Carrier

TRANSICOLD

Bus Air Conditioning Unit

Rearmount
68RM35-104
68RM35-604
68RM35-704

OPERATION AND SERVICE

T-263

OPERATION AND SERVICE MANUAL

BUS AIR CONDITIONING UNIT

Rearmount
68RM35-104
68RM35-604
68RM35-704

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DESCRIPTION

1.1 INTRODUCTION

This manual contains operating and electrical Data, and service instructions for the 68RM35 bus air conditioning, heating and vent systems shown in table 1-1.

The 68RM35 unit is a one-piece system consisting of a condenser, evaporator and heater coil assemblies. The units are installed in the rear A/C compartment of the bus.

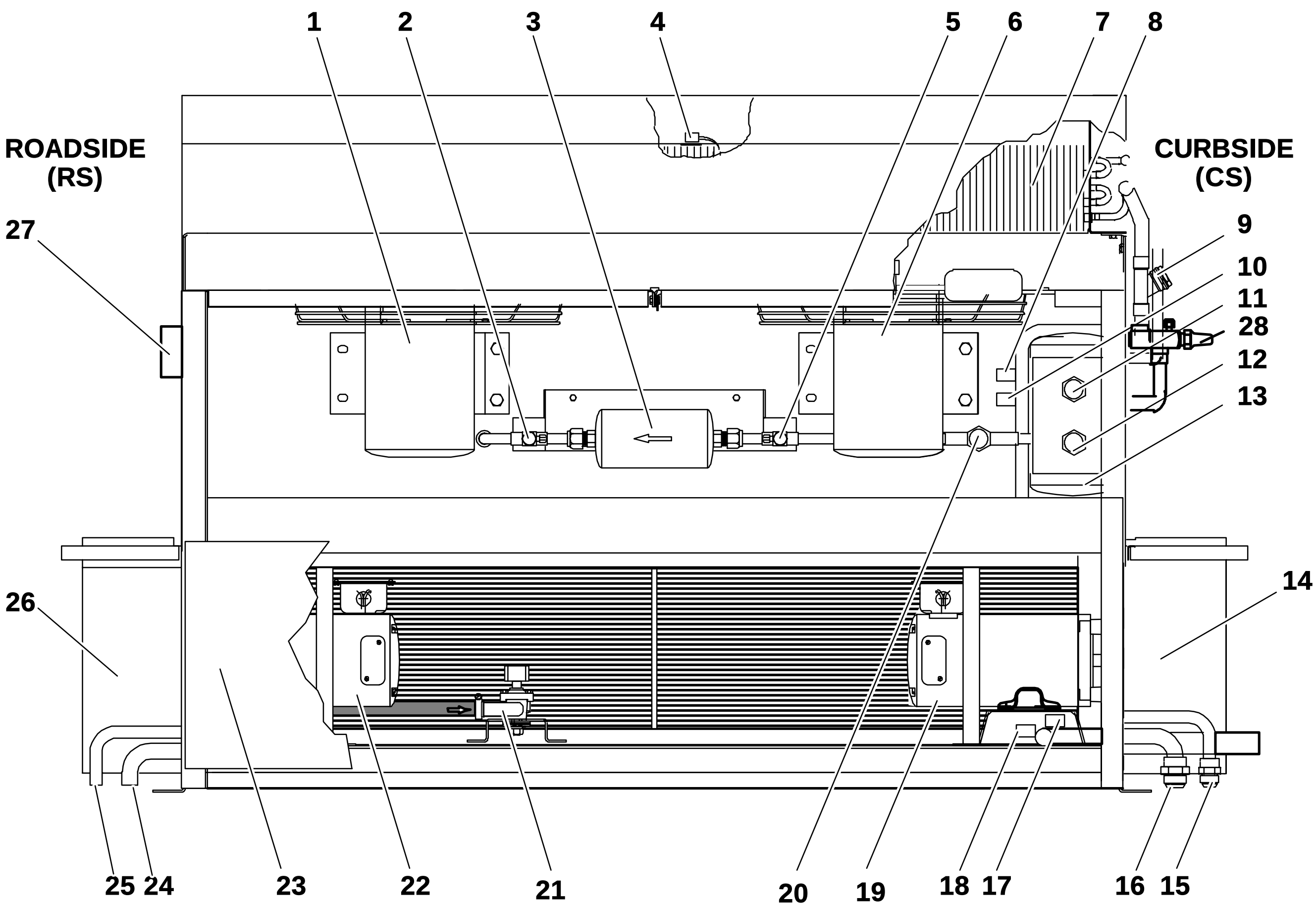
These units interface with the bus's (customer supplied) compressor, driver's switches and pump to provide a full air conditioning, heating and ventilation system.

All control systems are powered by 24 vdc supplied by the bus battery and alternator or alternate source.

Operation of the 68RM35 units is controlled automatically by the temperature controller, which maintains the vehicle's interior temperature at the desired setpoint.

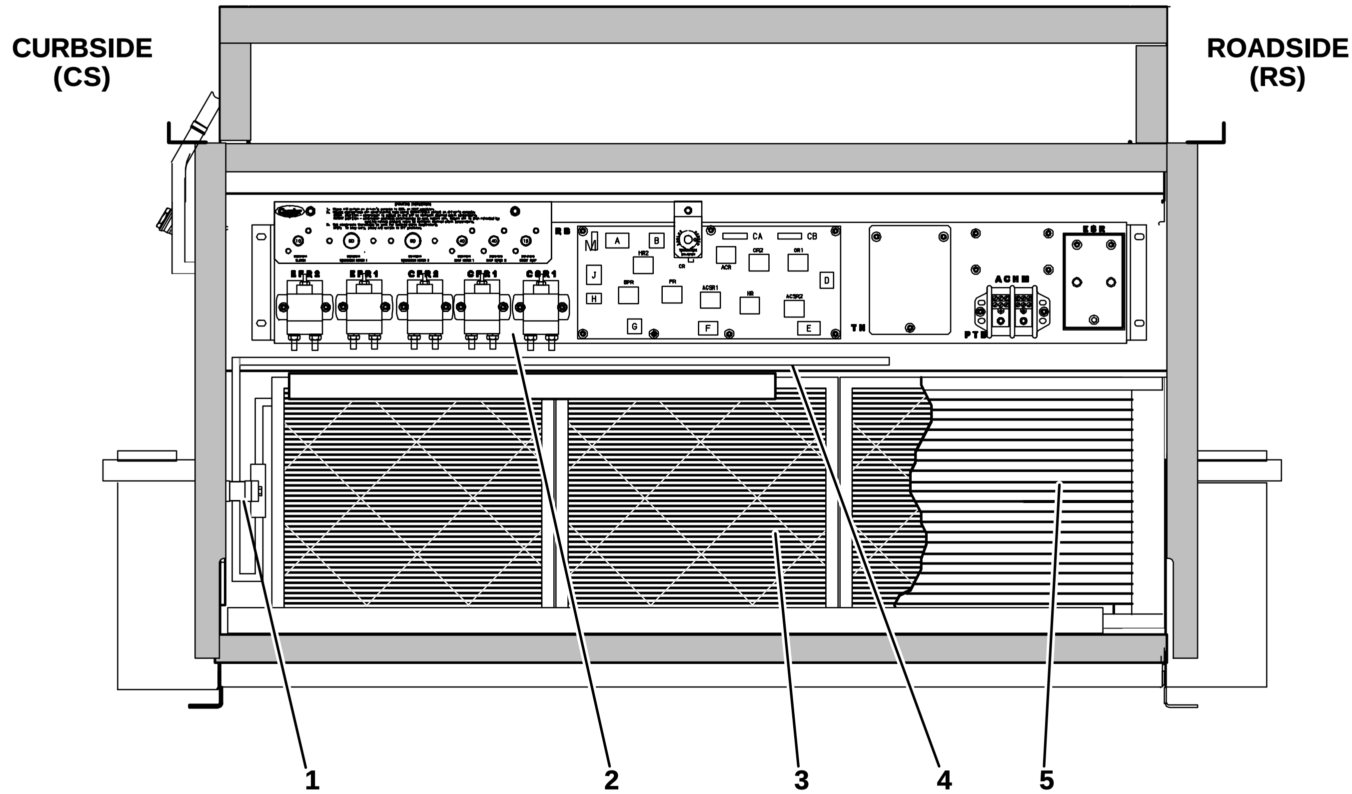
Table 1-1. Model Chart

Model Number	Description	Refrigerant
68RM35-104	Heat/Cool	R-22
68RM35-604	Heat/Cool	R-134a
68RM35-704	Heat Only	N/A



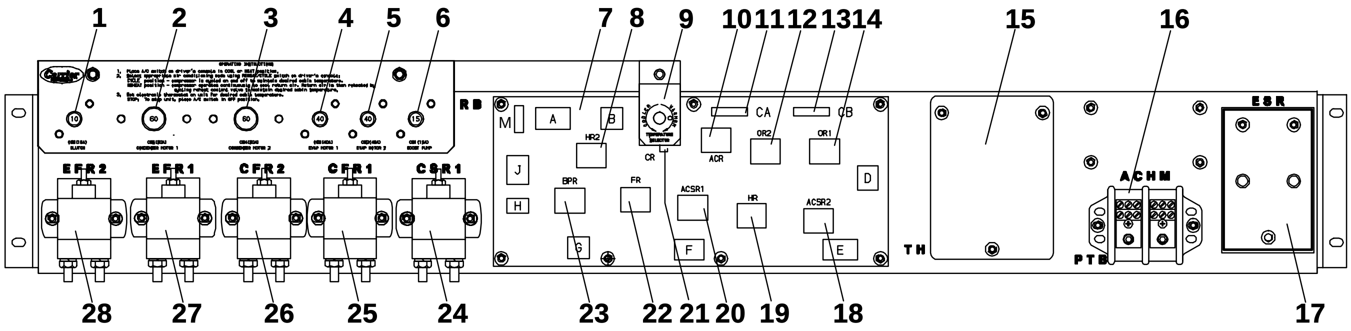
1. Condenser Fan Motor (CM1)
2. Filter-Drier Outlet Valve
3. Filter-Drier
4. Low Ambient Thermostat (LATH)
5. Filter-Drier Inlet Valve
6. Condenser Fan Motor (CM2)
7. Condenser Coil
8. Pressure Unloader Switch (UPS3)
9. Discharge Line Check Valve
10. Condenser Fan (Speed) Switch (CFS)
11. Receiver Sight Glass (Upper)
12. Receiver Sight Glass (Lower)
13. Receiver
14. Evaporator Fan Blower
15. Discharge Line Connection
16. Suction Line Connection
17. Unloader Pressure Switch (UPS1)
18. Unloader Pressure Switch (UPS2)
19. Evaporator Fan Blower Motor (EFM2)
20. Moisture Indicator
21. Reheat Coolant Valve (RCV)
22. Evaporator Fan Blower Motor (EFM1)
23. Access Panel
24. Inlet Hot Water Connection
25. Outlet Hot Water Connection
26. Evaporator Fan Blower
27. Electrical Interface
28. Discharge Line Shut Off Valve

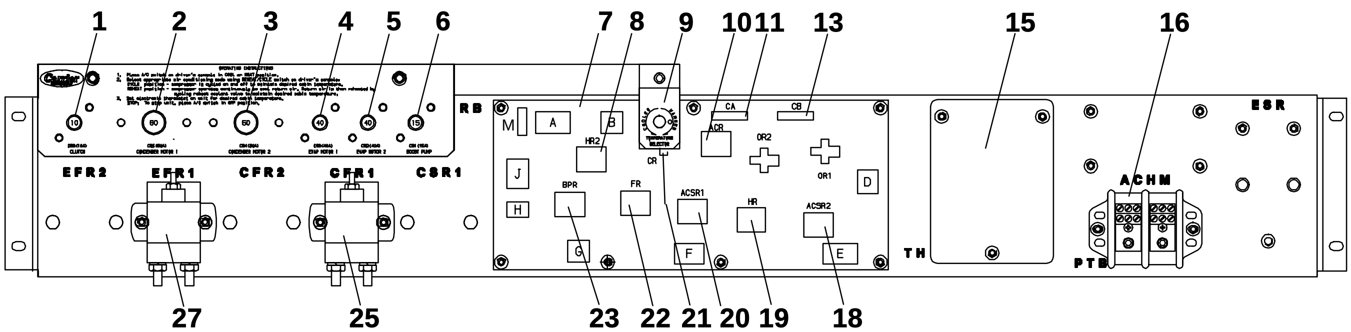
Figure 1-1. Unit Assembly – Back View



1. Thermostatic Expansion Valve (TXV)
2. Electrical Control Panel (See figure 1-3.)
3. Air Filter
4. Liquid Line
5. Evaporator Coil

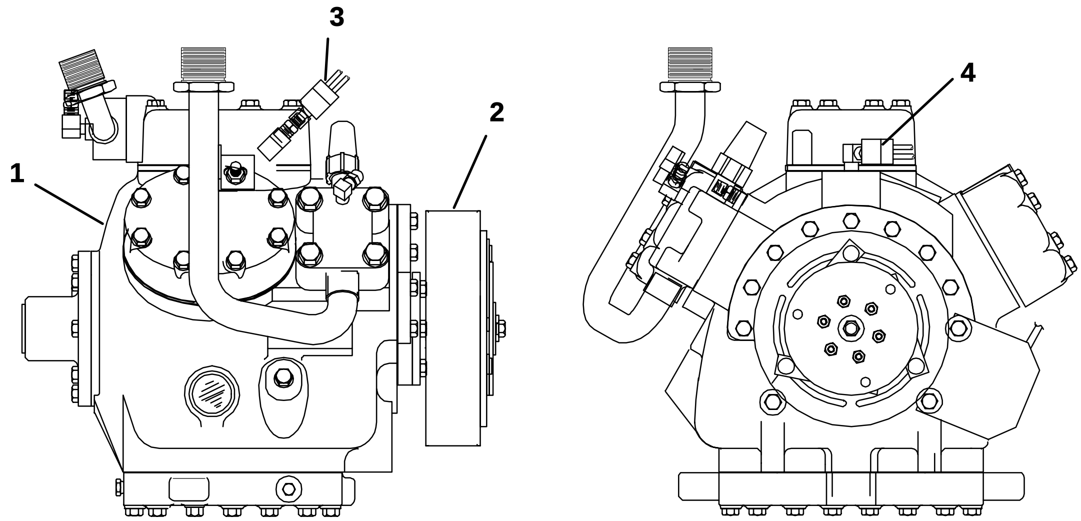
Figure 1-2. Unit Assembly – Inside View





1. Circuit Breaker (CB6)-10 Amp
2. Circuit Breaker (CB5)-60 Amp
3. Circuit Breaker (CB4)-60 Amp
4. Circuit Breaker (CB3)-40 Amp
5. Circuit Breaker (CB2)-40 Amp
6. Circuit Breaker (CB1)-15 Amp
7. Relay Board
8. Heat Relay No. 2 (HR2)
9. Temperature Selector
10. Air Conditioning Relay (ACR)
11. Reheat/External source Receptacle (CA)
12. Evaporator Overload Relay No. 2 (OR2)
13. Cycle Clutch Receptacle (CB)-Not Used
14. Evaporator Overload Relay No. 1 (OR1)
15. Electronic Thermostat
16. Terminal Block
17. Evaporator Speed Relay (ESR)
18. Air Conditioning Stop Relay No. 2 (ACSR2)
19. Heat Relay (HR)
20. Air Conditioning Stop Relay No. 1 (ACSR1)
21. Clutch Relay (CR)
22. Fault Relay (FR)
23. Booster Pump Relay (BPR)
24. Condenser Speed Relay No. 1 (CSR1)
25. Condenser Fan Relay No. 1 (CFR1)
26. Condenser Fan Relay No. 2 (CFR2)
27. Evaporator Fan Relay No. 1 (EFR1)
28. Evaporator Fan Relay No. 2 (EFR2)

