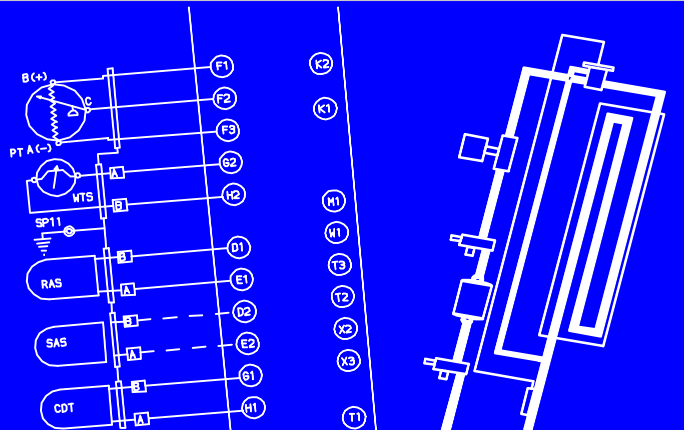
Carrier Transport Air Conditioning



OPERATION AND SERVICE
for
68G5-105 SERIES
MCI J4500 COACH
with
MICROMAX
Air Conditioning Unit

T–329 Rev –

Carrier
TRANSICOLD

OPERATION AND SERVICE MANUAL

TRANSPORT
AIR CONDITIONING
EQUIPMENT

Model 68G5–105 Series
for
MCI J4500 Model Coach
with
Micromax

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. The general safety notices are presented in the following three sections labeled: First Aid, Operating Precautions and Maintenance Precautions. 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 circuit breakers and start-stop switches are turned off, and the 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 condenser fan grille or evaporator access panels before turning the power off, and securing the power source.

Be sure power is turned off before working on motors, controllers, solenoid valves and electrical control switches. 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).

Familiarize yourself with the proper operation of any service equipment you will be using (voltmeter, amp probe, manifold gauges, etc.). Always read the owner's manual that is enclosed with the equipment

Always follow the manufacturers instructions for your recovery/recycling equipment. Failure to do so could cause personal injury or damage to your equipment. Never perform any maintenance or service on your equipment before consulting with authorized service personnel. Always unplug unit before attempting any maintenance. Removing internal fittings and filters can release pressurized refrigerant. Slowly release pressure and always wear appropriate safety wear.

Avoid breathing any refrigerant vapor, lubricant vapor, or mist. Exposure to these, particularly PAG oil mist, may irritate your eyes, nose, or throat.

Always use a DOT (Department of Transportation) approved cylinder for storing used and recycled refrigerant. Approved cylinders will be stamped DOT 4BW or DOT 4BA. Carrier recommends a MACS (Mobile Air Conditioning Society) certification in Recovery/Recycling to gain more information on handling and using refrigerants.

Never attempt to apply heat or open flame to a refrigerant cylinder. High temperatures can raise the cylinder pressure to dangerous levels. Carrier recommends using a heat blanket to increase the internal temperature of the refrigerant cylinder, greatly increasing the transfer of refrigerant to the bus air conditioning system.

Never use compressed air (shop-air) to leak-test or pressure test a R134a system. Under certain conditions, pressurized mixtures of R134a and air can be combustible. In addition, shop air will inject moisture into the system.

Always use mineral oil to lubricate "O" Rings, hoses, and fittings on R134a systems. PAG oils will absorb moisture and become very acidic and corrosive. Mineral oil will not absorb moisture and thus prevent corrosion. Always wear gloves when working with PAG and Ester lubricants to prevent irritation to your skin. R134a lubricants can also damage vehicles paint, plastic parts, engine drive belts and coolant hoses.

Beware of unannounced starting of the evaporator and condenser fans. Do not remove the evaporator cover or condenser fan guards without disconnecting the vehicle battery cable.

Be sure power is turned off before working on motors, controllers, and electrical control switches. Tag system controls and vehicle battery to prevent accidental energizing of the system.

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 vehicle, disconnect the vehicle battery.

In case of electrical fire, extinguish with CO_2 (never use water). Disconnect vehicle battery power if possible.

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

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

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.

WARNING

When moving the coil care must be taken to avoid personal injury because of the weight of the coil.

CAUTION

Do not under any circumstances attempt to service the microprocessor. Should a problem develop with the microprocessor, replace it.

CAUTION

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

CAUTION

Care must be taken to ensure that the manifold common connection remains immersed in oil at all times or air and moisture will be drawn into the system.

TABLE OF CONTENTS

TABLE OF CONTENTS – Continued

TABLE OF CONTENTS – Continued

LIST OF ILLUSTRATIONS

LIST OF TABLES

SECTION 1

DESCRIPTION

1.1 INTRODUCTION

This manual contains Operating and Service Instructions and Electrical Data for the Model 68G5-105 Coach Air Conditioning and Heating equipment with Micromax furnished by Carrier Transicold Division for the MCI J-Series Intercity coach. Table 1-1 provides a model number chart.

The Model 68G5-105 equipment (see Figure 1-1) consist of a condenser, a main evaporator with integral heater, a driver evaporator with integral heater, optional parcel rack evaporators, compressor assembly, main control box, driver display panel, check valve assembly, temperature sensors and a bypass heat valve.

The 68G5 air conditioning and heating equipment interfaces with electrical cabling, a parcel rack evaporator thermostat kit, 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	Controller	Fan Motors	Parcel Rack Connection
68G5-105	R-134a	Microprocessor	24VDC	Yes

Table 1-2. Additional Support Manuals

MANUAL/FORM NUMBER	EQUIPMENT COVERED	TYPE OF MANUAL
T−279PL	MCI E/J Coach	Parts List
62−02756	O5G Compressor	Workshop Manual
62−11052	O5G Twin Port Compressor	Workshop Manual
T−200PL	O5G Compressor	Parts List
62−11053	O5G Twin Port Compressor	Parts List

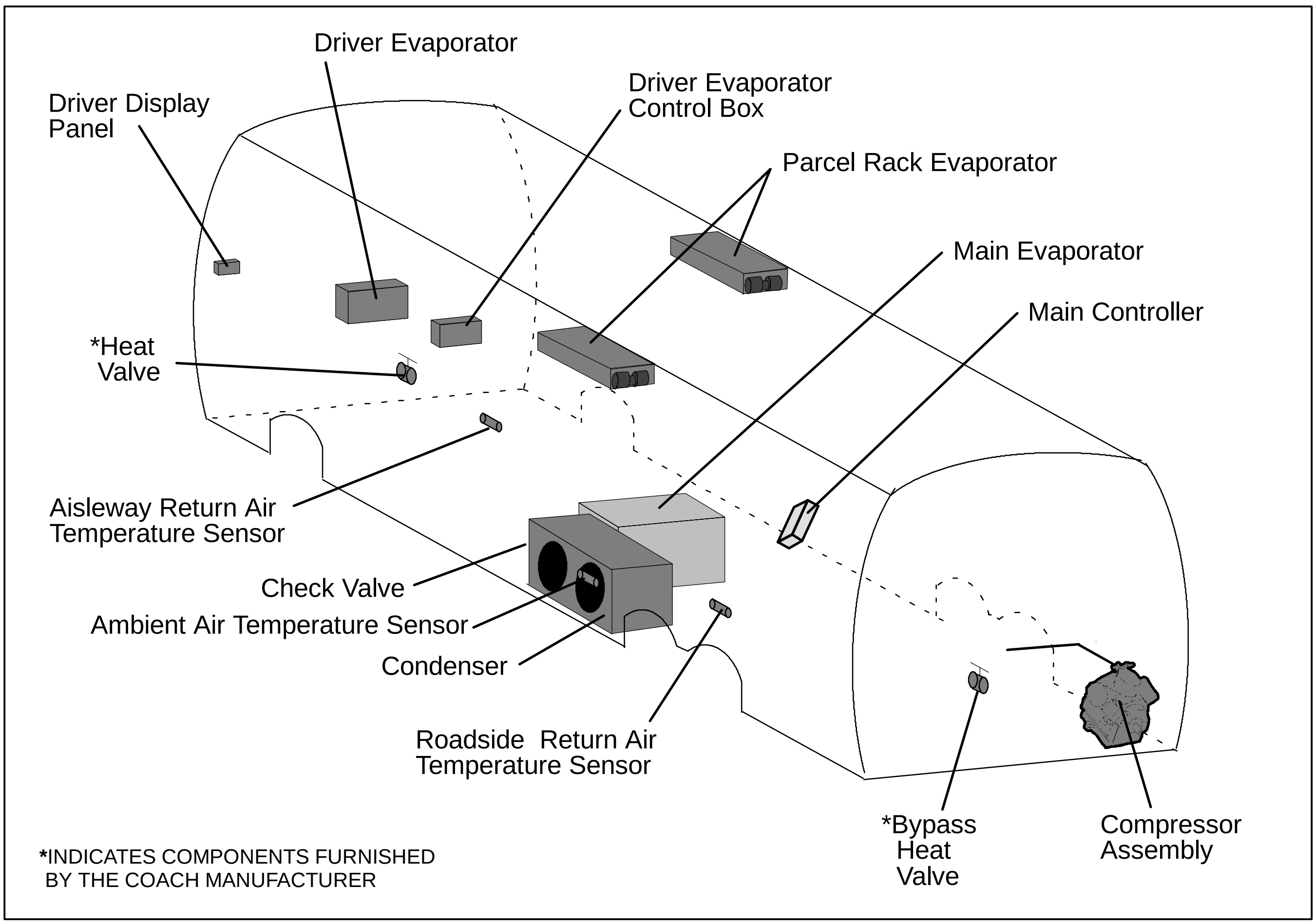


Figure 1-1. Coach Cutaway View

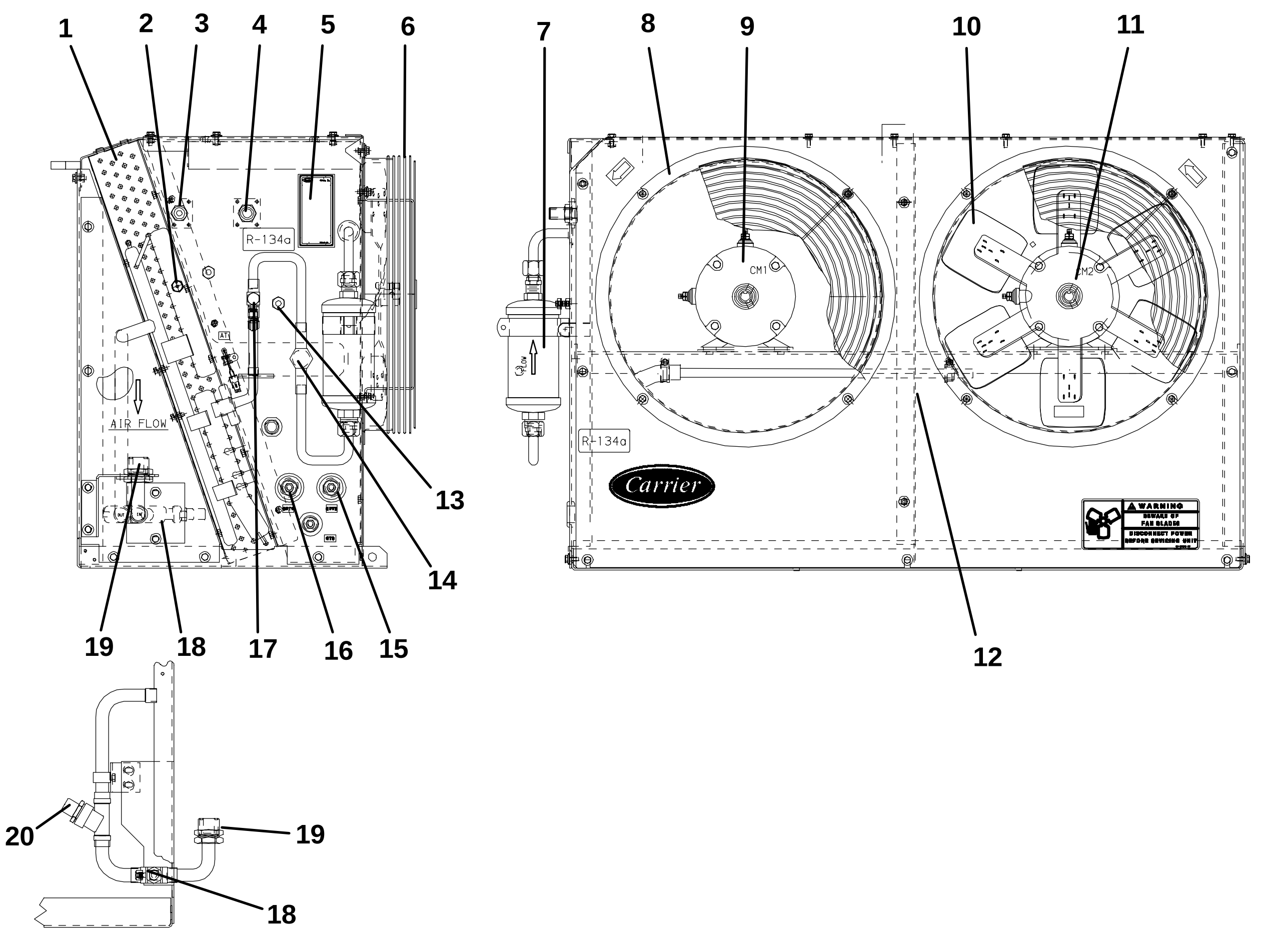
1.2 GENERAL DESCRIPTION

1.2.1 Condenser Assembly

The condenser assembly (See Figure 1-2) includes a condenser coil, fan and motor assemblies, filter-drier, sight glass, liquid line solenoid valve(s), king valves and an ambient temperature sensor.

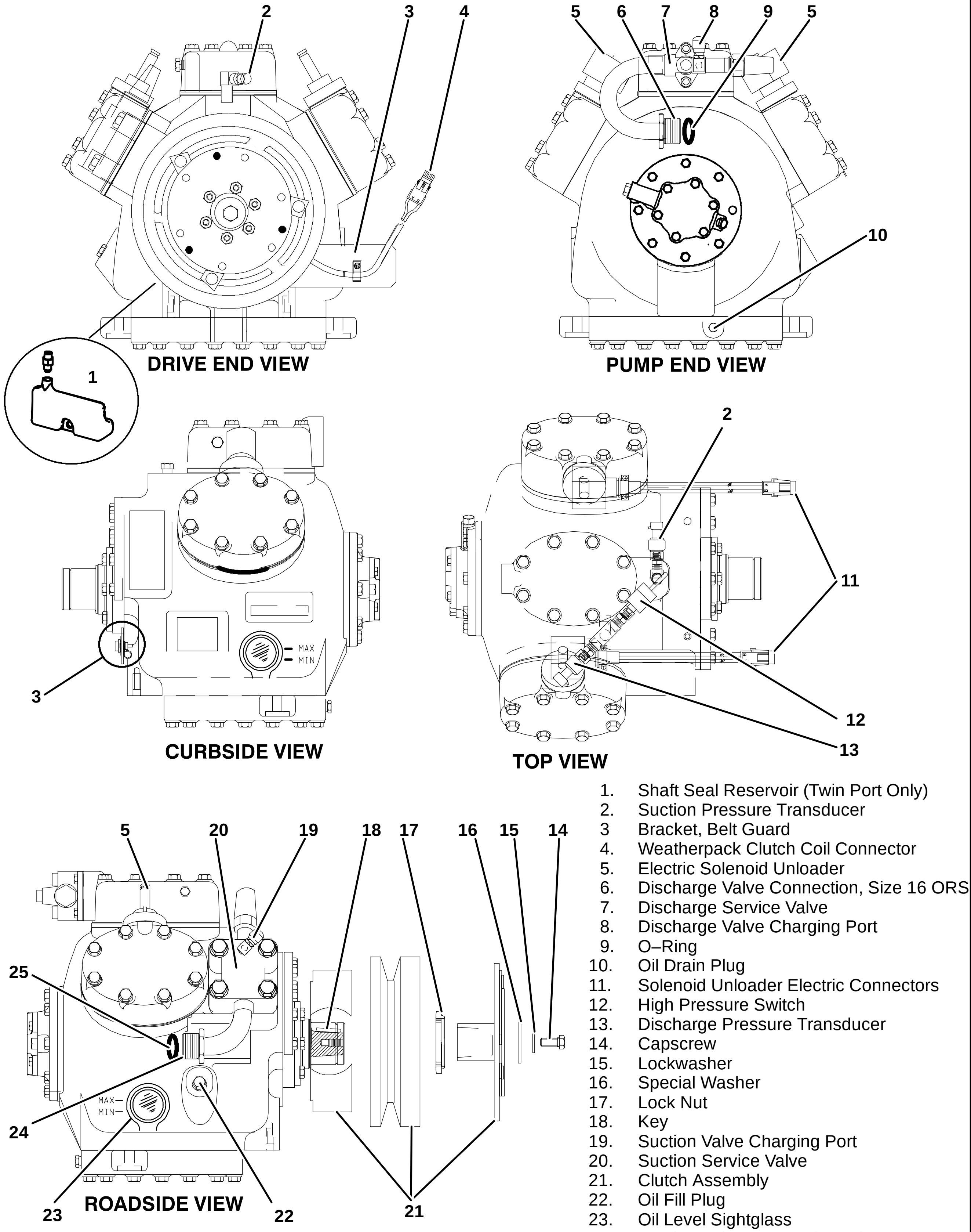
The condenser coil provides a heat transfer surface for condensing refrigerant gas at a high temperature and pressure into a liquid at high temperature and pressure. The condenser fans circulate ambient air across the outside of the condenser tubes at a temperature lower than refrigerant circulating 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 fusible plug which protects the system from unsafe high temperatures. The main evaporator liquid line solenoid valve and the parcel rack liquid line solenoid valve (when so equipped) closes when the system is shut down to prevent refrigerant migration and to isolate the filter-drier for servicing when the compressor is shut down. The king valves enable servicing of the condenser assembly. The ambient temperature sensor measures ambient temperature and sends an electrical signal to the main controller.



1. Condenser Coil Assembly
2. Fusible Plug
3. Liquid Line Outlet Fitting (Parcel Rack)
4. Liquid Line Outlet Fitting (Main)
5. Model/Serial No. Nameplate
6. Fan Guard
7. Filter-Drier
8. Venturi Ring
9. Condenser Fan Motor CM1
10. Fan Blade
11. Condenser Fan Motor CM2
12. Outside Temperature Sensor
13. Negative (–) Stud
14. Moisture & Liquid Indicator
15. Positive (+) Stud
16. Positive (+) Stud
17 Liquid Line (King) Valve
18. Discharge Shutoff King Valve
19. Refrigerant Inlet Fitting
20. Discharge Check Valve

Figure 1-2. Condenser Assembly



1. Shaft Seal Reservoir (Twin Port Only)
2. Suction Pressure Transducer
3 Bracket, Belt Guard
4. Weatherpack Clutch Coil Connector
5. Electric Solenoid Unloader
6. Discharge Valve Connection, Size 16 ORS
7. Discharge Service Valve
8. Discharge Valve Charging Port
9. O–Ring
10. Oil Drain Plug
11. Solenoid Unloader Electric Connectors
12. High Pressure Switch
13. Discharge Pressure Transducer
14. Capscrew
15. Lockwasher
16. Special Washer
17. Lock Nut
18. Key
19. Suction Valve Charging Port
20. Suction Service Valve
21. Clutch Assembly
22. Oil Fill Plug
23. Oil Level Sightglass
24. Suction Valve Connection, Size 24 ORS
25. O–Ring

Figure 1-3. Compressor Assembly

1.2.2 Compressor Assembly

The compressor assembly (See Figure 1-3.) includes the refrigerant compressor, clutch assembly, suction and discharge service valves, high pressure switch, suction and discharge pressure transducers, suction and discharge servicing (charging) ports, electric solenoid unloaders and a shaft seal reservoir (for the 05G Twin Port compressor only).

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. Transducers convert refrigerant pressures into electrical signal inputs which are sent to the main controller. 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 electric unloaders provide a means of controlling compressor capacity, which enables control of temperature inside the coach. For more detailed information on the compressor, refer to manual number 62-02756 or 62-11052 (05G Twin Port).

