Mobile Climate Control

T-365 Manual

OPERATION and SERVICE REPLACEMENT PARTS for Temsa TS45

MCC EVAPORATOR UNIT 73-0782

MCC CONDENSER UNIT 54-0354

MCC Compressor Assembly 26-2067

T-365

REV. 08/2015

SAFETY SUMMARY

GENERAL SAFETY NOTICES

The following general safety notices supplement the specific warnings and cautions appearing elsewhere in this manual. They are recommended precautions that must be understood and applied during operation and maintenance of the equipment covered herein. A listing of the specific warnings and cautions appearing elsewhere in the manual follows the general safety notices.

FIRST AID

An injury, no matter how slight, should never go unattended. Always obtain first aid or medical attention immediately.

OPERATING PRECAUTIONS

Always wear safety glasses.

Keep hands, clothing and tools clear of the evaporator and condenser fans.

No work should be performed on the unit until all start-stop switches are placed in the OFF position, and power supply is disconnected.

Always work in pairs. Never work on the equipment alone.

In case of severe vibration or unusual noise, stop the unit and investigate.

MAINTENANCE PRECAUTIONS

Beware of unannounced starting of the evaporator and condenser fans. Do not open the unit cover before turning power off.

Be sure power is turned off before working on motors, controllers, solenoid valves and electrical controls. Tag circuit breaker and power supply to prevent accidental energizing of circuit.

Do not bypass any electrical safety devices, e.g. bridging an overload, or using any sort of jumper wires. Problems with the system should be diagnosed, and any necessary repairs performed by qualified service personnel.

When performing any arc welding on the unit, disconnect all wire harness connectors from the modules in the control box. Do not remove wire harness from the modules unless you are grounded to the unit frame with a static-safe wrist strap.

In case of electrical fire, open circuit switch and extinguish with CO_2 (never use water).

UNIT HAZARD LABEL IDENTIFICATION

To help identify the hazard labels on the unit and explain the level of awareness each one carries, explanations with appropriate consequences are provided below:

⚠ DANGER

Indicates an immediate hazard which WILL result in severe personal injury or death.

⚠ WARNING

Indicates hazards or unsafe conditions which COULD result in severe personal injury or death.

⚠ CAUTION

Indicates potential hazards or unsafe practices which COULD result in minor personal injury, product or property damage.

SPECIFIC WARNING AND CAUTION STATEMENTS

The statements listed below are applicable to the refrigeration unit and appear elsewhere in this manual. These recommended precautions must be understood and applied during operation and maintenance of the equipment covered herein.

SPECIFIC WARNINGS AND CAUTIONS

⚠ WARNING

Be sure to observe warnings listed in the safety summary in the front of this manual before performing maintenance on the hvac system

⚠ WARNING

Read the entire procedure before beginning work. Park the coach on a level surface, with parking brake applied. Turn main electrical disconnect switch to the off position.

⚠ WARNING

Do not use a nitrogen cylinder without a pressure regulator

⚠ WARNING

Do not use oxygen in or near a refrigeration system as an explosion may occur.

⚠ WARNING

The filter-drier may contain liquid refrigerant. Slowly loosen the ORS hex nuts to avoid refrigerant contact with exposed skin or eyes.

⚠ WARNING

Battery disconnect should be off.

⚠ WARNING

Extreme care must be taken to ensure that all the refrigerant has been removed from the compressor crankcase or the resultant pressure will forcibly discharge compressor oil.

CAUTION

To prevent trapping liquid refrigerant in the manifold gauge set be sure set is brought to suction pressure before disconnecting.

CAUTION

Use care when checking/manipulating wires/plugs. Damage to the wiring harness can occur.

WARNING

Use of an electro-magnetic valve as a means of positive shutoff for service is not recommended or good service practice.

WARNING

For Safety, the bus and A/C system should be OFF, and lockout/tag out procedures should be implemented.

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SECTION 1

DESCRIPTION

1.1 INTRODUCTION

This manual contains Operating and Service Instructions and Electrical Data for the Coach Air Conditioning and Heating equipment furnished by Mobile Climate Control for the Temsa TS45 Coach. Table 1-1 provides a model number chart for components supplied.

The Air Conditioning equipment (see Figure 1-1) consist of a condenser, 4 main parcel evaporators with integral heaters, a driver evaporator with integral heater (OEM supplied), compressor assembly, driver display panel, check valve assembly and temperature sensors.

The air conditioning and heating equipment interfaces with electrical cabling, refrigerant piping, engine coolant piping, ductwork and other components furnished by the coach manufacturer to complete the system.

Table 1-1. Part (Model) Number Chart

Model No.	Refrigerant	Component	Operating Voltage	Quantity Supplied
54- 0354	R-134a	Condenser	24VDC	1
73- 0782	R-134a	Evaporator	24VDC	4
26- 2067	R-134a	Compressor	24VDC	1

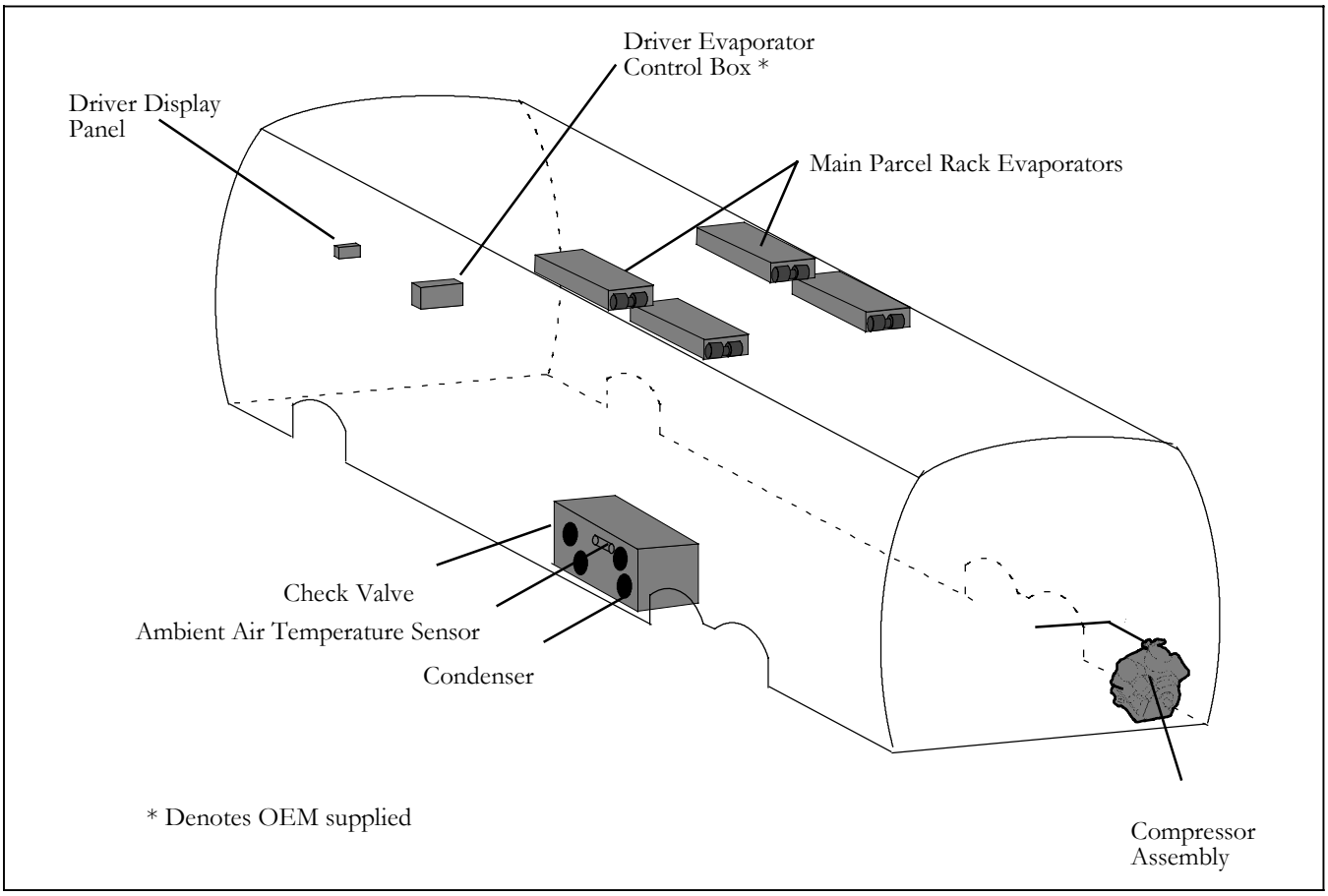


Figure 1-1. Coach Cutaway View

1.2 REFRIGERATION SYSTEM COMPONENT SPECIFICATIONS

a. Refrigerant Charge

R-134a: 32 lb *(12 kg)*

b. Compressor

Model: Bitzer 6NFCY
No. of Cylinder: 6
Weight (Dry): 88 lb *(40 kg)* without clutch
Oil Charge:
88 oz.*(2602.50cm³)*
Level in sight glass between bottom of glass and middle of glass on compressor crankcase

c. Thermostatic Expansion Valve - for R-134a Units:

1. Main Evaporator:

10 kW

d. High Pressure Switch (HPS): (Condenser mounted Trinary switch)

Opens at: 391.6 ±29 psig *(27 ± 2 BAR)*
Closes at: 304.6 ±29 psig *(21 ± 2 BAR)*

e. Low Pressure Switch (LPS): (Compressor mounted switch)

Opens at: 6 ±3 psig *(0.41 ± 0.20 BAR)*
Closes at: 25 ±3 psig *(1.7 ± 0.20 BAR)*

f. Low Pressure Switch (LPS): (Condenser mounted Trinary switch)

Opens at: 29 ± 2.9psig *(2 ± 0.20 BAR)*
Closes at: 30.5 ± 4 psig *(2.1 ± 0.28 BAR)*

1.3 ELECTRICAL SPECIFICATIONS

a. Main Evaporator/Heater

Bearing Lubrication: Factory Lubricated (additional grease not required)
Full Load Amps (FLA):
Ultra High Speed: 17.5 A (Not manually operated)
High Speed 13.5 A
Medium Speed 8.0 A
Low Speed: 3.1 A
Air Flow:
883 CFM (25 m³/min)
Voltage: 24 vdc
Cooling Capacity: 61,473 Btu/hr (18 kW)
Heating Capacity: 64,888 Btu/hr (19 kW)

b. Condenser

Bearing Lubrication: Factory Lubricated (additional grease not required)
Full Load Amps (FLA):
High Speed: 42
Fan Speed Switch (Condenser mounted Trinary switch)
Opens at: 188.5 ± 21.8 psig *(13 ± 1.5 BAR)*
Closes at: 232.1 ± 18.9 psig *(16 ± 1.3 BAR)*
Voltage: 24 vdc
Cooling Capacity: 163,928 Btu/hr (48 kW)

1.4 ELECTRICAL SPECIFICATIONS- INPUT SENSORS

c. Temperature Sensors

Input Range: -52.6 to 185°F *(-47 to 85°C)*
Output: NTC 10K ohms at 77°F *(25°C)*

1.5 GENERAL DESCRIPTION

1.5.1 Condenser Assembly

The condenser assembly includes a condenser coil, fan and motor assemblies, filter-drier, sight glass, receiver tank, trinary pressure switch, ball valves, service ports and an ambient temperature sensor.

The condenser coil provides a heat transfer surface for condensing refrigerant gas at a high temperature and pressure into a liquid at high temperature and pressure. The condenser fans circulate ambient air across the outside of the condenser tubes at a temperature lower than refrigerant circulating inside the tubes; this results in condensing the refrigerant into a liquid. The filter-drier removes moisture and other noncondensibles from the liquid refrigerant before it enters the thermal expansion valves in the evaporator assemblies.

The condenser is also fitted with a pressure relief valve which protects the system from unsafe high pressures/temperatures. The main evaporator liquid line solenoid valves (located in the OEM supplied liquid line piping) close when the system is shut down to prevent refrigerant migration when the compressor is shut down. The ball valves and service ports enable servicing of the condenser assembly. The ambient temperature sensor measures ambient temperature and sends an electrical signal to the main controller. If temperature falls below 46.4°F (8°C), the compressor circuit will be cut out.

1.5.2 Compressor Assembly

The compressor assembly includes the refrigerant compressor, clutch assembly, suction and discharge service valves, low pressure switch, unloader pressure switches, suction and discharge servicing (charging) ports, and electric solenoid unloaders.

The compressor raises the pressure and temperature of the refrigerant gas and forces it into the condenser tubes. The clutch assembly provides a means of belt driving the compressor by the coach engine. The suction and discharge service valves enable servicing of the compressor. Suction and discharge access (charging) ports mounted on the service valves enable connection of charging hoses for servicing of the compressor, as well as other parts of the refrigerant circuit. The high pressure switch (HPS) is a normally closed switch, its contacts open on a pressure rise to shut down the system when abnormally high refrigerant pressures occur. The HPS is located in the condenser assembly. The low pressure switch (LPS) is a normally closed switch, its contacts open on a pressure drop to shut down the system when abnormally low refrigerant pressures occur. The electric unloaders provide a means of controlling compressor capacity, which enables control of temperature inside the coach.

1.5.3 Evaporator Assemblies

The MCC provided evaporator assemblies include 4 main parcel mounted evaporator assemblies (See Figure 1-1).

The main evaporator assemblies include an evaporator and heater coil assembly, thermal expansion valve, 2 fan and motor assemblies, fresh air actuator and damper and condensate drain holes. There is also evaporator control relays, which control the main evaporator fans upon receipt of a signal from the main controller.

The evaporator coils provide a heat transfer surface for transferring heat from air circulating over the outside surface of the coil to refrigerant circulating inside the tubes; thus providing cooling when required. The thermal expansion valves meter the flow of refrigerant entering the evaporator coils. The heating coils provide a heat transfer surface for transferring heat from engine coolant circulating inside the tubes to air circulating over the outside surface of the tubes, thus providing heating when required. The OEM supplied evaporator heat valve(s) (EHV) control the flow of engine coolant supplied to the heating coils. The fans circulate the air over the coils. The air filters filter dirt particles from the air before the air passes over the coils. The condensate drain connections provide a means for disposing of condensate collected on the evaporator coils during cooling operation.

1.6 SAFETY DEVICES

System components are protected from damage caused by unsafe operating conditions with safety devices. Mobile Climate Control supplied safety devices include a high pressure switch (HPS), low pressure switch (LPS), evaporator freeze protection, circuit breakers and fuses.

a. Pressure Switches

High Pressure Switch (HPS)

During the A/C mode, compressor operation will automatically stop if the HPS switch opens due to an unsafe operating condition. Opening HPS de-energizes, through the controller, the compressor clutch shutting down the compressor. The high pressure switch is installed on the high side of the system in the condenser.

Low Pressure Switch

If the control monitors a pressure less than 3-9 psig (0.2-0.6 Bar) R-134a by the suction pressure switch mounted on the compressor, the system will be shut down for at least one minute.

Secondary Low Pressure Switch

If the control monitors a pressure less than 29 psig (2 Bar) R-134a by the Trinary pressure switch mounted in the condenser, the system will be shut down for at least one minute.

b. Fuses and Circuit Breakers

The Relay Board is protected against high current by a 20 amp circuit breaker. Independent 40 amp (evaporator), 60 amp (condenser) circuit breakers protect those circuits. During a high current condition, the breaker may open.

c. Ambient Lockout

The ambient temperature sensor located in the condenser section measures the condenser inlet air temperature. When the temperature is below the cut out set point,46.4°F (8°C), the compressor is locked out until the temperature rises above the cut in setting. This setting protects the compressor from damage caused by operation at low temperatures.

1.7 HEATING (ENGINE COOLANT) FLOW CYCLE

Heating circuit components furnished by Mobile Climate Control include heater cores for the main evaporator assemblies. Components furnished by the coach manufacturer may include auxiliary heater and engine water pump, hand valves and "Y" type strainers, a coolant bypass heat valve and main/driver's heat valves. The main controller automatically controls the EHV valves during heating and reheat cycles to maintain required temperatures inside the coach. Engine coolant (glycol solution) is circulated through the heating circuit by the engine and auxiliary water pumps.

1.8 AIR CONDITIONING REFRIGERANT CYCLE

When air conditioning (cooling) is selected by the main controller, the unit operates as a vapor compression system using R-134a as a refrigerant. The main components of the system are the reciprocating compressor, air-cooled condenser coil, filter-drier, thermostatic expansion valves, liquid line solenoid valves and evaporator coils. (See Figure 1-2)

The compressor raises the pressure and the temperature of the refrigerant and forces it through the discharge line, and the check valve into the condenser tubes. The condenser fan circulates surrounding air (which is at a temperature lower than the refrigerant) over the outside of the condenser tubes. Heat transfer is established from the refrigerant (inside the tubes) to the condenser air (flowing over the tubes). The condenser tubes have fins designed to improve the transfer of heat from the refrigerant gas to the air; this removal of heat causes the refrigerant to liquefy.

The refrigerant leaves the condenser and the liquid refrigerant passes through the liquid line (ball) service valve, and then through a filter-drier where an absorbent keeps the refrigerant clean and free of water.

From the filter-drier, the liquid refrigerant then flows through the main liquid line solenoid valve to the main evaporator and thermal expansion valve and to the driver's evaporator solenoid valve (if this option is active), and to the driver thermal expansion valve. The solenoid valves open during cooling to allow refrigerant to flow to the thermal expansion valves. The main liquid solenoid valve closes during shutdown to prevent refrigerant migration. The thermal expansion valves reduce the pressure and temperature of the liquid and meters the flow of liquid refrigerant to the evaporator to obtain maximum use of the evaporator heat transfer surface.