Figure 1-3. Electrical Control Panel



1. 05G Compressor
2. Clutch
3. High Pressure Switch
4. Low Pressure Switch

Figure 1-4. 05G Compressor

1.2 REFRIGERATION SYSTEM COMPONENT SPECIFICATIONS

a. Refrigeration Charge

R-22 or R-134a: 16 to 17 lb *(7.3 to 7.7 kg)*.

b. Compressor

Model: 05G
No. of Cylinder: 6
Weight (Dry): 145 lbs. *(66 kg)* including clutch
Oil Level:
Oil Charge: 6.75 pints (3.2 liters)
Oil Level:
Old Crankcase (before S/N 4994J):
Bottom to 1/4 of sight glass
New Crankcase (beginning S/N 4994J):
Between Min – Max marks on crankcase

Approved Compressor Oils – R-22
Calumet Refining Co.:R030
Texaco : SF68
Witco: 4GS Suniso
Approved Compressor Oils – R-134a
Castrol: Icematic SW68C
Mobil: EAL Artic 68
ICI: Emkarate RL68H

c. Thermostatic Expansion Valve

R-22 Units
Superheat Setting: 12 to 14_F *(6.7 to 7.8_C)*
MOP Setting: 95.5 ±7 psig *(6.7 ± 0.49 kg/cm@)*

R-134a Units
Superheat Setting: 10_F *(5.6_C)*
MOP Setting: 53.9 ±4 psig *(3.8 ± 0.28 kg/cm@)*

d. Low Pressure Switch (LPS)

Opens at: 6 ± 3 psig *(0.42 ± 0.21 kg/cm@)*
Closes at: 25 ± 5 psig *(1.8 ± 0.35 kg/cm@)*

e. High Pressure Switch (HPS)
R-22 Units

Opens at: 425 ± 10 psig *(30 ± 0.7 kg/cm@)*
Closes at: 300 ± 10 psig *(21 ± 0.7 kg/cm@)*

R-134a Units
Opens at: 300 ± 10 psig *(21 ± 0.7 kg/cm@)*
Closes at: 200 ± 10 psig *(14 ± 0.7 kg/cm@)*

f. Condenser Fan (Speed) Switch (CFS)
R-22 Units
Opens for high speed: 360 ± 10 psig *(25 ± 0.7 kg/cm@)*
Closes for Low Speed: 285 ± 15 psig *(20 ± 0.7 kg/cm@)*

R-134a Units
Opens for high speed: 250 ± 10 psig *(18 ± 0.7 kg/cm@)*
Closes for Low Speed: 190 ± 15 psig *(13 ± 0.7 kg/cm@)*

g. Condenser Fan Motor
Bearing Lubrication: Factory Lubricated (additional grease not required)
Horsepower: 0.8 hp (0.6 kw)
Full Load Amps (FLA): 18 amps
Operating Speed: Low: 1600 rpm
High: 1800 rpm
Voltage: 24 vdc

h. Low Ambient Switch (LATH)

Opens at: 45 ± 5_F *(7.3_C ± 2.8 _C)*
Closes at: 55 ± 5_F *(12.9 ± 2.8 _C)*

i. Engine Coolant Switch (ECS)
(Customer Supplied)

j. Coolant Valve

(Optional)

k. 05G Compressor Electric Unloaders Pressure Switches UPS1, UPS2 & UPS3
(See Table 1-2 for settings.)

1.3 ELECTRICAL SPECIFICATIONS

a. Evaporator Blower Motor

Bearing Lubrication: Factory Lubricated (additional grease not required)

Horsepower: 0.60 (0.45 kw)
Full Load Amps (FLA): 18 amps
Operating Speed: Low: 900 rpm
High: 1800 rpm
Voltage: 24 vdc

b. Condenser Fan Motor

Bearing Lubrication: Factory Lubricated (additional grease not required)

Horsepower: 0.8 hp (0.6 kw)
Full Load Amps (FLA): 18 amps
Operating Speed: Low: 1600 rpm
High: 1800 rpm
Voltage: 24 vdc

1.4 SAFETY DEVICES

System components are protected from damage caused by unsafe operating conditions with safety devices listed in table 1-3.

If the high pressure switch (HPS) or low pressure switch (LPS) opens due to unsafe operating conditions, the A/C operation will automatically stop. The A/C stop light will illuminate to indicate an unsafe condition. The evaporator blower motors will continue to operate to circulate air throughout the bus.
During any mode of operation, the evaporator or condenser motors will stop if excessive current draw is sensed by circuit breakers. All breakers must be manually reset by depressing the breaker button when opened.

When the high pressure switch (HPS) or low pressure switch (LPS) opens and unit operation stops, place the driver's A/C switch to the OFF position and back to the ON position to reset the A/C stop relay and de-energize the A/C stop light.

Table 1-2. Unloader Pressure Switch Settings

UNLOADER PRESSURE SWITCH-Contacts Open/Close Settings [psig(*kg/cm@*)]						
Refrigerant	UPS1		UPS2		UPS3	
	Load Up (Opens)	Unload (Closes)	Load Up (Opens)	Unload (Closes)	Load Up (Opens)	Unload (Closes)
R-22	66 ±2 *(4.6 ± 0.14)*	54 ±2 *(3.8 ± 0.14)*	61 ±2 *(4.3 ± 0.14)*	51 ±2 *(3.6 ± 0.14)*	400 ±10 *(28 ± 0.7)*	325 ±15 *(23 ± 1)*
R-134a	35 ±2 *(2.5 ± 0.14)*	26 ±2 *(1.8 ± 0.14)*	31 ±2 *(2.2 ± 0.14)*	23 ±2 *(1.6 ± 0.14)*	270±15 *(19 ± 1)*	220 ±15 *(19 ± 1)*

Table 1-3. Safety Devices

UNSAFE CONDITION	SAFETY DEVICE	DEVICE SETTING
Excessive current draw by the booster pump motor.	Circuit Breaker – CB1 Manual Reset	Opens at 15 amps
Excessive current draw by evaporator fan motor no. 1.	Circuit Breaker – CB2 Manual Reset	Opens at 40 amps
Excessive current draw by evaporator fan motor no. 2.	Circuit Breaker – CB3 Manual Reset	Opens at 40 amps
Excessive current draw by condenser fan motor no. 2.	Circuit Breaker – CB4 Manual Reset	Opens at 60 amps
Excessive current draw by condenser fan motor no. 1.	Circuit Breaker – CB5 Manual Reset	Opens at 60 amps
Excessive current draw by clutch	Circuit Breaker – CB6 Manual Reset	Opens at 10 amps
High system pressure	High Pressure Switch (HPS) Automatic Reset	**R-22 Units:** Opens at: 425 ± 10 psig *(30 ± 0.7 kg/cm@)* Closes at: 300 ± 10 psig *(21 ± 0.7 kg/cm@)* **R-134a Units:** Opens at: 300 ± 10 psig *(21 ± 0.7 kg/cm@)* Closes at: 200 ± 10 psig *(14 ± 0.7 kg/cm@)*
Low system pressure	Low Pressure Switch (LPS) Automatic Reset	**R-22 and R-134a Units**: Opens at: 6 ± 3 psig *(0.42 ± 0.21 kg/cm@)* Closes at: 25 ± 5 psig *(1.8 ± 0.35 kg/cm@)*

1.5 SYSTEM OPERATING CONTROLS AND COMPONENTS

a. Temperature Controller (Thermostat)

The temperature controller is a thermostat that senses and controls the vehicle interior air temperature.

The desired interior temperature setpoint of the controller is manually set with the temperature selector located on the electrical control panel. (See figure 1-3.) The controller's temperature sensor monitors the bus' interior temperature at the return air section of the unit and controls the operation function of the system to maintain temperature at the desired setpoint.

The controller regulates the operation of the unit with three interior switches (LOAD/UNLOAD, LOW/HIGH and HEAT/COOL). The LOAD/UNLOAD switch controls the compressor unloaders; the LOW/HIGH switch controls the evaporator fan speed; the HEAT/COOL switch establishes heating or cooling operating mode.

b. Manual Switches

A/C Switch (ACS)

The A/C switch (ACS) activates the air conditioning, heating or vent modes of operation by energizing the control circuits of the RM35 unit. The switch is located on the driver's control panel.

A/C Mode Switch (ACMS)

The A/C mode switch (ACMS) activates the cycling clutch, vent, heat, reheat and auto modes of operation. The switch is located on the driver's control panel. Placing the switch in the COOL position, energizes the clutch relay when the temperature controller is sensing a need for more cooling. Placing the switch in the VENT position, operates the evaporator fans only. Placing the switch in the HEAT position, energizes the booster pump relay when the temperature controller is sensing a need for more heating. Placing the switch in the REHEAT position, energizes the booster pump relay when the temperature controller is sensing that the coach is getting too cold. The compressor clutch is always energized during the reheat mode. When the switch is in the AUTO position, the need for heating or cooling is determined by the setpoint of the temperature controller and position of the evaporator speed switch (ESS), if installed.

Evaporator Speed Switch (ESS) - Optional

The evaporator speed switch (ESS), if installed, is located on the driver's control panel. The ESS, when in the LOW or HIGH position, overrides the temperature controller switch. When the switch is in the HIGH position, the evaporator fans are operated at high speed at all times. When in the LOW position, the fans are operated at low speed at all times. When in the AUTO position, evaporator fan speed is controlled by the temperature controller switch.

c. Thermal Switches

Engine Coolant Switch (ECS) – Optional-Supplied by OEM

The engine coolant switch (ECS) is located on the engine block of the vehicle and senses the engine coolant temperature. The ECS is a normally open switch which closes on a temperature rise to complete a path to energize the control circuits. If this switch is used, and the water temperature is below the switch setpoint, then the A/C system will not operate.

Condenser Motor Overload (COL1 and COL2)-Not Installed on Units with Rotron Motors

Each condenser fan motor is equipped with an internal thermal protector switch. If excessively high motor temperature exists, the COL switch will open to de-energize the corresponding condenser fan relay (CFR1 or CFR2); this will stop the corresponding condenser fan motor.

Evaporator Motor Overload (EOL1 and EOL2)-Not Installed on Units with Rotron Motors

Each evaporator fan motor is equipped with an internal thermal protector switch embedded in the motor windings. If excessively high motor temperature exists, the EOL switch will open to de-energize the corresponding evaporator fan relay (EFR1 or EFR2); this will stop the corresponding evaporator fan motor.

Rotron brushless motors are protected by manual circuit breakers in the system.

Low Ambient Thermostat (LATH) – Optional, Supplied by OEM

The low ambient thermostat (LATH) monitors temperature outside the vehicle. The switch opens at 45 ±5_F *(7.3 ± 2.8 _C)* and closes at 55 ±5_F *(12.9 ± 2.8 _C)*. When the outside temperature is below the open setting of the switch, the switch opens to stop the compressor clutch and condenser fans. The low ambient thermostat is mounted on the condenser coil.

d. Pressure Switches

Condenser Fan (Speed) Switch (CFS)-Not Installed on Units with Rotron Motors

The condenser fan speed switch (CFS) senses refrigerant discharge line pressure to control condenser fan speed. If the condenser coil discharge pressure rises to the CFS cutout setting, the switch will open to de-energize the condenser speed relay (CRS1); this will cause the condenser fan motors (CM1 and CM2) to run at high speed. When the pressure drops to the CFS cut-in setting, the switch will close, energizing CSR1 to run the condenser fan motors at low speed. Refer to paragraph 1.2 for switch settings.

On units with brushless Rotron motors, the pressure switch operation is the same except there is no speed relay. All switching is accomplished internal to the motor through the condenser motor (CM1 and CM2) circuitry.

Unloader Pressure Switches (UPS1, UPS2 and UPS3)

The unloader pressure switches UPS1, UPS2 and UPS3 control unloader operation during A/C mode of operation.

Unloader pressure switches UPS1 and UPS2 close on pressure drop to energize unloader valves (UV1 and UV2, respectively). Energizing UV2 will place the compressor in four cylinder operation. Energizing UV1 will place the compressor in 2 cylinder operation. As pressure rises, the switch will re-open. Refer to table 1.2 for switch settings.

Unloader pressure switch UPS3 closes on pressure rise to energize unloader valve UV2. Energizing UV2 will place the compressor in four cylinder operation. As pressure drops, the switch will re-open. Refer to table 1.2 for switch settings.

Energizing of unloader valve UV1 can also be accomplished through the controller LOAD/UNLOAD switch.

e. Relays

Fault Relay (FR)

The fault relay (FR) is plugged into the relay board on the electrical control panel located in the rear compartment of the unit. (See figure 1-3.) The FR relay is energized during initial start-up of the unit. If the high or low pressure switch (HPS or LPS) opens due to unsafe operating conditions, the fault relay (FR) de-energizes and closes an internal set of FR contacts to energize the ACSR.

A/C Stop Relays (ACSR1 and ACSR2)

The A/C stop relays (ACSR1 and ACSR2) are plugged into the relay board on the electrical control panel located in the rear compartment of the unit. (See figure 1-3.). The ACSR relay is a time delay relay that energizes the A/C stop light when activated by the fault relay (FR).

To restart the unit and turn the A/C stop light off, the A/C switch must be toggled off and on.

Clutch Relay (CR)

The clutch relay (CR) is plugged into the relay board on the electrical control panel located in the rear compartment of the unit. (See figure 1-3.) When the CR relay is energized, a set of internal contacts will close to activate the compressor clutch (CL) to start the refrigerant cycle.

Evaporator Fan Relays (EFR1 and EFR2)-Not Installed on Units with Rotron Motors

Evaporator fan relays (EFR1 and EFR2) are installed on the electrical control panel located in the rear compartment of the unit. (See figure 1-3.) When the air conditioning switch (ACS) is placed in either the ON position, EFR1 and EFR2 relays are energized. When energized, a set of internal EFR1 and EFR2 contacts are closed to start the evaporator fan motors.

Rotron motors require no external relays.

Evaporator Overload Relays (OR1 and OR2)-Not Installed on Units with Rotron Motors

Evaporator overload relays (OR1 and OR2) are plugged into the relay board on the electrical control panel located in the rear compartment of the unit. (See figure 1-3.) These relays are energized at the same moment the evaporator fan relays are. The OR1 and OR2 relays, when energized, will close a set of internal contacts to energize the evaporator speed relay (ESR).

