresh food and freezer doors) and compressor run times. The length of time between consecutive defrosts is reduced by each door opening. If the doors are not opened, the compressor will run up to 60 hours between defrosts. If the doors are opened frequently and/or for long periods of time, the compressor run time between defrosts will be reduced to as little as 8 hours.

Adaptive Defrost (Pre-Chill Operation)

When the main control board determines that defrost is necessary, it will force the refrigerator into a continuous cool mode (pre-chill). During pre-chill, the freezer temperature may be driven below the set point. However, the fresh food temperature will be regulated by the damper. Pre-chill will continue until one of the following 3 conditions have been met.

- freezer temperature of -9 °F
- evaporator temperature of -25 °F
- 110 minutes of continuous run time with no door openings

The average pre-chill is complete within 30 to 40 minutes. This model does not have a defrost holdoff.

Adaptive Defrost (Defrost Heater Operation)

After pre-chill has concluded, the main control board turns off the compressor, condenser fan, and evaporator fan.

During defrost operation, the main control board monitors the evaporator temperature using evaporator thermistor inputs. Typically, the evaporator thermistor will sense a temperature of 70 °F within 20 to 30 minutes. When the thermistor senses 70 °F, the main control board will terminate defrost heater operation. Maximum defrost cycle (heater on) time is 40 minutes (main control board time out).

The defrost system is protected by a defrost termination thermostat (bimetal switch). The thermostat opens when the evaporator temperature raises to 140 °F and closes when the evaporator temperature lowers to 110 °F.

Adaptive Defrost (Dwell Period)

After defrost heater operation has been terminated by the main control board, a 5-minute dwell period occurs. During this period, the compressor, condenser fan, and evaporator fan remain off. The remaining frost melting from the evaporator will continue to drip and drain so that, prior to the cooling operation, the evaporator will be totally clear of any moisture. After the 5-minute dwell period, the unit goes into post dwell.

Adaptive Defrost (Post Dwell)

The post dwell period is designed to cool the evaporator before circulating air within the refrigerator. This prevents any residual heat on the evaporator from being distributed in the freezer. During this period, the compressor and the condenser fan are on, but all interior fans are off and the damper is closed. Post dwell will last 20 minutes or until the evaporator temperature reaches 0 °F on this model.

Normal Operating Characteristics That Are Different from Previous Models

- Compressor changes speed.
- Condenser fan changes speed.
- Fresh food fan changes speed.
- Compressor and fans can run continuously for more than 8 hours.

Abnormal Operating Characteristics (Incorrect Operation)

- Rapid fan speed changes. Fan takes at least 1 minute to change speeds.
- Compressor running without the condenser fan. The compressor and condenser fan should always run at the same time.

Liner Protection Mode

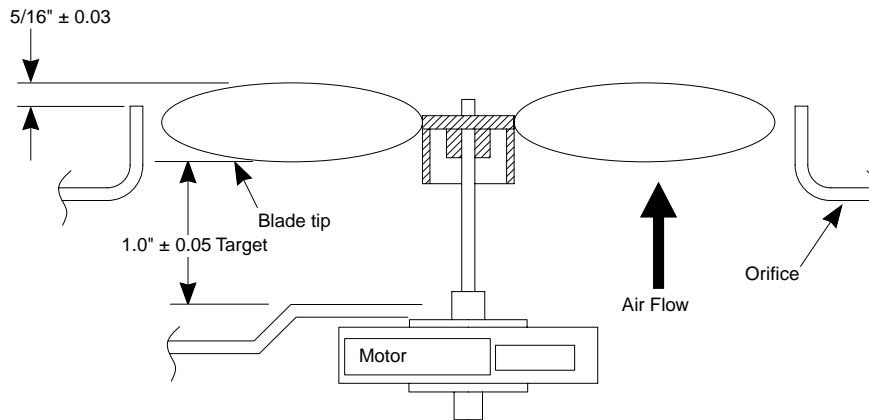
The liner protection mode will activate if either of the doors has been open for 3 minutes. This mode will start the evaporator fan on high speed.

This mode is controlled by 2 timers. Timer #1 monitors door-open time. A 3-minute door-open count begins when the door is opened. If 3 minutes elapse before the door is closed, the liner protection mode will become active. Once the door is closed, timer #1 resets and liner protection mode goes into standby. In standby, normal fan and damper operations resume and timer #2 begins a 3-minute door-closed count. If 3 minutes elapse without a door opening, liner protection mode will completely deactivate. If a door is opened within the timer #2 door-closed count, the remaining time in the door-closed count will be deducted from the timer #1 door-open count.

Fans

Evaporator Fan

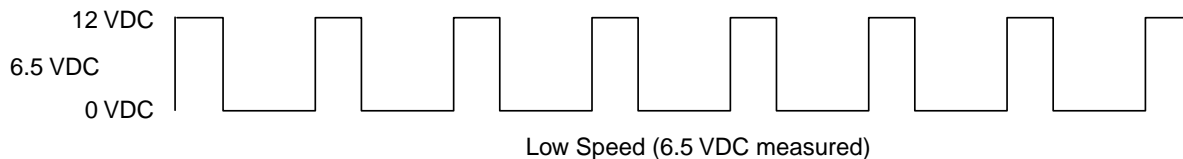
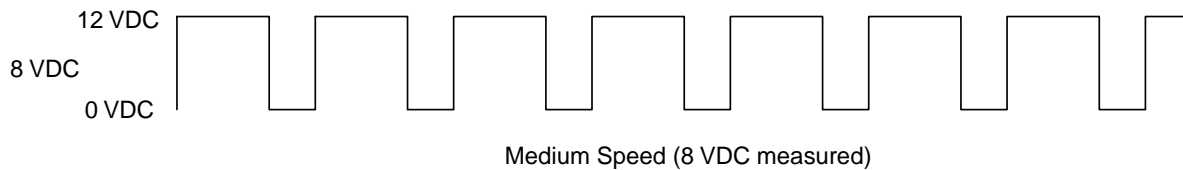
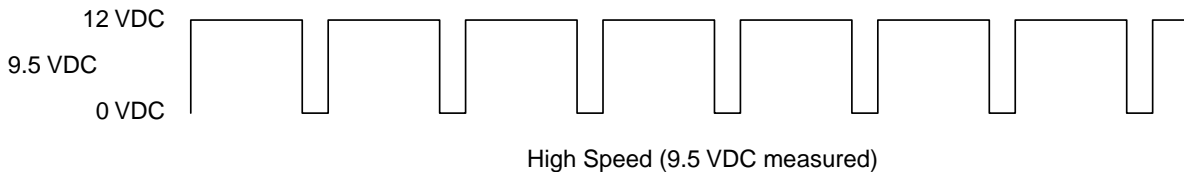
The position of the fan blade in relation to the shroud is important. Refer to illustration for specifications.



GEA01149

The evaporator fan is the same fan used on previous models; however a significant difference is that the main control board does not require, nor receive, input from the fan feedback/rpm (blue) wire. The fan utilizes a permanent magnet, 4-pole, DC motor that operates at three different speeds: high, medium, and low. The speed of the fan is controlled by the voltage output from the main control board. Voltage output from the control board to the fan is 13.2 VDC; however to regulate the speed of the fan, the main control board uses pulse width modulation (PWM). When operating, voltage is sent in pulses (much like a duty cycle) as opposed to an uninterrupted flow. This pulsing of 13.2 VDC produces effective voltage being received at the motor, which is the equivalent to a reduction in voltage. Fan speed will be selected and maintained by the main control board regulating the length and frequency of the 13.2 VDC pulse.

One complete revolution of the motor is comprised of all 4 poles. To determine the rpm of the fan, do the following: Measure the frequency being applied to the motor. Multiply this number by 15 (60 seconds divided by 4 poles). For example, a frequency measurement of 200 Hz multiplied by 15 would show a fan speed of 3000 rpm ($15 \times 200 = 3000$). Temperature may cause some fan speed variation. Fan speed may vary $\pm 5\%$, depending on the temperature, with higher temperatures causing slightly higher speeds.



The evaporator fan has a 4-wire connection:

White Wire (DC Common)

The white wire is the DC common wire used for testing. During repairs, DC polarity must be observed. Reversing the DC polarity will cause a shorted motor and/or board.

Red Wire (Supply)

Each motor uses an internal electronic controller to operate the motor. Supply voltage from the main control board remains at a constant 12 VDC.

Blue Wire (Feedback/RPM)

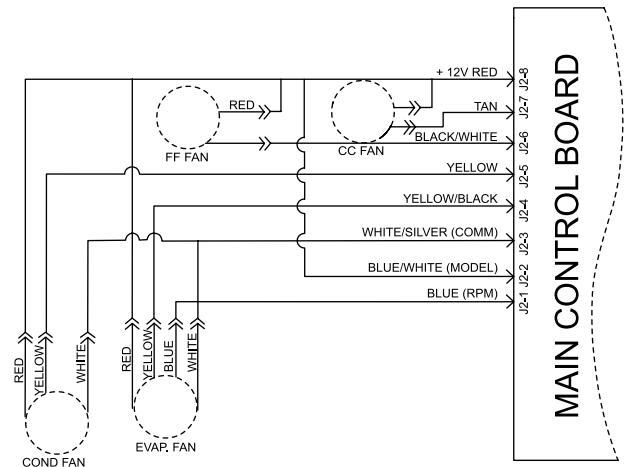
On previous Arctica models, the blue wire reported rpm (speed) information to the main control board for speed control purposes. On this model, the board does not require nor read any feedback information from the fan motor.

Yellow Wire (Signal)

The yellow wire is the input wire from the main control board. The main control board provides 6.5 VDC effective voltage for low speed, 8 VDC effective voltage for medium speed, and 9.5 VDC for high speed. The fan will operate in low speed only when the fresh food thermistor is satisfied.

Note: When testing these motors:

- You cannot test with an ohmmeter.
- DC common is not AC common.
- Verify 2 voltage potentials:
 - a. Red to white - power for internal controller
 - b. Yellow to white - power for fan
- Observe circuit polarity.
- Motors can be run for short periods using a 9-volt battery. Connect the white wire to the negative (-) battery terminal only. Connect the red and yellow wires to the positive (+) battery terminal.



Condenser Fan

The fan is mounted in the machine compartment with the No-Clean condenser. The fan and fan shroud are mounted on one end of the condenser, and the other end of the condenser is blocked. When the fan is operating, air is pulled from the center of the condenser, drawing air in through the coils. The air is then exhausted over the compressor and out the right side of the refrigerator.

