

ELECTRICAL SYSTEM

10. Compressor Protection

There is a Time Delay program within the microprocessor. This prevents a heavy load from being applied on the Compressor Motor when restarting the unit (Cool Mode) after a very short period of time. This "delay" is in effect any time when the compressor is turned on by either the "Cool On/Off" button, temperature set point (thermostatic control), power interruption restart or Condensate Pump (optional) operation.

Time Delay Program Specifications: 65 ± 10 sec.

11. Temperature Control

The compressor operation (Cool Mode) is controlled by the microprocessor which receives input signals from the room temperature thermostat (evaporator inlet air) and the setting of the Temperature Set Point. The Temperature Set Point (desired room temperature) can be adjusted by pressing the ▲/▼ buttons on the Control Panel. The adjustment range of the Temperature Set point is 65°F to 90°F (18°C to 32°C).

12. Fan Mode Control Switch

The fan motor operation is controlled by relays on the relay board through a microprocessor in the control panel assembly. The fan program in the microprocessor can be changed by a DIP-Switch on the left side of the Relay Board located in the Control Box. There are two settings:

A. Cool to Stop

When the DIP-Switch is set to the down or "Stop" position, the microprocessor controls the fan motor using the same room temperature thermostat that it uses to control the compressor. In this case, both the fan and the compressor stop when the microprocessor receives a sufficiently low intake air (room temperature) signal from the thermostat (equal to or less than the set point). When the temperature increases (exceeds the set point) the microprocessor will restart the fan and compressor automatically. However, if the unit has been off for less than 75 sec., the fan will start before the compressor (time delay program).

B. Cool to Operate

When the DIP-Switch is set in the up or "Operate" position, the microprocessor controls the fan operation using control panel inputs only. The fan will operate continuously during Fan Only and Cool Modes. (This is the "Factory Default" setting.)

13. Temperature Scale Display Switch

When the DIP Switch is set in the "down" or °C position, the Set Point and Room Temperature will be displayed in degrees Celsius (°C). The LED that indicates °C will also be illuminated.

When the DIP Switch is set in the "up" or °F position, the Set Point and Room Temperature will be displayed in degrees Fahrenheit (°F). The LED that indicates °F will also be illuminated (this is the "factory default" setting).

TROUBLESHOOTING AND REPAIR

Before troubleshooting the system, the following inspection should be performed.

1. Inspection of Power Source Voltage

Check the voltage of the power source.

Single phase 230 volts (60Hz)

Check the operation and condition of the fuse or circuit breaker in the power source.

2. Inspection of Air Filters

Remove the air filters and check the element. If the element is dirty, wash it as described in the OPERATION MANUAL supplied with the unit.

3. Inspection of Drain Tank

Be sure tank is fully drained.

The following chart is provided as a guide for categorized problem remedies. Detailed information is contained in the OPERATION MANUAL supplied with the unit.

4. Troubleshooting Chart

Trouble	Probable Cause	Trouble	Probable Cause
Unit does not operate at all	<ul style="list-style-type: none"> • Check for Power at Receptacle • Fan mode DIP switch is set to "Stop" and current Set Point Temperature exceeds Room Temperature • Fan mode DIP switch is set to "Stop" and unit has been equipped with optional Condensate Pump that is defective • Check for Power at Terminal Board • Check for Power at Relay Board • Check all wire connections • Defective Drain Tank Switch • Check Relay Board Fuse • Defective or Incorrect Relay Board • Defective Control Board 	Insufficient Air Flow	<ul style="list-style-type: none"> • Clogged fins on Evaporator or Condenser (running unit without filter(s)) • Fan on "Low" setting • Defective fan motor • Static pressure exceeds design specifications
		Insufficient Cooling	<ul style="list-style-type: none"> • Environmental conditions exceed design specifications • Clogged air filter • Clogged fins • Set point temperature exceeds room temperature • Defective room temperature thermistor • Exhaust outlet not properly ducted • Leak in refrigerant system • Restriction in refrigerant system
Unit starts, but stops immediately	<ul style="list-style-type: none"> • Room temperature and anti-freeze thermistor connectors are reversed on control board • Defective Fan Motor • Defective Compressor Motor • Defective Relay Board 	Display not working	<ul style="list-style-type: none"> • Compressor not operating
		Compressor not operating	<ul style="list-style-type: none"> • Set point temperature exceeds room temperature • Unit is operating in Fan Only Mode (Cool Mode not activated) • Defective or Incorrect Installation of Condensate Pump (optional) • Defective Compressor Capacitor • Defective Thermistor • Defective Compressor Motor • Check wiring connections • Defective Relay Board • Defective Control Board
Unit operates, but stops after a few minutes	<ul style="list-style-type: none"> • Drain Tank Full • Fan Mode Switch is set to "Stop" and unit reached "set point" temperature compressor cycled off • Defective Compressor Motor • Defective Fan Motor • Fan Mode Switch is set to "Stop" and compressor cycled off 		
Water leakage from the unit	<ul style="list-style-type: none"> • Drain Tank not installed • Drain Tank is defective (cracked) • Drain Pan hole is obstructed 	Fan Motor not operating	<ul style="list-style-type: none"> • Fan mode DIP switch is set to "Stop" and current Set Point Temperature exceeds Room Temperature • Fan mode DIP switch is set to "Stop" and unit has been equipped with optional Condensate Pump that is defective • Check wire connections • Defective fan motor capacitor • Defective fan motor • Defective Relay Board • Defective Control Board

TROUBLESHOOTING AND REPAIR

In case of trouble, perform the following inspection before disassembly.

5. Inspection of Plate Fins

To inspect the plate fins of either the evaporator or condenser you must remove the air filters. After removal of the air filters, inspect the plate fins for any dirt, dust, lint, or debris that may have caused poor cooling performance of the unit. If cleaning of the fins is necessary, it is recommended that this service be performed by a qualified service technician.

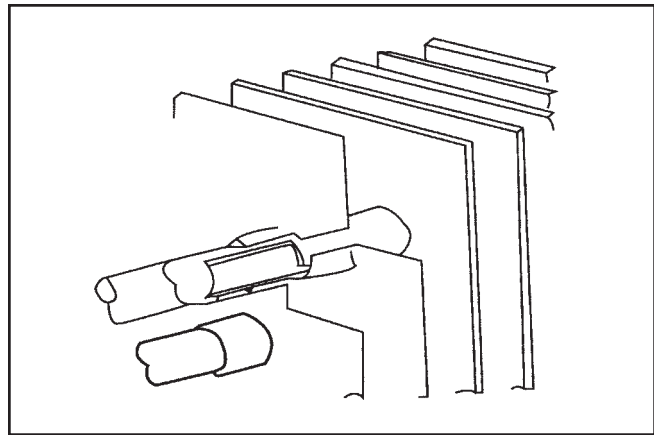


Figure 5-1: Plate Fins

6. Examination of Operating Environment

Operating environments will vary depending on location, climate and surrounding conditions. Installation location also can cause operational problems. Consult your reseller concerning operational environment requirements.

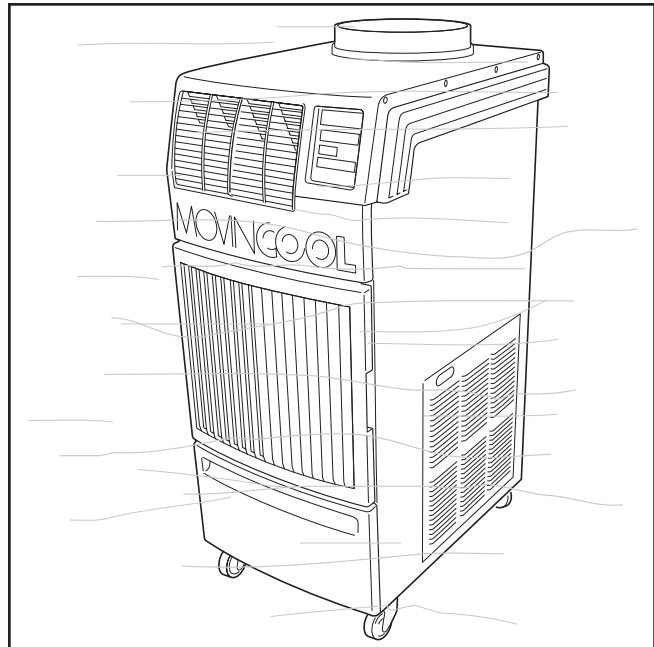


Figure 5-2: Operating Environment

7. Inspection of Cooling Capacity

Measure the difference in temperature between the inlet of the evaporator and the cool air vent. If the difference is out of the range given in the graphs on page 8, proceed with the possible causes suggested in the troubleshooting chart on page 19.

