Fisher&Paykel appliances

Service Manual

ELECTRONIC VERTICAL FREEZERS

Models E150, E210, E308, E388

517798

The specifications and servicing procedures outlined in this manual are subject to change without notice.

The latest version is indicated by the reprint date and replaces any earlier editions.

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1 INTRODUCTION

The service manual covers the implementation of electronic control to Vertical Freezers.

1.1 Electronics

Changes to the vertical freezers are that an electronic module has replaced the defrost timer and a variable resistor replaces the temperature control.

With the introduction of the electronic module, some of the current functions of the product will also now change. These will be covered under the appropriate headings.

The operational component such as the evaporator has also changed from the corrugated type evaporator to the new Showa fin on tube type evaporator. The internal condenser and cabinet do not change.

1.2 Product Specification

1.2.1 Compressors/Refrigerant Charge

Product Model	Compressor Part Number	Refrigerant Charge
E150	207119	85 grams R134a
E210	207120	105 grams R134a
E308	207120	105 grams R134a
E388	207121	115 grams R134a
VF-300EX	207200	105 grams R134a
VF-J300EX	207200	105 grams R134a

1.2.2 Compressor Specification

Brand	Matsushita	Matsushita	Matsushita
Model	DG66C11RAW5	DG73C12RAW5	DG77C14RAW5
Part Number	207119	207120	207121
Volts	220 – 240	220 – 240	220 – 240
Hertz	50	50	50
Nominal BTU	638	723	768
Output Watts	187	212	225
Run Current (Amps)	0.56	0. 62	0.71
Start Resistance (Ohms)	17.7	17.6	13.1
Run Resistance (Ohms)	15.4	14.1	11
Relay	F&P Electronic	F&P Electronic	F&P Electronic
Overload Part Number	207130	207130	207130
Run Capacitor Part Number	814809	814809	814809

Brand	Matsushita
Model	EGU80HLC 100V
Part Number	207200
Volts	100V
Hertz	50 / 60
Nominal BTU	-
Output Watts	205 / 240
Run Current (Amps)	1.41 / 1.52
Start Resistance (Ohms)	3.15
Run Resistance (Ohms)	3.05
Relay	PTC 207203
Overload Part Number	207202
Run Capacitor Part Number	814817

1.3 Condenser Layout

The compressors have no oil cooler lines; therefore the re-routing of the condenser is as follows: Discharge line from the compressor runs directly to the condenser on the back panel. From the back panel it enters the base panel, then through the left-hand side condenser, into the right-hand side condenser, then to the filter dryer capillary. The remaining circuit layout remains unchanged.

1.4 Suction Line Assembly

The accumulator has been incorporated into the Showa evaporator assembly, therefore the accumulator inside the insulating foam has been removed. This has, in effect, removed three internal welds and replaced them with two external welds (above the evaporator assembly). The suction line assembly now has exposed ends at the unit compartment and the FC compartment.

1.5 Bottom Step Evaporator

With the new electronics and thermistor temperature control, the bottom step evaporator has been made redundant. This also has the effect of removing a further two internal welds (inside the insulating foam) from the unit.

2 ELECTRONICS

2.1 Control Module

The electronic control module is situated in the unit compartment. It is connected to mains supply and switches the compressor, defrost heater and FC fan motor. The compressor is switched through a solid state Triac and relay, and the defrost heater through a relay. The compressor has an external overload and relay fitted. The defrost and FC sensors are located above the accumulator and on the rear duct. A variable resistor, which replaces the temperature controller, is used to cycle the freezer. The defrost timer has also been replaced by the electronics in the control module.

2.2 Temperature Controller

The temperature adjustment is a variable resistor located on the control module at the rear of the cabinet. The FC evaporator temperature range varies between –12ºC at the warmest setting of 1 and -24ºC at the coldest setting of 7. Between 3 and 4 is the mid factory setting (approx is -18ºC).

2.3 Temperature Sensors

These are thermistors whose resistance changes with respect to temperature. They have a single connector on the printed circuit board to ensure the integrity of the resistance of the sensor is measured. Two sensors are located within the FC compartment. The FC sensor is located in the centre of the duct panel above the evaporator and senses the temperature for switching the compressor on and off. The defrost sensor is located immediately above the FC evaporator accumulator. Its only job is to terminate the defrost (switch off the defrost element) once the sensor reaches +8º C.

