Carrier

TRANSICOLD

Bus Air Conditioning Equipment

Model CAPRI-280 Septa

OPERATION AND SERVICE

T-283

OPERATION AND SERVICE MANUAL

BUS
AIR CONDITIONING
UNIT

Model CAPRI-280
Septa

Carrier Transicold Division, Carrier Corporation, P.O. Box 4805, Syracuse, N.Y. 13221

Carrier
A United Technologies Company

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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 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 power off, and disconnecting and securing the power plug.

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).

SECTION 1

DESCRIPTION

1.1 INTRODUCTION

This manual contains Operating and Service Instructions and Electrical Data for the Model Capri 280 Air Conditioning and Heating equipment furnished by Carrier Transicold Division.

The Capri 280 consists of a condenser, evaporator and compressor. The air conditioning and heating equipment interfaces with electrical cabling, refrigerant piping, engine coolant piping for heating, ductwork and other components furnished by the bus manufacturer to complete the system.

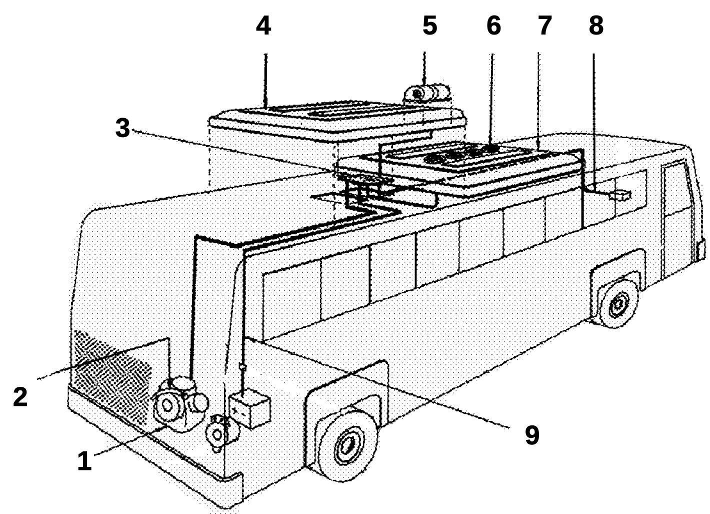


Figure 1-1. A/C Component Identification

1. Compressor
2. Pressure Switches
3. Electrical Control and Relay Board
4. Evaporator Section
5. Evaporator Blowers and Motors
6. Condenser Axial Fan/Motor Assemblies.
7. Condenser Section
8. Main Harness
9. Power Harness
10. Alternator
11. Power Relay

1.2 General description

1.2.1 Condenser Unit

The condenser unit includes condenser coils, fan and motor assemblies, filter-drier, receiver, liquid line solenoid valve, king valves, discharge check valve, and an ambient temperature sensor.

The condenser coils provide 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 assembly.

The receiver collects and stores liquid refrigerant. The receiver is fitted with upper and lower liquid level sight glasses to enable determining refrigerant liquid level in the receiver. The receiver is also fitted with a fusible plug which protects the system from unsafe high refrigerant temperatures. The main liquid line solenoid valve closes when system is shut down to prevent flooding of coils with liquid refrigerant and to isolate the filter-drier for servicing when the compressor is shut down. The king valves enable servicing of the filter-drier. The ambient temperature sensor measures ambient temperature and sends an electrical signal to the controller.

The discharge line check valve is a spring loaded, normally closed valve that opens with the flow of refrigerant from the compressor. When the compressor clutch is disengaged, the discharge check valve will close, preventing the flow of high pressure liquid from the condenser to flow back into the compressor.

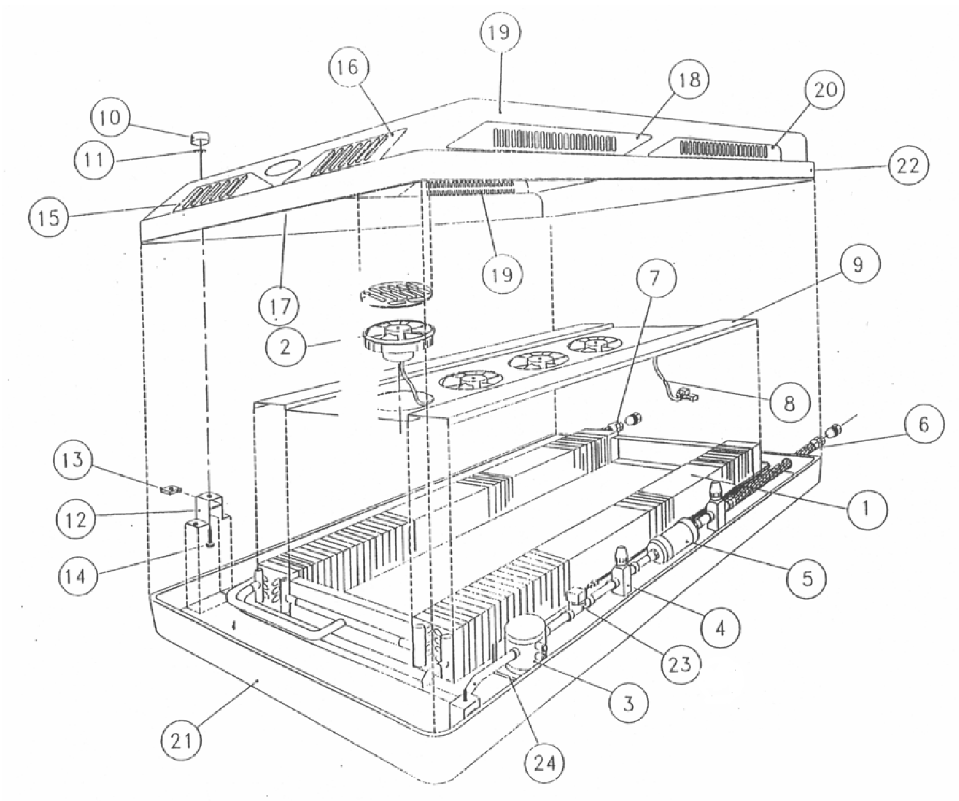


Figure 1-2. Condenser Unit

1. Condenser Coil
2. Condenser Fan Motor Assembly
3. Receiver Tank
4. Service Valve
5. Filter Drier
6. Liquid Hose
7. Gas Hose
8. Condenser Motor Harness
9. Condenser Motor Plate
10. Lid Screw Nut
11. Locking Screw Gasket
12. Lid Bolt Support
13. Square Nut
14. Locking Screw Gasket
15. Right Front Grille
16. Left Front Grille
17. Right Front Lateral Grille
18. Left Front Grille
19. Right Rear Lateral Grille
20. Left Rear Lateral Grille
21. Condenser Fiberglass Base
22. Condenser Top Cover Lid
23. Liquid Line Solenoid Valve
24. Receiver Tank Support

1.2.2 Evaporator Unit

The evaporator unit includes roadside and curbside evaporator coils.

Each evaporator unit includes six fan and motor assemblies, evaporator/heater coil assemblies, thermal expansion valves, condensate drain connection(s), and evaporator heat valve.

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 heating coils provide a heat transfer surface for transferring heat from engine coolant water circulating inside the tubes to air circulating over the outside surface of the tubes, thus providing heating when required. 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 thermal expansion valves meter the flow of refrigerant entering the evaporator coils. The heat valve controls the flow of engine coolant water supplied to the heating coils upon receipt of a signal from the controller. The condensate drain connections provide a means for connecting tubing for disposing of condensate collected on the evaporator coils during cooling operation.

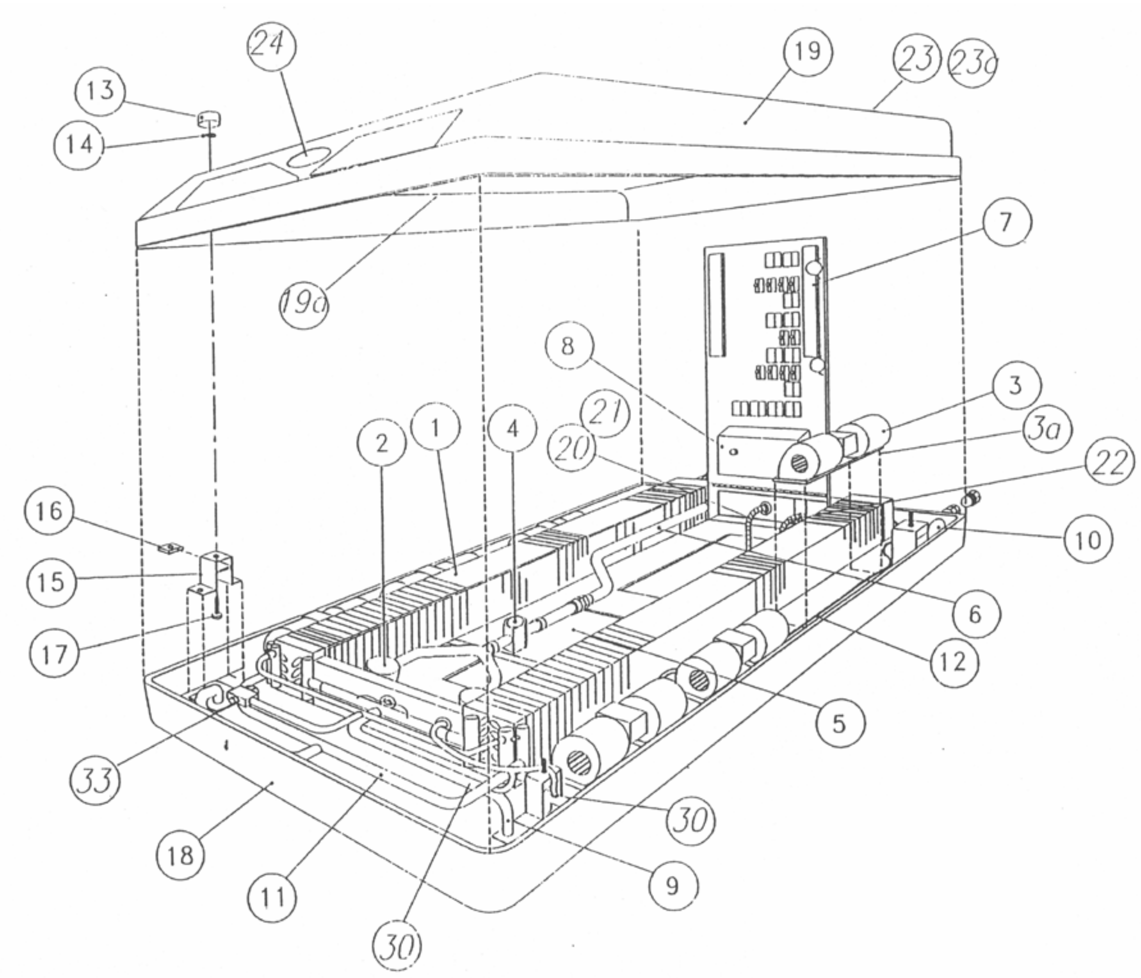


Figure 1-3. Evaporator Unit

1. Evaporator Coil, Roadside
1a. Evaporator Coil, Curbside
2. Expansion Valve
3. Evaporator Blower and Motor
3a. Allen Screw
4. Humidity Sight Glass
5. Return Air Filter
6. Liquid Line
7. Relay Board
8. Logic Board
9. Suction Line
10. Discharge Line
11. Heating Line
12. Evaporator Motor Harness
13. Lid Screw – Stopper
14. Locking Screw Gasket
15. Lid Bolt Support
16. Square Nut
17. Lid Locking Screw

1.2.3 Compressor Assembly

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

The compressor raises the pressure and temperature of the refrigerant and forces it into the condenser tubes. The clutch assembly provides a means of belt driving the compressor by the bus engine. The suction and discharge service valves enable servicing of the compressor. Suction and discharge servicing (charging) ports mounted on the service valves enable connection of charging hoses for servicing of the compressor, as well as other parts of the refrigerant circuit. The high pressure switch 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 bus. For more detailed information on the compressor, refer to manual number 62-02756.