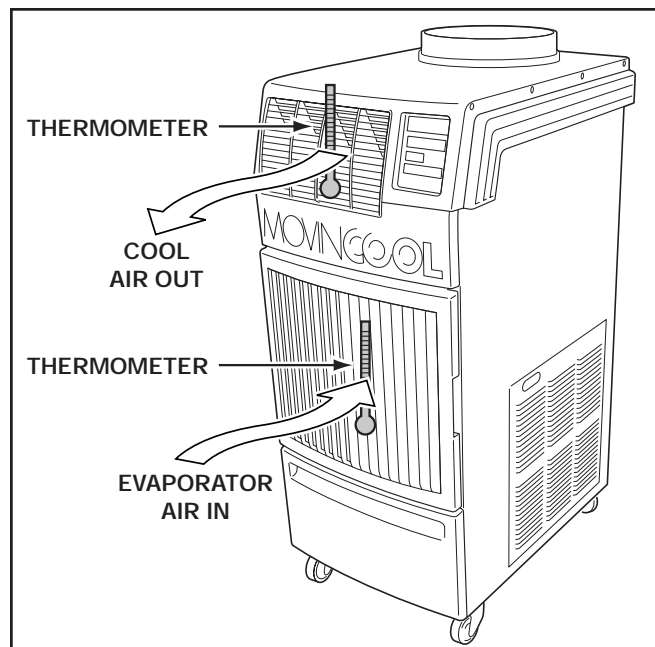


Figure 5-3: Cooling Capacity

TROUBLESHOOTING AND REPAIR

8. Disassembly

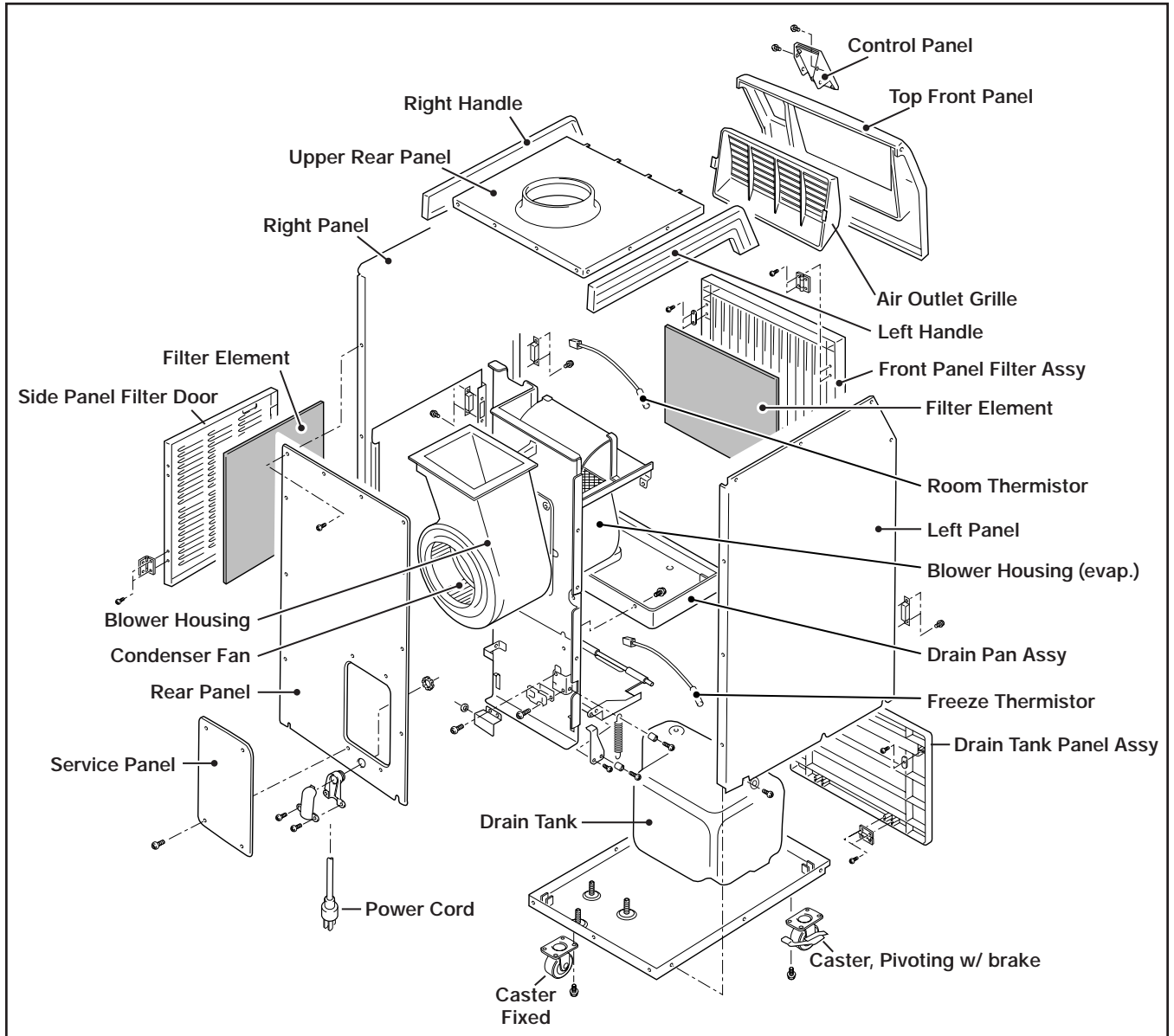


Figure 5-4: Disassembly

TROUBLESHOOTING AND REPAIR

- A. Remove drain tank.

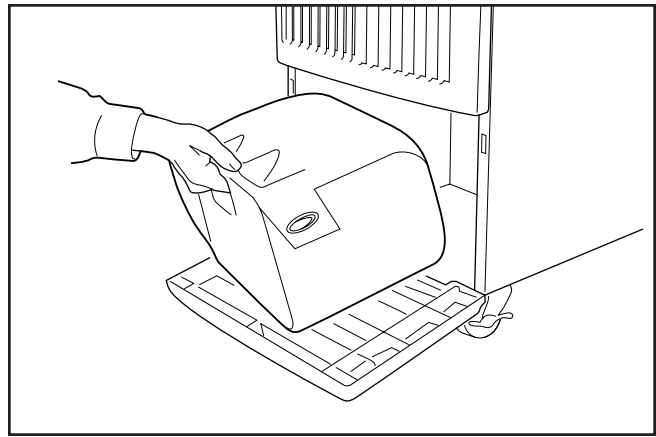


Figure 5-5: Removal of Drain Tank

- B. Remove four (4) screws from upper front panel.

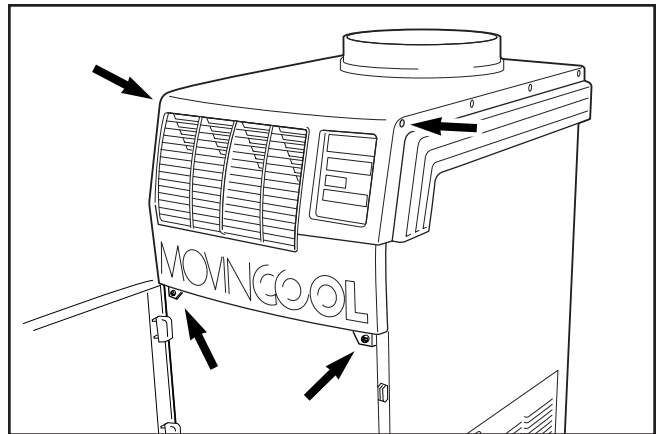


Figure 5-6: Removal of Upper Front Panel Screws

- C. Slide upper front panel forward and remove.

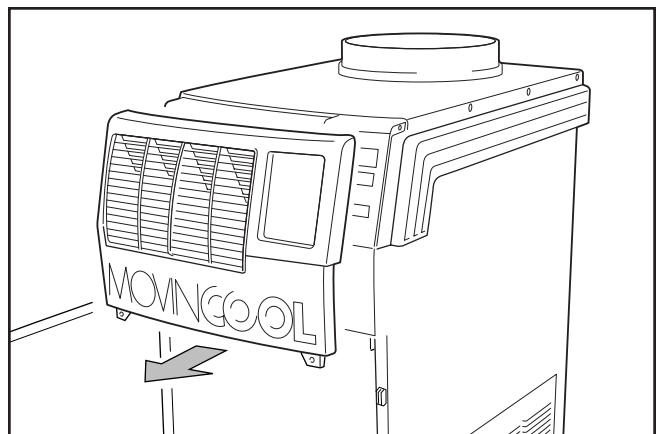


Figure 5-7: Removal of Upper Front Panel

TROUBLESHOOTING AND REPAIR

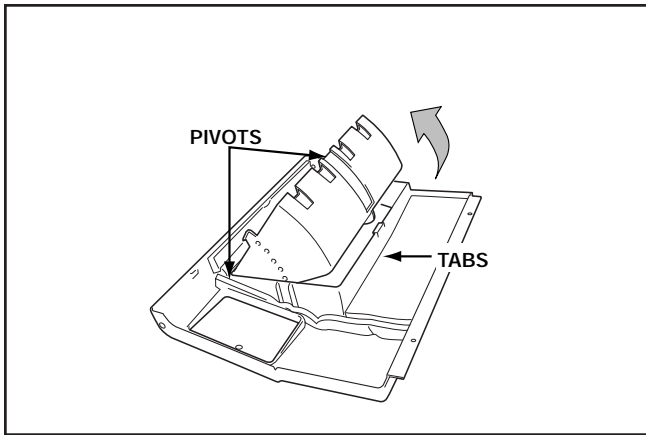


Figure 5-8: Removal of Air Outlet Louver

- D. Louver can be removed from upper front panel by unsnapping the lock tap and removing the louver from its pivots.

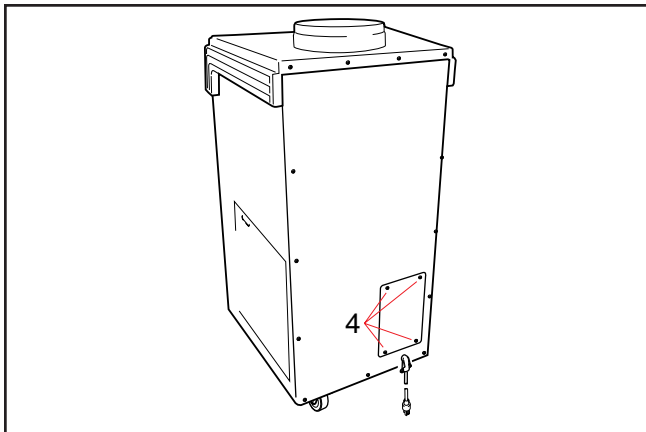


Figure 5-9: Removal of Service Panel

- E. Remove four (4) screws from service panel.

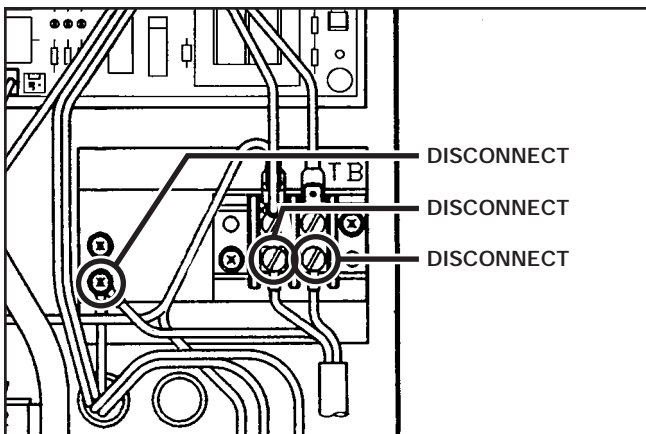


Figure 5-10: Removal of Power Cord Screws

- F. Disconnect the three (3) lead wires of the power cord.

TROUBLESHOOTING AND REPAIR

- G. Remove thirteen (13) screws from rear panel.
- H. Remove ten (10) screws (eight shown) from upper rear panel and two (2) screws on top.