The low pressure, low temperature liquid that flows into the evaporator tubes is colder than the air that is circulated over the evaporator tubes by the

evaporator blowers (fans). Heat transfer is established from the evaporator air (flowing over the tubes) to the refrigerant (flowing inside the tubes). The evaporator tubes have aluminum fins to increase heat transfer from the air to the refrigerant; therefore the cooler air is circulated to the interior of the coach.

The transfer of heat from the air to the low temperature liquid refrigerant in the evaporator causes the liquid to vaporize. This low temperature, low pressure vapor passes through the suction line and returns to the compressor where the cycle repeats.

When ventilation only is selected by the main controller, only the evaporator fans function to circulate air throughout the coach. The refrigerant cycle will remain off.

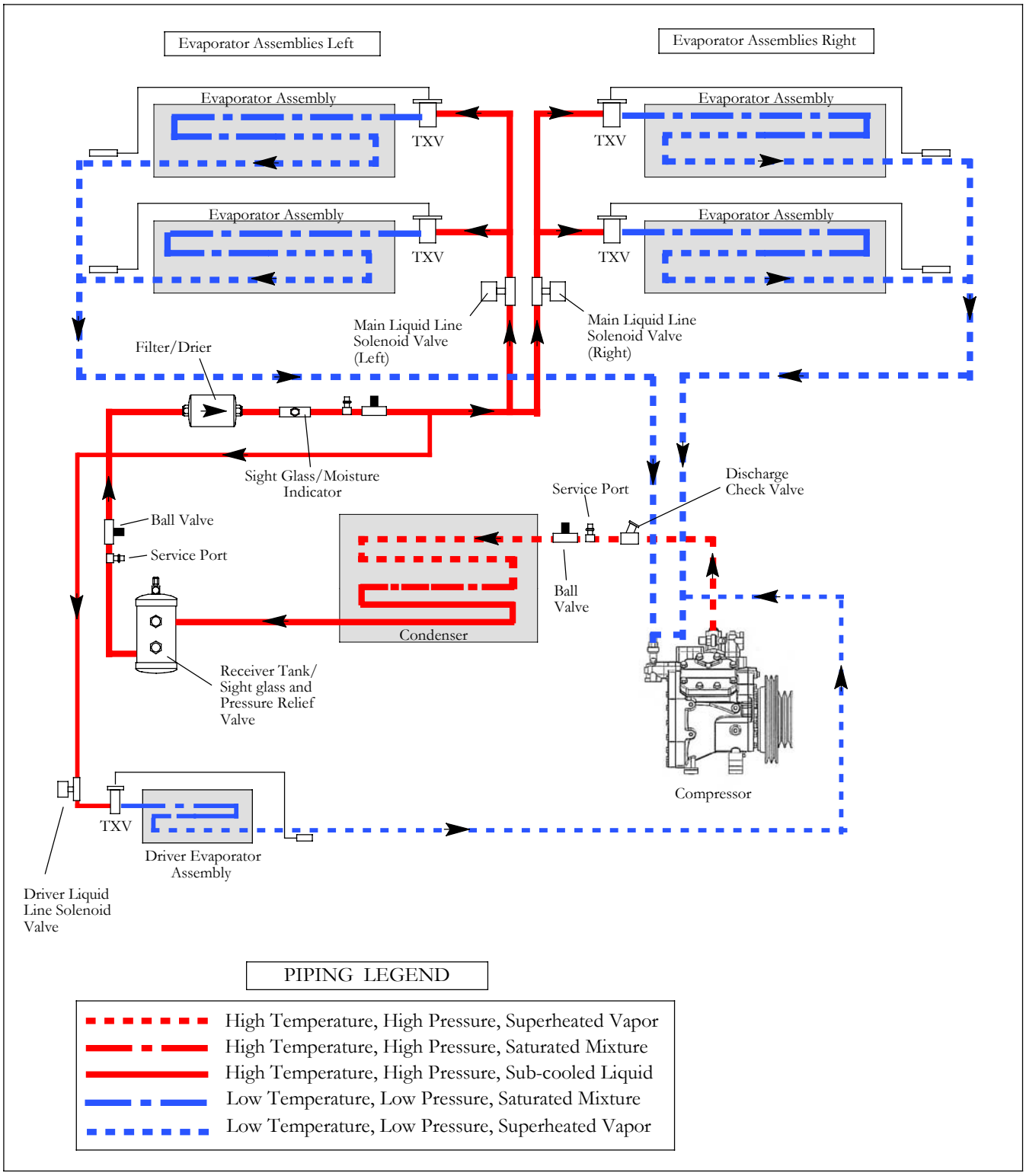


Figure 1-2 Air Conditioning Refrigerant Flow Diagram

SECTION 2

OPERATION of MVC CONTROLLER

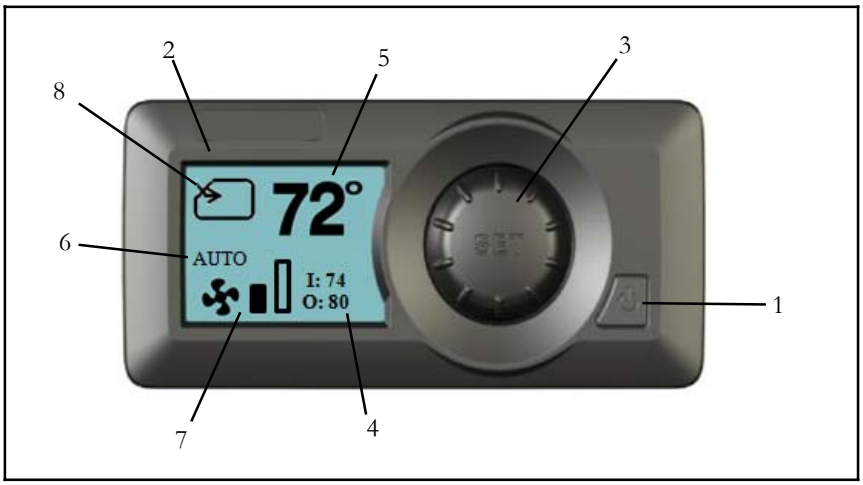


Figure 2-1 MVC Controller

1. On/Off Button
2. LCD Display
3. Set/Select Knob
4 Inside/Outside Temperature
5. Temperature Set Point
6. Mode of Operation
7. Blower Speed
8 Fresh Air/ Recirculation

NOTE:

The following procedures are general in nature and are dependant on the software version installed in the MVC Controller module and system related components and sensors.

2.1 System Operation

2.1.1 Mode Selection Descriptions

a. **Auto** - In the auto mode, the ECC Controller will adjust the individual components to maintain the desired set point temperature.

In the auto mode, the A/C system will continue to operate when set point is reached, and will energize the boost pump and de-energize the heat solenoid valve to maintain temperature. This is referred to as Reheat mode, to provide additional dehumidification of interior space.

The reheat mode will be disabled if the outside ambient air temperature is below 46.4° F (8° C).

b. **Cooling** - In the cooling mode, the Compressor, condenser fans and evaporator fans will be energized. The heater solenoid valve will remain closed, to provide full cooling.

c. **Heating** - In the heating mode, the compressor and condenser fans will remain de-energized. Evaporator fans will be energized. The boost pump will be energized when the heat valve is opened > 30% for at least one minute. The boost pump will be de-energized when the heat valve is opened < 5% for more than one minute.

d. **Defrost** - In the defrost mode, the A/C is forced on with high speed fan operation and the fresh air damper will open.

e. **Vent**- In the vent mode, the evaporator blowers are operated to circulate air in the bus.

2.1.2 Capacity Control "Ladder" Diagrams

Ladder diagram showing system operational control logic for Auto/ Cool (Reheat system), can be seen in Figure 2-2.

2.1.3 Compressor Operation

a. If the compressor clutch cycles off, a 1 minute delay will be applied before the clutch will re-engage.

b. If the compressor clutch cycles off four times due to pressure condition, the controller will lock out the compressor operation until the power is cycled.

c. Two seconds before compressor clutch is engaged, both unloaders will be energized to provide a "soft" start condition. Five seconds after the clutch is engaged, the first unloader will de-energize and provide 4 cylinder operation. Ten seconds after the clutch is engaged, the second unloader will de-energize and provide 6 cylinder operation.

NOTE

Temperature or pressure conditions will take priority over the start up sequence of the unloaders.

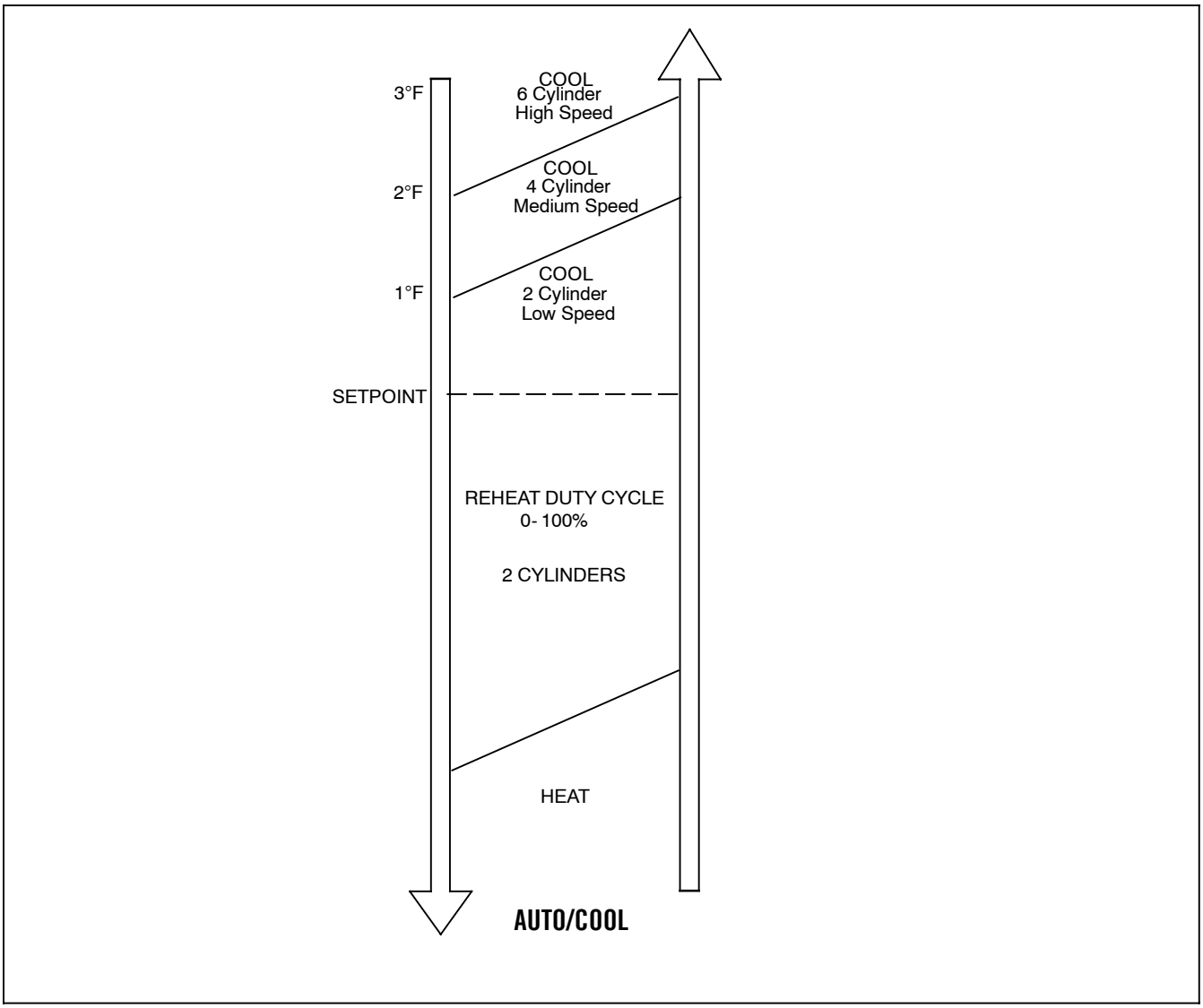


Figure 2-2 Capacity Control Ladder Diagrams

2.2 Display Operation

2.2.1 MAIN Menu

AUTO Mode With Fresh Air

COOL Mode With Fresh Air

HEAT Mode With Recirculation

DEFROST Mode With Fresh Air

Figure 2-3 Main Menus

To set the temperature, turn Set/Select knob until the desired temperature appears. The temperature range is between 82° F (28° C) and 61° F (16° C). If temperature is adjusted to it's lowest setting “MIN” will display. If temperature is adjusted to it's highest setting “Max” will display.

Temperature can be displayed in either Fahrenheit or Celsius scale by selecting preference in the Service Menu.

Figure 2-4 Blower Speed Adjustment

2.2.2 Blower Adjustment

Press the Set/Select knob once to display the blower mode menu. Turn the Set/Select knob clockwise to select “High” speed. Turn the Set/Select knob counter clockwise to select “Low” speed.

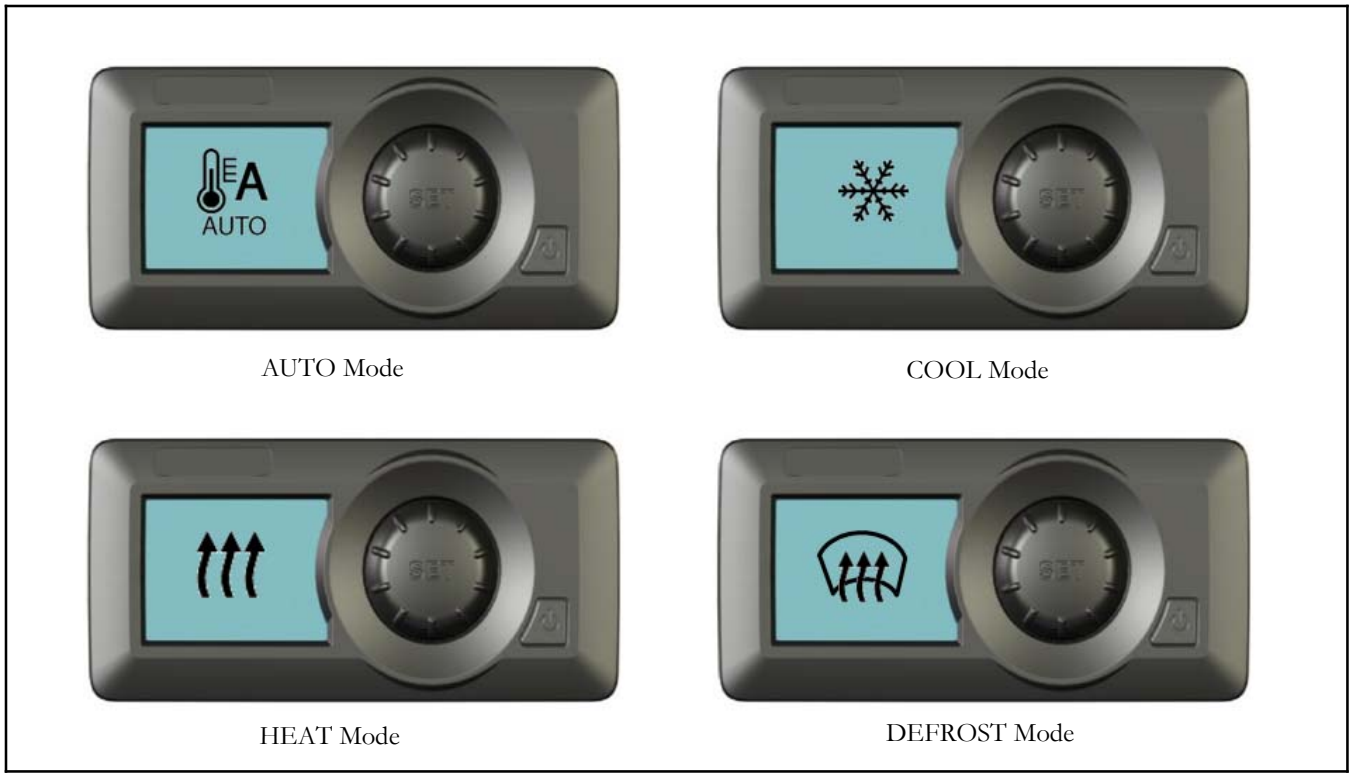


Figure 2-5 Operation Modes

2.2.3 MODE Select Menu

Press the Set/Select knob twice to display the Mode select menu. Turn the Set/Select knob to select desired Mode in the following sequence: AUTO_COOL_HEAT_DEFROST.

