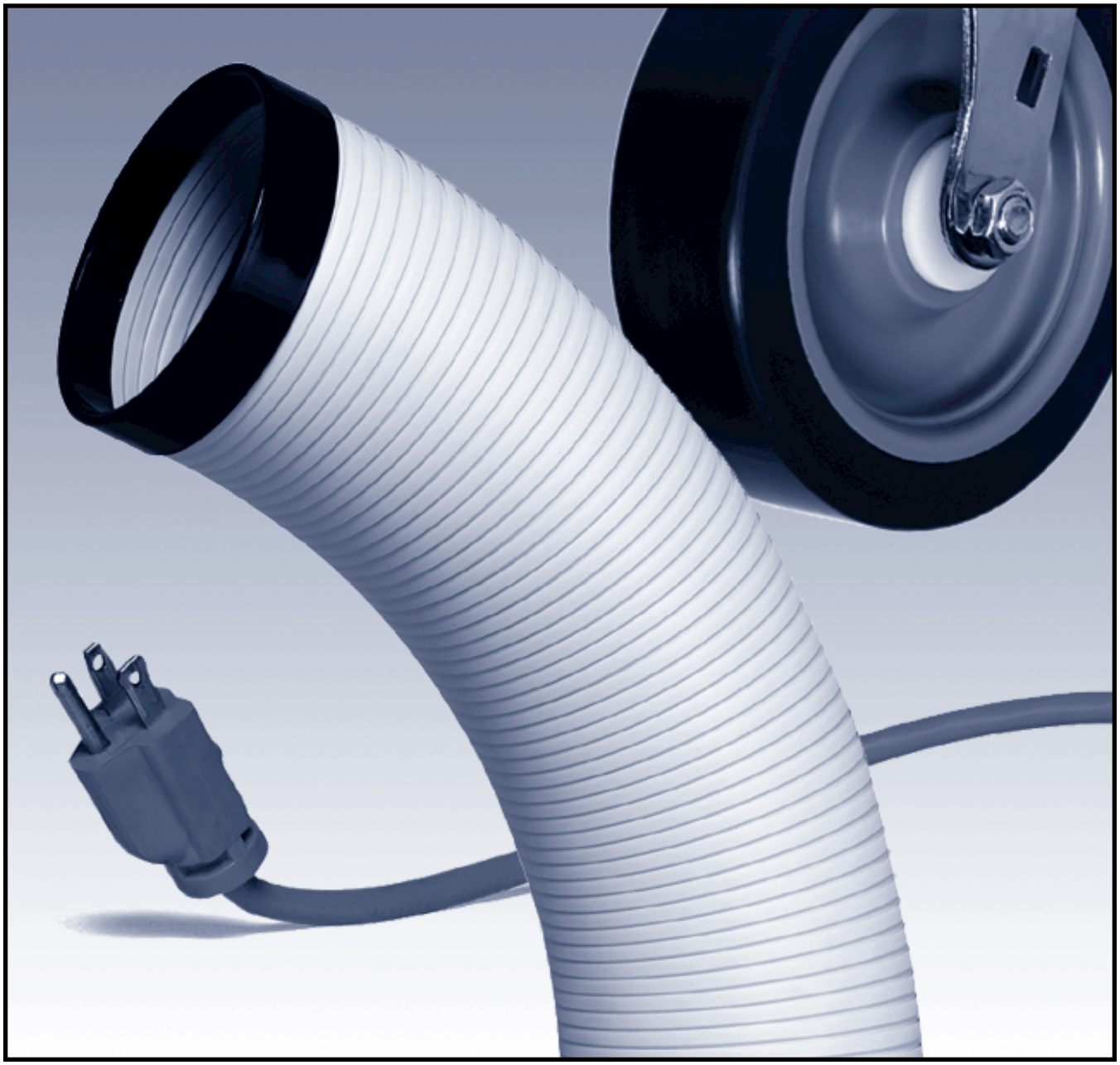
SERVICE MANUAL

OFFICE PRO 24



DENSO SALES CALIFORNIA, INC.
REGISTERED TO ISO 9002
FILE NO. A5537

MOVINCOOL®
Pioneering New Solutions With Portable Air-Conditioning

SERVICE MANUAL

OFFICE PRO 24

MOVINCOOL®

Pioneering New Solutions With Portable Air-Conditioning

FOREWORD

This manual has been published to service the MovinCool Office Pro 24. Please use this service manual only when servicing the Office Pro 24.

DEFINITION OF TERMS

⚠WARNING: Describes precautions that should be observed in order to prevent injury to the user during installation or unit operation.

⚠CAUTION: Describes precautions that should be observed in order to prevent damage to the unit or its components, which may occur during installation or unit operation if sufficient care is not taken.

NOTE: Provides additional information that facilitates installation or unit operation.

GENERAL PRECAUTIONS

⚠WARNINGS:

- **All electrical work if necessary, should only be performed by qualified electrical personnel. Repair to electrical components by non-certified technicians may result in personal injury and/or damage to the unit. All electrical components replaced must be genuine MovinCool, purchased from an authorized reseller.**
- **When handling refrigerant, always wear proper eye protection and do not allow the refrigerant to come in contact with your skin.**
- **Do not expose refrigerant to an open flame.**
- **The proper electrical outlet for MovinCool units must be equipped with a “UL” approved ground-fault breaker to prevent electrical shock from the unit.**
- **When brazing any tubing, always wear eye protection and work only in a well ventilated area.**

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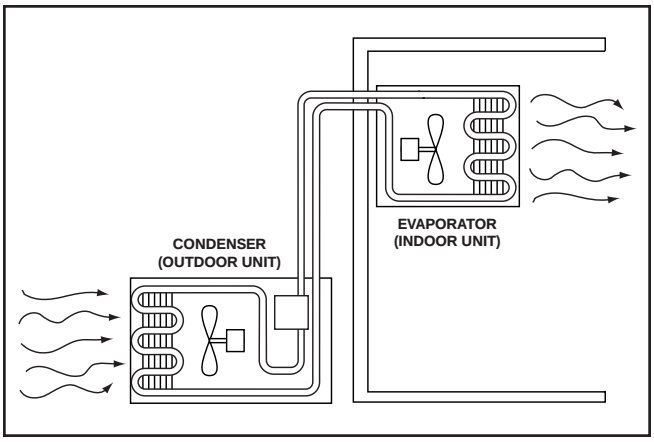
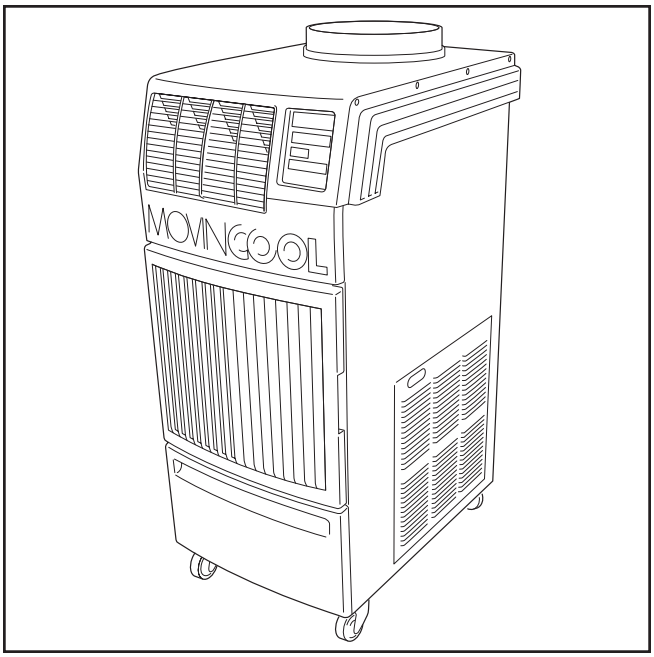
GENERAL DESCRIPTION



Conventional Air Conditioner

Generally speaking, conventional air conditioners cool the entire enclosed environment. They act as "heat exchangers", requiring an interior unit (evaporator) to blow cool air into the interior and an exterior unit (condenser) to exhaust exchanged heat to the outdoors. Unlike conventional air conditioners, the MovinCool Spot Cooling System is a spot cooler which directs cool air to particular areas or objects. MovinCool Spot Cooling Systems have the following features:



Office Pro 24

1. **Compact Design**
   The innovative design of MovinCool has resulted in one compact unit, replacing the need for two separate units.

2. **Easy Transportation and Installation**
   With the whole cooling system built into one compact unit, MovinCool requires no piping and can be easily transported and installed.

3. **Energy Conservation**
   MovinCool is economical because it cools only the area or objects which need to be cooled.

GENERAL DESCRIPTION

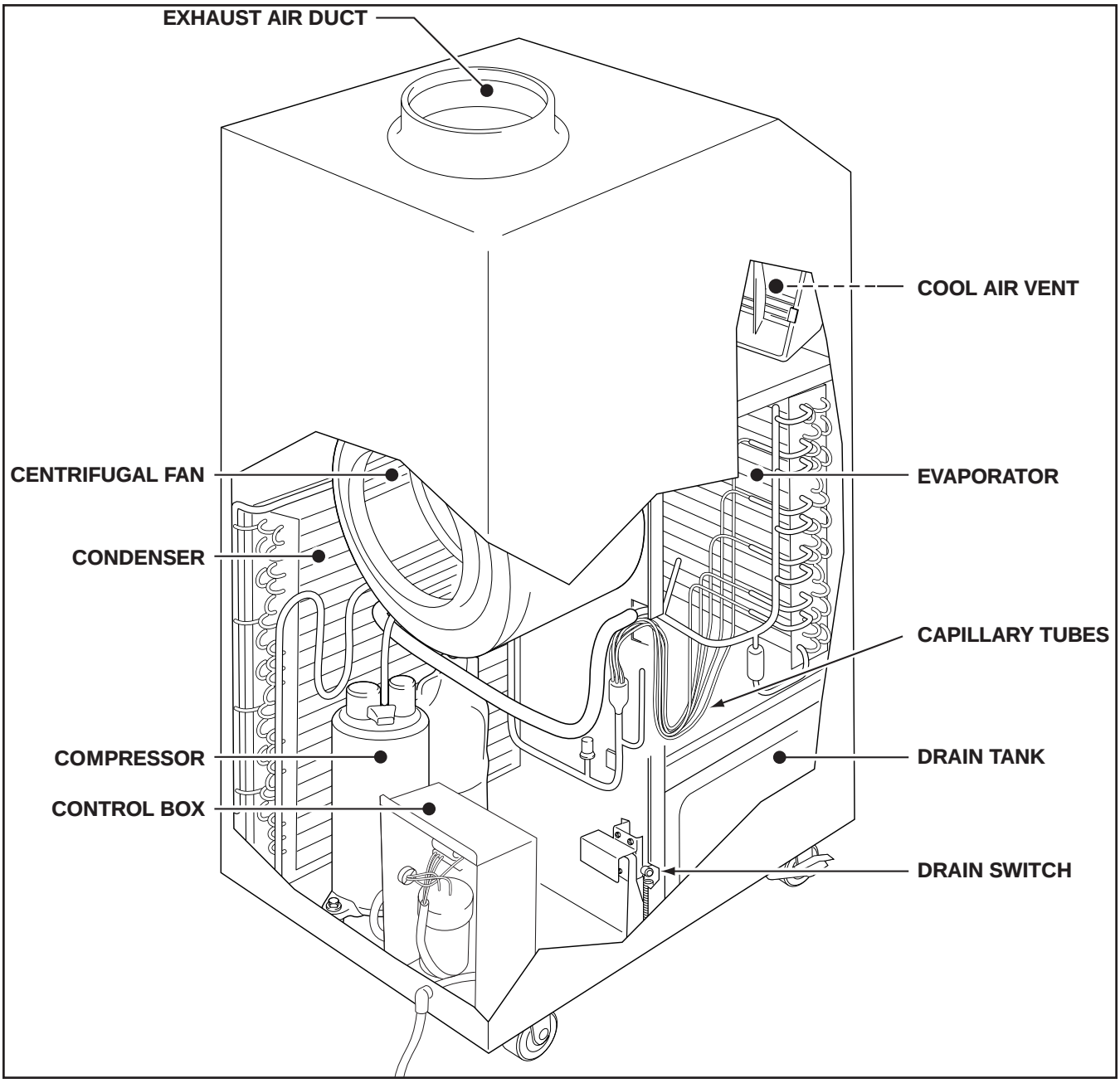


Figure 2-1: Construction of Office Pro 24

CONSTRUCTION, SPECIFICATIONS, and DATA

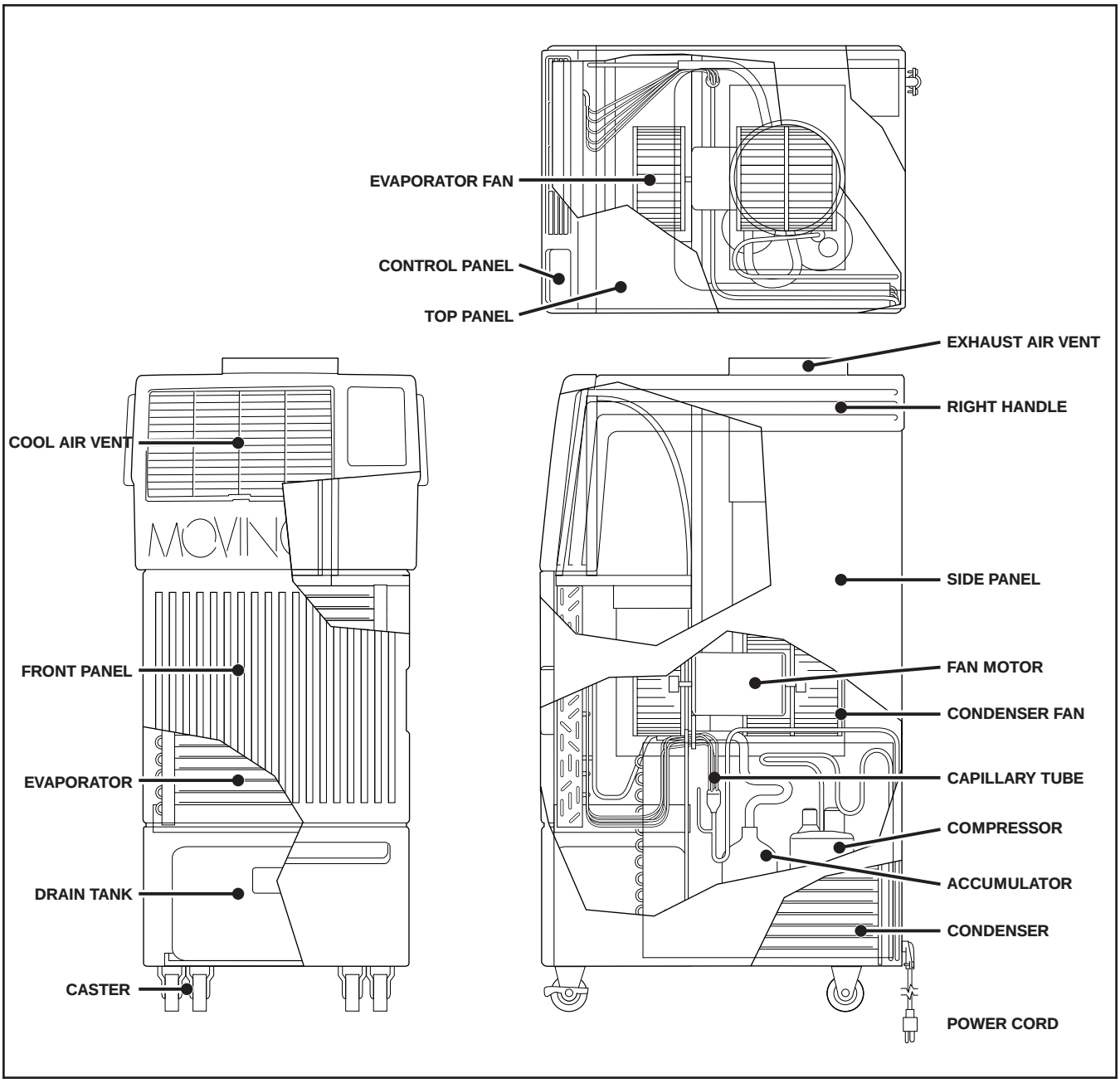


Figure 2-2: Construction Diagram

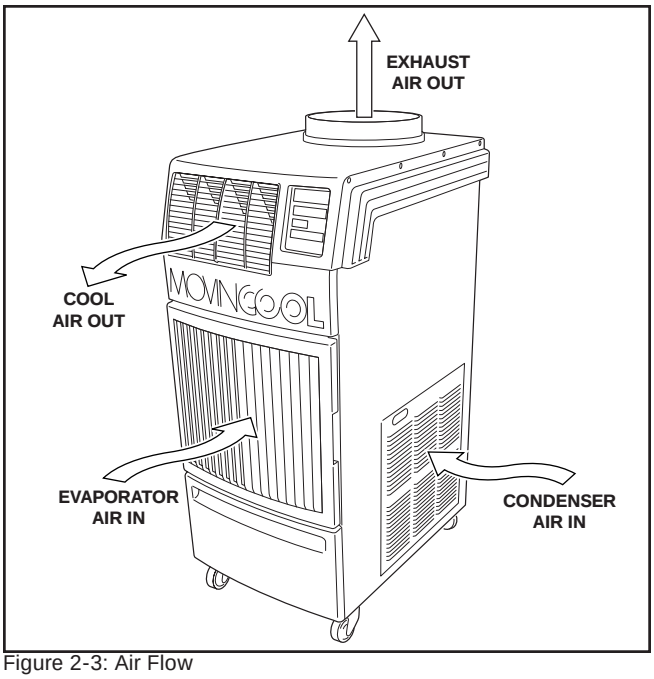


Figure 2-3: Air Flow

1. Basic Construction

The MovinCool Spot Cooling System is compact in construction because the condenser and the evaporator ar e enclosed in one unit. The interior is divided into thr ee sections. The upper fr ont face is equipped with the evaporator , while the lower fr ont face contains the drain tank. The r ear section contains the condenser , the compr essor and the contr ol box.