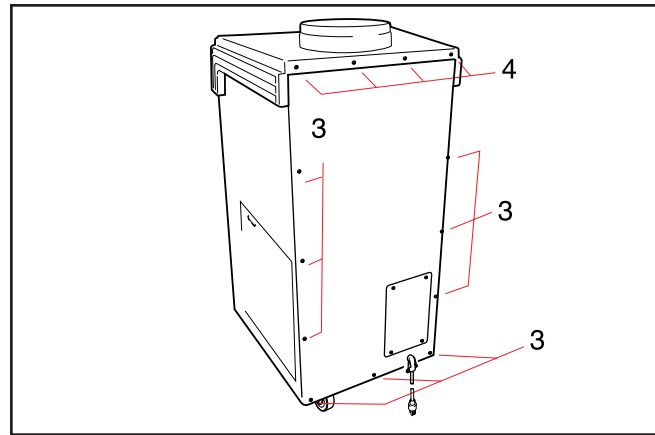


Figure 5-11: Removal of Back and Upper Rear panel Screws

9. Removal of Electrical Parts

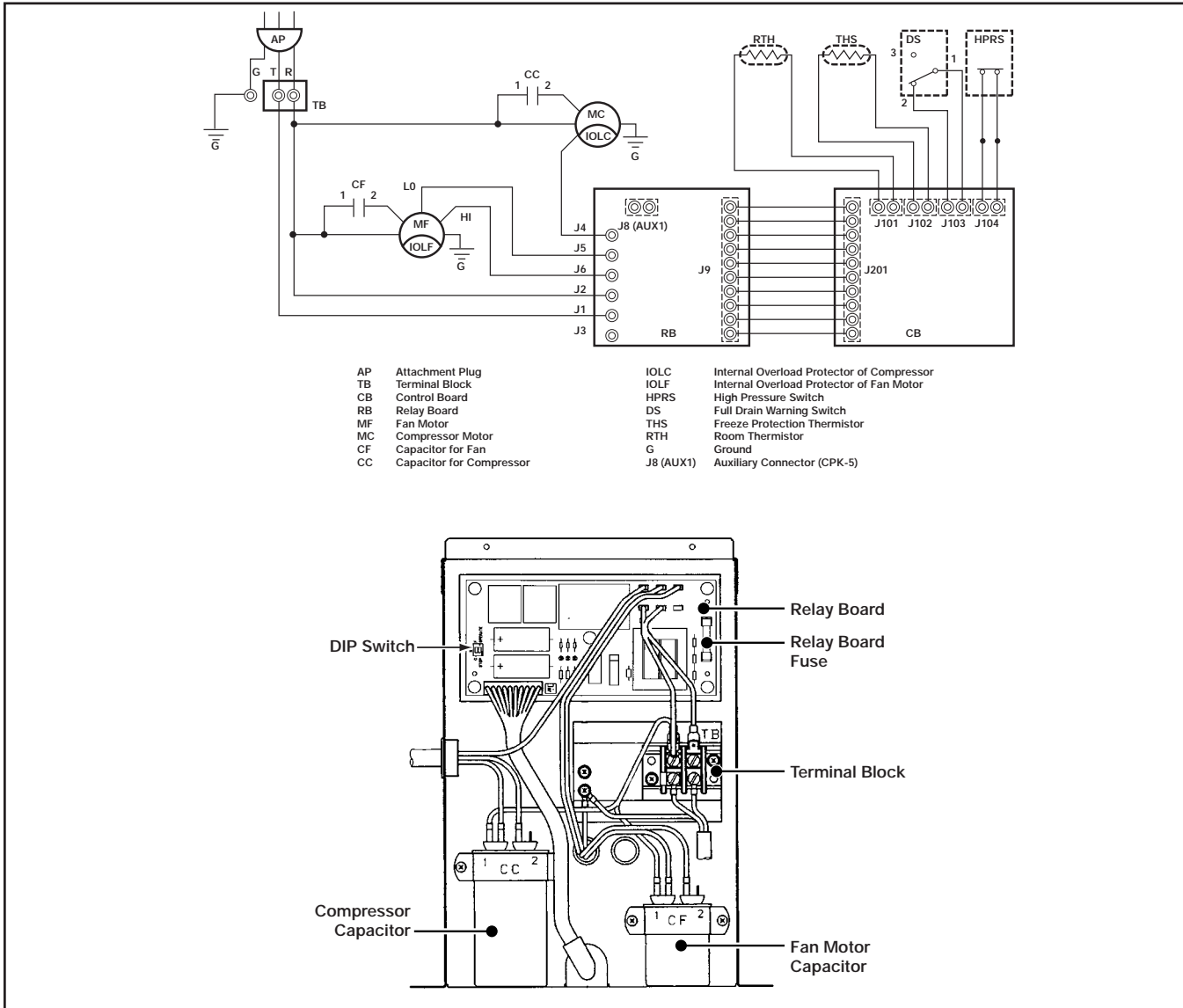


Figure 5-12: Removal of Electrical Parts in the Control Box

TROUBLESHOOTING AND REPAIR

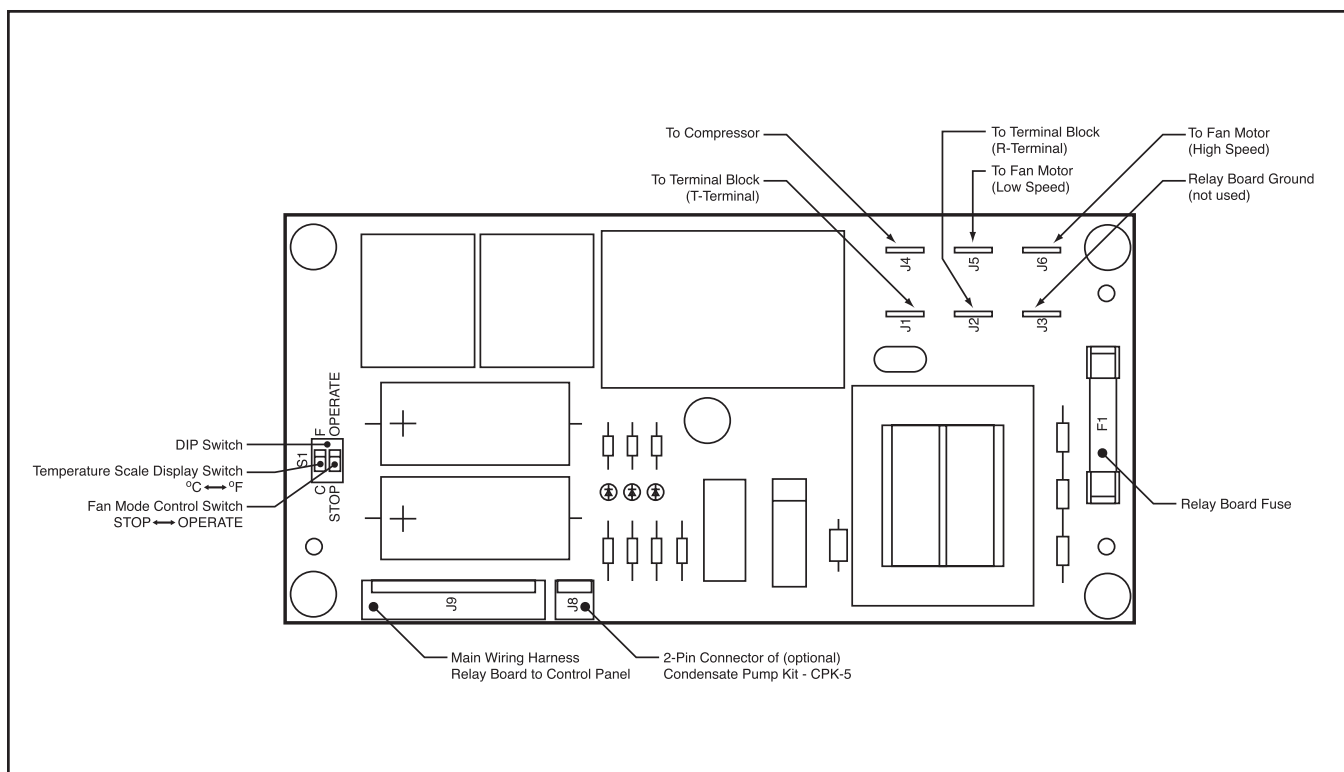


Figure 5-13: Connections to Relay Board

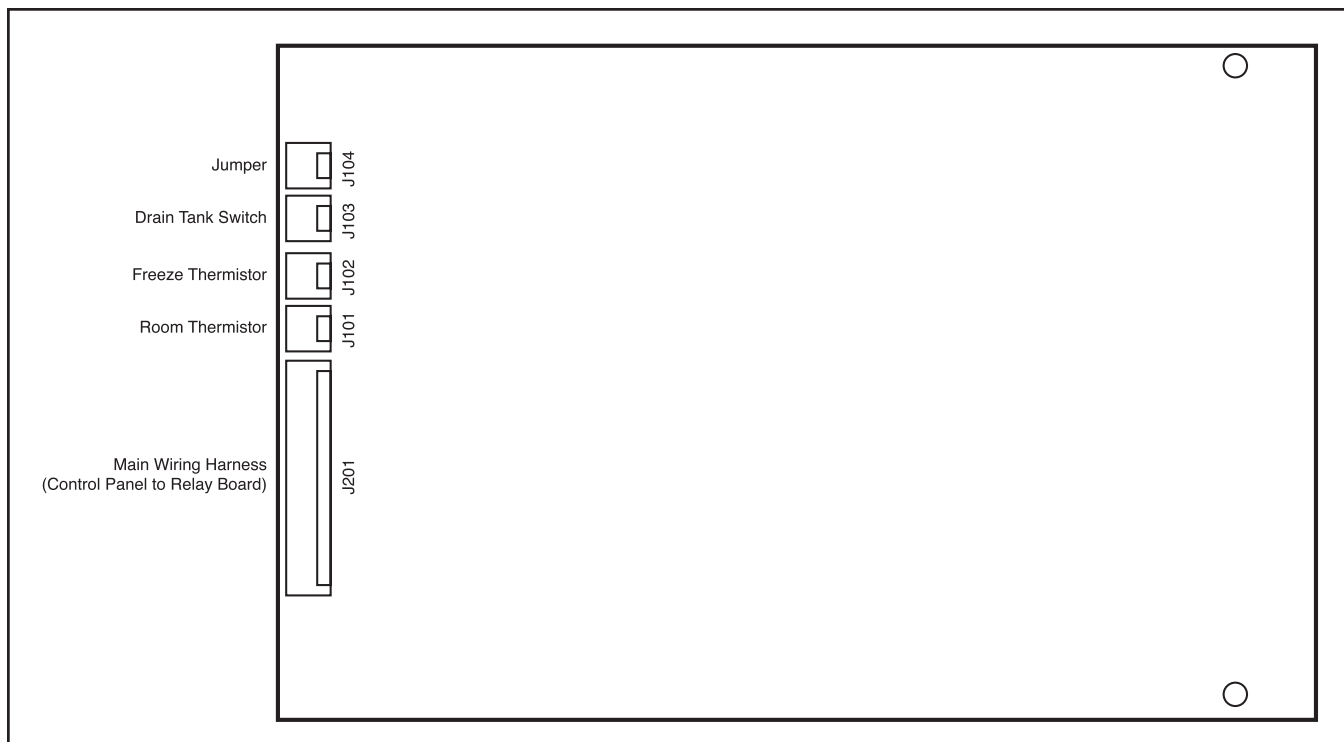


Figure 5-14: Connections to Control Board

TROUBLESHOOTING AND REPAIR

10. Removal of Blower Assembly

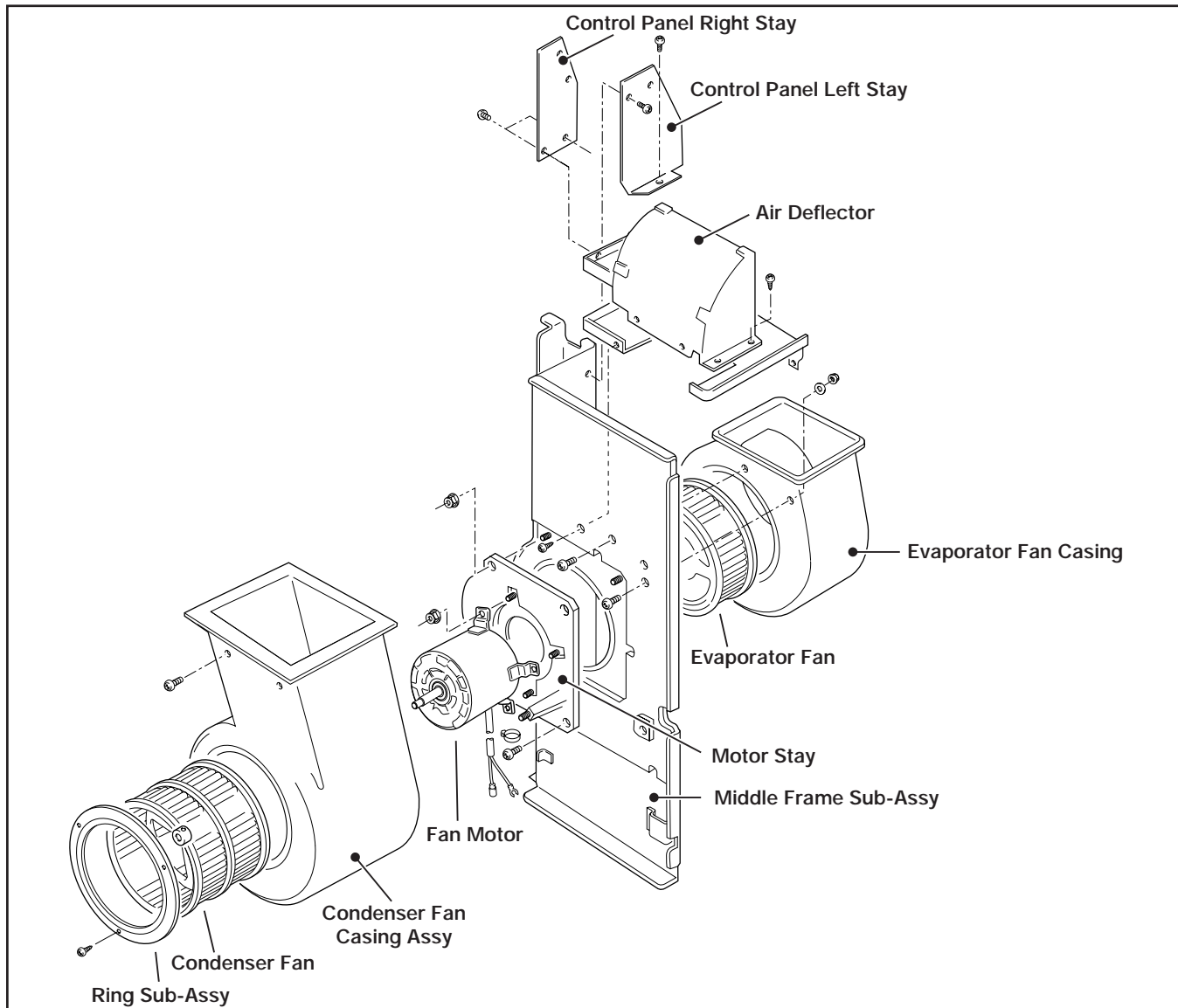


Figure 5-15: Disassembly of Blower

TROUBLESHOOTING AND REPAIR

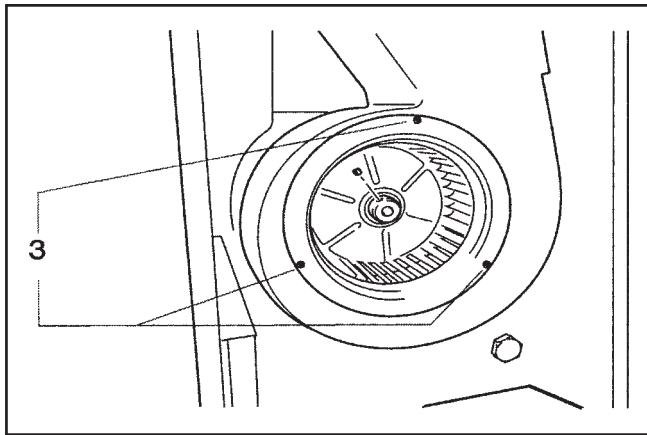


Figure 5-16: Removal of Ring Sub-Assy

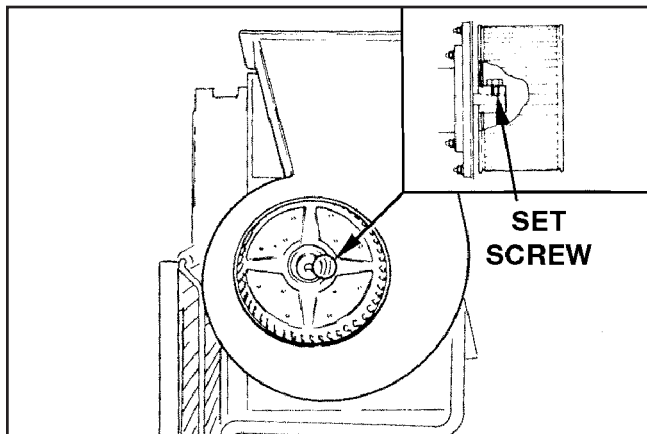


Figure 5-17: Removal of Centrifugal Fan

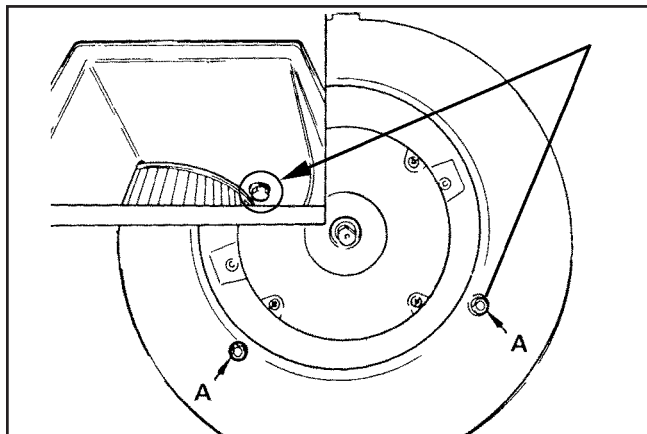


Figure 5-18: Removal of Blower Housing

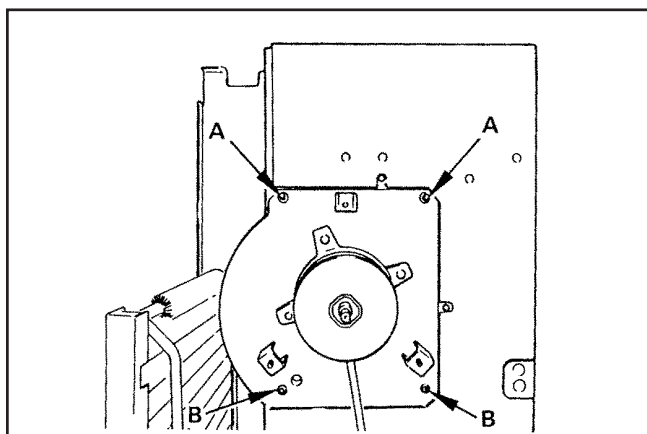