Evaporator Speed Relay (ESR)-Not Installed on Units with Rotron Motors

The evaporator speed relay (ESR) is installed on the electrical control panel located in the rear compartment of the unit. (See figure 1-3.) This relay will energize when temperature switch THSW2 calls for low speed evaporator fan operation in the HEAT mode. When energized, the internal contacts will close to start low speed evaporator fan operation.

On units with Rotron motors, evaporator fan motor speed control is accomplished internally.

Condenser Fan Relays (CFR1 and CFR2)-Not Installed on Units with Rotron Motors

The condenser fan relays (CFR1 and CFR2) are installed on the electrical control panel located in the rear compartment of the unit. (See figure 1-3.) When the air conditioning switch (ACS) is placed in the ON position and the temperature controller is calling for cooling, CFR1 and CFR2 are energized. When energized, a set of internal CFR1 and CFR2 contacts are closed to start the condenser fan motors. The low ambient thermostat (LATH), if installed, must be closed to energize the condenser fan relays.

Condenser Speed Relay (CSR1)-Not Installed on Units with Rotron Motors

The condenser speed relay (CSR1) is installed on the electrical control panel located in the rear compartment of the unit. (See figure 1-3.) This relay is energized at the same moment that the air conditioning switch (ACS) is placed in the ON position, provided that the condenser fan (speed) switch (CFS) is in the closed position. If the condenser coil pressure reaches the CFS switch cutout setting, the CFS switch will open to de-energize condenser speed relay CSR1. (Refer to paragraph 1.2 for switch settings.); this will cause the condenser fan motors (CM1 and CM2) to run at high speed.

On units with Rotron motors, evaporator fan motor speed control is accomplished internally.

Booster Pump Relay (BPR)

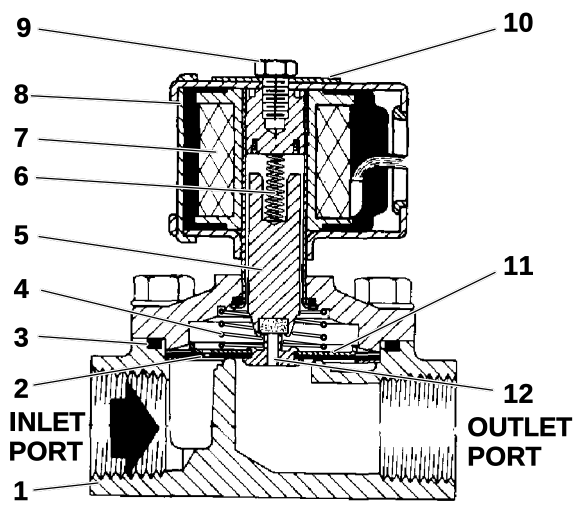
The booster pump relay (BPR) is plugged into the relay board on the electrical control panel located in the rear compartment of the unit. (See figure 1-3.) This relay is energized during the reheat and heating modes. When the booster pump relay (BPR) is energized, a set of internal contacts will close to activate the booster pump motor.

1.6 REHEAT COOLANT VALVE

The reheat coolant valve (RCV) is located in the evaporator section of the unit at the rear of the bus. (See figure 1-1.) The valve is an electrically operated solenoid valve controlled by thermostat command. The RCV controls the coolant flow to the heater coil during heating. The valve is normally closed and opens when the coil is energized and closes when the coil is de-energized.

When the thermostat calls for heating, the RCV coil is energized, the plunger is lifted and the pilot port is opened to relieve the pressure on top of the diaphragm. (See figure 1-5.) Now the valve inlet pressure will act on the bottom portion of the diaphragm, lifting the diaphragm to open the main port. Once the port is open, the diaphragm is held off the seat by the pressure difference across the port. When the coil is de-energized, the plunger drops due to the kick-off spring and closes the pilot port. The pressure above the diaphragm is no longer vented to the downstream side of the valve and the diaphragm drops, closing the main port.

The valve's maximum operating pressure differential (MOPD) is 35. The MOPD is the maximum pressure differential against which the solenoid will open. The valve has a 10 gallon per minute minimum capacity with a 3 psig pressure differential across the valve.



1. Valve Body
2. Equalizer Port
3. O-Ring
4. Closing Spring
5. Plunger
6. Kick-Off Spring
7. Coil
8. Coil Housing
9. Coil Retaining Screw
10. Nameplate
11. Diaphragm
12. Pilot Port

Figure 1-5. Reheat Coolant Valve

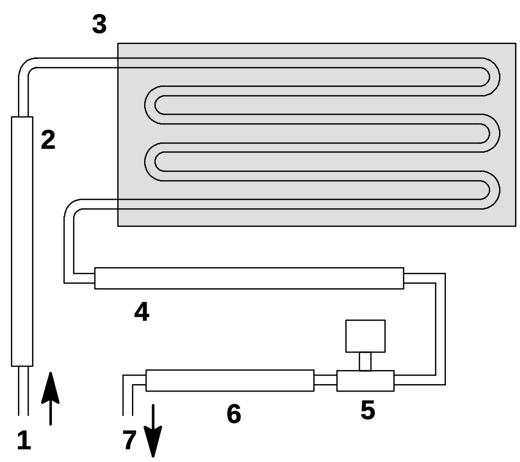
1-7 MOISTURE/LIQUID INDICATOR

The moisture/liquid indicator is located on the liquid line between the filter-drier and the receiver. The element in the indicator is highly sensitive to moisture and will gradually change color in direct relation to an increase or decrease in the moisture content of the system. The dry-caution-wet system operating conditions are then easily determined by matching the element color with the four colors displayed on the reference label. Colors change as often as the system moisture content changes.

1-8 HEATER COOLANT FLOW CYCLE

Heating is controlled by the thermostat which controls the operation of the reheat coolant valve (RCV). When the coolant valve solenoid is energized, the valve will open to allow engine coolant to flow through the heater coil. (See figure 1-6.)

At the same time the coolant valve is energized, the booster pump (customer supplied) is activated to circulate the engine coolant through the inlet tube and header hose to the heater coil. The coolant exits the coil and flows through the valve inlet hose. With the coolant valve opened, coolant flows through the valve outlet hose and coolant outlet tube back to the engine.



1. Coolant Inlet Tube
2. Header Inlet Hose
3. Heater Coil
4. Coolant Valve Inlet Hose
5. Reheat Coolant Valve (RCV)
6. Coolant Valve Outlet Hose
7. Coolant Outlet Tube

Figure 1-6. Heater Coolant Flow Diagram

1.9 AIR CONDITIONING REFRIGERANT CYCLE

The refrigeration cycle is the same for air conditioning and reheating. The refrigerant cycle is off during the vent mode and only the evaporator blowers operate to circulate air throughout the bus. When air conditioning is selected, the unit operates as a vapor compression system using R-22 or R-134a as a refrigerant. The main components of the system are the reciprocating compressor, air-cooled condenser coil, thermostatic expansion valve, and evaporator coil. (See figure 1-7.)

The refrigeration cycle begins when the compressor clutch is engaged. 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 outside of 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 evaporator as needed and as a storage space when pumping down the system. The receiver is equipped with a sight glass to observe the refrigerant for restricted flow and correct charge level.

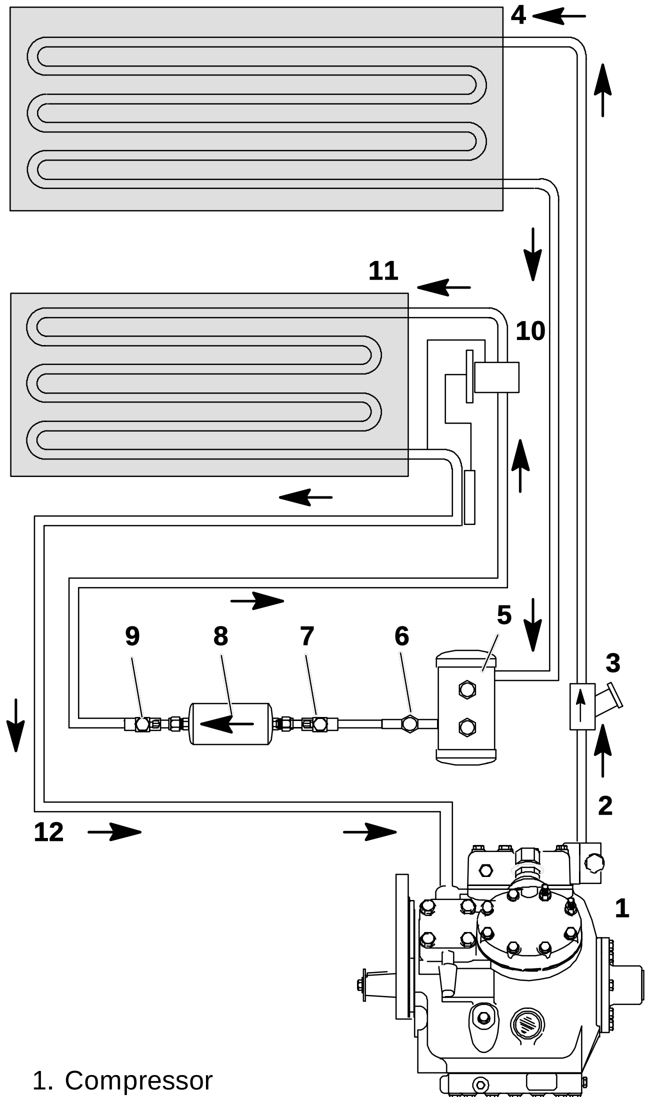
The refrigerant leaves the receiver and flows through a moisture-liquid indicator (which indicates the moisture content of the refrigerant), through the filter-drier inlet valve and through a filter-drier where an absorbent keeps the refrigerant clean and dry. It then flows out of the filter-drier and through the filter-drier outlet valve.

The liquid then flows to an externally equalized thermostatic expansion valve which reduces 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 mixture of liquid and vapor refrigerant that flows into the evaporator tubes is colder than the air that is circulated over the evaporator tubes by the evaporator blower. Heat transfer is established from the evaporator air (flowing over the tubes) to the refrigerant (inside the tubes). The evaporator tubes have aluminum fins to increase heat transfer from the air to the refrigerant. The cooler air is then circulated to the interior of the bus by the evaporator blowers.

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 back to the compressor.

The low pressure refrigerant vapor is now drawn into the compressor where the cycle repeats.



1. Compressor
2. Discharge Line
3. Discharge Line Check Valve
4. Condenser Coil
5. Receiver
6. Moisture-liquid Indicator
7. Filter-Drier Inlet Service Valve
8. Filter-Drier
9. Filter-Drier Outlet Service Valve
10. Thermostatic Expansion Valve
11. Evaporator Coil
12. Suction Line

Figure 1-7. Air Conditioning Refrigerant Cycle

SECTION 2

OPERATION

2.1 STARTING AND STOPPING INSTRUCTIONS

a. Starting

1. Start the vehicle engine.
2. Place the A/C switch in the ON position.
3. Place the A/C control switch in the desired mode of operation position (AUTO, COOL, VENT, HEAT or REHEAT).

NOTE

The engine coolant must be warm enough to close the engine coolant switch (if installed) for unit operation to start.

b. Stopping

1. Place the A/C switch to the OFF position.

NOTE

Be sure air conditioning unit is turned off before stopping the vehicle engine.

2.2 PRE-TRIP INSPECTION

After starting unit, allow system to stabilize (10 to 15 minutes) and proceed as follows:

1. Listen for abnormal noises.
2. Check compressor oil level.
3. Check refrigerant level.
4. Check moisture-liquid indicator.

2.3 UNIT OPERATION

The desired modes of operation (Auto, Cool, Vent, Heat or Reheat) are selected manually with the air conditioning switch located on the driver's switch panel. When a mode of operation is selected, the control thermostat senses the vehicle's interior temperature and automatically controls the system to maintain the desired temperature setpoint.

The unit control circuits and components operate on 24-volt power supplied by the bus battery or alternator.

2.3.1 Air Conditioning Operation-Auto Mode (See figure 2-1.)

To operate in the Auto mode of operation, Place the A/C control switch in the AUTO position. In the Auto mode, the temperature controller determines at what points cooling or heating are required to regulate vehicle interior temperature.

The driver's air conditioning switch (ACS) is placed in the ON position to activate the Auto mode of operation. With the ACS switch in the ON position, 24-volts is supplied to the evaporator fan motors (EM1 and EM2) and the temperature controller or thermostat (TH).

When the vehicle's interior temperature rises to 3˚F below the thermostat setpoint, the HEAT/COOL switch remains in the heat position. But, The HIGH/LOW switch switches from HIGH to LOW position; this causes the evaporator fan motors to change from high to low speed operation.

When the vehicle's interior temperature rises to the thermostat setpoint, the HEAT/COOL switch switches to a neutral position and unit now operates in the vent mode. The HIGH/LOW switch remains in the LOW position and the evaporator fan motors remain in low speed operation.

When the vehicle's interior temperature rises 3˚F above the thermostat setpoint, the HEAT/COOL switch switches to the COOL position to energize the clutch relay (CR) through the closed contacts of the low ambient thermostat (LATH), if supplied; this will start the refrigerant flow cycle. (See figure 1-7.) Condenser fan motors (CM1 and CM2) are also energized to start the condenser fans in low speed operation. The evaporator fan motors remain in low speed operation and the unit is now operating in the low speed cooling mode.

When the vehicle's interior temperature rises to 7˚F above the thermostat setpoint, the HEAT/COOL switch remains in the COOL position to keep the clutch relay energized. But, the HIGH/LOW switch switches from LOW to the HIGH position, which causes the evaporator fan motors to change from low speed to high speed operation. (See figures 2-1 and 2-6.) The unit now operates in the high speed cooling mode

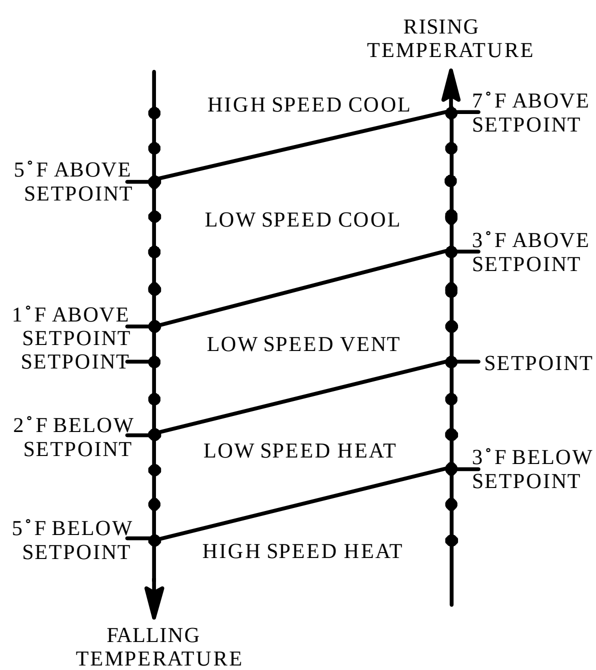


Figure 2-1. Temperature Controller Sequence During Auto Mode

When the vehicle's interior temperature falls to 5˚F above the thermostat setpoint, the HEAT/COOL switch remains in the COOL position to keep the clutch relay energized. But, the HIGH/LOW switch switches from HIGH to LOW position, which causes the evaporator fan motors to change from high speed to low speed operation.