1.2.3 Evaporator Assemblies

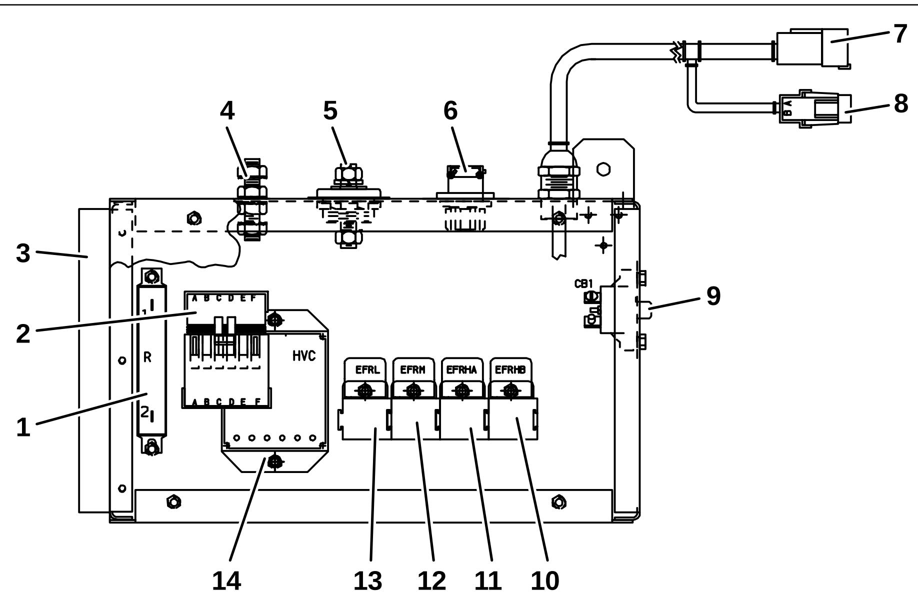
The evaporator assemblies include a driver evaporator assembly (See Figure 1-5), a main evaporator assembly (See Figure 1-7), and may include two parcel rack evaporator assemblies (See Figure 1-6).

The driver evaporator assembly includes an evaporator coil assembly, a thermal expansion valve, a heater coil assembly, an evaporator heat valve (EHV), two fan and motor assemblies, an air filter, and two condensate drain connections. The evaporator heat valve (EHV) for the driver evaporator is installed in the piping outside the evaporator assembly. In addition, the driver evaporator has an actuator, which controls the outside (RAM) air damper upon receipt of signal from the main controller.

The main evaporator assembly includes an evaporator and heater coil assembly, a thermal expansion valve, an evaporator heat valve (EHV), a fan and motor assembly, and two condensate drain holes. There is also an evaporator control panel assembly, which controls the main evaporator fans and condenser fans upon receipt of a signal from the main controller.

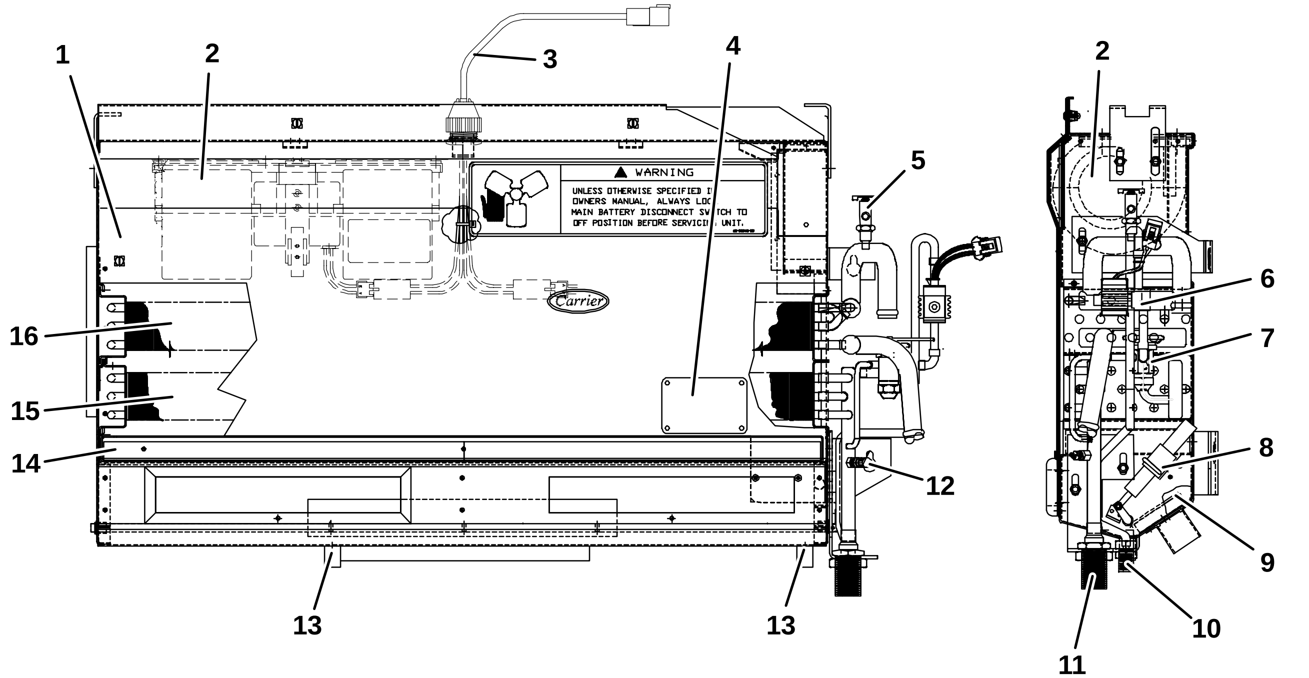
The optional parcel rack evaporator assemblies includes an evaporator coil assembly, a thermal expansion valve, a fan and motor assembly, condensate drain connection, and a return air thermostat (on the road side only).

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 evaporator heat valve(s) (EHV) controls 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.



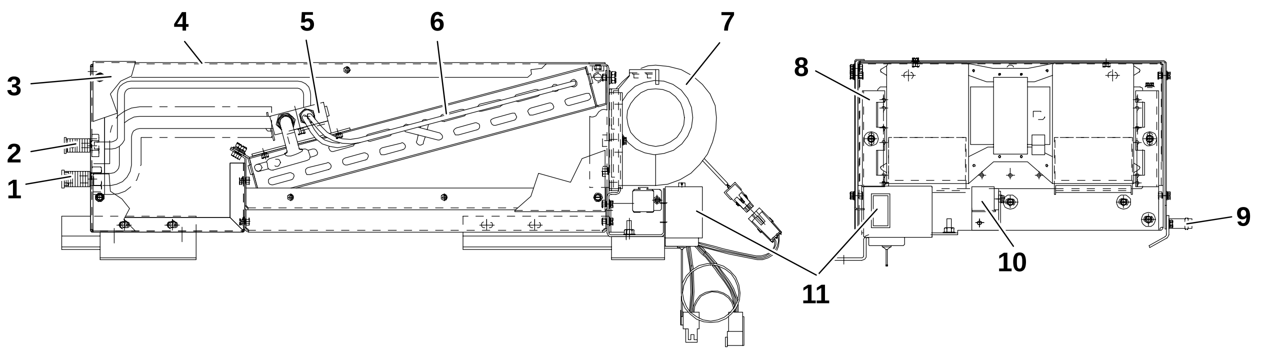
1. Resistor
2. Heat Valve Control Connector
3. Control Box
4. Ground Stud
5. Power Stud
6. Controller Interface Connector (DC3)
7. Driver Defrost Connector (DC1)
8. Driver Defrost Connector (DC2)
9. Circuit Breaker
10. Evaporator Fan Relay, High Speed, B
11. Evaporator Fan Relay, High Speed, A
12. Evaporator Fan Relay, Medium Speed
13. Evaporator Fan Relay, Low Speed
14. Heat Valve Controller

Figure 1-4. Driver Control Box



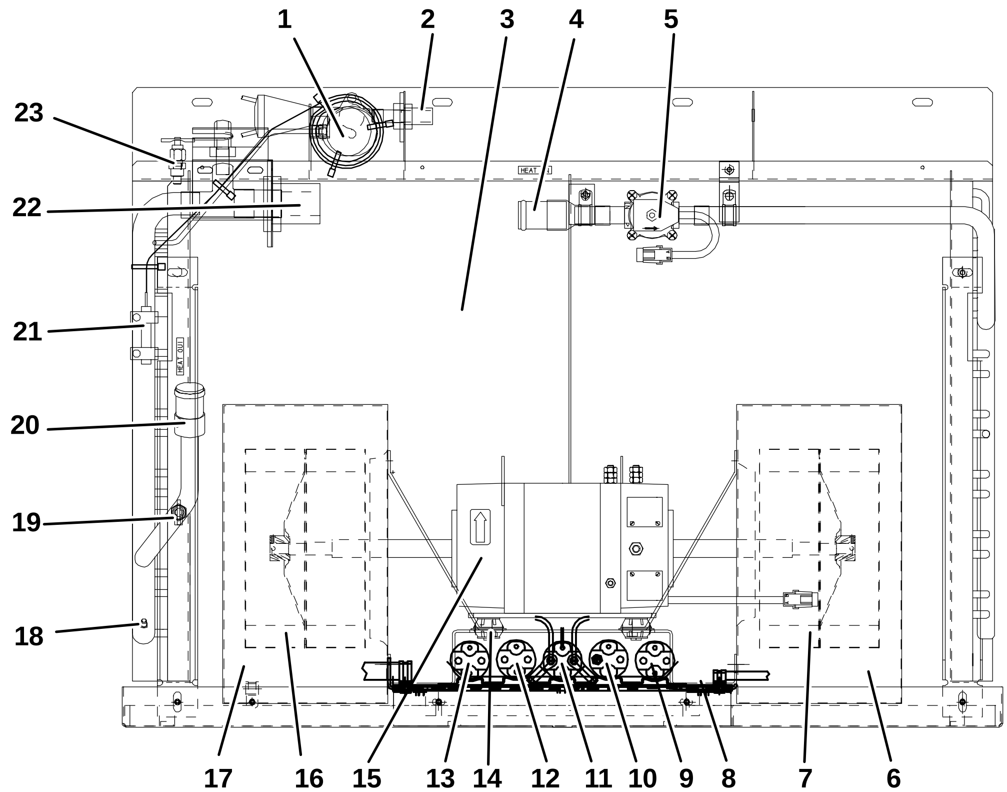
1. Access Panel
2. Fan and Motor
3. Electrical Connector
4. Nameplate
5. Air Bleed Valve
6. Solenoid Valve and Coil
7. Thermal Expansion Valve
8. RAM Actuator
9. RAM Air Door
10. Liquid Inlet Connection, Size 11/16 ORS
11. Suction Outlet Connection, 1-7/16 ORS
12. Service Port
13. Condensate Drain Connections
14. Air Filter
15. Evaporator Coil Assembly
16. Heater Coil Assembly

Figure 1-5. Driver Evaporator Assembly



1. Suction Outlet Connection
2. Liquid Inlet Connection
3. Side Access Panel
4. Top Access Panel
5. Thermal Expansion Valve
6. Evaporator Coil Assembly
7. Fan and Motor
8. Motor Mount Bracket
9 Condensate Drain Connection
10. Relay
11. Thermostat (Not supplied by Carrier)

Figure 1-6. Parcel Rack Evaporator Assembly



1. Thermal Expansion Valve
2. Refrigerant Liquid Inlet Connection, 3/8“ ORS
3. Evaporator/Heater Coil Assembly
4. Heater Coil Inlet Connection, 7/8 OD
5. Evaporator Heat Valve (EHV)
6. Blower Housing, Right
7. Blower Wheel, Right
8. Nameplate
9. Condenser Fan Relay 2 (CFR2)
10. Condenser Fan Relay 1 (CFR1)
11. Condenser Fan Speed Relay (CSR)
12. Evaporator Fan Relay, Low Speed (EFRL)
13. Evaporator Fan Relay, High Speed (EFRH)
14. Elastomeric Motor Mounts
15. 2-Speed Motor
16. Blower Wheel, Left
17. Blower Housing, Left
18. Service Port
19. Coolant Drain valve
20. Heater Coil Outlet Connection, 7/8 OD
21. Capillary Tube and Bulb (TXV)
22. Refrigerant Suction Outlet Connection, 1” ORS
23. Air Bleed Valve
24. Air Filter Channel

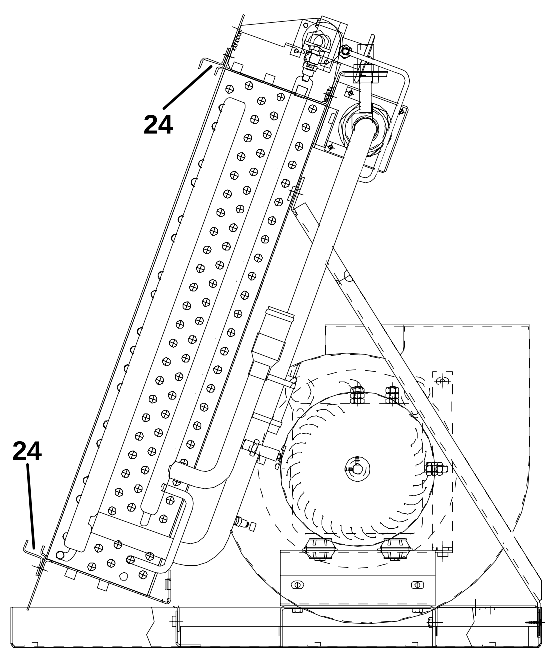
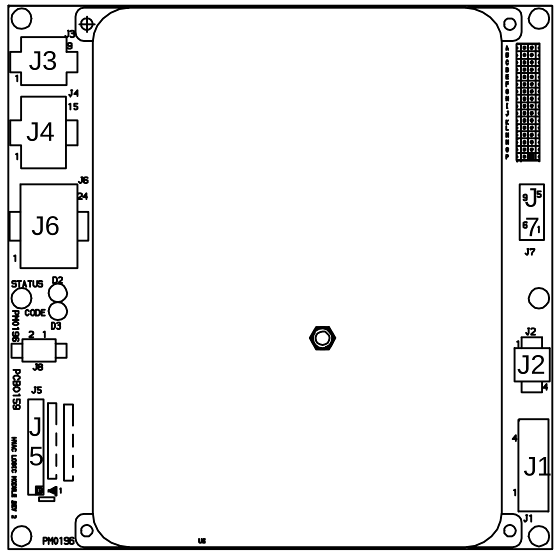


Figure 1-7. Main Evaporator Assembly

1.2.4 Main Control Box

The main control box includes a main controller (logic board assembly) (See Figure 1-8), a relay board, and a connector (ribbon cable) (See Figure 1-9). The main controller (microprocessor module) contains the electronic hardware to measure inputs and process the outputs to automatically control the air conditioning and heating system to maintain temperatures inside the coach. The microprocessor section has a built in memory facility for checking proper operation; this includes checks of the program memory, data memory and analog. It has a self test feature which is executed when the system is first powered up.



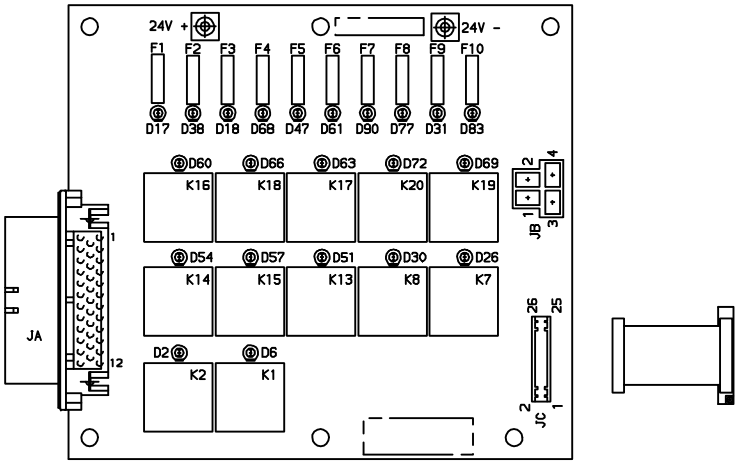
a. Connectors

- J1 24 Volt power input.
- J2 Micromate Display interface.
- J3 Manual control inputs.
- J4 Interlock inputs (WTS, low pressure switch, etc.)
- J5 Relay Board interface.
- J6 Sensor inputs (Thermistors, etc.).
- J7 Diagnostics interface (RS232, DB9).
- A-P Configuration Jumpers.

b. LEDS

- D 2 Blinks once per second in normal operation. On steady to indicate alarms detected.
- D 3 Off in normal operation, blinks out alarm codes (2 digits each) when alarms detected.

Figure 1-8. Logic Board



a. Relays

K1 Energizes evaporator fans in low speed
K2 Energizes evaporator fans in high speed (not energized in low speed).
K 7 Energizes condenser fans in low speed
K 8 Energizes condenser in high speed (not energized in low speed).
K13 Energizes the A/C clutch and liquid line solenoid valve.
K14 Energizes unloader 1.
K15 Energizes unloader 2.
K16 Energizes fresh air damper.
K17 Energizes reheat coolant valve.
K18 Energizes the fault light output.
K19 Energizes the boost pump.
K20 Energizes the driver's liquid line solenoid valve.

b. Connectors

JA Relay board connector(communication to system).
JB Boost pump.
JC Ribbon Cable (Logic Module to Relay Board)

c. Fuses

F1 Fresh air relay.
F2 Unloader 1 relay.
F3 Evaporator fan motor relay.
F4 Fault light out relay.
F5 Unloader 2 relay.
F6 Heater relay.
F7 Clutch relay.
F8 Spare.
F9 Condenser motor fan relay.
F10 Boost pump relay.

d. LEDS

D 2 Evaporator fans output active - high speed
D 6 Evaporator fans output active.
D26 Condenser fans output active.
D30 Condenser fans on high speed
D51 A/C clutch and liquid line solenoid valve output active.
D54 Unloader 1 output active.
D57 Unloader 2 output active.
D63 Heat output active (RCV).
D66 Fault output active.
D69 Boost pump output active.
D72 Driver's liquid line solenoid valve active.
D17 Fresh air relay fuse out.
D38 Unloader 1 relay fuse out.
D18 Evaporator fan motor relay fuse out.
D68 Fault light out relay fuse out.
D47 Unloader 2 relay fuse out.
D61 Heater relay fuse out.
D90 Clutch relay fuse out.
D77 Unloader 1 fuse out.
D31 Condenser motor fan relay fuse out.
D83 Boost pump relay fuse out.

Figure 1-9. Relay Board

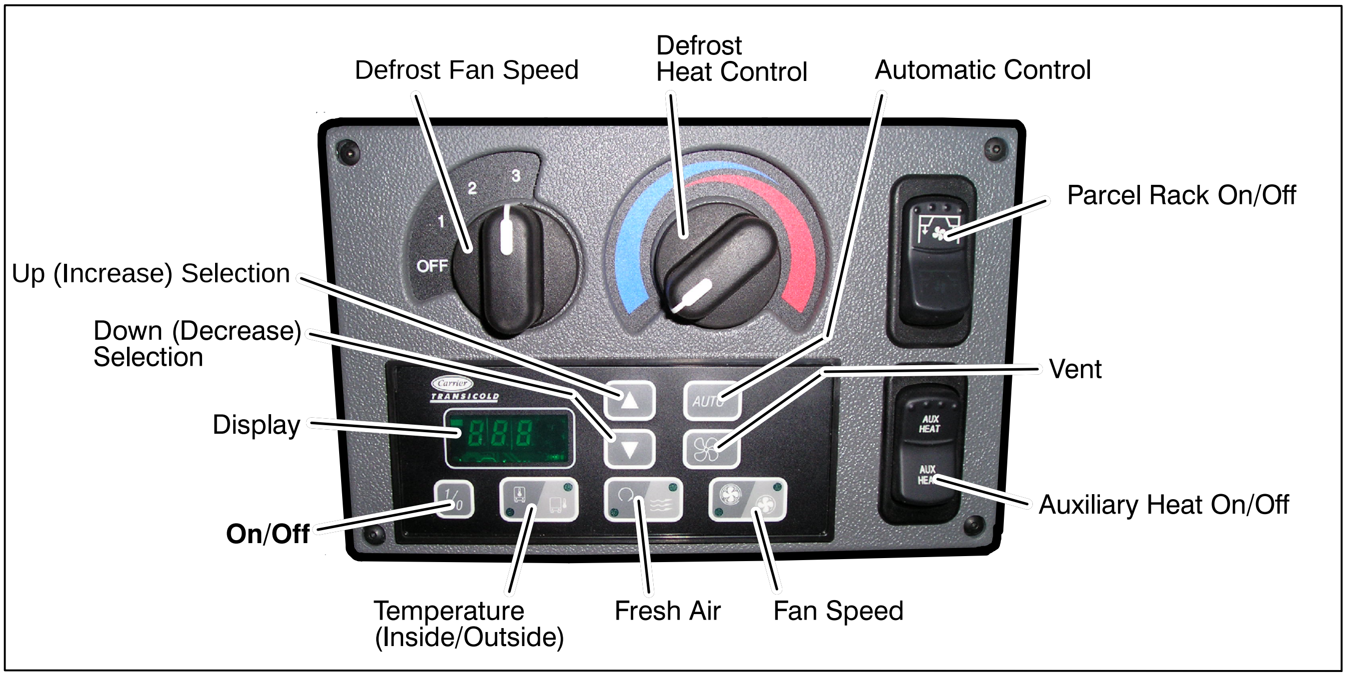


Figure 1-10. System Operating Controls (upper left hand switch panel)

1.2.5 System Operating Controls And Components

There are five controls on the driver's station which are located on the dashboard to the left of the steering wheel. They affect the operation of the Carrier supplied equipment covered by this manual. These controls include two rotating switches, two rocker switches, and the Micromate Control Panel.