Figure 5-19: Removal of Fan Motor Assembly

A. Remove the ring sub-assy

B. Loosen the set screw using an allen wrench and then remove the centrifugal fan.

C. Remove the two (2) nuts "A" on the inside of the housing in the locations shown. Then remove the blower housing (condenser).

A - NUT

D. Remove the two (2) nuts "A" and two (2) screws "B" as shown. Then remove the motor bracket together with the fan motor.

A - NUT

B - SCREW

TROUBLESHOOTING AND REPAIR

- E. Remove the centrifugal fan by loosening the set screw on the shaft. Remove the fan motor by loosening nuts "A".

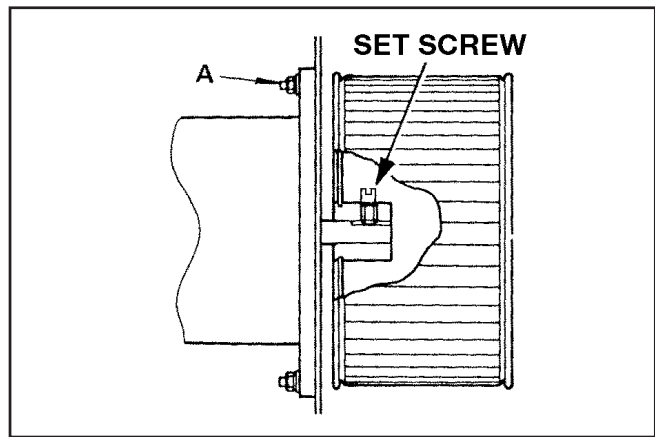


Figure 5-20: Removal of Fan Motor

- F. Remove seven (7) screws from left side panel.

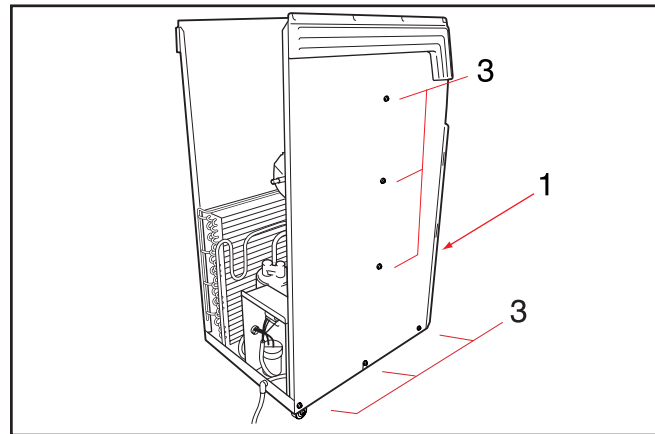


Figure 5-21: Removal of Screws for Left Side Panel

- G. Remove seven (7) screws from right side panel.