Thermistor Sensors Resistance Table

Temperature (°C)	Resistance (K Ω ± 5%)
-30.0	25.17
-25.0	19.43
-20.0	15.13
-15.0	11.88
-10.0	9.392
-5.0	7.481
0.0	6.000
5.0	4.844
10.0	3.935
15.0	3.217
20.0	2.644
25.0	2.186
30.0	1.817
35.0	1.518
40.0	1.274
45.0	1.075
50.0	0.9106

2.4 Beeper/Alarm

This is a piezo electric device located in the control module to provide the user with feedback on fault alarms. If a fault occurs or the door is left open, the alarm will sound. It will repeat the fault alarm each time the door is opened.

2.5 Defrost Heater

A 230/240v 260 watt (E150/210), 450 watt (E308/388) defrost heater is positioned beneath and around the evaporator and is used to defrost the evaporator.
There are two thermal fuses mounted in the wiring harness of the defrost element, having a tripping temperature of 72°C. Once open circuit they cannot be reset. The thermal fuses are part of the element heater assembly.
These fuses in both leads of the element protect the refrigerator from any overheating through failure of the defrost element itself or a failure in the control module. Both sides are protected in case polarity is reversed.
NOTE: Care should be taken if manually defrosting the evaporator using heat guns to ensure that the thermal fuses are not over heated.
In normal conditions the defrost period is terminated by the control module when the defrost sensor reaches +8º C.

2.6 FC Fan

The FC fan is a Shaded Pole Motor. The fan cycles with the compressor, however turns off if the door is opened. A further feature added into the electronic software energises the fan during the off cycle should the compressor run time fall below 25%. This feature will aid in preventing the unit from short cycling during low ambients.

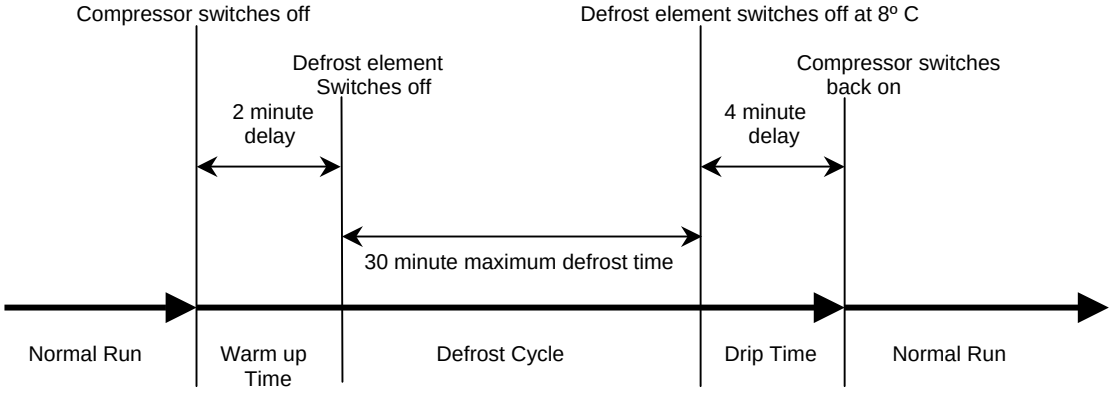
2.7 Door Reed Switch

The door reed switch is located on the bottom cross rail and is activated by a magnet located in the door.

2.8 Defrost Cycle

The defrost heater is controlled by the control module, which switches it via a relay. The defrost interval can vary from between 12 hours to 22 hours of compressor run time, depending on the duration time of the last defrost.
When the control module switches the compressor off for the defrost, there is a 2 minute delay (warm up time) before the defrost element is turned on. The defrost is terminated when the defrost sensor reaches +8º C. Then there is a 4 minute delay (drip time) after the defrost element has been switched off before the compressor is turned on and the system is back to normal run.

Defrost Cycle



2.9 Fault Alarm

If the control module detects a fault, which it is unable to correct, an alarm is sounded. When the cabinet has a fault, the alarm will sound a fault code each time the door is opened. The number of beeps indicates the fault code. If the door is closed, the alarm discontinues until the door is opened again. To repeat the fault code, close and open the door.