1.3 REFRIGERATION SYSTEM COMPONENT SPECIFICATIONS

a. Refrigeration Charge

R-134a: 11.3 lb *(5.1 kg)*

b. Compressor

Model: 05G
No. of Cylinder: 6
Weight (Dry): 165 lb *(75 kg)*
Oil Charge:
New Compressor: 6.75 pints (3.2 liters)
Replacement Compressor: 5.5 pints (2.6 liters)
Oil Level:
Level in sight glass between Min.–Max marks 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:

Superheat Setting (Non-externally adjustable): 10 to 12_F
MOP Setting (Nonadjustable): 55 ±4 psig *(375 ± 28.5 kPa)*

d. High Pressure Switch (HPS) - for R-134a Units:

Opens at: 300 ±10 psig
Closes at: 200 ±10 psig

1.4 ELECTRICAL SPECIFICATIONS ECDC MOTORS

a. Evaporator/Heater Blower (Fan) Motor

Full Load Amps (FLA): 8.4A
Horsepower: 0.34
Voltage: 24 vdc
Operating Speed: 4375 rpm

b. Condenser Fan Motor

Bearing Lubrication: Shell Dolium R
Horsepower: 0.15 hp
Full Load Amps (FLA): 7A
Operating Speed: 3180 rpm
Voltage: 24 vdc

1.5 ELECTRICAL SPECIFICATIONS – Controller Input Sensors and Transducers

a. Suction and Discharge Pressure Transducer

Supply Voltage: 4.5 to 5.5 vdc (5 vdc nominal)
Supply current: 8 mA maximum
Output Range: 8K ohms minimum
Input Range: –6.7 to 450 psig *(–46.2 kPa to 3.1 mPa)*
Output Current: -1.5 mA minimum to 1.5 mA maximum
Output Voltage: vdc = 0.0098 x psig + 0.4659 (See Table 4-2 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 4-1 for calculations.)

1.6 SAFETY DEVICES

System components are protected from damage caused by unsafe operating conditions with safety devices. Safety devices with Carrier Transicold supplied equipment include high pressure switch (HPS), low pressure switch (LPS), circuit breakers and fuses.

a. Thermal Switches

Condenser Motor Overloads

Each condenser fan motor is equipped with an internal thermal protector switch, condenser motor overloads. If excessive motor temperature exists, the condenser motor overload switch will open to de-energize the corresponding condenser fan.

Evaporator Motor Overloads

The evaporator fan motors are equipped with internal thermal protector switches. If excessive motor temperature exists, the switch will open to de-energize the corresponding evaporator fan; this will prevent the affected evaporator motor from operating.

b. Pressure Switches

High Pressure Switch (HPS)

During the A/C mode, HVAC system operation will automatically stop if the HPS switch contacts open due to an unsafe operating condition. Opening HPS contacts de-energizes, through the controller, the A/C compressor clutch and condenser fan motor relays shutting down the system.

The high pressure switch (HPS) is installed in the center head of the compressor and opens on a pressure rise to shut down the system when high pressure conditions occur. For R-134a systems, the switch is factory set to open at 300 ±10 psig and close at 200 ±10 psig.

Low Pressure Switch (LPS)

The low pressure switch is installed in the compressor and opens on a pressure drop to shut down the system when a low pressure condition occurs. For R-134a systems, the switch is factory set to open at 6 ±3 psig. In addition, if the control monitors a pressure less than 10 psig by the suction pressure transducer mounted in the evaporator section, the system will be shut down for at least one minute.

c. Fuses and Breakers

All outputs from the relay board are protected against high current by circuit breakers. Independent 15 amp circuit breakers protect each motor. In addition, a 15 amp fuse protects a motor from over current. During a high current condition, the breaker or fuse may open. When the breaker opens, power will be removed from the device and a breaker alarm will be generated. When a fuse opens, ground will be removed from the device and a motor alarm will be generated.

d. Ambient Lockout

The ambient temperature sensor located in the condenser section measures the condenser air temperature. When the temperature is less than 45°F, the compressor is locked out until the temperature increases above 50°F to prevent compressor damage.

1.7 AIR CONDITIONING REFRIGERANT CYCLE

When air conditioning (cooling) is selected by the 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 coils, receiver, filter-drier, thermostatic expansion valves, liquid line solenoid valve and evaporator coils.

The compressor raises the pressure and the temperature of the refrigerant and forces it 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, thus liquid refrigerant leaves the condenser and flows to the receiver.

The receiver serves as a liquid refrigerant reservoir so that a constant supply of liquid is available to the evaporators as needed, and acts as a storage space when pumping down the system. The receiver is equipped with sight glasses to observe the refrigerant for restricted flow and correct charge level.

The refrigerant leaves the receiver and passes through the receiver outlet/service valve, through a filter-drier where an absorbent keeps the refrigerant clean and dry.

From the filter-drier, the liquid refrigerant then flows to the thermal expansion valves which reduce 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 bus. Liquid line solenoid valves close during shutdown to prevent refrigerant flow.

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.

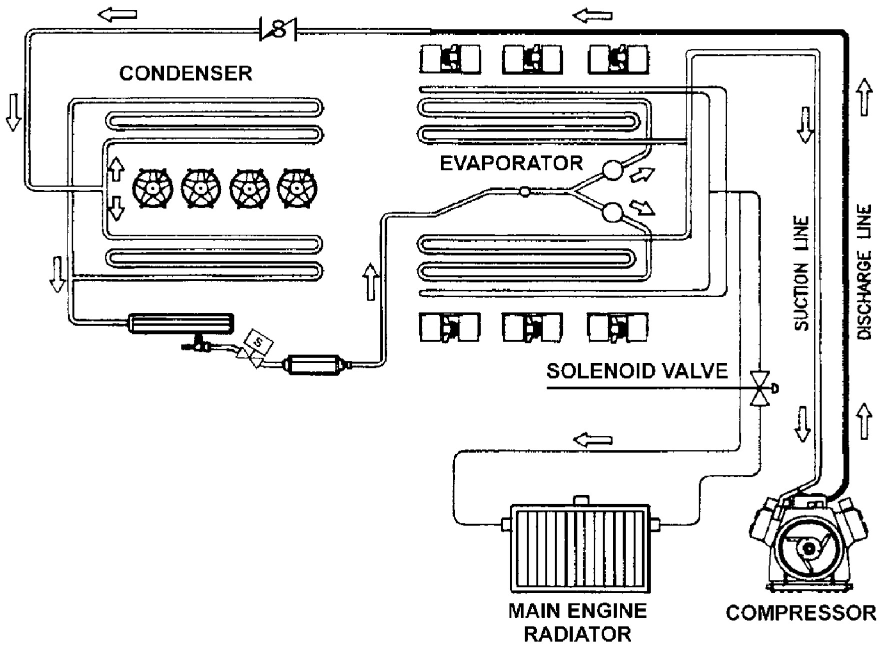


Figure 1-4. Heater Flow Diagram

1.8 HEATER FLOW CYCLE

Heating circuit components furnished by Carrier Transicold include heater cores and evaporator heat valves for each evaporator assembly. Components furnished by the bus manufacturer include auxiliary heater and engine water pumps. The controller automatically controls the heat valves during heating and reheat cycles to maintain required temperatures inside the bus. Engine coolant (glycol solution) is circulated through the heating circuit by the engine and auxiliary water pumps. When the evaporator heat valve solenoid is energized, the valve will open to allow engine coolant to flow through the heater coil (see Figure 1-4). The valve is normally closed so that if a failure occurs, it will be able to cool.

1.9 Relay Board – Electronically Commutated DC Motors with 2-speed Input Signal

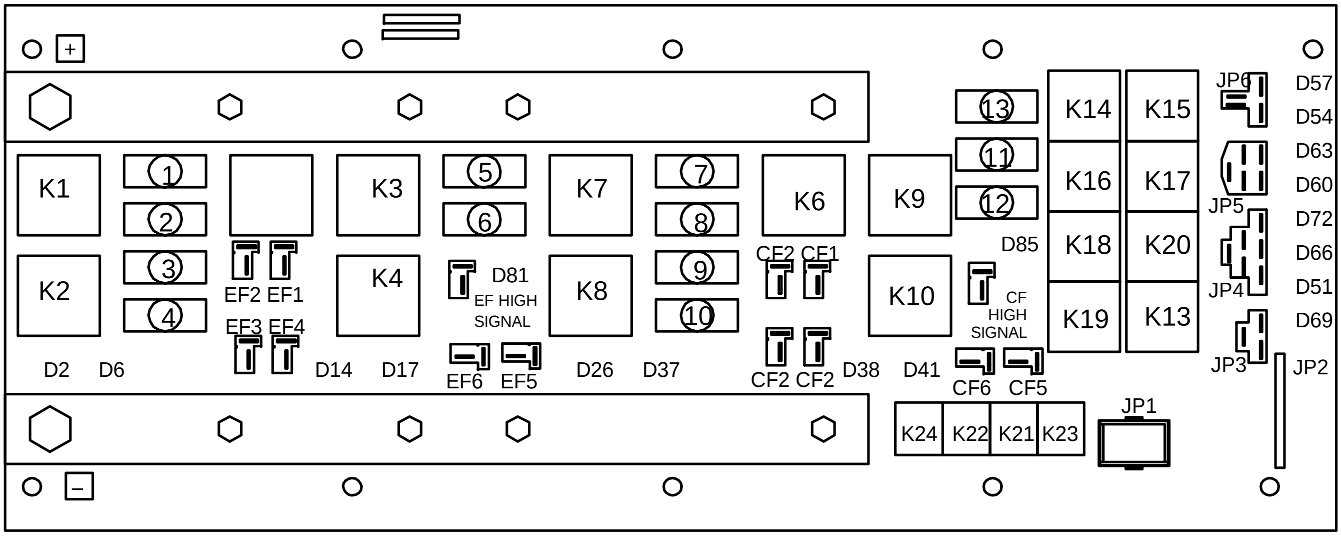


Figure 1-5 Relay Board

a. Relays

K1	Energizes evaporator fans 1 & 2.
K2	Energizes evaporator fans 3 & 4.
K3	Energizes evaporator fan 5.
K4	Energizes evaporator fan 6.
K5	Provides the evaporator fan high output signal.
K 6	Provides the condenser fan high output signal. (Not used).
K 7	Energizes condenser fans 1 & 2.
K 8	Energizes condenser fans 3 & 4.
K 9	Not used
K10	Not used
K13	Energizes the A/C clutch.
K14	Energizes unloader 1.
K15	Energizes unloader 2.
K16	Energizes the high low pressure failure.
K17	Energizes the heat solenoid valve.
K18	Energizes the alarm output.
K19	Energizes the booster pump.
K20	Energizes the motor fail light.