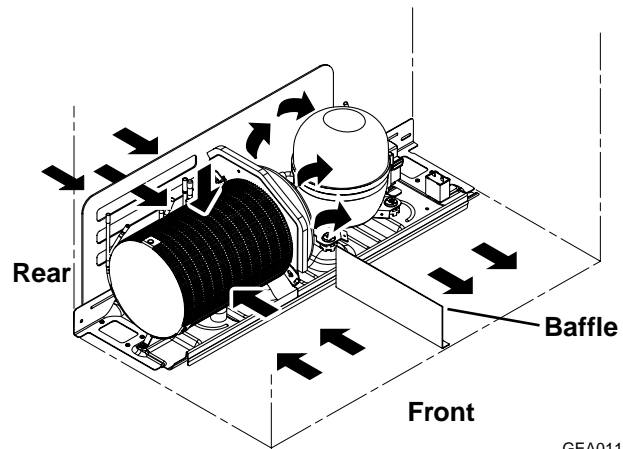
Inlet air is available through the left front and left rear of the machine compartment. A rubber divider strip underneath the refrigerator divides the inlet and outlet sides of the machine compartment.

The rear access cover must be tightly fitted to prevent air from being exhausted directly out of the rear of the machine compartment, bypassing the compressor.

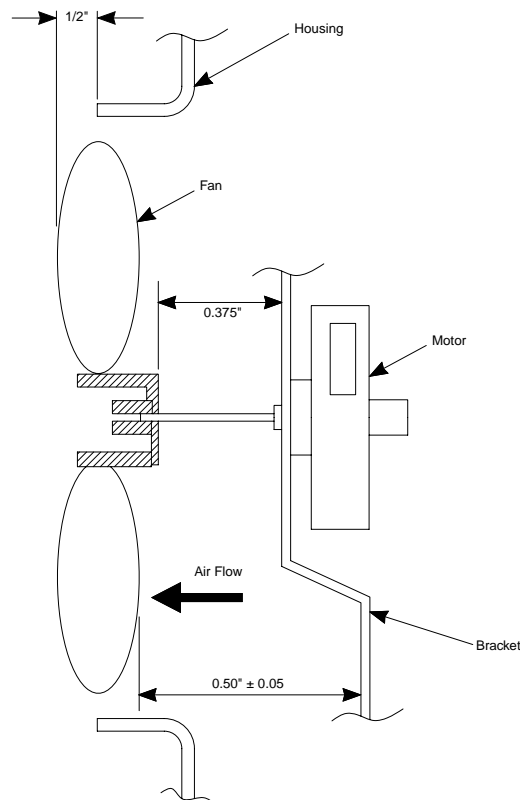
The condenser fan is mounted with screws to a fan shroud and mounting bracket that is attached to the condenser.

Refer to the illustration for fan blade adjustment.

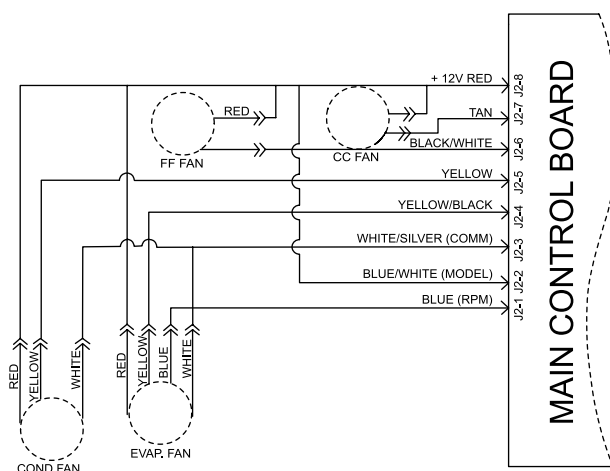
The condenser fan is the same permanent-magnet, 4-pole, DC motor used in previous Arctica models; however a significant difference is that the fan will operate at 3 speeds. Fan speed (low, medium, high) corresponds with compressor speed to minimize pressure variations in the sealed system. The speed of the fan is controlled by the voltage output from the main control board. Voltage output from the control board to the fan is 13.2 VDC; however to regulate the speed of the fan, the main control board uses pulse width modulation (PWM). When operating, voltage is sent in pulses (much like a duty cycle) as opposed to an uninterrupted flow. This pulsing of 13.2 VDC produces effective voltage being received at the motor, which is the equivalent to a reduction in voltage. Fan speed will be selected and maintained by the main control board regulating the length and frequency of the 13.2 VDC pulse.



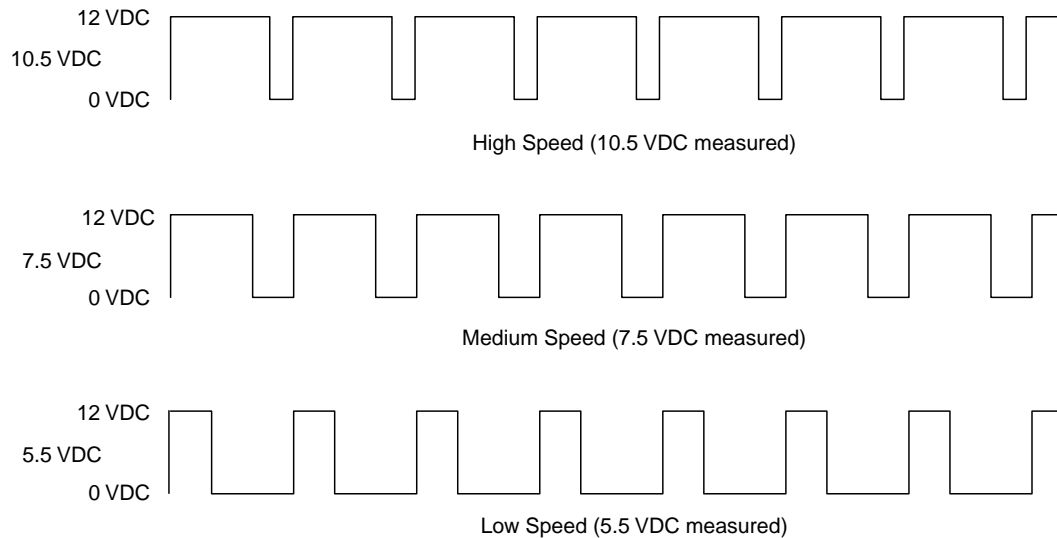
GEA01152



GEA01148



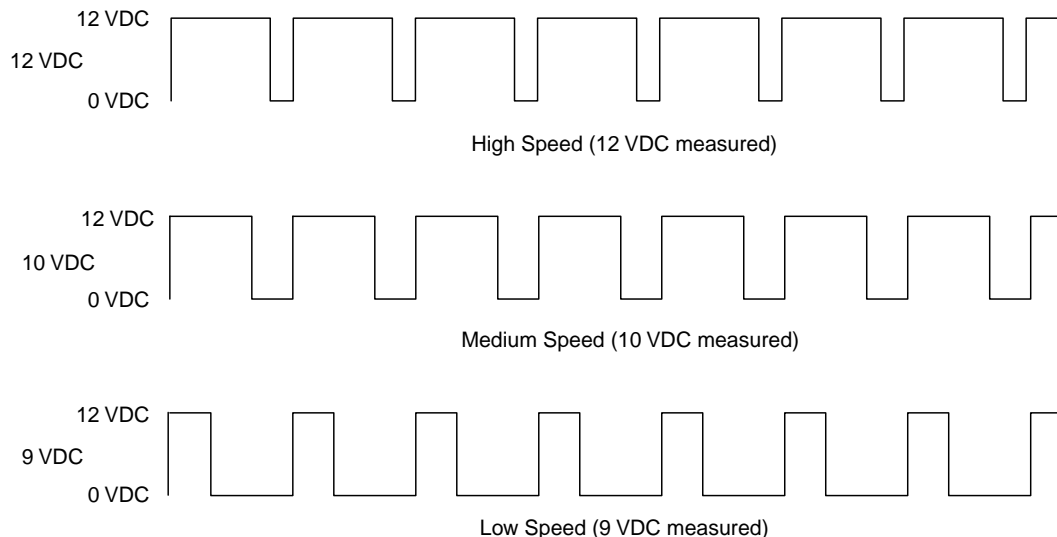
One complete revolution of the motor is comprised of all 4 poles. To determine the rpm of the fan, do the following: Measure the frequency being applied to the motor. Multiply this number by 15 (60 seconds divided by 4 poles). For example, a frequency measurement of 200 Hz multiplied by 15 would show a fan speed of 3000 rpm ($15 \times 200 = 3000$). Temperature may cause some fan speed variation. Fan speed may vary +/- 5%, depending on the temperature, with higher temperatures causing slightly higher speeds. Condenser fan speed is controlled by the same method (Pulse Width Modulation) used to control evaporator fan speed. The condenser fan and evaporator fan will usually operate at the same speed. No rpm/feedback wire is used for the condenser fan.



Fresh Food Fan

A variable speed fresh food fan is located in the top of the fresh food section. When activated, the fresh food fan will draw cool air from the freezer compartment into the fresh food compartment, providing cooling independent of evaporator fan operation.

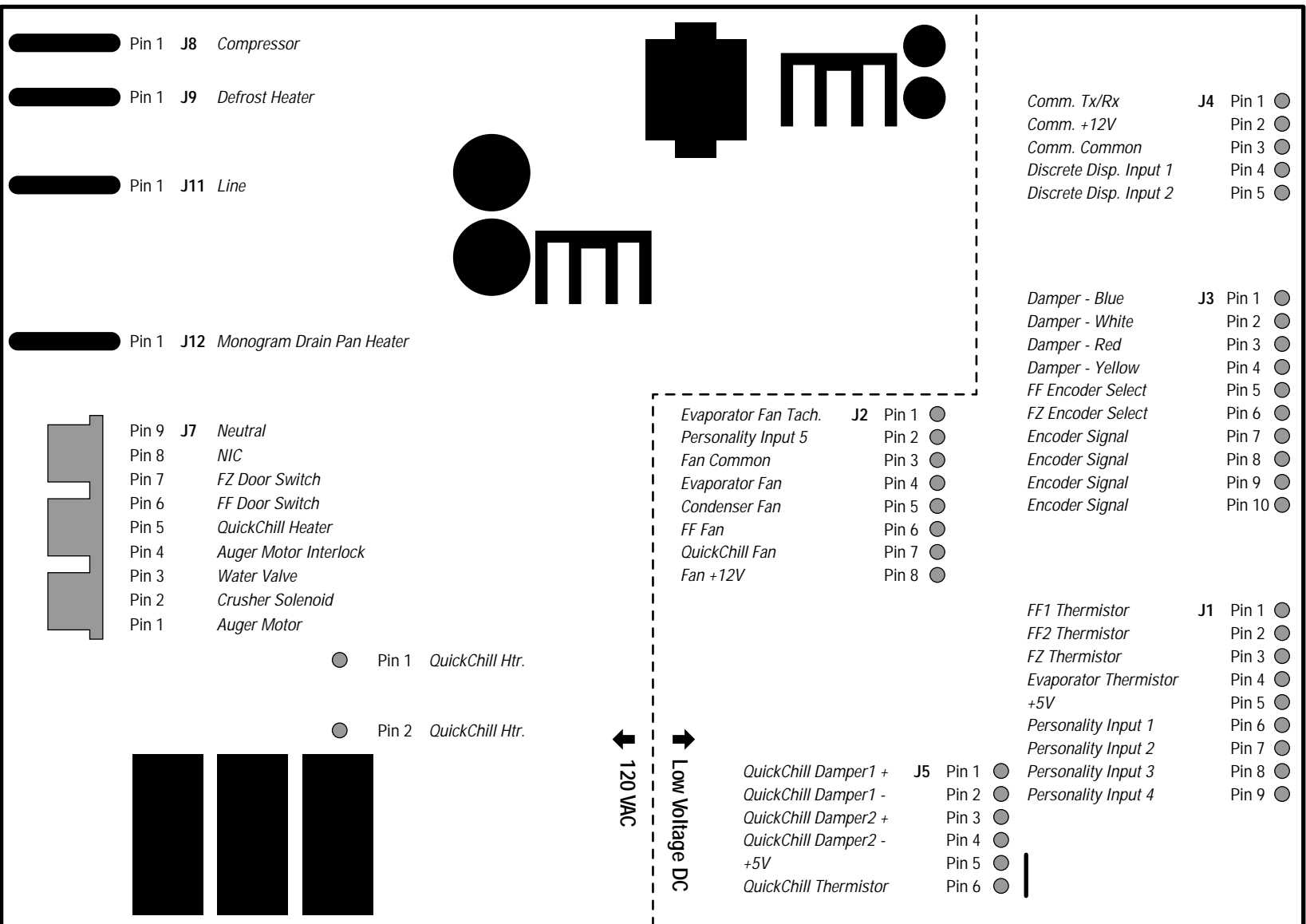
The main control board gathers information from the fresh food thermistors to determine when, and at what speed, fan operation should occur. A constant 12 VDC is provided to the fan from the main control board and switching occurs on the neutral side. Speed is regulated by Pulse Width Modulation on the common side of the fan. When operating, the common side of the circuit is pulsed open and closed. This pulsing produces effective voltage being received at the motor, which is the equivalent to a reduction in voltage. Fan speed will be selected and maintained by the main control board regulating the length and frequency of the 12 VDC pulse.