2.10 Compressor Starting

The compressor is started by the control module through the PTC (relay) fitted to the compressor. It is a timed start, therefore if the compressor does not start within 1 second, the controller will cancel the start. If the compressor draws too much current, the overload will activate and cut power to the compressor.

3 FAULT CODES

If a fault should develop in the temperature measuring system, defrost system, temperature control variable resistor, or should the compressor fail to start, an audio fault alarm will sound when the door is opened. The alarm consists of a number of beeps emitted by the beeper located in the control module. The number of beeps emitted indicates the fault code as shown in the Fault Code table below.

3.1 Fault Code Table

Fault 2: **2 beeps**

Reason: Defrost sensor failed to reach +8º C within 30 minutes. This has happened in the last three defrosts, therefore probably defrost heater failure.

Action: Check connections at the control module and inline connectors.
Check defrost heater. If faulty, replace.

Fault 3: **3 beeps**
Reason: The resistance of FC sensor is outside the normal range (> 45K Ohms)

Primary Action: Check the 4-way connector at the control module.

Secondary Action: Check sensor resistance.
Reterminate the 4-way connector.

Tertiary Action: Replace control module.

Fault 4: **4 beeps**
Reason: The resistance of FC sensor is outside the normal range (< 660 Ohms)

Primary Action: Check the 4-way connector at the control module.

Secondary Action: Check sensor resistance.
Reterminate the 4-way connector.

Tertiary Action: Replace control module.

Fault 7: **7 beeps**
Reason: The resistance of defrost sensor is outside the normal range (> 45K Ohms)

Primary Action: Check the 4-way connector at the control module.

Secondary Action: Check sensor resistance.
Reterminate the 4-way connector.

Tertiary Action: Replace control module.

Fault 8: **8 beeps**
Reason: The resistance of defrost sensor is outside the normal range (< 660 Ohms)

Primary Action: Check the 4-way connector at the control module.

Secondary Action: Check sensor resistance.
Reterminate the 4-way connector.

Tertiary Action: Replace control module.

Fault 9: **9 beeps**
Reason: Compressor has failed to start after 5 attempts

Primary Action: Check the integrity of the compressor

Secondary Action: Replace control module.

Fault 10: **10 beeps**
Reason: The control variable resistor has an open circuit fault.

Primary Action: Check the continuity of the circuit between the variable resistor and the control module and the connections at the variable resistor and the control module.

Secondary Action: Replace control module

3.2 To Disable Alarm

Turn the control knob fully clockwise and then fully anticlockwise within 5 seconds.

3.3 To Manually Force a Defrost

Open the door for 5 seconds, then shut the door, turn the control knob fully clockwise and then fully anticlockwise within 10 seconds.

4 SERVICE PROCEDURES

Note: No work is to be carried out on the product while in a live situation. All components can be at a mains potential. The product is to be turned off and disconnected from the power supply.

Electrical Safety Check.
Whenever any part of the electrical circuit is services or disturbed in the course of carrying out service adjustments or repair, it is essential that insulation resistance and earth continuity tests are carried out using the appropriate test equipment.

4.1 Control Module

- Unplug the refrigerator from the outlet socket.
- Remove the drain pan/tray.
- Remove the two screws securing the module to the cabinet.
- Pull the module outwards.
- Remove all the connectors from the control module.
- Refit the module in reverse order making sure all wiring is secured in the module and the wiring harness is located in the module slot.

4.2 Compressor Overload

Remove the compressor cover. Once the cover is removed, the compressor connector from the module needs to be removed before the overload is removed by pulling it from the compressor terminals. An Ohmmeter is used to test for continuity of the overload.

4.3 FC and Defrost Sensor

The FC and defrost sensor are tested at the module. The module is to be removed and the sensor RAST connector can be removed for testing.

4.3.1 To Replace FC Sensor

- Unplug the refrigerator from the outlet socket.
- Remove evaporator cover.
- Remove the affected sensor from its holder.
- Cut the sensor from the loom and replace it by soldering and heat shrinking the new sensor to the loom.
- Replace sensor into its holder.
- Replace fan cover.