When the vehicle's interior temperature falls to 1˚F above the thermostat setpoint, the HEAT/COOL switch will switch to a neutral position to de-energize the clutch relay (CR) and the condenser fan motors (CM1 and CM2); this will stop the flow of refrigerant and stop operation of the condenser fans. The HIGH/LOW switch will remain in the LOW position keeping the evaporator fans operating on low speed in the vent mode.

When the vehicle's interior temperature falls to 2˚F below the thermostat setpoint, the HEAT/COOL switch switches to the HEAT position to energize the booster pump relay (BPR), water pump relay (WPR) and the reheat coolant valve (RCV); this starts the flow of hot water through the reheat coil. The HIGH/LOW switch will remain in the LOW position keeping the evaporator fan motors operating on low speed. The unit is now operating in the low speed heat mode.

When the vehicle's interior temperature falls to 5˚F below the thermostat setpoint, the HEAT/COOL switch remains in the HEAT position. But, the HIGH/LOW switch switches from LOW to HIGH position; this causes the evaporator fan motors to change from low to high speed operation.

2.3.2 Air Conditioning Operation-Reheat Mode (See figure 2-2)

To operate in the Reheat mode, place the A/C control switch in the REHEAT position. In the Reheat mode, the reheat coolant valve opens and closes on thermostat demand to control vehicle interior temperature while the air conditioning mode continues to operate.

During the Reheat mode, the HEAT/COOL switch controls the operation of the reheat control valve RCV and the booster pump. The HIGH/LOW switch controls the evaporator fan speed (low or high). While the air conditioning unit is operating in the Reheat mode, the clutch relay circuit is always energized.

When the vehicle interior temperature falls to 5˚F above the thermostat setpoint, the HIGH/LOW switch switches from HIGH to LOW position; this causes the evaporator fan motors to switch from high speed to low speed operation.

When the vehicle interior temperature falls to 2˚F below the thermostat setpoint, the HEAT/COOL switch switches to the HEAT position (see figure 2-2 and figure 2-7) to energize the booster pump relay BPR, water pump relay WPR and the reheat coolant valve RCV; this allows hot water to start flowing through the heater coils. The clutch relay is still energized and the clutch is still engaged allowing refrigerant to flow through refrigerant cycle. The HIGH/LOW switch is still in the LOW position keeping the evaporator fan motors running on low speed.

When the vehicle interior temperature falls to 5˚F below the thermostat setpoint, the HIGH/LOW switch switches to the HIGH position; this causes the evaporator fan motors to change from low speed to high speed operation. The HEAT/COOL switch remains in the HEAT position, which keeps the booster pump relay, water pump relay and the reheat control valve energized. (See figure 2-7.)

When the vehicle interior temperature rises to 3˚F below the thermostat setpoint, the HIGH/LOW switch switches to the LOW position; this causes the evaporator fan motors to change from high speed to low speed operation. The HEAT/COOL switch remains in the HEAT position keeping the booster pump relay, water pump relay and the reheat coolant valve energized.

When the vehicle interior temperature rises to the thermostat setpoint, the HEAT/COOL switch switches to the COOL position; this de-energizes the booster pump relay, water pump relay and the reheat coolant relay stopping the flow of hot water through the reheat coils. The HIGH/LOW switch remains in the LOW position to keep the evaporator fan motors running at low speed. Also, the clutch and condenser fan relays remain energized.

When the vehicle interior temperature rises to 7˚F above the thermostat setpoint, the HIGH/LOW switch switches to the HIGH position; this changes the evaporator fan motors from low speed to high speed operation. The clutch and condenser fan relays remain energized, keeping refrigerant flowing through the refrigerant cycle.

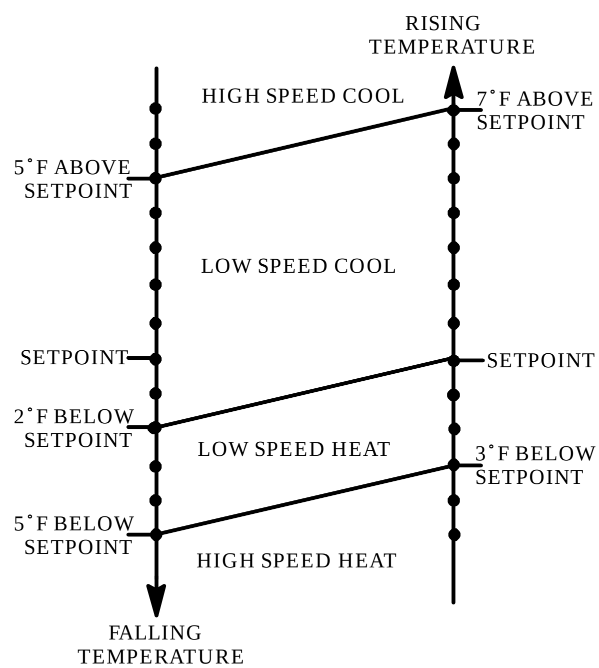


Figure 2-2. Temperature Controller Sequence During REHEAT Mode

2.3.3 Air Conditioning Operation-Cool (Clutch Cycling) Mode (See figure 2-3)

To operate in cool (clutch cycling) mode, Place the A/C control switch in the COOL position. In cool, the compressor clutch is energized/de-energized on thermostat command to control vehicle interior temperature.

During the cool mode, the HEAT/COOL switch controls the operation of the clutch relay (CR), which in turn controls the operation of the clutch on the air conditioning compressor.

When the vehicle interior temperature rises to 3˚F above the thermostat setpoint, the HEAT/COOL switch switches to the COOL position to energize the clutch relay, which engages the compressor clutch and starts the flow of refrigerant in the refrigerant cycle. The HIGH/LOW switch remains in the LOW position, which keeps the evaporator fan motors operating on low speed.

When the vehicle interior temperature rises to 7˚F above the thermostat setpoint, HIGH/LOW switch switches from LOW to HIGH position; this causes the evaporator fan motors to change from low to high speed operation. The HEAT/COOL switch remains in the COOL position, keeping the clutch engaged and refrigerant flowing. (See figure 2-6.)

When the vehicle interior temperature falls to 5˚F above the thermostat setpoint, the HIGH/LOW switch switches from HIGH to LOW position, which causes the evaporator fan motors to change from high speed to low speed. The HEAT/COOL switch remains in the COOL position, which keeps the compressor clutch energized and refrigerant flowing through the refrigerant cycle.

When the vehicle interior temperature falls to 1˚F above the thermostat setpoint, the HEAT/COOL switch switches to a neutral position; this de-energizes the clutch relay, which in turn de-energizes the compressor clutch, stopping the flow of refrigerant. The HIGH/LOW switch remains in the LOW position to keep the evaporator fan motors operating on low speed in the vent mode. (See figure 2-8.)

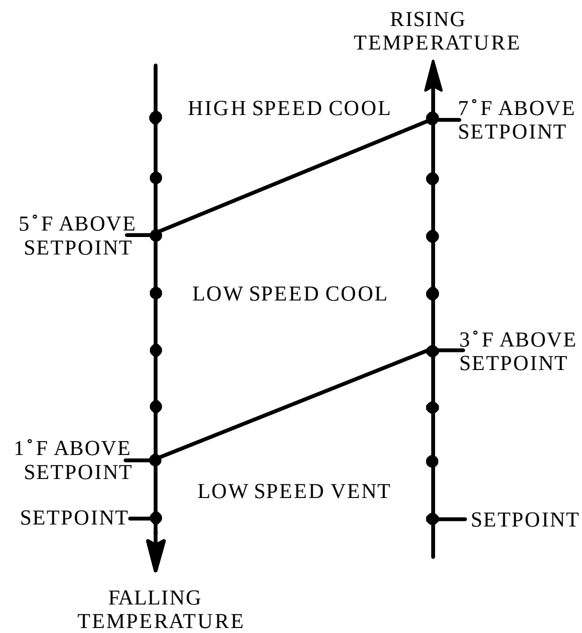


Figure 2-3. Temperature Controller Sequence During Cooling Mode

2.3.4 Vent Mode (See figure 2-4.)

To operate in Vent mode, place the A/C control switch in the VENT position. In vent, the evaporator fan motor speed is controlled on thermostat command to control vehicle interior temperature.

During the Vent mode, the HIGH/LOW switch controls the evaporator fan motor speed.

When the vehicle interior temperature falls to 5˚F above the thermostat setpoint, the HIGH/LOW switch switches from HIGH to LOW; this causes the evaporator fan motors to change from high to low speed operation. The unit now operates on low speed vent. (See figure 2-8.)

When the vehicle interior temperature falls to 5˚F below the thermostat setpoint, the HIGH/LOW switch switches from LOW to HIGH; this causes the evaporator fan motors to change from low to high speed operation.

When the vehicle interior temperature rises to 3˚F below the thermostat setpoint, the HIGH/LOW switch switches from HIGH to LOW position; this causes the evaporator fan motors to change from high to low speed operation. (See figure 2-8.)

When the vehicle interior temperature rises to 7˚F above the thermostat setpoint, the HIGH/LOW switch switches from LOW to HIGH position; this causes the evaporator fan motors to change from low to high speed operation.

2.3.5 Heat Mode (See figure 2-5.)

To operate in the Heat mode, place the A/C control switch in the HEAT position. In heat, the reheat coolant valve (RCV) opens and closes on thermostat command to control vehicle interior temperature.

During the Heat mode, the HEAT/COOL switch controls operation of the booster pump relay (BPR), which in turn controls the operation of the booster pump.

When the vehicle interior temperature falls to 2˚F below the setpoint, HEAT/COOL switch switches from COOL to HEAT position; this energizes the BPR relay, which energizes the booster pump allowing hot water to flow through reheat coils. Evaporator fans are operating on low speed. (See figure 2-7.)

When the vehicle interior temperature falls to 5˚F below the setpoint, the HIGH/LOW switch switches from LOW to HIGH position; this causes the evaporator fan motors to change from low to high speed operation.

When the vehicle interior temperature rises to 3˚F below the setpoint, the HIGH/LOW switch switches from HIGH to LOW position; this causes the evaporator fan motors to change from high to low speed operation.

When the vehicle interior temperature rises to the setpoint, the HEAT/COOL switch switches from HEAT to COOL position; this de-energizes the BPR relay, which de-energizes the booster pump stopping the flow of hot water through the reheat coils. The evaporator fan motors continue to operate on low speed.

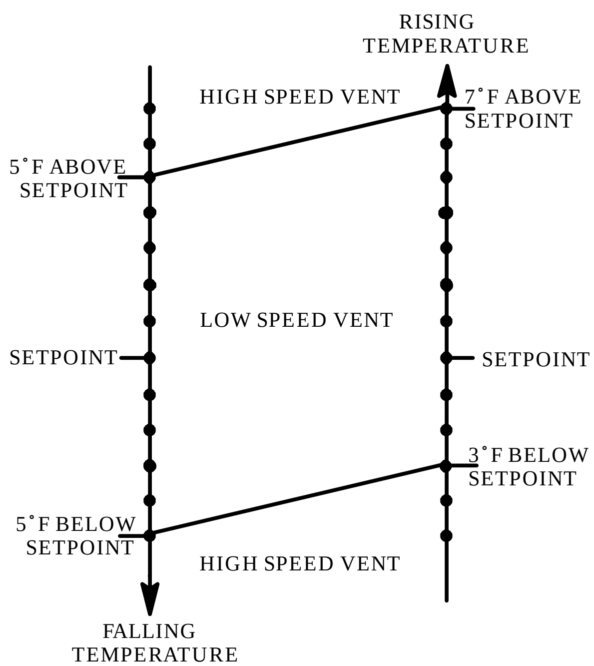


Figure 2-4. Temperature Controller Sequence During Vent Mode

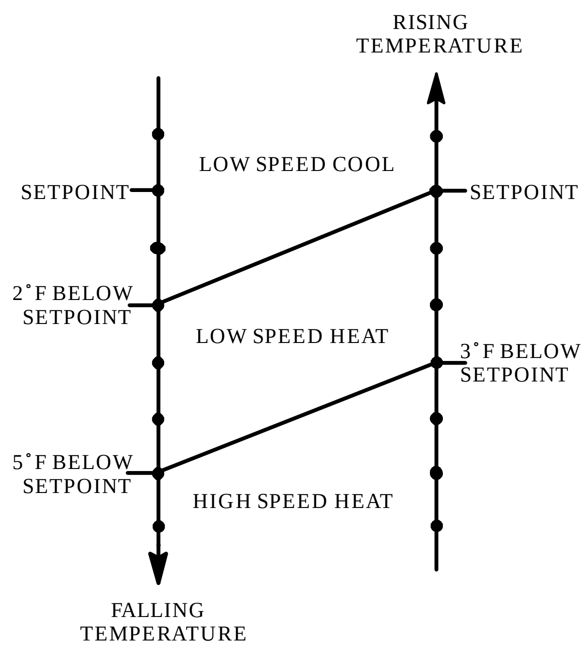
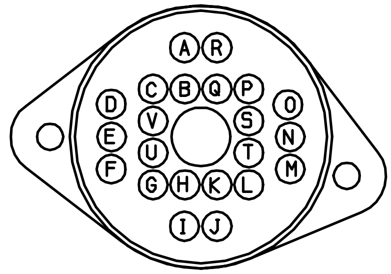


Figure 2-5. Temperature Controller Sequence During HEAT Mode

LEGENDS, SYMBOLS AND NOTES FOR ELECTRICAL DIAGRAMS

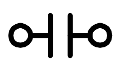
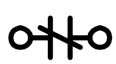
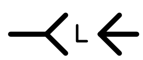
LEGEND

SYMBOL	DESCRIPTION
ACHM	A/C HOURMETER (OPTIONAL)
ACS	A/C SWITCH (OFF-ON)
ACSR1	A/C STOP RELAY #1
ACSR2	A/C STOP RELAY #2
BPR	BOOST PUMP RELAY
CB1	15A CIRCUIT BREAKER (WATER PUMP RELAY)
CB2	35A CIRCUIT BREAKER (EVAP MOTOR #2)
CB3	35A CIRCUIT BREAKER (EVAP MOTOR #1 AND 2)
CB4	70A CIRCUIT BREAKER (COND MOTOR #1)
CB5	70A CIRCUIT BREAKER (COND MOTOR #2)
CB6	10A CIRCUIT BREAKER (CLUTCH)
CFS	CONDENSER FAN SPEED SWITCH (360 PSI)
CL	CLUTCH
CM1	CONDENSER FAN MOTOR #1
CM2	CONDENSER FAN MOTOR #2
CR	CLUTCH RELAY
D1-D27	DIODE #1 - DIODE #27
DFS	DEFROST SWITCH (OPTIONAL)
ECS	ENGINE COOLANT SWITCH (OPTIONAL)
EM1	EVAPORATOR FAN MOTOR #1
EM2	EVAPORATOR FAN MOTOR #2
FR	FAULT RELAY
HPS	HIGH PRESSURE SWITCH
LATH	LOW AMBIENT THERMOSTAT (OPTIONAL)
LPS	LOW PRESSURE SWITCH
PTB	POWER TERMINAL BLOCK
RCV	REHEAT COOLANT VALVE
TH	ELECTRONIC THERMOSTAT
UPS1	UNLOADER PRESSURE SWITCH #1
UPS2	UNLOADER PRESSURE SWITCH #2
UPS3	UNLOADER PRESSURE SWITCH #3
UV1	UNLOADER VALVE #1
UV2	UNLOADER VALVE #2
WPR	WATER PUMP REL