2. Air Flow

Air drawn fr om the right side face passes thr ough the condenser which extracts the heat. This hot air is blown out thr ough the upper exhaust air duct. Air taken in fr om the fr ont face is cooled by the evaporator and then blown thr ough the cool air vent. All the air inlets ar e equipped with filters, while the exhaust air duct is pr otected by wir e mesh.

3. Compressor and Fans

The compr essor is her metically sealed. A two-speed fan motor is used with two centrifugal fans to draw air acr oss the evaporator and condenser .

4. Drain Tank

The capacity of the drain tank is 5.0 gallons (19 liters). The unit is equipped with a "T ank Full" LED and a device to automatically stop the operation of the unit when the drain tank r eaches a level of appr oximately 4.0 gallons (15 liters).

CONSTRUCTION, SPECIFICATIONS, and DATA

Rating Conditions

dry bulb	95º F (35º C)
wet bulb	83º F (28.2º C)
humidity	(60%)

Specifications

power frequency	60Hz
line voltage	single phase 208/230V
power consumption	2.7 Kw
current consumption	13.1/11.8 Amps
power factor	99%
starting current	32.9A
power wiring	12 (3-core) AWG

Cooling Unit

cooling capability	6,000 Kcal/hr 24,000 BTU/hr
cooling system	direct expansion

Blower

type of fan		centrifugal fan
air volume:	Evaporator (High speed)	632 ft ^{3}/min (1068 m^3/h)
	Condenser (High speed)	867 ft ^{3}/min (1465 m^3/h)
motor output	(High)	0.48 Kw
	(Low)	0.41 Kw

Compressor

type	rotary
output	1.4 Kw
refrigerant type	R-22
refrigerant capacity	2.17 lbs (0.96 kg)

Safety Devices

compressor overload protector	included
fan motor protector	included
anti-freezing thermistor	included
full drain tank switch	included
automatic restart (power interruption)	included
compressor time delay program	included

Dimensions & Weight

W x D x H (in)	21.2" x 27.4" x 47.25"
W x D x H (mm)	538 x 696 x 1200
weight (lbs/kg)	210 / 95

Operating Conditions

inlet air (relative humidity)	95º F (35º C), ≤ 60% 65º F (18.3º C), ≥ 50%

Control Devices

temperature control	included
programmable timer	included
two speed fan	included

Specifications are subject to change without notice.

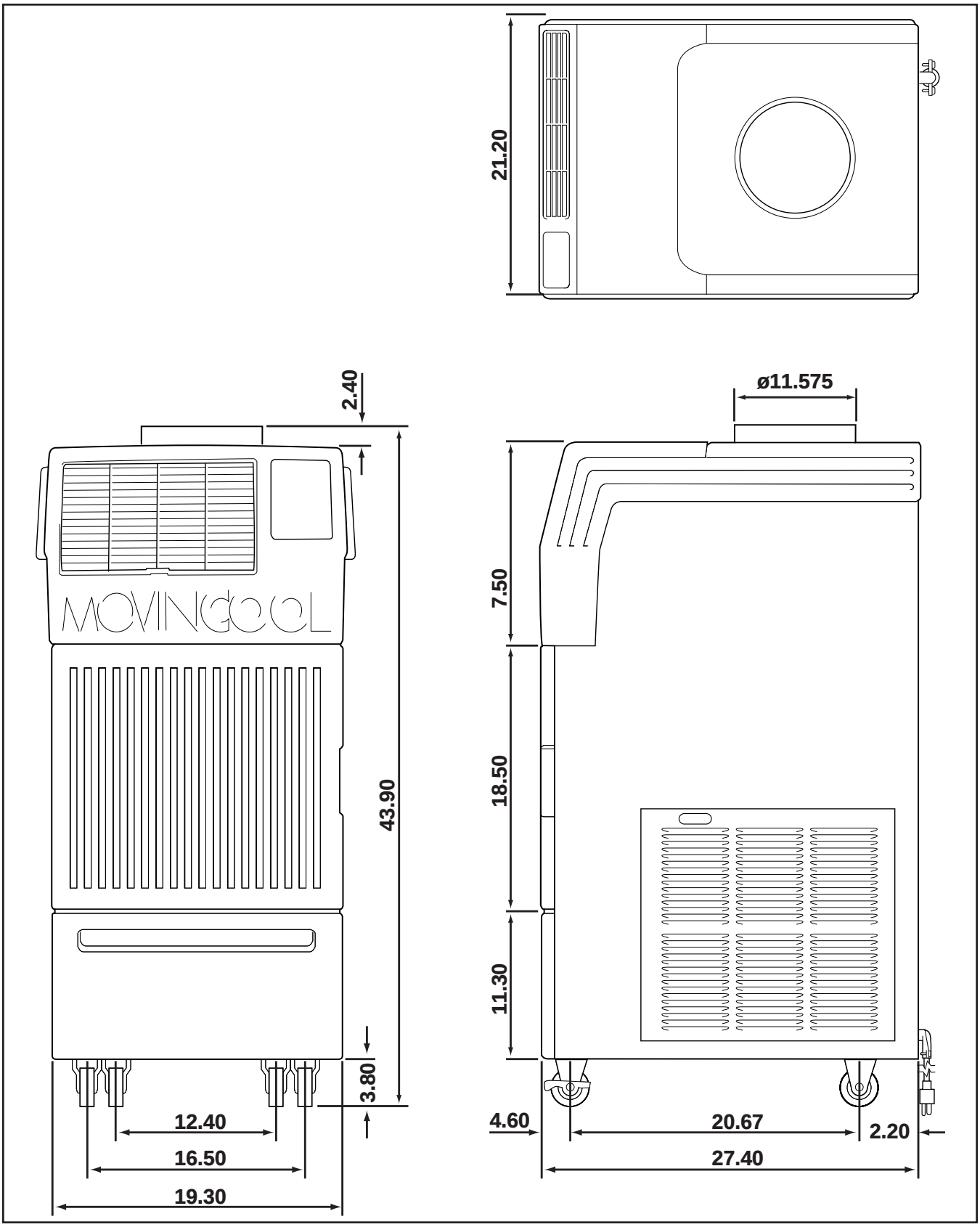
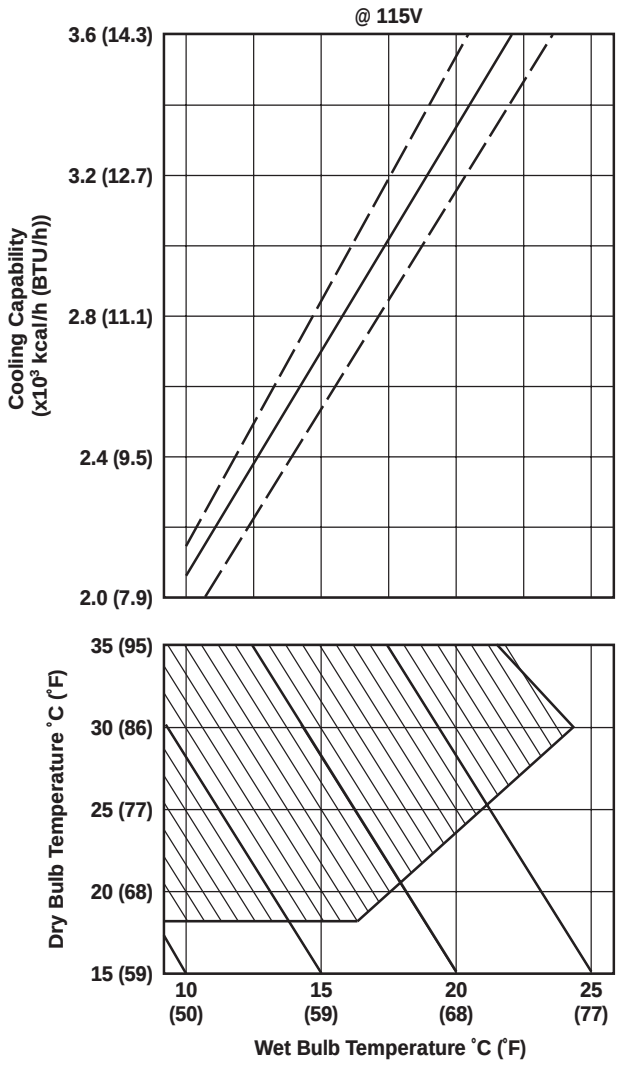
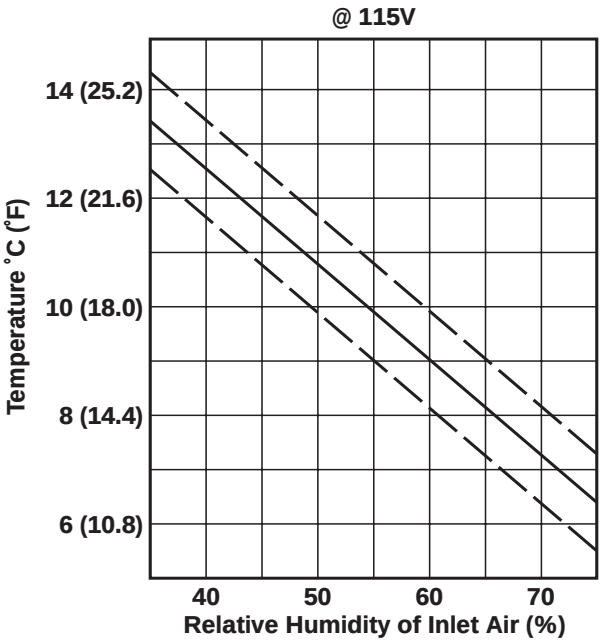


Figure 2-4: Exterior Dimensions (units: inches)

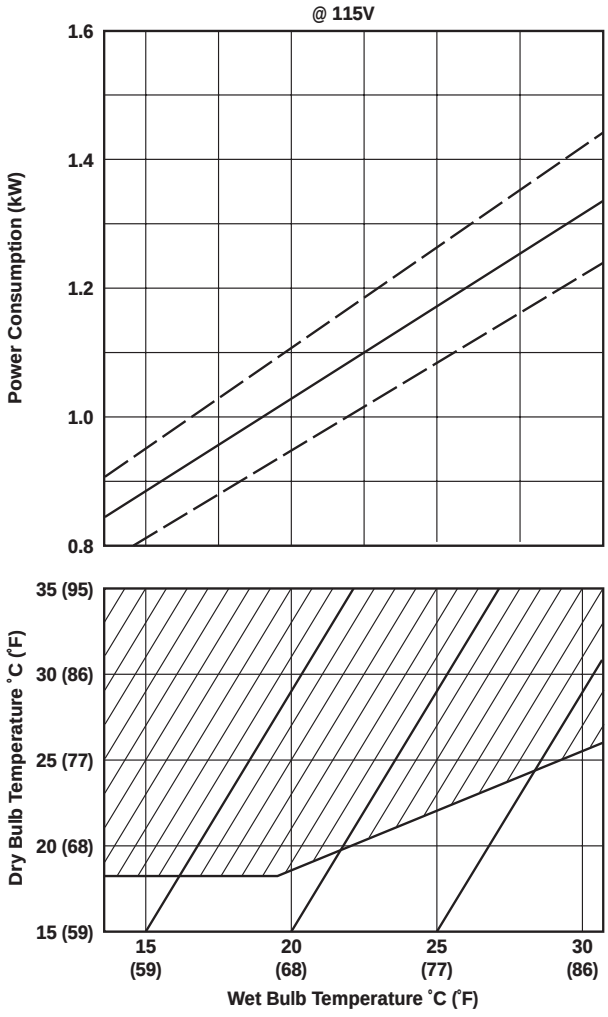
DATA



Cooling Capability Curve



Cool Air Temperature Difference Curve



Power Consumption Curve

1. The component parts of the refrigerant system include the following:

- Compressor
- Condenser
- Capillary tube
- Evaporator
- Accumulator

These parts are all connected by copper tubing. All the connections have been brazed.

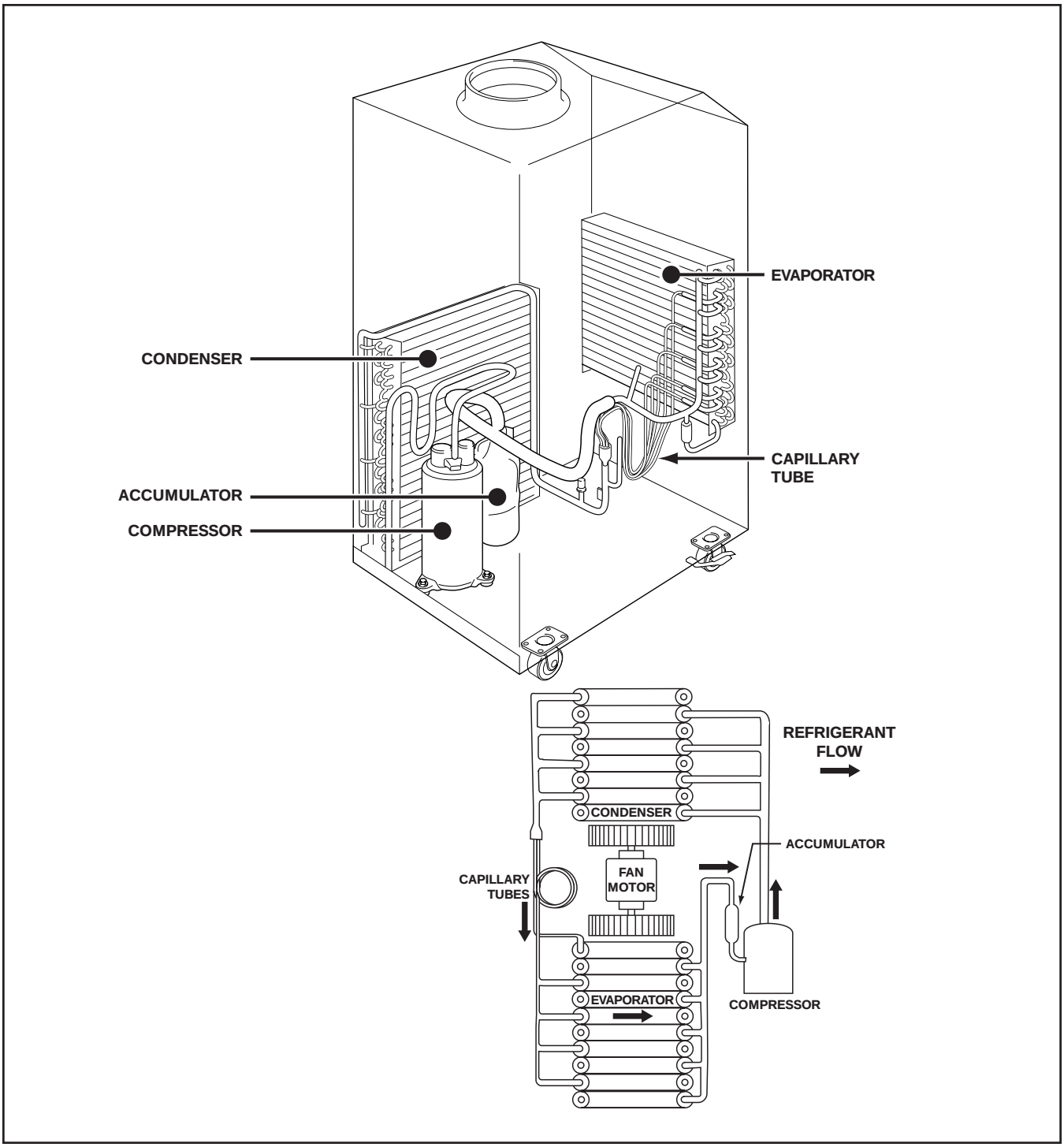


Figure 3-1: Refrigerant System

2. Compressor

The compressor used for the unit is hermetically sealed. The compressor and the compressor motor are in one casing.