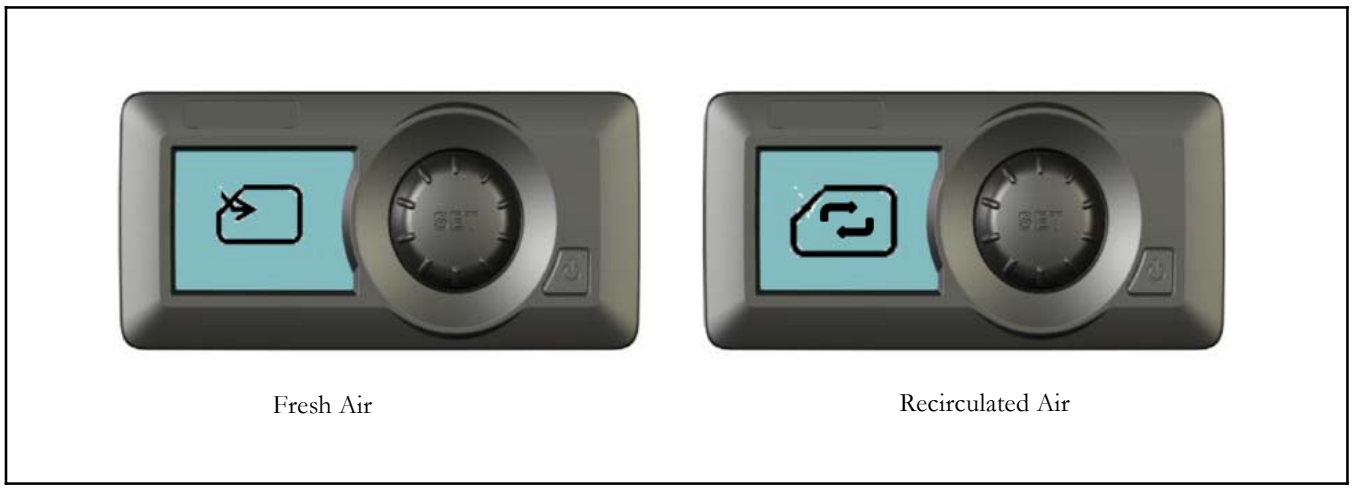


Figure 2-6 Fresh/Recirculated Air Adjustment

2.2.4 Fresh/Recirc Air Select Menu

Press the Set/Select knob 3 times to display the air select menu. Turn the Set/Select knob clockwise to select “Fresh” air or “Recirculated” air.

Figure 2-7 Service Menu

2.2.5 Service Menu

Press the Set/Select knob 3 times to display the air select menu. Press and hold the power button and turn the Set/Select knob 3 times counter clockwise to display menu.

The contrast is selected and flashes. It can be adjusted by turning the knob clockwise to increase contrast, and counter clockwise to decrease contrast.

By pressing the Set/Select knob, brightness is selected and flashes. Turn the knob clockwise to increase brightness, and counter clockwise to decrease brightness.

By pressing the Set/Select knob again, temperature scale is selected and flashes. Turn the knob clockwise to select Fahrenheit, and counter clockwise to select Celcius.

By pressing the Set/Select knob again, the display returns to the main menu. If the knob is not pressed, the display returns automatically to main menu in 10 seconds.

2.3 Diagnostic Operations

Press the Set/Select knob 3 times to display the air select menu (Fresh/Recirc Air). Press and hold the power button and turn the Set/Select knob 3 times clockwise to display menu.

Turn knob to switch through the following menus: SETUP_VIEW_Error List_Statistics_EXIT

Press the Set/Select knob to enter the selected function.

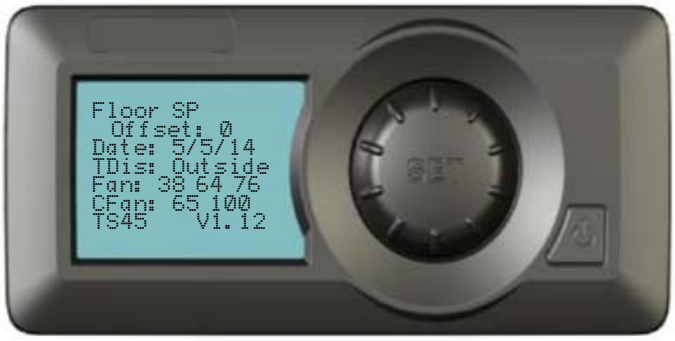


Figure 2-8 Setup Menu

2.3.1 Setup Menu

Press the Set/Select knob to edit these parameters displayed and the item will flash. Turn the Set/Select knob to adjust the value of selected item

VIEW 1

VIEW 2

Figure 2-9 Setup Menu

2.3.2 VIEW Menu

Press the Set/Select knob to view these parameters. These parameters are viewable only.

Error List 1

Error List 2

Error List 3

Figure 2-10 Error List Menu

2.3.3 Error List Menu

Press the Set/Select knob to scroll through the Error list screens 1 thru 3. Values of failed temperature sensors, heat valve and compressor can be viewed.

To "RESET ALL" error list, set display to Error list 1 screen. Turn Set/Select knob 1 time counter clockwise and a message will flash. Press the Set/Select knob once to reset error list.

Statistics 1

Statistics 2

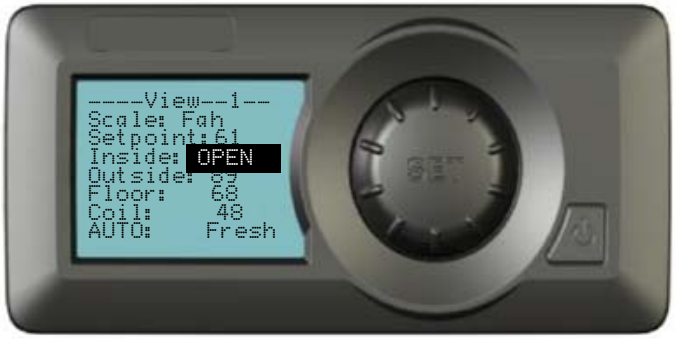
Figure 2-11 Statistics Menu

2.3.4 Statistics Menu

Press the Set/Select knob to scroll through the Statistics menu screens 1 and 2. Values of compressor and evaporator hours can be viewed, as well as clutch cycles.

To "RESET " clutch cycles and run time, while in statistics menu 1, turn Set/Select knob 1 time counter clockwise and press Set/Select knob once. To "RESET " evaporator hours in statistics menu 2, turn Set/Select knob 1 time counter clockwise and press Set/Select knob once.

Failure Alert



Diagnostics VIEW 1

Figure 2-12 Failure Alert

2.3.5 Failure Alert Display

The MVC controller detects failures or alerts of temperature sensors open or shorted, valves open, shorted or stuck, and compressor faults. When this failure occurs, an “alert” icon will be displayed in place of the fan symbol on the display.

To view the cause of fault, go to the “VIEW” menu and the affected item will be highlighted (Refer to Figure 2-12).

2.3.6 ECC Coolview

Coolview is a PC based diagnostic and HVAC monitoring software. Coolview will display temperatures,staus of input/output devices, clutch operating time and cycles, as well as providing access to error codes.

Coolview provides a means to adjust operation modes, blower speeds, temperature set point, temperature scale, fresh/recirculated air and contrast/brightness.

Coolview can provide a means to simulate temperatures of inside, outside, de-ice and after coil sensors, as well as clutch operation and valve operations.

Set up requires a USB to RS485 adaptor interface between the MVC display harness and PC. Once Coolview software is opened, "click" down arrow to select the appropriate Com port. Press start button and communication will be established (Rx indicator will flash).

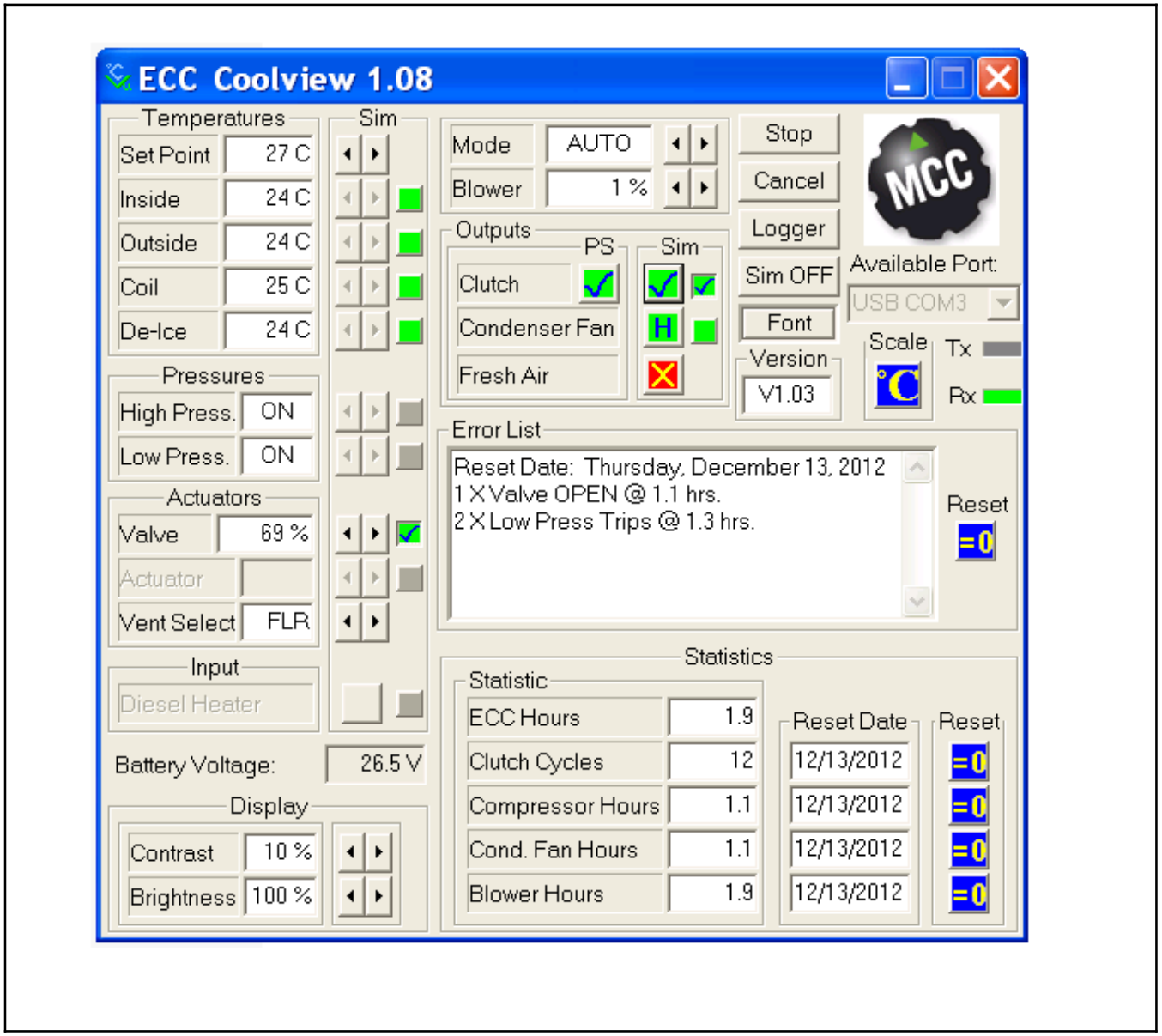


Figure 2-13 Coolview Simulation

SECTION 3

SERVICE

WARNING

Be sure to observe warnings listed in the safety summary in the front of this manual before performing maintenance on the hvac system.

WARNING

Read the entire procedure before beginning work. Park the coach on a level surface, with parking brake applied. Turn main electrical disconnect switch to the off position.

NOTE

To avoid damage to the earth's ozone layer, use a refrigerant recovery system whenever removing refrigerant. When working with refrigerants you must comply with all local government environmental laws.

3.1 MAINTENANCE SCHEDULE

SYSTEM ON	SYSTEM OFF	SYSTEM
a. Daily Maintenance		
X		Pre-trip Inspection - after starting
	X	Check tension and condition of V-belt
b. Weekly Inspection		
	X	Perform daily inspection
	X	Check condenser, evaporator coils and air filters for cleanliness
	X	Check refrigerant hoses and compressor shaft seal for leaks
X		Feel filter-drier for excessive temperature drop across drier
c. Monthly Inspection and Maintenance		
	X	Perform weekly inspection and maintenance
	X	Clean evaporator drain pans and hoses
	X	Check wire harnesses for chafing and loose terminals
	X	Check fan motor bearings
	X	Check compressor mounting bolts for tightness
	X	Check fan motor brushes

3.2 SUCTION AND DISCHARGE SERVICE VALVES

The suction and discharge service valves (Figure 3-1) are provided with a double seat and a gauge port, which allows servicing of the compressor and refrigerant lines.

Turning the valve stem counterclockwise (all the way out) will *backseat* the valve to open the line to the compressor and close off the gauge port. In normal operation, the valve is backseated to allow full flow through the valve. The valve should always be backseated before removing the gauge port cap.

Turning the valve stem clockwise (all the way forward) will *frontseat* the valve to isolate the compressor line and open the gauge port.

To measure suction or discharge pressure, midseat the valve by opening the valve clockwise 1/4 to 1/2 turn. With the valve stem midway between frontseated and backseated positions, the suction or discharge gauge port is open to both the compressor and the line.

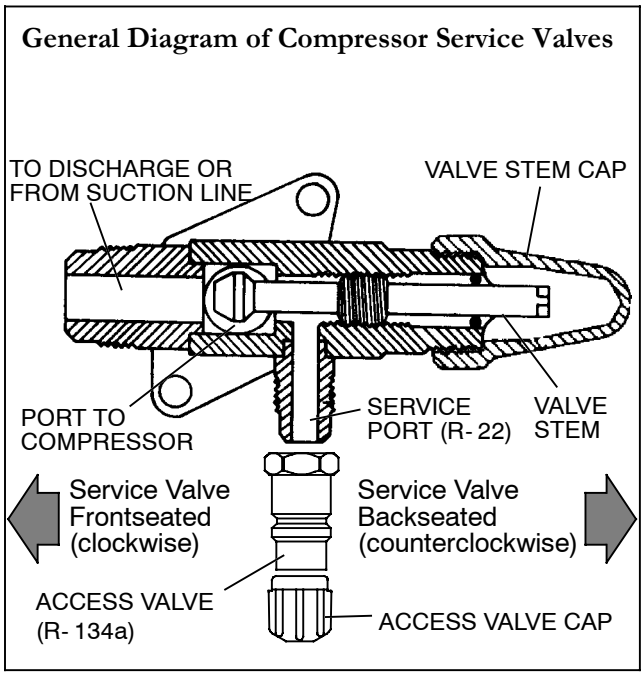


Figure 3-1 Suction or Discharge Service Valve

3.2.1 Installing R-134a Manifold Guage Set

A R-134a manifold gauge/hose set with self-sealing hoses is required for service of models covered within this manual. To perform service using the manifold gauge/hose set, do the following:

a. Preparing Manifold Gauge/Hose Set For Use

1. If the manifold gauge/hose set is new or was exposed to the atmosphere it will need to be evacuated to remove contaminants and air as follows:
2. Back seat (turn counterclockwise) both field service couplers (see Figure 3-2) and midseat both hand valves.
3. Connect the yellow hose to a vacuum pump and an R-134a cylinder.
4. Evacuate to 10 inches of vacuum and then charge with R-134a to a slightly positive pressure of 1.0 psig.
5. Front seat both manifold gauge set hand valves and disconnect from cylinder. The gauge set is now ready for use.

b. Connecting Manifold Gauge/Hose Set

To connect the manifold gauge/hose set for reading pressures, do the following:

1. Remove service valve stem cap and check to make sure it is backseated. Remove access valve cap.
2. Connect the field service coupler (see Figure 3-2) to the access valve.
3. Turn the field service coupling knob clockwise, which will open the system to the gauge set.
4. Read system pressures.
5. Repeat the procedure to connect the other side of the gauge set.

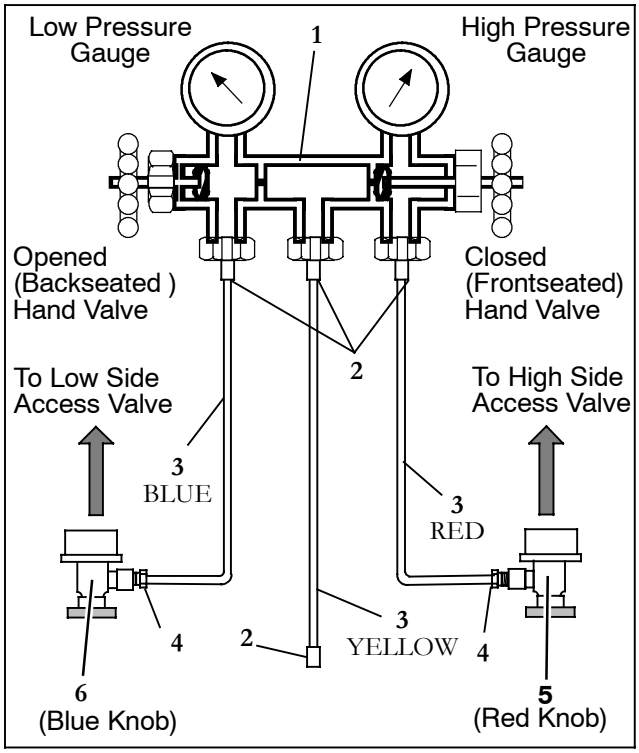
c. Removing the Manifold Gauge Set

1. While the compressor is still ON, backseat the high side service valve.
2. Midseat both hand valves on the manifold gauge set and allow the pressure in the manifold gauge set to be drawn down to low side pressure. This returns any liquid that may be in the high side hose to the system.

⚠ CAUTION

To prevent trapping liquid refrigerant in the manifold gauge set be sure set is brought to suction pressure before disconnecting.

3. Backseat the low side service valve. Backseat both field service couplers and frontseat both manifold set hand valves. Remove the couplers from the access valves.
4. Install both service valve stem caps and access valve caps (finger-tight only).