22 PIN CONNECTOR
WIRING SIDE

SYMBOLS

D2	INDICATES RELAY BOARD CONNECTION
	INDICATES A WIRE GROUND
	INDICATES CUSTOMER SUPPLIED COMPONENTS & WIRING
	INDICATES A CONNECTION (LUG,SCREW ETC.)
	INDICATES A CONNECTOR
	INDICATES A NORMALLY OPEN CONTACT
	INDICATES A NORMALLY CLOSED CONTACT
 L	INDICATES BUS INTERFACE CONNECTOR PIN LOCATION
	INDICATES RELAY BOARD TRACE

NOTES:

1. UNIT SHOWN IS IN THE OFF POSITION OR IN OPERATING MODE SHOWN.
2. RELAY CONTACTS ARE IN THE APPLICABLE POSITION FOR THE OPERATING MODE SHOWN.
3. ADDRESS SYSTEM EXAMPLE: CFR22-CM2A2 INDICATES A WIRE BETWEEN COND. FAN RELAY #2 TERMINAL #2 AND COND. MOTOR #2 TERMINAL A2.
4. WIRE IDENTIFICATION SYSTEM:
   COLORS: WHITE - DC CONTROL CIRCUIT
   GREEN - GROUND
   YELLOW - OPTIONAL CIRCUITS

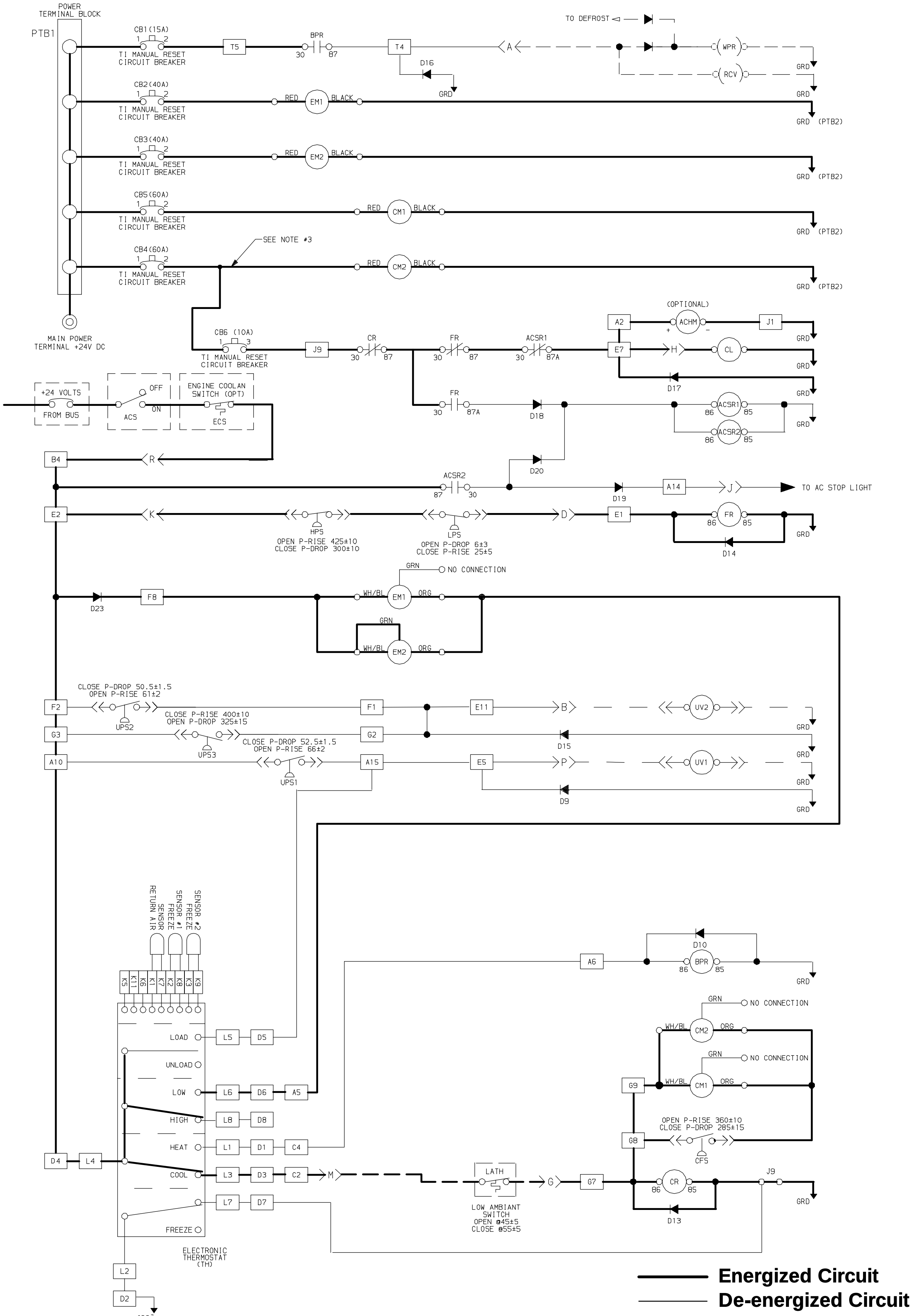


Figure 2-6. Automatic High Speed Cool

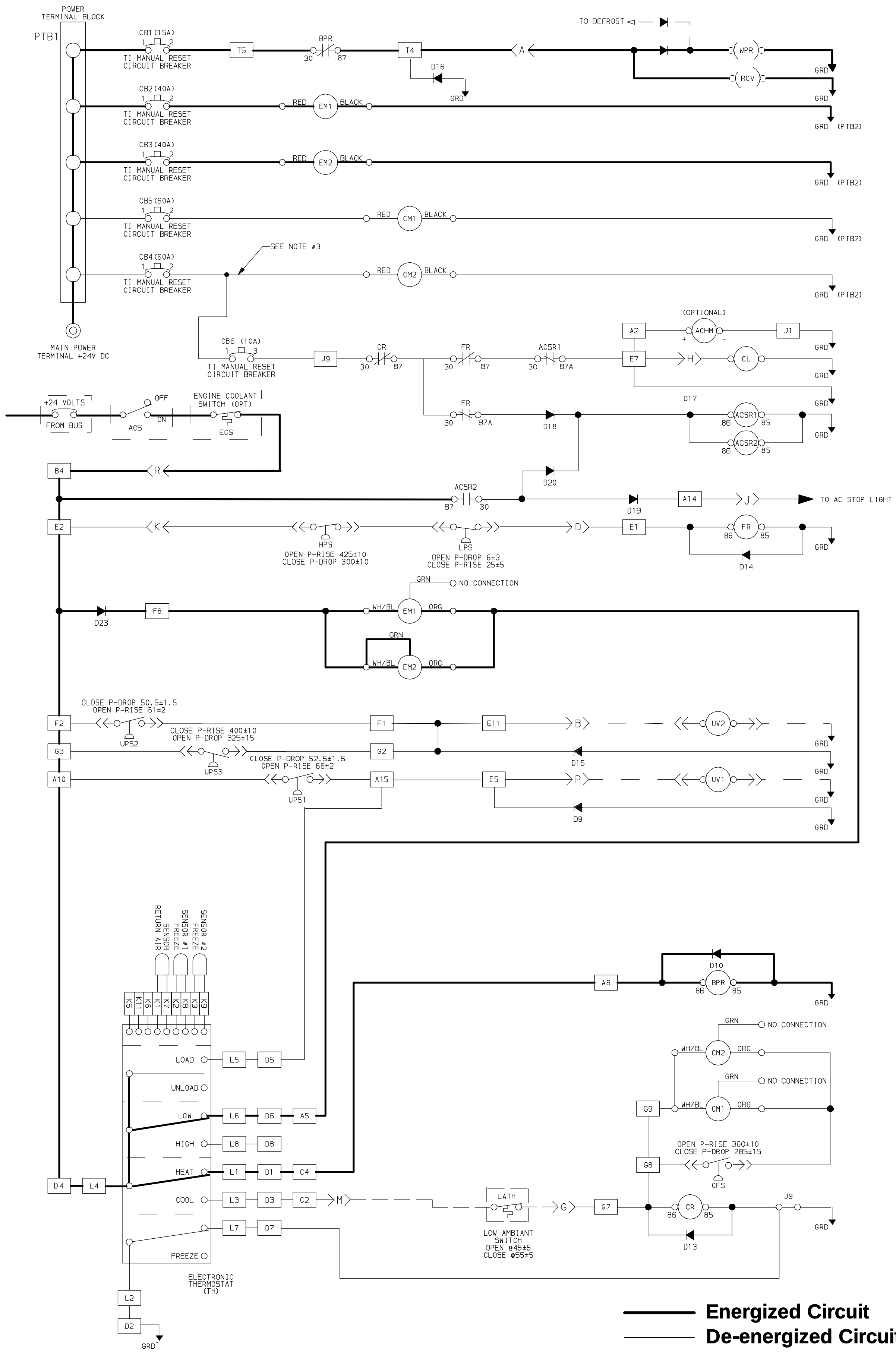


Figure 2-7. Automatic Low Speed Heat

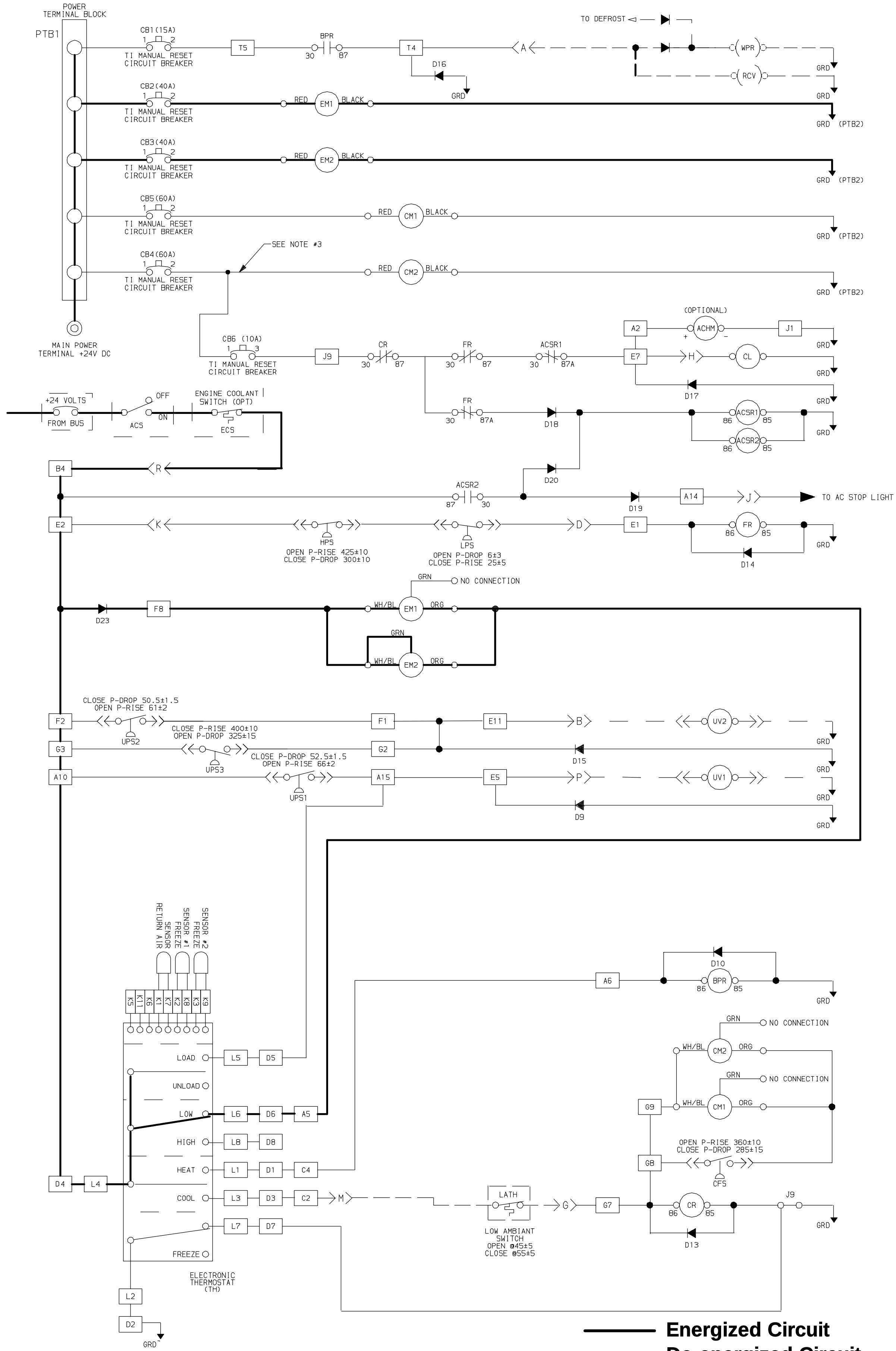


Figure 2-8. Automatic Low Speed Vent

SECTION 3

TROUBLESHOOTING

INDICATION/ TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
3.1 UNIT WILL NOT COOL		
Compressor will not run	V-Belt loose or defective	Check
	Compressor malfunction	See Note
	Clutch malfunction	Check/Replace
	Safety device open	1.4
Electrical malfunction	A/C switch defective	Check
	Low Ambient Thermostat open	1.5
	Circuit breaker CB6 open	Check/Reset
	Temperature Controller malfunction	3.5
	Engine Coolant Switch (ECS) Open- If installed	1.5
3.2 UNIT RUNS BUT HAS INSUFFICIENT COOLING		
Compressor	Compressor valves defective	See Note
	V-belt loose	Check
Refrigeration system	Abnormal pressures	3.3
	No or restricted evaporator air flow	3.6
	Expansion valve malfunction	3.7
	Restricted refrigerant flow	3.7 & 4.12
	Low refrigerant charge	4.9
	Service valves partially closed	Open
	Safety device open	1.4
3.3 ABNORMAL PRESSURE		
High discharge pressure	Refrigerant overcharge	4.9
	Noncondensibles in system	Check Pressure
	Condenser fan motor rotation incorrect	Check
	Condenser coil dirty	Clean
Low discharge pressure	Compressor valves(s) worn or broken	See Note
	Low refrigerant charge	4.9
High suction pressure	Compressor valves worn or broken	See Note
Low suction pressure	Suction service valve partially closed	Open
	Filter-drier inlet or outlet valves partially closed	Check/Open
	Filter-drier partially plugged	4.10
	Low refrigerant charge	4.9
	Expansion valve malfunction	3.7
	Restricted air flow	3.6
Low evaporator air flow	Blower running in reverse	Check
	Dirty air filter	4.17
	Icing of coil	Clean
Suction and discharge pressures tend to equalize when unit is operating	Compressor valves defective	See Note

NOTE: Refer to 05G Compressor manual, Form T-199.