b. Thermal Circuit Breakers 24V

CB 1	Evaporator fan #1.	15 Amp.
CB 2	Evaporator fan #2.	15 Amp.
CB 3	Evaporator fan #3.	15 Amp.
CB 4	Evaporator fan #4.	15 Amp.
CB 5	Evaporator fan #5.	15 Amp.
CB 6	Evaporator fan #6.	15 Amp.
CB 7	Condenser fan #1.	15 Amp.
CB 8	Condenser fan #2.	15 Amp.
CB 9	Condenser fan #3.	15 Amp.
CB10	Condenser fan #4.	15 Amp.
CB11	Spare.	15 Amp.
CB12	Spare.	15 Amp.
CB13	A/c clutch, unloaders 1&2 motor fail, heat valve, pressure fail & spare output.	15 Amp.

c. Connectors

EF1-EF6	Evaporator Fans.
CF1-CF4	Condenser Fans.
JP1	External evaporator & condenser fan thermal overload connections.
JP2	Logic board connector.
JP3	Booster pump.
JP4	A/C Clutch, Pressure fault output, Compressor High Pressure Switch.
JP5	High pressure fail, motor fail output, heat valve.
JP6	Unloaders 1 & 2.
EF-HIGH SIGNAL	Output to the evaporator fans to operate on high speed.
CF-HIGH SIGNAL	Output to condenser fans to operate on high speed. (Not used)

d. LEDS

D 2	Evaporator fans 1 & 2 are energized.
D 6	Evaporator fans 3 & 4 are energized.
D14	Evaporator fan 5 is energized.
D17	Evaporator fan 6 is energized.
D26	Condenser fans 1 & 2 energized.
D30	Condenser fans 3 & 4 energized.
D38	Condenser fans 5 & 6 energized. (Not used).
D51	A/C clutch output active.
D54	Unloader 1 output active.
D57	Unloader 2 output active.
D60	High low pressure failure.
D63	Heat valve output active.
D66	Alarm output active.
D69	
D72	Motor fail light.
D81	Evaporator fans on high.
D85	Condenser fans on high. (Not used).

1.10 Logic Board

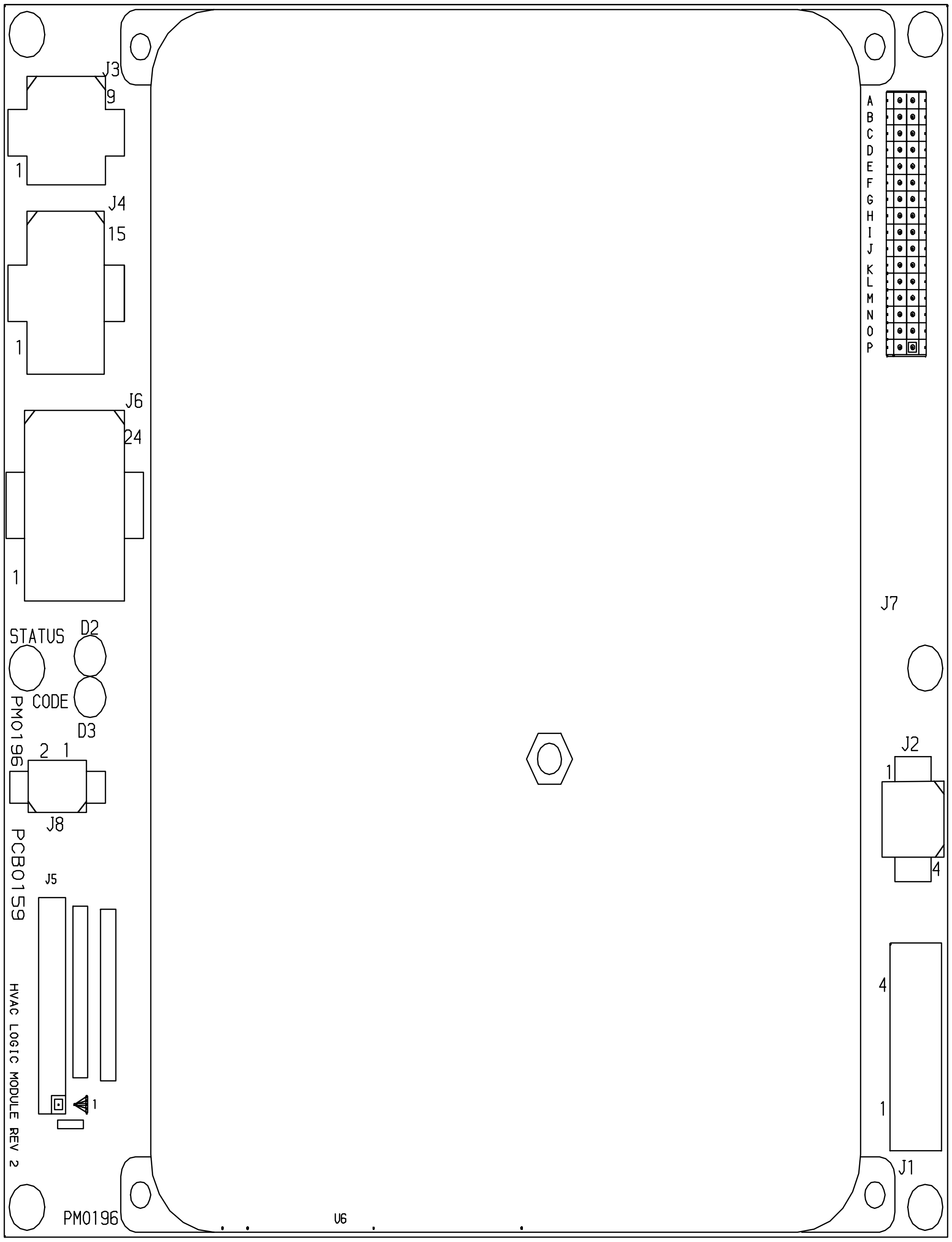


Figure 1-6 Logic Board

J1 Logic board power in.
J2 Display interface.
J3 Manual control inputs.
J4 Interlock Inputs
(WTS, low side pressure switch etc.)
J5 Relay board interface.
J6 Sensor inputs (Thermistors, etc.).
J7 Diagnostics interface (RS232, DB9).
D2 Blinks once per second in normal operation.
On steady to indicate alarms detected.
D3 Off In normal operation, blinks out alarm
codes (2 digits each) when alarms detected.

1.11 Control Panel (Diagnostic Module)

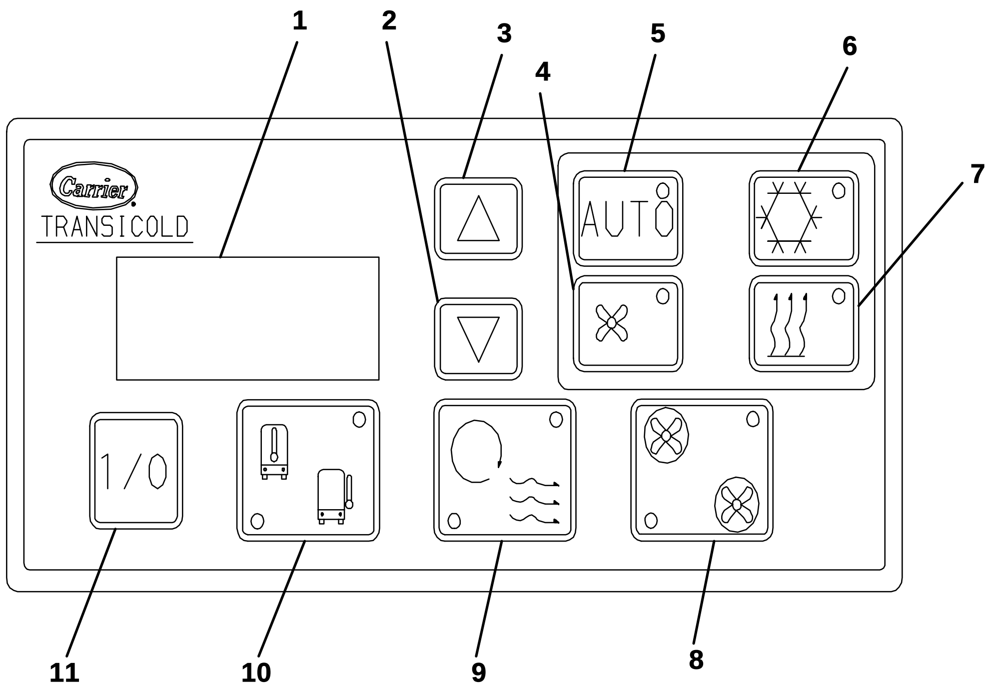


Figure 1-7. Diagnostic Module

1. Display
2. Down – decrease selection
3. Up – increase selection
4. Ventilation
5. Auto Control Selection
6. Air Conditioning
7. Heating
8. Fan Speed Selection
9. Not used
10. Temperature Inside / Outside
11. Turn On / Turn Off

SECTION 2

OPERATION

2.1 STARTING, STOPPING AND OPERATING INSTRUCTIONS

2.1.1 HVAC Power to Controller

Before starting the system, electrical power must be available from the bus power supply. The HVAC controller receives power from two sources:

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

b. 24 vdc, 125 amp, power from a fuse in the battery compartment supplies power which controls relays, clutch and unloader solenoids in the compressor, evaporator and condenser assemblies; this power is controlled by the HVAC controller.

2.1.2 Starting

a. If the engine is not running, start the engine. After the engine is started place the A/C switch located on the dash in the on position. All system controls will operate automatically in heating, cooling or ventilating mode, as required.

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

Self-test of the main controller electrical circuit is automatically initiated when the system is first powered up. If there is an error in the circuit, *ER*"x" will be indicated by flashing the error code on both the status and code LED's simultaneously. If a diagnostic module is connected to the controller, 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 controller 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 diagnostic tool display. If an alarm condition exists, diagnostics can be manually initiated to isolate system fault(s) by simultaneously pressing the up and down keys continuously for five seconds to view more information. Refer to section 3 for definition of system errors and alarms and general troubleshooting procedures.

2.1.4 Stopping

With the system operating, switching the AC switch to the off position will stop the HVAC system operation by removing power to the logic module.

2.2 PRE-TRIP INSPECTION

After starting system operation, 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 4.12.2.)

c. Check refrigerant level. (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 2.1.7.)

2.3 SYSTEM OPERATION

2.3.1 Temperature Control

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

2.3.1.1 Capacity Control

The controller automatically compares system temperatures with the controller setpoints and changes system operating modes at certain temperature deviations. Figure 2-1 shows various changes in operating modes and controller actions at various temperature deviations from controller setpoint. Upon rising temperature, mode changes occur when temperatures are above those given in Figure 2-1 above controller setpoints, On a falling temperature, mode changes occur when temperatures are below those given in Figure 2-1. The system will operate in these modes unless pressures override the controller settings.