1. Manifold Gauge Set
2. Hose Fitting (0.5-16 Acme)
3. Refrigeration and/or Evacuation Hose . (SAE J2196/R-134a)
4. Hose Fitting w/O-ring (M14 x 1.5)
5. High Side Field Service Coupler
6. Low Side Field Service Coupler

Figure 3-2 Manifold Gauge Set (R-134a)

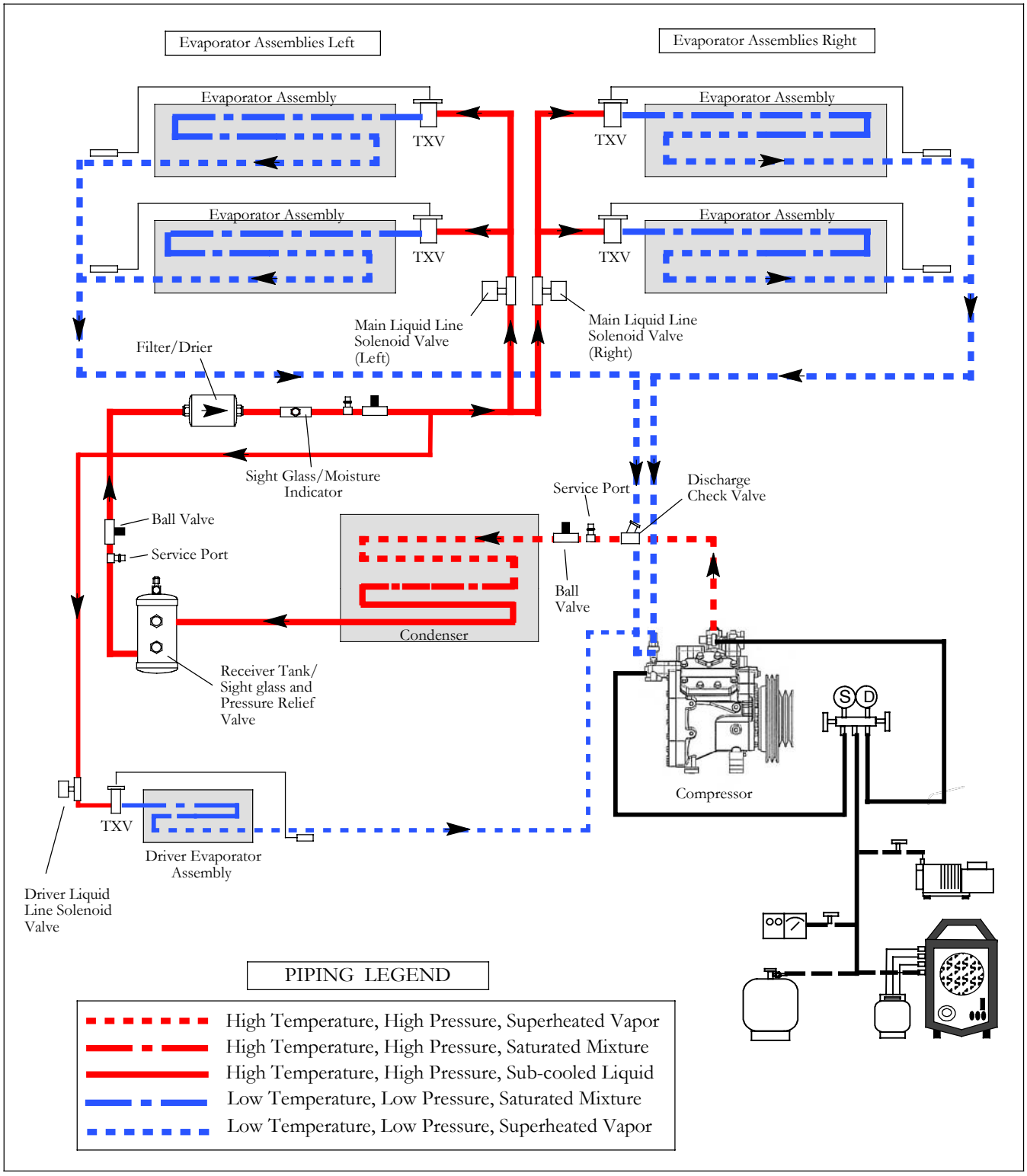


Figure 3-3 Low Side Pump Down Connections

3.2.2 SYSTEM PUMP DOWN FOR LOW SIDE REPAIR

To service or replace the thermostatic expansion valves, filter drier, suction line or liquid line solenoid valve. pump the refrigerant to the condenser and receiver as follows:

a. Install manifold gauge set to compressor suction & discharge valve service ports. Refer to Figure 3-3.

b. Close the filter-drier inlet service valve (ball valve after receiver tank) by turning ¼ turn. Install a jumper on the compressor mounted low pressure switch (electrical connector on harness).

c. Start the system and run in cooling. Stop the unit when suction reaches 0 psig (0 Bar).

⚠ DANGER

Disconnect the compressor clutch wire to disable accidental clutch operation.

d. Frontseat the compressor discharge service valve to trap refrigerant in the high side of the system between the compressor discharge service valve and the filter-drier inlet valve. Wait 5 minutes to verify that system remains at approximately 0 psig (0 Bar). If system pressure rises above 0 psig (0 Bar), open the compressor discharge service valve, reconnect the compressor clutch wiring and repeat steps c and d until the system remains at 0 psig (0 Bar).

e. Service or replace necessary components.

f. Energize the Liquid Line Solenoid Valve (LSV) using an external power source (24 VDC).

⚠ WARNING

Failure to energize liquid line solenoids will prevent full access to the entire portion of the system that was pumped down, resulting in non-condensibles being trapped in the system.

g. Leak check connections after repair with dry nitrogen pressurized to 150 psig (10.3 Bar).

h. Replace filter-drier .

i. Using refrigerant hoses designed for vacuum service, evacuate and dehydrate the low side of the system by connecting a vacuum pump to the center hose connection of manifold gauge set. Verify the compressor suction service valve is midseated. Open (backseat) the manifold suction and discharge service valves. Evacuate system to 500 microns. Close off vacuum pump valve and stop pump. Wait 5 minutes to verify that vacuum holds. If vacuum holds below 1000 microns, isolate the micron gauge from system to prevent exposure to pressure.

j. Open compressor suction and discharge service valves and inlet service valve of filter drier.

k. Disconnect external 24 VDC to liquid solenoid valves.

l. Re-connect the compressor clutch and low pressure switch electrical connectors.

m. Run and check refrigerant level. Refer to paragraph 3.5.

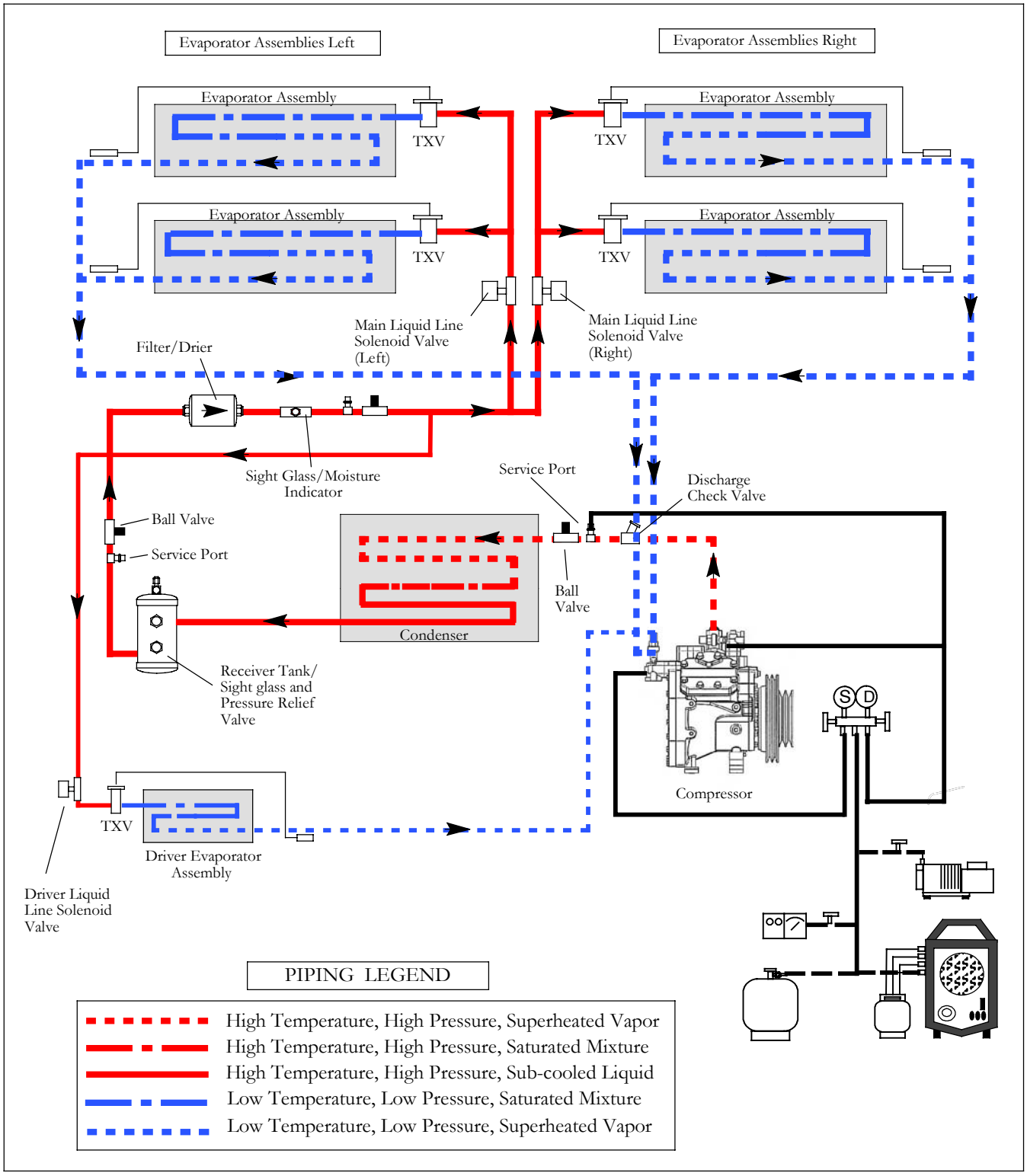


Figure 3-4 Removing Entire Refrigerant Charge

3.2.3. Removing Entire System Charge

NOTES

It is recommended that the Filter/Drier be replaced after opening the refrigeration system for any repair.

⚠ WARNING

Use of an electro-magnetic valve as a means of positive shutoff for service is not recommended or good service practice.

⚠ WARNING

For Safety, the bus and A/C system should be OFF, and lockout/tag out procedures should be implemented.

To remove the entire refrigerant charge for system component repair, do the following:

a. Connect a manifold gauge set to the system as shown in Figure 3-4.

b. Connect a reclaimer to the center manifold gauge set connection.

c. Recover refrigerant in accordance with reclaimer manufacturers instructions.

d. After repair is completed, a leak check should be performed prior to system evacuation/dehydration and charging.

3.3 REFRIGERANT LEAK CHECK

A refrigerant leak check should always be performed after the system has been opened to replace or repair a component. To check for leaks in the refrigeration system, perform the following procedure:

NOTE

It is emphasized that only the correct refrigerant should be used to pressurize the system. Use of any other refrigerant will contaminate the system, and require additional evacuation.

a. Ensure the service valves are open.

b. If system is without refrigerant, charge system with refrigerant vapor to build up pressure to approximately 30 PSIG (R-134a).

c. Add sufficient nitrogen to raise system pressure to 150 to 200 psig (10.3 to 13.8 bar).

d. Check for leaks. The recommended procedure for finding leaks in a system is with an electronic leak detector. Testing joints with soap suds is satisfactory and may be necessary under conditions when an electronic leak detector will not function correctly.

e. Remove test gas and replace filter-drier.

f. Evacuate and dehydrate the system. Refer to paragraph 3.4.

g. Charge the unit. Refer to Section 3.5.

3.4 EVACUATION AND DEHYDRATION

3.4.1 General

The presence of moisture in a refrigeration system can have many undesirable effects. The most common are copper plating, acid sludge formation, "freezing-up" of metering devices by free water, and formation of acids, resulting in metal corrosion. A one time evacuation (Refer to paragraph 3.4.3) should take place after a minor system repair (replacement of a solenoid valve or a filter drier).

3.4.2 Preparation

NOTE

Using a compound gauge for determination of vacuum level is not recommended because of its inherent inaccuracy.

a. Evacuate and dehydrate only after pressure leak test. Refer to paragraph 3.3.

b. Essential tools to properly evacuate and dehydrate any system include a good two stage vacuum pump with a minimum of 6 cfm (10.2 m^3/hr) volume displacement.

c. Keep the ambient temperature above 60°F (15.6°C) to speed evaporation of moisture. If ambient temperature is lower than 60°F (15.6°C), ice may form before moisture removal is complete.

3.4.3 Procedure for Evacuation and Dehydrating System

a. If applicable, remove refrigerant using a refrigerant recovery system. Refer to paragraph 3.2.3.

b. The recommended method is connecting lines (refrigerant hoses designed for vacuum service) as shown in Figure 3-4.

⚠ WARNING

If connections to the system are only made at the compressor (as shown in Figure 3-3), it will be necessary to energize the liquid line solenoids to evacuate entire refrigerant system.

c. Start vacuum pump. Slowly open valves halfway and then open vacuum gauge valve.

d. Evacuate unit until vacuum gauge indicates 500 microns Hg vacuum.

e. Close off vacuum pump valve , and stop pump. Wait five minutes to see if vacuum holds below 1000 microns.

f. If system rises above 1000 microns, re-start pump and repeat steps d. and e. until proper level of vacuum is maintained.

g. Close vacuum gauge isolation valve to prevent damage to vacuum gauge. Vacuum gauges should never be exposed to positive pressure to avoid damage or affect the vacuum gauge calibration.

h. Charge system. Refer to paragraph 3.5.3.

3.5 CHECKING AND ADDING REFRIGERANT TO SYSTEM

3.5.1 Checking Refrigerant Charge By Pressures

For the purpose of checking refrigerant pressures to determine if the approximate charge level is correct, the following conditions and method can be used:

a. Install Manifold Gauge set as described in Paragraph 3.2.1

b. Coach engine operating at high idle.

c. Unit operating fully loaded in cool mode for 15 minutes.

d. Compressor discharge (head) pressure to minimum of 150 PSIG (10.3 Bar) for R-134a. (It may be necessary to heat the coach to provide sufficient heat load).

e. Under the above conditions, the "Rule of Thumb" method can be used as a reference for proper charge level. See Figure 3-5.

"Rule of Thumb"
Air Conditioning System Pressures

For Discharge Pressure

Condenser Inlet Temperature	_____	_ F
Plus (Constant)	40	_ F
Equals	_____	_ F
P/T Chart Temperature	_____	PSIG

For Suction Pressure

Evap. Return Air Temperature	_____	_ F
Minus (Constant)	30	_ F
Equals	_____	_ F
P/T Chart Temperature	_____	PSIG

Figure 3-5 Rule of Thumb

3.5.2 Checking Refrigerant Charge By Receiver Sight Glasses

For the purpose of checking refrigerant sight glasses to determine if the approximate charge level is correct, the following conditions and method can be used:

a. Unit operating fully loaded in cool mode for 15 minutes.

b. Compressor discharge (head) pressure to 150 PSIG (10.3 Bar) for R-134a. (It may be necessary to heat the coach to provide sufficient heat load).

c. Under the above conditions, the system is charged properly when liquid refrigerant is full in the lower sight glass located on receiver tank, with no refrigerant visible in the upper sight glass.

3.5.3 Adding Full Charge

a. Install manifold gauge set at the compressor suction service valve and discharge service port after discharge check valve. See figure Figure 3-4.

b. Leak check the system. Refer to paragraph 3.3.

c. Evacuate and dehydrate system. Refer to paragraph 3.4.

NOTE

Liquid charging can be done at the discharge service port after the discharge check valve.

d. Place appropriate refrigerant cylinder on scales. Prepare to charge liquid refrigerant into the system by connecting the charging hose from refrigerant cylinder to the discharge service port after the discharge check valve.

e. Note weight of refrigerant and cylinder.

f. Open cylinder valve and add liquid charge through discharge hose connection only.

⚠ WARNING

Do not add liquid refrigerant through the low side manifold connection going to the compressor

g. When correct charge has been added (refer to paragraph 1.2), close cylinder valve.

NOTE

It may be necessary to add refrigerant vapor to the suction side of system at the compressor suction service valve in order to raise system pressure above the low pressure cut out switch.

h. Check charge level in accordance with the procedures of paragraph 3.5.1.

3.5.4 Adding Partial Charge

a. Check charge level in accordance with the procedures of paragraph 3.5.2.

b. Install manifold gauge set at the compressor suction service valve.

c. Place appropriate refrigerant cylinder on scale. Prepare to charge vapor refrigerant by connecting charging hose from container to center connection on gauge manifold. Purge air from hoses.

d. Run the unit in the cool mode and allow system to stabilize. With the suction service valve midseated, open the refrigerant cylinder valve and add vapor charge until proper liquid level is detected in the receiver sight glasses (refrigerant full in lower sight glass and none in upper glass).

e. Backseat the suction service valve. Close the vapor valve on the refrigerant drum and note weight. Remove the manifold gauge set and replace all valve caps.

3.6 CHECKING SYSTEM FOR NON-CONDENSIBLES

To check for noncondensibles, proceed as follows:

a. Stabilize system to equalize pressure between the suction and discharge side of the system.

b. Check temperature at the condenser and receiver.

c. Check pressure at the filter-drier inlet service port.

d. Check saturation pressure as it corresponds to the condenser/receiver temperature using the Temperature-Pressure Chart, Table 3-2.

e. If gauge reading is 3 psig (0.20 bar) or more than the saturation pressure in step d, noncondensibles are present.

f. Remove refrigerant using a refrigerant recovery system.

g. Evacuate and dehydrate the system. Refer to paragraph 3.4.3.

h. Charge the unit. Refer to paragraph 3.5.3.

3.7 FILTER-DRIER

3.7.1 To Check Filter-Drier

The filter-drier must be changed if the drier is partially restricted or service has been performed on the refrigerant system. Check for a restriction by feeling the inlet and outlet lines of the filter-drier. If the outlet side feels cooler than the inlet side, then the filter-drier should be changed.