INDICATION/ TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
3.4 ABNORMAL NOISE AND VIBRATIONS		
3.4.1 ABNORMAL NOISE		
Compressor	Loose mounting bolts	Check
	Worn bearings	See Note
	Worn or broken valves	See Note
	Liquid slugging	3.7
	Insufficient oil	4.18.2
	Clutch loose or rubbing	Check
Condenser or Evaporator fan	Loose or defective	Check/Adjust
	Bearings	Replace
	Blade Interference	Check
	Blade broken or missing	Check
3.4.2 ABNORMAL VIBRATION		
Compressor	Loose mounting bolts	Check
Evaporator or Condenser fan	Bent shaft on motor	Replace Motor
	Blade broken or missing	Check
3.5 TEMPERATURE CONTROLLER MALFUNCTION		
Will not control	Controller defective	Replace
	Sensor defective	Replace
	Defective wiring	Check
3.6 NO EVAPORATOR AIR FLOW OR RESTRICTED AIR FLOW		
No evaporator air flow	Motor defective	4.16
	Fan damage	4.16
	Brushes defective	4.16
	Return air filter dirty	Check
	Fan Relays EFR1 or EFR2 defective	Check
	Safety device open	1.4
	Wiring polarity incorrect	Check/5.1
3.7 EXPANSION VALVE MALFUNCTION		
Low suction pressure with high superheat	Low refrigerant charge	4.9
	Wax, oil or dirt plugging valve orifice	Check
	Ice formation at valve seat	4.7
	Superheat setting too high	4.12
	Power assembly failure	Replace
	Loss of bulb charge	Replace
	Broken capillary	4.12
	Loose bulb	Check
Low superheat and liquid slugging in compressor	Superheat setting too low	4.12
	Ice holding valve open	4.12
	Foreign material in valve	4.12
	Pin and seat of expansion valve eroded or held open by foreign material	4.12
	Broken capillary	4.12
Fluctuating suction pressure	Improper bulb location or loose bulb installation	4.12
	Low superheat setting	4.12

NOTE: Refer to 05G Compressor manual, Form T-199.

INDICATION/ TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
3.8 NO OR INSUFFICIENT HEATING		
Insufficient heating	Dirty or plugged heater coil or filter	Check
	Coolant valve malfunction or plugged	Check
	Low coolant level	Check
No heating	Coolant valve malfunction or plugged	Check
	Controller malfunction	3.5
	Booster relay or pump malfunction	Check
	Safety device open	1.4

NOTE: Refer to 05G Compressor manual, Form T-199.

SECTION 4

SERVICE

WARNING

BEWARE OF ROTATING FAN BLADES AND UNANNOUNCED STARTING OF FANS.

4.1 MAINTENANCE SCHEDULE

UNIT ON	UNIT OFF	OPERATION	REFERENCE SECTION
a. Daily Maintenance			
X		Pre-trip inspection – after starting	2.1
	X	Check tension and condition of V-belt(s)	None
b. Weekly Inspection and Maintenance			
	X	Perform daily inspection	4.1.a
	X	Check condenser, evaporator coils and air filters	None
	X	Check refrigerant hoses and compressor shaft seal for leaks	4.6
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 pan and hose(s)	None
	X	Check wire harness 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	4.16

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.

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.

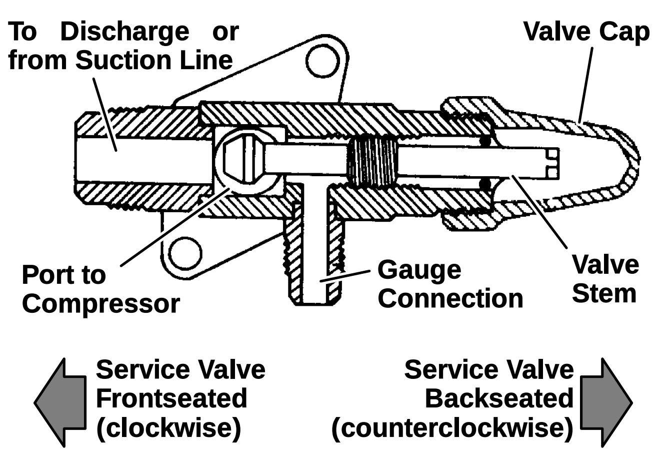


Figure 4-1. Suction or Discharge Service Valve

4.3 MANIFOLD GAUGE SET

The manifold gauge set can be used to monitor system operation pressure, add or remove refrigerant, evacuate, and equalize the system.

The manifold gauge in Figure 4-2 shows hand valves, gauges and refrigerant openings. When the manifold hand valves are backseated (open), the high and low side hoses are common with the center hose as well as each other. When the low and high side valves are frontseated (closed), the high and low side hoses are isolated from each other and the center hose. It is in the front seated (closed) position that system pressures can be monitored. When both valves are open (backseated), pressure will cause vapor to flow from the high side to the low side across the compressor. When only the low side valve is opened, it is possible to add refrigerant in vapor form to the system.

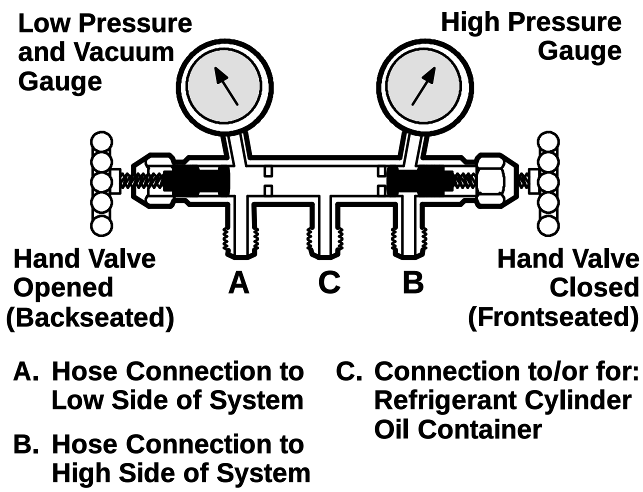


Figure 4-2. Gauge Manifold Set

a. Installing the Gauge Manifold Set

To avoid the unsafe conditions near the running compressor, the recommended gauge manifold set connection is to the service ports located on the suction and discharge drop tubes. These service port are located above the engine next to the fire wall in the engine compartment.

The drop tube connections are equipped with schrader fitting which open when the connection is made.

1. Frontseat the gauge manifold hand valves to close off the center port.

2. Connect the high side hose *tightly* to the discharge drop tube service port.

3. Connect the low side hose *loosely* to the suction drop tube service port.

4. Loosen gauge manifold charging (center) hose at dummy fitting.

5. Open (counterclockwise) manifold discharge hand valve to purge discharge line through the center hose dummy fitting. Tighten the center hose dummy fitting.

6. Open (counterclockwise) manifold suction hand valve to purge suction hose. Tighten the suction hose fitting at the suction quick connect (schrader) fitting.

4.4 SYSTEM PUMP DOWN

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

a. Attach the gauge manifold as outlined in section 4.3.

b. Disconnect low pressure switch quick connect. Install a jumper wire across switch connection to prevent the switch from disengaging the clutch.

c. Start the unit in A/C by placing the driver's A/C switch in the cool position. The thermostat should be set below ambient temperature to ensure A/C operation.

d. Run unit for 5 – 10 minutes to allow system to stabilize.

e. Frontseat (close) the liquid line valve at the inlet of the filter-drier.

f. Observe the suction gauge. The pressure will drop off noticeably. Stop the unit when a 0 to 10 in. vacuum is reached.

g. Stop the unit. Observe the suction gauge. If the reading increases, restart the unit until the specified vacuum is achieved.

h. Repeat the above step until the specified vacuum is maintained after stopping.

i. Before opening the system a slight positive pressure (1-2 psig) is necessary to prevent air from being drawn into the system.

4.5 REMOVING REFRIGERANT CHARGE

A refrigerant recovery system is the recommended method for removing refrigerant charge. For the recovery system procedure, refer to instructions provided by the manufacture.

A refrigerant recovery system should always be used whenever removing contaminated refrigerant from the system.

If a recovery system is not available, proceed as follows:

Equipment Required

1. Appropriate evacuated returnable refrigerant cylinder, preferably a 60 – 120 lb net capacity may be used. Refrigerant removal will be faster and more complete with the larger cylinder.

WARNING

Do not use a disposable refrigerant container to store the refrigerant, an explosion may occur.

2. Gauge manifold set.

Equipment Required (Cont'd)

3. Vacuum pump, preferably 5 cfm (8 cu/H) or larger. CTD P/N 07-00176-01.

4. Weight scale (0 to 100 lb = 0 to 46 kg range, minimum).

5. A standard 1/4 in. charging hose.

To remove the refrigerant charge:

a. Installamanifoldgaugesetasoutlinedinsection 4.3.

b. Connect evacuated refrigerant cylinder to the liquid line valve at the inlet valve of the filter-drier. The service line to the liquid valve of the cylinder should be attached loosely. Crack open the liquid line valve momentarily to purge service line at cylinder. Tighten connection at cylinder.

c. Place evacuated refrigerant cylinder on scale and note weight of empty cylinder. Leave cylinder on scale.

d. Frontseat liquid line valve at the inlet of the filter-drier.

e. Run the unit in high speed cool with the condenser coil completely blocked off. Head pressure will quickly rise. Stop the unit when the system pressure reaches 250 psig for R-22 systems or 150 psig for 134a systems using the rear control switch.

f. Fully open the refrigerant cylinder liquid valve. Liquid refrigerant will flow from the liquid line valve to the cylinder. Head (discharge) pressure will drop.

g. Monitor weight of the refrigerant cylinder to determine how much refrigerant is being removed. Shut off cylinder valve when the scale weight has stabilized, indicating the refrigerant flow into the cylinder has stopped. Run the unit for a few more minutes to condense more liquid and raise head pressure.

NOTE

Refrigerant will flow from the system to the cylinder until the pressures equalize. It is possible to remove more refrigerant by cooling the refrigerant cylinder in a container of ice.

h. Backseat the liquid line valve and remove cylinder hose.

i. Service or replace the necessary component in the system.

NOTE

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.

4.6 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.

a. Systems Without Refrigerant

1. If system is without refrigerant, charge system with refrigerant to build up pressure between 30 to 50 psig (2.1 to 3.5 kg/cm@).

NOTES

1. It is recommended that the appropriate refrigerant used, be used to pressurize the system.

2. Under no circumstance should the system be pressurized above 100 psig when leak testing.

2. Check for leaks. The recommended procedure for finding leaks in a system is with a halide torch or electronic leak detector.

3. Remove the refrigerant used to pressurize the system prior to leak repair using a recovery system.

4. Repeat the entire procedure if necessary.

5. Evacuate and dehydrate the system as outlined in section 4.7.

6. Charge the unit as outlined in section 4.8.

4.7 EVACUATION AND DEHYDRATION

Proper evacuation and dehydration procedures are imperative when service repairs or component replacement are performed on the system to ensure proper unit performance and long compressor life.

The results of improper evacuation are harsh. Non-condensible gases in the system result in high head pressure; moisture may cause ice blockage at the expansion valve; moisture and refrigerant may react to form an acid. This acid may cause copper plating of the bearing surfaces and eventual compressor failure.

a. Equipment Needed

1. **Vacuum Pump –** A good vacuum pump (3 to 5 cfm volume displacement, at atmospheric pressure) A pump of this capacity is available through the Carrier Service Parts, CTD P/N 07-00176-01.

2. **Thermistor Vacuum Gauge –** A thermistor vacuum gauge (electronic vacuum gauge) measures the low absolute pressures necessary to remove moisture from the system. *A compound gauge (manifold gauge set) is not recommended because of it's inherent inaccuracy.* A vacuum gauge is available from a refrigeration supplier.

3. **Evacuation Hoses –** Three 3/8" evacuation hoses, the length to be determined by the application of the service set-up. 3/8 to 1/4 adapter connector are also needed to make compressor connections. (Evacuation hoses and adapters are available from your local refrig-

eration supplier.) Do not use standard refrigeration hoses to evacuate. These standard hoses are designed for pressure not vacuum and may collapse during evacuation.

4. **Recovery System –** A refrigerant recovery system is recommended for removing the refrigerant.

5. **Evacuation Manifold –** A evacuation manifold is recommended for connecting the equipment needed for a proper evacuation. The evacuation manifold can be made easily as shown in Figure 4-3.

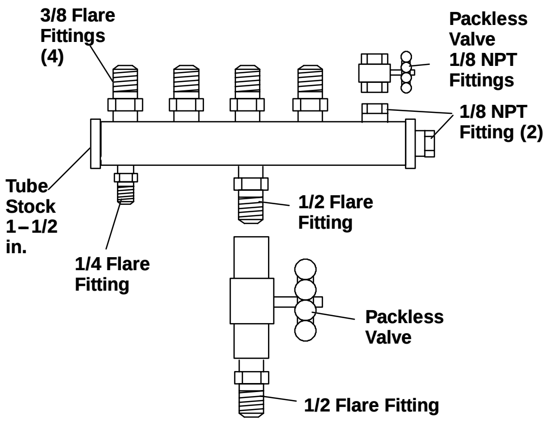


Figure 4-3. Evacuation Manifold

b. Evacuation Procedure

To help speed up the evacuation process and to increase the evaporation of moisture, keep the ambient temperature above 60_F (15.6_C). If ambient temperature is lower than 60_F (15.6_C), ice may form before moisture removal is complete. Heat lamps or alternate sources of heat may be used to raise system temperature if necessary.

a. Before refrigerant removal and evacuation, leak test unit.

b. Remove all remaining refrigerant charge in the system.

c. Connect evacuation manifold, vacuum pump, vacuum gauge, reclaimer and hoses as shown in Figure 4-4. All hand valves on manifold should be closed. The compressor service valves should be midseated if used. The reclaimer valve should be closed.