A. Compressor Construction

The construction of a rotary type compressor is divided into two mechanisms. The drive mechanism (compressor motor) and the compression mechanism (compressor). When the rotor shaft of the motor (drive mechanism) turns, the roller of the compressor (compression mechanism) rotates to compress the refrigerant.

B. Basic Compressor Operation

The roller (compression mechanism) is set eccentrically with a certain distance given from the axis of the center of the cylinder. A spring loaded blade is mounted on the cylinder. The roller turns to compress the refrigerant in the space between the cylinder and eccentrically mounted roller.

The blade is in contact with the roller by means of spring force. It partitions the space between the suction side and the discharge side to keep compressed refrigerant from returning to the suction side.

There is no suction valve. The discharge valve is designed not to open until the pressure of the refrigerant within the cylinder reaches or exceeds that of the refrigerant on the discharge side. This design prevents the backward flow of discharge gas.

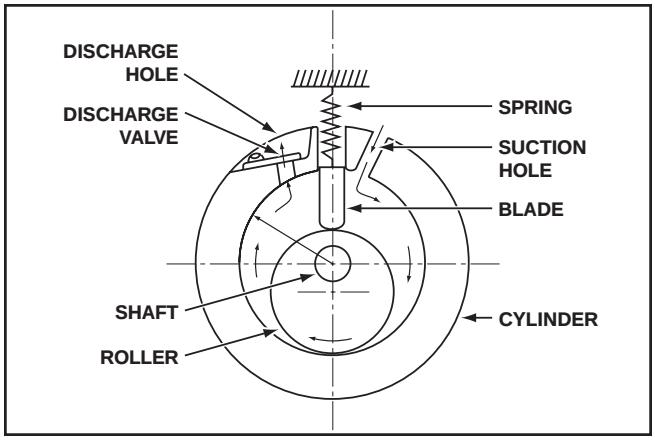


Figure 3-2: Compressor Operation

3. Condenser

The condenser is a heat exchanger with copper tubes that are covered with thin aluminum projections called spine fins. Heat is given off and absorbed by air being pulled across the condenser fins by the centrifugal fan and then expelled through the exhaust air duct.

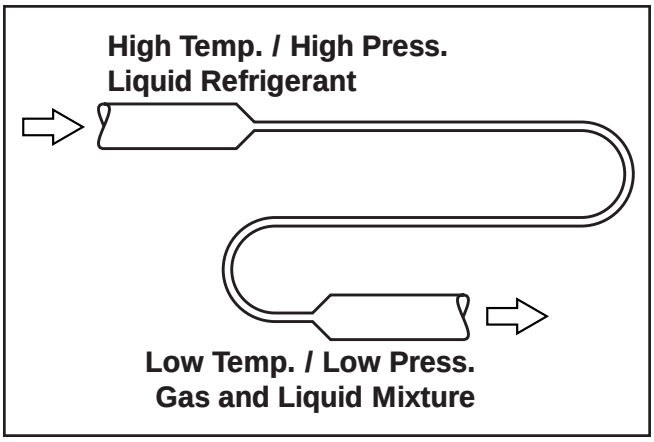


Figure 3-3: Capillary Tube

4. Capillary Tubes

The capillary tubes are a long thin tubes utilizing line flow resistance to serve as an expansion valve. The length and the inner diameter of the capillary tubes are determined by the capacity of the refrigeration system, specified operating conditions, and the amount of refrigerant.

The capillary tubes cause the high pressure, high temperature liquid refrigerant sent from the condenser to expand rapidly as the refrigerant is sprayed out through the fixed orifice in the capillary tubes. As a result, the temperature and state of the refrigerant become low and mist-like respecitively, causing it to evaporate easily.

5. Evaporator

The evaporator, like the condenser, is a heat exchanger utilizing plate fins. Heat is removed from the air being pulled across the evaporator by the centrifugal fan and the resulting cool air is expelled through the cool air vent.

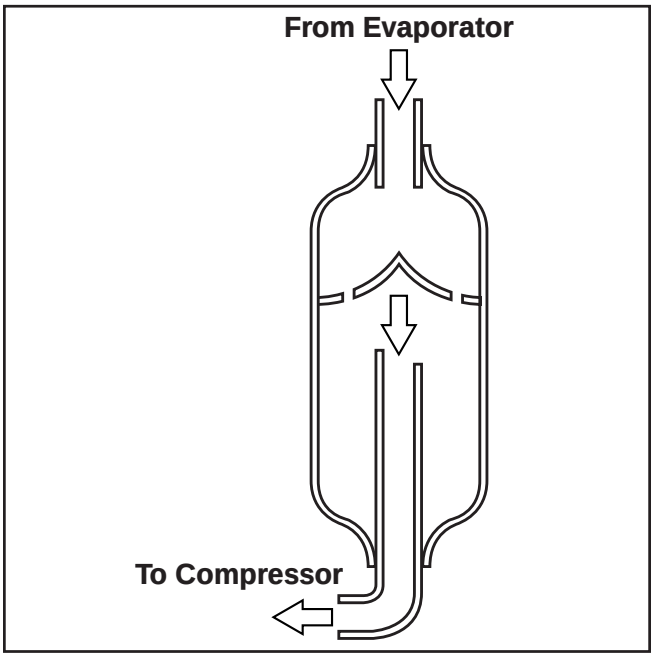


Figure 3-4: Accumulator

6. Accumulator

The accumulator is mounted on the suction gas piping between the evaporator and the compressor. The accumulator separates the liquid refrigerant from the gas refrigerant letting only the gas refrigerant enter the compressor. In the accumulator, suction gas is led into a vessel having a cylindrical body, and the gas speed is decreased inside the vessel. This separates the refrigerant contained in the gas by the force of gravity causing it to accumulate at the bottom of the vessel. This protects the compressor from possible damage caused by the intake of liquid refrigerant.

REFRIGERANT SYSTEM

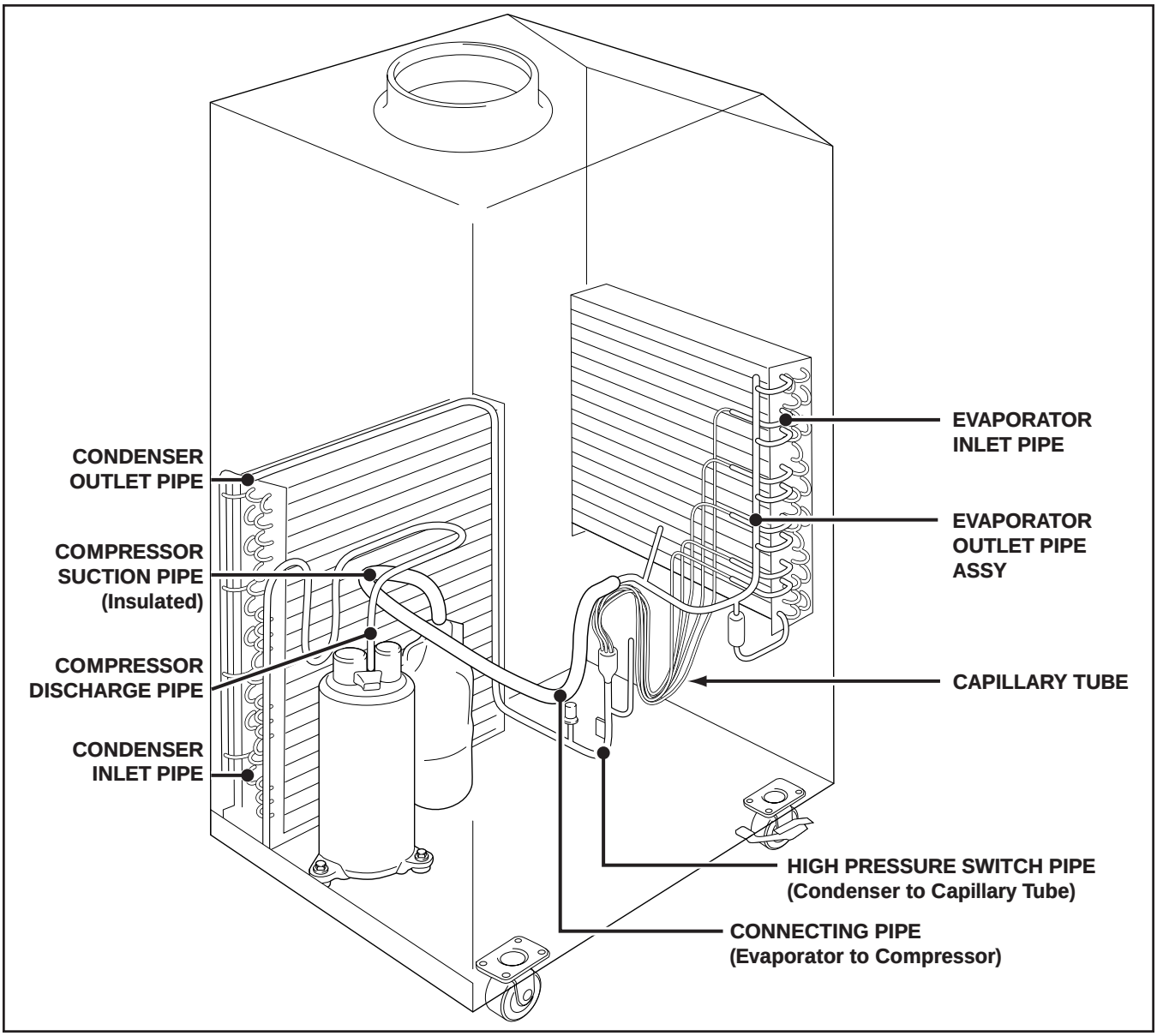
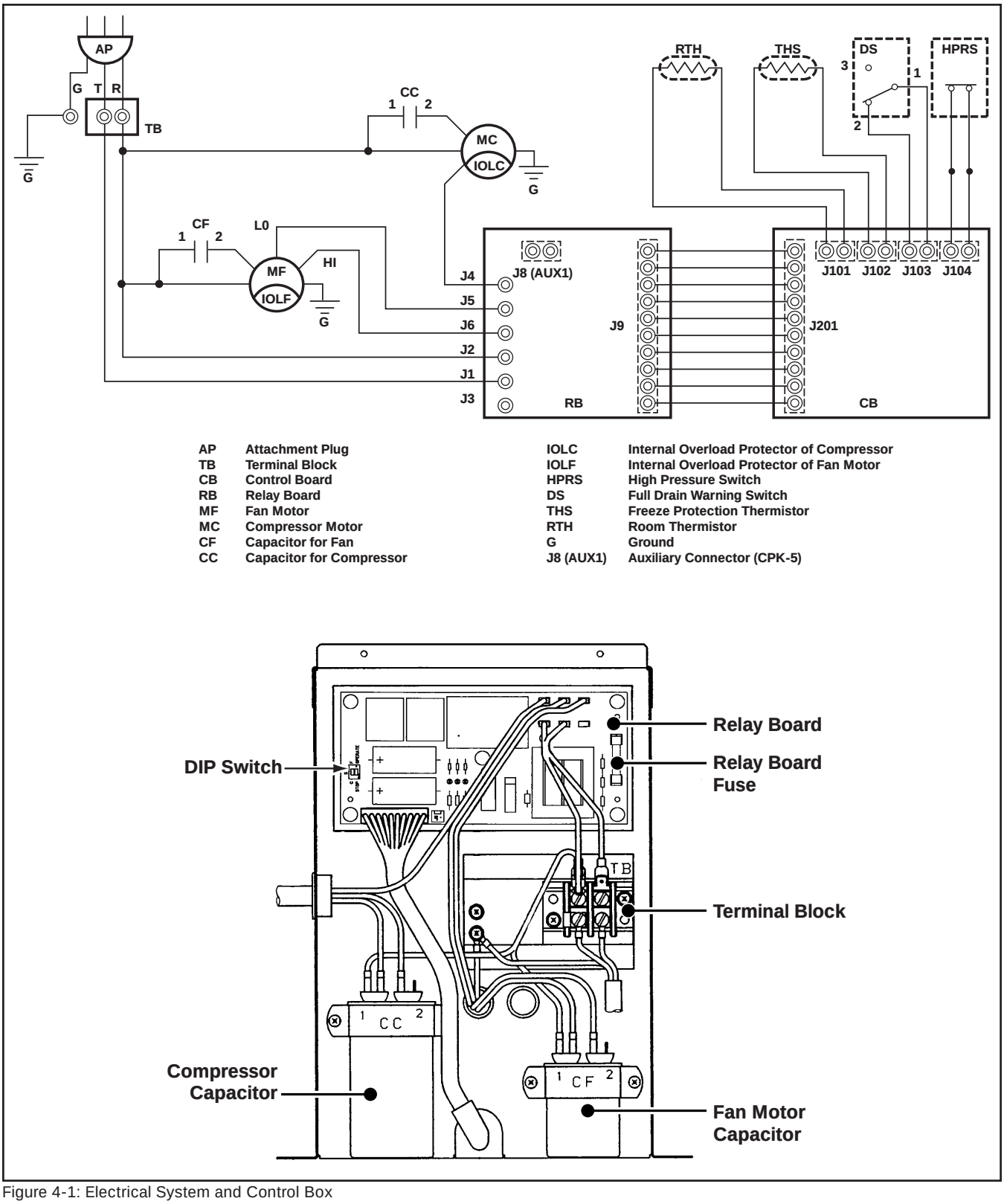


Figure 3-5: Refrigerant System Piping



AP	Attachment Plug	IOLC	Internal Overload Protector of Compressor
TB	Terminal Block	IOLF	Internal Overload Protector of Fan Motor
CB	Control Board	HPRS	High Pressure Switch
RB	Relay Board	DS	Full Drain Warning Switch
MF	Fan Motor	THS	Freeze Protection Thermistor
MC	Compressor Motor	RTH	Room Thermistor
CF	Capacitor for Fan	G	Ground
CC	Capacitor for Compressor	J8 (AUX1)	Auxiliary Connector (CPK-5)

Figure 4-1: Electrical System and Control Box

ELECTRICAL SYSTEM

1. Basic Operation of Office Pro 24 Electrical Circuit

There are two basic components used to control the operation of the Classic Plus 26 Electrical System:

- Control Panel Assembly
- Control Box

The Control Panel Assembly contains the Control Panel, Control Board (with inputs for the freeze and room temperature thermistors), drain switch, and a microprocessor.

A. Fan "Only" Mode

Low Fan Mode - When the "Low" Fan Mode button on the control panel is pressed, the microprocessor turns on the button's LED and activates the Fan "On" Relay (Relay Board), sending line voltage (208/230 VAC) to the N.C. (Normally Closed) contacts of the fan "mode" relay. This output is connected to the J5 terminal (relay board) where the LOW SPEED wire of the fan motor is connected.

High Fan Mode – When the "High" Fan Mode button on the control panel is pressed, the microprocessor turns on the button's LED and activates both the Fan "On" Relay and Fan "Mode" Relay. This sends line voltage (208/230 VAC) from the Fan "On" Relay to the N.O. (Normally Open) contacts of the Fan "Mode" Relay. This output is connected to the J6 terminal (Relay Board) where the HIGH SPEED wire of the Fan Motor is connected.

B. Cool Mode - In Addition to Fan "Only" Mode (as described above)

When the Cool On/Off button on the control panel is pressed, the microprocessor turns on the button's LED and if the Temperature Set Point is less than the current room temperature, activates the Compressor Relay (Relay Board). This sends line voltage (208/230 VAC) to the J4 terminal (Relay Board) where the wire from the Compressor wire harness is connected.