3.7.2 To Replace Filter-Drier

⚠ WARNING

Use of an electro-magnetic valve as a means of positive shutoff for service is not recommended for safety, or good service practice.

a. Perform a system low side pump down. Refer to paragraph 3.2.2.

b. Front seat the filter drier outlet ball valve to isolate filter drier.

c. Lock out/Tag out the bus electrical system to prevent unit operation.

d. Using wrenches to back up the system piping, slowly loosen hex nuts retaining the filter drier.

⚠ WARNING

The filter-drier may contain liquid refrigerant. Slowly loosen the ORS hex nuts to avoid refrigerant contact with exposed skin or eyes.

e. Place a new filter-drier near the unit for immediate installation.

f. Loosen or remove clamps securing the filter-drier.

g. Remove the filter-drier.

h. Remove seal caps from the new filter-drier. Apply a light coat of mineral oil to the O-Rings and seat in the grooves of the filter-drier.

i. Assemble the new filter-drier to lines ensuring that the arrow on the body of the filter-drier points in the direction of the refrigerant flow (refrigerant flows from the condenser to the evaporator), and that the O-Rings have remained in place. Finger tighten ORS hex nuts.

j. Tighten the filter-drier ORS hex nuts using two open end wrenches.

k. Leak check filter drier connections with nitrogen by adding through service valve ports.

l. Remove nitrogen and evacuate filter drier using service ports.

m. Open filter drier service ball valves and restore electrical power to unit.

3.8 SERVICING THE LIQUID LINE SOLENOID VALVE

The Liquid line solenoid valve requires no maintenance unless a malfunction to the internal parts or coil occurs. This may be caused by foreign material such as: dirt, scale, or sludge in the refrigeration system, or improper voltage to the coil.

There are only three possible valve malfunctions: coil burnout, failure to open, or failure to close.

Coil burnout may be caused by the following:

1 Improper voltage.

2 Continuous over-voltage, more than 10% or under-voltage of more than 15%.

3 Incomplete magnet circuit due to the omission of the coil housing or plunger.

Failure to open may be caused by the following:

1 Coil burned out or an open circuit to coil connections.

2 Improper voltage.

3 Defective plunger or deformed valve body assembly.

Failure to close may be caused by the following:

1 Defective plunger or deformed valve body assembly.

2 Foreign material in the valve.

3.8.1 Coil Replacement

a. It is not necessary to remove the refrigerant charge from the system.

b. Place main battery disconnect switch in OFF position and lock.

c. Disconnect wire leads to coil.

d. Remove/loosen retainer of solenoid coil.

e. Lift coil from enclosing tube and replace.

f. Connect wire leads and test operation

3.8.2 Internal Part Replacement

a. Perform a low side pump down. Refer to paragraph 3.2.2.

b. Carefully loosen enclosing tube assembly and ensure no pressure remains within the valve. Disassemble valve and replace defective parts.

c. Assemble valve and leak check. Refer to paragraph 3.3

d. Evacuate/Dehydrate system. Refer to paragraph 3.4.

3.9 THERMOSTATIC EXPANSION VALVE

The thermostatic expansion valve is an automatic device which maintains constant superheat of the refrigerant gas leaving the evaporator regardless of suction pressure. The valve functions are: (a) automatic control of refrigerant flow to match the evaporator load and (b) prevention of liquid refrigerant entering the compressor. Unless the valve is defective, it seldom requires any maintenance.

3.9.1 Valve Replacement

a. Perform a low side pump down. Refer to paragraph 3.2.2.

b. Remove insulation from expansion valve and bulb. See Figure 3-6.

c. Loosen retaining straps holding bulb to suction line and detach bulb from the suction line.

d. Loosen flare nuts on equalizer line and disconnect equalizer line from the expansion valve.

e. Un-braze the connections to the expansion valve.

NOTE

When any brazing is performed on system piping, an inert gas should be used to prevent system contamination.

f. Reinstall the new valve assembly.

g. Fasten equalizer line to the expansion valve.

h. Assemble valve and leak check. Refer to paragraph 3.3

i. The thermal bulb is installed below the center of the suction line (four or eight o'clock position). This area must be clean to ensure positive bulb contact. Strap thermal bulb to suction line. Ensure that retaining straps are tight and renew insulation.

j. Evacuate/Dehydrate system. Refer to paragraph 3.4.

k. Recharge system. Refer to paragraph 3.5.3.

l. Run the coach for approximately 30 minutes on fast idle.

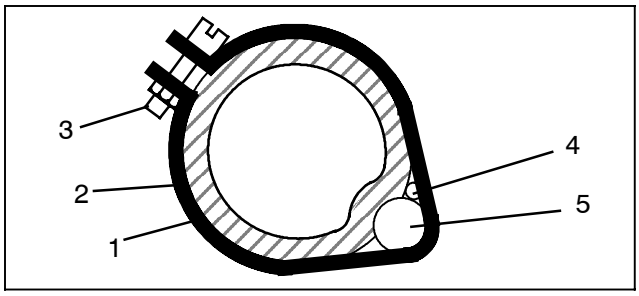
m. Check refrigerant level. Refer to paragraph 3.5.1.

n. Check superheat. Refer to paragraph 3.9.2.

3.9.2 Superheat Measurement

NOTE

All readings must be taken from the TXV bulb location and out of the direct air stream.



1. Suction Line (section view)
2. TXV Bulb Clamp
3. Nut & Bolt (clamp)
4. Thermocouple
5. TXV Bulb (Shown in the 4'clock position)

Figure 3-6 Thermostatic Expansion Valve Bulb and Thermocouple

a. Remove Presstite insulation from expansion valve bulb and suction line.

b. Loosen one TXV bulb clamp and make sure area under clamp is clean.

c. Place temperature thermocouple in contact with the suction tube and parallel to the TXV bulb, and then secure loosened clamp making sure both bulb and thermocouple are firmly secured to suction line. See Figure 3-6. Reinstall insulation around the bulb.

d. Connect an accurate low pressure gauge to the low pressure port .

e. Start bus and run on fast idle until unit has stabilized, about 20 to 30 minutes.

NOTE

When conducting this test, the suction pressure must be at least 6 psig (0.41 bar) below the expansion valve maximum operating pressure (MOP).

f. From the temperature/pressure chart (Table 3-2), determine the saturation temperature corresponding to the evaporator outlet pressure.

g. Note the temperature of the suction gas at the expansion valve bulb. Subtract the saturation temperature from this temperature. The difference is the superheat of the suction gas.

h. The superheat may cycle from a low to high reading. Monitor the superheat taking readings every 3-5 minutes for a total of 5-6 readings. Calculate the superheats, add the readings and divide by the number of readings taken to determine average superheat.

3.10 REPLACING EVAPORATOR RETURN AIR FILTERS

The evaporator return air filters are located in the evaporator section next to the evaporator coils. Access to the filters is accomplished by opening the evaporator covers.

The filters should be checked for cleanliness periodically depending on operating conditions. A dirty filter will restrict air flow over the evaporator coil which may cause insufficient cooling or heating and possible frost buildup on the coil. To remove the filters, do the following.

a. Place main battery disconnect switch in OFF position and lock.

b. Open the evaporator front covers.

c. Grasp and lift the filter elements out using care not to damage the evaporator coil.

d. Reverse procedure to install new filters and close the covers.

3.11 COMPRESSOR MAINTENANCE

General maintenance and procedures regarding the Bitzer 6NFCY Compressor are addressed in this section. For more detailed information regarding the compressor and repair procedures, please refer to the manufactures manual by downloading from the following website.

www.bitzerus.com

3.11.1 Removing the Compressor

a. Place main battery disconnect switch in OFF position and lock.

a. Connect manifold gauge set as shown in Figure 3-3. Frontseat (close) the compressor suction and discharge service valves and recover refrigerant from the compressor through the service valve ports.

b. Tag and disconnect wiring to the high pressure and low pressure switch, unloaders and clutch.

c. Remove tension on drive belts, remove drive belts.

d. Loosen bolts at suction and discharge service valve flanges and break seal to be sure pressure is released. Remove bolts.

e. Remove bolts holding compressor to base

f. Attach sling or other device to the compressor and remove compressor from the coach through the rear access door.

g. Check oil level in service replacement compressor.

h. Remove the pressure switches and install on replacement compressor.

i. Remove clutch assemble and clutch key. Install on replacement compressor.

j. Install compressor in unit by performing the removal steps in reverse. Install new gaskets on service valves and tighten bolts uniformly. Refer to Bitzer Service manual for torque values.

k. Evacuate/Dehydrate compressor.

l.Backseat (open) the compressor suction and discharge service valves.

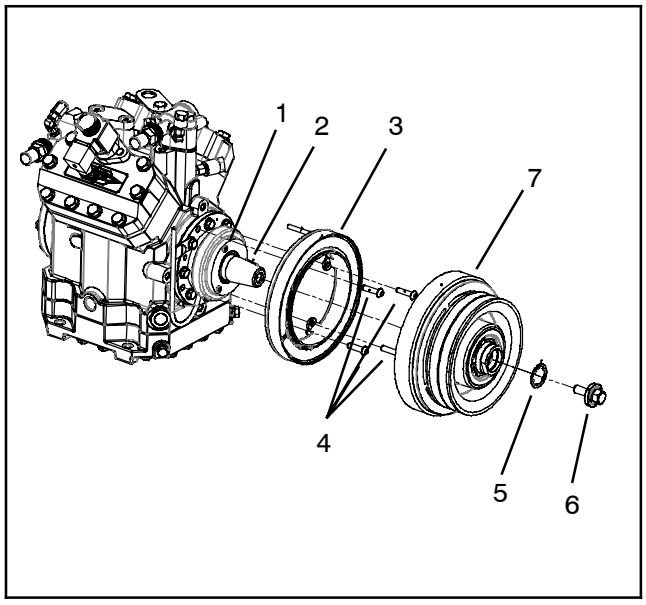
m.Check compressor oil level. Refer to paragraph 3.11.3.

n. Check compressor unloader operation. Refer to paragraph 3.11.4

o. Remove manifold gauge set. Refer to paragraph 3.2.1.

3.11.2 Transferring Compressor Clutch

To remove a clutch (see Figure 3-7) from a compressor and install on a replacement compressor, do the following:



1. Bearing Flange
2. Woodrfuff Key
3. Magnet/Coil
4. Screws M8x30
5. Straining Screw
6. Seeger- K- Ring
7. Clutch Assembly

Figure 3-7 Compressor Clutch

a. Place main battery disconnect switch in OFF position and lock.

b. Tag and disconnect wiring to the clutch.

c. Remove tension on drive belts, remove drive belts.

d. Turn the straining screw (item 5 in Figure 3-7) counterclockwise until the collar of the Seeger-K-Ring (item 6 in Figure 3-7) lies flat.

e. Continue turning the straining screw counterclockwise, hard enough to release the clutch from the shaft.

f. Remove the clutch.

g. Remove the 4 screws (item 4 in Figure 3-7) and remove magnet/coil (item 3 in Figure 3-7).

h. Re-install in reverse order.

i. Install magnet/coil. Install the 4 screws retaining the coil in crosshatch pattern, and torque to 18 ft/lb (25 Nm).

j. Mount Woodruff Key (item 2 in Figure 3-7).

k. Slide clutch assembly onto shaft and magnet/coil. Lubricate the straining screw into shaft end and torque to 63 ft/lb (85 Nm).

l. Re-connect wiring to the magnet/coil. Route and secure wiring from sources of heat and chafing.

3.11.3 Compressor Oil Level

To check the compressor oil level do the following:

a. Operate the coach for at least one-half hour at fast idle speed, with the temperature controls at the coolest setting, and the compressor fully loaded. It may be necessary to pre-heat the coach and/or operate the system in the reheat mode to keep the compressor fully loaded throughout this procedure

b. Ensure the system is fully charged (refer to paragraph 3.5) and the compressor crankcase is warm to the touch after fifteen minutes of operation.

c. Shut off the system and immediately record the oil level in the compressor sight glass. If the compressor is not level, an average between the sight glass levels will have to be made to determine level.

d. The correct oil level for this application should be between the 1/4 and 3/4 of the oil level sightglass.

⚠ WARNING

Extreme care must be taken to ensure that all the refrigerant has been removed from the compressor crankcase or the resultant pressure will forcibly discharge compressor oil.

3.11.4 Checking Unloader Operation

To check unloader operation do the following:

a. Install a manifold gauge set onto suction and discharge service valves at compressor. Ensure both manifold valves are frontseated and center connection is tight on blank fitting.

b. Midseat compressor suction and discharge valves to monitor pressures.

c. Start the bus and run in cooling, lower set point if required to ensure system remains in full cooling (fully loaded).

d. Slowly frontseat (turn clockwise) the compressor suction service valve until gauge pressure reaches 26 psig (1.8 Bars). This should force the first unloader to be energized.

e. Verify unloader solenoid is energized by checking for 24 VDC at solenoid coil.

f. Slowly frontseat (turn clockwise) the compressor suction service valve further until gauge pressure reaches 23 psig (1.6 Bars). This should force the second unloader to be energized.

g. Verify unloader solenoid is energized by checking for 24 VDC at solenoid coil.

h. Monitor the suction and discharge pressures on the manifold gauge set. If the internal operation of unloader is functional, the suction pressure should rise, and the discharge pressure should drop.

i. Backseat (turn counter clockwise) the compressor suction and discharge service valves and remove manifold gauge set. Replace all service valve caps.

3.12 TEMPERATURE SENSOR CHECKOUT

a. An accurate ohmmeter must be used to check resistance values shown in Table 3-1.

b. Due to variations and inaccuracies in ohmmeters, thermometers or other test equipment, a reading within two percent of the chart value would be considered acceptable. If a sensor is bad, the resistance value would usually be much higher or lower than the value given in Table 3-1.

c. At least one sensor lead must be disconnected from the controller before any reading can be taken. Not doing so will result in a false reading. Two preferred methods of determining the actual test temperature at the sensor are an ice bath at 32°F (0°C) and/or a calibrated digital temperature meter.

Table 3-1 Temperature Sensor Resistance

Temperature		Resistance In Ohms
°F	°C	
-20	-28.9	165,300
-10	-23.3	117,800
0	-17.8	85,500
10	-12.2	62,400
20	- 6.7	46,300
30	- 1.1	34,500
32	0	32,700
40	4.4	26,200
50	10.0	19,900
60	15.6	15,300
70	21.1	11,900
77	25	10,000
80	26.7	9,300
90	32.2	7,300
100	37.8	5,800
110	43.3	4,700
120	48.9	3,800

Table 3-2 R-134a Temperature - Pressure Chart

Temperature		Vacuum		
°F	°C	"/hg	Cm mercury	Bar
-40	-40	14.6	37.08	0.49
.35	.37	12.3	31.25	0.42
-30	-34	9.7	24.64	0.33
-25	-32	6.7	17.00	0.23
-20	-29	3.5	8.89	0.12
-18	-28	2.1	5.33	0.07
-16	-27	0.6	1.52	0.02

Temperature		Pressure		
°F	°C	Psig	Kg/cm2	Bar
-14	-26	0.4	0.03	0.03
-12	-24	1.2	0.08	0.08
-10	-23	2.0	0.14	0.14
-8	-22	2.9	0.20	0.20
-6	-21	3.7	0.26	0.26
-4	-20	4.6	0.32	0.32
-2	-19	5.6	0.39	0.39
0	-18	6.5	0.46	0.45
2	-17	7.6	0.53	0.52
4	-16	8.6	0.60	0.59
6	-14	9.7	0.68	0.67
8	-13	10.8	0.76	0.74
10	-12	12.0	0.84	0.83
12	-11	13.2	0.93	0.91
14	-10	14.5	1.02	1.00
16	-9	15.8	1.11	1.09
18	-8	17.1	1.20	1.18
20	-7	18.5	1.30	1.28
22	-6	19.9	1.40	1.37
24	-4	21.4	1.50	1.48
26	-3	22.9	1.61	1.58

Temperature		Pressure		
°F	°C	Psig	Kg/cm2	Bar
28	-2	24.5	1.72	1.69
30	-1	26.1	1.84	1.80
32	0	27.8	1.95	1.92
34	1	29.6	2.08	2.04
36	2	31.3	2.20	2.16
38	3	33.2	2.33	2.29
40	4	35.1	2.47	2.42
45	7	40.1	2.82	2.76
50	10	45.5	3.20	3.14
55	13	51.2	3.60	3.53
60	16	57.4	4.04	3.96
65	18	64.1	4.51	4.42
70	21	71.1	5.00	4.90
75	24	78.7	5.53	5.43
80	27	86.7	6.10	5.98
85	29	95.3	6.70	6.57
90	32	104.3	7.33	7.19
95	35	114.0	8.01	7.86
100	38	124.2	8.73	8.56
105	41	135.0	9.49	9.31
110	43	146.4	10.29	10.09
115	46	158.4	11.14	10.92
120	49	171.2	12.04	11.80
125	52	184.6	12.98	12.73
130	54	198.7	13.97	13.70
135	57	213.6	15.02	14.73
140	60	229.2	16.11	15.80
145	63	245.6	17.27	16.93
150	66	262.9	18.48	18.13
155	68	281.1	19.76	19.37

SECTION 4

ELECTRICAL

4.1 INTRODUCTION

This section includes electrical wiring schematics. The schematics shown in this section provides information for the TEMSA TS45 model air conditioning units which are fitted with two evaporator blower/motor assemblies in each evaporator section, and four (4) condenser fan motor assemblies. Figure 4-1 shows the MVC wiring diagram used with the TS45.

Figure 4-2 Thru Figure 4-4 show the evaporator, condenser and compressor components individually.