The first rotating switch is the Defrost Fan Speed Switch (Figure 1-10). This switch controls the driver evaporator blower motor speed. The second rotating switch is the Heat Control Switch (Figure 1-10). This switch controls the driver evaporator coolant valve.

The third control is the rocker switch for the Parcel Rack. This switch will activate the parcel rack evaporator blowers.

The forth control is the rocker switch for the Auxiliary Heater. This switch will activate the system to provide additional heat to engine coolant.

The fifth control is the Micromate Control Panel (Figure 1-10) which communicates with the Carrier Transicold Micromax microprocessor controller which consists of a logic board, fuses and relays. Modes of operation include Vent and Auto.

1.2.6 Other Carrier Supplied Items

Other Carrier supplied items include two return air temperature sensors, two coolant control valves and a check valve. The temperature sensors provide input to the controller on temperature conditions in the coach. The bypass heat (coolant control) valve provides a path for coolant flow when all evaporator heat valves are closed. The other coolant control valve is the heat valve that controls the flow of coolant to the driver heater coil. The check valve is installed in the refrigerant discharge line at the condenser and allows refrigerant flow in only one direction to prevent liquid return to the compressor when the compressor is shut down.

1.3 REFRIGERATION SYSTEM COMPONENT SPECIFICATIONS

a. Refrigerant Charge

R-134a: 17.5 lb *(8 kg)*

b. Compressor

Model: 05G
No. of Cylinder: 6
Weight (Dry): 145 lb *(66 kg)* including clutch
Oil Charge:
New Compressor: 5.8 pints *(2.7 liters)*
Replacement Compressor: 5.5 pints *(2.6 liters)*
Oil Level:
Level in sight glass between bottom of glass and middle of glass on compressor crankcase (curbside)
Approved Compressor Oils - R-134a:
Castrol: Icematic SW68C
Mobil: EAL Arctic 68
ICI: Emkarate RL68H

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

1. Main Evaporator:

Superheat Setting (Nonadjustable): 12 to 22°F *(6.7 to 12.2°C)*
MOP Setting: None

2. Driver Evaporator and Parcel Rack Evaporator:

Superheat Setting (Nonadjustable): 5 to 12°F *(6.7 to 12.2°C)*
MOP Setting: None

d. High Pressure Switch (HPS):

Opens at: 385 ±10 psig *(26.2 ± .68 BAR)*
Closes at: 285 ±10 psig *(19.39 ± .68 BAR)*

1.4 ELECTRICAL SPECIFICATIONS - WOUND FIELD MOTORS

a. Main Evaporator/Heater Blower (Fan) Motor

Bearing Lubrication: Factory Lubricated (additional grease not required)
Horsepower:
High Speed: 1.6 *(1.2 kw)*
Low Speed: 0.7 *(0.5 kw)*
Full Load Amps (FLA):
High Speed: 56
Low Speed: 28
Operating Speed:
High Speed: 1550 rpm
Low Speed: 1200 rpm
Voltage: 24 vdc

b. Driver Evaporator/Heater Blower (Fan) Motor

Bearing Lubrication: Factory Lubricated (additional grease not required)
Full Load Amps (FLA): 9.5
Operating Speed:
High Speed: 3300 rpm
Medium Speed: 1600 rpm
Low Speed: 1100 rpm
Voltage: 24 vdc

c. Condenser Fan Motor

Bearing Lubrication: Shell Dolium R
Horsepower: 0.8 hp *(1.072 kw)*
Full Load Amps (FLA):
High Speed: 32
Low Speed: 21
Operating Speed:
High Speed: 1800 rpm
Low Speed: 1600 rpm
Voltage: 24 vdc

d. Parcel Rack Evaporator Fan Motor

Bearing Lubrication: Factory Lubricated (additional grease not required)
Full Load Amps (FLA): 9.5
Operating Speed: 3300 rpm
Voltage: 24 vdc

1.5 ELECTRICAL SPECIFICATIONS-MAIN CONTROLLER INPUT SENSORS AND TRANSDUCERS

a. Suction and Discharge Pressure Transducer

Supply Voltage: 4.5 to 5.5 vdc (5 vdc nominal)
Input Range: –6.7 to 450 psig *(–0.05 to 30.62 BAR)*
Output Voltage: vdc = 0.0098 x psig
\+ 0.4659 (See Table 4-4 for calculations.)

b. Temperature Sensors

Input Range: –52.6 to 158°F *(–47 to 70°C)*
Output: NTC 10K ohms at 77°F *(25°C)*
(See Table 4-3 for calculations.)

1.6 SAFETY DEVICES

System components are protected from damage caused by unsafe operating conditions with safety devices. Carrier Transicold supplied safety devices include a high pressure switch (HPS), low pressure switch (LPS), 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 in the center head of the compressor.

Low Pressure Transducer

If the control monitors a pressure less than 10 psig - R-134a by the suction pressure transducer mounted on the compressor, 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 an OEM supplied 30 amp fuse. Independent 70 amp (evaporator), 100 amp (condenser) 40 amp (driver's evaporator) and 70 amp (parcel evaporators) circuit breakers protect those circuits. During a high current condition, the breaker (or OEM fuse) may open. When power is removed from a device, a breaker alarm will be generated.

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 the compressor is locked out until the temperature rises above the cut in setting. The set points will be programmed to cut out at 25°F (-3.9°C) and cut in at 35°F (1.7°C). 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 Carrier Transicold include heater cores and an evaporator heat valve (EHV) for the main evaporator assembly. Components furnished by the coach manufacturer include auxiliary heater and engine water pump, hand valves and "Y" type strainers, a coolant bypass heat valve and a driver's heat valve. 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. When the evaporator heat valve solenoid is de-energized, the valve will open to allow engine coolant to flow through the heater coil. (See Figure 1-11.) The valve is normally open so that if a failure occurs, the system will still be able to supply heat.

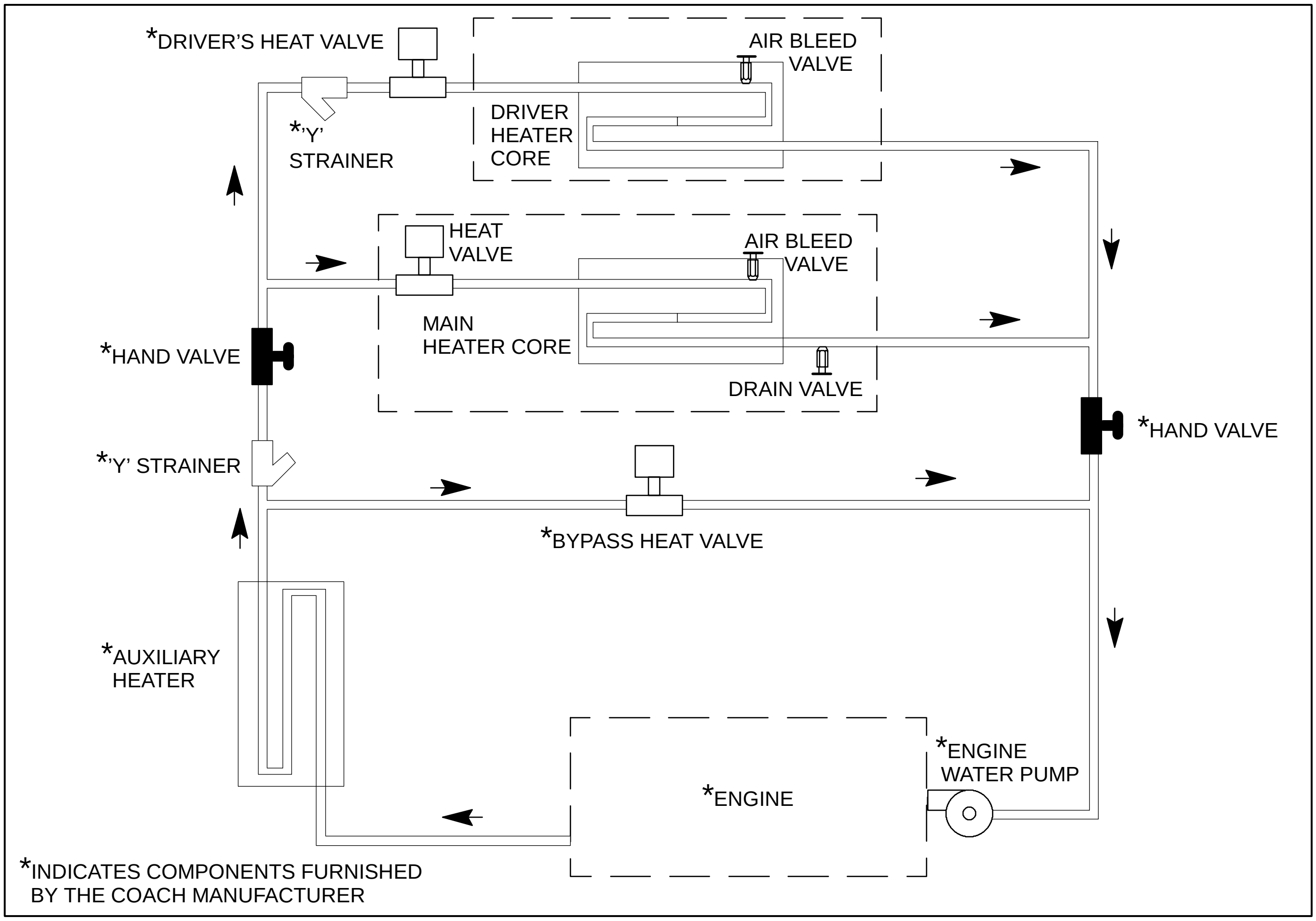


Figure 1-11. Heating System Flow Diagram

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, subcooler, filter-drier, thermostatic expansion valves, liquid line solenoid valves and evaporator coils. (See Figure 1-12)

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 then flows through the subcooler, which subcools the refrigerant (before it enters the thermal expansion valves; this reduces flash gas in the evaporator). From the subcooler, the liquid refrigerant passes through the liquid line (King) 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 parcel rack evaporator solenoid valve (if this option is active) the parcel rack thermal expansion valve and through the driver 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 and the parcel rack liquid line solenoid valve (when so equipped) 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 blower (fan). 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.

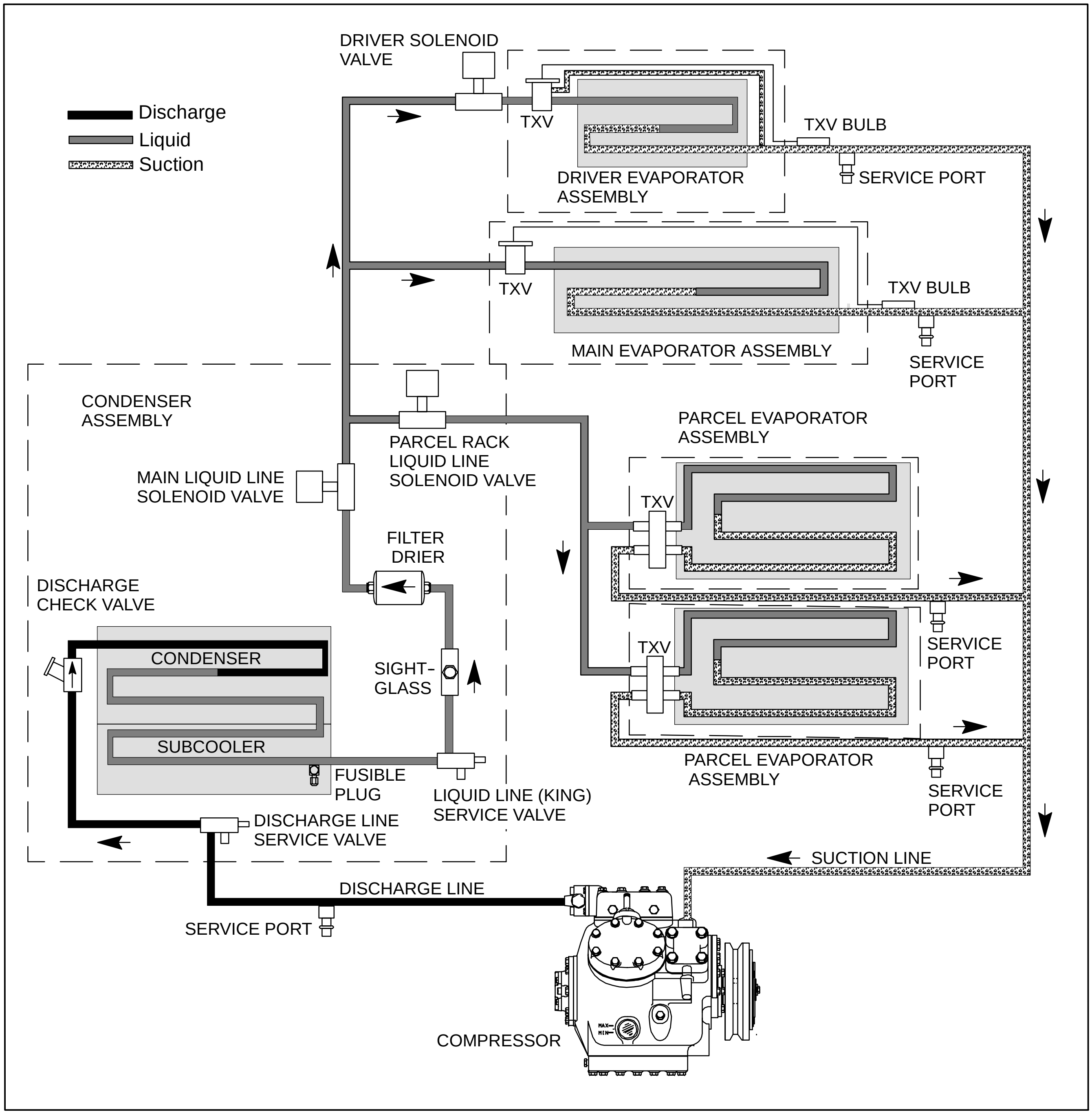


Figure 1-12 Air Conditioning Refrigerant Flow Diagram

SECTION 2

OPERATION

2.1 STARTING, STOPPING AND OPERATING INSTRUCTIONS

2.1.1 Power to Logic Board

Before starting, electrical power must be available from the bus power supply. The system components receive power from two sources:

a. 24 vdc power for the microprocessor electronics is supplied through the bus interface.

b. 24 vdc, 150 amp, power from a fuse in the battery compartment supplies power for the clutch, compressor, unloader solenoids, evaporator and condenser assemblies; this power is controlled by the Logic Board.

2.1.2 Starting

a. If the engine is not running, start the engine.

b. MICROMATE CONTROL PANEL
It is suggested the system be started in the automatic mode.

1 To start the system, press the I/O button to illuminate the indicator light and signal the Logic Board to perform start up. Ensure the AUTO button indicator is illuminated. If not, press the AUTO button to place the system in the automatic mode. After the pre-trip inspection is completed, the switches may be set in accordance with the desired control modes.

2 The Micromate Control Panel Display (see Figure 1-10) may be programmed to display the set point temperature or return air temperature. To determine which display temperature is programmed, press the TEMPERATURE button so that the OUT SIDE AIR indicator is illuminated. If the controller cycles back to the INSIDE AIR indicator, then the controller is programmed to display return air temperature. If the controller does not automatically cycle back to the return air indicator, then the controller is programmed to display set point temperature.

3 If ventilation only is desired, press the Vent button (Figure 1-10) to illuminate the indicator light and place the system in that mode of operation.

4 If low or high speed evaporator fan speed is desired, press the FAN SPEED button to illuminate the indicator light and bring speed to the desired level.

5 To open or close the fresh air damper, press the FRESH AIR button to illuminate the indicator light and bring the damper to the desired position.

6 To read interior or exterior temperature, press the TEMPERATURE button to illuminate the indicator light and bring the display to the desired temperature reading. After a short delay, the display will return to the default set point or return air temperature reading.

7 Setpoint may be changed by pressing the UP or DOWN arrow button. The UP button will increase the setpoint temperature and the DOWN button will decrease the setpoint temperature.

8 The Auto button places the system into the Auto mode where the system is energized to provide cooling or heating as required to control the interior temperature to the desired set point.

9 For additional Micromate operating data refer to paragraph 2.4.

2.1.3 Self-Test and Diagnostics (Check for Errors and/or Alarms)

Self-test of the main Logic Board electrical circuit is automatically initiated when the system is powered up. If there is an error in the circuit, an alarm will be indicated by flashing LED's on the Logic Board. If a Micromate is connected to the Logic Board, the error code can also be read on the display. If there are no errors in the circuit, system will operate normally and flash the status LED at a one second interval. During normal operation, the Logic Board monitors system operating parameters for out of tolerance conditions. If an out of tolerance condition occurs, *ALARM* will be indicated through the code LED or on the Micromate display. Refer to section 3 for definition of system errors and alarms and general troubleshooting procedures.

2.1.4 Stopping

Pressing the Micromate ON/OFF button will stop system operation.

2.2 PRE-TRIP INSPECTION

After starting system, allow system to stabilize for ten to fifteen minutes and check for the following:

a. Listen for abnormal noises in compressor or fan motors.

b. Check compressor oil level. (Refer to section 4.12.5)

c. Check refrigerant charge. (Refer to section 4.7.1)

d. Ensure that self-test has been successfully performed and that there are no errors or alarms indicated. (Refer to section 2.1.3.)

2.3 MODES OF OPERATION

The system is operated by a Carrier Transicold Micromax microprocessor controller which consists of a logic board (Figure 1-8), relay board (Figure 1-9), and manual operator switches. The logic board regulates operational cycles (modes) of the system by energizing or de-energizing Relay Board relays in response to deviations in interior temperature. Modes of operation include Cooling, Heat and Vent. Refer to Figure 2-1 and the following paragraphs for a description of each mode. Figure 2-1 shows the Logic Board actions at various temperature deviations from setpoint. On rising temperature, changes occur when the temperature rises above Logic Board setpoints, On falling temperature, changes occur when temperatures falls below Logic Board set point. The system will operate in these modes unless pressures override the Logic Board settings.

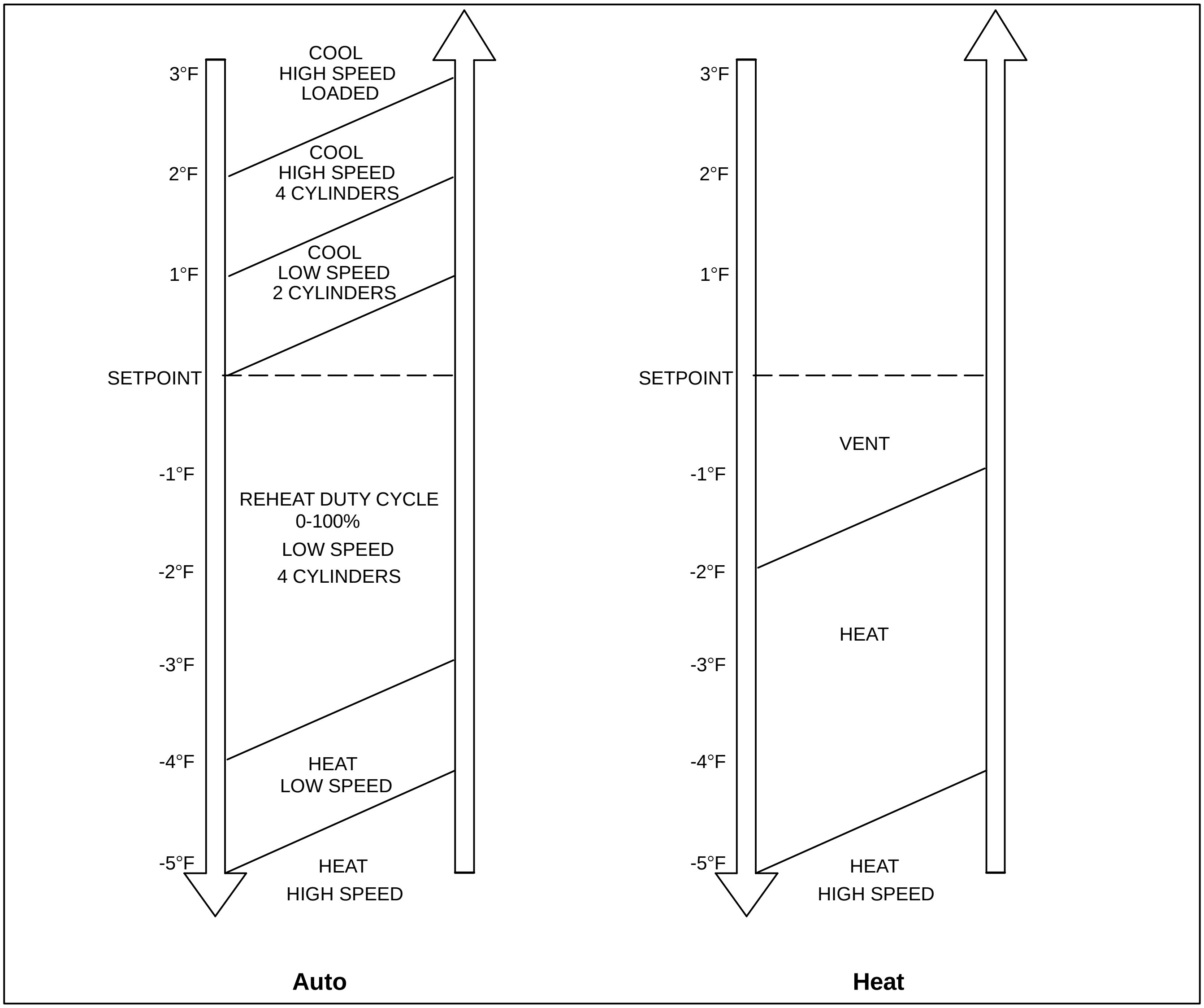


Figure 2-1 Capacity Control Diagram

2.3.1 Temperature Control

Temperature is controlled by maintaining the return air temperature measured at the return air grille.