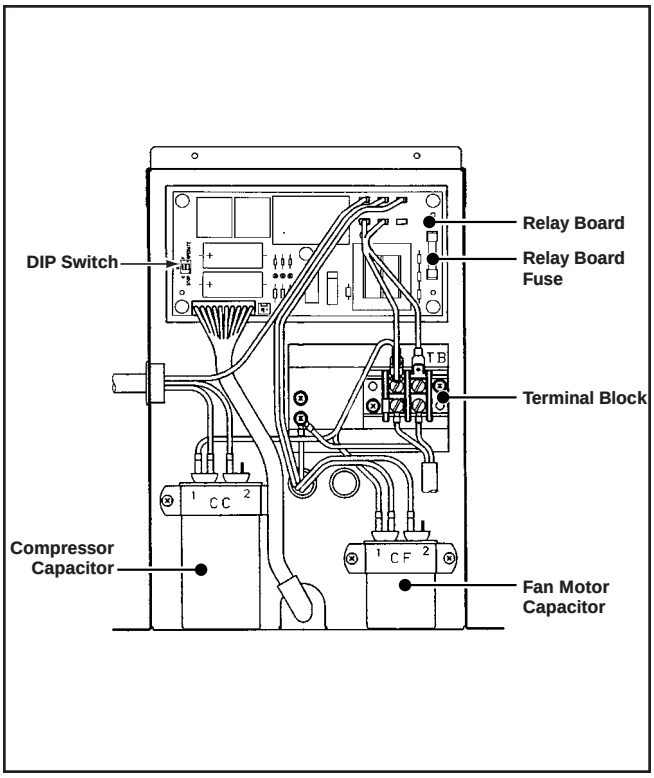


Figure 4-2: Control Box

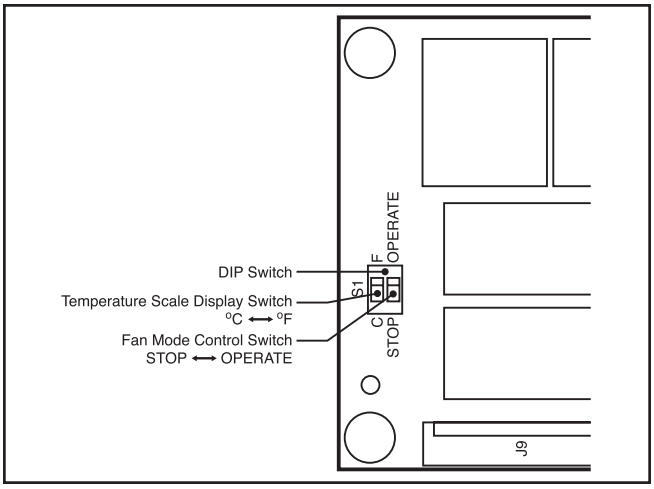


Figure 4-3: DIP Switch

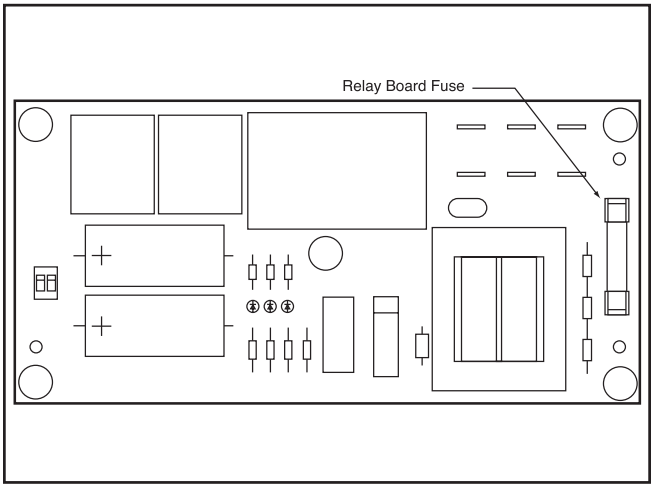


Figure 4-4: Relay Board

2. Control Box

A. Capacitors

The capacitors are used to temporarily boost the power output available to the fan motor and the compressor at start-up.

The specifications of each capacitor are listed below:

CAPACITOR APPLICATION	VOLTAGE RATING	CAPACITANCE (μf)
Fan Motor	440	12.5
Compressor	440	50

B. Relay Board

The Relay Board receives signals and outputs from the control board that contains a micro-processor. The relay board contains the compressor, fan on and fan mode (speed) relays. It also contains a step-down transformer that converts the line voltage (230 VAC) to 16 volts. This is then converted from AC to DC and used for relay coil activation. The 16V (DC) power is sent to the Control Panel Assembly where it is further reduced to 5 volts for the system logic.

The relay board also contains the DIP-Switch. The DIP-Switch is used to change the Fan Mode operation from Stop to Operate and change the Set Point temperature display from ˚F to ˚C.

NOTE: The relay board must be serviced as a complete assembly. It has only <u>one</u> serviceable component, the fuse.

(a) Relay Board Fuse

NOTE: The relay board fuse is the <u>only</u> serviceable component on the relay board assembly.

This fuse provides protection against damage to the step-down transformer. It must be replaced with the exact type of fuse or an equivalent.

Fuse Specifications: 2/10A 250V

⚠CAUTION: Failure to use the exact type of fuse could result in damage to the unit and/or to components. It will also void the warranty of the unit.

3. Fan Motor

The fan motor is a single phase, induction type two-speed motor . The motor r otates fans on the evaporator side and the condenser side at the same time.

Specifications: Rated V oltage: 230 volts 60 Hz
Rated Output: 480 watts
410 watts

4. Compressor Motor

The compr essor motor is a single phase motor . It is contained within the same housing as the compr essor.

Specifications: Rated V oltage: 230 volts
Rated Output: 1400 Watts

NOTE: An internal overload relay is used to protect the compressor motor and fan motor. This relay is built into the compressor motor and fan motor and will interrupt the flow of current when there is an overcurrent situation or if abnormally high temperature builds up in the compressor motor or fan motor.

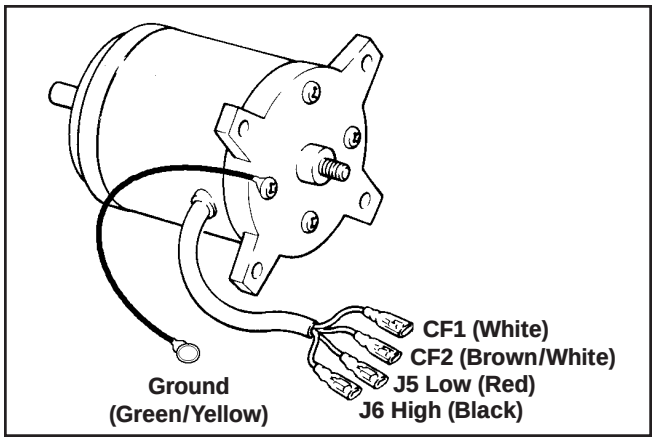


Figure 4-5: Fan Motor

6. Drain Switch

The Office Pro 24 is equipped with a drain tank switch. When the drain tank accumulates approximately 4.0 gallons (15 liters) of condensate (water) in the drain tank, the drain tank switch sends a signal to the microprocessor. The microprocessor stops all operation of the unit and flashes the "Tank Full" LED.

This system utilizes a .1 AMP, 250 VAC micro-switch for this function. When drain water accumulates approximately 4.0 gallons (15 liters) in the drain tank, the drain tank base plate, which is supported at its fulcrum, is pushed down in the arrow direction as shown in the figure below. When the drain tank base plate is forced down, the top of the drain tank base plate turns off the contacts (1) – (2) of the micro switch. This causes the ground signal at the J103 connector of the control panel assembly to go open. When the microprocessor detects this event, it shuts the unit off and flashes the "Tank Full" LED.

When the drain tank is removed (or the drain tank is emptied), the top of the drain tank base plate returns to its original position from the tension of the coil spring. Then contacts (1) – (2) of the drain tank switch close. This provides a ground to the microprocessor through the J103 connector.

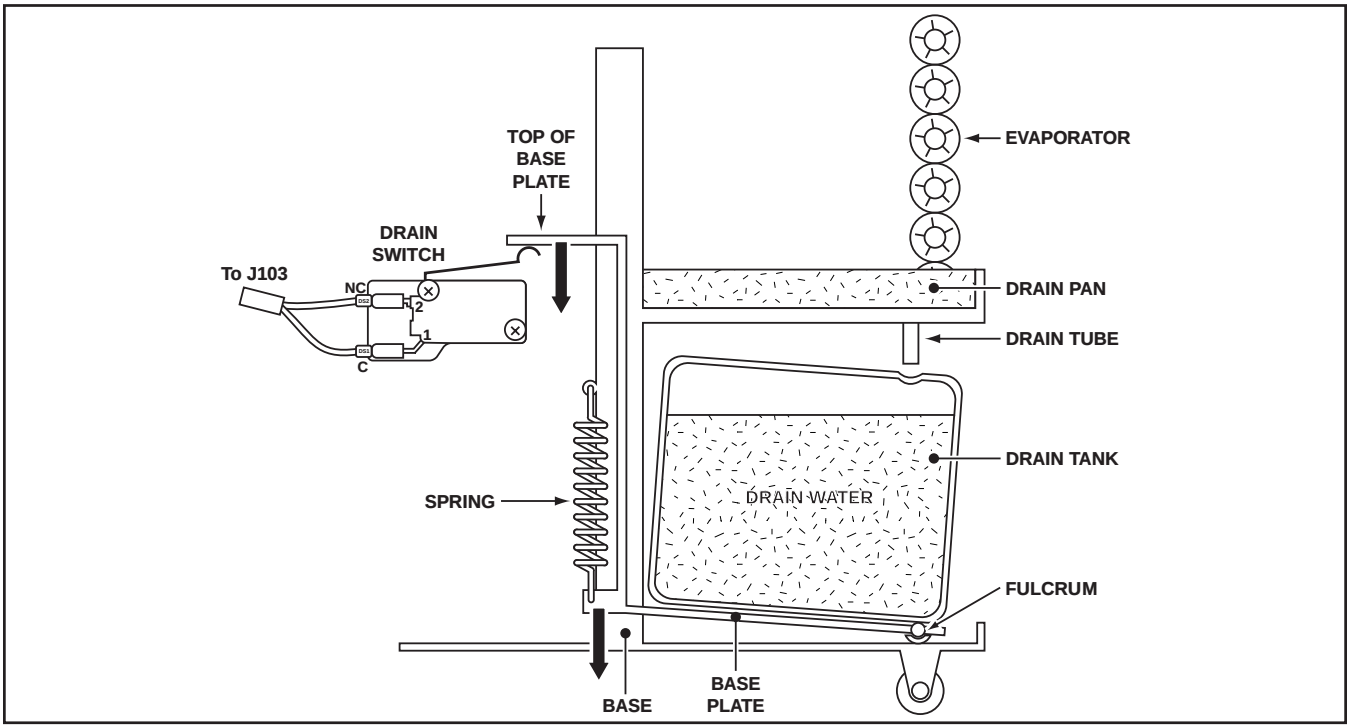


Figure 4-6: Operation of Drain Switch

7. How to re-start the unit

If the program "Run" LED is flashing, press the "Cool On/Off" button to continue running the program. If the program "Run" LED is illuminated continuously (program activated), no further steps are necessary. If no program exists or the program was "deactivated", press one of the fan mode buttons or the "Cool On/Off" button. The unit will return to the previous Temperature Set Point.

8. Condensate Pump Kit (optional)

The Office Pro 24 model comes standard with a drain tank, which collects the water that forms on the evaporator during normal cooling operation. If the MovinCool unit is required to operate continuously without periodic emptying of this tank, a condensate pump may be needed. A condensate pump kit (CPK-5) is available for the Office Pro 24 model.

9. Automatic Restart after Power Interruption

The program within the microprocessor of the Office Pro 24 contains a feature that will automatically re-start the unit after power is lost and then regained. The unit also has memory in order to return itself back to the operating mode (either Manual or Preset Program) it was in prior to the loss of power. Any "Preset" Program will also be retained in the memory in the event power loss occurs.

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 thermistor (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 Contol 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 thermistor that it uses to control the compressor. In this case, <u>both the fan and the compressor stop</u> when the microprocessor receives a sufficiently low intake air (room temperature) signal from the thermistor (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 Celcius (˚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 Far enheit (˚F). The LED that indicates ˚F will also be illuminated (this is the "factory default" setting).

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
Unit does not operate at all	• 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
Unit starts, but stops immediately	• Room temperature and anti-freeze thermistor connectors are reversed on control board • Defective Fan Motor • Defective Compressor Motor • Defective Relay Board
Unit operates, but stops after a few minutes	• 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	• Drain Tank not installed • Drain Tank is defective (cracked) • Drain Pan hole is obstructed
Abnormal noise and/or shaking	• Loose Compressor mounting nut • Deformed or worn rubber grommet on the compressor mounting bolt • Internal interference with other components • Damaged or out of balance fan
Insufficient Air Flow	• 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	• 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
Display not working	• Compressor not operating
Compressor not operating	• 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
Fan Motor not operating	• 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.

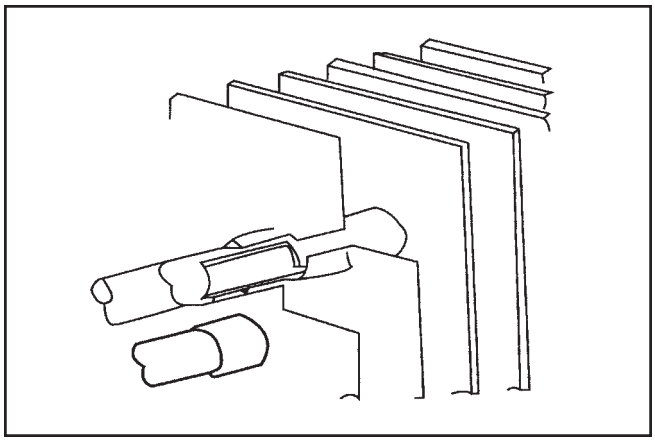


Figure 5-1: Plate Fins

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.

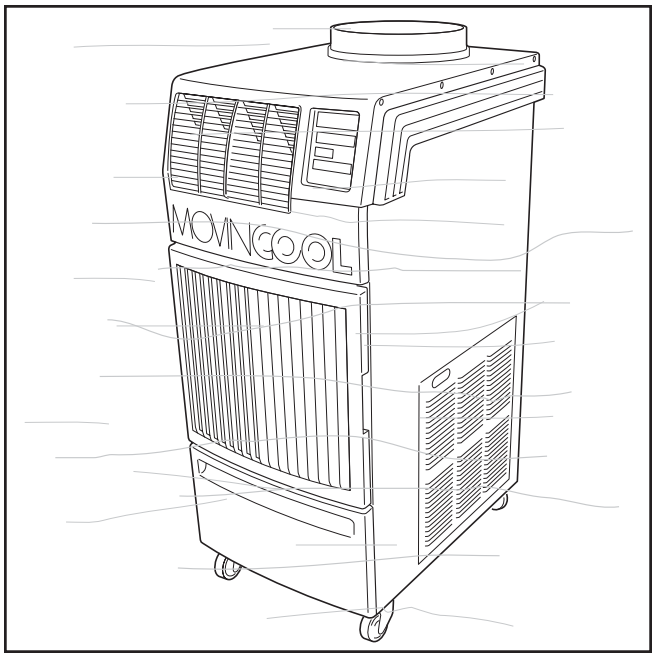


Figure 5-2: Operating Environment

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.