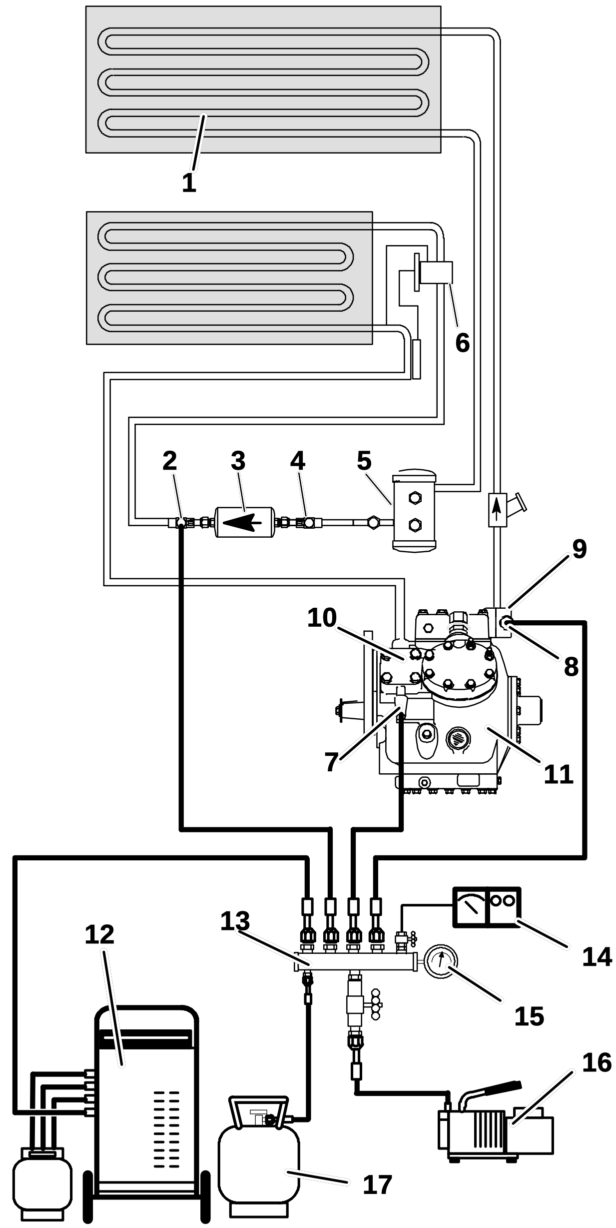
d. Start vacuum pump. Slowly open manifold valve to the pump. Open valve to the vacuum gauge. Evacuate unit until vacuum gauge indicates 1500 microns (29.86 inches = 75.8 cm) Hg vacuum. Close gauge valve, vacuum pump valve, and stop vacuum pump.

e. Open the refrigerant cylinder vapor valve to break the vacuum. Raise the pressure approximately 2 psig. This will absorb any remaining moisture in the system for the second evacuation. Close the cylinder valve.

f. Repeat steps 4 and 5.

g. Evacuate again as described in step 3 to 300–500 microns Hg vacuum.

h. Charge the system to specifications through the refrigerant recovery machine (using manufactures charging procedure) or as outlined in the following section 4.8 (Charging the Refrigeration System).



1. Condenser Coil
2. Filter-Drier Outlet Service Valve
3. Filter-Drier
4. Filter-Drier Inlet Service Valve
5. Receiver
6. Thermostatic Expansion Valve
7. Suction Service Port
8. Discharge Service Port
9. Discharge Service Valve
10. Suction Service Valve
11. Compressor
12. Reclaimer
13. Vacuum Manifold
14. Thermistor Vacuum Gauge
15. Compound Gauge
16. Vacuum Pump
17. Refrigerant Cylinder

Figure 4-4. Evacuation Set-Up

4.8 ADDING REFRIGERANT TO SYSTEM

a. Installing a Full Charge

a. Install a manifold gauge set as outlined in section 4-3.

b. Evacuate and dehydrate the system as outlined in section 4.7 if not completed at this time.

c. Place the appropriate refrigerant cylinder (R-22 or 134a) on the scale and connect charging line from the cylinder to the filter-drier inlet valve. Purge charging line at valve.

d. Note weight of refrigerant cylinder.

e. Open liquid valve on refrigerant cylinder. Open filter-drier inlet valve half way and allow the liquid refrigerant to flow into the unit. Monitor weight of refrigerant cylinder to determine how much refrigerant is entering the system. The correct charge is 17 lbs.

f. When refrigerant cylinder weight (scale) indicates that the correct charge has been added, close liquid line valve at the cylinder and backseat the filter-drier inlet valve. Disconnect lines. Check refrigerant charge.

If the entire charge cannot be added, a partial charge may be necessary.

b. Adding a Partial Charge

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

b. Place the appropriate refrigerant container (R-22 or 134a) on the scale and connect charging hose from refrigerant cylinder vapor valve to the compressor suction service valve or the drop tube service port. Purge charging line.

d. Open the refrigerant cylinder vapor valve. Midseat suction valve (if used) and monitor the weight of the cylinder to add the remaining refrigerant. Disconnect cylinder.

4.9 CHECKING THE REFRIGERANT CHARGE

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

1. Bus engine operating at high idle.
2. Unit operation in cool mode for 15 minutes.
3. Head pressure at least 250 psig. for R-22 systems or 150 psig. for 134a systems. (It may be necessary to block condenser air flow to raise head pressure.)

a. Under the above conditions, the system is properly charged when the bottom receiver sight glass appears half full with refrigerant. If the bottom sight glass is not half full, add or delete refrigerant charge to the proper level.

4.10 FILTER-DRIER REMOVAL

If the sight glass on the receiver appears to be flashing or excessive bubbles are constantly moving through the sight glass, the unit may have a low refrigerant charge, or the filter-drier could be partially plugged.

If a pressure drop across the filter-drier is indicated or the moisture-indicator may show an abnormal (wet) condition, the filter-drier must be changed.

a. Check for a restricted filter. Backseat the inlet and outlet valves of the filter-drier and attach the gauge manifold set. Midseat both valve and start unit. Observe the pressure reading. If a pressure drop of more than 10 psig is indicated the filter is plugged and must be changed.

b. Pump down the system as outlined in section 4.4.

c. Turn the driver’s A/C switch and rear control switch the “OFF” position.

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

e. Using two open end wrenches, slowly crack open the flare nuts on each side of the filter-drier. After remaining refrigerant has escaped, remove the filter-drier.

CAUTION

The filter-drier may contain liquid refrigerant. Slowly open the flare nuts and avoid contact with exposed skin or eyes.

f. Remove seal caps from the new filter-drier. Apply a light coat of compressor oil to the flares.

g. Assemble the new filter-drier to lines ensuring that the arrow on the body of the filter-drier points in the direction of the refrigerant flow (refrigerant flows from right to left as viewed). Finger tighten flare nuts.

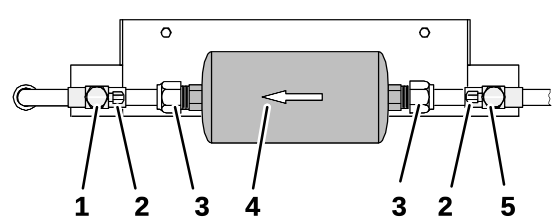
h. Tighten filter-drier inlet line flare nut using two open end wrenches.

i. Open the filter-drier inlet liquid line valve slowly to purge the filter-drier momentarily. Tighten the outlet flare nut using two open end wrenches.

j. Immediately backseat (fully close both service valve ports and replace valve caps.

k. Test filter-drier for leaks.

l. Check refrigerant level.



1. Filter-Drier Outlet Liquid Line Valve
2. Valve Service Port
3. Flare Nut
4. Filter-Drier
5. Filter-Drier Inlet Liquid Line Valve

Figure 4-5. Filter Drier Removal

4.11 CHECKING PRESSURE SWITCHES

The recommended procedure for testing the High Pressure Switch (HPS), Low Pressure Switch (LPS), Condenser Fan Speed Switch (CFS), and Unloader Pressure Switches #2 & #3 (UPS2 & UPS3) is to remove the the switch from the unit and bench tested as described in the following procedure.

All pressure switches are threaded into positive shut off connections (schrader) to allow easy removal and installation without pumping down or removing refrigerant from the unit. All wire leads to the switches are quick disconnects.

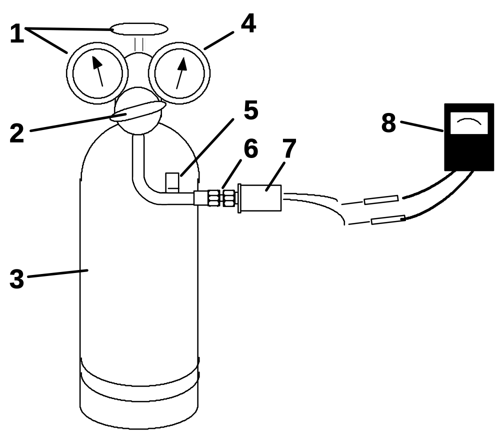
The High Pressure switch (black wire leads) and Low Pressure switch (red wire leads) are located on the compressor. The Condenser Fan Speed switch (gray wire leads) and the Unloader Pressure switch #3 (white wire leads) are located on the discharge line above the curbside evaporator fan blower assembly. The Unloader Pressure switch #2 (tan wire leads) is located on the suction line behind the curbside return air grille.

If the switch does not function as described below, the switch is defective and should be replaced.

a. Remove switch from the unit.

b. Connect an ohmmeter across switch leads (with no pressure applied to the switch). A continuity reading should indicate a closed switch. If the switch is good, continue.

c. Connect switch to a cylinder of dry nitrogen as shown in Figure 4-6.



1. Cylinder Valve and Gauge
2. Pressure Regulator
3. Nitrogen Cylinder
4. Pressure Gauge (0 to 500 psig = 0 to 36 kg/cm@)
5. Bleed-Off Valve
6. 1/4 inch Connection
7. High or Low Pressure Switch
8. Ohmmeter

Figure 4-6. Checking High Pressure Switch

WARNING

Do not use a nitrogen cylinder without a pressure regulator. Cylinder pressure is approximately 2350 psi (165 kg/cm@). Do not use oxygen in or near a refrigeration system as an explosion may occur.

d. Back-off regulator adjustment completely. Open the cylinder valve.

e. Slowly open the regulator valve to increase the pressure to the applicable pressures listed in Table 4-1 open or close the switch. If the ohmmeter reading does not correspond with the pressure listed in Table 4-1, the switch is defective and should be replaced.

f. Close cylinder valve and release the pressure through the bleed-off valve. As the pressure drops, the applicable switch will open or close. If the ohmmeter reading does not correspond with the pressure listed in Table 4-1, the switch is defective and should be replaced.

Table 4-1. Pressure Switch Continuity Check

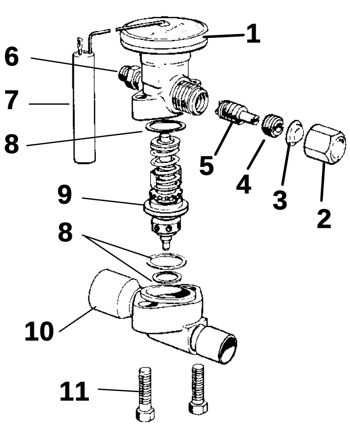
	Ohmmeter Reading	
	No Continuity	Continuity
	Opens at	Closes at
R-22 Switches		
High Pressure (HPS)	425 ± 10 psig	300 ± 10 psig
Low Pressure (LPS)	6 ± 3 psig	25 ± 3 psig
Condenser Fan Speed (CFS)	360 ± 10 psig	285 ± 15 psig
Unloader Pressure #1 (UPS1)	66 ± 2 psig	54 ± 2 psig
Unloader Pressure #2 (UPS2)	65 ± 5 psig	50 ± 3 psig
Unloader Pressure #3 (UPS3)	325 ± 15 psig	400 ± 10 psig
134A Switches		
High Pressure (HPS)	300 ± 10 psig	200 ± 10 psig
Low Pressure (LPS)	6 ± 3 psig	25 ± 3 psig
Condenser Fan Speed (CFS)	250 ± 10 psig	190 ± 15 psig
Unloader Pressure #1 (UPS1)	35 ± 2 psig	26 ± 2 psig
Unloader Pressure #2 (UPS2)	40 ± 5 psig	23 ± 3 psig
Unloader Pressure #3 (UPS3)	220 ± 15 psig	270 ± 10 psig

4.12 THERMOSTATIC EXPANSION VALVE

The thermal expansion valve is an automatic device which maintains constant superheat of the refrigerant gas leaving the evaporator regardless of suction pressure. The valve functions are: (a) automatic 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

1. Pump down the unit. (Refer to section 4.4)
2. Remove left return air access panel.
3. Remove insulation (Presstite) from expansion valve bulb and remove from suction line.
4. Loosen flare nut and disconnect equalizer line from expansion valve.
5. Remove flange screws and lift off power head and cage assemblies. Check for foreign material in valve body.
6. Install new gaskets and assemble new cage and power head assemblies.
7. Attach the sensor bulb just below center of the suction line (4 or 7 o'clock position viewing from cross section to the suction line, see Figure 4-8). This area must be clean to ensure positive bulb contact. Do not insulate the bulb until the superheat is measured.
8. Fasten equalizer tube to expansion valve.
9. Evacuate by placing vacuum pump on the compressor suction service valve port or suction drop tube port (located in the engine compartment).
10. Open the inlet service valve to the filter-drier. Check refrigerant level. (Refer to paragraphs 4.5 and 4-9.)
11. Check superheat.



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

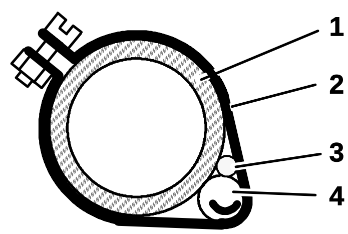
Figure 4-7. Thermostatic Expansion Valve

b. To Measure Superheat

NOTE

When conducting this test the suction pressure must be at least 6 psig (.42 kg/cm@) below the expansion valve maximum operating pressure (MOP). Refer to section 1.2.d for applicable valve settings.

1. Remove insulation from sensor bulb and suction line if installed..
2. Loosen one bulb clamp and make sure area under clamp is clean.
3. Place the temperature thermocouple above (parallel) TXV bulb and tighten loosened clamp making sure both bulbs are firmly secured to suction line as shown in Figure 4-8. Place insulation around TXV bulb and thermocouple.
4. Connect suction gauge to the service port located on the suction line near the valve.
5. Set temperature selector to lowest setting. Run unit for at least 20 minutes to stabilize the system.
6. Using the temperature/pressure chart (Table 4-2 or Table 4-3) for the applicable refrigerant used, determine the saturation temperature corresponding to the pressure taken at the suction service valve.
7. Note the temperature of the suction gas at the sensor bulb.
8. Subtract the saturation temperature determined in Step 6 from the average temperature measured in Step 7. The difference is the superheat of the suction gas.



1. Suction Line (end view)
2. Clamp
3. Thermocouple
4. TXV Sensor Bulb

Figure 4-8. Thermostatic Expansion Valve Bulb and Thermocouple

c. Adjusting Superheat

Refer to section 1.2.d for the superheat setting.

The thermostatic expansion valve used in this application is externally adjustable. The valve is preset at the factory and should not be adjusted unnecessarily. If necessary to adjust the superheat, proceed as follows:

1. Remove the seal cap to gain access to the superheat adjusting stem (see Figure 4-7).

2. Turn the adjusting stem clockwise to compress the valve spring which will decrease refrigerant flow through the valve, increasing superheat. Turn the adjusting stem counterclockwise to decompress the valve spring which will increase refrigerant flow through the valve, decreasing superheat.

3. When the unit has stabilized operation for at least 20 minutes, recheck superheat setting.

4. If superheat setting is correct, replace stem cap, remove gauge and thermocouple. Insulate bulb and suction line.

4.13 REMOVING THE HEATER COIL

a.. Disconnect the bus battery.

b. Remove evaporator motor and heater coil access panels.

c. Open the air vent fitting at the top of the outlet header of the heater coil to bleed.

d. Open the drain-cock on the coolant inlet tube to drain coil.

e. Remove both evaporator fan motor assemblies with mounting brackets (refer to section 4.16).

f. Disconnect hoses from the coil.

g. Disconnect and remove coolant solenoid valve assembly from the unit.