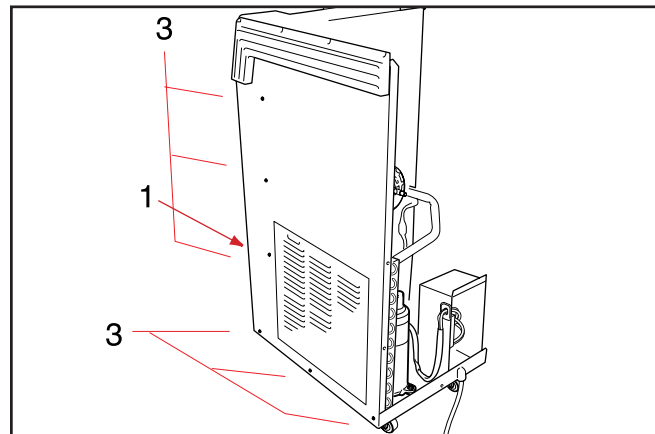


Figure 5-22: Removal of Screws for Right Side Panel

- H. Remove lower air deflector

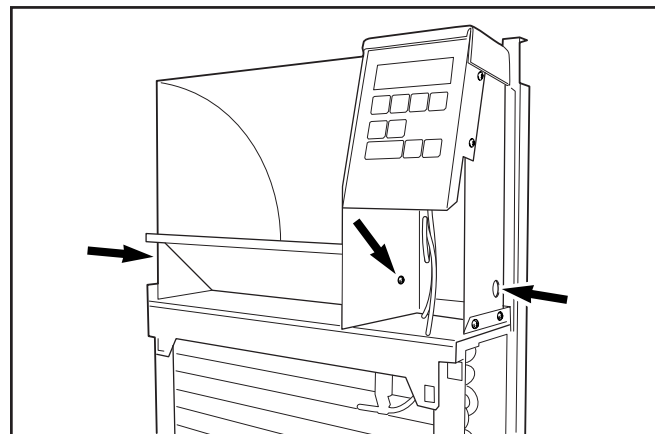


Figure 5-23: Removal of Lower Air Deflector

TROUBLESHOOTING AND REPAIR

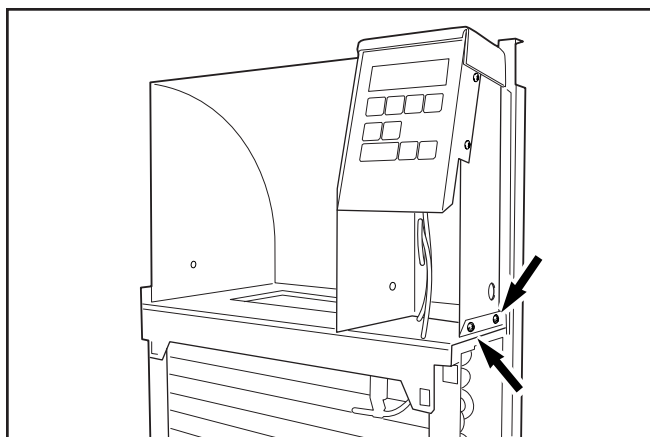


Figure 5-24: Removal of Control Panel

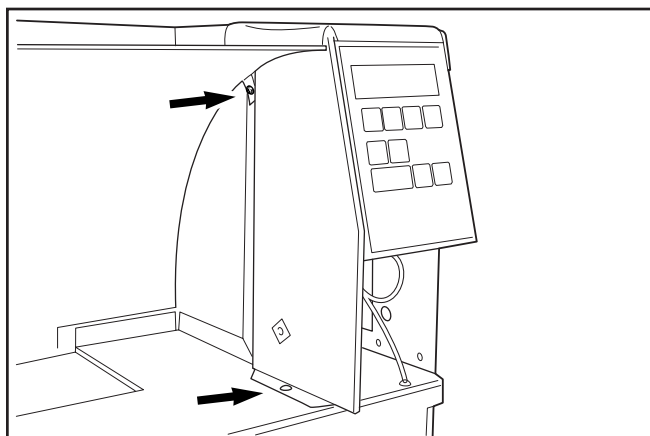


Figure 5-25: Removal of Control Panel

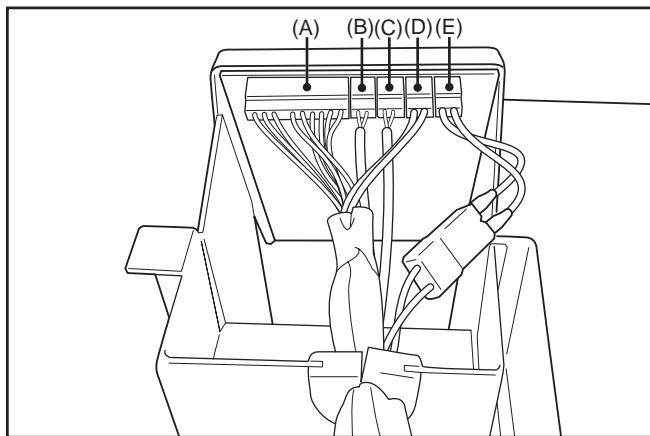


Figure 5-26: Removal of Connectors from Control Panel

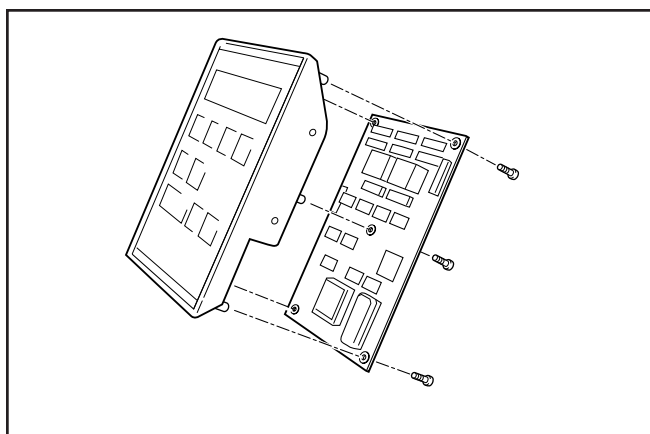


Figure 5-27: Removal of Control Board

I. Remove two (2) screws from the control panel stay.

J. Remove two (2) screws from the control panel stay.

K. Disconnect the following connectors from the control board:

(A) Wire Harness, Relay Board to Control Board J201 (10-pin)

(B) Drain Tank Switch J103 (2-pin)

(C) Room Temperature Thermistor J101 (2-pin)

(D) Freeze Thermistor J102 (2-pin)

(E) High Pressure Switch Sub-Harness

NOTE: Mark each of the 2-pin connectors with a different color marker to ensure the correct orientation when they are re-connected.

L. Remove the five (5) screws from the control

TROUBLESHOOTING AND REPAIR

board on the control panel assembly. Remove the control board.

11. Inspection of Capacitor (for Fan Motor and Compressor)

Ohmeter Method – Set the ohmeter to the 100K Ω range. Place the two probes against the two terminals of the capacitor. At first, the ohmeter should indicate 0 Ω , then the reading should gradually increase towards infinity (∞). This indicates that the capacitor is charging. If the reading indicates infinity right away (shorted) or the ohmeter fails to move from 0 Ω (open), replace the capacitor.

12. Capacitance Tester Method

Using a capacitance tester and the chart on page 15, test the capacitor for the value indicated. If the value tested is not within 10% of indicated capacitance, replace the capacitor.

⚠WARNING: Properly discharge the capacitor(s) before testing and after testing has been com-

pleted. Failure to do so could cause damage to test equipment or the unit and/or result in personal injury (electrical shock) or death.

13. Inspection of Drain Switch

Check for continuity between terminals 1 and 2. Continuity should exist. With switch depressed,

no continuity should exist between terminals 1 and 2. If continuity is not as specified above, replace the switch.

14. Inspection of Fan Motor

Measure resistance across the terminals of the fan motor.

Terminals (at 77°F (25°C))

J6-CF1 Approx. 6.8

J5-CF1 Approx. 14.8

CF1-CF2 Approx. 19.4

If the measured resistance is not equal to these standard values, replace the fan motor.

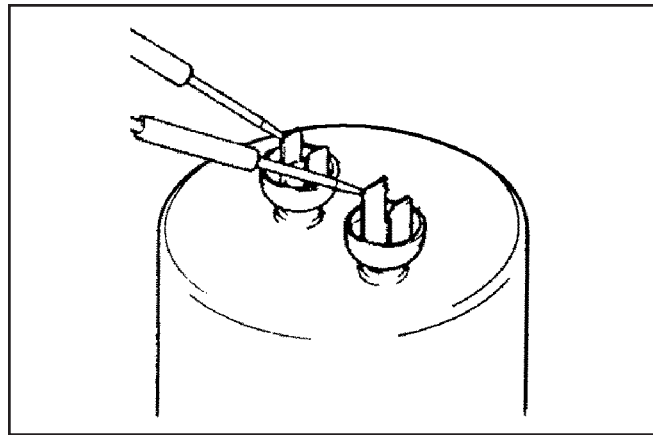


Figure 5-28: Inspection of Capacitor

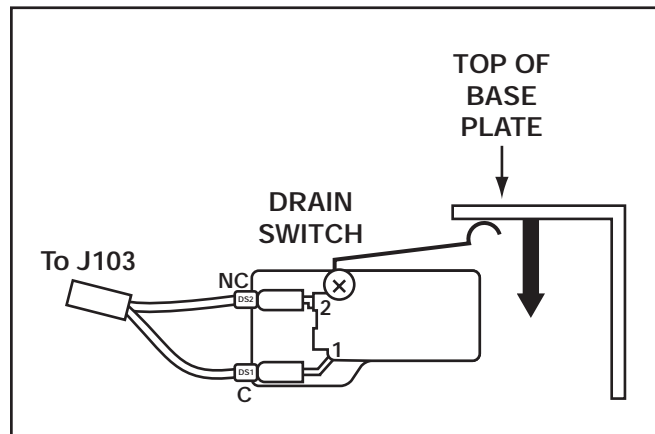


Figure 5-29: Inspection of Drain Switch

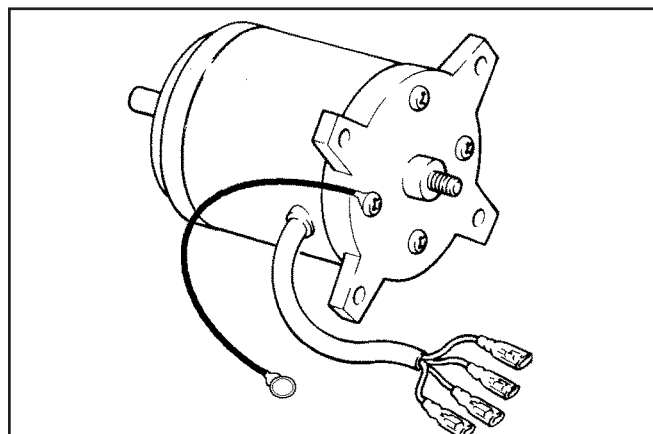


Figure 5-30: Inspection of Fan Motor

TROUBLESHOOTING AND REPAIR

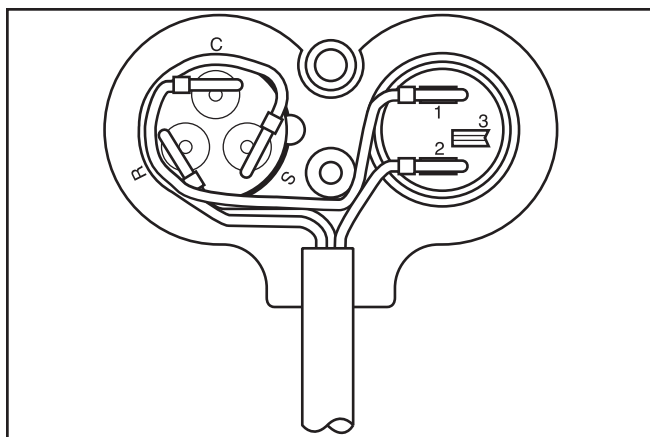


Figure 5-31: Inspection Of Compressor

15. Inspection of Compressor Motor

Measure resistance across the terminals of the compressor motor.

Terminals (at 77°F (25°C))

R-C Approx. 2.0Ω

C-S Approx. 2.2Ω

S-R Approx. 3.8Ω

If the measured resistance is not equal to these standard values, replace the compressor.

16. Inspection of Wiring Connection

Refer to the Wiring Diagrams on page 39 and check for connection of each wire.

17. Inspection of Thermistor

Using an Ohmmeter, check the resistance value across the 2-pin connector. At normal temperature (77°F (25°C)) either thermistor (room or freeze) should measure approximately 10,000 or 10K ohms.

18. Inspection

In most cases, the probable cause for insufficient cooling is a clogged system, too much static pressure/leakage or an incorrect amount of refrigerant. In such cases, inspect the system according to the following procedure.

A. Inspection of Clogged System

Check the component parts of the refrigerant system, including piping, that could be clogged with refrigerant. If clogged with refrigerant, only the clogged part is frosted partially. In such a case, change the part in question.

B. Inspection of Refrigerant Leak

Carefully check all connections, and each component for leaks whenever the refrigerant system is installed or repaired. Use an electronic gas leak tester to inspect the system.

C. Insufficient Refrigerant

In case the unit is judged to be deficient in cooling capacity, be sure to perform the inspections in 18A and 18B to confirm the cause of trouble. After that, charge the system with refrigerant to the specified amount.

TROUBLESHOOTING AND REPAIR

19. Repair of Refrigerant System

In case there is a leak, obstruction, or trouble in the refrigerant system of the Spot Cooling System, replace or repair the part in question. After replacing any component all connections must be brazed.

A. Proper Brazing Techniques

It is desirable to use a slightly reducing flame. Oxyacetylene is commonly used since it is easy to judge and adjust the condition of the flame. Unlike gas welding, a secondary flame is used for brazing. It is necessary to preheat the base metal properly depending on the shape, size or thermal conductivity of the brazed fitting.

The most important point in flame brazing is to bring the whole brazed fitting to a proper brazing temperature. Care should be taken to not cause overflow of brazing filler metal, oxidization of brazing filler metal, or deterioration due to the overheating of flux.