4.3.2 To Replace Defrost Sensor

- Unplug the refrigerator from the outlet socket.
- Remove evaporator cover.
- Remove the affect sensor from its holder.
- Cut the sensor from the loom and replace it by soldering and heat shrinking the new sensor to the loom.
- Replace sensor into its holder.
- Replace fan cover.

4.4 Variable Resistor

Built into control module. If faulty, replace control module.

4.5 FC Defrost Element

Defrost element is replaceable as it is located below the evaporator and held in place by two side plate tabs.

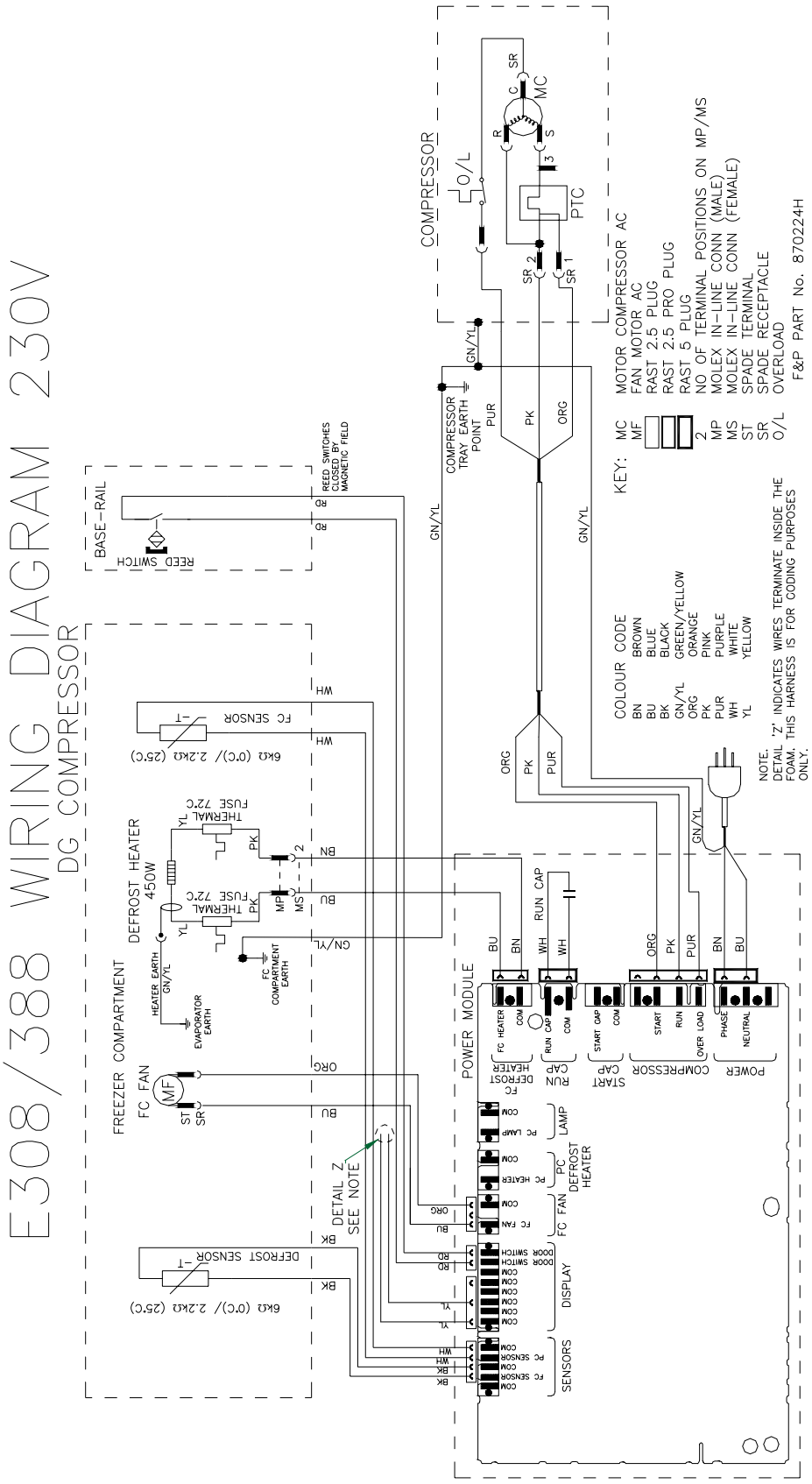