Main Control Board

The main control board is located at the back of the refrigerator, above the machine compartment on the right-hand side.

It controls all refrigerator operations except the fresh food lights, freezer lights, and icemaker.



CONTROL BOARD PIN DEFINITIONS				
CONNECTOR	PIN	INPUT	OUTPUT	FUNCTION
J1	1	VDC		Feedback of fresh food thermistor value. Thermistor is NTC, when temperature drops, resistance value increases, causing return voltage reduction. This value is used to cycle fresh food fan (when used), evaporator fan, compressor, and condensor fan. Feedback is filtered to respond to 8 degrees of change per minute.
J1	2	VDC		Feedback of second fresh food thermistor value (when used). Thermistor is NTC, when temperature drops, resistance value increases, causing return voltage reduction. This value is used to cycle fresh food fan (when used), evaporator fan, compressor, and condensor fan. Feedback is filtered to respond to 8 degrees of change per minute.
J1	3	VDC		Feedback of freezer thermistor value. Thermistor is NTC, when temperature drops, resistance value increases, causing return voltage reduction. This value is used to cycle evaporator fan, compressor, and condensor fan, and will not cycle fresh food fan (when used). Feedback is filtered to respond to 8 degrees of change per minute.
J1	4	VDC		Feedback of evaporator thermistor value. Thermistor is NTC, when temperature drops, resistance value increases, causing return voltage reduction. This thermistor value is used to cycle the heater on during defrost when temperature is below defrost value and off when the temperature is above defrost value. This value is also read during power-up to determine if refrigerator goes into pulldown mode or cycle continuation. Feedback is unfiltered, responds immediately.
J1	5		VDC	Provides 5 VDC for thermistors and personality pins on J1.
J1	6	VDC		Selection pin that, when connected in combination with other personality pins, determines model and programming used. Reads combination on power-up only.
J1	8	VDC		Selection pin that, when connected in combination with other personality pins, determines model and programming used. Reads combination on power-up only.
J1	9	VDC		Selection pin that, when connected in combination with other personality pins, determines model and programming used. Reads combination on power-up only.

CONTROL BOARD PIN DEFINITIONS				
CONNECTOR	PIN	INPUT	OUTPUT	FUNCTION
J2	1	Hz		Feedback from evaporator fan. Evaporator fan feedback is not read for this application.
J2	2		VDC	Model selection pin.
J2	3		VDC	Evaporator fan and condenser fan common - VDC ground.
J2	4		VDC	Output to evaporator fan for motor operation. Effective voltage is determined by PWM.
J2	5		VDC	Output to condensor fan for motor operation. Effective voltage is determined by PWM.
J2	6		VDC	Common to fresh food fan for motor operation. Switched for PWM fan speed control. Effective voltage is determined by PWM.
J2	7		VDC	Switched commom to QuickChill (Custom Cool) fan.
J2	8		VDC	Provides 12-VDC supply voltage to all fans, constant voltage.

CONTROL BOARD PIN DEFINITIONS				
CONNECTOR	PIN	INPUT	OUTPUT	FUNCTION
J3	1		VDC	Damper stepper motor.
J3	2		VDC	Damper stepper motor.
J3	3		VDC	Damper stepper motor.
J3	4		VDC	Damper stepper motor.
J3	10		VDC	Inverter for compressor speed control. As voltage increases, compressor speed decreases.

CONTROL BOARD PIN DEFINITIONS				
CONNECTOR	PIN	INPUT	OUTPUT	FUNCTION
J4	1	Digital Communication	Digital Communication	2-way digital communication between main control board and door dispenser display board, temperature control (board), and QuickChill (Custom Cool) temperature control (board).
J4	2		VDC	12 VDC supply.
J4	3		VDC	DC common.

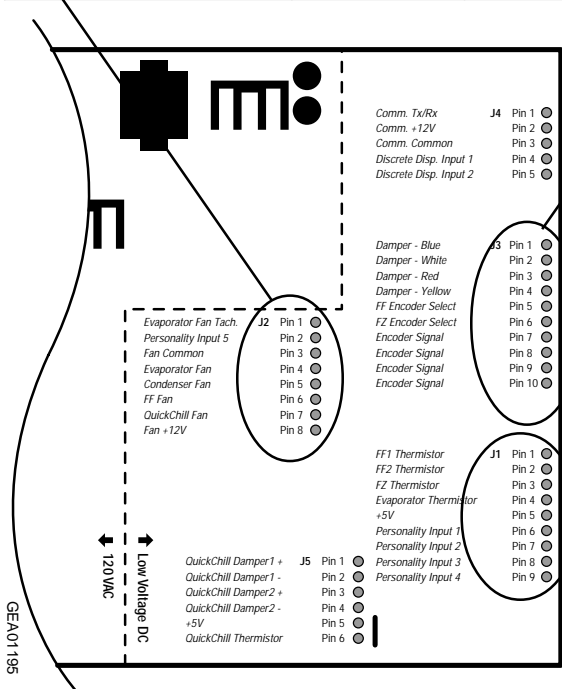
CONTROL BOARD PIN DEFINITIONS				
CONNECTOR	PIN	INPUT	OUTPUT	FUNCTION
J5	1			QuickChill (Custom Cool) damper.
J5	2			QuickChill (Custom Cool) damper.
J5	3			QuickChill (Custom Cool) damper.
J5	4			QuickChill (Custom Cool) damper.
J5	5		VDC	Provides 5 VDC for QuickChill (Custom Cool) thermistor.
J5	6	VDC		Feedback of QuickChill (Custom Cool) thermistor. Thermistor is NTC, when temperature drops, resistance value increases, causing a reduction in return voltage.

CONTROL BOARD PIN DEFINITIONS				
CONNECTOR	PIN	INPUT	OUTPUT	FUNCTION
J7	1		VAC	Switched L1 voltage to the auger motor - 120 VAC.
J7	2		VAC	Switched L1 voltage to the crusher solenoid - 120 VAC.
J7	3		VAC	Switched L1 voltage to the water valve - 120 VAC.
J7	4	VAC		Receives L1 input from freezer door switch when freezer door is closed.
J7	5		VAC	Switched L1 voltage to the Quick Chill (Custom Cool) heater - 120 VAC.
J7	6	VAC		Receives L1 input from fresh food door switch when door is open. This input is used for evaporator fan control, liner protection mode calculations, door alarm calculations, and adaptive defrost calculations.
J7	7	VAC		Receives L1 input from freezer door switch when door is open. This input is used for evaporator fan control, liner protection mode calculations, adaptive defrost calculations, door alarm calculations, and some door interlock functions. Switch must be closed in door closed position (switch depressed) for dispenser light and duct door magnet to energize.
J7	9	VAC		AC neutral in.

CONTROL BOARD PIN DEFINITIONS				
CONNECTOR	PIN	INPUT	OUTPUT	FUNCTION
J9 (Tab 2)	1		VAC	Switched L1 voltage to the defrost circuit - 120 VAC. A timer counts how long this circuit is energized and uses this information to determine if the next defrost cycle is adaptive or nonadaptive.

CONTROL BOARD PIN DEFINITIONS				
CONNECTOR	PIN	INPUT	OUTPUT	FUNCTION
J11 (Tab 4)	1	VAC		Constant L1 voltage to control board circuits - 120 VAC input potential for switched L1 terminals.

Main Control Board J2 Connector (Low-Voltage DC Side)				
Pin	Wire Color	Component Termination	Input/Output	Pin-to-Pin Voltage Reading
1	Blue	Evaporator fan tachometer	Input	Not applicable to this model.
2	Blue/White	Model	Input	J2 pin 2 to pin 3 = 12 VDC
3	White/Silver	Fan common	Common	J2 pin 8 to pin 3 = 12 VDC
4	Yellow/Black	Evaporator fan	Output	J2 pin 4 to pin 3 = 9.5 VDC (high), 8 VDC (med), 6.5 VDC (low)
5	Yellow	Condenser fan	Output	J2 pin 5 to pin 3 = 10.5 VDC (high), 7.5 VDC (med), 5.5 VDC (low)
6	Black/White	Fresh food fan	Common	J2 pin 8 to pin 6 = 12 VDC (high), 10 VDC (med), 9 VDC (low)
7	Tan	Custom Cool fan	Common	J2 pin 7 to pin 8 = 12 VDC
8	Red	Fan supply voltage (12 VDC)	Output	J2 pin 8 to pin 3 = 12 VDC