• BRAZED FITTING AND ITS CLEARANCE

In general, the strength of brazing filler metal is lower than that of the base metal. So, the shape and clearance of the brazed fitting are quite important. As for the shape of the brazed fitting, it is necessary to *maximize its adhesive area*. The clearance of the brazed fitting must be minimized to facilitate brazing filler metal to flow into it by capillary action.

• CLEANING OF BRAZING FILLER METAL AND PIPE

When the refrigerant system has been opened up, exposure to heat may have caused brazing filler metal to stick to the inside and outside of the pipe. Brazing filler metal may also be compounded with oxygen in the air to form oxide film. Fats and oils may stick to the pipe from handling. All these factors will reduce effectiveness of brazing. It is necessary to eliminate excess brazing filler metal using sand paper and by cleaning thoroughly with a solvent such as Trichlene.

• USE OF DRY NITROGEN GAS

During brazing, the inside of the pipe undergoes an oxidative reaction due to the brazing flame. Introduce dry nitrogen gas (1l/min.; adjust with the flow regulator) through the pinch-off tube of the refrigerant cycle to prevent oxidation.

NOTE: Take care not to allow dirt, water, oil, etc. to enter into the pipe

• VERTICAL JOINT

Heat the whole brazed fitting to a proper brazing temperature. Bring the brazing filler metal into contact with the fitting so that the brazing filler metal starts flowing by itself. Stop heating the fitting as soon as the brazing filler metal has flown into the clearance. Since the brazing filler metal flows easily into the portion heated to a proper temperature, it is essential to keep the whole fitting at a proper brazing temperature.

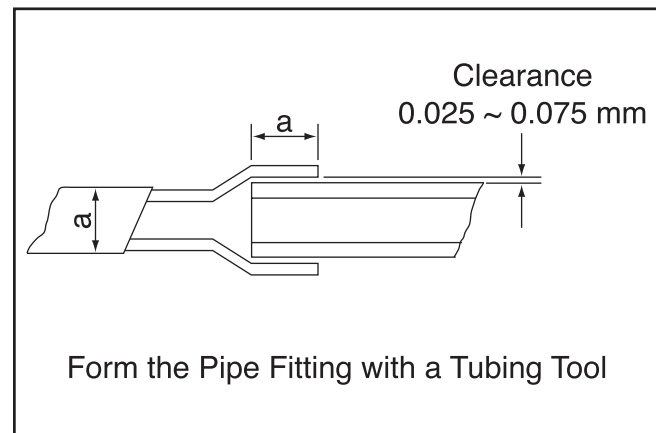


Figure 5-32: Form the Pipe Fitting

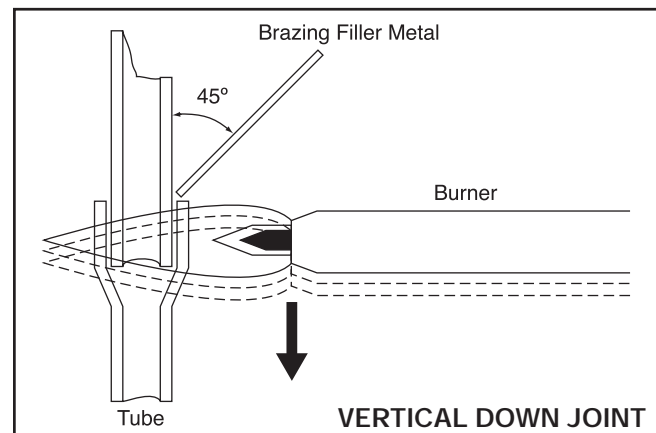


Figure 5-33: Vertical Down Joint

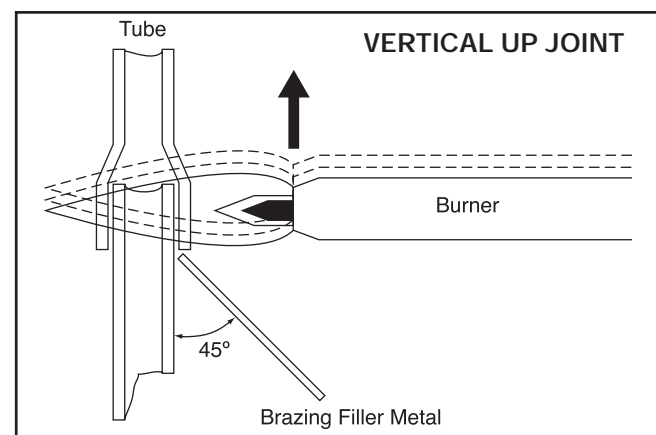


Figure 5-34: Vertical Up Joint

TROUBLESHOOTING AND REPAIR

B. Removal of Refrigeration Cycle Components

⚠CAUTION

1. Before any refrigeration cycle component can be replaced, it is necessary to recover the refrigerant using standard recovery procedures and equipment.
2. To prevent oxidation, dry nitrogen should be conducted (flow rate 1l/min) through the pinch-off tube during any brazing operation.
3. During any component replacement involving brazing, shield nearby parts with a steel plate, asbestos, etc., to protect them from the flame.

- (1) Evaporator
- (2) Capillary tubes
- (3) Condenser
- (4) Compressor

NOTE: Hold the compressor body, not the tube, when carrying the compressor.

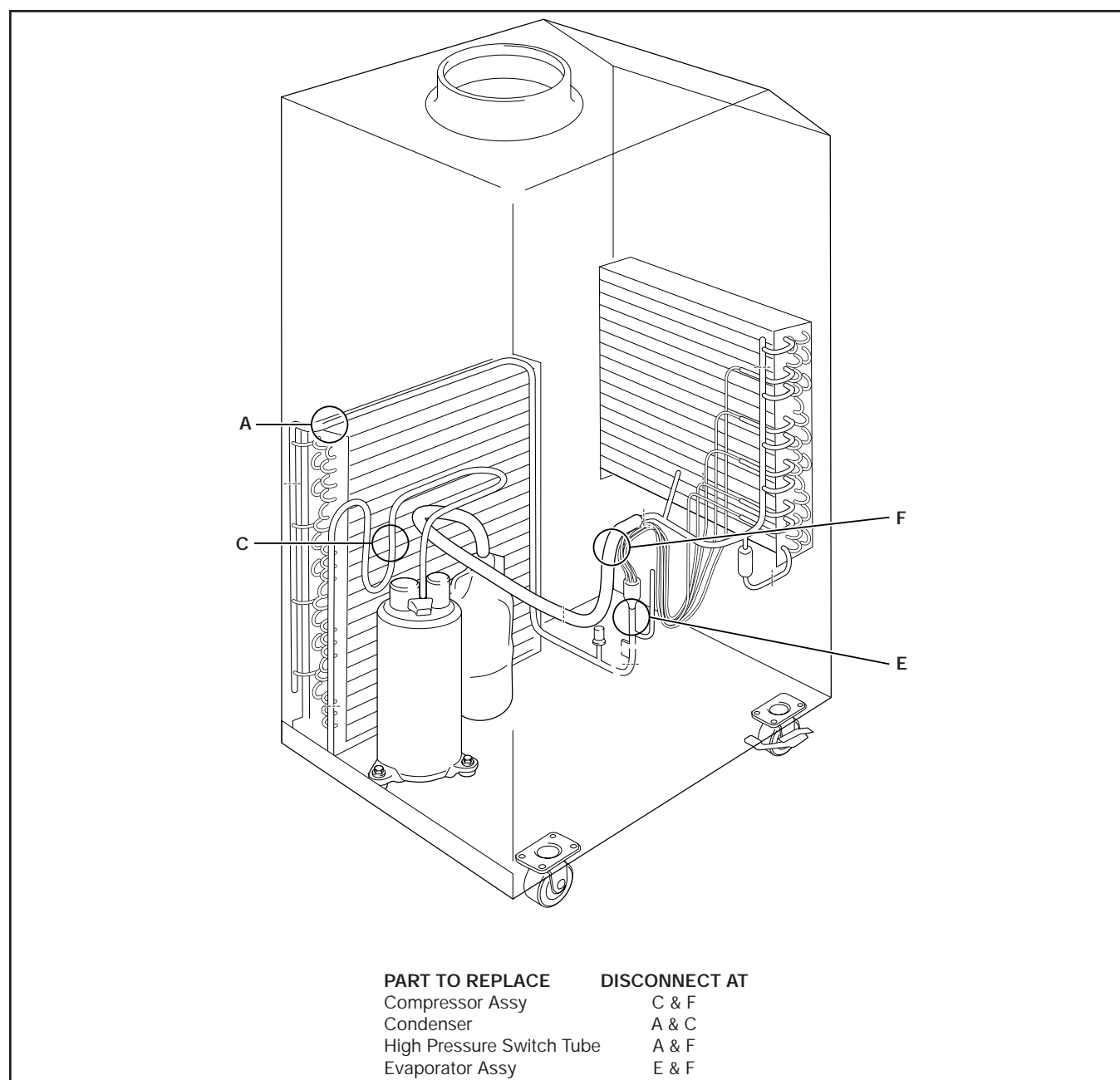


Figure 5-35: Refrigeration Cycle Components

TROUBLESHOOTING AND REPAIR

20. Charging the System with R-22 Refrigerant

Always ensure that the refrigerant system has been properly evacuated before charging with the specified amount of R-22.

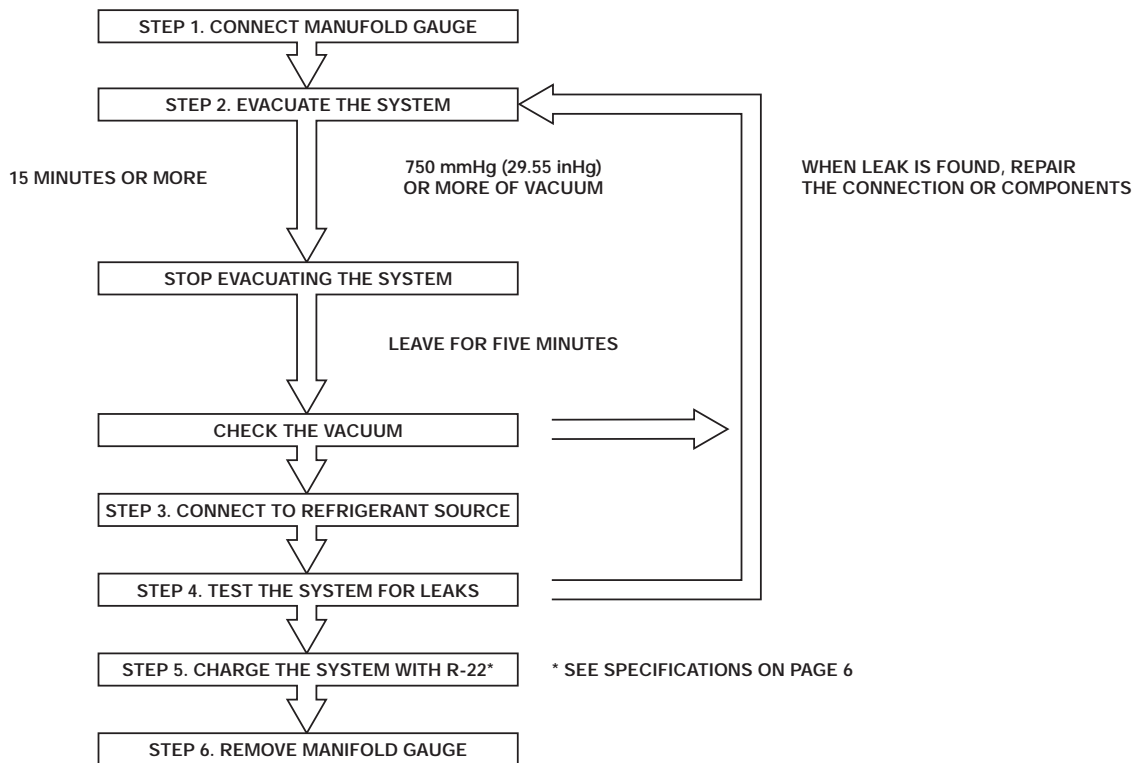
⚠WARNING

When handling refrigerant (R-22), the following precautions should always be observed:

- Always wear proper eye protection while handling refrigerant.
- Maintain the temperature of the refrigerant container below 40°C (104°F).
- Perform repairs in a properly ventilated area. (Never in an enclosed environment.)
- Do not expose refrigerant to an open flame.
- Never smoke while performing repairs, especially when handling refrigerant.
- Be careful the liquid refrigerant does not come in contact with the skin.