2.3.2 Cooling

Cooling is accomplished by energizing the compressor and condenser fans, opening the liquid line solenoid valve and closing the heating valve. Once interior temperature reaches the desired set point, the system will operate in the reheat mode.

A controller programmed for reheat will maintain compressor operation and cycle the heat valve to allow reheating of the return air. Interior temperature is maintained at the desired set point while additional dehumidification takes place.

2.3.3 Heating

In the heat mode the liquid line solenoid is closed and the compressor and condenser fans are shut down. The heat valve is opened to allow a flow of engine coolant through the heat section of the evaporator coil. The evaporator fans speed is varied as required to circulate air over the evaporator coil based on the temperature difference from setpoint.

2.3.4 Vent Mode

In the vent mode the evaporator fans are operated to circulate air in the bus interior.

2.3.5 Compressor Unloader Control

When operating in cooling, the unloaders are used to reduce system capacity as return air temperature approaches set point. Operation of the unloaders balances system capacity with the load and thereby prevents overshoot from set point.

Relay Board mounted unloader outputs control the capacity of the compressor by energizing or de-energizing unloader solenoid valves. The model 05G compressor has three banks of two cylinders each. Energizing a valve de-activates a bank of cylinders. The outboard cylinder banks of the 05G are equipped with unloader valves (UV1 and UV2), each controlling two cylinders; this allows the 05G to be operated with two, four or six cylinders.

Whenever the compressor is started, the unloaders are energized for a preset delay time to reduce starting torque. After the delay, unloaders may be de-energized. Any subsequent changes between energizing and de-energizing the unloaders for temperature control is also staged for a preset delay time. Once an unloader is energized for pressure control, it remains energized for two minutes to prevent short cycling. Only one unloader may change state at a time when staging is required. Operating parameters for temperature control, suction pressure control and discharge pressure control are as follows.

a. Temperature Control

The unloaders are used to control system capacity by controlling compressor capacity.

1 Compressor Unloader UV1 Relay. When return air temperature falls to less than 2°F (1.1°C) above set point unloader UV1 is energized. If temperature rises to greater than 3°F (1.7°C) above set point, UV-1 will be de-energized to place the compressor at 100% capacity.

2 Compressor Unloader UV2 Relay. When return air temperature falls to less than 1°F (0.6°C) above set point unloader UV2 is energized. If temperature rises to greater than 2°F (1.1°C) above set point, UV-2 will be de-energized to place the compressor at 66% capacity.

b. Suction Pressure

The unloaders are used to control suction pressure and thereby prevent coil frosting:

1 Compressor Unloader UV1 Relay. When the suction pressure decreases below 26 psig, unloader UV1 is energized unloading a cylinder bank (two cylinders); this output will remain energized until the pressure increases to above 34 psig.

2 Compressor Unloader UV2 Relay. When suction pressure decreases below 23 psig, unloader UV2 is energized unloading the second compressor cylinder bank; this output will remain energized until the pressure increases to above 31 psig.

c. Discharge Pressure

Discharge pressure is also controlled by the unloaders:

1 Compressor Unloader UV1 Relay. When the discharge pressure increases and stays above 330 PSIG for 3 seconds, unloader UV1 is energized; this unloader will remain energized until the pressure decreases below 265 PSIG for a minimum of one minute. UV2 needs to be de-energized for at least 30 seconds for before UV1 will de-energize.

2 Compressor Unloader UV2 Relay. When the discharge pressure increases above 330 PSIG and UV1 has been energized for 30 seconds, unloader UV2 is then energized; this unloader will remain energized for 1 minute then be allowed to de-energize when the pressure decreases below 245PSIG.

2.3.6 Evaporator Fan Speed Selection

Temperature control is the primary method of determining the fan speed selection. Section NO TAG or section 2.3.7.1 describe relay operational status for the evaporator fans while Figure 2-1 provides Logic Board speed selections at various deviations from set point.

2.3.7 Fan Motor Operation Sequence

The evaporator and condenser fans are energized by relays on the relay board. Depending on relay board configuration the fan ON and fan HIGH SPEED relays may be directly energized by the microprocessor or they may be energized by a set of interim relays.

2.3.7.1 Relay Board (12-00486-01)

On systems with relay board 12-00486-01 (see Figure 1-9) Power is available: from relay board terminal JC-1 (see Figure 1-9) to the fan ON relays (K1 & K7) and fan HIGH SPEED relays (K2 & K8), and grounded thru terminals JC-2, -3, -4, -5.

When condenser fan operation is required, the microprocessor energizes (grounds thru JC-5) the condenser fan ON relay K7. Relay K7 closes it's contacts to energize the condenser fan relays CFR1 and CFR2. With the CFR relay contacts closed, power flows from the circuit breaker, through the relay contacts to the condenser fan motors.

When high speed condenser fan operation is required, the microprocessor energizes (grounds thru JC-4) the HIGH SPEED relay K8. Relay K8 closes it's contacts to energize the condenser speed relay CSR. With the CSR relay contacts closed, power flows through the motor high speed circuit, by passing the CSR resistor.

When evaporator fan operation is required, the microprocessor energizes (grounds thru JC-3) the relay K1. Relay K1 closes it's contacts to energize evaporator fan relay EFRL. A circuit is established from the circuit breaker to the motor.

When high speed evaporator fan operation is required, the microprocessor energizes (grounds thru JC-2) the evaporator fan HIGH SPEED relay K2. Relay K2 closes it's contacts to energize the evaporator speed relay ESRH which closes its contacts. The circuit continues through the motor high speed circuit (S2 to S3) adding an additional ground circuit..

2.3.8 Condenser Fan Control

The condenser fans are energized when the compressor clutch output is energized. The fans are started in low speed and will remain in low speed until the discharge pressure increases to 190 psig. The fans will remain in high speed until discharge pressure decreases below 135 psig. The fans will also be activated if a high pressure alarm has been activated and operation has not been locked out (refer to Table 3-2).

2.3.9 Compressor Clutch Control

A belt driven electric clutch is employed to transmit engine power to the air conditioning compressor. De-energizing the clutch electric coil disengages the clutch and removes power from the compressor. The clutch will be engaged when in cooling and disengaged when the system is off, in heating or during high and low pressure conditions.

The clutch coil will be de-energized if the discharge pressure rises to the cutout setting of the compressor mounted high pressure switch. An alarm will be triggered if this condition exists for more than a 0.5 second. The clutch coil will energize when the discharge pressure falls to the reset point of the high pressure switch.

The clutch coil will be de-energized whenever the suction pressure decreases below 6 PSIG, an alarm will be triggered if this condition exists for more than 10 seconds. The clutch coil will energize when the suction pressure rises to the reset point. If the alarm is triggered 3 times in a 30 minute time period the system will be locked out (See 3.2.1 Alarm Codes).

The clutch coil is prevented from engagement when the ambient temperature is below ambient lockout setpoint.

2.3.10 Liquid Line Solenoid Control

The liquid line solenoid is energized (open) when the compressor clutch is energized and de-energized (closed) when the clutch is not.

2.3.11 Alarm Description

Alarm descriptions and troubleshooting procedures are provided in section 3.

2.3.12 Hour Meters

Hour meter readings are available in the parameter code list of the Micromate. The hour meters record the compressor run time and the total time the evaporator fans are on. The maximum hours are 999,999. Refer to paragraph 2.4.2 for instructions on reading parameter codes.

2.4 MICROPROCESSOR DIAGNOSTICS

The Micromate control panel allows the user to interface with the microprocessor based control. This allows system parameters, alarms and settings to be viewed.

NOTE

If a replacement Logic Module is installed, it is necessary to match the configuration jumpers (See Figure 1-8) to the original board. Refer to paragraph 4.26.

2.4.1 Control

a. Activate the system by pressing the I/O key on the Micromate panel.

2.4.2 Diagnostic Mode

The diagnostic mode can be entered by pressing the UP and DOWN arrow keys simultaneously for 3 seconds. The Micromate control panel display screen will go blank for one second and then enter the alarm screen. The diagnostic mode allows alarms and system parameters to be viewed. If there are any alarms stored, the most recent alarm will be shown. To exit the diagnostic mode, press the ON/OFF key once, or do not touch any keys for 30 seconds. To view additional alarm information, refer to section 3.

2.4.3 System Parameters

To view system parameters, first enter the Diagnostic Mode. Refer to paragraph 2.4.2. . The parameters are shown in Table 2-2. While in the diagnostic mode, press an UP or DOWN arrow key to switch the display to the Parameter Display. With the first Parameter displayed, press the DOWN arrow key to scroll through the list from the first to the last parameter or press the UP arrow to scroll from the last to the first parameter. When scrolling through the parameters, the current parameter will be displayed for two seconds. After two seconds, the display will show the data for the current parameter. When the last parameter is reached, the list will wrap back to P1.

2.4.4 Test Mode

With the system in normal operation, the controller may be placed in the test mode, by doing the following:

a. Enter the diagnostic mode by pressing the UP and DOWN arrow keys simultaneously for 3 seconds. Enter the test mode immediately by pressing the COOL button five times (If control has no cool button, use the FRESH AIR button).

b. In the test mode, the display will read “T##” where “##” indicated the test number that is currently running.

c. The initial indication will be “T00”. This indicates the controller is in the test mode and all relays are de-energized. Press the DOWN arrow key to bring the Micromate to the next test screen and energize the corresponding component(s). Press the UP arrow key move backwards through the list. A listing of tests is provided in Table 2-1.

d. To terminate testing, press the I/0 key.

Table 2-1. Controller Test List

TEST	OUTPUT	STATE
T00	All Relays	Off
T01	Evaporator Fans High	On
T02	Evaporator Fans Low	On
T03	Condenser Fans High	On
T04	Condenser Fans Low	On
T05	Compressor & Liquid Line Solenoid	On
T06	Unloader Valve 1	On
T07	Unloader Valve 2	On
T08	Not Applicable	On
T09	Reheat Coolant Valve	On
T10	Fault	On
T11	Boost	On
T12	Spare/Motor Input/	On
	Floor Blower	

Table 2-2. Parameter Codes

CODE	CODE NAME	DESCRIPTION
P1	Return Air Temperature	This value is the temperature measured by the return air sensor. If the sensor is shorted it will display *CL.* If it is open circuited it will display *OP*.
P2	Coil Temperature	Not used.
P3	Ambient Temperature	This value is the outside temperature measured by the ambient temperature sensor. If the sensor is shorted it will display *CL.* If it is open circuited it will display *OP*.
P4	Suction Line Temperature	Not used.
P5	Suction Pressure	This value is the suction pressure measured by the suction pressure transducer. If the sensor is shorted it will display *CL* If it is open circuited it will display *OP*.
P6	Discharge Pressure	This value is the discharge pressure measured by the discharge pressure transducer. If the sensor is shorted it will display *CL* and if it is open circuited it will display *OP*.
P7	Superheat	Not used.
P8	Analog Set Point Temperature	Not used.
P9	A/C Control Window #1	This is the number of degrees F above setpoint at which the unloaders will be both energized. This value can be modified between 0 and 10 degrees F. The default value is 1 degree F.
P10	A/C Control Window #2	This is the number of degrees F above AC control window one at which the first unloader will be energized. This value can be modified between 0 and 10 degrees F. The default value is 1 degree F.
P11	A/C Control Window #3	This is the number of degrees F above AC control window two at which the evaporator fan speed will be set to low. This value can be modified between 0 and 10 degrees F. The default value is 1 degree F.
P12	Heat Control Window	This is the number of degrees F below setpoint before the reheat coolantvalve is energized. This value can be modified between 0 and 10 degrees F. The default value is 2 degree F for heat and 4 degrees F for reheat.
P13	Compressor Safety Off Delay	This number is the minimum time in minutes that the compressor must be off after a high or low pressure alarm before it can be restarted. This value can be modified between one and five minutes. The default value is 1.
P14	Fan Delay	This is the minimum time (in seconds) that the fans must run at a particular speed before changing to another speed. This value can be modified between one and 60 seconds. The default value is two seconds.
P15	Reheat Valve Delay	This is the minimum time (in seconds) that the reheat valve must be in a particular state (open /closed) before changing to another state. This value can be modified between 1 and 60 seconds. The default value is 2 seconds.
P16	Compressor High Pressure Switch	This is the current state of the compressor high pressure switch input. “CL” will be displayed if it is closed and “OP” will be displayed if it is open.
P17	Condenser Fan Speed Switch	Not used.
P18	Maximum Setpoint	This is the maximum value that the operator will be allowed to set the setpoint temperature. The value can be modified in degrees with the up and down keys to a value between 60°F and 80°F.
P19	Minimum Setpoint	This is the minimum value that the operator will be allowed to set the setpoint temperature. The value can be modified in degrees with the up and down keys to a value between 60°F and 80°F.

Table 2-2. Parameter Codes - Continued

Code	Code Name	Description
P20	Compressor Hours High	This is the number of hours of operation that the compressor has run with the clutch energized in thousands.
P21	Compressor Hours Low	This is the number of hours of operation that the compressor has run with the clutch energized in hundreds, tens and ones.
P22	Evaporator Hours High	This is the number (in thousands) of hours of operation with the evaporator fans energized.
P23	Evaporator Hours Low	This is the number (in hundreds, tens and ones) of hours of operation with the evaporator fans energized.
P24	Maintenance 1 Hour High	This is the value of compressor hours high (P20) at which maintenance alarm #1 will be activated. This value can be modified by the up and down arrow keys. If both high and low values are zero the alarm is disabled.
P25	Maintenance 1 Hour Low	This is the value of compressor hours low (P21) at which maintenance alarm #1 will be activated. This value can be modified by the up and down arrow keys. If both high and low values are zero the alarm is disabled.
P26	Maintenance 2 Hours High	This is the value of evaporator fan hours high (P22) at which maintenance alarm #2 will be activated. This value can be modified by the up and down arrow keys. If both high and low values are zero the alarm is disabled.
P27	Maintenance 2 Hours Low	This is the value of evaporator fan hours low (P23) at which maintenance alarm #2 will be activated. This value can be modified by the up and down arrow keys. If both high and low values are zero the alarm is disabled.
P28	Freeze Alarm Setting	This is the value at which the freeze alarm will be activated. The default value is 32°F. This value can be modified between 20°F and 40°F in one degree increments by using the arrow keys
P29	Relay Module Voltage	This is the voltage being supplied to the relay module.
P30	Main Board Software Version	This is the software version of the logic board.
P31	Display Software Version	This is the software version of the display module.
P32	Ki	Not used.
P33	Kp	Not used.
P34	Heat Set Point Offset	This value is the offset that can be used to change the points at which the unit switches between heat and vent in the heat mode. A positive value will raise the critical temperatures (winter use) and a negative value will decrease the critical temperatures (summer use).
P35	Default Display Temperature	This value determines what temperature value the driver’s display will show as a default. When the value is OFF, set-point temperature is displayed. When the value is ON, return air temperature is displayed. This option is only available in logic module software revisions 1.9 and newer, and drivers display software revision 1.3 and newer. Otherwise P35 will not be active and set-point temperature will only be displayed as default.
P40	Enable Hidden Alarm	This value determines if alarms A33 and A34 are displayed. When the value is OFF, alarms A33 and A34 will not be displayed. When the value is ON, alarms A33 and A34 will be displayed.
P41	Fresh Air Damper	Not used.
P42	Defrost Operation	This value determines if the defrost switch will override the Micromate controller. If the parameter is ON the defrost switch will initiate unit defrost whenever it senses a need for defrosting (the Micromate display will shut off in defrost). If the parameter is OFF the Micromate display will continue to operate and override the defrost switch.

SECTION 3

TROUBLESHOOTING

CAUTION

Do not under any circumstances attempt to service the microprocessor. Should a problem develop with the microprocessor, replace it.

3.1 SELF DIAGNOSTICS

A self test is performed by the Micromax Logic Board each time the board is powered up. Errors, if any, will be indicated and the unit will not be allowed to start. The error codes can be read by counting the number of times that the Logic Board STATUS and CODE LED's (see Figure 1-9) flash simultaneously. The Micromate control panel display will indicate errors with the code ER-#, where "ER" is the error prefix and # is the error number.

Table 3-1 Error Codes

CODE	NAME	DESCRIPTION
ER 1	Data Memory	Logic board data memory failure.
ER 2	Program Memory	Logic board program memory failure.
ER 3	A/D	A/D and multiplexer failure.
ER 4	Communication Failure	Failure in communication between the logic board and MDST.
ER 5	Program Memory	Display program memory failure.

3.2 SYSTEM ALARMS

3.2.1 Alarm Codes

The Micromax Logic Board continuously monitors system parameters and will generate an ALARM if a parameter exceeds preset limits. Alarms are indicated and the controller will respond in accordance with the information provided in Table 3-2. The alarm codes can be read by counting the number of times that the Logic Board CODE LED (see Figure 1-9) flashes. Each alarm code is a two digit number, the first set of flashes is the first digit and (after a slight pause) the second set of flashes is the second digit.

The Micromate control panel display will indicate alarms with the code A-## or i-##, where "A" is an active alarm prefix, "i" is an inactive alarm prefix and ## is the alarm number. If no alarms are present, the display will show "---". To access the alarm codes, press the UP and DOWN arrow keys at the same time and hold for 3 seconds. If multiple alarms are present the user can scroll through each alarm by pressing the AUTO key. When the end of the alarm list is reached the display will show "---". Press VENT to scroll backward from the latest alarm to the earliest alarm in the queue. When using the VENT key to scroll back, only the alarm code will be shown, the alarm time will not be shown. If the AUTO key is held down for five seconds while "---" is displayed all inactive alarms are cleared. A listing of alarm codes is provided in Table 3-2.

3.2.2 Activation

When alarms are detected, they are placed in an alarm queue in the order at which they initiated unless the alarm is already present. Each alarm recorded will also capture an evaporator hour meter reading corresponding to the activation time. If the AUTO key is pressed while an alarm is displayed, the activation time capture will be shown.

3.2.3 Alarm Queue

The alarm queue consist of 10 alarm locations. When the alarm queue is full the Logic Board will take the required action but the alarm will not be recorded. When this situation occurs, an "Alarm Queue Full"alarm will be generated. When the alarms are viewed this will be the first alarm to be shown.

3.2.4 Alarm Clear

The user may clear inactive alarms using the Micromate control panel keypad. Refer to paragraph 3.2.1.

3.3 TROUBLESHOOTING

General procedures for system troubleshooting are provided in Table 3-3

Table 3-2 Alarm Codes

ALARM NO.	TITLE	CAUSE	REMEDY	CONTROLLER RESPONSE
A11	Coil Freeze	Coil temperature is less than 32°F and the compressor is operating.	Check causes of coil freezing. (Refer to section 3.3.6)	An alarm will be generated and the system will shutdown. The evaporator fans will remain running while the compressor is off.
A12	High Voltage	The battery voltage is greater than 32 volts.	Check, repair or replace alternator.	The system is shut down until the voltage returns to normal levels.
A13	Low Voltage	The battery voltage is less than 17 volts.	Check, repair or replace wiring or alternator.	The system is shut down until the voltage returns to normal levels.
A14	Return Air Probe Failure	Return air temperature sensor failure or wiring defective.	Ensure all connectors are plugged in. Check sensor resistance or wiring. Refer to paragraph 4.13. Replace sensor or repair wiring.	All outputs except the evaporator fans will be de-energized.
A15	Suction Pressure Transducer Failure	Suction pressure transducer failure or wiring defective.	Ensure all connectors are plugged in. Check sensor voltage or wiring. Replace sensor or repair wiring.	Both unloaders are energized.
A16	Discharge Pressure Transducer Failure	Discharge pressure transducer failure or wiring defective.	Ensure all connectors are plugged in. Check sensor voltage or wiring. Replace sensor or repair wiring.	One unloader is energized. Condenser fans will run on high speed.
A17	Low Pressure Shutdown	Low suction pressure switch open or wiring defective.	Check cause of low suction pressure. (Refer to section 3.3.3)	The clutch is de-energized for the minimum off time. The evaporator fans will remain running during this period. After the compressor cycles off three times in 30 minutes all outputs will be de-energized (except for the evaporator fans and heat) and the system is locked out until the power is cycled or the alarm is reset.