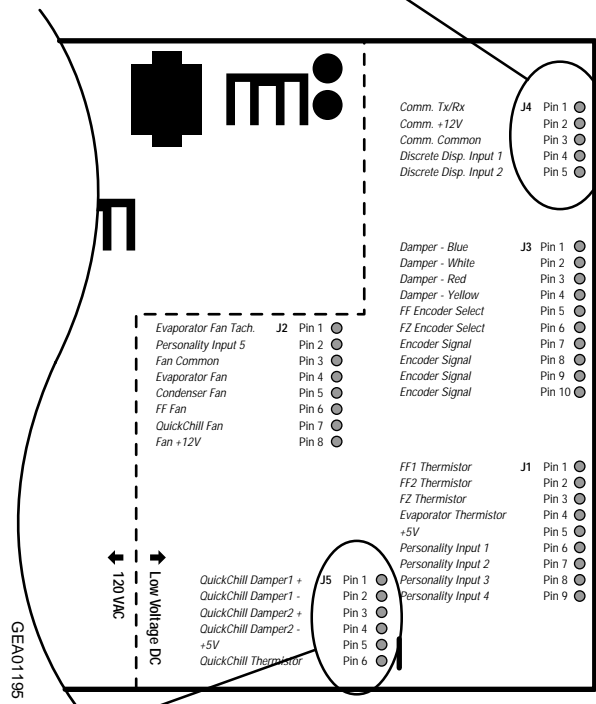


Main Control Board J3 Connector (Low-Voltage DC Side)				
Pin	Wire Color	Component Termination	Input/Output	Pin-to-Pin Voltage Reading
1	Yellow	Damper Stepper Motor		J3 pin 1 to J4 pin 3 = Standing Voltage - less than 1.3 VDC Traveling Voltage - approx. 6.5 VDC
2	Red/Black	Damper Stepper Motor		J3 pin 2 to J4 pin 3 = Standing Voltage - less than 1.3 VDC Traveling Voltage - approx. 6.5 VDC
3	White/Brown	Damper Stepper Motor		J3 pin 3 to J4 pin 3 = Standing Voltage - less than 1.3 VDC Traveling Voltage - approx. 6.5 VDC
4	Blue/Yellow	Damper Stepper Motor		J3 pin 4 to J4 pin 3 = Standing Voltage - less than 1.3 VDC Traveling Voltage - approx. 6.5 VDC
10	Blue/Green	Inverter	Output	J3 pin 10 to J2 pin 3 = 1.5 to 3.5 VDC

Main Control Board J1 Connector (Low-Voltage DC Side)				
Pin	Wire Color	Component Termination	Input/Output	Pin-to-Pin Voltage Reading
1	Blue/Red	Fresh food thermistor 1	Input	N/A
2	Yellow	Fresh food thermistor 2	Input	N/A
3	Red/White	Freezer thermistor	Input	N/A
4	Blue/White	Evaporator thermistor	Input	N/A
5	Blue	Thermistor supply voltage (5 VDC)	Output	J1 pin 5 to J2 pin 3 = 5 VDC
6	Blue	Personality pin	Input	J1 pin 6 to J2 pin 3 = 5 VDC
8	Blue	Personality pin	Input	J1 pin 8 to J2 pin 3 = 5 VDC
9	Blue	Personality pin	Input	J1 pin 9 to J2 pin 3 = 5 VDC

Main Control Board J4 Connector (Low-Voltage DC Side)

Pin	Wire Color	Component Termination	Input/Output	Pin-to-Pin Voltage Reading
1	Black	Temperature control	Communication	2-way digital communication.
2	Red	Temperature control	Output	J4 pin 2 to pin 3 = 12 VDC
3	Blue	Temperature control	Common	J4 pin 2 to pin 3 = 12 VDC

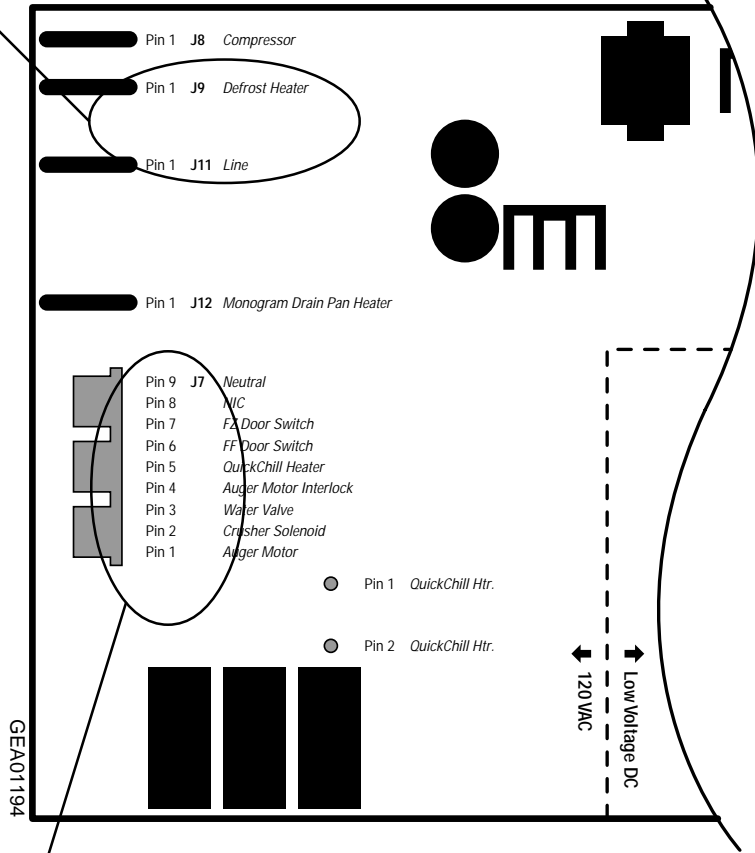


Main Control Board J5 Connector (Low-Voltage DC Side)

Pin	Wire Color	Component Termination	Input/Output	Pin-to-Pin Voltage Reading
1	Pink	QuickChill (Custom Cool) Damper	Input/Output	J5 pin 1 to pin 2 = 12 VDC (reversing polarity)
2	Yellow	QuickChill (Custom Cool) Damper	Input/Output	J5 pin 2 to pin 1 = 12 VDC (reversing polarity)
3	Brown	QuickChill (Custom Cool) Damper	Input/Output	J5 pin 3 to pin 4 = 12 VDC (reversing polarity)
4	Yellow/Black	QuickChill (Custom Cool) Damper	Input/Output	J5 pin 4 to pin 3 = 12 VDC (reversing polarity)
5		Supply Voltage (5 VDC)	Output	J5 pin 10 to J2 pin 3 = 5 VDC
6		QuickChill (Custom Cool) Thermistor	Input	N/A

Main Control Board J9, J11, Connectors (High-Voltage Side)

Pin	Wire Color	Component Termination	Input/Output	Pin to Pin Voltage Reading
J9 (Tab 2)	Blue	Defrost Heater	Output	J9 to J7 pin 9 = 120 VAC
J11 (Tab 4)	Brown	Icemaker	Input	J11 to J7 pin 9 = 120 VAC

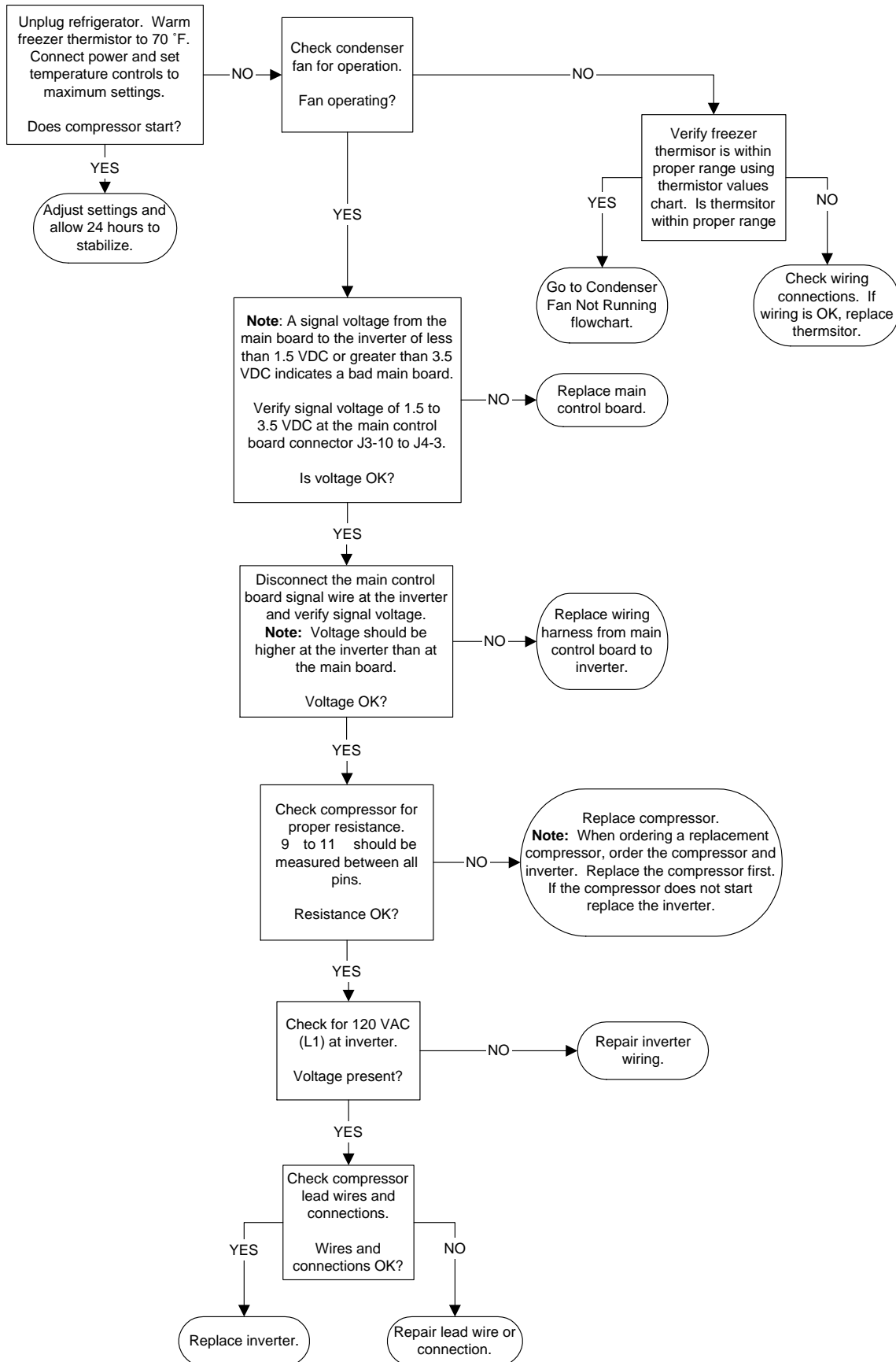


Main Control Board J7 Connector (120 VAC Side)