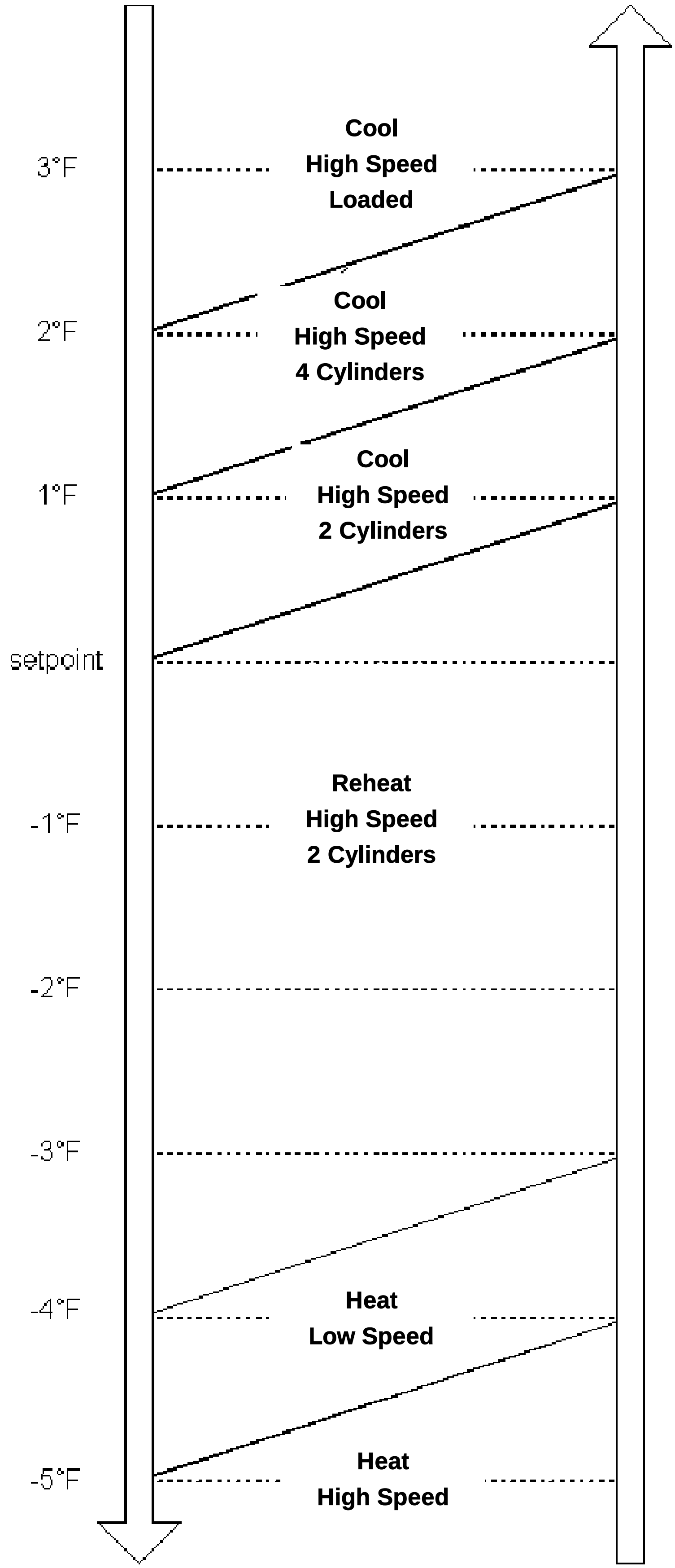


Figure 2-1. Auto Reheat Mode

2.3.1.2 Cooling/Reheat

Cooling and reheat require various combinations of compressor unloading. Cooling is accomplished by energizing the compressor and condenser fans, opening the liquid solenoid valve and closing the heating valve. Reheat opens the heat valve while cooling. This allows for reduced capacity around setpoint and de-humidification.

2.3.1.3 Heating

During heating, the liquid solenoid is closed to stop cooling and the compressor and condenser fans will shut down. The fan speed will vary based on the temperature difference from setpoint. Heating will not start until the engine coolant switch (ECS) closes. The ECS is located on the block of the vehicle and is provided by the OEM. It senses the engine coolant temperature. The switch closes at 105°F on temperature rise. The switch prevents the circulation of cooler air throughout the vehicle during initial start-up.

2.3.2 Boost Pump

When the unit is in heat the boost pump relay is energized. This signal is read by the bus multiplex system to activate the boost pump.

2.3.3 Compressor Unloader Control

The unloader outputs control the capacity of the compressor by energizing or de-energizing unloader solenoid valves. Energizing a valve solenoid de-activates a pair of compressor cylinders. The Model 05G compressor has six cylinders. Four cylinders are equipped with two sets of unloader valves (UV1 and UV2), each controlling two cylinders; this allows the compressor to be operated with two, four or six cylinders. When the compressor is off, the unloaders are de-energized immediately.

Whenever the compressor is changed from off to on, the unloaders are forced energized for fifteen seconds. After fifteen seconds, one unloader may be de-energized, if required. Any subsequent changes between energizing and de-energizing the unloaders must be staged with a two second delay. Only one unloader may change state at a time when staging is required.

a. Suction Pressure

In addition to temperature control, the electric unloaders will be used to prevent coil frosting:

1. <u>Compressor Unloader UV1 Relay.</u> When the suction pressure decreases below 26 psig, the first unloader is energized unloading the first compressor cylinder bank (two cylinders); this output will remain energized until the pressure increases to above 34 psig.
2. <u>Compressor Unloader UV2 Relay.</u> When the suction pressure decreases below 23 psig, the second unloader is energized unloading the second compressor cylinder bank (two cylinders); this output will remain energized until the pressure increases to above 31 psig.

b. Discharge Pressure

Head Pressure is also controlled by the unloaders:

1. <u>Compressor Unloader UV1 Relay.</u> When the discharge pressure increases above 275 psig, the first compressor unloader is energized; this output will remain energized until the pressure decreases below 220 psig. Staging is ignored for energizing the unloader due to discharge pressure overrides.
2. <u>Compressor Unloader UV2 Relay.</u> When the discharge pressure increases above 285 psig, the second unloader is energized; this output will remain energized until the pressure decreases below 225 psig.

2.3.4 Evaporator Fan Speed Selection

Each air conditioning unit is equipped with six two speed fan motors. Temperature control is the primary method of determining the fan speed selection. The following table indicates relay operational status for the various fan motor states.

Table 2-1. Main Evaporator Fan Speed Relay Operation

STATE	HIGH SPEED RELAY	EVAP FAN RELAYS
Off	Off	Off
Low	Off	On
High	On	On

The evaporator fans will start in low speed and run in high speed for cool and reheat modes. During heat mode the fans will run in either high or low speed (see figure 2-1).

Exceptions to the above are as follows:

a. In the event that the coolant temperature switch is open, the evaporator fans are kept off during heating.

2.3.5 Condenser Fan Speed Control

The condenser fans are energized when the compressor clutch output is energized. The fans will also be activated if a high pressure alarm has been activated and operation has not been locked out (refer to table 3-3).

2.3.6 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. The clutch will be disengaged when the system is off, when in heating or during high and low pressure conditions.

The clutch coil is prevented from engagement when the ambient temperature is below 45_F *(7.2_C)*.

The clutch coil will be de-energized if the discharge pressure rises to 300 psig, the setting of the compressor mounted high pressure switch. The clutch coil will energize when the discharge pressure falls to 200 psig.

The clutch coil will be de-energized if the suction pressure decreases below 10 psig.

2.3.7 Alarm Description

Alarm descriptions and troubleshooting procedures are provided in section 3.

2.3.8 Hour Meters

An hour meter records the compressor run time hours. The maximum hours is 999,999.
(Refer to table 3-2)

An hour meter records the total time the evaporators are on in hours. The maximum hours is 999,999. (Refer to table 3-2)

2.4 MICROPROCESSOR DIAGNOSTIC SERVICE TOOL (MDST)

The MDST is a diagnostic service tool that allows the user to interface with the microprocessor based control. This allows system parameters, alarms and settings to be viewed and modified.

2.4.1 Connecting

Connect the MDST harness to the service port located in the return air section of the A/C system. When the MDST is connected, the panel lights will be energized and the currently stored setpoint will be displayed. If any alarm is active, the reading will be *Axx,* where *A* indicates that the alarm is active and *xx* indicates the alarm number.

2.4.2 Control

NOTE

This procedure should be performed by an HVAC educated technician who knows the Carrier Capri 280 system design. Control configuration is preset in by the manufacturer and resetting of the parameters should not be required. It is recommended that Carrier Service or Engineering is contacted before any control configuration is changed. Carrier can not be responsible for changes made by the customer which cause system failure if there has not been an opportunity to approve the changes.

a. Turn the A/C main switch located in the driver's area to OFF.

b. Connect the MDST to the service port located in the return air section.

c. Unplug the logic board connector J3.

d. Turn the A/C main switch located in the driver's area back to the ON position.

e. Activate the system by pressing the 1/0 key on the MDST panel.

NOTE

Be sure to reconnect J3 when testing is completed or the system will fail to operate when the MDST is disconnected.

2.4.3 Setpoint Change

Setpoint may be changed by pressing up or down arrow keys. The up key will increase the setpoint temperature and the down key will decrease the setpoint temperature.

NOTE

When modifying the setpoint temperature for diagnostic purposes, be sure to reset the setpoint when testing is complete.

2.4.4 Mode Keys

The mode keys allow the operation to be selected as auto, cool, heat, or vent. The default operation is auto as shown in Figure 2-1.

2.4.4.1 Cool

The compressor is always operational in cool mode unless overridden by safety device. Air conditioning will run until setpoint is reached at which time the heat valve will open and reheat is performed.

2.4.4.2 Heat

The compressor will not operate in heat mode. The heat valve is opened until 1_F below setpoint at which time the heat valve closes and the evaporator fans run in ventilation.

2.4.4.3 Vent

In vent mode, only the evaporator fans operate.

2.4.5 Fan Key

The fan key allows the evaporator fan speed to be overridden to high or low. The evaporator fan speed will be reset to auto when auto mode key is pressed.

2.4.6 Temperature Key

The temperature key allows the actual return air ambient temperatures to be displayed.

2.4.7 Diagnostic Mode

Diagnostic mode can be entered by pressing the up and down arrow keys simultaneously for 5 seconds. Diagnostic mode allows alarms and system parameters to be viewed. If there are any alarms stored, the most recent alarm will be shown. To view additional alarm information, refer to section 3. Press the up and down arrow keys to view parameters.

2.4.8 SYSTEM PARAMETERS

Pressing the up/down arrow keys will allow the user to scroll up or down through the parameters. If no key is pressed for 30 seconds this mode is exited and the display will revert back to setpoint. Pressing the on/off key any time will exit this mode and the display will again indicate the setpoint setting. The parameters are shown in Table 2-2. When scrolling through the parameters, the current parameter 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 next parameter will wrap back to one.

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	This value is the coil temperature measured by the evaporator temperature sensor. If the sensor is shorted it will display *CL.* If it is open circuited it will display *OP.*
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)	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.* If the auto key is pressed and held for five seconds the suction pressure will be calibrated to zero and the offset will be stored in no-volatile memory. This calibration will be locked out if the offset is greater than 20 or less than 6.7 or if the clutch output is energized.
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”. If the auto key is pressed and held for five seconds the suction pressure will be calibrated to zero and the offset will be stored in non-volatile memory. This calibration will be locked out if the offset is greater than 20 or less than 6.7 or if the clutch output is energized.
P7	Superheat (not used)	Not used.
P8	Analog Setpoint Temperature (not used)	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 heat valve 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.