Table 3-2. Alarm Codes - Continued

ALARM NO	TITLE	CAUSE	REMEDY	CONTROLLER RESPONSE
A21	High Discharge Pressure	High discharge pressure switch open or wiring defective.	Check discharge pressure transducer reading, wiring or cause of high discharge pressure. (Refer to section 3.3.3)	The clutch is de-energized for the minimum off time. The condenser and evaporator fans will remain running during this period. After the compressor cycles off three times in 30 minutes all outputs will be de-energized (except for the evaporator fans and heat) and the system is locked out until the power is cycled or the alarm is reset.
A22	Breaker Trip/Blown Fuse Alarm	A breaker/fuse on the relay board has tripped or a fan relay has failed.	Check breakers/fuse for tripped device. Repair short and reset/ replace breaker/fuse.	Alarm will be generated.
A23	Evaporator Fan Overload	Evaporator fan overload jumper is open.	Ensure connector is plugged in or repair wiring.	Alarm will be generated.
A24	Condenser Fan Overload	Condenser fan overload jumper is open.	Ensure connector is plugged in or repair wiring.	Alarm will be generated.
A25	Not used			
A26	Not used			
A31	Maintenance Alarm 1	The compressor hour meter is greater than the value in Maintenance Hour Meter 1.	Reset the maintenance hour meter.	Alarm will be generated.
A32	Maintenance Alarm 2	The evaporator hour meter is greater than the value in Maintenance Hour Meter 2.	Reset the maintenance hour meter.	Alarm will be generated.
A33	Low Pressure Warning	Suction pressure low enough to energize UV2.	Check cause of low suction pressure. (Refer to section 3.3.3)	Alarm will be generated.
A34	High Pressure Warning	Discharge pressure high enough to energize UV2.	Check cause of high discharge pressure. (Refer to section 3.3.3)	Alarm will be generated.
A99	Alarm Queue Full	All locations of the alarm queue are currently full and no more alarms can be saved.	Record and clear alarm queue.	Alarm will be generated.

Table 3-3. General System Troubleshooting Procedures

INDICATION/ TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
3.3.1 System Will Not Cool		
Compressor will not run	Active system alarm V-Belt loose or defective Clutch coil defective Clutch malfunction Compressor malfunction	3.2 Check Check/Replace Check/Replace See Table 1-2
Electrical malfunction	Coach power source defective Circuit Breaker/safety device open	Check/Repair Check/Reset
3.3.2 System Runs But Has Insufficient Cooling		
Compressor	V-Belt loose or defective Compressor valves defective	Check See Table 1-2
Refrigeration system	Abnormal pressures No or restricted evaporator air flow Expansion valve malfunction Restricted refrigerant flow Low refrigerant charge Service valves partially closed Safety device open Liquid solenoid valve stuck closed	3.3.3 3.3.6 3.3.7 4.10 4.7 Open 1.6 Check
Restricted air flow	No evaporator air flow or restriction	3.3.6
Heating system	Reheat coolant valve stuck open	3.3.8
3.3.3 Abnormal Pressures		
High discharge pressure	Discharge transducer failure Refrigerant overcharge Noncondensable in system Condenser motor failure Condenser coil dirty	Replace 4.4 Check Check Clean
Low discharge pressure	Discharge transducer failure Compressor valve(s) worn or broken Low refrigerant charge	See Note. See Table 1-2 4.7
High suction pressure	Compressor valve(s) worn or broken	See Table 1-2
Low suction pressure	Suction service valve partially closed Filter-drier inlet valve partially closed Filter-drier partially plugged Low refrigerant charge Expansion valve malfunction Restricted air flow Suction transducer failure	Open Check/Open 4.10 4.7 3.3.7 3.3.6 Replace
Suction and discharge pressures tend to equalize when system is operating	Compressor valve defective	See Table 1-2
3.3.4 Abnormal Noise Or Vibrations		
Compressor	Loose mounting hardware Worn bearings Worn or broken valves Liquid slugging Insufficient oil Clutch loose, rubbing or is defective V-belt cracked, worn or loose Dirt or debris on fan blades	Check/Tighten See Table 1-2 See Table 1-2 3.3.7 4.12.6 Check Check/Adjust Clean

Table 3-3 General System Troubleshooting Procedures - Continued

INDICATION/ TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
3.3.4 Abnormal Noise Or Vibrations - Continued		
Condenser or evaporator fans	Loose mounting hardware Defective bearings Blade interference Blade missing or broken	Check/Tighten Replace Check Check/Replace
3.3.5 Control System Malfunction		
Will not control	Sensor or transducer defective Relay(s) defective Microprocessor controller malfunction Logic Board J3 connector unplugged	4.15 Replace Check Check
3.3.6 No Evaporator Air Flow Or Restricted Air Flow		
Air flow through coil blocked	Coil frosted over Dirty coil Dirty filter	Defrost coil Clean Clean/Replace
No or partial evaporator air flow	Motor(s) defective Motor brushes defective Evaporator fan loose or defective Fan damaged Return air filter dirty Icing of coil Fan relay(s) defective Safety device open Fan rotation incorrect	Repair/Replace Replace Repair/Replace Repair/Replace Clean/Replace Clean/Defrost Check/Replace 1.6 Check
3.3.7 Expansion Valve Malfunction		
Low suction pressure with high superheat	Low refrigerant charge Wax, oil or dirt plugging valve orifice Ice formation at valve seat Power assembly failure Loss of bulb charge Broken capillary tube	4.7 Check 4.6 Replace Replace 4.11
Low superheat and liquid slugging in the compressor	Bulb is loose or not installed. Superheat setting too low Ice or other foreign material holding valve open	4.11 4.11
Side to side temperature difference (Warm Coil)	Wax, oil or dirt plugging valve orifice Ice formation at valve seat Power assembly failure Loss of bulb charge Broken capillary	Check 4.6 Replace Replace 4.11
3.3.8 Heating Malfunction		
Insufficient heating	Dirty or plugged heater core Reheat coolant solenoid valve(s) malfunctioning or plugged Low coolant level Strainer(s) plugged Hand valve(s) closed Water pumps defective Auxiliary Heater malfunctioning.	Clean Check/Replace Check Clean Open Repair/Replace Repair/Replace
No Heating	Reheat coolant solenoid valve(s) malfunctioning or plugged Controller malfunction Pump(s) malfunctioning Safety device open	Check/Replace Replace Repair/Replace 1.7
Continuous Heating	Reheat coolant solenoid valve stuck open	Replace

SECTION 4

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.

NOTE

Following completion of all maintenance or service activities, the alarm queue should be cleared of any original alarms and any alarms generated during service. Refer to paragraph 3.2.1.

4.1 MAINTENANCE SCHEDULE

SYSTEM ON	SYSTEM OFF	OPERATION	REFERENCE paragraph
a. Daily Maintenance			
X		Pre-trip Inspection – after starting	2.2
	X	Check tension and condition of V-belt	None
b. Weekly Inspection			
	X	Perform daily inspection	4.1.a
	X	Check condenser, evaporator coils and air filters for cleanliness	None
	X	Check refrigerant hoses and compressor shaft seal for leaks	4.5
X		Feel filter-drier for excessive temperature drop across drier	4.10
c. Monthly Inspection and Maintenance			
	X	Perform weekly inspection and maintenance	4.1.b
	X	Clean evaporator drain pans and hoses	None
	X	Check wire harnesses for chafing and loose terminals	Replace/Tighten
	X	Check fan motor bearings	None
	X	Check compressor mounting bolts for tightness	None
	X	Check fan motor brushes	4.18, 4.22

4.2 SUCTION AND DISCHARGE SERVICE VALVES

The suction and discharge service valves (See Figure 4-1) used on the compressor are equipped with mating flanges for connection to flanges on the compressor. These valves are provided with a double seat and a gauge connection, 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 suction or discharge line to the compressor and close off the gauge connection. In normal operation, the valve is backseated to allow full flow through the valve. The valve should always be backseated when connecting the service manifold gauge lines to the gauge ports.

Turning the valve stem clockwise (all the way forward) will *frontseat* the valve to close off the suction or discharge line to isolate the compressor and open the gauge connection.

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 line is open to both the compressor and the gauge connection.

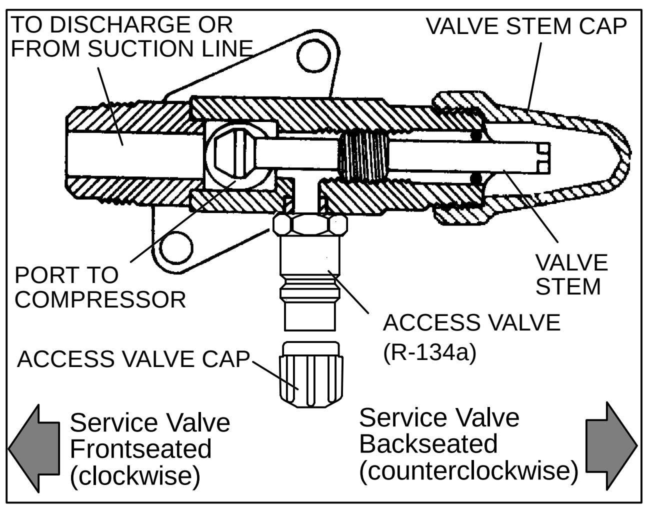
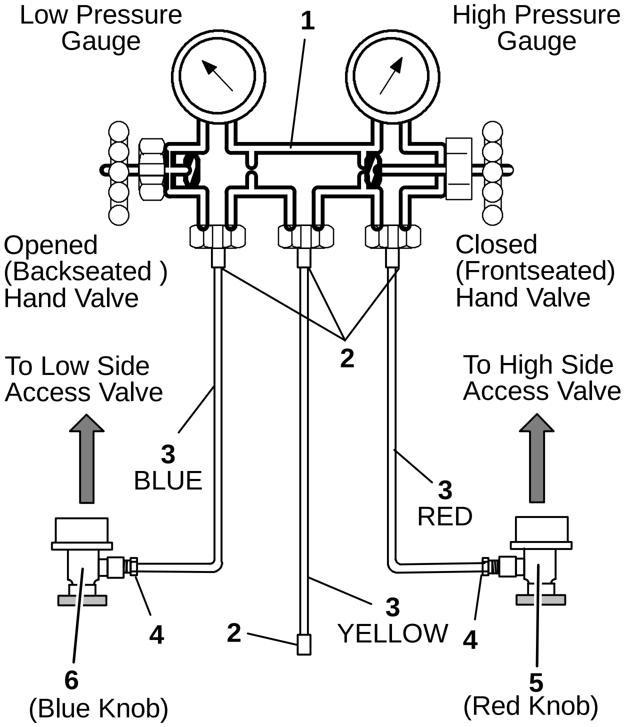


Figure 4-1. Suction or Discharge Service Valve

4.3 MANIFOLD GAUGES

The manifold gauge set can be used to determine system operating pressures, add charge, equalize or evacuate the system.



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 4-2. Manifold Gauge Set (R-134a)

4.3.1 Installing R-134a Manifold Gauge Set

An R-134a manifold gauge/hose set with self-sealing hoses is required for service of models covered within this manual. The manifold gauge/hose set is available from Carrier Transicold. (CTD P/N 07-00294-00, which includes items 1 through 6, see Figure 4-2.) 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 4-2, items 5 and 6) and midseat both hand valves.
3. Connect the yellow hose to a vacuum pump and an R-134a cylinder.
4. Evacuate to 10 inches (*0.69 BAR*) of vacuum and then charge with R-134a to a slightly positive pressure of 1.0 psig (*0.07 BAR*).
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 4-2, items 5 and 6) 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).

4.4 PUMPING THE SYSTEM DOWN OR REMOVING THE REFRIGERANT CHARGE

NOTE

To avoid damage to the earth's ozone layer, use a refrigerant recovery system whenever removing refrigerant.

4.4.1 System Pumpdown

To service or replace the filter-drier, expansion valve, evaporator coil, or suction line, pump the refrigerant into condenser coil as follows:

a. Install manifold gauge set. (Refer to paragraph 4.3)

b. Start the unit and allow it to run in the cool mode for 15 to 20 minutes.

c. Unplug the suction pressure transducer(SPT).

NOTE

The following procedure may have to be repeated several times to maintain the 0 to 2 psig *(6.9 kPa)* pressure depending upon amount of refrigerant absorbed in the oil.

d. Frontseat the liquid line (King) valve by turning clockwise. Start system and run in cooling. Stop the unit when the suction pressure reaches 1 psig (*0.07 BAR*).

e. Frontseat (close) suction service valve to trap the refrigerant in the high side of the system between the compressor suction service valve and the filter drier inlet valve. The low side of the system will now be at 1 psig *(0.07 BAR)* pressure and ready for servicing,

f. Service or replace the necessary component on the low side of the system.

g. Leak check connections. (Refer to paragraph 4.5)

h. Evacuate and dehydrate the low side. (Refer to paragraph 4.6)

i. Reconnect the suction pressure transducer (SPT).

j. Clear the low pressure alarm. (Refer to paragraph 3.2.1)

4.4.2 Removing the Refrigerant Charge

Connect a refrigerant recovery system to the unit at the condenser service (King) valve to remove refrigerant charge. (See Figure 4-4) Refer to instructions provided by the manufacturer of the refrigerant recovery system.

NOTE

1. Before opening up any part of the system, *a slight positive pressure should be indicated on the gauge.*

2. When opening up the refrigerant system, certain parts may frost. Allow the part to warm to ambient temperature before dismantling; this avoids internal condensation, which puts moisture into the system.

3. When opening or closing the service valves, care should be given to note if the packing around the valve stem is worn or may need adjustment to prevent refrigerant leaks.

4.4.3 Refrigerant Removal From An Inoperative Compressor.

To remove the refrigerant from a compressor that is not operational, do the following:

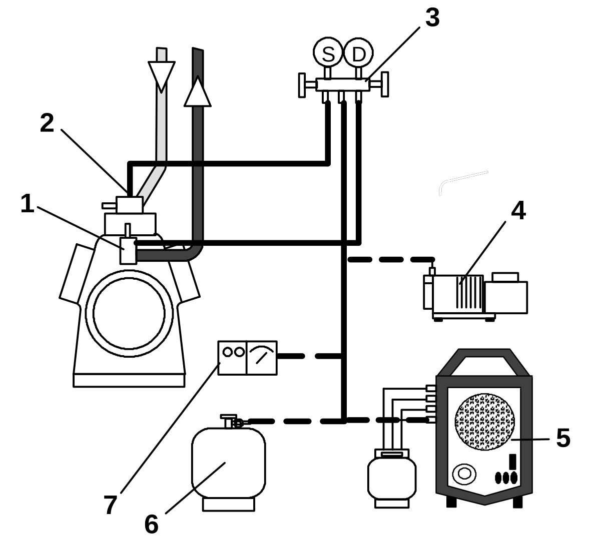
a. Attach a manifold gauge set as shown in Figure 4-3 and isolate the compressor by front seating the suction and discharge valves.

b. Recover refrigerant with a refrigerant reclaimer. If the discharge service valve port is not accessible, it will be necessary to recover refrigerant through the suction service valve port only.

c. Service or replace components as required and leak check the compressor.

d. Using refrigerant hoses designed for vacuum service, connect a vacuum pump to center connection of manifold gauge set. Evacuate compressor to 500 microns. Close off pump valve, isolate vacuum gauge and stop pump. Wait 5 minutes to verify that vacuum holds.

e. Once vacuum is maintained, recharge low side with R-134a to 20 to 30 PSIG by admitting vapor from the refrigerant cylinder. Backseat compressor service valves and disconnect manifold gauge set.



1. Discharge Service Valve and Port
2. Suction Service Valve and Port
3. Manifold Gauge Set
4. Vacuum Pump
5. Reclaimer
6. Refrigerant Cylinder
7. Thermistor Vacuum Gauge

Figure 4-3. Compressor Service Connections

4.4.4 Pump Down An Operable Compressor For Repair

To service an operable compressor, pump the refrigerant into the condenser coil as follows:

a. Install manifold gauge set. (See Figure 4-3)

b. Unplug the suction pressure transducer (SPT).

c. Frontseat the compressor suction service valve by turning clockwise.

d. Start the unit and run in cooling until 10 "/hg *(0.69 BAR)* of vacuum is reached. Shut the system down and tag out system power source.

e. Frontseat the compressor discharge service valve and wait 5 minutes to verify vacuum is maintained. If the pressure rises above vacuum, open the compressor discharge service valve and repeat steps c and d until a vacuum is maintained.

f. Service or replace components as required and leak check the compressor.

g. Using refrigerant hoses designed for vacuum service, connect a vacuum pump to center connection of manifold gauge set. Evacuate system to 500 microns. Close off pump valve, isolate vacuum gauge and stop pump. Wait 5 minutes to verify that vacuum holds.

h. Once vacuum is maintained, backseat compressor service valves and disconnect manifold gauge set.

i. Reconnect the suction pressure transducer (SPT).

j. Clear the low pressure alarm. (Refer to paragraph 3.2.1)

4.5 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 must be emphasized that only the correct refrigerant drum should be connected to pressurize the system. Any other gas or vapor will contaminate the system, which will require additional evacuation.

a. Ensure all the service valves and solenoid valves are open. It will be necessary to energize the solenoid valves from an external power source.

b. If the system is without refrigerant, charge the system with refrigerant vapor to build up pressure between 30 to 50 psig *(2.74 to 3.40 BAR)*.

c. Add sufficient nitrogen to raise system pressure to a maximum of 150 psig *(10.21 BAR)*.

d. Check for leaks. It is recommended that an electronic leak detector be used to find refrigerant leaks in a system. Testing joints with soapsuds is satisfactory and may be necessary under conditions when an electronic leak detector will not function correctly.

e. Remove refrigerant from system and repair any leaks.

f. Evacuate and dehydrate the system. (Refer to paragraph 4.6)

g. Charge the unit. (Refer to paragraph 4.7)

h. Ensure that self-test has been performed and that there are no errors or alarms indicated. (Refer to paragraphs 2.1.3 and 2.4.2)

4.6 EVACUATION AND DEHYDRATION

4.6.1 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.

4.6.2 Preparation

NOTE

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

2. Never evacuate an open drive compressor below 500 microns.

a. Evacuate and dehydrate only after pressure leak test. (Refer to paragraph 4.5)

b. Essential tools to properly evacuate and dehydrate any system include a good vacuum pump with a minimum of 6 cfm *(10.2 m^3/hr)* volume displacement, (CTD P/N 07-00176-11), and a good digital (micron) vacuum indicator (CTD P/N 07–00414–00).

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. It may be necessary to use heater blankets, heat lamps or alternate sources of heat to raise system temperature.