If liquid refrigerant strikes eye or skin:

- Do not rub the eye or the skin.
- Splash large quantities of cool water on the eye or the skin.
- Apply clean petroleum jelly to the skin.
- Go immediately to a physician or to a hospital for professional treatment.



A. Connection of Gauge Manifold

- (1) Properly remove the crushed end of the pinch-off tube at the high pressure side and the low pressure side of the refrigerant cycle with a pipe cutter.
- (2) Fit the process tube fitting to the pinch-off tube on both sides.

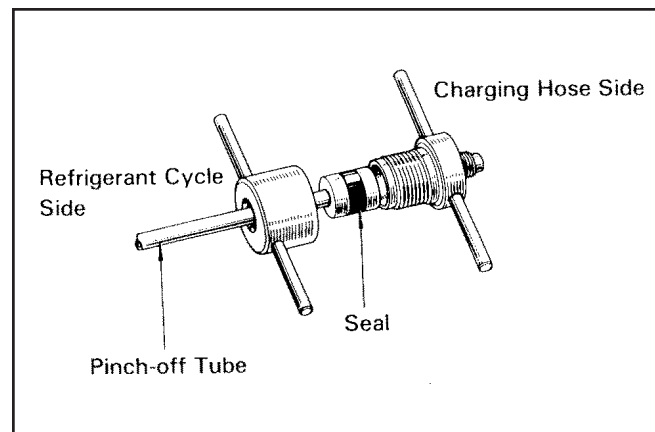


Figure 5-36: Connection of Gauge Manifold

TROUBLESHOOTING AND REPAIR

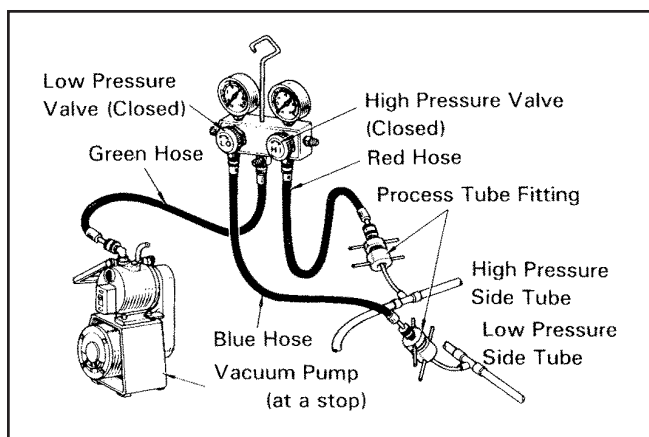


Figure 5-37: Hose Connection

- Connect the charging hoses (red - high pressure side, blue - low pressure side) of the gauge manifold to the process tube fittings.

NOTE: Connect the hoses using care not to mistake the high pressure side for the low pressure side and vice versa.

- Connect the charging hose (green) at the center of the gauge manifold to the vacuum pump.

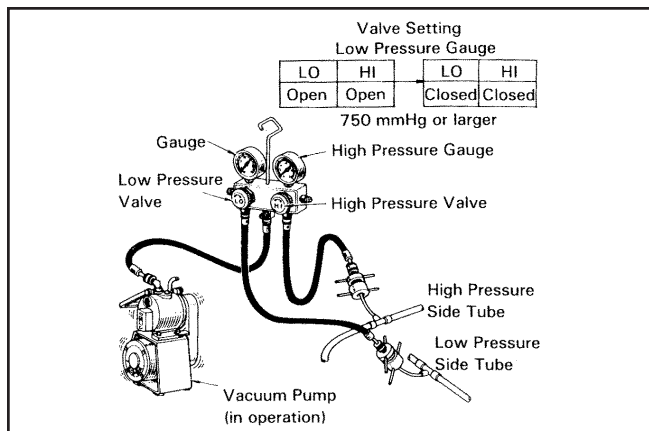


Figure 5-38: Evacuation

B. Evacuation

- Open the high pressure valve (HI) and the low pressure valve (LO) of the gauge manifold.
- Turn on the vacuum pump to start evacuation. (Evacuate the system for approximately 15 minutes.)
- When the low pressure gauge indicates 750mmHg (29.55 in.Hg) or larger, turn off the vacuum pump and close the high and low pressure valves of the gauge manifold.

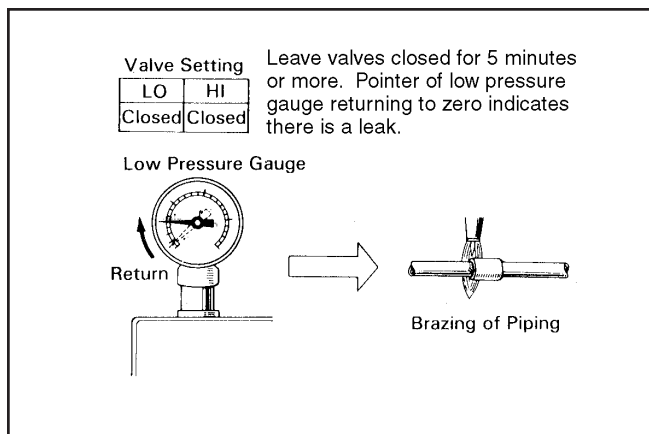


Figure 5-39: Checking Vacuum

C. Checking Vacuum

- Leave the high pressure valve and the low pressure valve of the gauge manifold closed for five minutes or more, and confirm that the gauge pointer does not return to zero.
- If the gauge pointer returns gradually to zero there is a leak somewhere in the system (this could also include gauge manifold). Perform leak check according to procedure indicated in 20D. Once leak has been found and repaired evacuate the system once more, and confirm system holds vacuum.

TROUBLESHOOTING AND REPAIR

D. Checking Gas Leak

- (1) Remove the charging hose (green) from the vacuum pump, and connect the hose to the refrigerant cylinder (R22).

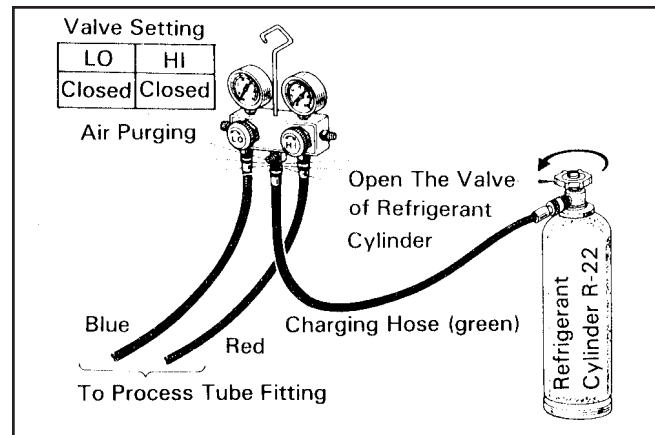


Figure 5-40: Checking Gas Leak

- (2) Loosen the nut on the gauge manifold side of the charging hose (green).
- (3) Open the high pressure valve of the gauge manifold. Charge the system with refrigerant until the low pressure gauge indicates 57 PSIG. (4 kg/cm²G.) After charging is complete, close the high pressure valve.
- (4) Check carefully for gas leaks inside the refrigerant system using the gas leak tester.
- (5) Repair any leak.

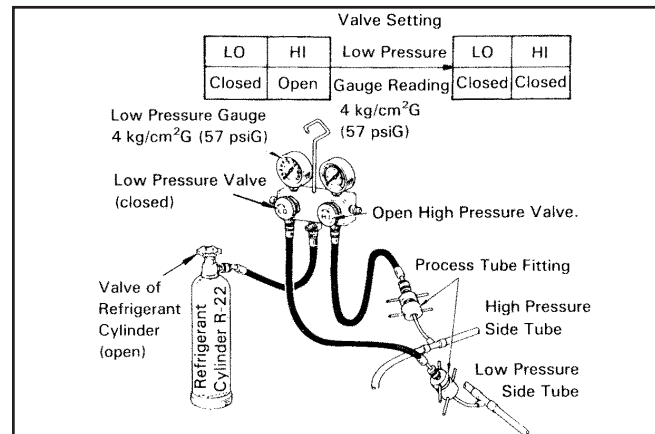


Figure 5-41: Still Checking Gas Leak

⚠WARNING: Do not attempt any repair on a charged system.

⚠WARNING: Before checking for gas leaks, fully confirm that there is nothing flammable in the area to cause an explosion or fire. Contact of refrigerant with an open fire generates toxic gas.

E. Evacuation (Repeat)

- (1) Close the valve of the refrigerant cylinder. Then remove the charging hose (green) from the refrigerant cylinder, and connect it to the refrigerant recovery machine.

NOTE: Keep the high pressure valve and the low pressure valve of the gauge manifold closed.

- (2) Using procedure 20B., evacuate the system until the low pressure gauge indicates 750mmHg (30in.HG) or greater. (For 15 minutes or more.)
- (3) After evacuation is complete, close the high and the low pressure valves of the gauge manifold.

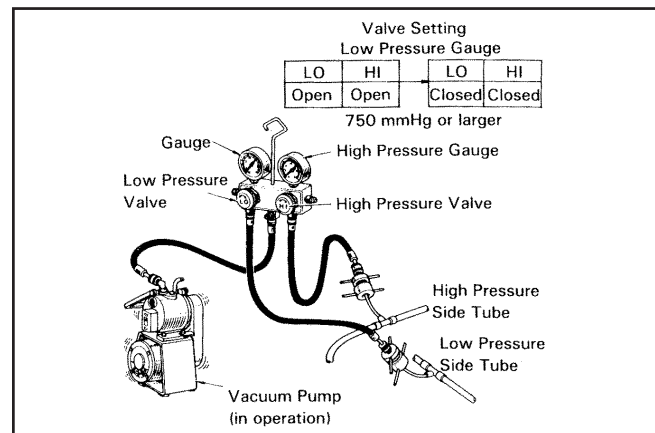


Figure 5-42: Evacuation

⚠CAUTION: Be sure to evacuate the system twice or more using the repetitive vacuum method. Evacuate the system an additional time on rainy or humid days.