4.6 Reed Switch

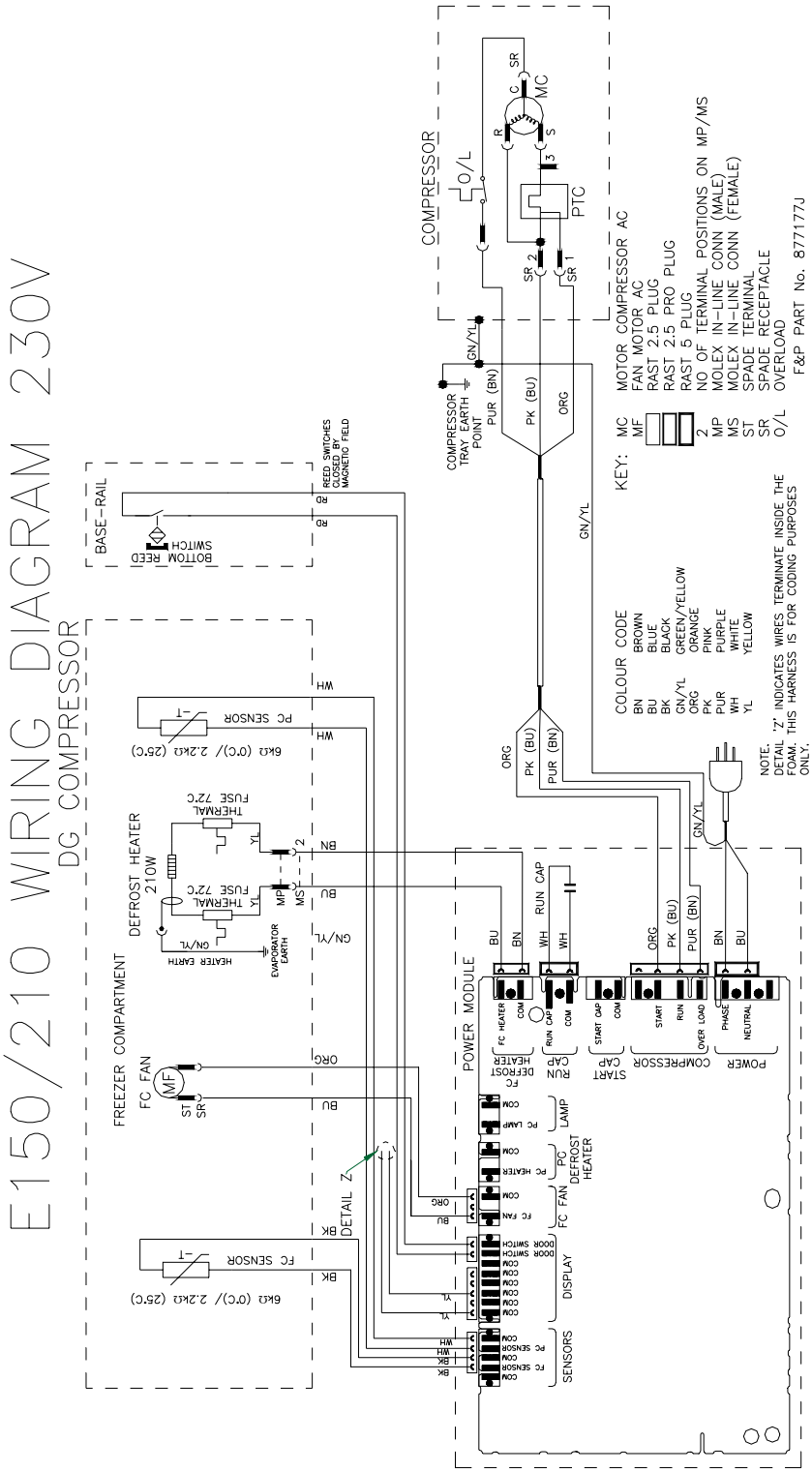
- Unplug the refrigerator from the outlet socket.
- Remove the door switch cover (located in the centre of the base rail).
- Unclip the encapsulated reed switch from the housing.
- Replacement of the new switch is done by cutting the wiring back from the switch end and soldering in a new switch, making sure both connecting wires are not shorting but insulated with heat shrink sleeving. Take care not to leave too much excess wire as the reed switch must be able to be fitted back in to the housing.
- Refit in reverse order.