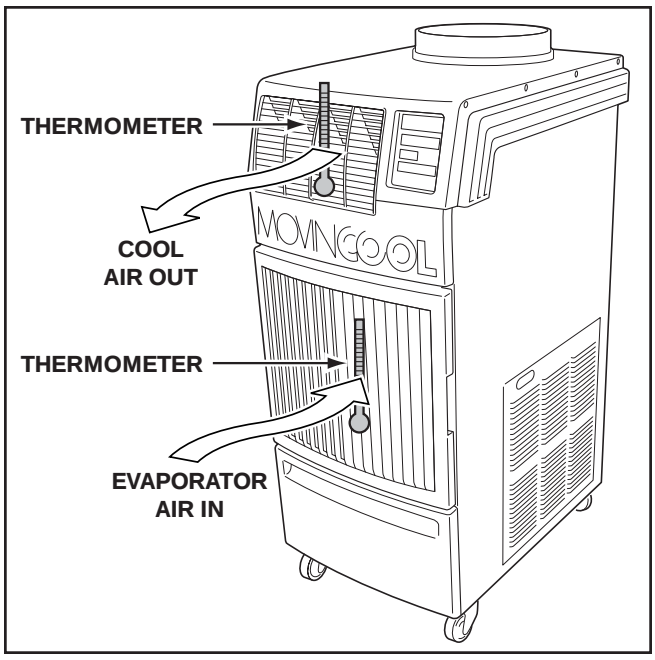


Figure 5-3: Cooling Capacity

8. Disassembly

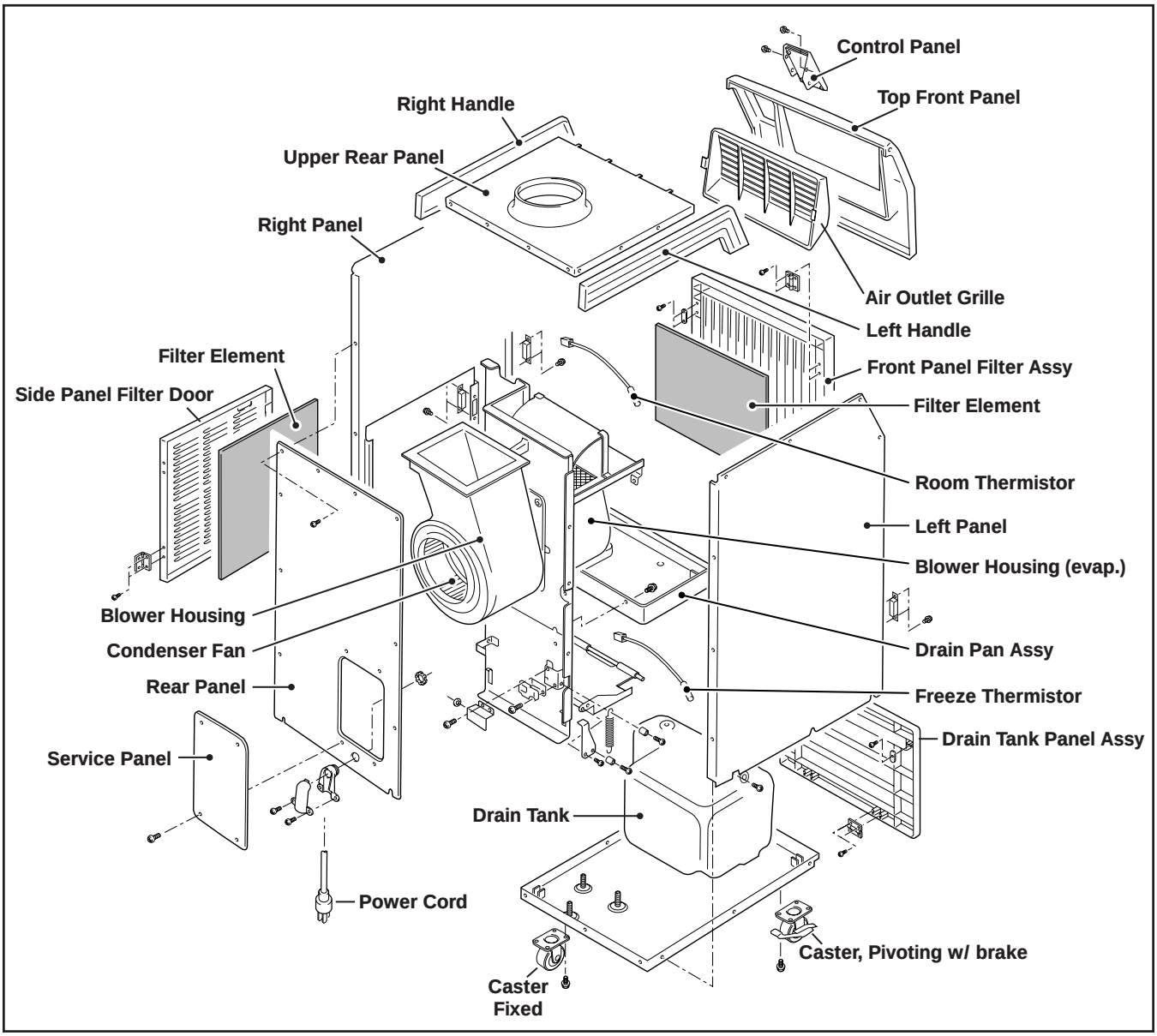


Figure 5-4: Disassembly

A. Remove drain tank.

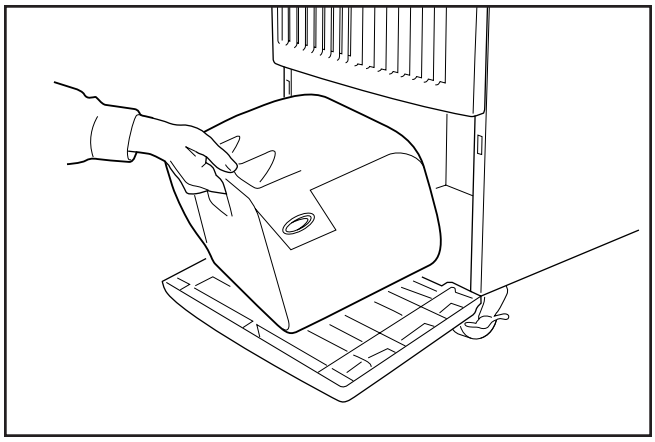


Figure 5-5: Removal of Drain Tank

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

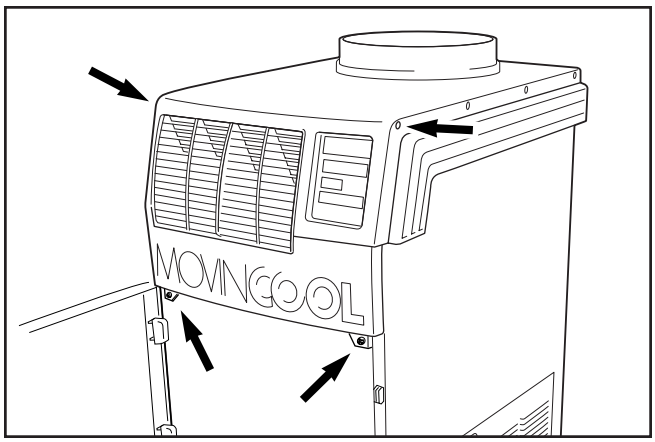


Figure 5-6: Removal of Upper Front Panel Screws

C. Slide upper front panel forward and remove.

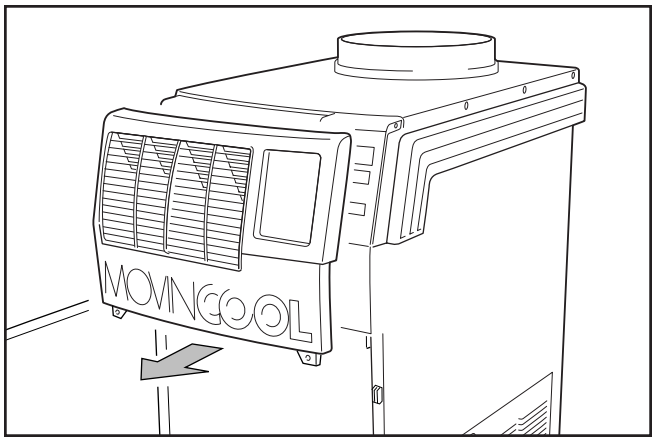


Figure 5-7: Removal of Upper Front Panel

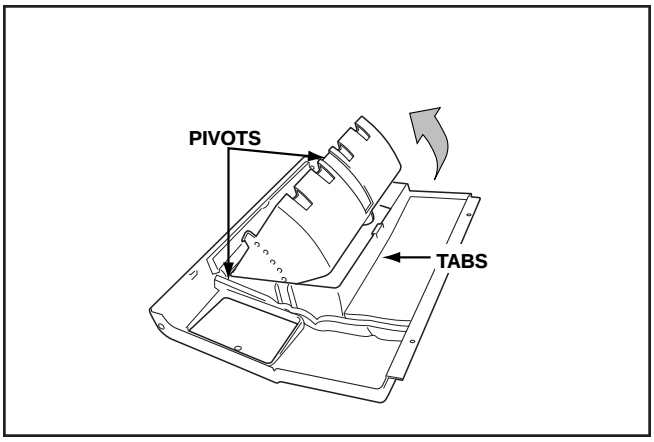


Figure 5-8: Removal of Air Outlet Louver

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

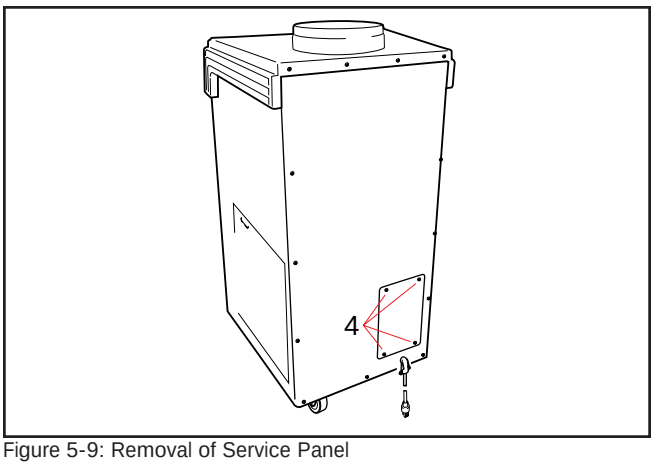


Figure 5-9: Removal of Service Panel

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

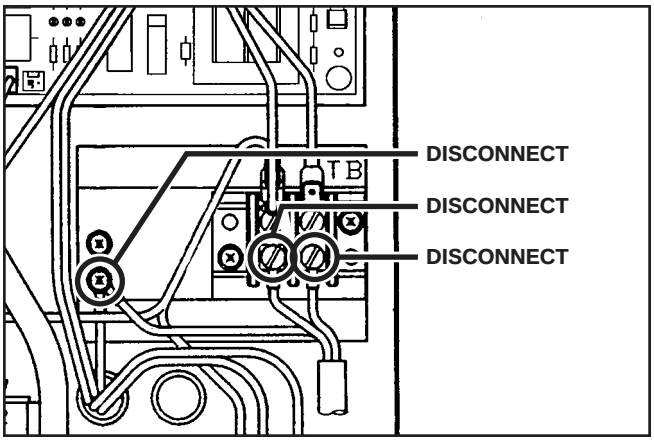


Figure 5-10: Removal of Power Cord Screws

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

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.