Table 2-2. Parameter Codes – Continued

Code	Code Name	Description
P15	Unloader/Heat Valve Delay	This is the minimum time (in seconds) that the unloaders and heat 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 Head Pressure Switch	This is the current state of the compressor head 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)	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.
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 module.
P31	Display Software Version	This is the software version of the display module.
P32	Ki	Not used.
P33	Kp	Not used.

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

Self tests are executed on power up during operation. Errors, if any, will be indicated by the display and the unit will not be allowed to operate. The display will indicate errors with the code ER-X (X is the error number). The error codes can also be read by counting the number of times that the status and alarm LED's flash simultaneously.

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

a. Alarm codes

Alarms will be displayed by "AXX", or "IXX" where "A" indicates that the alarm is active and "I" indicates that the alarm is inactive. If the auto key is pressed the display will scroll through the three digit hour meter readings. 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 "– – –". If the auto key is held down for five seconds while "– – –" is displayed all inactive alarms are cleared.

b. Activation

When an alarm becomes active they will be placed in an alarm queue in the order at which they initiate unless the alarm is already present. Each alarm recorded will also have an evaporator hour meter reading corresponding to the activation time. When an alarm becomes inactive a status indicator in the alarm queue will change to indicate that the alarm is inactive. If any alarms are active the fault output will be energized.

c. Alarm queue

The alarm queue consist of 10 alarm locations. When the alarm queue is full an alarm will be generated but not stored to indicated this. When alarms are viewed this will be the first alarm to be shown.

d. Alarm clear

The user may clear inactive alarms through the MDST keypad or computer communications.

Table 3-2. Alarm Codes				
ALARM NO.	**TITLE**	**CAUSE**	**REMEDY**	**CONTROLLER RESPONSE**
11	Coil Freeze	Coil temperature is less than 32°F and the compressor is operating.	Check causes of coil freezing. (Refer to section 3.5.6)	An alarm will be generated and the system will shutdown. The evaporator fans will remain running while the compressor is off.
12	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.
13	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.
14	Return Air Probe Failure	Return air temperature sensor failure or wiring defective.	Ensure all connectors are plugged in. Check sensor resistance or wiring. Replace sensor or repair wiring.	All outputs except the evaporator fans will be de-energized.
15	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.
16	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.
17	Low Pressure Shutdown	Low suction pressure switch open or wiring defective.	Check cause of low suction pressure. (Refer to section 3.5.3)	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 and the system is locked out until the power is cycled or the alarm is reset through the keypad.
21	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 3.5.3)	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 and the system is locked out until the power is cycled or the alarm is reset through the keypad.
22	Breaker Trip Alarm	A breaker on the relay board has tripped or a fan relay has failed.	Check breakers for tripped device. Repair short and reset breaker.	Alarm will be generated.
23	Evaporator Fan Overload	Evaporator fan overload jumper is open.	Ensure connector is plugged in or repair wiring.	Alarm will be generated.
24	Condenser Fan Overload	Condenser fan overload jumper is open.	Ensure connector is plugged in or repair wiring.	Alarm will be generated.

Table 3-2. Alarm Codes (Continued)				
ALARM NO	TITLE	CAUSE	REMEDY	CONTROLLER RESPONSE
25	Motor Failure	A motor has not reached full operating speed or the condenser motors have shut down due to a pressure alarm or the motor fuse has blown.	Replace motor, or correct pressure shutdown.	Alarm displayed and the motor fail output is energized.
26	Not used			
31	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.
32	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.
99	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**
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 Note
Electrical malfunction	Coach power source defective Circuit Breaker/safety device open	Check/Repair Check/Reset
SYSTEM RUNS BUT HAS INSUFFICIENT COOLING		
Compressor	V-Belt loose or defective Compressor valves defective	Check See Note.
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	see below 3.5.6 p. 3-5 and 4.11 p. 3-5 and 4.11 4.5 and 4.7 Open 1.6 Check
Restricted air flow	No evaporator air flow or restriction	p. 3-5
Heating system	Heat valve stuck open	p. 3-5
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. 4.5 & 4.7
High suction pressure	Compressor valve(s) worn or broken	See Note.
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 4.5 and 4.7 p. 3-5 p. 3-5 Replace
Suction and discharge pressures tend to equalize when system is operating	Compressor valve defective	See Note.
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 Note. See Note. p. 3-5 4.12.2 Check Check/Adjust Clean

Table 3-3. General System Troubleshooting Procedures - Continued		
INDICATION/ TROUBLE	**POSSIBLE CAUSES**	**REFERENCE SECTION**
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
CONTROL SYSTEM MALFUNCTION		
Will not control	Sensor or transducer defective Relay(s) defective Microprocessor controller malfunction	4.14 or 4.15 Check Check
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
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	4.5 and 4.7 Check 4.6 Replace Replace 4.11
Low superheat and liquid slugging in the compressor	Superheat setting too low Ice or other foreign material holding valve open	4.11 4.6
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
HEATING MALFUNCTION		
Insufficient heating	Dirty or plugged heater core 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	Coolant solenoid valve(s) malfunctioning or plugged Controller malfunction Pump(s) malfunctioning Safety device open	Check/Replace Replace Repair/Replace 1.6
Continuous Heating	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**

4.1 MAINTENANCE SCHEDULE

SYSTEM		OPERATION	REFERENCE SECTION
ON	OFF		
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	None

4.2 SUCTION AND DISCHARGE SERVICE VALVES

The suction and discharge service valves 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. (See Figure 4-1.)

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.

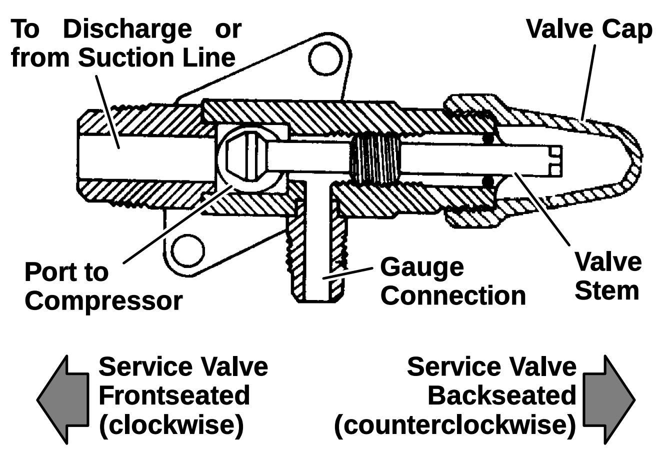
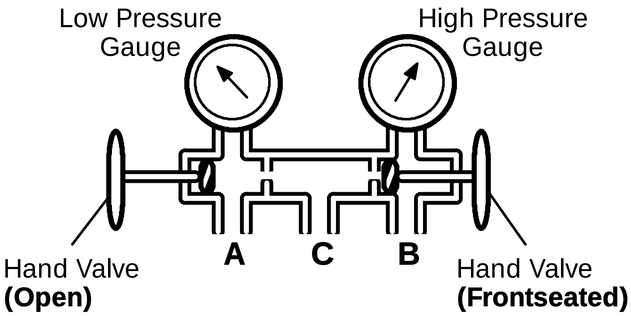


Figure 4-1. Suction or Discharge Service Valve

4.3 INSTALLING MANIFOLD GAUGES

The manifold gauge set can be used to determine system operating pressures, add charge, equalize or evacuate the system. (See figure 4-2.)



A. Connection to Low Side of System

B. Connection to High Side of System

C. Connection to Either:
Vacuum Pump
Refrigerant Cylinder
Oil Container
Evacuation Line

Figure 4-2. Manifold Gauge Set

The manifold gauge in figure 4-2 shows hand valves, gauges and refrigerant openings. When the low pressure hand valve is frontseated (turned all the way in), the low (evaporator) pressure can be checked. When the high pressure hand valve is frontseated, high (condensing) pressure can be checked. When both valves are open (turned counterclockwise), high pressure vapor will flow into the low side. When the low pressure valve is open, the system can be charged or evacuated. Oil can also be added to the system.

Install the manifold gauge set as follows:

a. Remove both service valve stems and service port caps. Backseat (counterclockwise) both service valves.

b. Connect the high side hose *tightly* to discharge service valve port.

c. Connect the low side hose *loosely* to suction service valve port.

d. Loosen charging (center) hose at dummy fitting of manifold set.

e. Frontseat (clockwise) both manifold gauge hand valves.

f. Open discharge service valve counterclockwise approximately 1/4 to 1/2 turns.

g. Slowly open (counterclockwise) manifold discharge hand valve approximately one turn.

h. Tighten charging hose onto dummy fitting.

i. Slowly open the manifold suction hand valve to remove air from line.

j. Tighten suction hose at the suction service valve port.

k. Frontseat (close) both manifold hand valves.

l. Open suction service valve counterclockwise approximately 1/4 to 1/2 turns.

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 and receiver as follows:

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

NOTE

The following procedure may have to be repeated several times to maintain the 1 psig *(6.9 kPa)* pressure depending upon amount of refrigerant absorbed in the oil.

b. Frontseat filter-drier inlet service valve by turning clockwise. Start system and run in cooling. Stop the unit when the suction pressure reaches 1 psig *(6.9 kPa)* to maintain a slight positive pressure.

c. 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 *(6.9 kPa)* pressure and ready for servicing,

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

e. Leak check connections. (Refer to section 4.5.)

f. Evacuate and dehydrate the low side. (Refer to section 4.6.)

4.4.2 Removing the Refrigerant Charge

Connect a refrigerant recovery system to the unit near the receiver to remove refrigerant charge. Refer to instructions provided by the manufacturer of the refrigerant recovery system.

NOTES

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

b. 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 in the system.

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 and evacuation of the high (discharge) side of the system.

a. Ensure the main liquid line and driver solenoid valves are open.

b. If system is without refrigerant, charge system with refrigerant to build up pressure between 30 to 50 psig *(207 to 345 kPa)*.

c. Add sufficient nitrogen to raise system pressure to 150 to 200 psig *(1.03 to 1.4 mPa)*.

d. Check for leaks. The recommended procedure for finding leaks in a system is with a halide torch or electronic leak detector. Testing joints with soapsuds is satisfactory only for locating large leaks.

e. Remove refrigerant using a refrigerant recovery system and repair any leaks.

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

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

h. Ensure that self-test has been performed and that there are no errors or alarms indicated. (Refer to paragraph 2-1.7.)

4.6 EVACUATION AND DEHYDRATION

a. 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.

b. Preparation

NOTE

Using a compound gauge is not recommended because of its inherent inaccuracy.

1. Evacuate and dehydrate only after pressure leak test. (Refer to section 4.5.)

2. Essential tools to properly evacuate and dehydrate any system include a good vacuum pump with a minimum of 5 cfm *(8.5 m^3/hr)* volume displacement, CTD P/N 07-00176-01), and a good vacuum indicator (available through Robinair Manufacturing, Montpelier, Ohio, Part Number 14010).

3. 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.

c. Procedure for Evacuation and Dehydrating System

1. Remove refrigerant using a refrigerant recovery system.

2. The recommended method is connecting three lines (3/8” OD copper tubing or larger) to manifold. Attach one line to the filter-drier outlet valve, compressor suction and discharge service valves. (See Figure 4-3.)