4.7 Fan Motor

- Unplug the refrigerator from the outlet socket.
- Remove food, shelves and baskets.
- Remove long duct cover.
- Remove front cover.
- Pull off fan blade.
- Disconnect motor leads.
- Remove the one screw from fan mounting bracket and lift motor clear.
- Fit replacement fan motor in reverse order.

5 WIRING DIAGRAM




E150/210 WIRING DIAGRAM 230V
DC COMPRESSOR
COMPRESSOR
O/L
PTC
MC
SR
C
R
S
SR 2
SR 1
COMPRESSOR TRAY EARTH POINT
GN/YL
PUR (BN)
PK (BU)
ORG
KEY: MC MOTOR COMPRESSOR AC
MF FAN MOTOR AC
RAST 2.5 PLUG
RAST 2.5 PRO PLUG
RAST 5 PLUG
2 NO OF TERMINAL POSITIONS ON MP/MS
MP MOLEX IN-LINE CONN (MALE)
MS MOLEX IN-LINE CONN (FEMALE)
ST SPADE TERMINAL
SR SPADE RECEPTACLE
O/L OVERLOAD
F&P PART No. 877177J
COLOUR CODE
BN BROWN
BU BLUE
BK BLACK
GN/YL GREEN/YELLOW
ORG ORANGE
PK PINK
PUR PURPLE
WH WHITE
YL YELLOW
NOTE: 'Z' INDICATES WIRES TERMINATE INSIDE THE DETAIL FOAM. THIS HARNESS IS FOR CODING PURPOSES ONLY.
BASE-RAIL
BOTTOM REED SWITCH
REED SWITCHES CLOSED BY MAGNETIC FIELD
RD
FREEZER COMPARTMENT
FC FAN
MF
ST
SR
DEFROST HEATER 210W
THERMAL FUSE 72°C
HEATER EARTH
EVAPORATOR EARTH
MP
MS
PC SENSOR
6kΩ (0°C)/ 2.2kΩ (25°C)
FC SENSOR
6kΩ (0°C)/ 2.2kΩ (25°C)
DETAIL Z
POWER MODULE
FC HEATER
COM
RUN CAP
START CAP
START
RUN
OVER LOAD
PHASE
NEUTRAL
DEFROST HEATER
RUN CAP
START CAP
COMPRESSOR
POWER
PC LAMP
PC HEATER
FC FAN
DOOR SWITCH
DISPLAY
PC SENSOR
SENSORS
LAMP
FC DEFROST HEATER

6 FAULT FINDING

The following faults and probable causes have been listed with the assumption that all basic checks have been carried out, such as product has power, door is closing correctly etc.

6.1 Compressor Won't Start.

- Check continuity of overload. If no continuity, replace overload.
- Check start and run winding (as per specification).
- Check Run capacitor.

(Manual starting devices can be used to confirm diagnostics.)

6.2 Compressor Starts, Runs and Then Stops.

- Check the connections at the fusite plug, overload and control module connections.
- Check supply voltage.

(Manual starting devices can be used to confirm diagnostics.)

6.3 Compressor Humming

- Check continuity of overload. If no continuity, replace overload.
- Check connections at fusite plug, overload and control module connections.
- Check start and run windings (as per specifications).
- Check run capacitor.

6.4 Freezer Too Cold

- Check resistance of variable resistor.
- Check resistance of FC sensor as per table.
- Check evaporator for frost pattern. Full frost pattern required. If there is not a full frost pattern, check product for shortage of refrigerant or inefficient compressor.
- Check evaporator temperatures at the entry and exit of the evaporator. If the temperature of the exit differs by 5 - 10º from that of the entry, further investigation is required.

6.5 Freezer Too Warm

- Check setting of control knob.
- Check resistance of variable resistor.
- Check resistance of FC sensor as per table.
- Check that the fan is operational.
- Check if evaporator is defrosting correctly, if not check the defrost sensor and/or defrost element.
- If defrost is working, check temperature of the evaporator to rule out or confirm system and/or compressor fault/s.