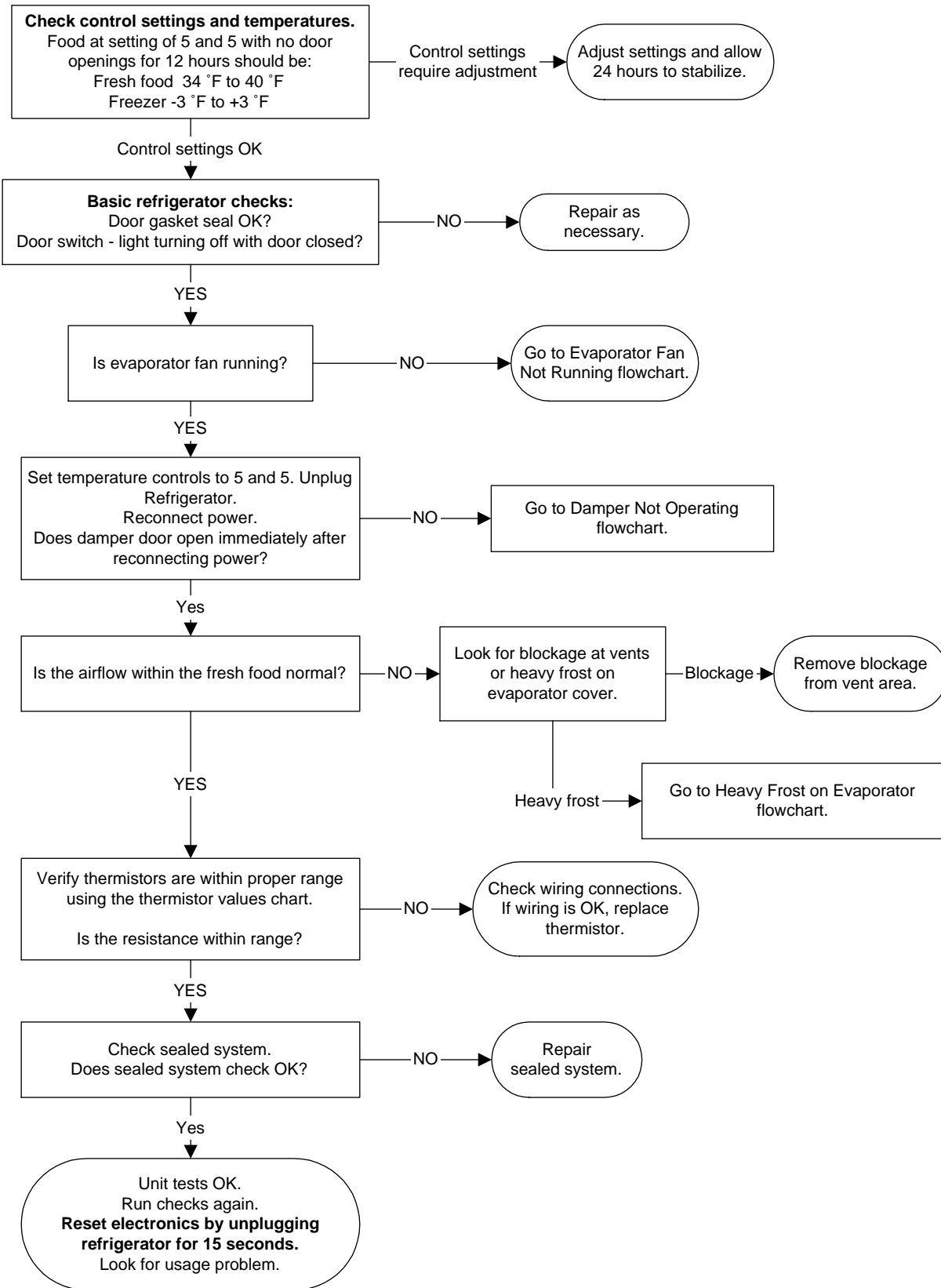
Pin	Wire Color	Component Termination	Input/Output	Pin-to-Pin Voltage Reading
1	Beige	Auger	Output	J7 pin 1 to J7 pin 9 = 120 VAC
2	Silver	Cube Soleniod	Output	J7 pin 2 to J7 pin 9 = 120 VAC
3	Yellow	Water Valve	Output	J7 pin 3 to J7 pin 9 = 120 VAC
4	Red/White	FZ Door Switch	Input	J7 pin 4 to J7 pin 9 = 120 VAC (FZ door closed)
5	Blue/White	Quick Chill	Output	J7 pin 5 to J7 pin 9 = 120 VAC
6	Purple	FF door light switch	Input	J7 pin 6 to J7 pin 9 = 120 VAC (FF door open)
7	Red	Freezer door light switch	Input	J7 pin 7 to J7 pin 9 = 120 VAC (FZ door open)
9	Orange	Neutral	Neutral	Neutral