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

4. Open solenoid valves electrically (jumper 24v to coil) to ensure a good vacuum is obtained.

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

6. Evacuate unit until vacuum gauge indicates 1500 microns (29.86 inches = 75.8 cm) Hg vacuum. Close gauge valve, vacuum pump valve, and stop vacuum pump.

7. Break the vacuum with clean dry refrigerant. Use refrigerant that the unit calls for. Raise system pressure to approximately 2 psig *(13.8 kPa)*.

8. Remove refrigerant using a refrigerant recovery system.

9. Start vacuum pump and open all valves. Dehydrate unit to 500 microns (29.90 inches = 75.9 cm) Hg vacuum.

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

11. With a vacuum still in the unit, the refrigerant charge may be drawn into the system from a refrigerant container on weight scales.

4.7 ADDING REFRIGERANT TO SYSTEM

4.7.1 Checking Refrigerant Charge

The following conditions must be met to accurately check the refrigerant charge.

a. Coach engine operating at high idle.

b. Unit operating in cool mode for 15 minutes.

c. Head pressure at least 150 psig *(1.03 mPa)* for R-134a systems. (It may be necessary to block condenser air flow to raise head pressure.)

d. Under the above conditions, the system is properly charged when the refrigerant liquid level is visible in the receiver lower sight glass. If it is not visible, add or remove refrigerant until it is at the proper level.

4.7.2 Adding Full Charge

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

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

c. Note weight of refrigerant and cylinder.

d. Open liquid valve on refrigerant container. Midseat filter-drier inlet valve and allow refrigerant to flow into the unit. Correct charge will be found in section 1.3.

e. When cylinder 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

a. Start the vehicle engine and allow unit to stabilize.

b. Place appropriate refrigerant cylinder on scales and connect charging hose from container vapor valve to compressor suction service valve.

c. Run unit in cool mode for 15 minutes. With suction service valve midseated, remove air from hose at refrigerant cylinder. Open cylinder valve and add vapor charge until refrigerant level appears in the lower receiver sight glass. Under the above conditions, the system will be properly charged when the lower receiver sight glass appears full of refrigerant. Add or remove refrigerant until the proper level is obtained. *Refrigerant level should not appear in the upper sight glass, as this would indicate and overcharge.*

d. Backseat suction service valve. Close vapor valve on refrigerant drum and note weight. 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.

b. Check temperature at the condenser and receiver.

c. Check pressure at the compressor discharge service valve.

d. Check saturation pressure as it corresponds to the condenser/receiver temperature using the Temperature-Pressure Chart, Table 4-4.

e. If gauge reading is 3 psig *(21 kPa)* or more than the calculated P/T pressure in step d, noncondensibles are present.

f. Remove refrigerant using a refrigerant recovery system.

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

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

4.9 CHECKING AND REPLACING HIGH PRESSURE CUTOUT SWITCH

4.9.1 Checking High Pressure Switch

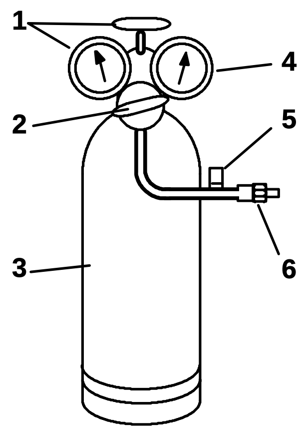
WARNING

DO NOT USE A NITROGEN CYLINDER WITHOUT A PRESSURE REGULATOR. DO NOT USE OXYGEN IN OR NEAR A REFRIGERATION SYSTEM OR 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 no resistance, indicating that the contacts are closed.

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



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 4-3. Checking High Pressure Switch

d. Set nitrogen pressure regulator higher than cutout point on switch being tested. (See section 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 infinite 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 no resistance on the ohmmeter.

g. Replace switch if it does not function as outlined above. (Refer to section 4.9.2.)

4.9.2 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. Disconnect wiring from defective switch.

c. Install new cutout switch.

d. Check switch operation. (Refer to section 4.9.1.)

4.10 FILTER-DRIER

a. 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.

b. To Replace Filter Drier

1. Pump down the unit. (Refer to section 4.4.)
2. Replace filter-drier, ensuring that the arrow points in the direction of the refrigerant flow.
3. Drier can be evacuated at liquid service valve. (See Figure 4-3.)
4. Check refrigerant level. (Refer to section 4.7.1.)

4.11 THERMOSTATIC EXPANSION VALVE

The thermostat 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 entering the compressor. Unless the valve is defective, it seldom requires any maintenance.

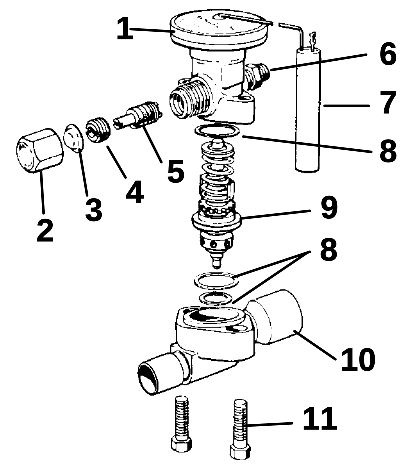
a. Replacing the Expansion Valve (See Figure 4-5.)

1. Pump down low side of the unit. (Refer to section 4.4.)
2. Remove insulation (Presstite) from expansion valve bulb.
3. Loosen retaining straps holding bulb to suction line and detach bulb from the suction line.
4. Loosen flare nuts on equalizer line and disconnect equalizer line from the expansion valve.
5. Remove capscrews and lift off power head and cage assemblies and gaskets.
6. Check, clean and remove any foreign material from the valve body, valve seat and mating surfaces.

NOTE

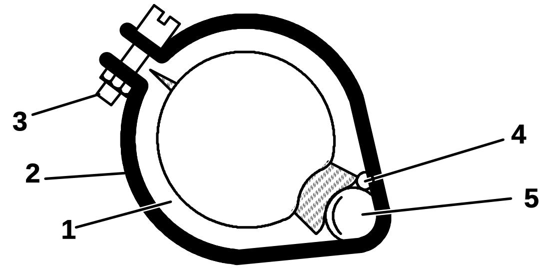
Do not adjust the new replacement expansion valve. Valves are preset at the factory.

7. Using new gaskets, install new cage and power head assemblies provided with repair kit.
8. 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 4-6.)
9. Fasten equalizer line to the expansion valve.
10. Evacuate and dehydrate. (Refer to section 4-6.)
11. Open filter-drier inlet valve (liquid line service valve) and all service valves.
12. Run the coach for approximately 30 minutes on fast idle.
13. Check refrigerant level. (Refer to section 4.7.1.)
14. Check superheat. (Refer to section 4.11.b.)



1. Power Head Assembly
2. Cap Seal
3. Flare Seal
4. Retaining Nut
5. Adjusting Stem
6. Equalizer Connection
7. Bulb
8 Gasket
9. Cage Assembly
10. Body Flange
11. Capscrew

Figure 4-4. Thermostatic Expansion Valve



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

Figure 4-5. Thermostatic Expansion Valve Bulb and Thermocouple

Monitor the superheat over a five minute period and record the maximum and minimum readings. Add the maximum and minimum readings and divide by two to determine the superheat. The superheat should be 10°F to 12°F.

b. To Check/Measure Superheat

NOTE

All readings must be taken from the suction side area of the evaporator near the TXV and out of the direct air stream.

1. Remove filter access door.
2. Remove Presstite insulation from expansion valve bulb and suction line.

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

4. 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 4-5). Reinstall insulation around the bulb.

5. Reinstall evaporator access door being careful to route thermocouple sensing wire outside the evaporator.

6. Connect an accurate low pressure gauge to the 1/4" port on the suction service valve or install a manifold gauge set. (Refer to section 4.3.)

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

NOTE

When conducting this test, the suction pressure must be at least 6 psig *(41 kPa)* below the expansion valve maximum operating pressure (MOP). Refer to section 1.3 for MOP.

8. From the temperature/pressure chart, determine the saturation temperature corresponding to the evaporator outlet pressure. (See Table 4-4.) Add an estimated suction line loss of 2 psig *(13.8 kPa)* to the number taken at the compressor.

9. 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.

10. Monitor the superheat over a five minute period and record the maximum and minimum readings. Add the maximum and minimum readings and divide by 2 to determine superheat. The superheat should be 10°F to 12°F.

c. To Adjust Superheat

NOTE

It is not recommended to adjust thermal expansion valves unless absolutely necessary. The procedure is very time consuming. Therefore, it is highly recommended that the expansion valve be replaced rather than adjusting.

If adjustment is necessary, perform the following procedure:

1. Pump down the load side of the system. (Refer to section 4.4.)

2. Remove capscrews and note relative position of cage assembly. (See Figure 4.5.) Lift out power head and cage assemblies while maintaining position of the cage assembly. Turn/rotate cage assembly counterclockwise to decrease superheat setting or clockwise to increase superheat setting. Each full turn will change superheat setting by 1_F *(0.56_C)*.

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

4. Reinstall power head and cage assemblies using new gaskets.

5. Tighten capscrews.

6. Evacuate and dehydrate. (Refer to section 4-6.)

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

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

9. Check refrigerant level. (Refer to section 4.7.1.)

10. Check superheat setting. (Refer to section 4.11.b.)

4.12 Model 05G COMPRESSOR MAINTENANCE

4.12.1 Removing the Compressor

If compressor is inoperative and the unit still has refrigerant pressure, frontseat suction and discharge service valves to trap most of the refrigerant in the system.

If compressor is operative, pump down the system. (Refer to section 4.4.)

a. Turn main battery disconnect switch to OFF position.

b. Slowly release compressor pressure.

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

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

e. Remove four bolts holding compressor to base

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

g. Remove the three socket head capscrews from both cylinder heads that have unloader valves installed on the 05G compressor. Remove the unloader valve and bypass piston assembly, keeping the same capscrews with the assembly. 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.

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. 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 section 1.3 and 4.12.2.)

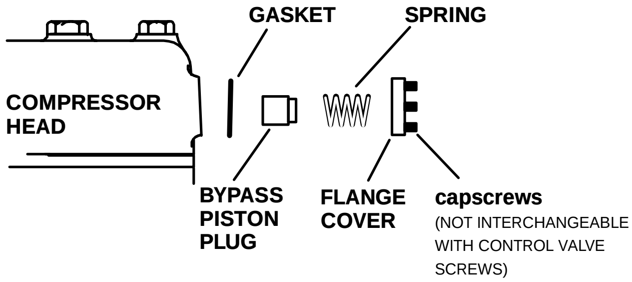


Figure 4-6. Removing Bypass Piston Plug

h. Remove the high pressure switch assembly and install on replacement compressor after checking switch operation.

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

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

k. Attach two lines (with hand valves near vacuum pump) to the suction and discharge service valves. (Dehydrate and evacuate compressor to 500 microns (29.90" Hg vacuum = 75.9 cm Hg vacuum). Turn off valves on both lines to pump.