4.6.3 Procedure for Evacuation and Dehydrating System

a. Remove refrigerant using a refrigerant recovery system. (CTD P/N MVS–115–F–L–CT for 115 volt power source or CTD P/N MVS–240–F–L–CT for 240 volt power source)

b. The recommended method is connecting two lines (3/8” OD copper tubing or refrigerant hoses designed for vacuum service) to the manifold guage set. Attach one line to the condenser service (King) valve and the other line to the evaporator service port. (See Figure 4-4)

c. Connect lines to unit and manifold and make sure vacuum gauge valve is closed and vacuum pump valve is open.

d. To speed up evacuation time, open solenoid valves electrically. An additional vacuum pump may be added and connected to the compressor suction service port. (See Figure 4-4)

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

f. Evacuate unit until vacuum gauge indicates 1500 microns vacuum. Close gauge valve, vacuum pump valve, and stop vacuum pump.

g. Break the vacuum with clean dry refrigerant or dry nitrogen. Use the refrigerant that the unit calls for. Raise system pressure to approximately 2 psig *(0.14 BAR)*.

h. Remove refrigerant using a refrigerant recovery system, or if using nitrogen vent to atmosphere.

i. Start vacuum pump and open all valves. Evacuate unit to 500 microns vacuum.

j. Close off pump valve, isolate vacuum gauge in system and stop pump. Wait five minutes to see if vacuum holds.

k. With a vacuum still in the unit, the refrigerant charge may be drawn into the system from a refrigerant container on weight scales. (Refer to paragraph 4.7)

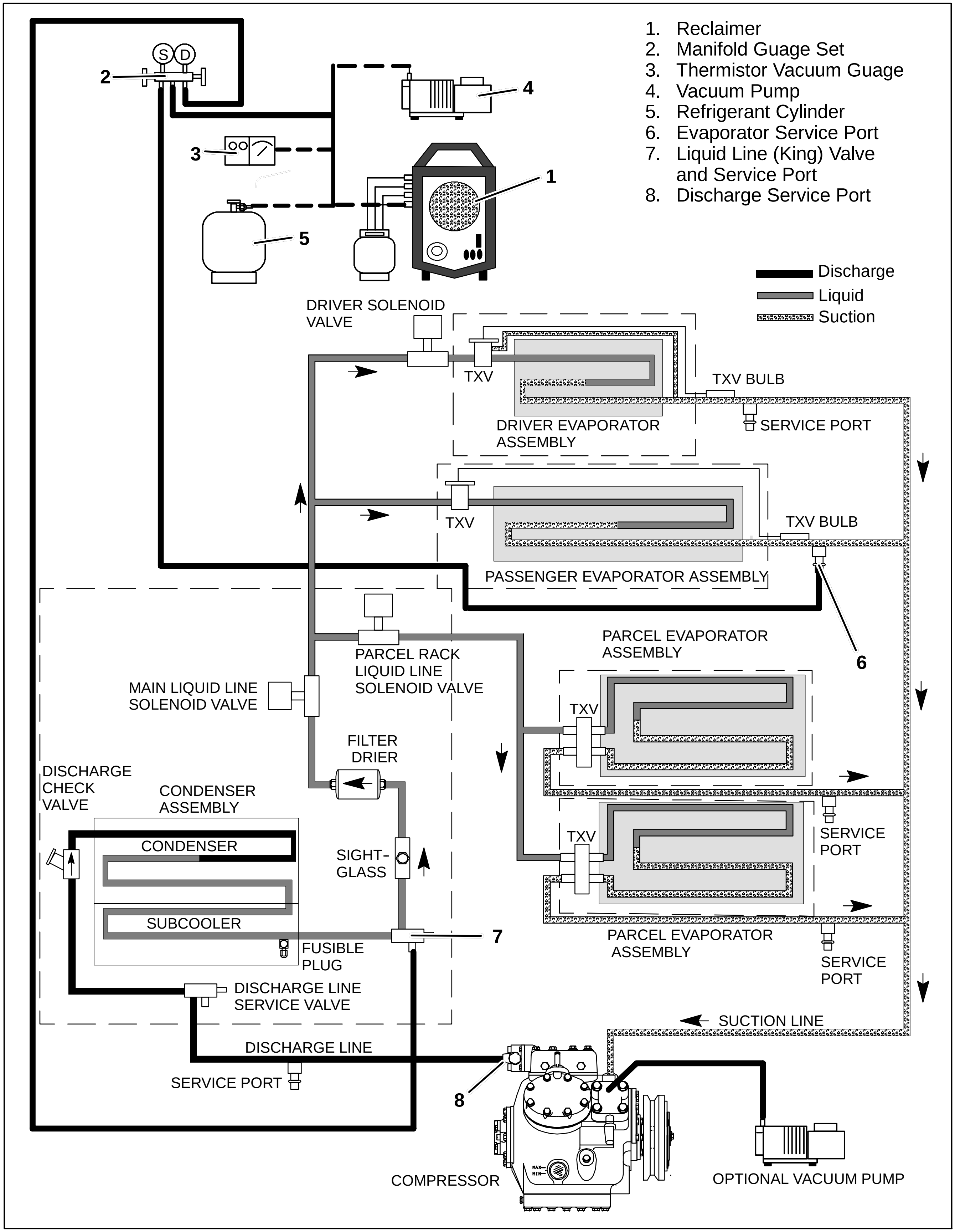


Figure 4-4. Refrigerant Service Connections

4.7 ADDING REFRIGERANT TO SYSTEM

4.7.1 Checking Refrigerant Charge

a. Connect an accurate high pressure gauge to the discharge service port at the compressor. (See Figure 4-4)

b. The condenser coil should be clean and free of any debris.

c. Coach engine operating at high idle (800–1000RPM).

d. The compressor should be fully loaded (six cylinder operation).

e. Unit must be operating in the cool mode until the discharge pressure has stabilized (3 to 5 minutes) and the interior temperature is between 70 and 80°F (21.1 and 26.7°C).

f. Discharge pressure at least 150 psig *(10.21 BAR)* and stable for R-134a systems (It may be necessary to partially block condenser airflow to raise discharge pressure).

g. Observe the Liquid Line Sight Glass and use the following chart to determine the condition of the refrigerant charge:

Table 4-1. Checking Refrigerant Charge

Sight Glass Observation	Condition
Liquid present Clear of all bubbles	Good/Possible over charge – Continue to step i.
Liquid present Occasional bubbles present	Good
Liquid present Many bubbles present	Possible under charge – Continue to step i.

h. If the conditions in steps b. thru f. are met and there is still doubt about the refrigerant charge level use Table 4-2:

Table 4-2. Checking Refrigerant Charge

Condenser Inlet Air Temperature		Discharge Pressure Range	
°F	°C	PSIG	BAR
60	16	110–135	7.48–9.19
65	18	120–145	8.16–9.87
70	21	130–155	8.85–10.55
75	24	140–165	9.53–11.23
80	27	150–175	10.21–11.91
85	29	160–186	10.89–12.66
90	32	175–200	11.91–13.61
95	35	190–212	12.93–14.42

i. With an accurate temperature gauge, measure the condenser inlet air temperature.

NOTE

Do not use a temperature gun as it measures surface temperature and not air temperature.

1. If the actual discharge pressure is higher than the discharge pressure range, the system may be over charged.
2. If the actual discharge pressure is lower than the discharge pressure range, the system may be under charged.
3. If the actual discharge pressure is in the discharge pressure range, the system charge is adequate.

NOTE

Many system related problems will effect system pressures. Use General System Troubleshooting Procedures Table 3.3.3 to determine other possible causes before adding or removing refrigerant.

4.7.2 Adding Full Charge

a. Evacuate and dehydrate system. (Refer to paragraph 4.6.)

b. Place appropriate refrigerant cylinder on scales and connect charging hose from container to filter-drier inlet valve. Remove air from hoses.

c. Note weight of refrigerant and container.

d. Open liquid valve on refrigerant container. Midseat filter-drier inlet valve and allow refrigerant to flow into the unit. Refer to paragraph 1.3 for correct charge.

e. When drum weight (scale) indicates that the correct charge has been added, close liquid line valve on drum and backseat the filter-drier inlet valve.

4.7.3 Adding Partial Charge

NOTE

Refrigerant charge is critical, when adding charge to the unit do not add any more charge to the system after bubbles have been eliminated from the sight glass.

a. Start the vehicle engine and allow the system to stabilize. (Refer to 4.7.1a. to f.)

b. Connect charging hose from appropriate refrigerant cylinder vapor valve to compressor suction service valve.

c. Open cylinder valve and add vapor charge. Under the above conditions, the system is properly charged when the condenser sight glass is clear with occasional bubbles showing. Add or remove refrigerant until the proper charge is obtained.

d. Backseat suction service valve. Close vapor valve on refrigerant drum. Replace all valve caps.

4.8 CHECKING FOR NONCONDENSIBLES

To check for noncondensibles, proceed as follows:

a. Stabilize system to equalize pressure between the suction and discharge side of the system. The engine needs to be off for several hours.

b. Measure temperature at any of the copper tubing in the condenser.

c. Check pressure at the compressor discharge service valve.

d. Determine saturation pressure as it corresponds to the condenser temperature using the Temperature-Pressure Chart, Table 4-6.

e. If gauge reading is 3 psig *(.2 BAR)* or higher than the calculated P/T pressure in step d, noncondensibles are present.

f. Remove refrigerant using a refrigerant recovery system. (Refer to paragraph 4.6.3)

g. Evacuate and dehydrate the system. (Refer to paragraph 4.6)

h. Charge the unit. (Refer to paragraph 4.7)

4.9 CHECKING AND REPLACING HIGH PRESSURE CUTOUT SWITCH

4.9.1 Replacing High Pressure Switch

a. The high pressure switch is equipped with schrader valve to allow removal and installation without pumping the unit down.

b. Unplug the wiring from the switch.

c. Check switch operation. (Refer to paragraph 4.9.2)

d. Replace switch if it does not function as outlined below. (Refer to paragraph 4.9.2)

4.9.2 Checking High Pressure Switch

WARNING

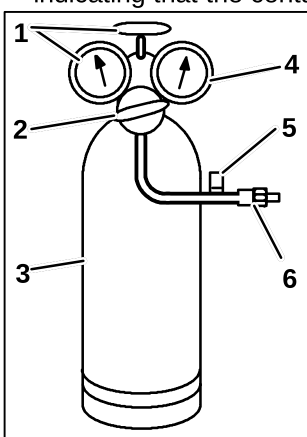
Do not use a nitrogen cylinder without a pressure regulator.

WARNING

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

a. Remove switch from unit. All units are equipped with schrader valves at the high pressure switch connection.

b. Connect an ohmmeter across switch terminals. If the switch is good, the ohmmeter will indicate continuity, indicating that the contacts are closed.



1. Cylinder Valve and Gauge
2. Pressure Regulator
3. Nitrogen Cylinder
4. Pressure Gauge, 0 to 400 psig *(0 to 2.8 mPa)*
5. Bleed-Off Valve
6. 1/4 inch Connection

Figure 4-5. Checking High Pressure Switch

c. Connect switch to a cylinder of dry nitrogen. (See Figure 4-5)

d. Set nitrogen pressure regulator higher than cutout point on switch being tested. (Refer to paragraph 1.3)

e. Open cylinder valve. Slowly open the regulator valve to increase the pressure until it reaches cutout point. The switch should open, which is indicated by an infinity reading on an ohmmeter (no continuity).

f. Close cylinder valve and release pressure through the bleed-off valve. As pressure drops to cut-in point, the switch contacts should close, indicating continuity on the ohmmeter.

4.10 FILTER-DRIER

4.10.1.To Check Filter Drier

Check for a restricted or plugged filter-drier by feeling the liquid line inlet and outlet connections of the filter-drier. If the outlet side feels cooler than the inlet side, then the filter-drier should be changed.

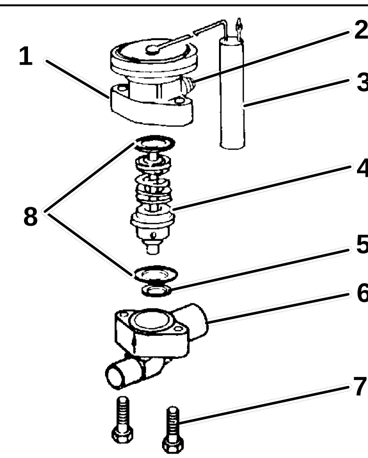
4.10.2.To Replace Filter Drier

a. Pump down the unit. (Refer to paragraph 4.4)

b. Replace filter-drier, ensuring that the arrow points in the direction of the refrigerant flow.

c. Drier can be evacuated at liquid line service valve. (See Figure 4-4)

d. Check refrigerant charge. (Refer to paragraph 4.7.1)



1. Power Head Assembly
2. Equalizer Connection
3. Bulb
4. Cage Assembly
5. Seat Gasket
6. Body Flange
7. Capscrew
8. Body Flange Gasket

Figure 4-6. Thermostatic Expansion Valve

4.11 THERMOSTATIC EXPANSION VALVE

The thermostatic expansion valve (TXV) 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 response of refrigerant flow to match the evaporator load and (b) prevention of liquid refrigerant returning to the compressor. Unless the valve is defective, it seldom requires any maintenance. All TXV's are non-adjustable.

4.11.1 Replacing the Expansion Valve (See Figure 4-6)

a. Pump down low side of the unit. (Refer to paragraph 4.4)

b. Remove insulation (Presstite) from expansion valve bulb.

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

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

e. Remove capscrews and lift off power head and cage assemblies and gaskets.

f. Check, clean and remove any foreign material from the valve body, valve seat and mating surfaces.

NOTE

Do not adjust the new replacement expansion valve. Valves are preset at the factory.

g. Using new gaskets, install new cage and power head assemblies provided with repair kit.

h. 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 and insulate both with "Presstite." Ensure that retaining straps are tight. (See Figure 4-7)

i. Connect equalizer line to the expansion valve.

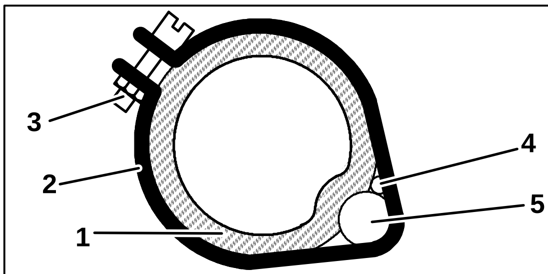
j. Evacuate and dehydrate. (Refer to paragraph 4.6)

k. Open filter-drier inlet valve (liquid line service valve) and all service valves.

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

m. Check refrigerant charge. (Refer to paragraph 4.7.1)

n. Check superheat. (Refer to paragraph 4.11.2)



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

Figure 4-7. Thermostatic Expansion Valve Bulb and Thermocouple Installation

4.11.2 To Check/Measure Superheat

NOTE

All readings must be taken from the leaving side of the evaporator.

a. Open the evaporator compartment door in the third baggage bay.

b. Open filter access door.

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

d. Loosen one TXV bulb clamp and make sure area under clamp (above TXV bulb) is clean.

e. Place temperature thermocouple in contact with the suction tube and parallel to the TXV bulb, and then secure loosened clamp making sure both bulbs are firmly secured to suction line. (See Figure 4-7) Reinstall insulation around the bulb.

f. Connect an accurate low pressure gauge (or install a manifold gauge set) to the service port on the leaving side of the evaporator. (Refer to paragraph 4.3)

g. Close evaporator access door being careful to route thermocouple sensing wire and guage hose thru the access hole to outside the evaporator.

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

i. From the temperature/pressure chart, determine the saturation temperature corresponding to the evaporator outlet pressure. (Refer to Table 4-6)

j. Note the temperature of the suction gas at the expansion valve bulb. Subtract the saturation temperature determined in step 8 from the temperature measured in this step. The difference is the superheat of the suction gas.

k. Repeat steps 8. and 9. six times at three minute intervals and average the six readings to determine average superheat. Average superheat should be 12 to 22°F *(6.7 to 12.2°C)*.

4.12 MODEL 05G COMPRESSOR MAINTENANCE

4.12.1 Shaft Seal Reservoir

If compressor is fitted with a shaft seal reservoir, it is recommended that the reservoir is serviced (checked and drained) at least once a year. Refer to the 05G Twin Port workshop manual 62-11052 for complete instructions.

4.12.2 Removing the Compressor

If compressor is inoperative and the unit still has refrigerant pressure, isolate the compressor and remove the refrigerant. (Refer to paragraph 4.4.3)

If compressor is operative, perform a pump down. (Refer to paragraph 4.4.4)

a. Turn main battery disconnect switch to OFF position and lock.

b. Loosen the compressor drive belt, and remove.

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

d. Remove bolts from suction and discharge service valve flanges.

e. Tag and disconnect wiring to the high pressure cutout switch, discharge pressure transducer, suction pressure transducer, unloaders and the clutch.

f. Remove four bolts holding compressor to base.

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

h. Set the compressor on a sturdy work surface.

4.12.3 Re-installing the Compressor

NOTES

1. The service replacement 05G compressors are sold without shutoff valves. Valve pads are installed in their place. The optional unloaders are not supplied, as the cylinder heads are shipped with plugs. The customer should retain the original unloader valves for use on the replacement compressor.

2. The piston plug that is removed from the replacement compressor head must be installed in the failed compressor if returning for warranty.

3. Do not interchange allen head capscrews that mount the piston plug and unloader; they are not interchangeable.

4. Check oil level in service replacement compressor. (Refer to paragraphs 1.3 and 4.12.5)

5. Service replacement compressors are supplied with a suction filter sock for initial startup. Ensure the filter sock is installed and removed in accordance with the instructions furnished.

a. Remove the three socket head capscrews from both unloader valves on the side heads of the 05G compressor. Remove the unloader valve and bypass piston assembly, keeping the same capscrews with the assembly. (See Figure 4-8) The original unloader valve must be transferred to the replacement compressor. The plug arrangement removed from the replacement is installed in the original compressor as a seal. If piston is stuck, it may be extracted by threading a socket head capscrew into top of piston. A small Teflon seat ring at the bottom of the piston must be removed.

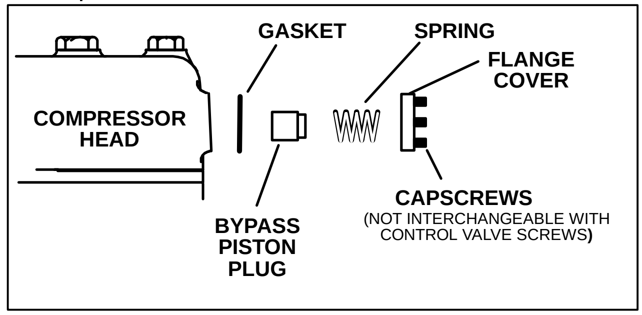


Figure 4-8. Removing Bypass Piston Plug

b. Remove the high pressure switch and pressure transducer assemblies and install on replacement compressor after checking switch operation.

c. Install compressor in unit by performing steps c. through g. in reverse sequence. It is recommended that new locknuts be used when replacing compressor. Install new gaskets on service valves and tighten bolts uniformly.

d. Re-install and tension the compressor drive belt.

e. Unlock and turn main battery disconnect switch to ON position..

f. Attach two lines (with hand valves near vacuum pump) to the suction and discharge service valves.

g. Fully backseat (open counterclockwise) both suction and discharge service valves.

h. Remove vacuum pump lines and install manifold gauges.

i. Start unit and check refrigerant level. (Refer to paragraph 4.7.1)

j. Check compressor oil level. (Refer to paragraph 4.12.5) Add or remove oil if necessary.

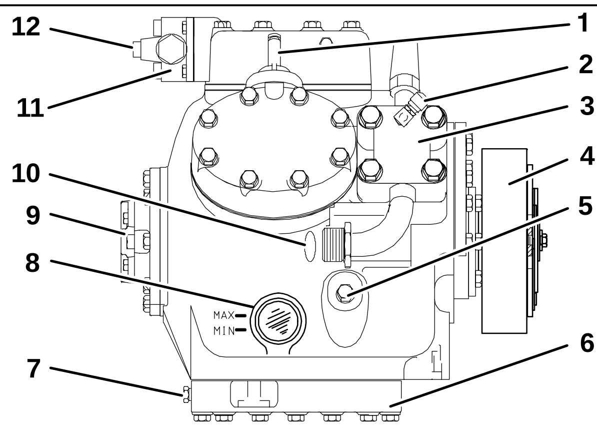
k. Check compressor unloader operation.

4.12.4 Compressor Unloaders

Although the electric unloaders are non-adjustable, they will require some periodic maintenance. Service kits are available for repair of the electric unloaders solenoid and stem assemblies.

To check the unloaders proceed as follows:.

a. Ensure that the compressor is fully loaded. Heat the interior of the coach if necessary.



1. Electric Unloader Valve
2. Suction Service Valve Charging Port
3. Suction Service Valve
4. Clutch
5. Oil Fill Plug
6. Bottom Plate
7. Oil Drain Plug
8. Oil Level Sight Glass
9. Oil Pump
10. O'Ring
11. Discharge Service Valve
12. Service Port

Figure 4-9. Model O5G Compressor

b. Connect manifold guages to the compressor.

c. Slowly frontseat the suction valve until 26 psig shows on the suction guage. The first unloader should energize (check for magnetism at the unloader coil) increasing suction pressure by 3 to 5 psig.

d. Slowly open the suction valve until the suction gauge reads 32 psig. The first unloader should de-energize decreasing suction pressure by 3 to 5 psig to show it is operating properly.

e. To check the second unloader, continue to frontseat the suction valve until 21 psig shows on the suction guage. The second unloader should energize (check for magnetism at the unloader coil) increasing suction pressure by 3 to 5 psig.

f. Slowly open the suction valve until the suction guage reads 28 psig. The first unloader should de-energize decreasing suction pressure by 3 to 5 psig to show it is operating properly.

g. Back seat the suction service valve, remove the guage(s) to resume normal operation.

4.12.5 Compressor Oil Level

NOTE

The compressor should be fully loaded (six cylinder operation); the unit should be fully charged and the compressor crankcase should be warm to the touch.

a. Start the unit and allow the system to stabilize.

b. Check the oil sight glass on the compressor to ensure that no foaming of oil is present after 20 minutes of operation. If oil is foaming excessively after 20 minutes of operation, check the refrigerant system for flood-back of liquid refrigerant. Correct this situation before proceeding.

c. Check the level of oil in oil level sight glass immediately after shutting down the compressor. The lowest level visible should be at the bottom of the sightglass and the highest level should be at the middle of the sight glass. (See Figure 4-9)

4.12.6 Adding Oil with Compressor in System

Two methods for adding oil are: the oil pump method and closed system method.