UNIT	CONTROLLER	FIGURE NUMBERS
TS 45	MVC	Figure 4-1

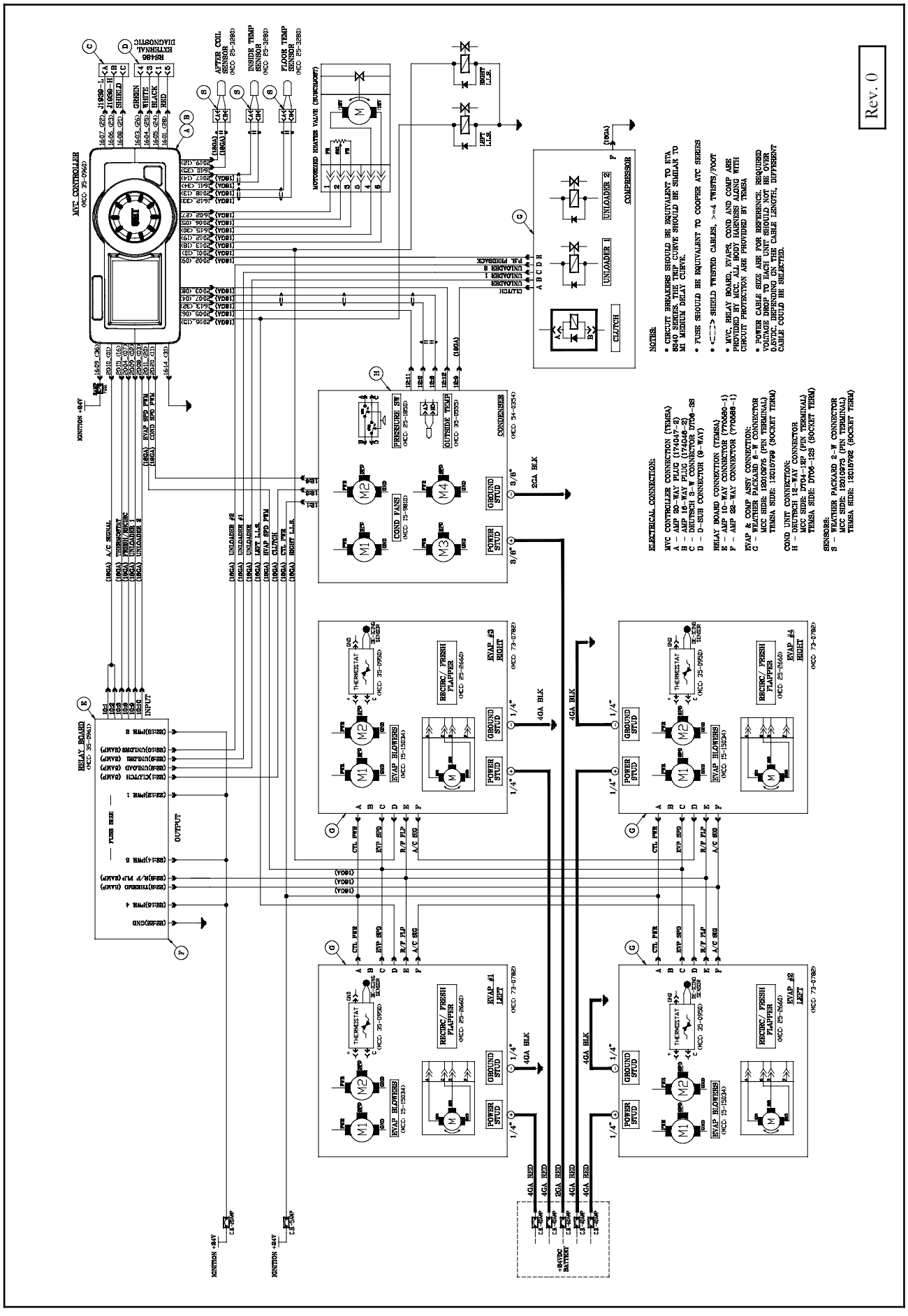
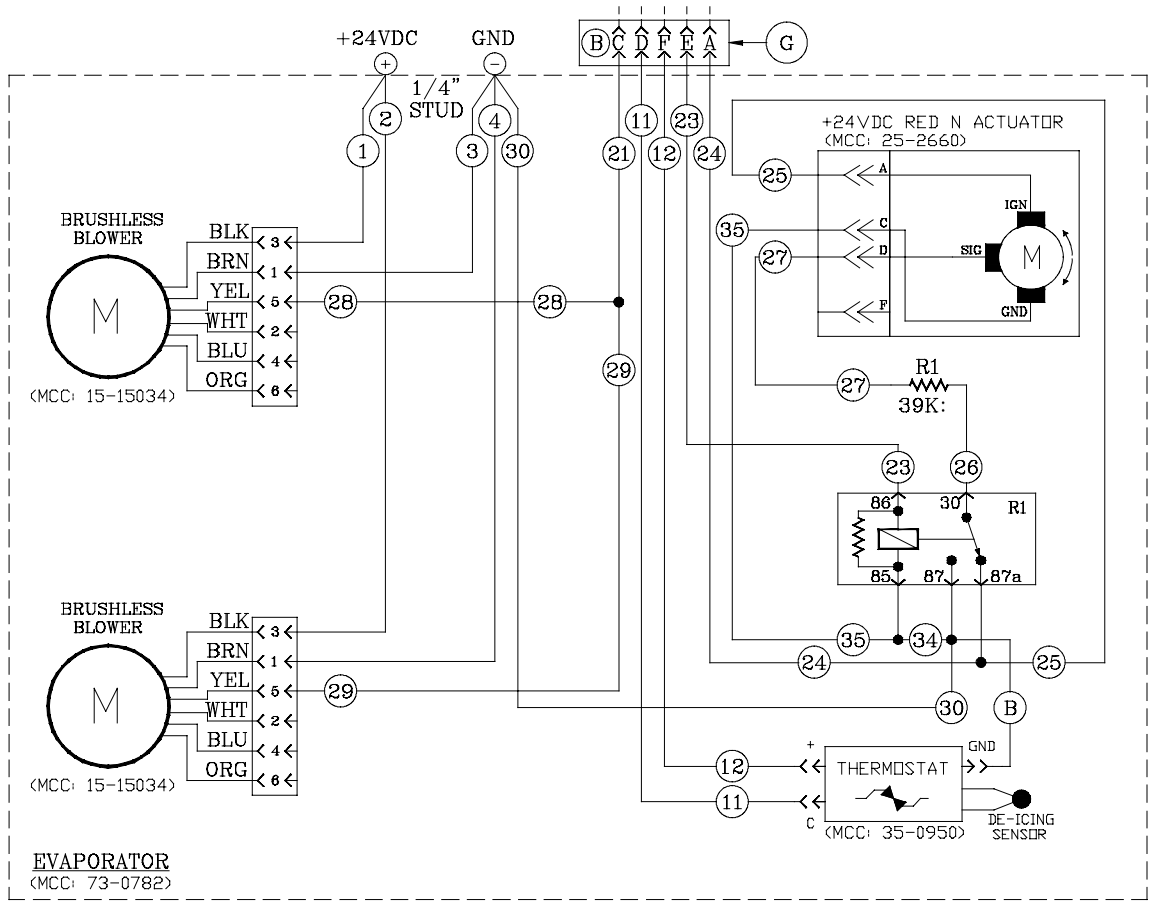


Figure 4-1 Wiring Diagram (19-0791)



ELECTRICAL WIRES:

- #1 –#20: 14GA GXL WHITE
- #21–#35: 18GA GXL WHITE
- #B: 18GA GXL BLACK

INTERFACE CONNECTION:

* CONNECTOR G: 6–WAY PACKARD
- MCC SIDE: 12010975 (PIN TERM)
- TEMSA SIDE:12015799 (SOC TERM)

* PIN ASSIGNMENTS:
A – CONTROL POWER
B – NOT USED
C – EVAP SPEED INPUT
D – CLUTCH OUTPUT
E – FLAPPER SIGNAL (FRESH AIR)
F – CLUTCH INPUT

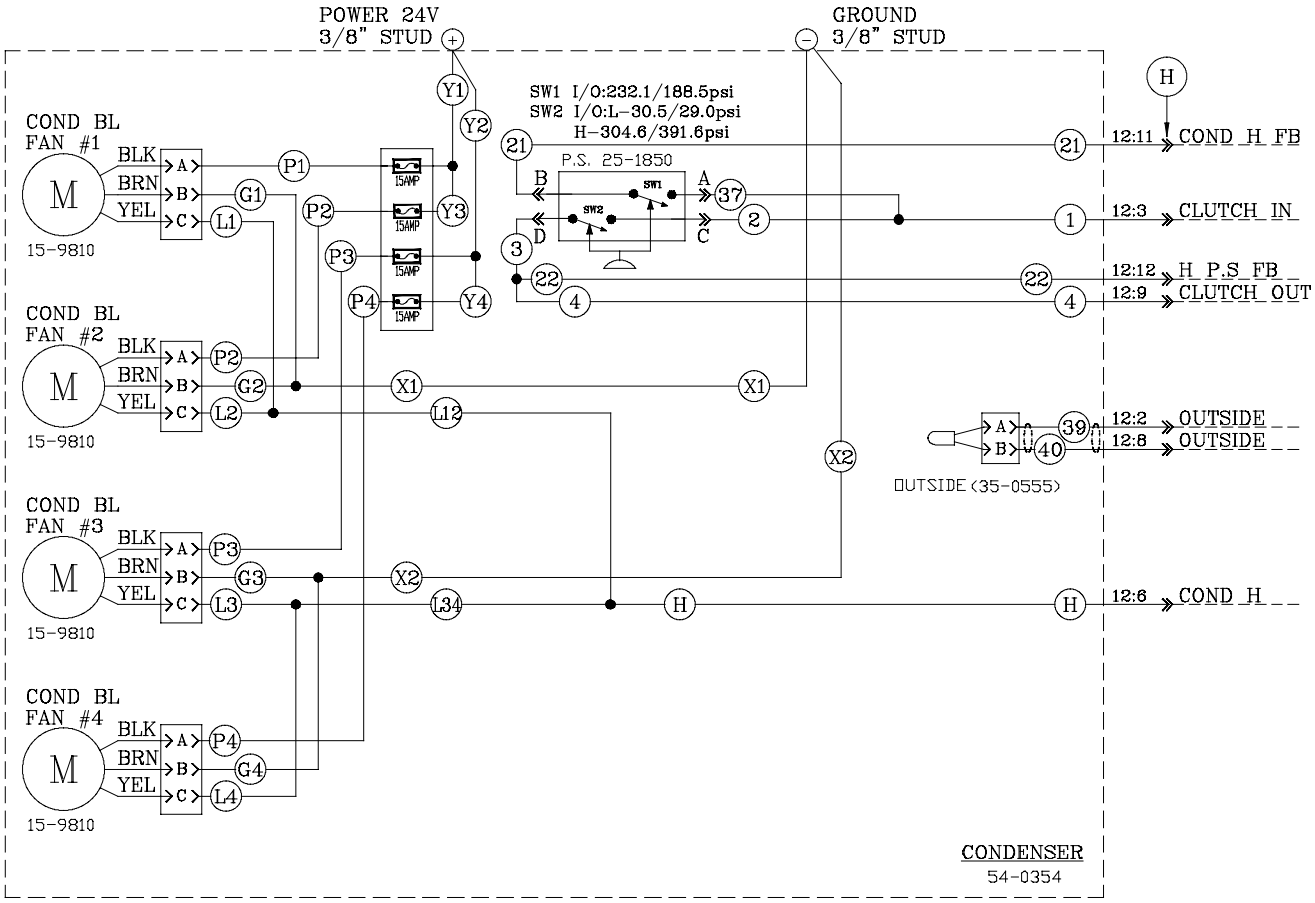
FLAPPER DOOR OPERATION:

- RECIRC:CCW ROTATE 45 DEGREE
- FRESH: CW ROTATE 45 DEGREE

(NOTE: ROTATION LOOK FROM ACTUATOR CONNECTOR SIDE. ANGLE COUNT FROM CENTRE POSITION)

Rev. D

Figure 4-2 Evaporator Diagram



ELECTRICAL WIRES:

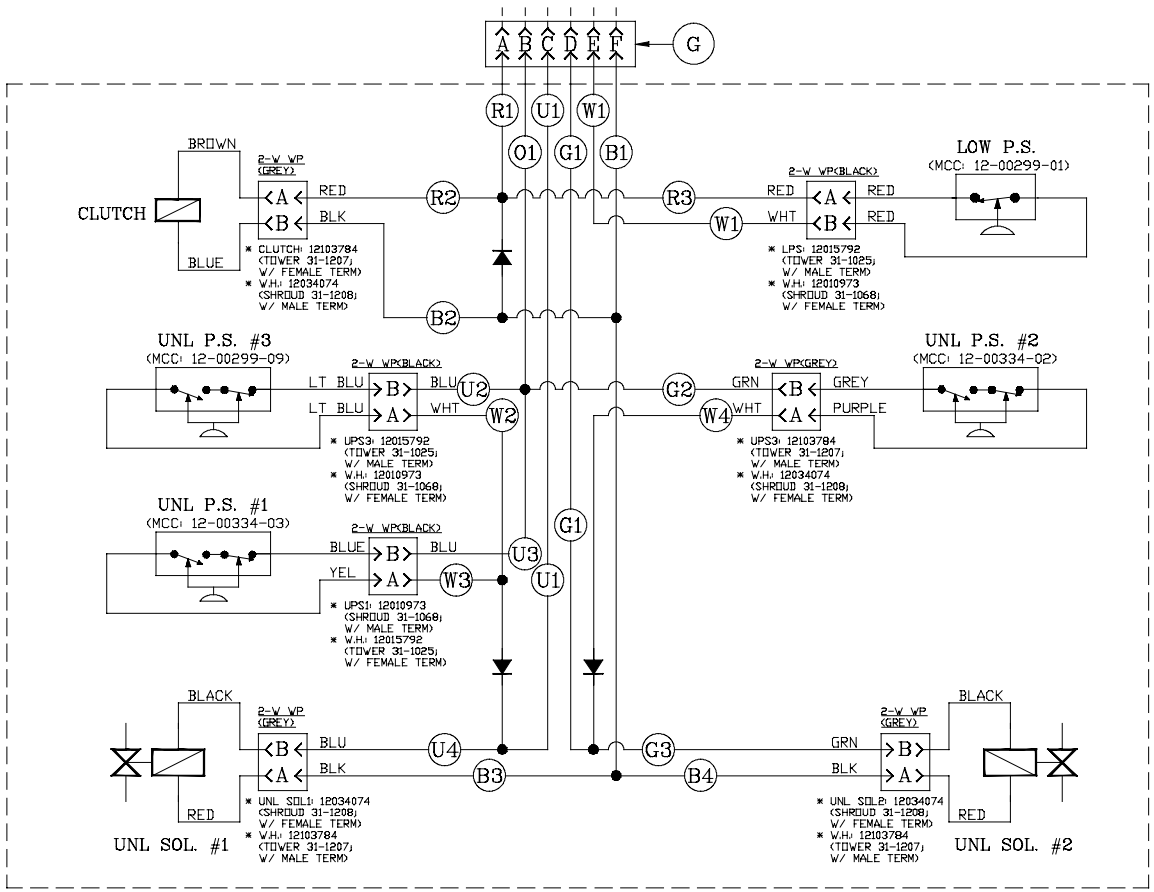
- #1 -#15: 16GA GXL WHITE
- #21-#40: 18GA GXL WHITE
- #PX, #GX: 14GA GXL WHITE
- #LX, #HX: 18GA GXL WHITE
- #Y1, Y2: 12GA GXL ORANGE
- #Y3, Y4: 14GA GXL ORANGE
- #X1, X2: 12GA GXL BLACK

NOTES:

* NEW PROPOSAL WITH SPAL BRUSHLESS FAN (4PCS)
* REMOVED L.L.S. AND USE PWM FAN SPD CONTROL

Rev. C

Figure 4-3 Condenser Diagram



ELECTRICAL WIRES:

- #R1–#R3: 18GA GXL RED
- #B1–#B4: 18GA GXL BLACK
- #W1–#W4: 18GA GXL WHITE
- #U1–#U4: 18GA GXL BLUE
- #G1–#G3: 18GA GXL GREEN
- #O1: 18GA GXL ORANGE

INTERFACE CONNECTION:

* CONNECTOR G: 6–WAY PACKARD
- MCC SIDE: 12010975 (PIN TERM)
- TEMSA SIDE:12015799 (SOC TERM)

* PIN ASSIGNMENTS:
  - A – CLUTCH
  - B – UNLOADER
  - C – UNLOADER 1
  - D – UNLOADER 2
  - E – PS FEEDBACK
  - F – GROUND

Rev. D

Figure 4-4 Compressor Diagram

SECTION 5.1

SERVICE PARTS

INTRODUCTION

This section provides identification of service replacement parts for the Mobile Climate Control Evaporator and Condenser units supplied for the TEMSA/TS45 .

CONFIGURATION IDENTIFICATION

Unit identification information is provided on a plate (decal) located on the unit assembly. This plate provides the unit model number and the unit serial number. The model number identifies the unit configuration and differences in detailed parts.

GENERAL NOTES

To find replacement parts, determine major group in which replacement parts are located and turn to the appropriate page for the illustrated breakdown of the replacement parts. The following letter designations are used to classify parts throughout this list. Parts can be obtained by ordering from the following website:

www.mcc-hvac.com

A/R As Required

N.S. Not Shown on Illustration

NSI Non-Stock Item (Items **may not be available** for purchase, or **may require extended lead times**)

NSS Not Sold Separately - Order next higher assembly or kit.