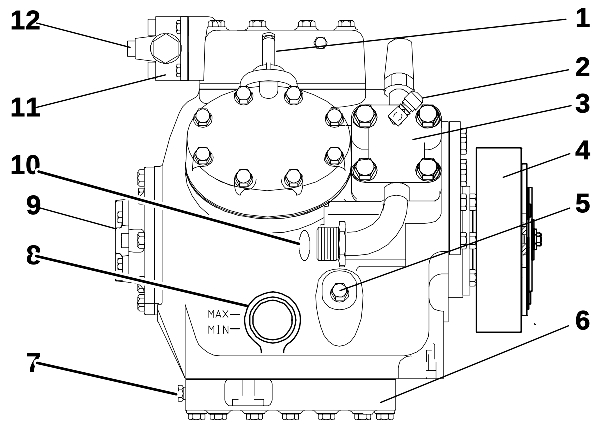
l. Fully backseat (open counterclockwise) both suction and discharge service valves.

m. Remove vacuum pump lines and install manifold gauges.

n. Start unit and check refrigerant level.

o. Check compressor oil level. (Refer to section 4.12.2.) Add or remove oil if necessary.

p. Check compressor unloader operation.



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 4-7. Model O5G Compressor

4.12.2 Compressor Oil Level

4.12.2.1 Checking the 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 the oil is present after 20 minutes of operation. If the oil is foaming excessively after 20 minutes of operation, check the refrigerant system for flood-back of liquid refrigerant. Correct this situation before proceeding. (Refer to section 3.3.4.)

c. Check the level of the oil in the oil level sight glass immediately after shutting down the compressor. The lowest level visible should be between the "Min" and "Max" indicators on the compressor crankcase adjacent to the sight glass. (See Figure 4-8.)

4.12.2.2 Adding Oil with Compressor in System

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

a. Oil Pump Method

1. 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 mliters)* per stroke when connected to the suction service valve port. Also, there is no need to remove pump from can after each use.

2. 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.

3. 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.

b. Closed System Method

1. In an emergency where an oil pump is not available, oil may be drawn into the compressor through the suction service valve.

CAUTION

EXTREME 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

2. Connect the suction connection of the gauge manifold to the compressor suction service valve port, and immerse the common connection of the gauge manifold in an open container of refrigeration oil. Refer to section 1.3.b. for oil specifications. Remove air from the lines. Close the gauge manifold valve.

3. Remove air from the lines.

4. With the unit running, frontseat (counterclockwise) the suction service valve and pull a vacuum in the compressor crankcase. *Slowly* crack the suction gauge manifold valve and oil will flow through the suction service valve into the compressor. Add oil as necessary.

4.12.2.3 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 suction service valve flange cavity or by removing the oil fill plug. (See Figure 4-8.)

4.12.2.4 Removing Oil from the Compressor:

a. If the lowest oil level observed in paragraph 4.12.2.1, step c., is above "Max" indication on compressor crankcase, oil must be removed from the compressor by performing the following procedure. If lowest oil level visible is below "Min" indication, oil must be added to the compressor by following the procedure in section 4.12.2.2.

b. Close suction service valve (frontseat) 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.

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 4-1.

b. Due to variations and inaccuracies in ohmmeters, thermometers or other test equipment, a reading within two percent of the chart value would be considered good. If a sensor is bad, the resistance value would usually be much higher or lower than the value given in the Table 4-1.

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

Table 4-1. 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

4.14 SUCTION AND DISCHARGE PRESSURE TRANSDUCER CHECKOUT

NOTE

System must be operating to check transducers.

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 measure voltage across the transducer and compare to values in Table 4-2. A reading within two percent of the values in the table would be considered good.

Table 4-2. 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	2.406
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 section 4.13, 4.14 or 4.15, as applicable.)

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

4.16 Controller Configuration

When a controller is replaced it must be configured to work in the model of unit it is being installed in. Table 4-3 shows the configuration jumper settings that must be set to correctly operate the Capri-280 SEPTA unit.

Table 4-3. Controller Configuration		
Configuration	**Description**	**Jumper**
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.	REMOVED
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.	REMOVED
C.	NA	IN
D.	Reheat/Cycle – When the reheat cycle configuration is removed the unit is in reheat mode. The default configuration is cycle clutch mode.	REMOVED
E.	Transducers – When the transducer configuration is removed transducers will assumed to be present.	REMOVED
F.	NA	IN
G.	Unit Type – SEPTA unit enabled with G in and H removed	IN
H.	Unit Type – SEPTA unit enabled with G in and H removed	REMOVED
I.	NA	NA
J.	NA	IN
K.	Voltage – When this configuration is removed the voltage selection will be changed from 12 to 24V DC.	REMOVED
L.	NA	REMOVED
M.	NA	IN
N.	°C/°F – When this configuration is removed the display will show temperatures in °F. When not removed the display will show temperature in °C.	REMOVED
O.	NA	IN
P.	NA	IN

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

BOLD NO. = Inches Mercury Vacuum *(cm Hg Vac)*

Temperature		Pressure				Temperature		Pressure			
_F	_C	Psig	kPa	Kg/cm@	Bar	_F	_C	Psig	kPa	Kg/cm@	Bar
−40	−40	**14.6**	**49.4**	**37.08**	**0.49**	30	−1	26.1	180.0	1.84	1.80
−35	−37	**12.3**	**41.6**	**31.25**	**0.42**	32	0	27.8	191.7	1.95	1.92
−30	−34	**9.7**	**32.8**	**24.64**	**0.33**	34	1	29.6	204.1	2.08	2.04
−25	−32	**6.7**	**22.7**	**17.00**	**0.23**	36	2	31.3	215.8	2.20	2.16
−20	−29	**3.5**	**11.9**	**8.89**	**0.12**	38	3	33.2	228.9	2.33	2.29
−18	−28	**2.1**	**7.1**	**5.33**	**0.07**	40	4	35.1	242.0	2.47	2.42
−16	−27	**0.6**	**2.0**	**1.52**	**0.02**	45	7	40.1	276.5	2.82	2.76
−14	−26	0.4	1.1	0.03	0.03	50	10	45.5	313.7	3.20	3.14
−12	−24	1.2	8.3	0.08	0.08	55	13	51.2	353.0	3.60	3.53
−10	−23	2.0	13.8	0.14	0.14	60	16	57.4	395.8	4.04	3.96
−8	−22	2.9	20.0	0.20	0.20	65	18	64.1	441.0	4.51	4.42
−6	−21	3.7	25.5	0.26	0.26	70	21	71.1	490.2	5.00	4.90
−4	−20	4.6	31.7	0.32	0.32	75	24	78.7	542.6	5.53	5.43
−2	−19	5.6	36.6	0.39	0.39	80	27	86.7	597.8	6.10	5.98
0	−18	6.5	44.8	0.46	0.45	85	29	95.3	657.1	6.70	6.57
2	−17	7.6	52.4	0.53	0.52	90	32	104.3	719.1	7.33	7.19
4	−16	8.6	59.3	0.60	0.59	95	35	114.0	786.0	8.01	7.86
6	−14	9.7	66.9	0.68	0.67	100	38	124.2	856.4	8.73	8.56
8	−13	10.8	74.5	0.76	0.74	105	41	135.0	930.8	9.49	9.31
10	−12	12.0	82.7	0.84	0.83	110	43	146.4	1009	10.29	10.09
12	−11	13.2	91.0	0.93	0.91	115	46	158.4	1092	11.14	10.92
14	−10	14.5	100.0	1.02	1.00	120	49	171.2	1180	12.04	11.80
16	−9	15.8	108.9	1.11	1.09	125	52	184.6	1273	12.98	12.73
18	−8	17.1	117.9	1.20	1.18	130	54	198.7	1370	13.97	13.70
20	−7	18.5	127.6	1.30	1.28	135	57	213.6	1473	15.02	14.73
22	−6	19.9	137.2	1.40	1.37	140	60	229.2	1580	16.11	15.80
24	−4	21.4	147.6	1.50	1.48	145	63	245.6	1693	17.27	16.93
26	−3	22.9	157.9	1.61	1.58	150	66	262.9	1813	18.48	18.13
28	−2	24.5	168.9	1.72	1.69	155	68	281.1	1938	19.76	19.37

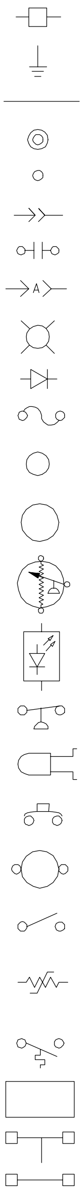
SECTION 5

ELECTRICAL

Figure 5-1 INTRODUCTION

This section includes electrical wiring schematics. The schematic shown in this section is for R-134a refrigerant systems.

SYMBOLS



- INDICATES CONNECTOR TERMINAL
- INDICATES GROUND
- INDICATES A WIRE
- INDICATES GROUND STUD CONNECTION
- INDICATES POWER STUD
- INDICATES A CONNECTOR
- INDICATES A NORMALLY OPEN CONTACT
- INDICATES A CONNECTOR
- INDICATES LAMP
- INDICATES DOIDE
- INDICATES FUSE
- INDICATES A COIL
- INDICATES MOTOR
- INDICATES PRESSURE SENSOR
- INDICATES LED ASSEMBLY
- INDICATES PRESSURE SWITCH NC
- INDICATES TEMPERATURE SENSOR
- INDICATES MANUAL RESET BREAKER
- INDICATES RELAY COIL
- INDICATES SWITCH N/O
- INDICATES POLY SWITCH
- INDICATES TEMPERATURE SWITCH NO
- INDICATES MULTI-PLEX MODULE
- INDICATES RIBBON CABLE