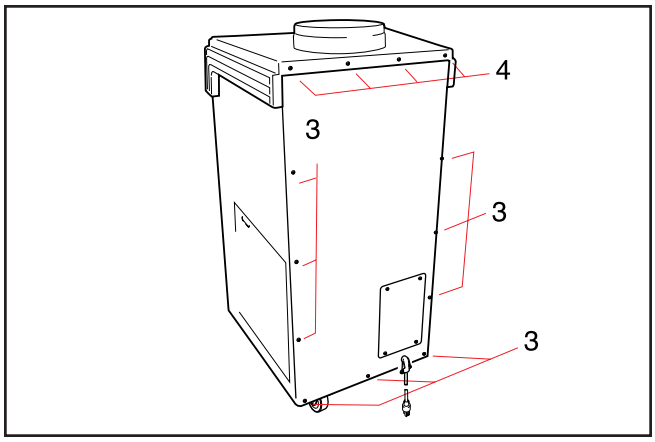


Figure 5-11: Removal of Back and Upper Rear panel Screws

9. Removal of Electrical Parts

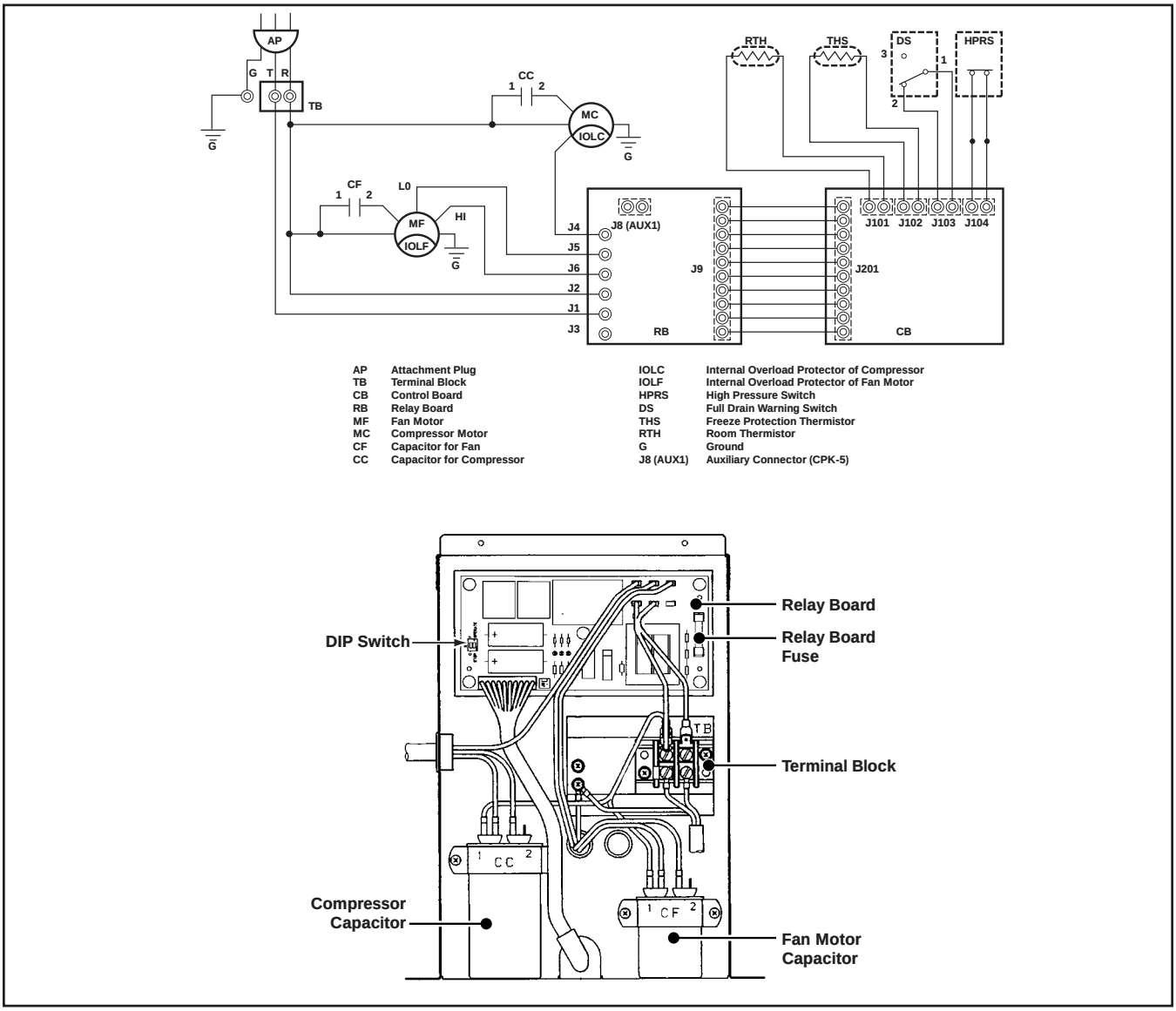


Figure 5-12: Removal of Electrical Parts in the Control Box

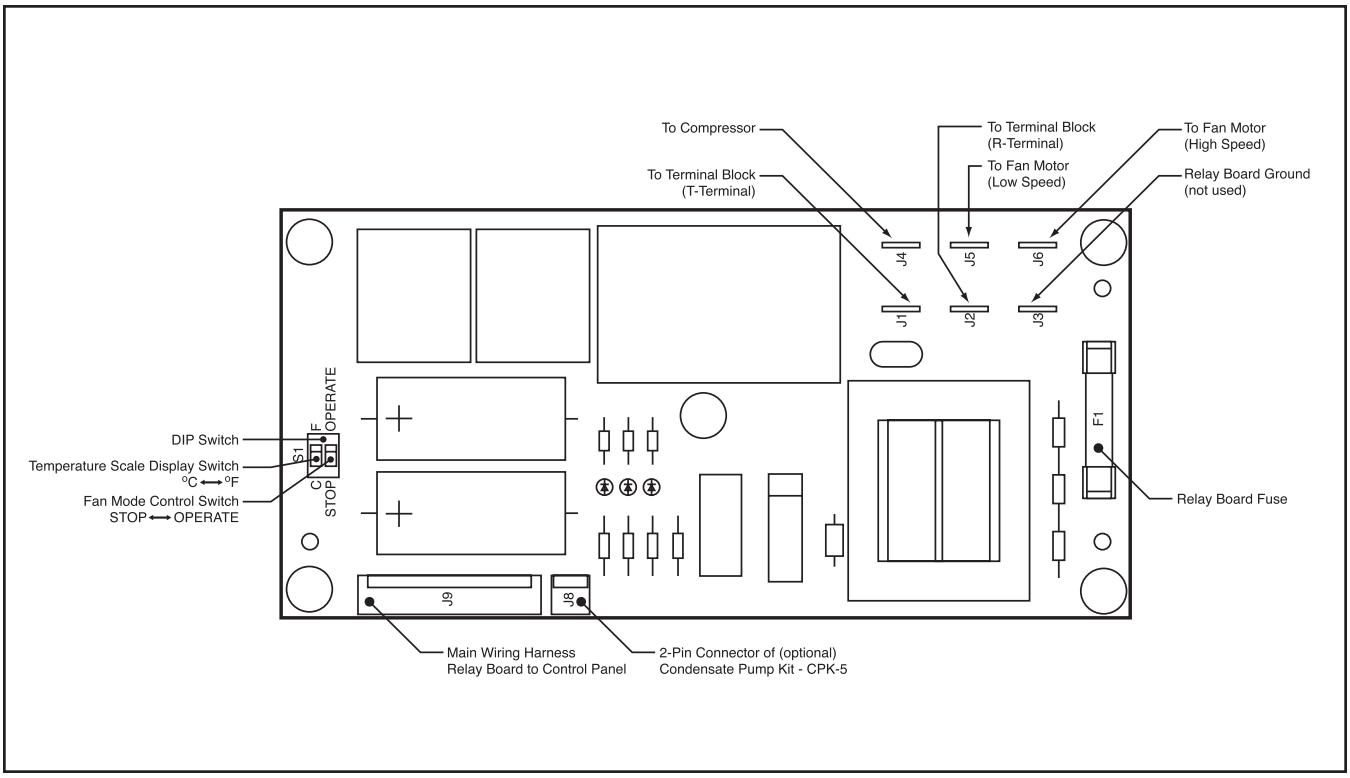


Figure 5-13: Connections to Relay Board

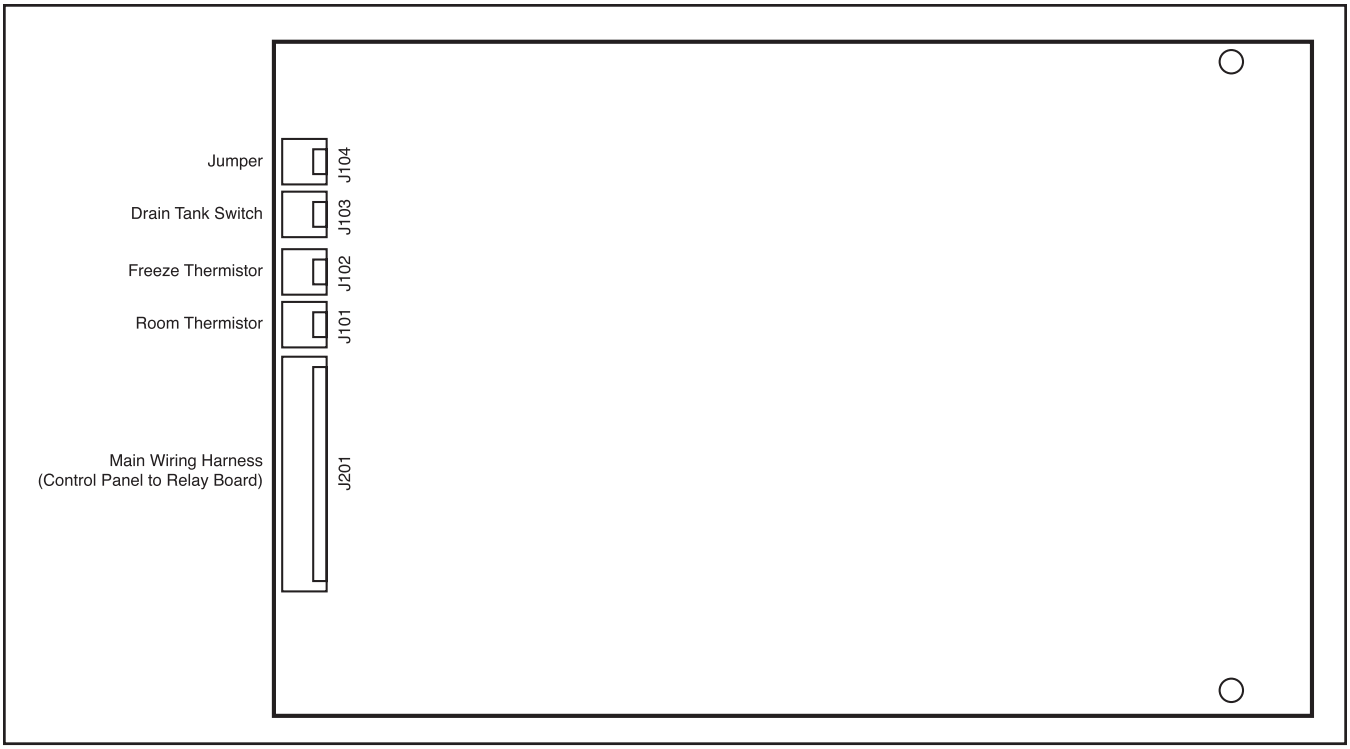


Figure 5-14: Connections to Control Board

10. Removal of Blower Assembly

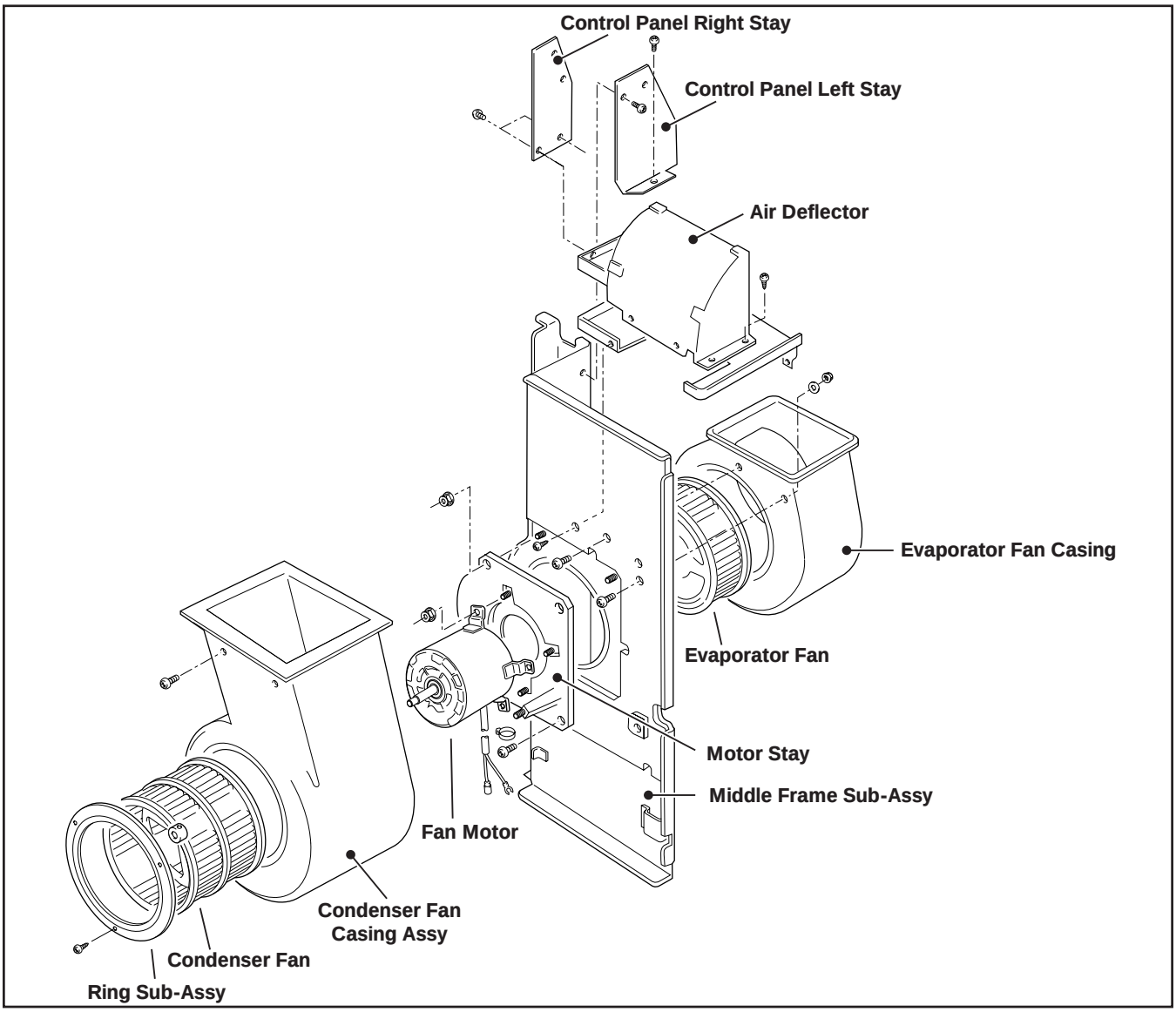


Figure 5-15: Disassembly of Blower

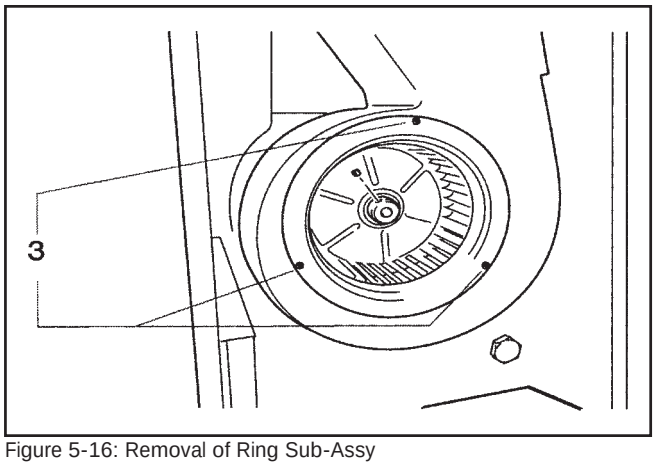


Figure 5-16: Removal of Ring Sub-Assy

A. Remove the ring sub-assy

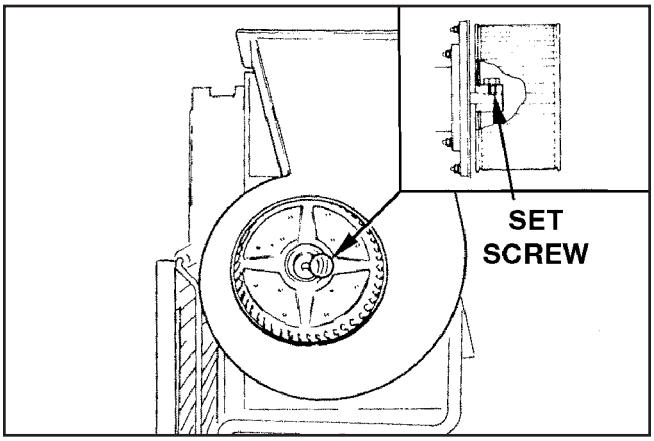


Figure 5-17: Removal of Centrifugal Fan

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

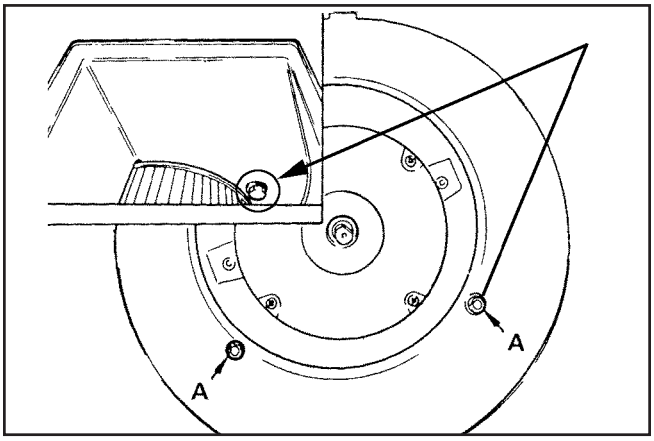


Figure 5-18: Removal of Blower Housing

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

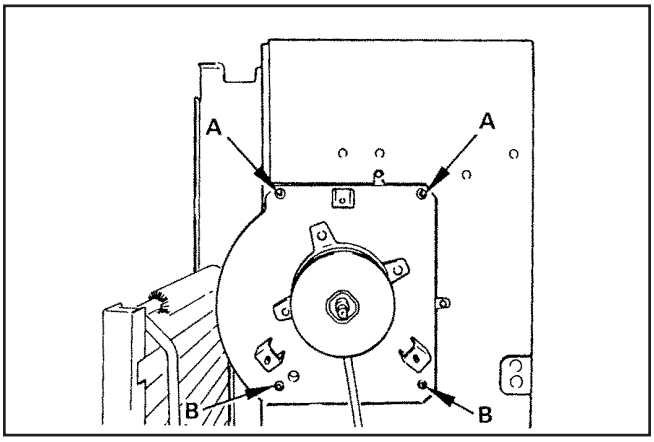


Figure 5-19: Removal of Fan Motor Assembly

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

E. Remove the centrifugal fan by loosening the set screw on the shaft. Remove the fan motor by loosening nuts “A”.

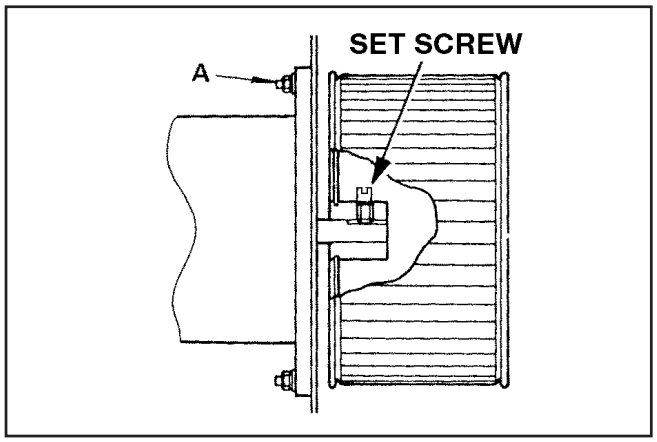


Figure 5-20: Removal of Fan Motor

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

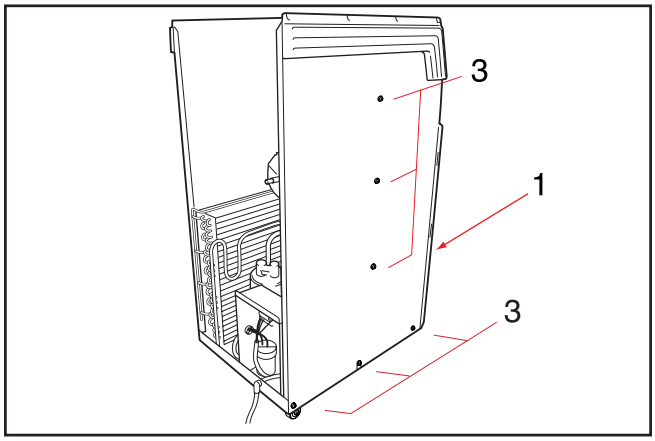


Figure 5-21: Removal of Screws for Left Side Panel

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

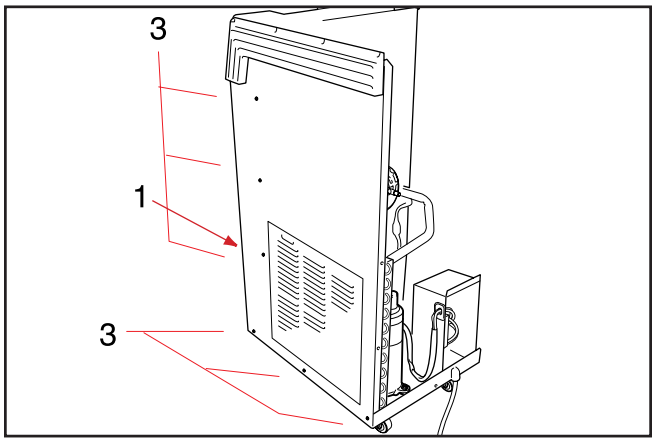


Figure 5-22: Removal of Screws for Right Side Panel

H. Remove lower air deflector

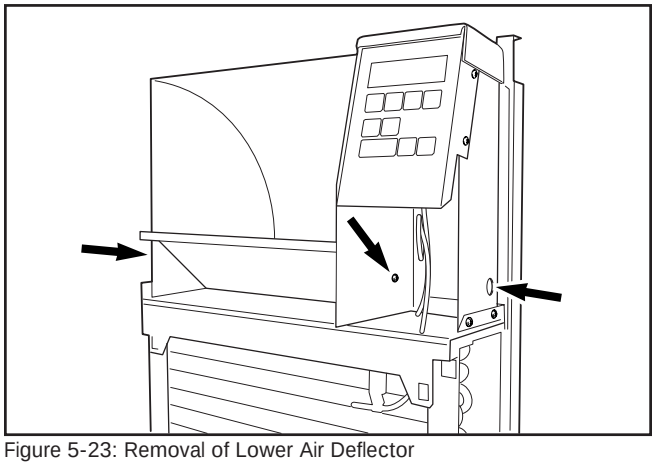


Figure 5-23: Removal of Lower Air Deflector

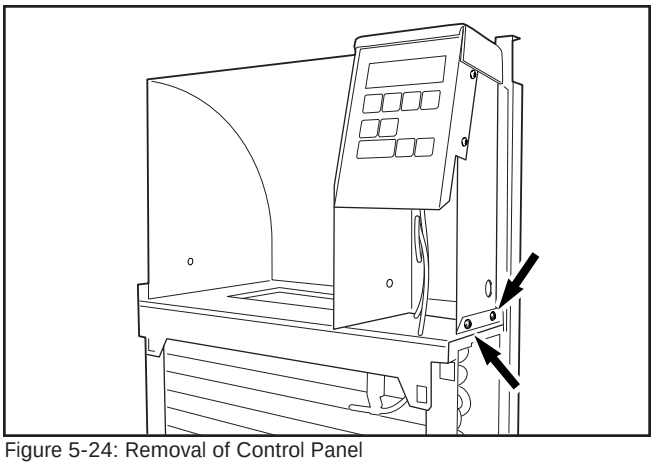


Figure 5-24: Removal of Control Panel

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

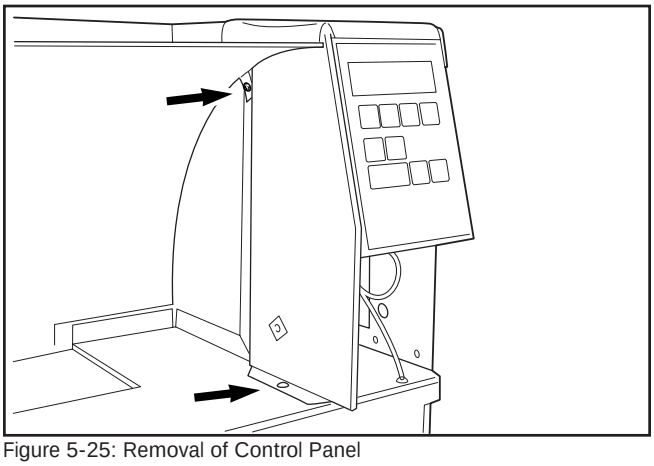


Figure 5-25: Removal of Control Panel

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

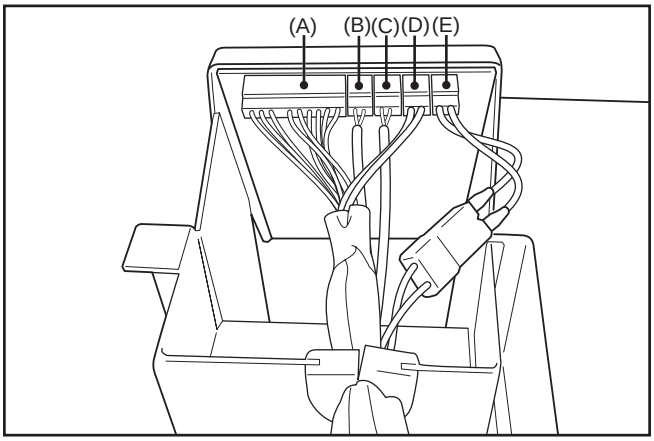


Figure 5-26: Removal of Connectors from Control Panel

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.