Diagnosics

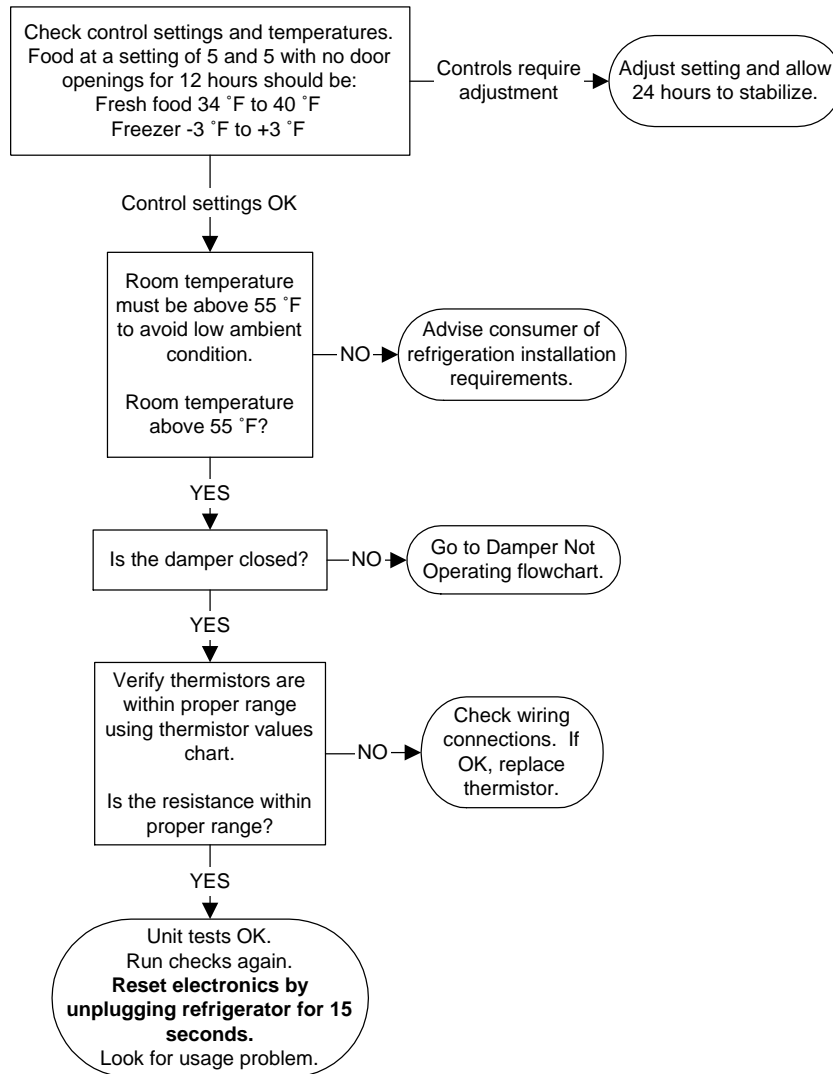
Compressor Not Running



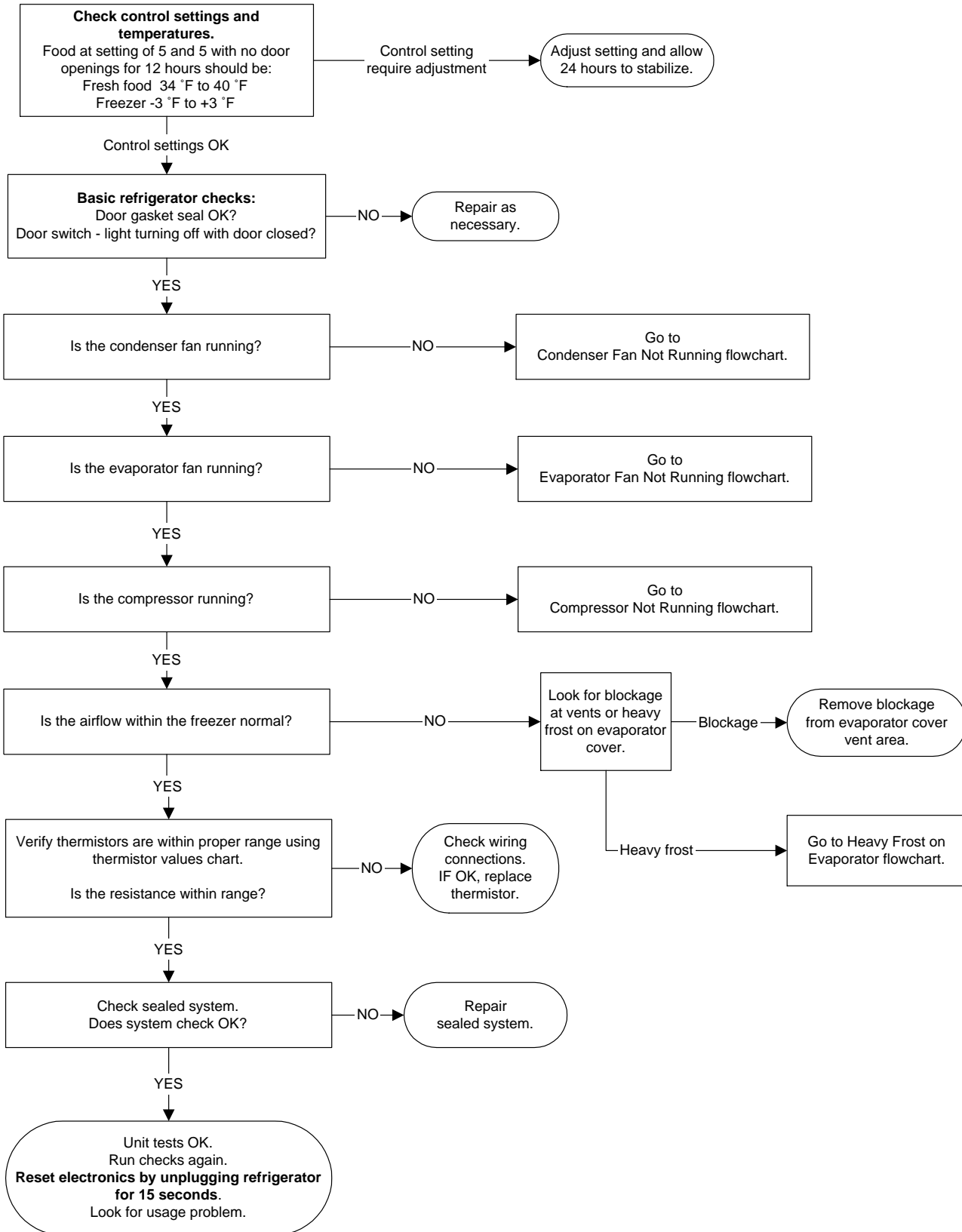
Fresh Food Warm - Freezer Normal



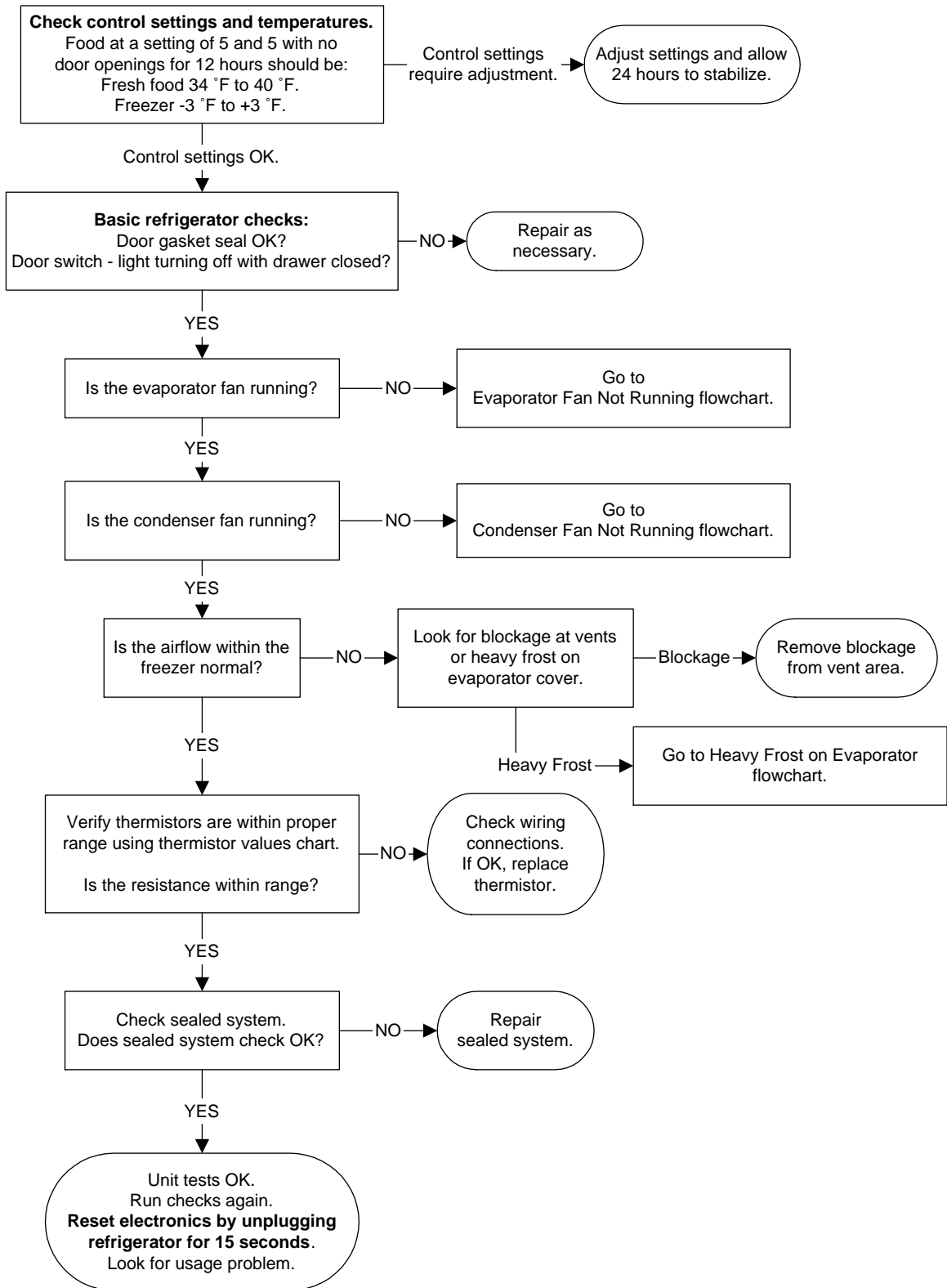
Fresh Food Too Cold - Freezer Normal



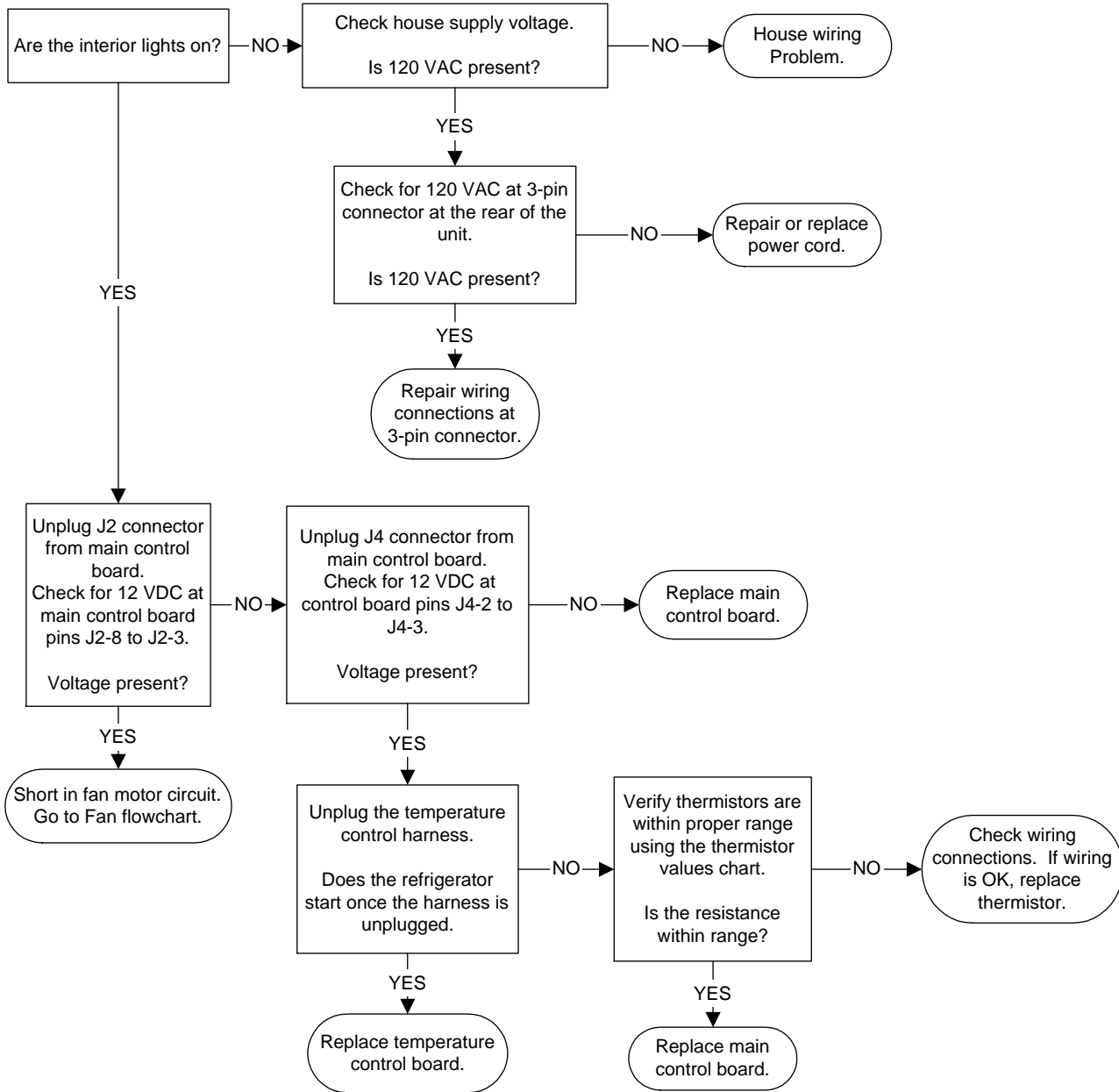
Fresh Food Warm - Freezer Warm