TROUBLESHOOTING AND REPAIR

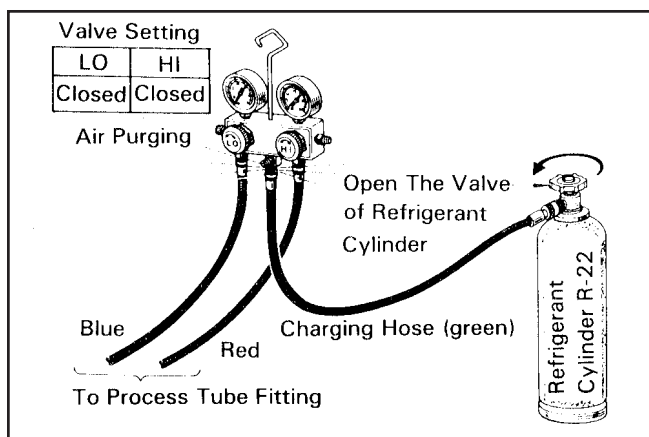


Figure 5-43: Refrigerant Charging Work

21. Refrigerant Charging Work

A. Refrigerant Charging

- (1) Remove the charging hose (green) from the vacuum pump, and connect it to the refrigerant cylinder (R-22).
- (2) Loosen the nut on the gauge manifold side of the charging hose (green). Open the valve of the charging hose (green). Open the valve of the refrigerant cylinder.

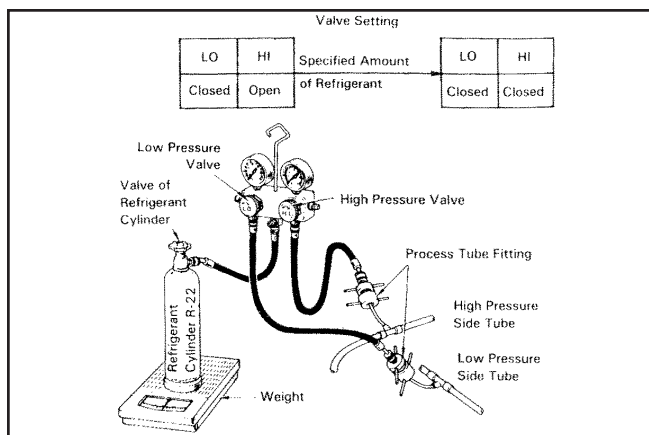


Figure 5-44: Refrigerant Charging Work

- (3) Securely place the refrigerant cylinder on a scale with a weighing capacity of 70 lbs (30 kg) that is graduated by 0.2 oz (5 g).
- (4) Open the high pressure valve of the gauge manifold and the valve of the refrigerant cylinder. Charge the system with refrigerant to the specified amount.

**Standard Amount of Refrigerant:
15.2 oz / 2.17 lbs (960g)**

If the system cannot be charged with the specified amount of refrigerant under this condition, follow the steps below:

- (a) Close the high-pressure valve of manifold.
- (b) Operate the refrigerant system.
- (c) Slowly open the low-pressure valve while observing the scale reading.
- (d) When the scale reads the specified amount, immediately close the low-pressure valve.
- (e) Bring the system to a stop.

⚠CAUTION: The amount of refrigerant charged has a great effect on the cooling capacity of the unit. Charge to the specified amount, always observing the scale graduations while charging.

- (5) Close the high pressure valve of the gauge manifold and the valve of the refrigerant cylinder.

TROUBLESHOOTING AND REPAIR

B. Removal of Gauge Manifold

- (1) Crimp the pinch-off tube with a pinch-off tool.
- (2) Remove the gauge manifold and the process tube fitting. Crush the end of the pinch-off tube.
- (3) Braze the end of the pinch-off tube.
- (4) Ensure that a gas leak is not present at the pinched off portion and the brazed end.

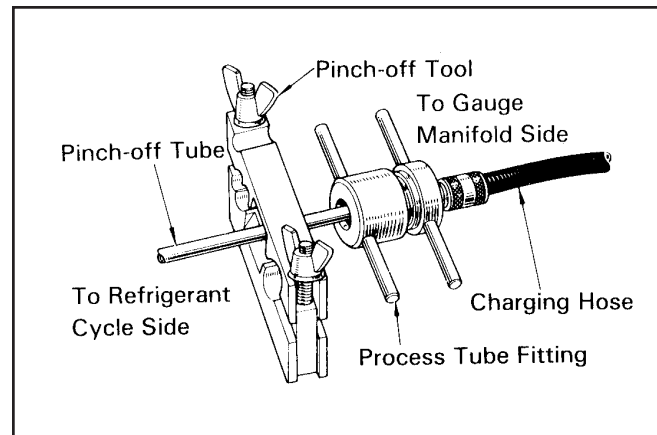


Figure 5-45: Removal of Gauge Manifold

Reassemble the unit in the reverse order of removal. Described below are the parts that require special care in reassembling the unit. Perform all wiring or rewiring as referenced in the wiring diagram.

22. Compressor Mounting

Mount the compressor on the frame, using cushions, steel collars, spring washers, plate washers and nuts.

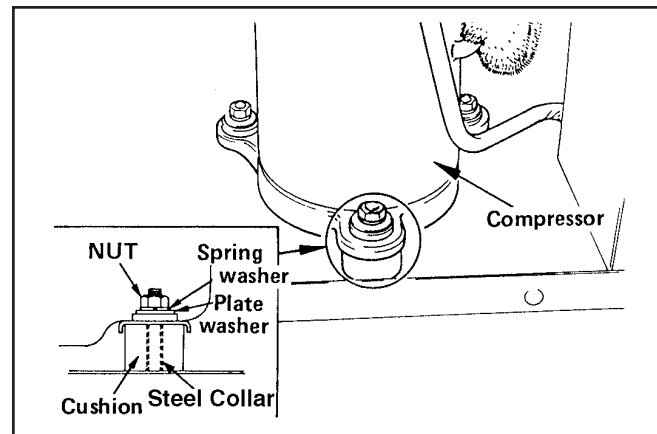


Figure 5-46: Compressor Mounting

23. Blower Assembly

Install blower fans (for evaporator and condenser).

Tightening torque:

10.84 ± 2.17 lbf•ft (150 ± 30 kgf•cm)

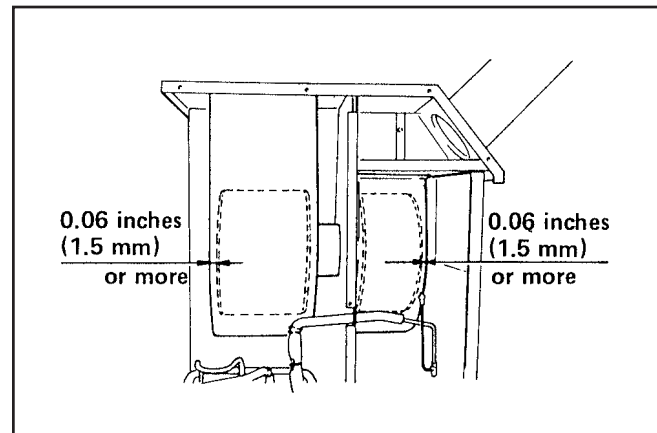


Figure 5-47: Blower Assembly

24. Wiring Notice

Secure the wires using clamps so that they do not come into contact with the edges of the structure, etc. Secure the wires using clamps in the same position they were before removal.

25. Perform the inspection of cooling capacity and check for abnormal noise or abnormal vibration.

TROUBLESHOOTING AND REPAIR

26. Schematic

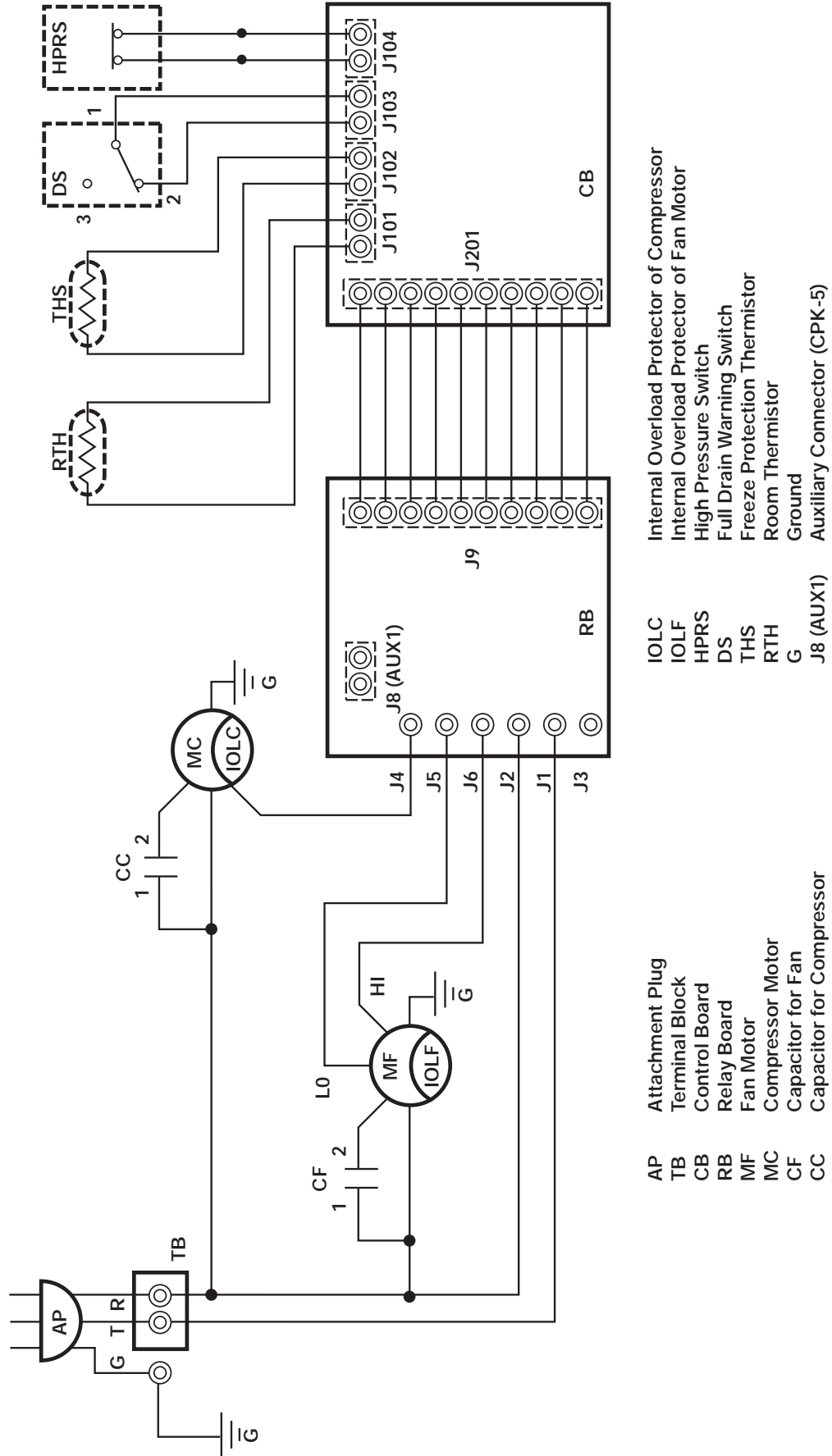


Figure 5-48: Wiring Diagram

TROUBLESHOOTING AND REPAIR

DENSO

DENSO SALES CALIFORNIA, INC.

TECHNICAL SERVICE DEPARTMENT

Second Issue: June 2000

DSCA P/N: LA990009-0531

Printed in U.S.A.

(800) 264-9573

www.movincool.com

DSCA P/N: LA990009-0531