NOTE

Special care must be taken when working with POE oil that is used with HFC refrigerants such as R-134a, as POE oil is very hygroscopic. (POE oil will easily absorb water.) Do not leave POE oil containers open to the atmosphere.

4.12.6.1. Oil Pump Method

a. One compressor oil pump that may be purchased is a Robinair part no. 14388. This oil pump adapts to one U.S. gallon *(3.785 liters)* metal refrigeration oil container and pumps 2-1/2 ounces *(72.5 milliliters)* per stroke when connected to the suction service valve port. Also, there is no need to remove pump from can after each use.

b. When the compressor is in operation, the pump check valve prevents the loss of refrigerant while allowing servicemen to develop sufficient pressure to overcome the operating suction pressure to add oil, as necessary.

c. Backseat suction service valve and connect oil charging hose to port. Crack open the service valve and remove air from the oil hose at the oil pump. Add oil as necessary.

NOTE

Allow time (at least 60 seconds) for the oil to flow thru to the crankcase and show on the sightglass.

4.12.6.2. Closed System Method

a. Install manifold gauge set. (See Figure 4-3)

b. Unplug the suction pressure transducer (SPT).

c. Frontseat the compressor suction service valve by turning clockwise.

d. Start the unit and run in cooling until 10 "/hg (25.4 cm/hg) of vacuum is reached. Shut the system down and tag out system power source.

e. Frontseat the compressor discharge service valve and wait 5 minutes to verify vacuum is maintained.

f. Remove the crankcase oil fill plug on the side of the crankcase.

g. Replace the crankcase oil fill plug with a Carrier Service Parts no. OTBO889 fitting. This fitting has a 1/4 inch flare access port with a shrader valve.

h. Using refrigerant hoses designed for vacuum service, connect a vacuum pump to center connection of manifold gauge set.

CAUTION

Care must be taken to ensure that the manifold common connection remains immersed in oil at all times or air and moisture will be drawn into the system.

i. Connect a refrigerant hose with a shrader depressor to the fitting described in step g. above, put the other end of the hose in a fresh oil container.

j. Evacuate the compressor and observe the oil level in the compressor crankcase. When the desired oil level is reached, disconnect the hose from the fitting.

k. Reinstall the crankcase oil fill plug.

l. Using refrigerant hoses designed for vacuum service, connect a vacuum pump to center connection of manifold gauge set. Evacuate system to 500 microns. Close off pump valve, isolate vacuum gauge and stop pump. Wait 5 minutes to verify that vacuum holds.

m. Once vacuum is maintained, backseat compressor service valves and disconnect manifold gauge set.

n. Reconnect the suction pressure transducer(SPT).

4.12.7 Adding Oil to Service Replacement Compressor

Service replacement compressors may or may not be shipped with oil.

If the replacement compressor is shipped without oil, add oil through the oil fill plug. (See Figure 4-9)

4.12.8 Removing Oil from the Compressor:

a. If the lowest oil level observed in paragraph 4.12.5, step c., is above middle of the sight glass on compressor crankcase, oil must be removed from the compressor by performing the following procedure. If lowest oil level visible is below bottom of the sightglass, oil must be added to the compressor by following the procedure in paragraph 4.12.6.

b. Close (frontseat) suction service valve and pump unit down to 3 to 5 psig *(21 to 34 kPa).* Reclaim remaining refrigerant.

NOTE

If oil drain plug is not accessible, it will be necessary to extract oil through the oil fill plug with a siphon tube.

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.

c. Remove the oil drain plug on the bottom plate of the compressor and drain the proper amount of oil from the compressor. Replace the plug securely back into the compressor.

d. Repeat step a. to ensure proper oil level.

4.13 TEMPERATURE SENSOR CHECKOUT

a. An accurate ohmmeter must be used to check resistance values shown in Table 4-3.

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 good. If a sensor is bad, the resistance value would usually be much higher or lower than the value given in the Table 4-3.

Table 4-3. Temperature Sensor (AT, TSC, TSD and TSR) 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

NOTE

This system is equipped with three temperature sensors, two located in the return air ducts inside the coach, the third sensor is located in the condenser section. The two inside sensors are wired in parallel and together send an averaged signal to the controller. If one of these sensors fails the control function will continue with the remaining sensor. The sensor located in the condenser section reads outdoor temperature.

4.14 SUCTION AND DISCHARGE PRESSURE TRANSDUCER CHECKOUT

NOTE

1. System must be operating to check transducers.

2. Both transducers are mounted on the compressor

a. With the system running, use the driver display or manifold gauges to check suction and/or discharge pressure(s).

b. Use a digital volt-ohmmeter to measure voltage across the transducer and compare to values in Table 4-4. A reading within two percent of the values in the table would be considered good.

Table 4-4. Suction and Discharge Pressure Transducer (SPT and DPT) Voltage

Psig	Voltage	Psig	Voltage	Psig	Voltage
20”	0.369	105	1.495	220	2.622
10”	0.417	110	1.544	225	2.671
0	0.466	115	1.593	230	2.720
5	0.515	120	1.642	235	2.769
10	0.564	125	1.691	240	2.818
15	0.614	130	1.740	245	2.867
20	0.663	135	1.789	250	2.916
25	0.712	140	1.838	255	2.965
30	0.761	145	1.887	260	3.014
35	0.810	150	1.936	265	3.063
40	0.858	155	1.985	270	3.112
45	0.907	160	2.034	275	3.161
50	0.956	165	2.083	280	3.210
55	1.007	170	2.132	285	3.259
60	1.054	175	2.181	290	3.308
65	1.103	180	2.230	295	3.357
70	1.152	185	2.279	300	3.406
75	1.204	190	2.328	305	3.455
80	1.250	195	2.377	310	3.504
85	1.299	200	2.426	315	3.553
90	1.348	205	2.475	320	3.602
95	1.397	210	2.524	325	3.651
100	1.446	215	2.573	330	3.700

4.15 REPLACING SENSORS AND TRANSDUCERS

a. Turn main battery disconnect switch to OFF position and lock.

b. Tag and disconnect wiring from defective sensor or transducer.

c. Remove and replace defective sensor or transducer.

d. Connect wiring to replacement sensor or transducer.

e. Checkout replacement sensor or transducer. (Refer to paragraph 4.13 or 4.14 as applicable.)

4.16 SERVICING MAIN EVAPORATOR BLOWER ASSEMBLY

a. Turn main battery disconnect switch to OFF position and lock.

b. Remove access door located in the #3 baggage compartment. To remove the access door, grab recessed handles and pull up.

c. Disconnect electrical connections to the motor.

d. Remove blower transitions ducts.

e. Remove the four bolts securing the evaporator motor mounting plate, motor and blower housing assembly to the bottom panel.

f. Remove motor and blower wheel assembly by sliding out of evaporator housing.

g. Repair or replace any defective component(s), as required.

h. Replace by reversing steps b. thru f.

4.17 ACCESSING MAIN EVAPORATOR MOTOR BRUSHES

a. Turn main battery disconnect switch to OFF position and lock.

b. Remove access door. (Refer to 4.16.b.)

c. Disconnect electrical connections to the motor.

d. With a marker, trace the outline of the motor on the motor plate.

e. Remove the four brush access doors on the motor.

f. Service two brushes (top front and top rear).

g. Remove the four bolts securing the evaporator motor to the mounting plate.

h. Rotate the motor to gain access to the lower front brush.

i. Rotate the motor the opposite way to gain access to the lower rear brush.

j. Rotate the motor back to its feet and position back to its original position guided by the outline drawn in step d.

k. Re-secure the motor with the four bolts removed in step g. Check fan rotation, insuring that the fan wheels do not make contact with the fan housings.

l. Complete the procedure by performing steps a. thru c. in reverse.

4.18 SERVICING MOTOR BRUSHES

If the brushes are broken, cracked, severely chipped, or worn to 1/3 their original length, replace them.

a. Remove the four brush access doors on the motor.

b. With fingers or a suitable hook, lift the brush spring end up so the brush may slide up and out of the holder. Loosen the brush screw to remove the brush shunt terminal. Remove the brush.

c. To replace, lift the brush spring and place the brush in the holder. Position the end of the spring on top of the brush.

d. Connect the brush shunt terminal to its proper crossover with the brush screw assembled loosely.

NOTE

Assure positioning of the brush to permit the brush shunt to travel freely in the holder slot as the brush wears. If the brush hangs up, commutator damage and motor failure will result

e. Tighten screw.

4.19 SERVICING THE MAIN EVAPORATOR AND HEATER COIL

a. Drain engine coolant from the heater coil.

b. Pump down low side of the HVAC system. (Refer to paragraph 4.4.1.)

c. Remove remaining refrigerant. (Refer to paragraph 4.4.)

d. Remove the evaporator motor by following paragraph 4.16 steps a. thru f.

e. Disconnect all remaining electrical connections, move wires out of the way.

f. Remove the evaporator electrical panel assembly.

g. Remove the liquid line (3 connection points) and the discharge line (2 connection points) that pass thru the evaporator and connect to the evaporator.

h. Disconnect and remove the suction line.

i. Disconnect and remove the heater hoses.

j. Remove the door frame surrounding the evaporator enclosure.

k. Remove the four bolts that secure the coil bracket to the drain pan. Leave the coil bracket bolted to the evaporator coil until the coil has been removed from the coach.

⚠ WARNING

When moving the coil care must be taken to avoid personal injury because of the weight of the coil.

l. Brace the top of the coil hold it in position.

m. Remove the four bolts that secure the top of the coil to the evaporator housing.

n. Rotate the top of the coil till the coil is horizontal and slide out of the evaporator housing.

o. Re-install by performing the above procedure in reverse.

4.20 REMOVING THE CONDENSER ASSEMBLY

a. Remove two side access panels from rear of the last baggage bay.

b. Remove and reclaim the entire refrigerant charge. (Refer to paragraph 4.4.2.)

c. Turn main battery disconnect switch to OFF position and lock.

d. Disconnect all electrical leads to the module.

e. Disconnect refrigerant lines to the module.

f. Remove the door latch stud to the right side of the condenser compartment.

g. Remove the front panel and the eight screws fastening the condenser to the coach.

h. Remove the stabilizing bracket on the top of the condenser.

i. Remove the eight screws securing the condenser door hinges to the frame.

j. Remove condenser module by sliding out on mounting rails.

4.21 SERVICING THE CONDENSER COIL

a. Remove the condenser assembly from the coach. (Refer to paragraph 4.20)

b. Remove side panel (with control box).

c. Remove front shroud and panel assemblies.

d. Unbraze coil/tubing connections and roll front module assembly forward to provide clearance for coil removal.

e. Remove condenser coil.

f. Repair or replace the condenser coil.

g. Re-install by performing the above procedure in reverse.

4.22 SERVICING THE CONDENSER MOTOR

a. Turn main battery disconnect switch to OFF position and lock.

b. Remove appropriate front condenser grill.

c. Remove fan blade, secure the shaft key to the motor shaft or fan hub slot.

d. Disconnect the wires to the motor.

e. Remove the four motor base mounting screws.

f. Remove the motor and place on workbench.

g. Repair or replace defective component(s), as required.

h. For brush inspection/replacement refer to paragraph 4.18.

i. Re-install by performing the above procedure in reverse.

4.23 SERVICING THE DRIVER CONTROL BOX

The driver control box is located behind the return air panel below the passenger side dash and under the right headlight. (See Figure 4-10.) Remove the return air panel by removing the eight screws holding the panel in place. Remove and service the control box by performing the following procedure:

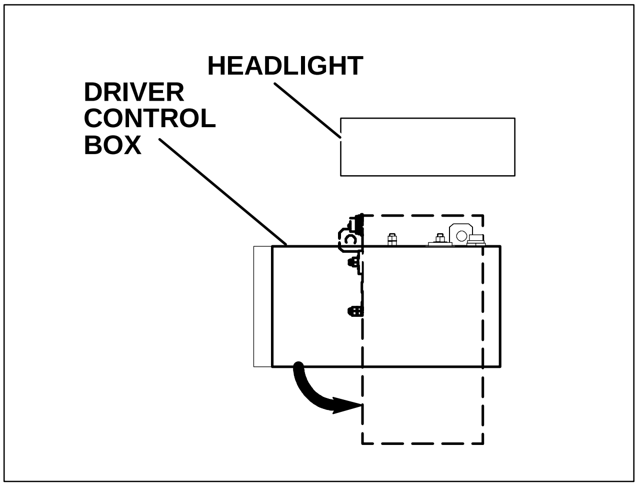


Figure 4-10. Removing Driver Control Box

a. Turn main battery disconnect switch to OFF position and lock.

b. Remove the power wire from the power stud and the connector from the box.

c. Remove the 1/4-inch capscrew at the upper right cover of the box. Pull the box laterally approximately 3/4-inch to the right to remove it from the pocket.

d. Rotate box counterclockwise 90 degrees as shown in Figure 4-10 and carefully lift the box out.

e. Repair or replace defective components, as necessary.

f. Re-install the driver control box by reversing the above procedure.

4.24 SERVICING THE DRIVER EVAPORATOR

4.24.1 Access Cover Removal

a. Remove stepwell access cover and disconnect 2-inch flex hose adapter.

b. Using a flat screwdriver, unfasten three 1/4 turn fasteners from access cover on driver evaporator assembly.

c. Open driver storage compartment and remove plug in sheet metal.

d. With screwdriver, unfasten the last 1/4 turn fastener.

e. Draw access cover towards the rear and slide to the right.

4.24.2Blower Removal

a. Disconnect plugs and speed control from the blower.

b. Undo latch and push the blower towards the rear.

c. Drop the blower down and remove.

4.24.3 Air filter Removal

a. With the access cover removed, slide right hand side air filter towards center and turn right corner past edge.

b. Slide left hand side filter to the right and repeat as above.

c. Clean/replace filter and re-install.

4.24.4 Removal of Evaporator/Heater Coil Assembly

a. Clamp off silicon hose close to the input and output end of the heater core.

b. Disconnect hose clamps and separate hose from fitting.

c. Pump down the refrigerant system. (Refer to paragraph 4.4.1)

d. Disconnect liquid line solenoid valve plug.

e. Disconnect expansion valve thermal bulb attached to the 7/8-inch copper tube.

f. Disconnect 7/8 and 3/8-inch copper lines.

g. Remove screws that attach the heater core to the unit.

h. Lift evaporator coil up and pull towards the rear for removal.

4.24.5 RAM Air Actuator Removal

a. Disconnect the plug.

b. Remove the no. 10 screw from the end of the spring on the RAM air actuator.

4.25 SERVICING THE PARCEL RACK EVAPORATOR

4.25.1 Motor Removal

a. Disconnect the motor wires from the connector.

b. Remove the two bolts from the motor mount and remove the motor.

c. Remove the blower and motor assembly.

4.25.2 Removal of Parcel Rack Evaporator Coil

a. Pump down the refrigerant system. (Refer to paragraph 4.4.1)

b. Remove the side access panel.

c. Disconnect expansion valve thermal bulb attached to the 7/8-inch copper tube.

d. Disconnect 7/8 and 3/8-inch copper lines.

e. Lift evaporator coil up and push towards the rear for removal.

4.26 LOGIC BOARD REPLACEMENT

Control configuration is preset at the factory and resetting of the parameters is not advised. If a replacement Logic Board is installed, it is necessary to match the configuration jumpers (see Figure 1-8) to the original board. Table 4-5 provides a list of jumper functions. Carrier is not responsible for failures or damage resulting from unauthorized changes.

Table 4-5. Logic Board Configuration

Configuration	Description
A.	High Reheat - When this configuration is removed, the unit will default to high speed in reheat mode and in the low speed cool band. If not removed, heat/reheat will default to low speed.
B.	High Vent - When this configuration is removed, the unit will default to high speed in vent mode. If not removed vent mode will default to low speed.
C.	Dry Heat - When this configuration is removed, the unit will run on 100% reheat instead of heat.
D.	Reheat/Cycle - When the reheat cycle configuration is removed, the unit is in reheat mode. The default configuration is cycle clutch mode.
E.	Transducers - When the transducer configuration is removed, transducers will assume to be present.
F.	Refrigerant R-22/R-134a - When the refrigerant configuration is removed, the refrigerant is set for R-22. The default refrigerant is R-134a.
	With “G” removed and “H” removed, 385 PSIG high pressure switch
	With “G” removed and “H” installed, 300 PSIG high pressure switch
I.	Factory - Reserved for the manufacturer.
J.	Invert H_2O - When this configuration is removed, the logic for the water temperature switch will be inverted.
K.	Voltage - When this configuration is removed, the voltage selection will be changed from 12 to 24 vdc.
L.	Security - Reserved for the manufacturer.
M.	Psig/Bars - When this configuration is removed, the display will indicate pressures in *bars*. When not removed, the display will indicate pressures in *psig*.
N.	°C/°F - When this configuration is removed, the display will show temperatures in °F. When not removed the display will show temperatures in °C.
O.	PI Reheat - When this configuration is removed, reheat mode will use the PI algorithm to vary the duty cycle of the heat valve. If it is not removed, the heat valve will be on constantly.
P.	Low Ambient Lockout - When this configuration is removed, the compressor clutch will disengage at 25°F. With this configuration in place, the compressor will disengage at 45°F.

Table 4-6. R-134a Temperature - Pressure Chart

Temperature		Vacuum		
°F	°C	"/hg	Kg/cm2	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 5
ELECTRICAL SCHEMATIC DIAGRAMS

5.1 INTRODUCTION

This section contains Electrical Schematic Diagrams covering the Models listed in Table 1-1. Contact your Carrier Transicold service representative or call the technical hot line at 800-450-2211 for a copy of the schematic for your specific model.