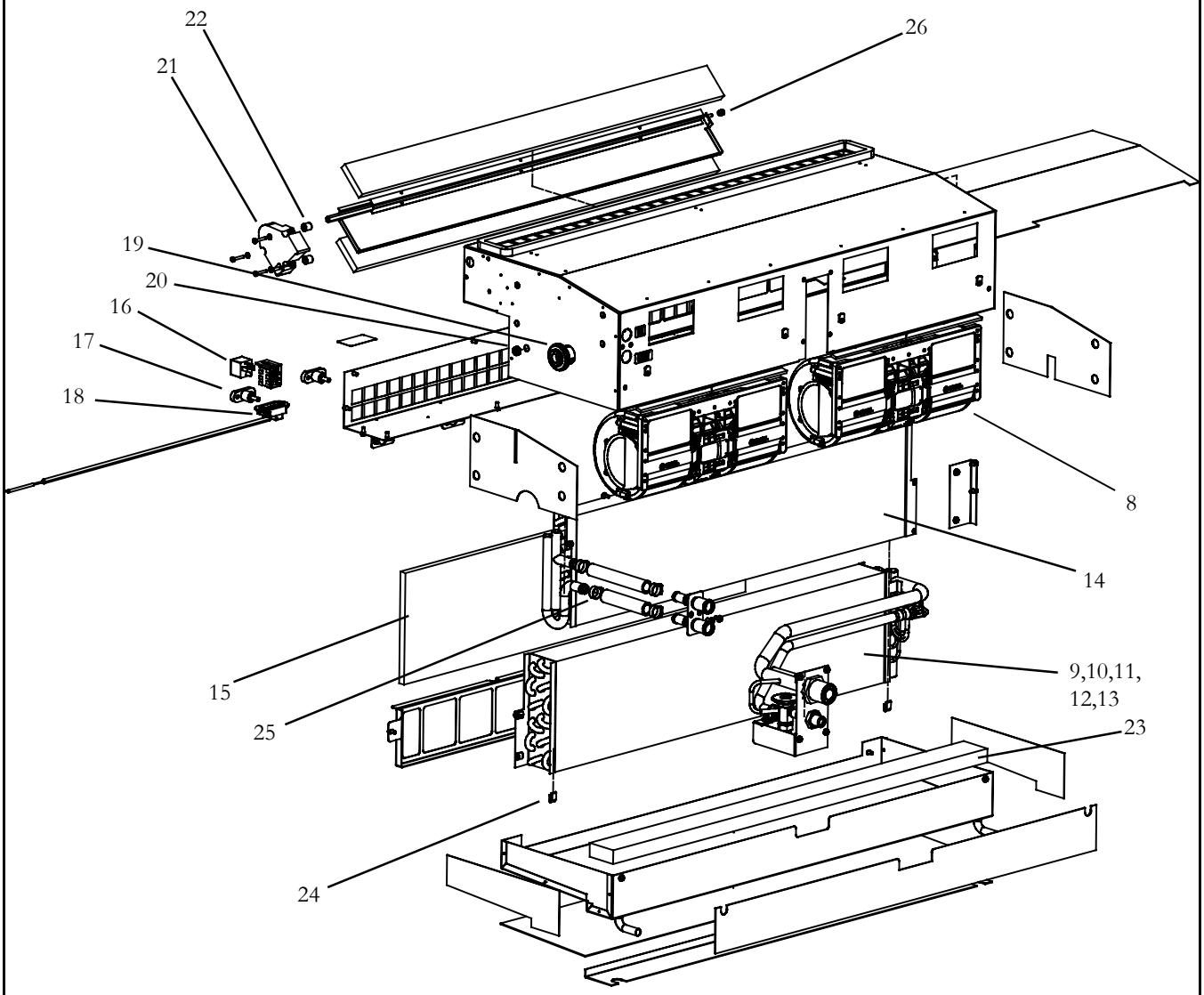
P-- Suffix P-- added to part number means part is available in packaged quantity only.

PL Purchase Locally

SS Stainless Steel

SV Suffix SV added to part number designates service replacement part.

5.1 MCC Evaporator Unit 73-0782



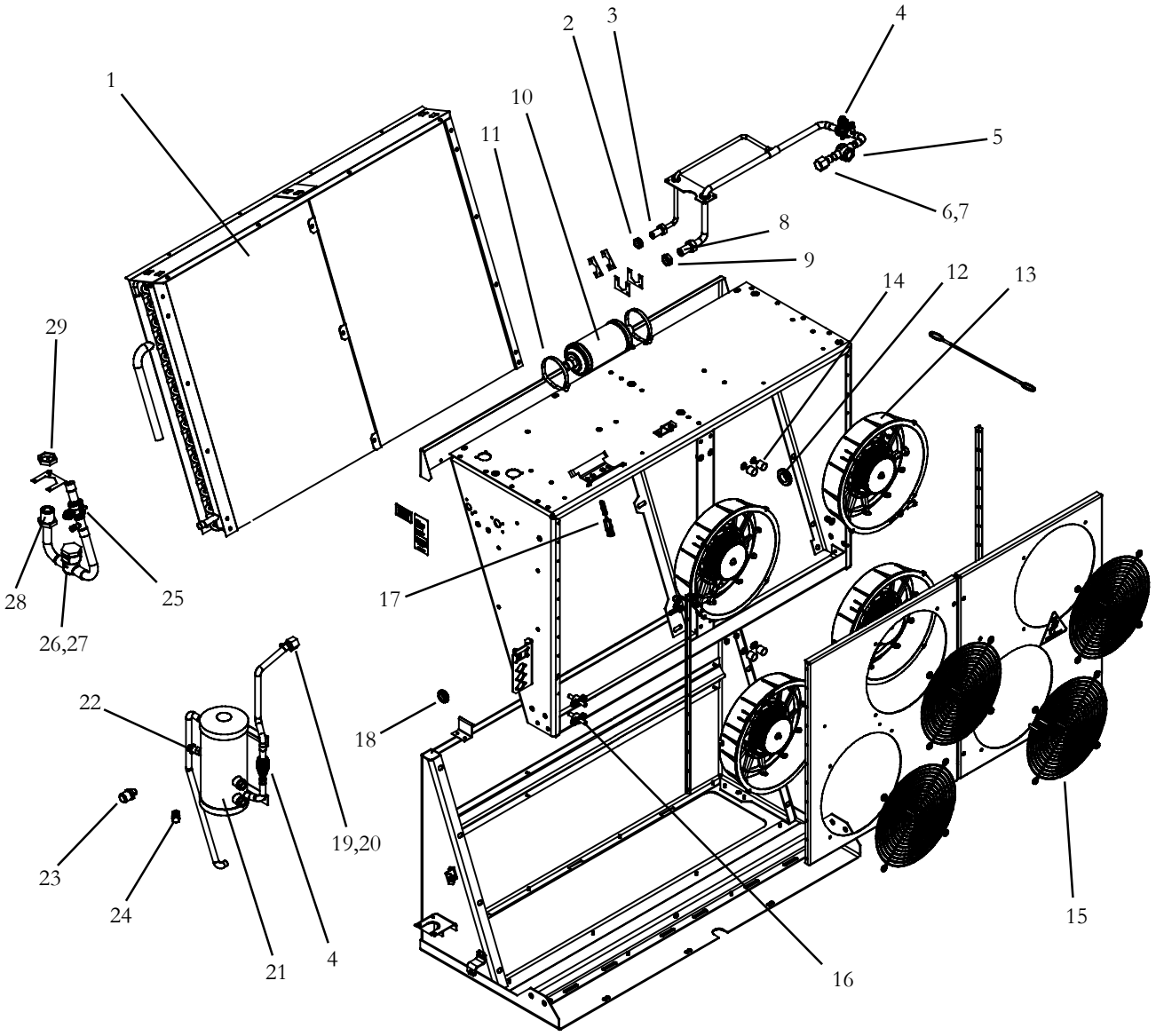
REF: 73-0782

Item	Part Number	Description	Qty
8	15-15034	Blower Assembly, 24 VDC	2
9	21-1991	Evaporator Coil, Includes:	1
10	26-1694	Expansion Valve, 10 kW	1
11	27-1712	Braze Nut, #16 ORS	1
12	27-2294	Fitting, #8	1
13	27-2300	Locknut, #8 MIOR	1
14	22-1340	Heater Coil	1
15	23-0604	Air Filter	1
16	25-0219	Relay 24 VDC	1
17	25-1257	Jumper Stud, ¼" - 20	2

5.1 MCC Evaporator Unit 73-0782 (Continued):

Item	Part Number	Description	Qty
18	35-0950	De-Icing Thermostat	1
19	28-0005	Grommet, ⅝”	1
20	28-0014	Grommet, ⅜”	1
21	25-2660	Motor Actuator, 24 VDC	1
22	29-0124	Nylon Spacer, ½”	3
23	28-1084	Wicking Foam	1
24	29-0437	Panel, Coil Clip	2
25	27-0059	Gear Clamp, ⅝”	4
26	28-0326	Snap Bushing, 3/16”	1
N.S.	25-3349	Wire Harness	**NSI**

5.2 MCC Condenser 54-0354



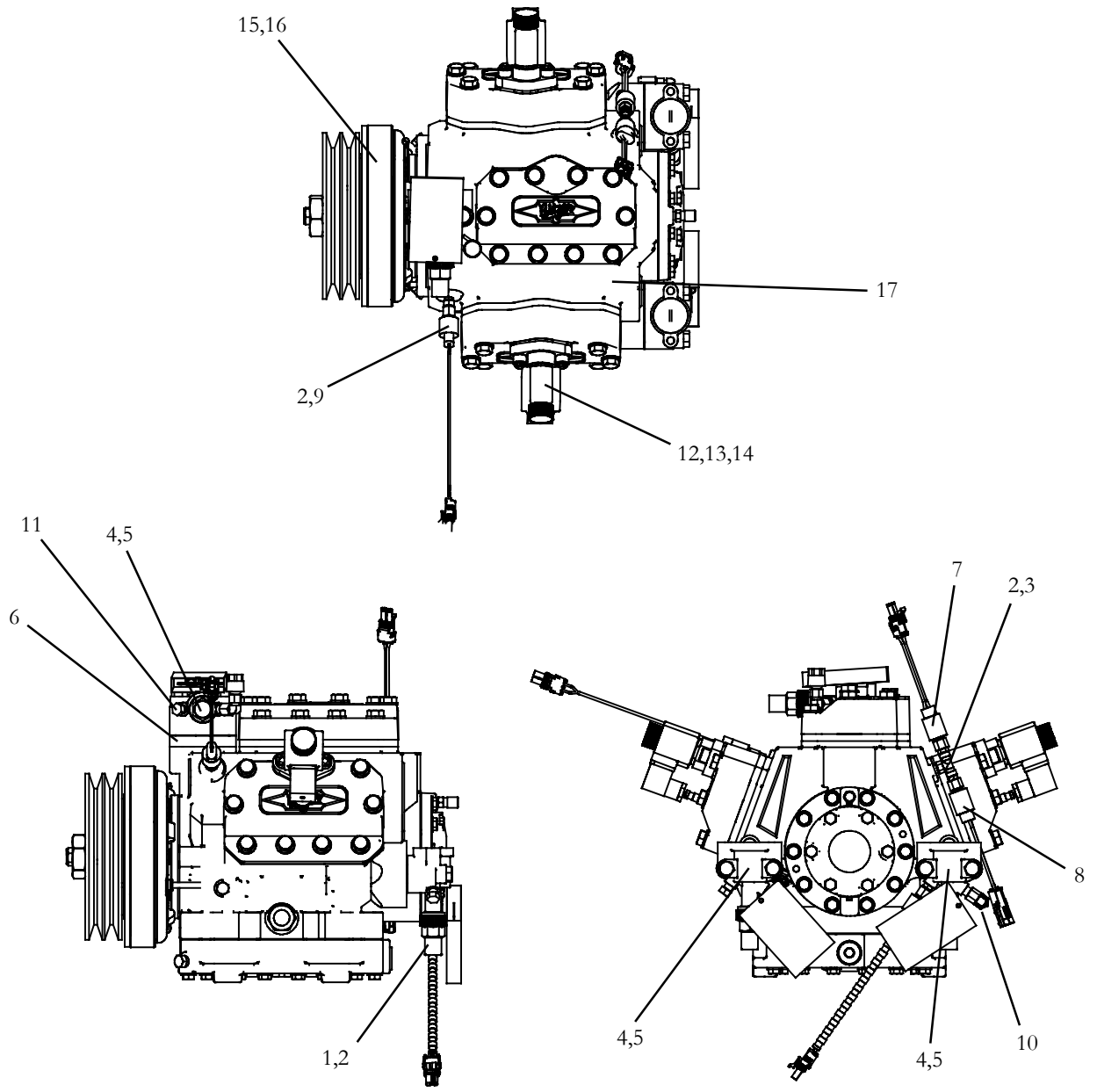
REF: 54-0354

Item	Part Number	Description	Qty
1	21-1266	Condenser Coil	1
2	27-1725	Lock Nut, #6 ORS	1
3	27-1708	Fitting, #6 ORS	1
4	26-1866	Ball Valve, BVS 058	2
5	26-0663	Sight Glass, ⅝" Sweat	1
6	27-1734	Braze Shoulder, #10	1
7	27-1720	Female Nut, #10	1
8	27-2482	Fitting, #8 ORS	1
9	27-1726	Lock Nut, #8 ORS	1

5.2 MCC Condenser 54-0354 (Continued):

Item	Part Number	Description	Qty
10	26-0658	Filter Drier	1
11	27-0183	Gear Clamp, 3.4" - 4"	2
12	28-0007	Grommet, 1 ⅜"	1
13	15-9810	Fan Assembly, 24 VDC	4
14	39-0022	Bumper, Flat Top, Recessed	6
15	23-0678	Finger Guard, 12"	4
16	25-2580	⅜" Stud, (Black)	2
17	35-0555	Air Sensor Assembly	1
18	28-0008	Grommet	1
19	27-1734	Braze Shoulder, #10	1
20	27-1720	Female Nut, #10	1
21	26-2046	Receiver Tank	1
22	26-0691	Pressure Relief Valve	1
23	25-1850	Pressure Switch Assembly	1
24	27-1804	Service Port, High Side	1
25	26-1867	Ball Valve, BVS 078	1
26	26-1242	Check Valve	1
27	26-1242-50	Check Valve Repair Kit	1
28	27-1712	Fitting, #16 ORS	1
29	27-1729	Lock Nut, #16 ORS	1
N.S.	25-3350	Wire Harness	**NSI**

5.3 MCC Compressor Assembly 26-2067

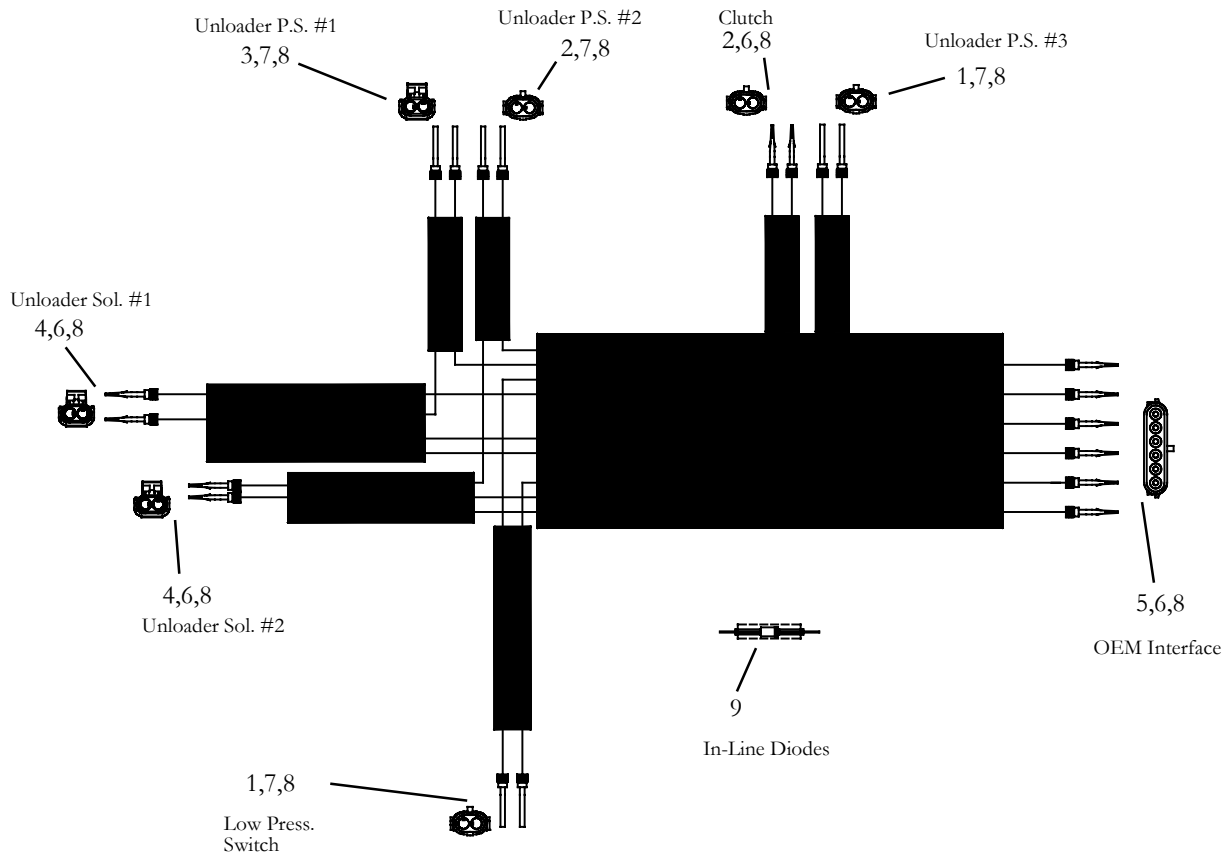


Item	Part Number	Description	Qty
1	12-00299-01	Pressure Switch, Low	1
2	40-00190-00	Fitting, Adaptor, ⅛" Pipe x ¼" Flare w/Core	4
3	40-00249-00	Tee, Male Branch, (FPT x FPT x MPT)	1
4	14-00374-00	Valve, Compressor Shut Off	3
5	42-62134-00	Gasket, Service Valve	3
6	48-62035-00	Spacer, Service Valve	1
7	12-00334-02	Pressure Switch, Unloader, Low Pressure (Open 28-34 psig, Close 21.5-24.5 psig)	1
8	12-00334-03	Pressure Switch, Unloader, Low Pressure (Open 31-37 psig, Close 25-28 psig)	1
9	12-00299-09	Pressure Switch, Unloader, High Pressure (Open 205-235 psig, Close 265-285 psig)	1
10	40-62116-01	Fitting, Adaptor, 134a Low Side Port, ¼ Flare x R134a (16MM)	1