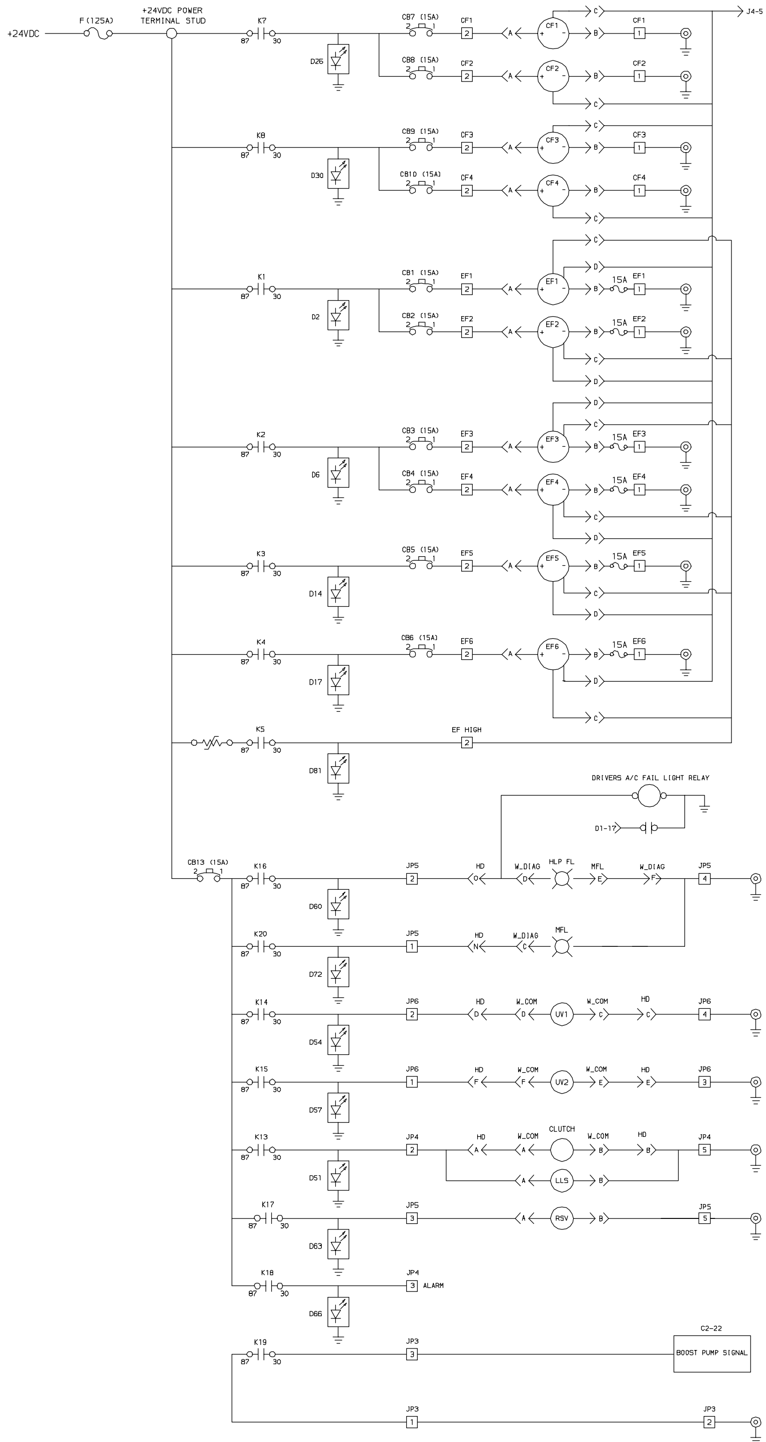
LEGEND

SHEET NO./ZONE	SYMBOL	DESCRIPTION
3/B7	ATS	AMBIENT TEMPERATURE SENSOR
3/D7	C2-6	A/C ON (MULTIPLEX SIGNAL)
2/D1	C2-22	BOOST PUMP SIGNAL (MULTIPLEX SIGNAL)
2/C7	CB1	CIRCUIT BREAKER, EF1
2/C7	CB2	CIRCUIT BREAKER, EF2
2/C6	CB3	CIRCUIT BREAKER, EF3
2/C6	CB4	CIRCUIT BREAKER, EF4
2/C5	CB5	CIRCUIT BREAKER, EF5
2/C5	CB6	CIRCUIT BREAKER, EF6
2/C8	CB7	CIRCUIT BREAKER, CF1
2/C8	CB8	CIRCUIT BREAKER, CF2
2/C7	CB9	CIRCUIT BREAKER, CF3
2/C7	CB10	CIRCUIT BREAKER, CF4
2/B4	CB13	CIRCUIT BREAKER, MISC
2/C8	CF1	COND MOTOR 1
2/C8	CF2	COND MOTOR 2
2/C7	CF3	COND MOTOR 3
2/C7	CF4	COND MOTOR 4
2/D2	CLUTCH	CLUTCH
2/D4	D1-17	A/C FAIL LIGHT (MULTIPLEX SIGNAL)
3/D7	D1-21	ALTERNATOR ON RELAY (MULTIPLEX SIGNAL)
2/C6	D2	EF1/2 LED ASSEMBLY
2/C6	D6	EF3/4 LED ASSEMBLY
2/C5	D14	EF5 LED ASSEMBLY
2/C5	D17	EF6 LED ASSEMBLY
2/C8	D26	CF1/2 LED ASSEMBLY
2/C7	D30	CF3/4 LED ASSEMBLY
2/C2	D51	CLUTCH LED ASSEMBLY
2/C3	D54	UV1 LED ASSEMBLY
2/C2	D57	UV2 LED ASSEMBLY
2/C3	D60	HPLFL LED ASSEMBLY
2/C2	D63	RSV LED ASSEMBLY
2/C2	D66	ALARM LED ASSEMBLY
2/C3	D72	MFL LED ASSEMBLY
2/C4	D81	EF HIGH ASSEMBLY
3/B7	DPT	DISCHERGE PRESSURE TRANSDUCER
2/C7	EF1	EVAP MOTOR FRONT CURB
2/C6	EF2	EVAP MOTOR MIDDLE CURB
2/C6	EF3	EVAP MOTOR BACK CURB
2/C6	EF4	EVAP MOTOR FRONT ROAD
2/C5	EF5	EVAP MOTOR MIDDLE ROAD
2/C5	EF6	EVAP MOTOR BACK ROAD
2/B8	F	FUSE
3/B7	FTS	FREEZE TEMPERATURE SENSOR
2/D4	HLP FL	HIGH/LOW PRESSURE FAIL
2/B7,3/D2	K1	EF1/2 RELAY
2/B6,3/C2	K2	EF3/4 REALY
2/B5,3/C2	K3	EF5 RELAY
2/B5,3/C2	K4	EF6 RELAY
2/B4,3/C2	K5	EF HIGH RELAY
2/B8,3/C2	K7	CF1/2 RELAY
2/B7,3/B2	K8	CF3/4 RELAY
3/B2	K9	UNUSED
3/B2	K10	UNUSED
2/B2,3/C5	K13	CLUTCH RELAY
2/B3,3/C5	K14	UV1 RALAY
2/B3,3/C5	K15	UV2 RELAY
2/B4,3/C5	K16	PRES. FAIL RELAY
2/B2,3/C5	K17	HEAT RELAY
2/B2,3/C5	K18	FAULT RELAY
2/B1,3/B5	K19	BOOST RELAY
2/B3,3/B5	K20	MOTOR FAIL RELAY
3/B5,3/C1	K21	EVAP. FAN HIGH RELAY
3/B5,3/C1	K22	EVAP. FAN LOW RELAY
3/B5,3/C1	K23	COND. FAN HIGH RELAY
3/B5,3/B1	K24	COND. FAN LOW RELAY
3/C7	LPS	LOW PRESSURE SWITCH
2/D2	LLS	LIQUID LINE SOLENOID
3/D7	MBC-1	MASTER SW #1 (MULTIPLEX SIGNAL)
3/D7	MBC-15	A/C ON SWITCH (MULTIPLEX SIGNAL)
3/C7	RAS	RETURN AIR SENSOR
2/D2	RSV	REHEAT SOLENOID VALVE
3/B7	SPT	SUCTION PRESSURE TRANSDUCER
2/D3	UV1	UNLOADER SOLENOID VALVE #1
2/D3	UV2	UNLOADER SOLENOID VALVE #1

CONNECTOR LEGEND

SHEET NO./ZONE	SYMBOL	DESCRIPTION
2/C2,C3,C4 3/C5,C7	HD	COMPRESSOR INTERFACE CONNECTOR
3/B6,3/D6	J1	LOGIC POWER CONNECTOR
3/D6	J3	ON/TEST CONNECTOR
3/C6	J4	INPUT CONNECTOR
3/D6	J5	RELAY BOARD INTERFACE CONNECTOR
3/B6	J6	SENSOR CONNECTOR
3/D6	J7	DIAGNOSTIC LINK CONNECTOR
3/C3	JP1	MOTOR OVERLOAD CONNECTOR
3/C5	JP2	LOGIC BOARD INTERFACE CONNECTOR
2/C2	JP3	BOOST PUMP CONNECTOR
2/C2	JP4	CLUTCH CONNECTOR
2/C3	JP5	HEAT/FAIL CONNECTOR
2/C3	JP6	UNLOADER CONNECTOR
2/C3	W_COM	COMPRESSOR CONNECTOR
2/C3	W_DIAG	DIAGNOSTIC LIGHT CONNECTOR
3/C5	W_HPS	HIGH PRESSURE SWITCH CONNECTOR
3/C7	W_LPS	LOW PRESSURE SWITCH CONNECTOR

Figure 5-1. Electrical Wiring Schematic Diagram
Drawing No. 62-10112-00 Sheet 1 of 3



POWER CIRCUIT

62-10112-00

Figure 5-1. Electrical Wiring Schematic Diagram
Drawing No. 62-10112-00 Sheet 2 of 3

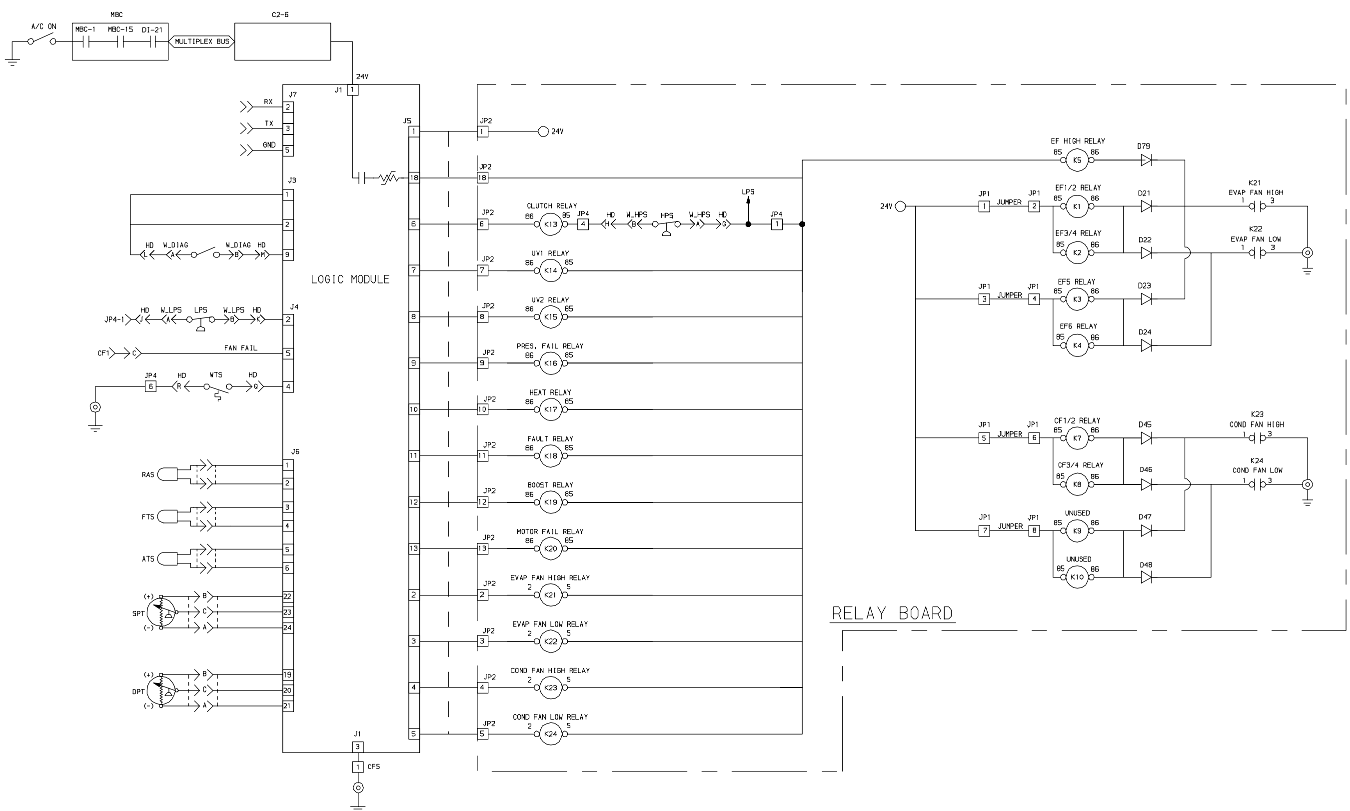


Figure 5-1. Electrical Wiring Schematic Diagram
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