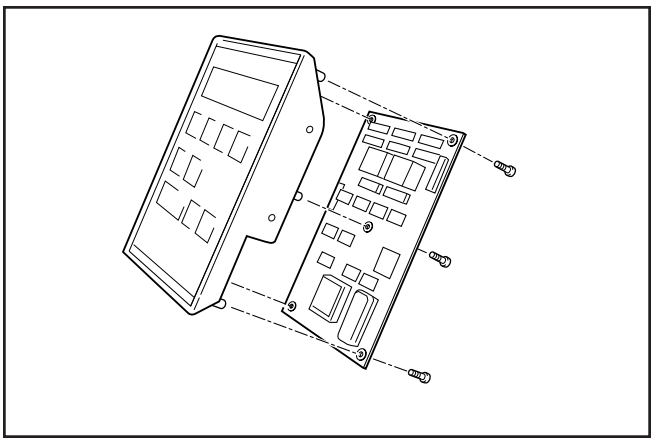


Figure 5-27: Removal of Control Board

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

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 100KΩ range. Place the two probes against the two terminals of the capacitor. At first, the ohmeter should indicate 0Ω, 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 0Ω (open), replace the capacitor.

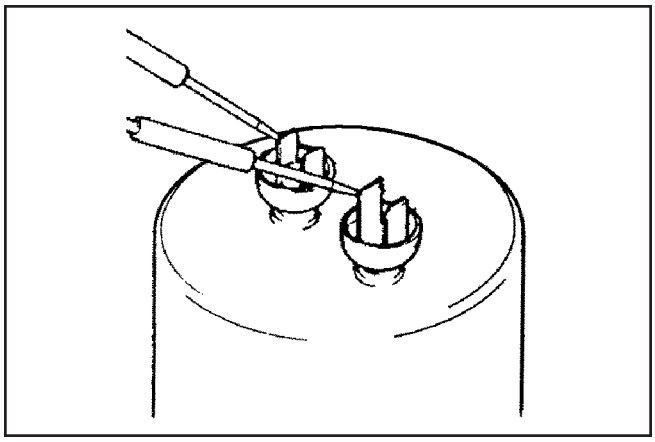


Figure 5-28: Inspection of Capacitor

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 completed. 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.

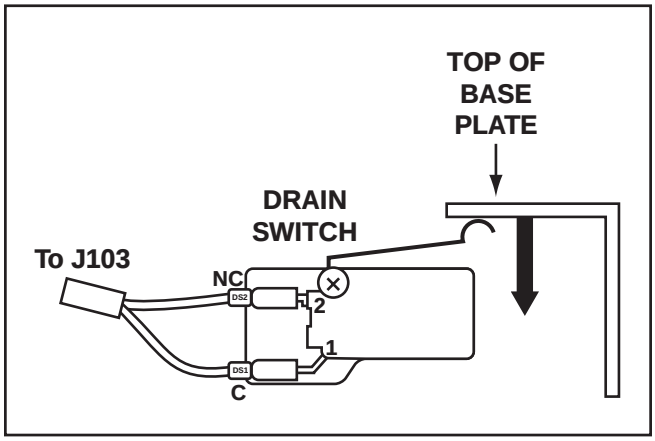


Figure 5-29: Inspection of Drain Switch

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.

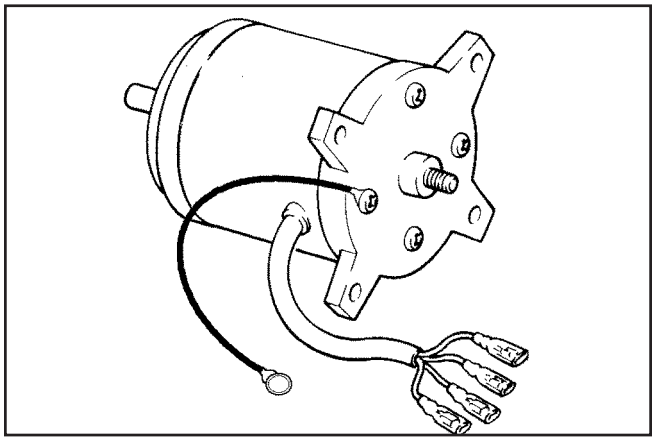


Figure 5-30: Inspection of Fan Motor

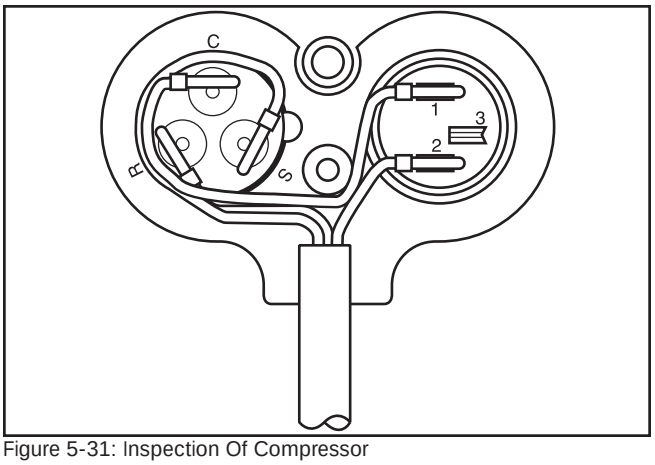


Figure 5-31: Inspection Of Compressor

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 Ohmeter, 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 pressureleakage 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.

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.

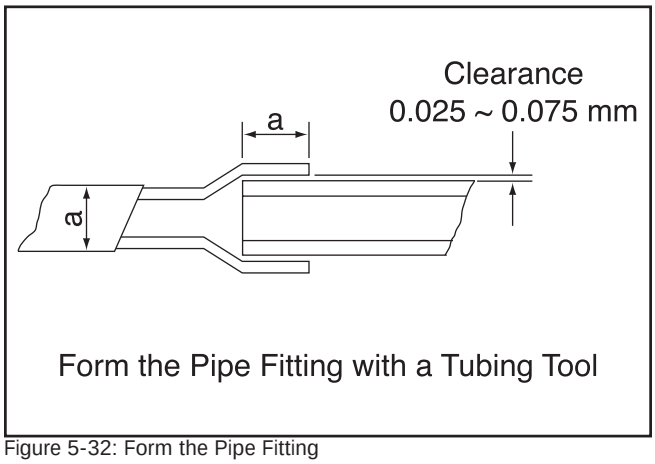


Figure 5-32: Form the Pipe Fitting

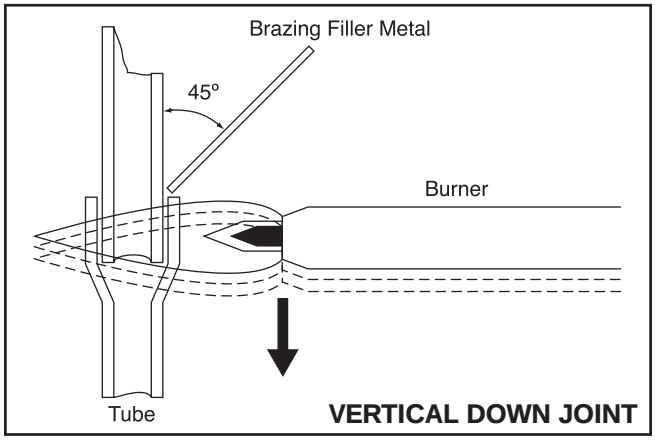


Figure 5-33: Vertical Down Joint

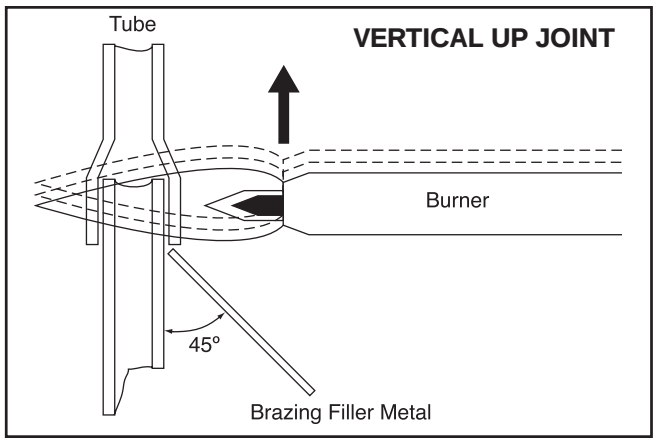


Figure 5-34: Vertical Up Joint

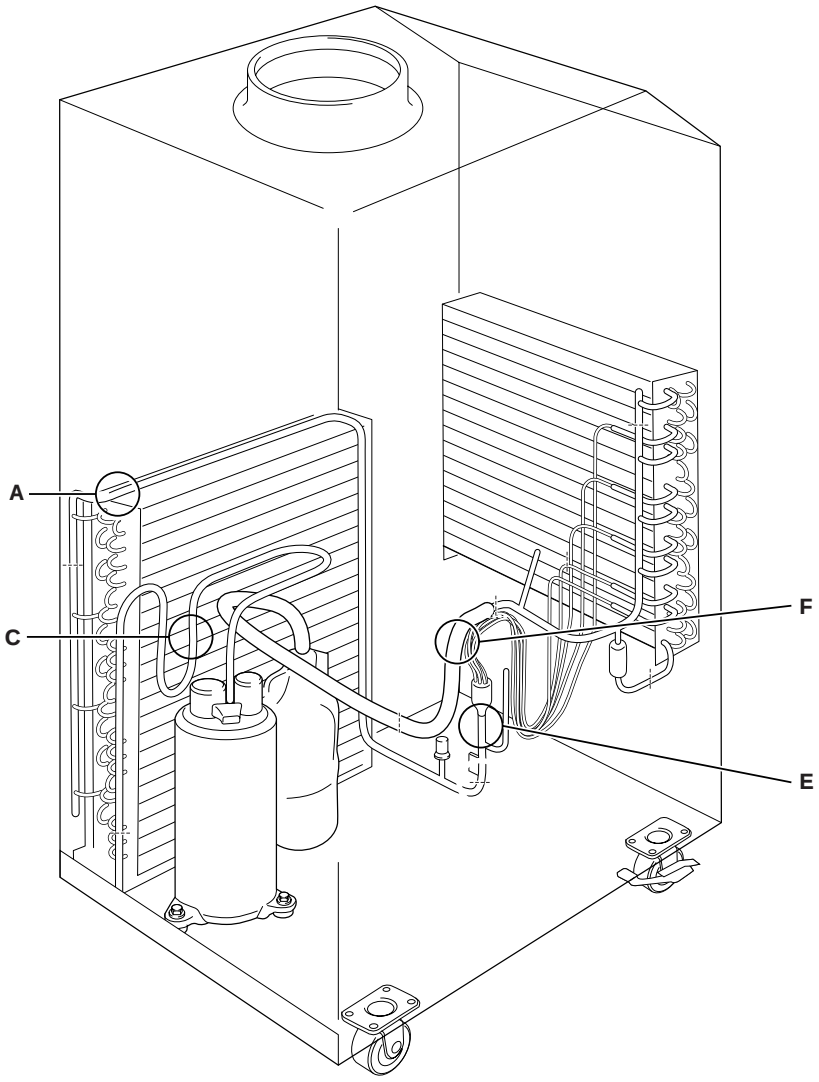
B. Removal of Refrigeration Cycle Components

⚠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.



PART TO REPLACE	DISCONNECT AT
Compressor Assy	C & F
Condenser	A & C
High Pressure Switch Tube	A & F
Evaporator Assy	E & F

Figure 5-35: Refrigeration Cycle Components

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.

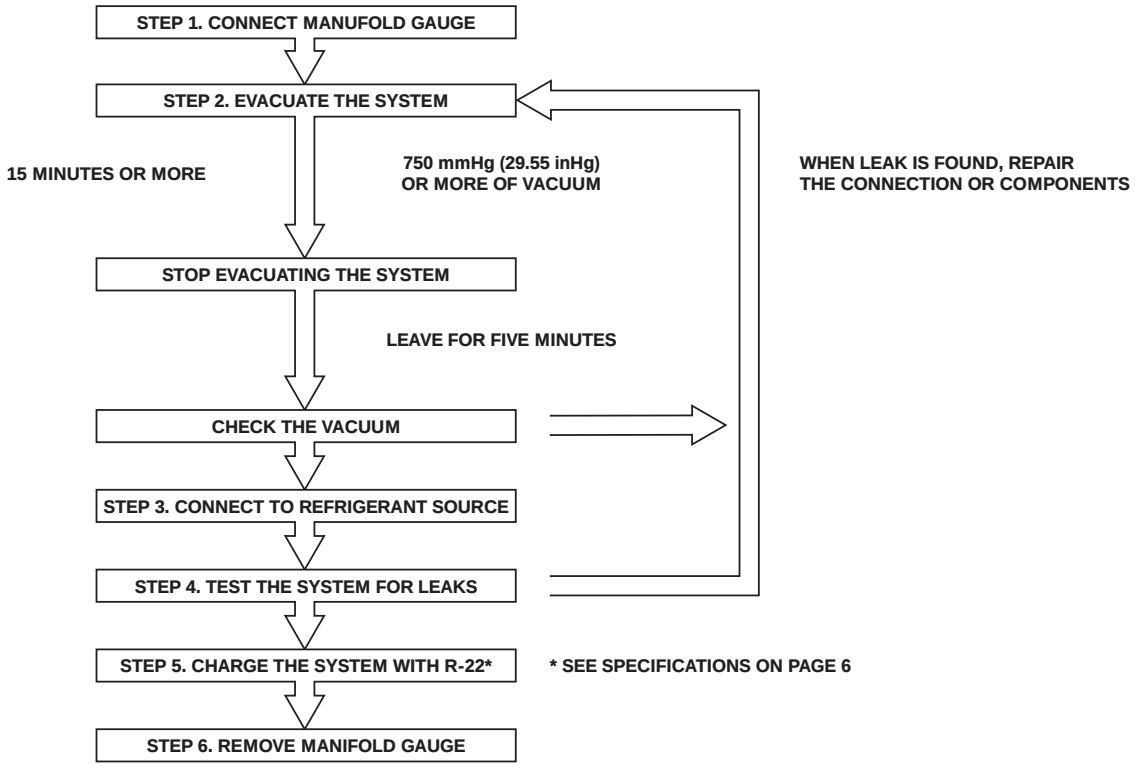
⚠WARNING

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.