Freezer Warm - Fresh Food Normal

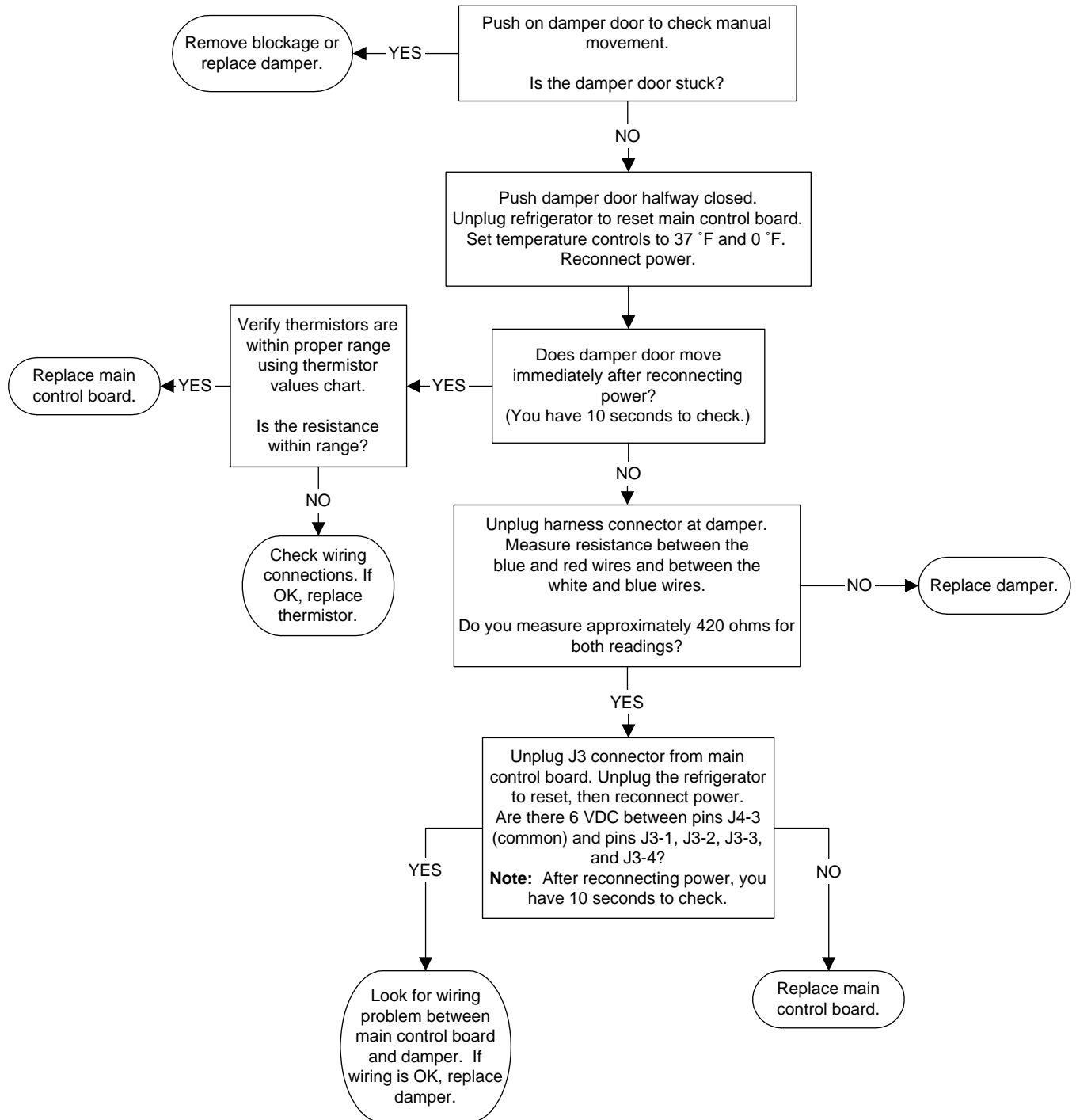


Refrigerator Dead - No Sound, No Cooling

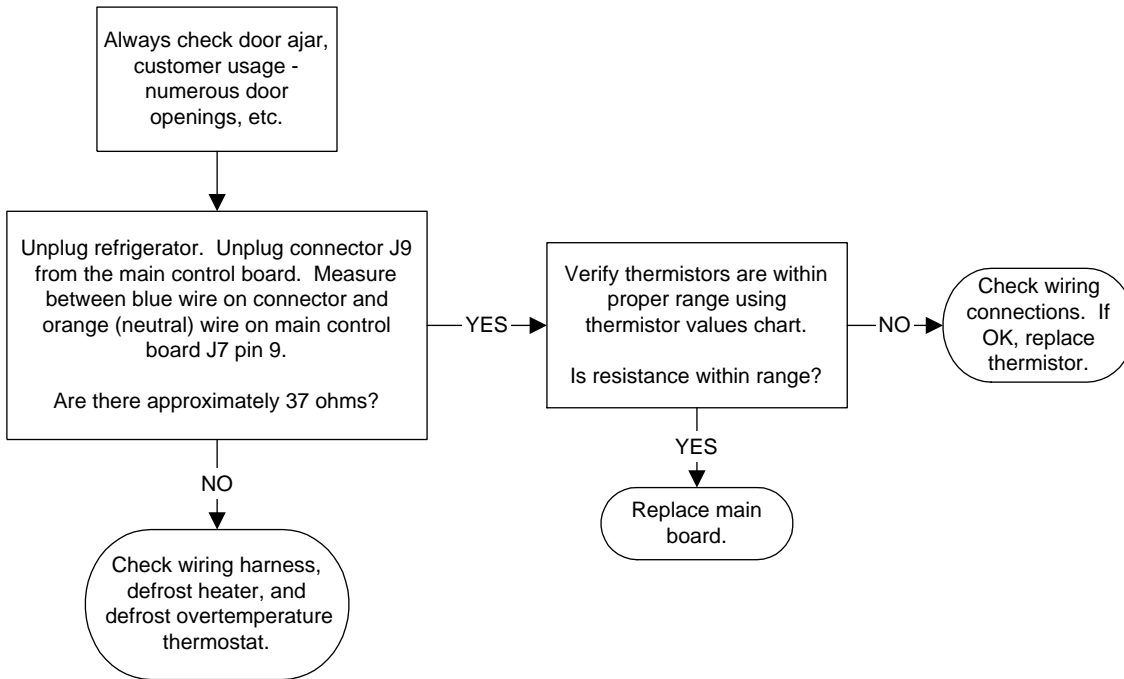


Damper Not Operating

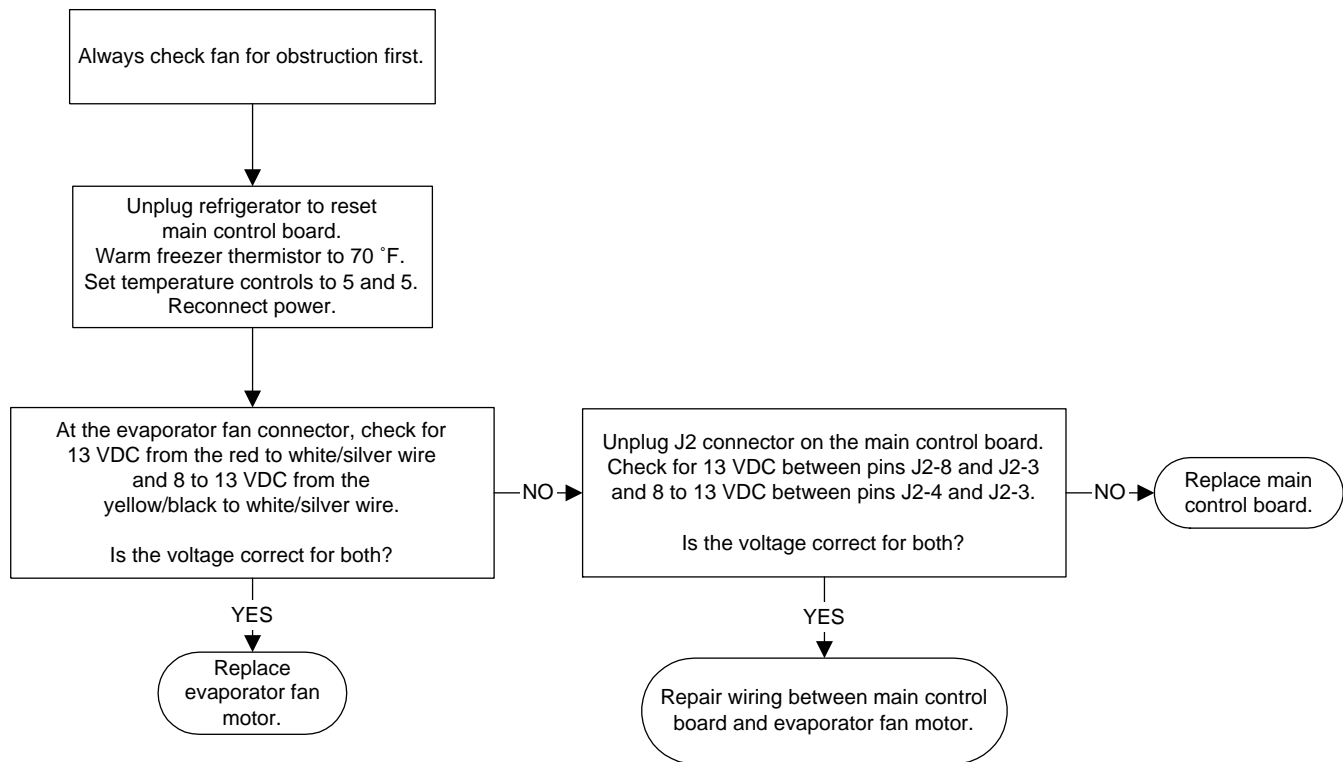
Note: The damper will cycle open and closed every 1/2 hour.