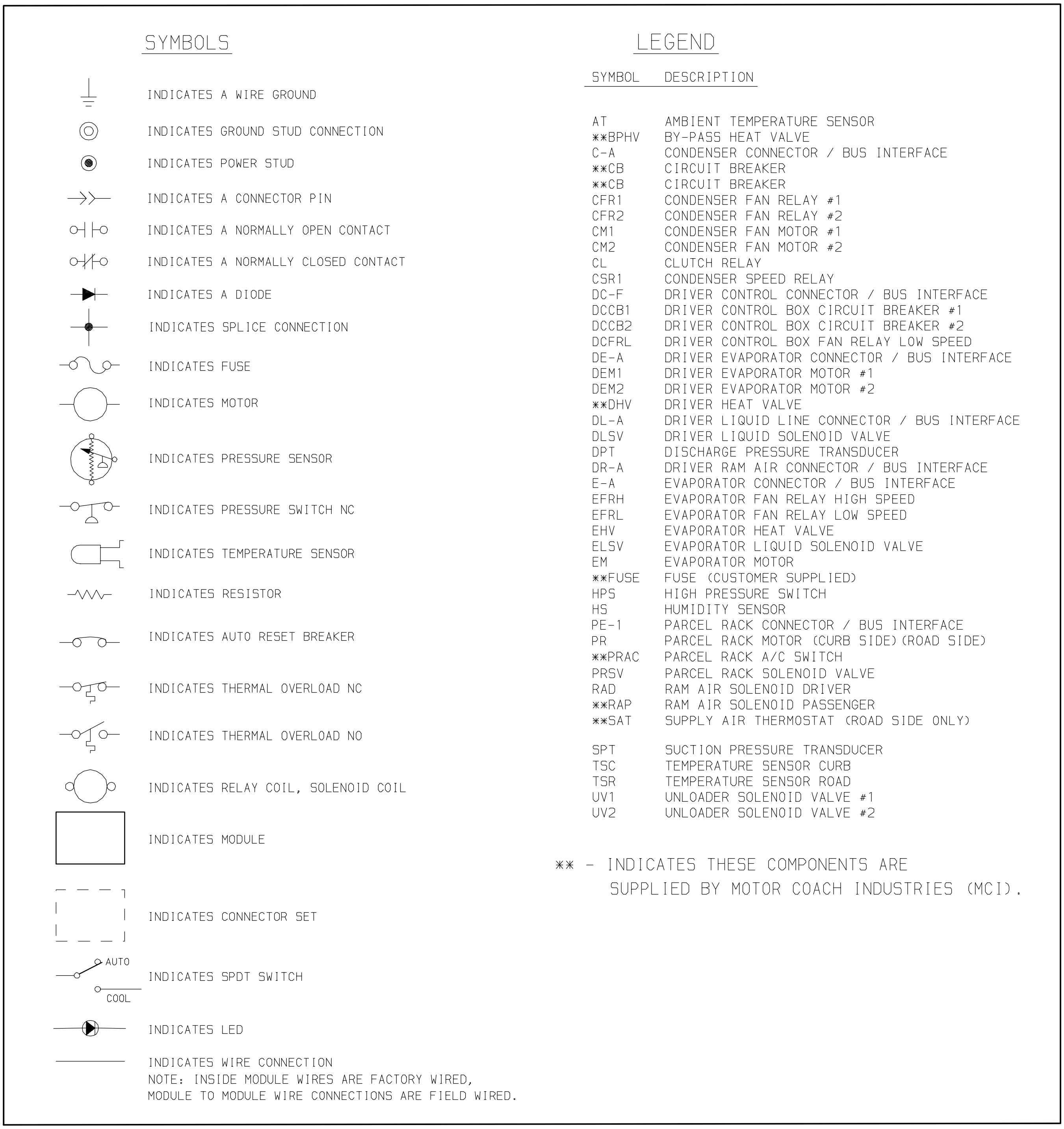
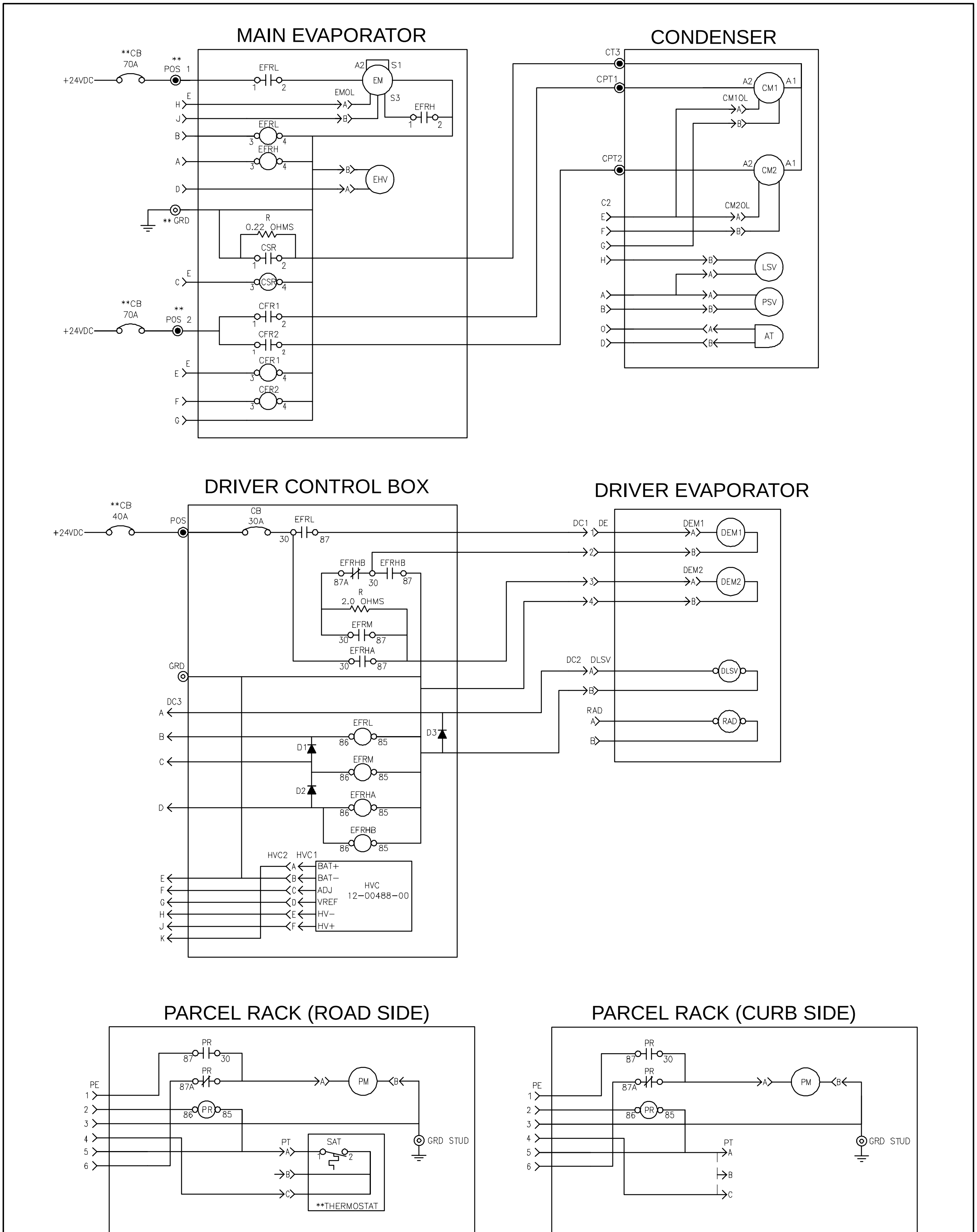


Figure 5-1. Electrical Schematic Diagram Legend and Symbols (Based On Drawing No. 62-10981 Rev--)



See NO TAG for legend and symbols.

Figure 5-2. Electrical Schematic Diagram, Sheet 1 of 2 (Based On Drawing No. 62-10981 Rev–)

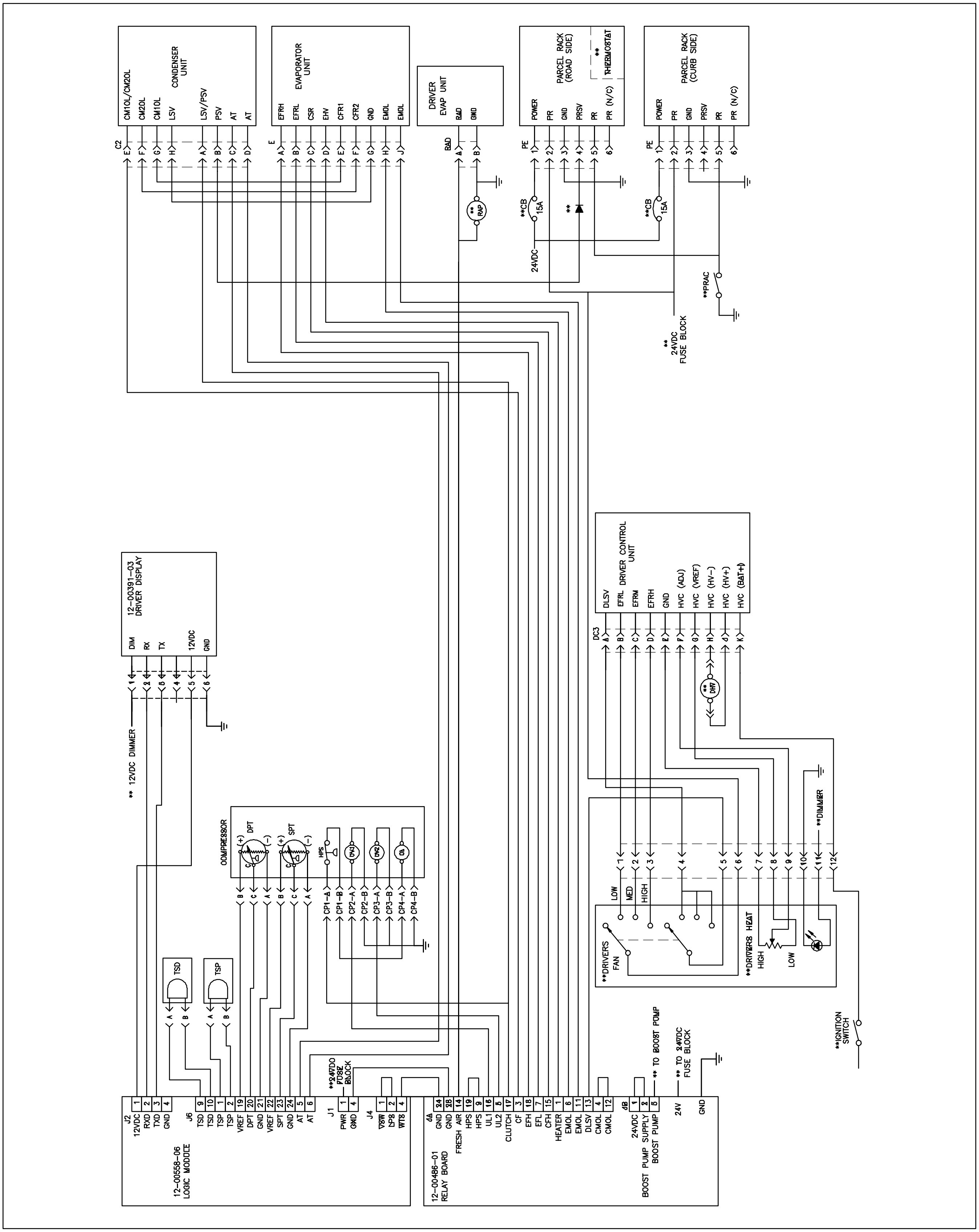
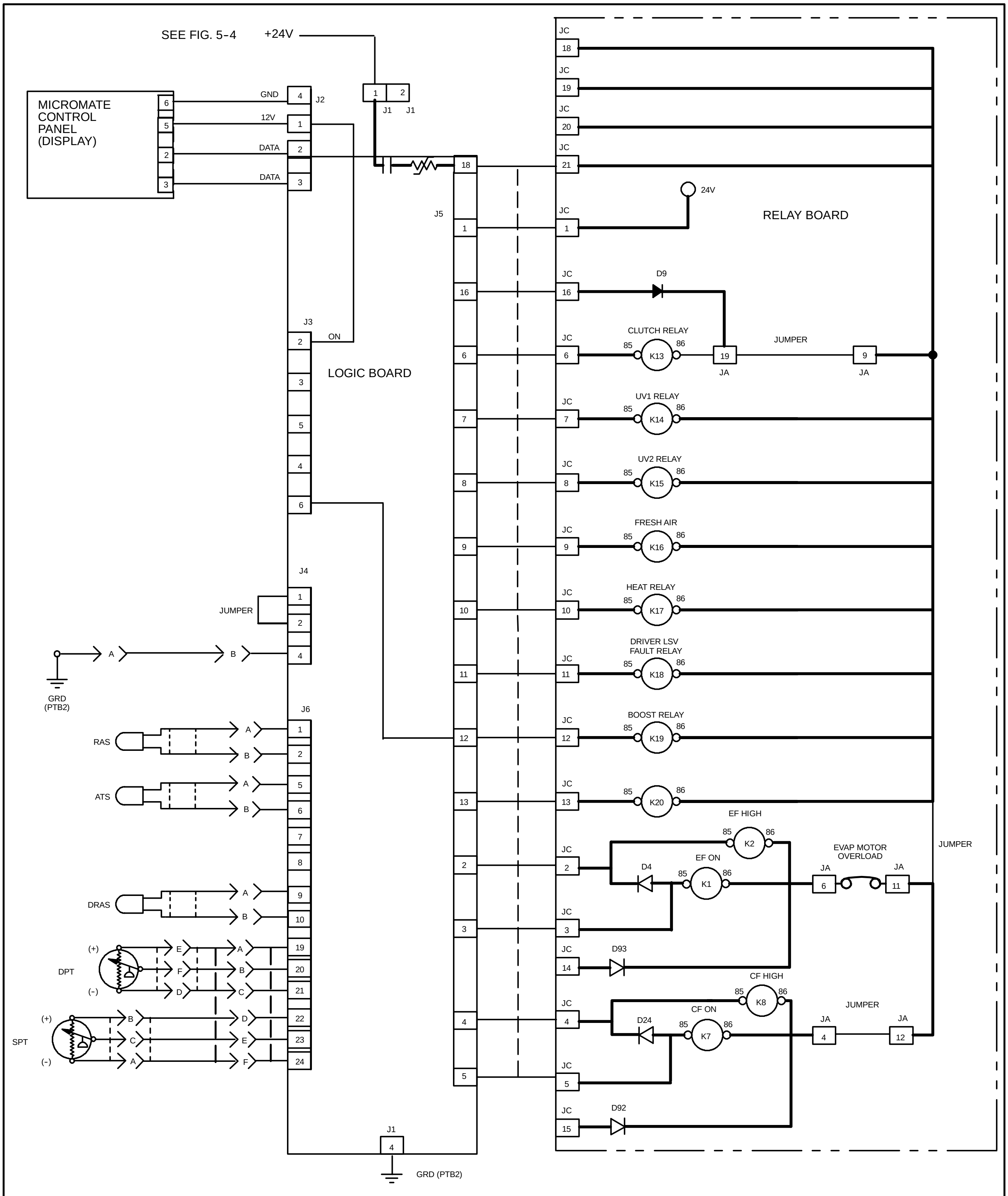
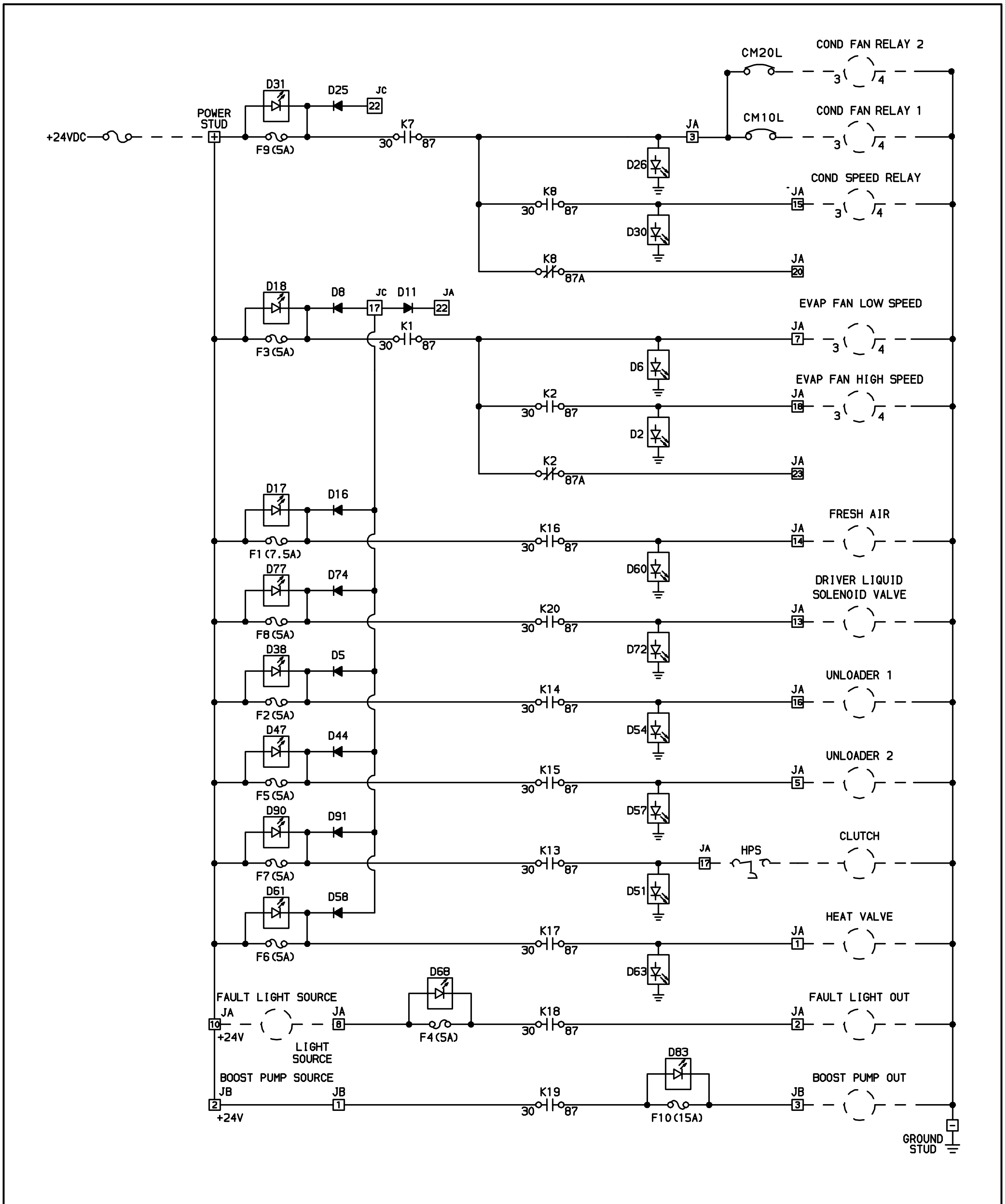


Figure 5-3. Electrical Schematic Diagram, Sheet 2 of 2
(Based On Drawing No. 62-10981 Rev–)



See Figure 5-1 for legend and symbols.

Figure 5-4. Wiring Schematic - Logic/Relay Board (12-00486-00)



See Figure 5-1 for legend and symbols.

Figure 5-5. Wiring Schematic - Relay Board and External Contactors (12-00486-00)

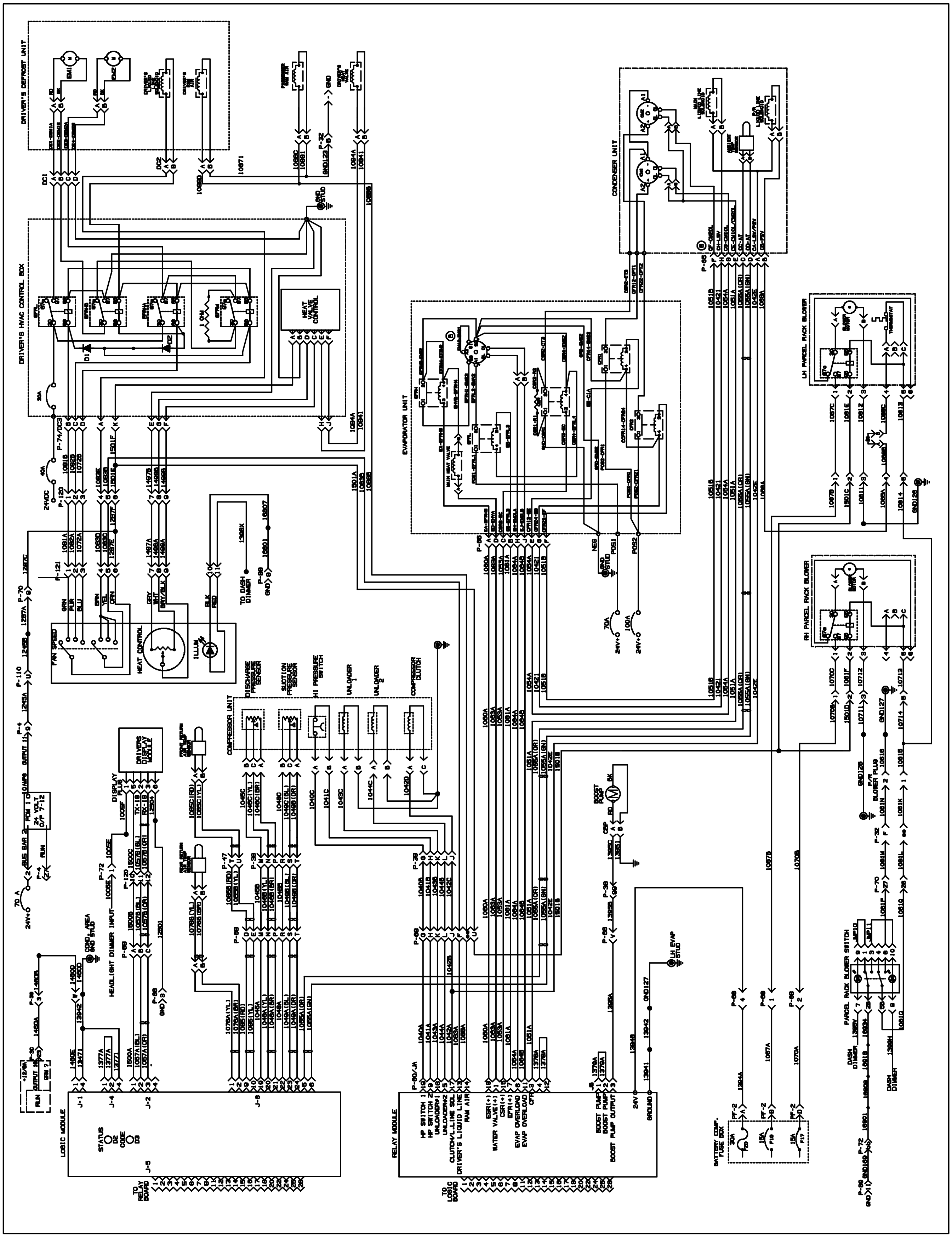


Figure 5-6. Electrical Schematic Diagram
(Contact vehicle manufacturer for a specific diagram)

INDEX

INDEX

Carrier Transport Air Conditioning
50 Grumbacher Road
York PA 17402 USA
Tel: 1-800-673-2431
Fax: 1-717-764-0401

Carrier
A United Technologies Company

Carrier Transicold Division,
Carrier Corporation
Transport Air Conditioning Group
P.O. Box 4805
Syracuse, N.Y. 13221 U.S A

www.carrier.transicold.com

Carrier TRANSICOLD