5.3 MCC Compressor Assembly - 26-2067 (Continued):

Item	Part Number	Description	Qty
11	40-62117-01	Fitting, Adaptor, 134a High Side Port, ¼ Flare x R134a (13MM)	1
12	14-00370-00	Stem, Unloader	2
13	22-62268-01	Coil, Solenoid, Unloader, w/ Elec. Connector, 24VDC	2
14	42-62136-00	Gasket, Unloader	2
15	Y60-00006-01	Clutch Assembly, 2B x 20 cm, Linnig, 24VDC w/Connector (Includes):	1
16	Y60-00006-53	Coil, 24VDC	1
17	Y61-NFC02-99	Compressor, Bitzer 6NFC (Bare)	1
N.S.	Y60-00012-00	Shaft Seal, Compressor	1

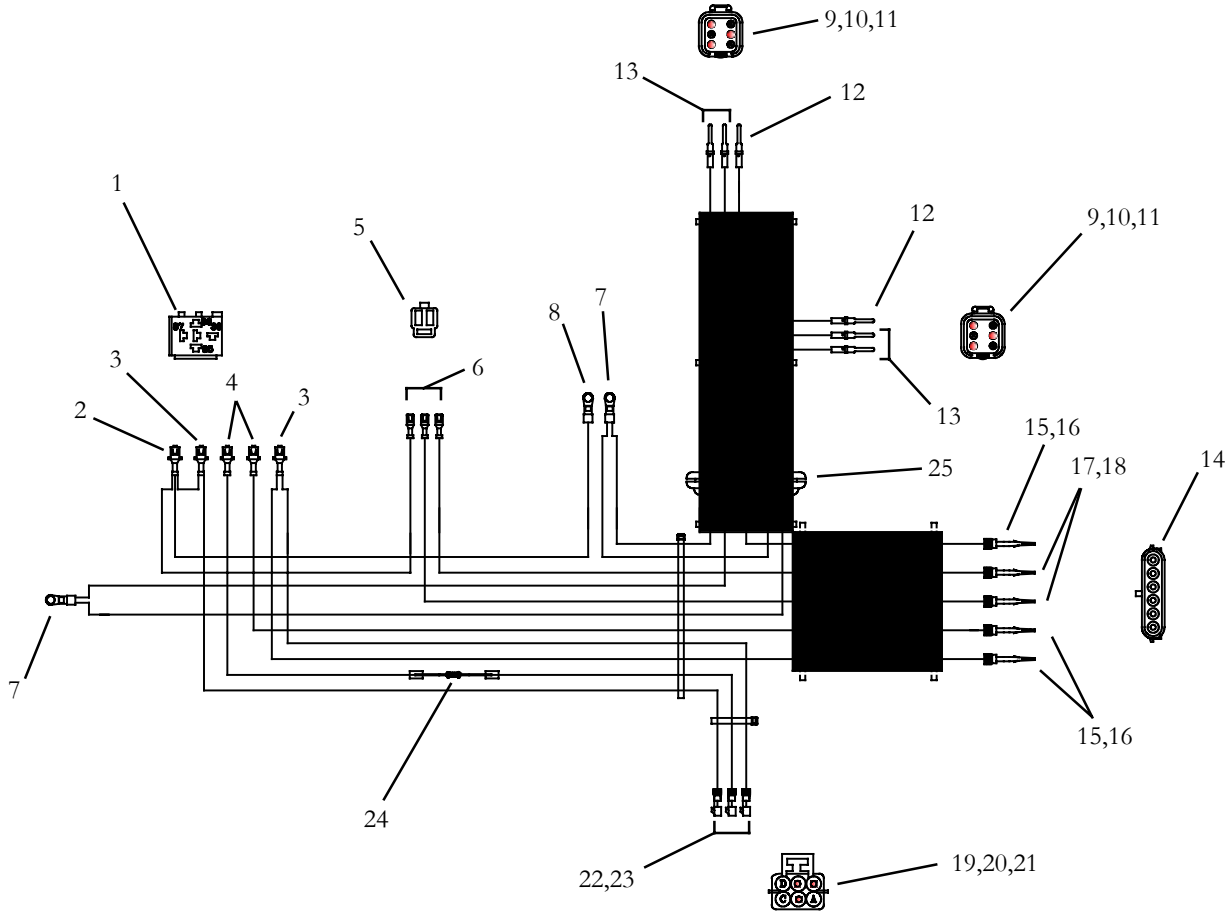
5.3.1 MCC Compressor Wire Harness- 25-3351



Item	Part Number	Description	Qty
1	31-1068	Connector, WP 2 Way Shroud (Black)	2
2	31-1208	Connector, WP 2 Way Shroud (Gray)	2
3	31-1025	Connector, WP 2 Way Tower (Black)	1
4	31-1207	Connector, WP 2 Way Tower (Gray)	2
5	31-1046	Connector, WP 6 Way Shroud	1
6	31-1266	Terminal, WP Male 18 AWG	12
7	31-1267	Terminal, WP Female 18 AWG	8
8	31-1131	Seal, WP 18 AWG (Green)	20
9	25-0237	Diode, 3 Amp	3

5.4 MCC Electrical Components

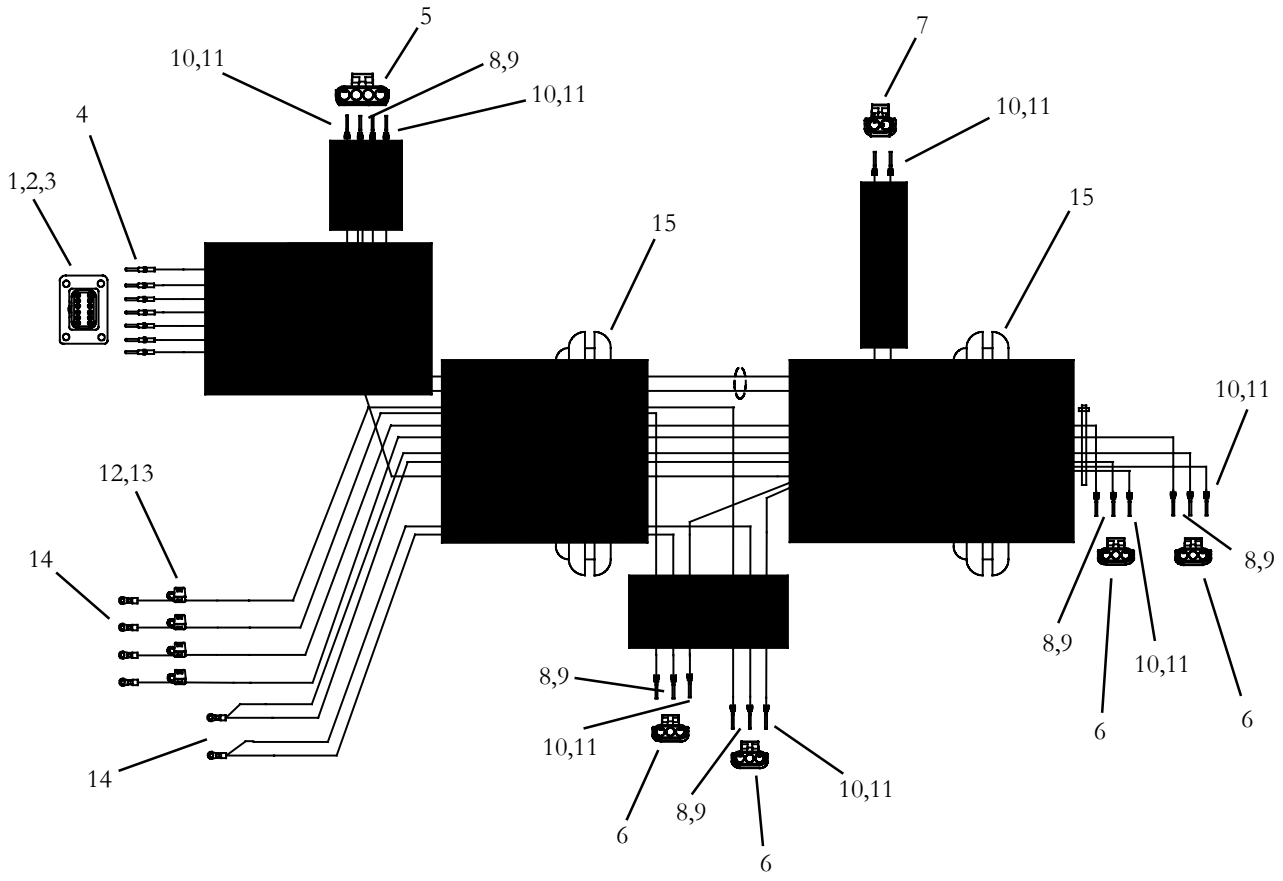
5.4.1 MCC Evaporator Wire Harness- 25-3349



Item	Part Number	Description	Qty
1	25-0221	Socket, Relay	1
2	31-1099	Terminal, Female, Relay Base, 10 AWG	1
3	31-1126	Terminal, Female, Relay Base, 14 AWG	2
4	31-1397	Terminal, Female, Relay Base, 18 AWG	2
5	31-1029	Female Connector, 3 Way	1
6	31-1369	Terminal, Female, 18-20 AWG	3
7	31-1187	Terminal, Ring, ⅜", 10-12 AWG	2
8	31-1402	Terminal, Ring, ⅜", 18 AWG	1
9	31-1157	Deutsch, 6 Way Receptacle	2
10	31-1158	Deutsch, Wedge, 6 Way	2
11	31-1054	Plug, Cavity	6
12	31-1371	Deutsch Pin, Male, 18 AWG	2
13	31-1053	Deutsch Pin, Male, 14 AWG	4
14	31-1046	Connector, Shroud, 6 Way, WP	1
15	31-1266	Terminal, Male, WP, 18 AWG	3
16	31-1131	Seal, 18 AWG, WP, (Green)	3
17	31-1024	Terminal, Male, WP, 14 AWG	2
18	31-1039	Seal, 14 AWG, WP, (Gray)	2

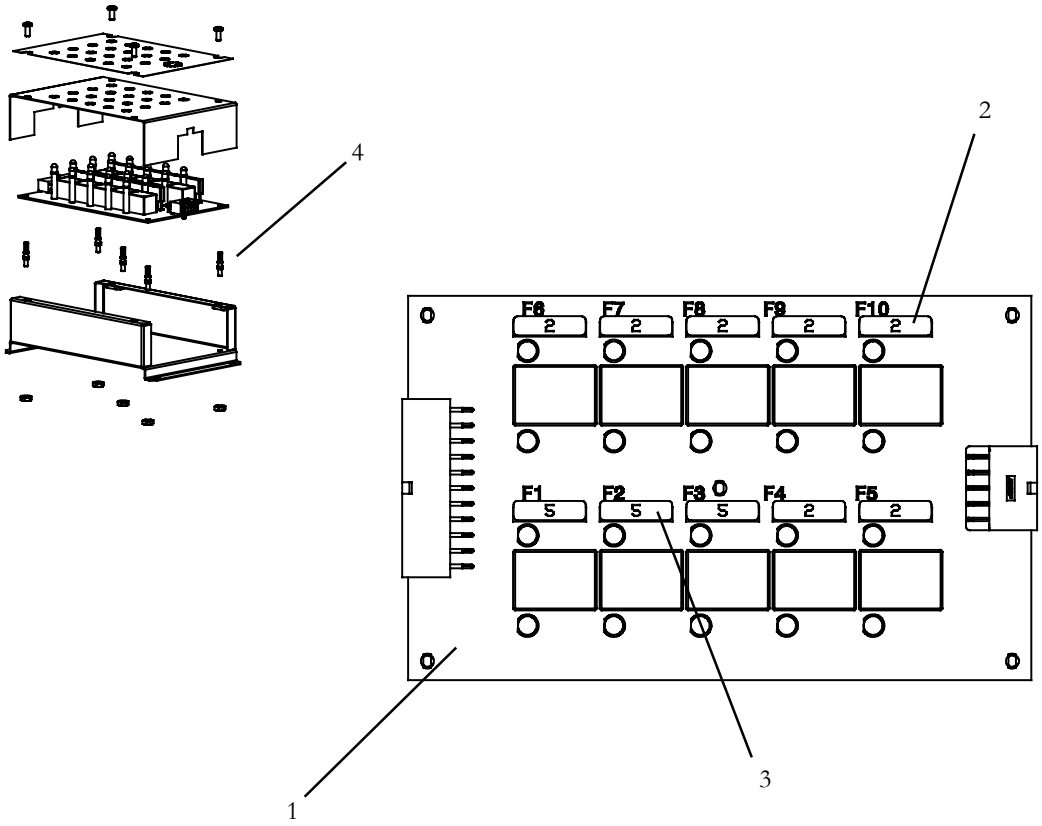
5.4.1 MCC Evaporator Wire Harness- 25-3349 (Continued)			
Item	**Part Number**	**Description**	**Qty**
19	31-1340	Connector, Male, 6 Way, MP	1
20	31-1388	Secondary Lock, 6 Way, MP	1
21	31-1232	Plug, Cavity	3
22	31-1088	Terminal, Female, MP, 18 AWG	3
23	31-1314	Seal, MP, 18 AWG	3
24	35-0288	Resistor, 39K OHM, 2W	1
25	28-0005	Grommet	1

5.4.2 MCC Condenser Wire Harness- 25-3350



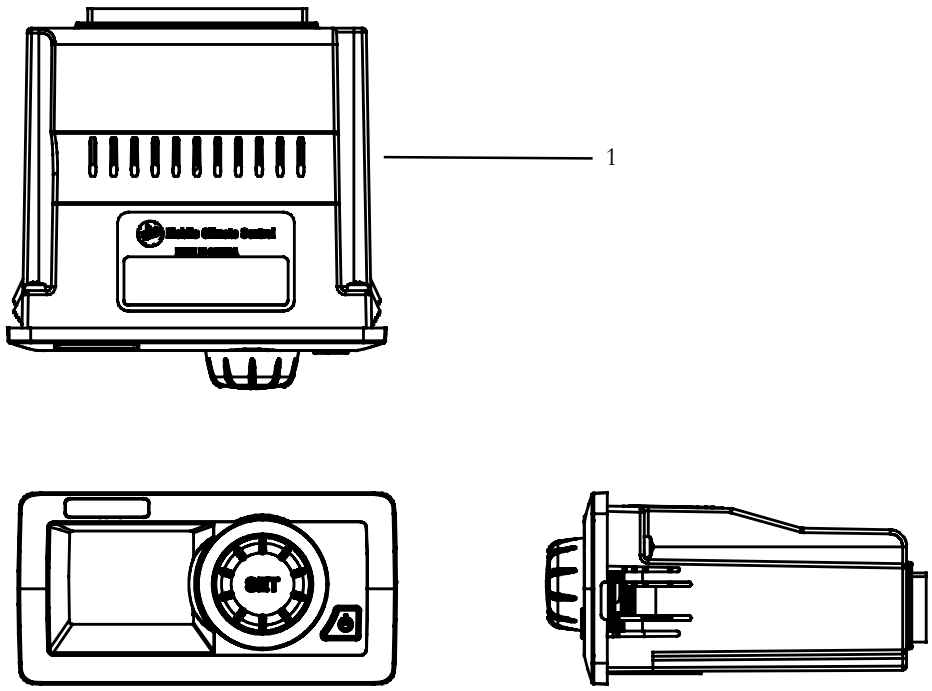
Item	Part Number	Description	Qty
1	31-1222	Deutsch, 12 Way FLA Receptacle	1
2	31-1118	Deutsch, Wedge, 12 Way Receptacle	1
3	31-1054	Plug, Deutsch	5
4	31-1371	Terminal, Deutsch, 16-20 AWG, Male	7
5	31-1056	Tower Connector, 4 way, WP	1
6	31-1091	Tower Connector, 3 way, WP	4
7	31-1025	Tower Connector, 2 way, WP	1
8	31-1026	Terminal, Female, 14 AWG, WP	10
9	31-1024	Seal, 14 AWG, WP, (Gray)	10
10	31-1267	Terminal, Female, 18 AWG, WP	8
11	31-1131	Seal, 18 AWG, WP	8
12	25-0682	Fuse Holder, In Line	4
13	25-0685	Fuse, 15 AMP	4
14	31-1187	Ring Terminal, 12-10 AWG	6
15	28-0005	Grommet	2

5.4.3 MCC - Relay Panel- 35-0961



Item	Part Number	Description	Qty
1	35-1048	Relay Board	1
2	25-0610	Fuse, 2 AMP	7
3	25-0569	Fuse, 5 AMP	3
4	31-1169	Plastic Stand Off	5

5.4.4 MCC - MVC Display Panel



Item	Part Number	Description	Qty
1	35-0960	MVC Controller	1

Parts Index

1

2

3

Parts Index

4

Y

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