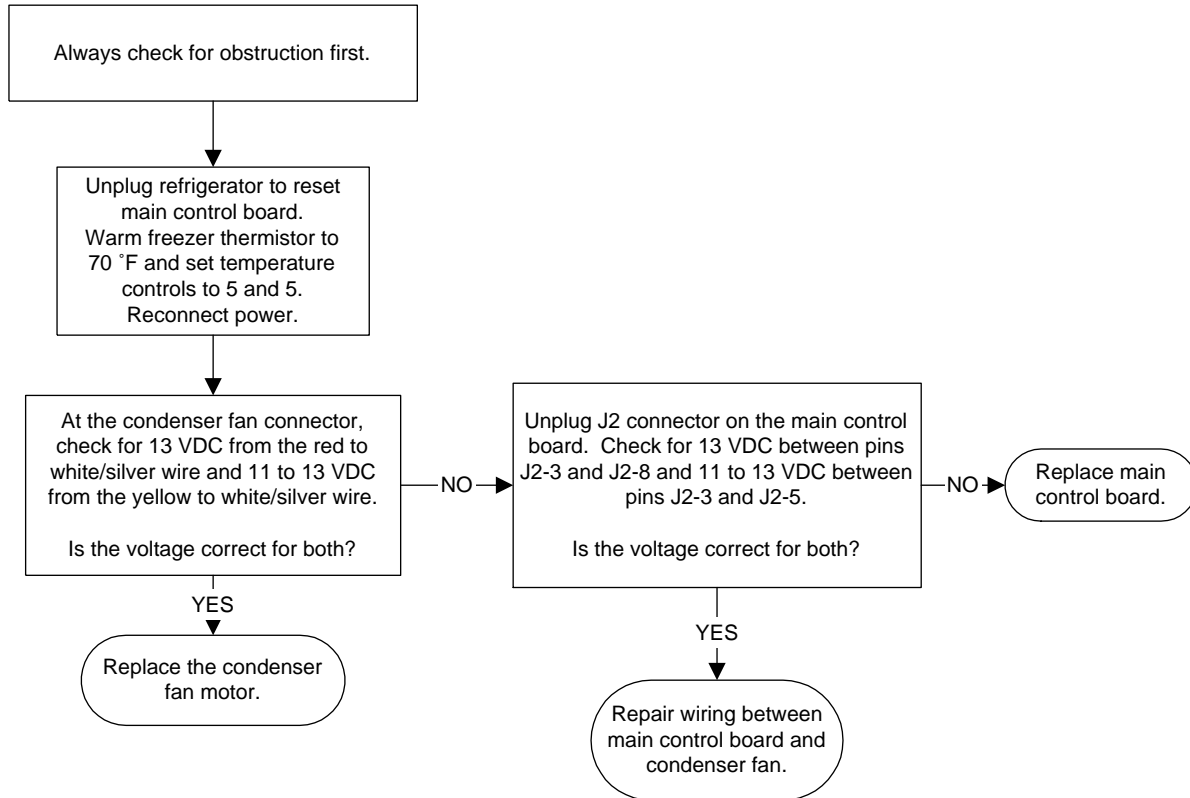
Heavy Frost on Evaporator



Evaporator Fan Not Running



Condenser Fan Not Running



Thermistors

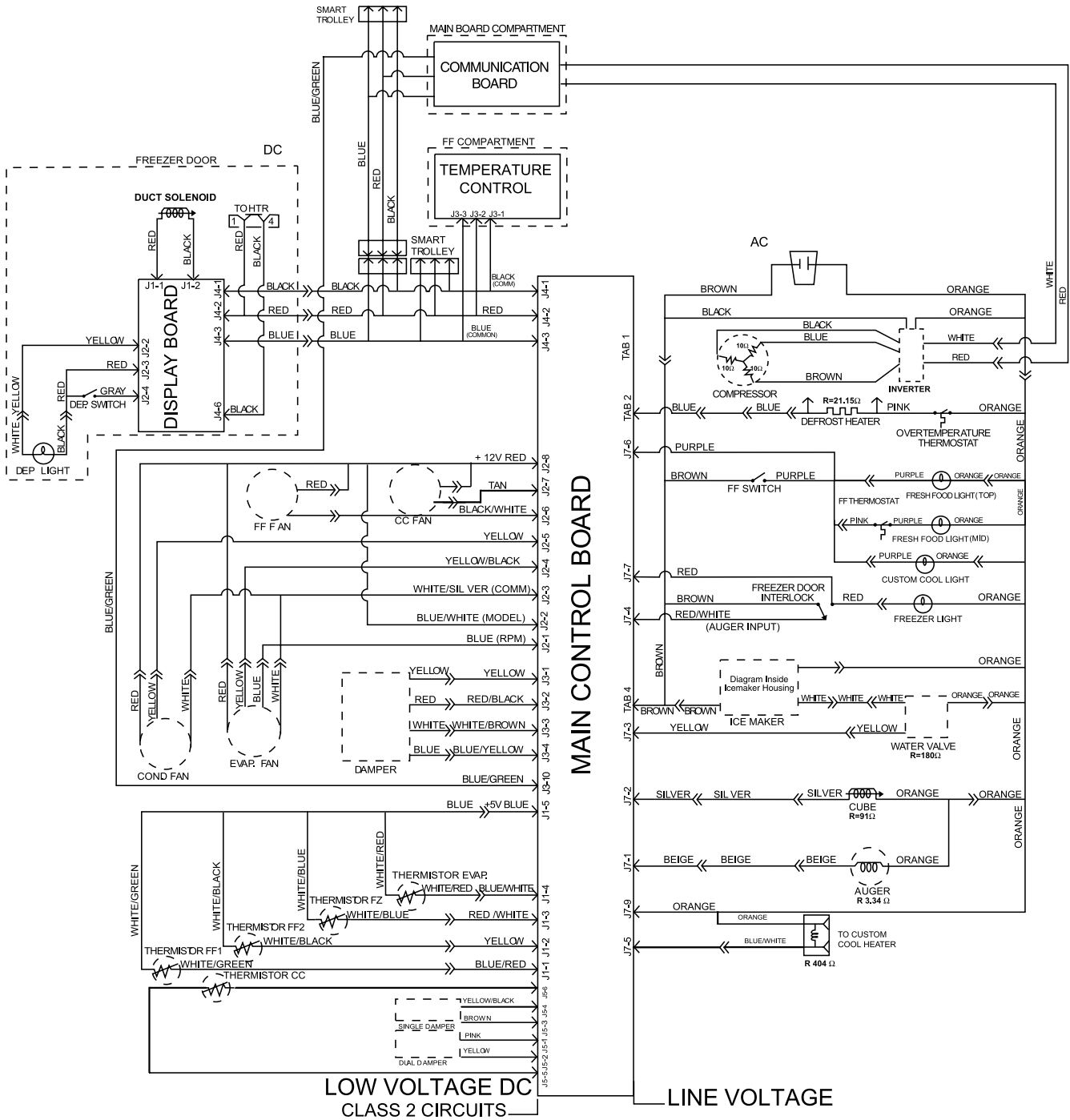
This main control board uses input from 4 thermistors. These thermistors are located in the fresh food section, the freezer section, and on the evaporator. The main control board monitors the thermistors to determine the temperature in these areas of the unit and determines which components to run and when to run them based on this information.

Thermistors can also be checked using diagnostic mode.

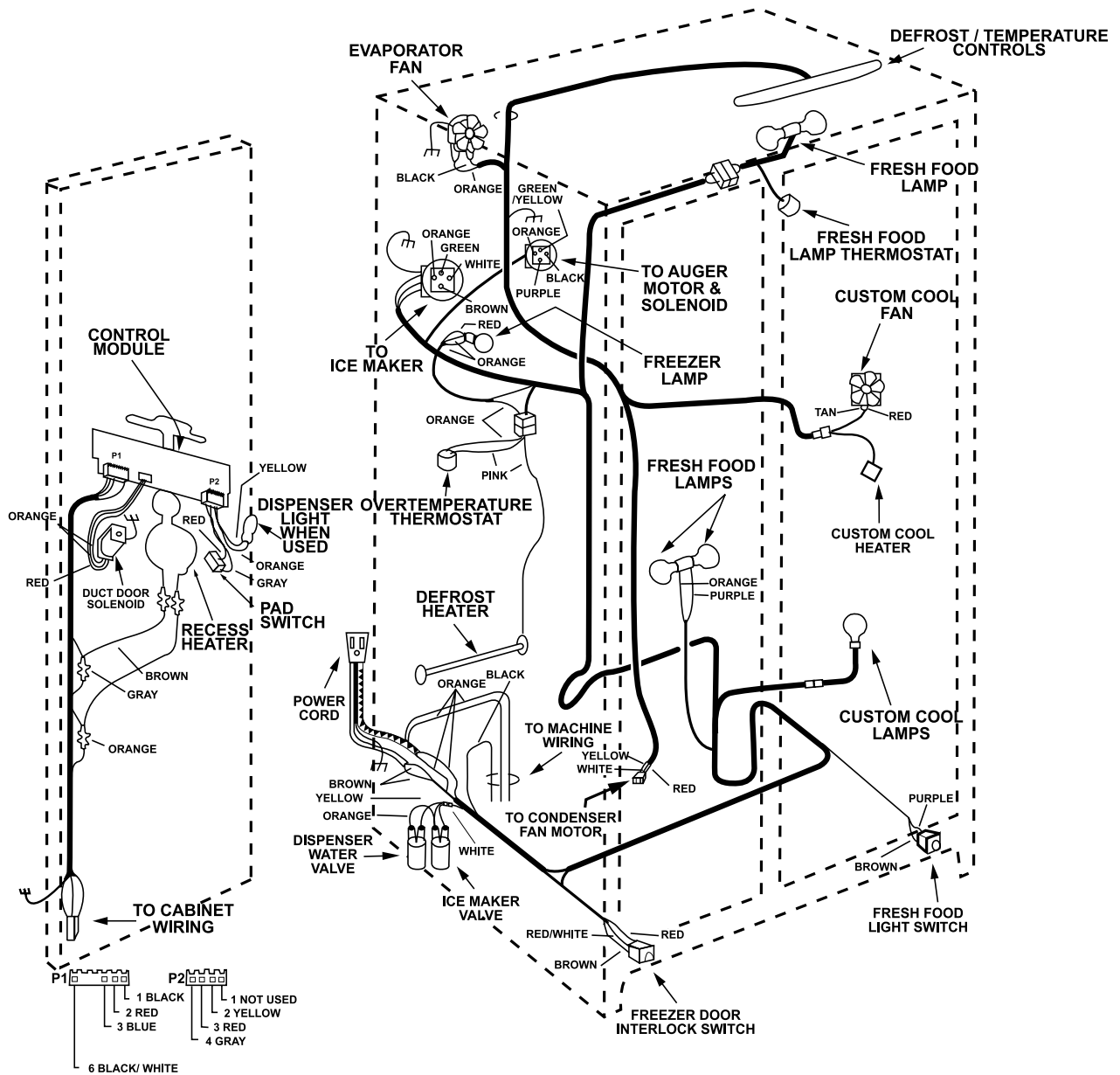
Thermistor Values		
Temperature Degrees (C)	Temperature Degrees (F)	Resistance in Kilo-ohms
-30	-22	88 kΩ
-20	-4	48.4 kΩ
-10	14	27.6 kΩ
0	32	16.3 kΩ
10	50	10 kΩ
20	68	6.2 kΩ
30	86	4 kΩ
40	104	2.6 kΩ

NOTE: The thermistor's resistance has a negative coefficient. As the temperature increases, the thermistor's resistance decreases.

Schematic

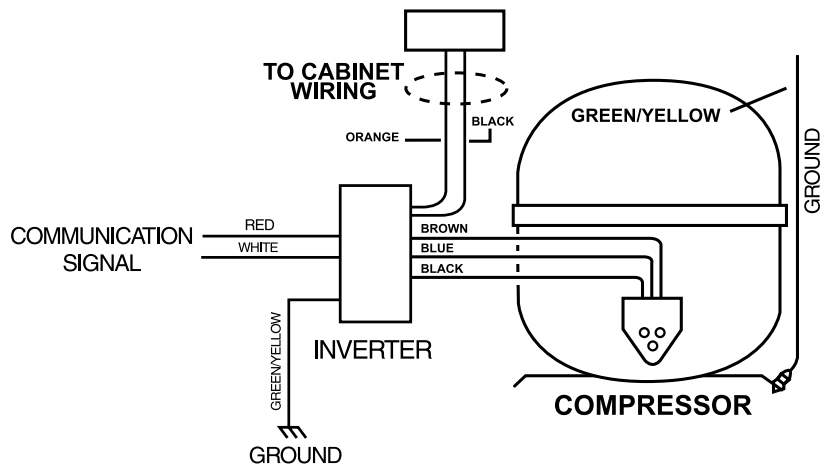


Wiring Diagram



Warning: Disconnecting the 6-pin connector does not disconnect power (120 VAC) from the inverter. The refrigerator must be unplugged before servicing the inverter or compressor.

Caution: Do not attempt to direct-start the compressor. The compressor operates on a 3-phase power supply. Applying 120 VAC to the compressor will permanently damage the unit. It is not possible to start the compressor without an inverter.



Parts List

DESCRIPTION	PART NUMBER	QUANTITY
ACCUMULATOR	WR02X11264	1
COMPRESSOR	WR87X10064	1
HARNES INVERTER COMM	WR23X10274	1
INVERTER ASM EMBRACE	WR55X10155	1
BOARD ASM MAIN CTRL VSC	WR55X10156	1

Warranty

Sales slip or cancelled check is required as proof of original purchase date to obtain service under warranty.

All warranty service is provided by our Factory Service Centers or an authorized Customer Care® technician.

For The Period Of:	GE Will Replace:
One Year From the date of the original purchase	Any part of the refrigerator (excluding water filter cartridge) which fails due to a defect in materials or workmanship. During this full one-year warranty , GE will also provide, free of charge , all labor and in-home service to replace the defective part.
Five Years From the date of the original purchase	Any part of the sealed refrigerating system (the compressor, condenser, evaporator, and all connecting tubing) which fails due to a defect in materials or workmanship. During this five-year warranty , GE will also provide, free of charge , all labor and in-home service to replace the defective part.
Lifetime From the date of the original purchase	Any see-through pan or drawer furnished with the refrigerator if the pan or drawer breaks during normal household use. Drawer covers are not included.
Thirty Days From the date of the original purchase	Any part of the water filter cartridge which fails due to a defect in materials or workmanship. During this full thirty-day warranty , we will also provide, free of charge , all labor and in-home service to replace the defective part.

What GE Will Not Cover:

- Service trips to your home to teach you how to use the product.
- Improper installation.
- Failure of the product if it is abused or used for other than the intended purpose or used commercially.
- Loss of food due to spoilage.
- Replacement of house fuses or resetting of circuit breakers.
- Replacement of the water filter cartridge due to water pressure that is outside the specified operating range or due to excessive sediment in the water supply.
- Replacement of water filter cartridge after its expected useful life, 30 days.
- Damage to the product caused by accident, fire, floods, or acts of God.
- Incidental or consequential damage caused by possible defects with this appliance.

This warranty is extended to the original purchaser and any succeeding owner for products purchased for home use within the USA. In Alaska, the warranty excludes the cost of shipping or service calls to your home.

Some states do not allow the exclusion or limitation of incidental or consequential damages. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state. To know what your legal rights are, consult your local or state consumer affairs office or your state's Attorney General.

Warrantor: General Electric Company, Louisville, KY 40225