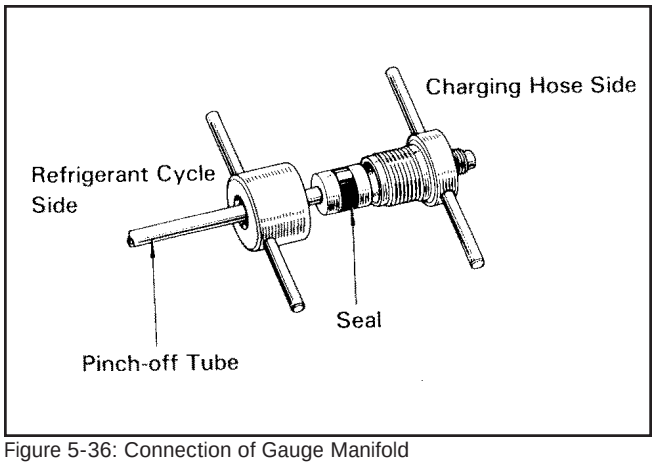


Figure 5-36: Connection of Gauge Manifold

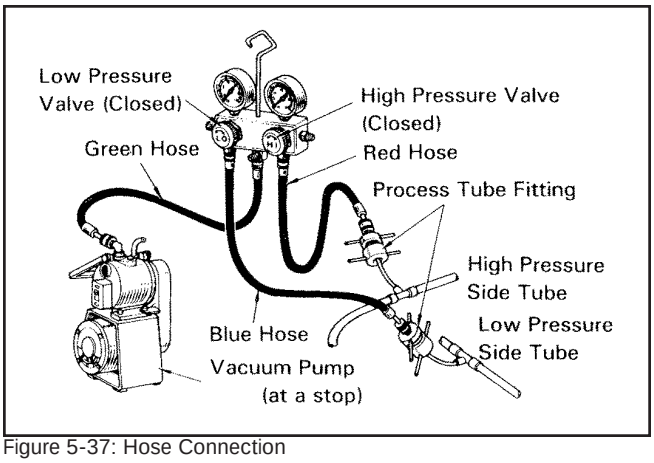


Figure 5-37: Hose Connection

(3) 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.

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

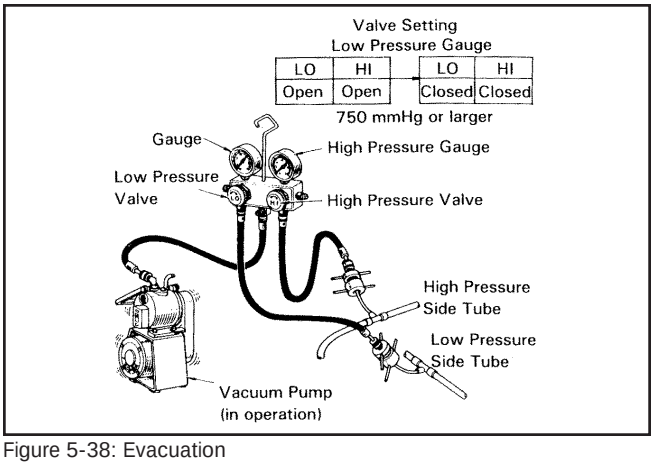


Figure 5-38: Evacuation

B. Evacuation

(1) Open the high pressure valve (HI) and the low pressure valve (LO) of the gauge manifold.

(2) Turn on the vacuum pump to start evacuation. (Evacuate the system for approximately 15 minutes.)

(3) 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.

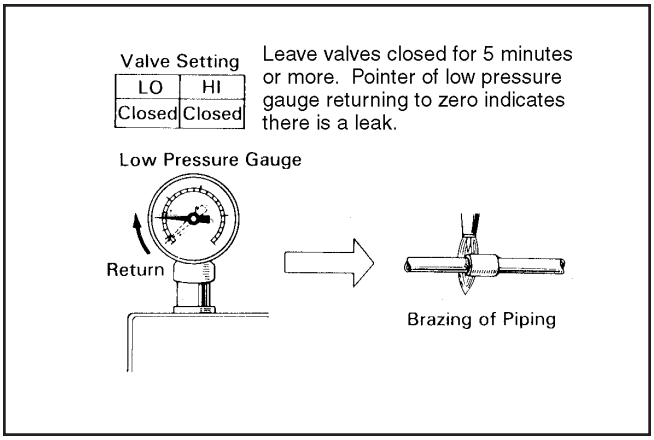


Figure 5-39: Checking Vacuum

C. Checking Vacuum

(1) 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*.

(2) 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.

D. Checking Gas Leak

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

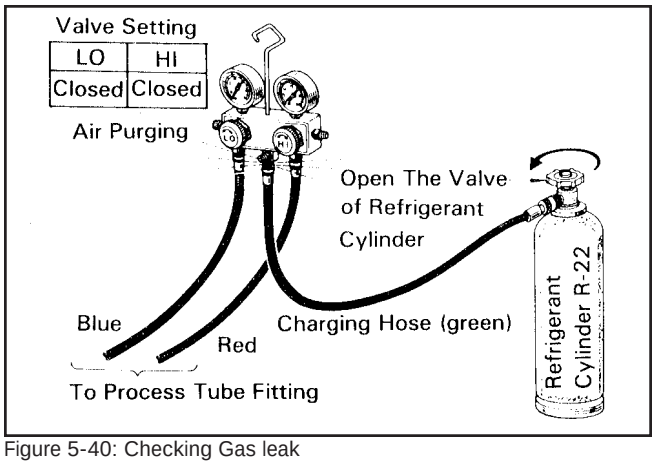


Figure 5-40: Checking Gas leak

(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.

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

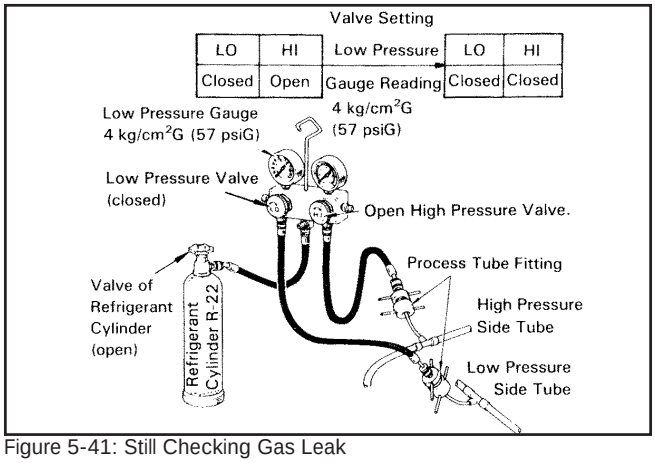


Figure 5-41: Still Checking Gas Leak

⚠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.

⚠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.

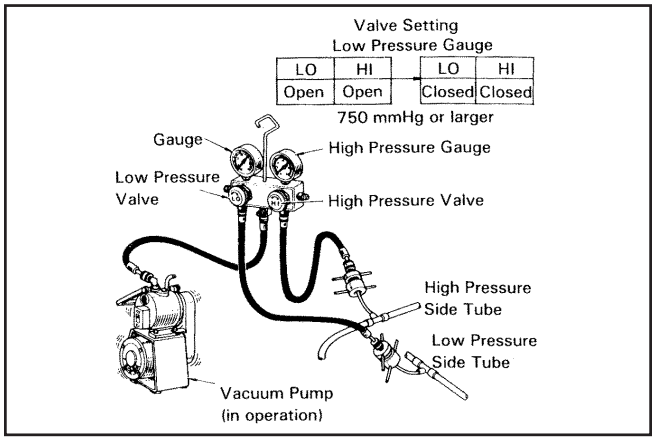


Figure 5-42: Evacuation

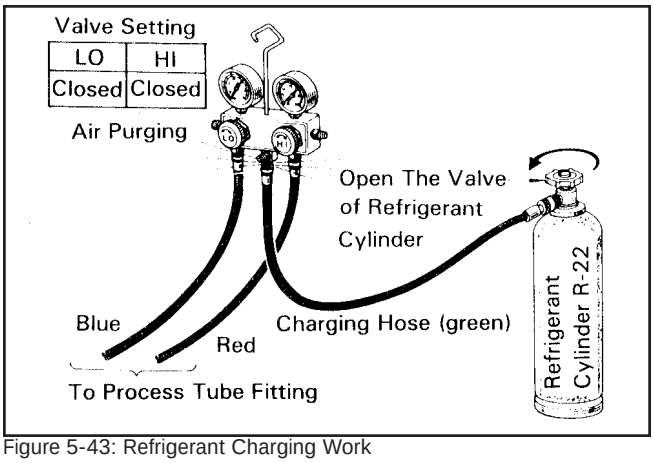


Figure 5-43: Refrigerant Charging Work

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.

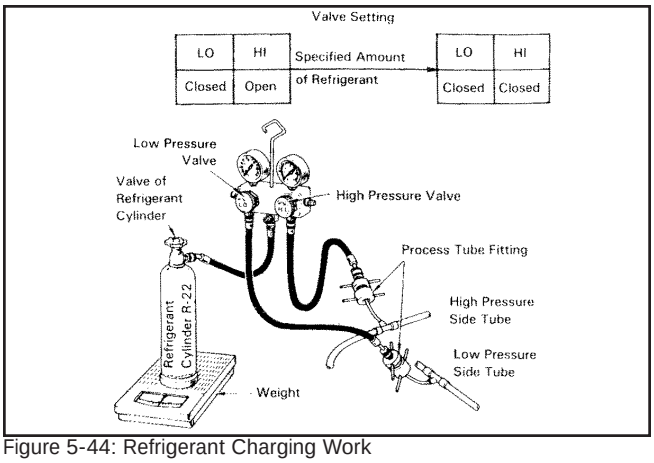


Figure 5-44: Refrigerant Charging Work

(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.

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.

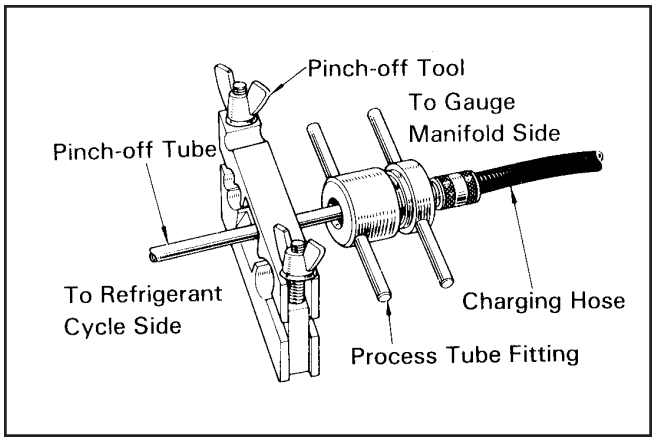


Figure 5-45: Removal of Gauge Manifold

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.

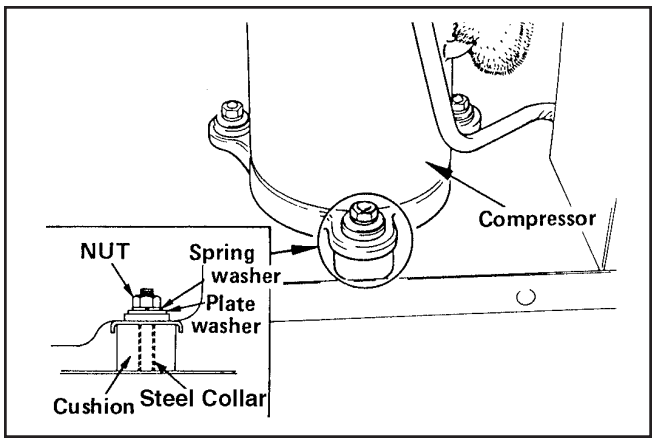


Figure 5-46: Compresor Mounting

23. Blower Assembly

Install blower fans (for evaporator and condenser).

Tightening torque:
10.84 ± 2.17 lbf•ft (150 ± 30 kgf•cm)

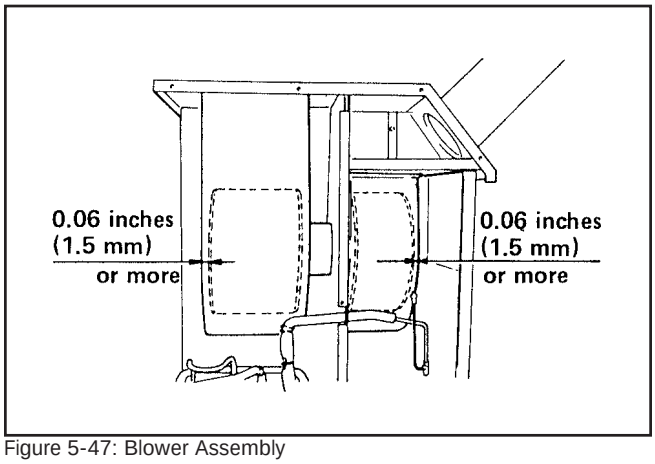


Figure 5-47: Blower Assembly

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.

26. Schematic

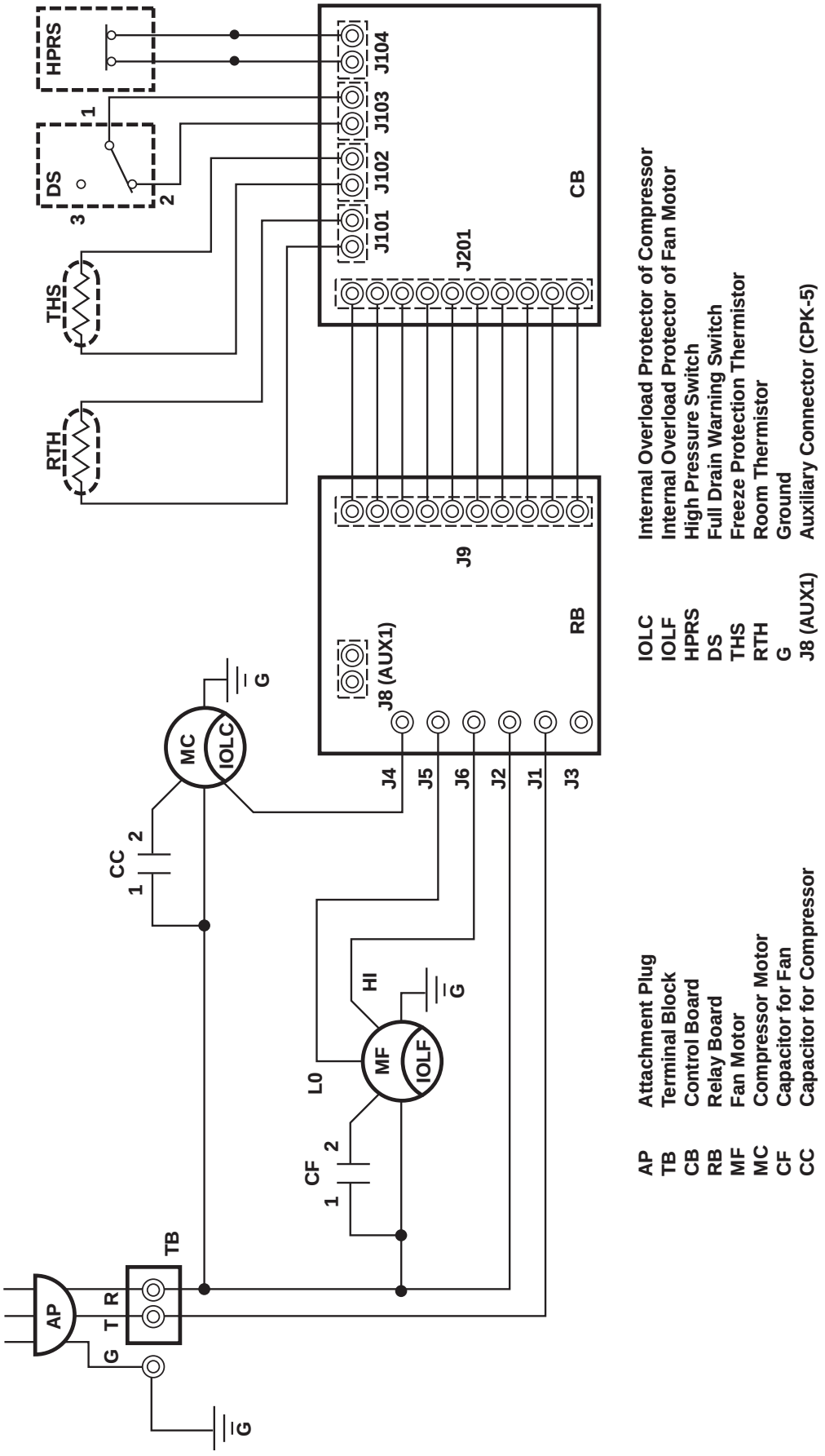


Figure 5-48: Wiring Diagram

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