CAUTION

If unit was recently operating, be careful of remaining hot coolant in the hoses when disassembling.

h. Remove coil retaining bolts on each side of the coil assembly (three each side). Pull top of coil assembly forward and down to remove from unit.

i. Reverse procedure for installing new heater coil assembly.

4.14 SERVICING THE REHEAT COOLANT VALVE

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

To service the valve includes replacement of the internal parts shown in Figure 4-9 or the entire valve.

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

Coil burnout may be caused by the following:

1. Improper voltage.
2. Continuous over-voltage, more than 10% or Under-voltage of more than 15%.
3. Incomplete magnetic circuit due to the omission of the coil housing or plunger.
4. Mechanical interference with movement of plunger which may be caused by a deformed enclosing tube.

Failure to open may be caused by the following:

1. Coil burned out or an open circuit to coil connections.
2. Improper voltage.
3. Torn diaphragm.
4. Defective plunger or deformed valve body assembly.

Failure to close may be caused by the following:

1. Defective plunger or deformed valve body assembly.
2. Foreign material in the valve.

a. To replace a burnout coil, it is not necessary to drain the coolant from the system.

1. Place the rear control switch in the “OFF” position.
2. Disconnect wire leads to coil.
3. Remove coil retaining screw and nameplate.
4. Lift burned-out coil from enclosing coil assembly and replace.
5. Connect wire leads and test operation.

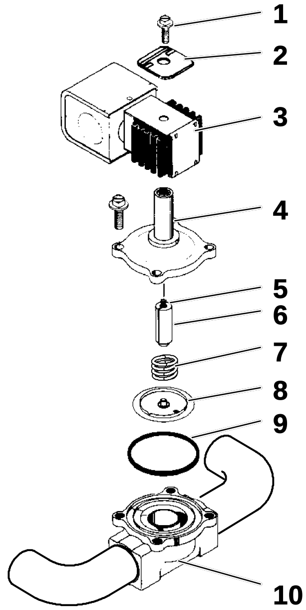
b. To replace the internal parts of the valve:

1. Place the rear control switch in the “OFF” position.
2. Open the vent fitting at the top of the outlet header of the heater coil.
3. Drain coil by opening the drain-cock on the inlet tube.
4. Disassemble valve and replace defective parts.
5. Assemble valve and connect coolant hoses.

c. To replace the entire valve:

1. Drain coolant system and disconnect hoses to valve as previously described.
2. Disconnect wire leads to coil.
3. Remove valve assembly from bracket.
4. Install new valve and re-connect hoses. It is not necessary to disassembly the valve when installing.

5. Fill system with coolant and bleed air through the vent fitting.
6. Connect wire leads and test operation.



1. Coil Retaining Screw
2. Nameplate
3. Coil Housing Assembly
4. Enclosing Tube & Bonnett Assembly
5. Kick-Off Spring
6. Plunger
7. Closing Spring
8. Diaphragm
9. O-Ring
10. Valve Body

Figure 4-9. Reheat Coolant Valve Assembly

4.15 REMOVING THE CONDENSER FAN MOTOR

When removing or installing the condenser fan motor, the fan blade must be remove to prevent any damage to the condenser coil.

a. Remove fan blade guard.

b. Using 5/16 ratchet or equivalent, loosen the two retaining screws in the fan blade hub. The fan blade will sit on the shaft of the motor.

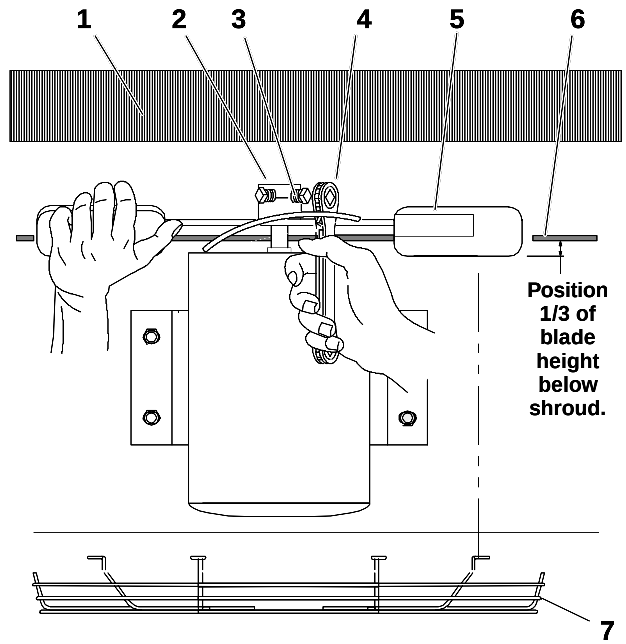
c. Remove the four motor mounting bolts from the bracket.

d. Remove the motor by sliding the motor down and out from the fan blade and unit. Remove blade.

e. Using a adhesive, secure the shaft key to the serviced motor shaft or fan hub slot.

e. When installing the motor, secure the fan blade above the shroud before mounting the motor. Align the motor shaft through the fan blade hub and secure motor mounting bolts.

f. Position the fan blade 1/3 (the height of blade) below the shroud, tighten the two retaining screws in the fan hub.



1. Condenser Coil
2. Fan Blade Hub
3. Retaining Set Screw
4. 5/16 Ratchet Wrench
5. Fan Blade
6. Shroud
7. Fan Blade Guard

Figure 4-10. Condenser Fan Motor Removal

4.16 SERVICING THE EVAPORATOR FAN BLOWER MOTOR ASSEMBLY

a. Removing and Disassembling

1. Switch the rear control switch to the OFF position.

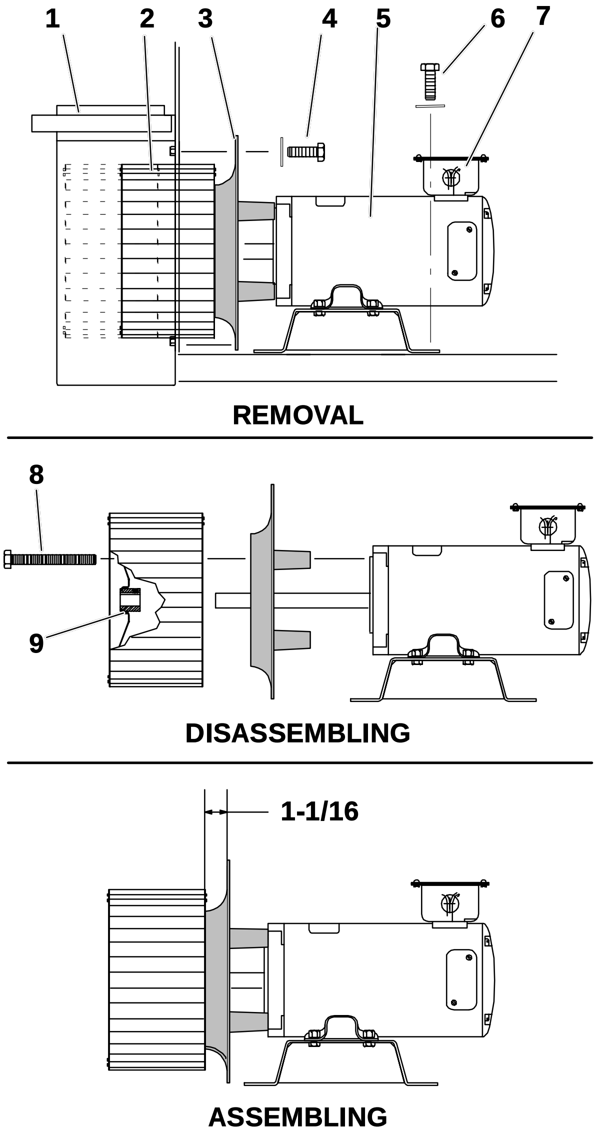
2. Disconnect the wire leads to the junction box of the motor. Mark the leads for proper reassembly. It is not necessary to disconnect the wire leads when moving the motor assembly to replace the heater coil.

3. Remove motor mounting bolts to the bottom panel.

4. Remove the four shroud mounting bolts. Slide assembly out of the blower housing.

5. Loosen the two blower hub set screws to remove blower. Remove four shroud retaining bolts to the motor housing to remove shroud.

6. To reassemble, reverse the above procedure. Position blower 1-1/16 inch from inside blower edge to shroud flange (see Figure 4-11).



1. Blower Housing
2. Fan Blower
3. Shroud
4. Shroud Mounting Bolt
5. Evaporator Motor
6. Mounting Bolt
7. Wire Junction Box
8. Shroud/Motor Retaining Bolt
9. Hub Set Screw

Figure 4-11. Evaporator Fan Blower Removal

4.16.1 Routine Examination and Cleaning

a. At regular maintenance periods, remove brush covers and clean and examine motor interior.

b. Remove all foreign material, such as dirt and carbon dust from with dry compressed air. Clean by suction if possible to avoid blowing foreign matter into the motor.

c. Confirm free moving brushes to prevent binding.

d. Examine brush wear and general condition. If brushes are broken, cracked, severely chipped, or worn to 1/3 the length of a new brush, replace them. Refer to section 4.16.2.

e. Examine the condition of the brush springs. A discolored spring is a sign of overheating which may weaken the spring, in which case the spring should be replaced.

f. Observe the condition of the commutator and the armature coils that are visible.

4.16.2 Brush Replacement

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

a.. Remove brush covers.

b. With fingers or 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 brush.

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

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

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

f. Tighten the brush screw.

4.17 REPLACING THE RETURN AIR FILTERS

The return air filters are located in front of the evaporator coil. Access to the filters is through the return air opening inside the bus.

The filters should be checked periodically depending on operating conditions for cleanliness. A dirty air filter will restrict the air flow over the evaporator coil. This could cause insufficient cooling or heat and possible frost build up on the coil.

Remove filters as follows:

a. Turn the rear control switch to OFF.

b. Remove the two return air grille.

c. Loosen the filter retaining clips.

d. Pull the first filter forward and out through the return air opening.

e. Slide the second filter past the holding channel to the right position and remove

f. Repeat the above step with the third filter.

g. Reverse the procedure for installing the new filters.

4.18 COMPRESSOR

4.18.1 Replacing the Compressor

a. Removing

1. If compressor is inoperative and refrigerant pressure still exists, frontseat the suction and discharge service valves to isolate most of the refrigerant in the system from the compressor.

If the compressor runs, pump down the compressor by frontseating the suction service valve until the pressure drops to 1 psig, then stop the unit.

2. Slowly release compressor pressure to a recovery system.

3. Remove the suction and discharge service valves and disconnect the high and low pressure switches (HPS & LPS).

4. Loosen the compressor to allow removal of all belts from the compressor.

5. Disconnect the wire connections to the unloader.

6. Attach sling or other device to compressor to remove. The compressor weighs approximately 146 lbs.

7. Remove the clutch from the compressor.

NOTE

If the compressor is to be returned to the factory, drain oil from defective compressor before shipping.

b. Installing

NOTE

It is important to check the compressor oil level of the new compressor and fill if necessary.

1. 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 cap screw into top of piston. A small Teflon seat ring at bottom of piston must be removed.

NOTE

The service replacement compressor is sold without shutoff valves (but with valve pads). These should be placed on the old compressor before shipping. Check oil level in service replacement compressor. If none add the applicable amount outlined in section 1.2.b.

2. Remove the high pressure switch and install on new compressor after checking switch setting (refer to section 4.11).

3. Install compressor in unit by reversing step 4.18.a. It is recommended using new locknuts when replacing compressor. Install new gaskets on service valves and tighten bolts uniformly.

4. 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.

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

6. Remove vacuum pump lines and install manifold gauges.

7. Start unit and check for noncondensibles

8. Check refrigerant level and add if necessary.

9. Check compressor oil level (refer to section 4.18.2). Add oil if necessary.

10. Check compressor unloader operation.

11. Check refrigerant cycles.

4.18.2 Checking the Compressor Oil Level

a. Operate the unit in high idle cooling for at least 20 minutes.

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 adding oil.

c. Check the level of the oil in the sight glass with the compressor operating. The correct level should be between 1/4 and 1/2 of the sight glass. If the level is above 1/2, oil must be removed from the compressor. If the level is below 1/8, add oil to the compressor as outlined in the following section.

4.18.3 Adding Oil to the Installed Compressor

CAUTION

The appropriate compressor oil must be used according to the refrigerant used in the system. (Refer to section 1.2.b.)

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

a. Oil Pump Method

1. Connect an oil pump to a one U.S. gallon (3.785 liters) refrigeration oil container. Using the Robinair compressor oil pump (Carrier Transicold P/N 14388) is recommended.

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.

2. Backseat suction service valve and connect oil charging hose to port. Crack the service valve and purge the oil hose at oil pump. Add oil as necessary.

b. Closed System Method

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 the manifold common connection remains immersed in oil at all times. Otherwise air and moisture will be drawn into the compressor.

1. Connect manifold gauge set. Place center charging line into compressor oil container as shown in Figure 4-12. Slowly open discharge hand valve to purge line, then close.

2. Frontseat the suction service valve and place a jumper wire on the low pressure switch to by-pass the switch.

3. Start unit and pull crankcase pressure until suction pressure gauge indicates 5 inches/hg. Shut down unit.

4. Crack open manifold valve and allow vacuum in compressor to draw oil slowly into compressor. When level is just above one quarter glass, close manifold valve. Midseat the suction service valve. Remove the LPS jumper wire.

5. Start unit and check compressor oil level.

6. Backseat valve to remove hose from suction service valve and replace service valve caps.

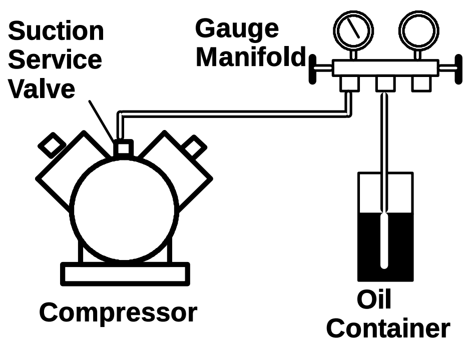


Figure 4-12. Compressor Oil Charge Connections

4.18.4 Adding Oil to Service Replacement Compressor

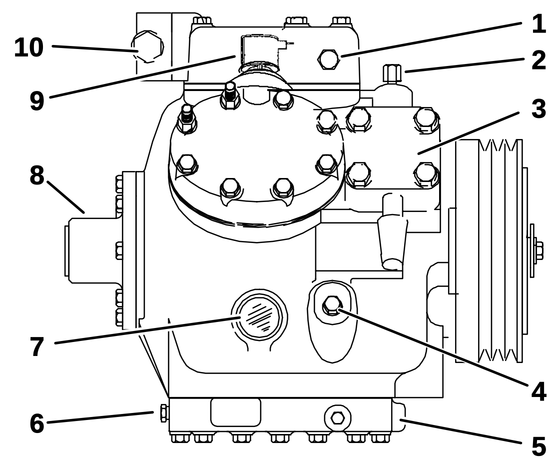
CAUTION

The appropriate compressor oil must be used according to the refrigerant used in the system. (Refer to section 1.2.b.)

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

If compressor is without oil:

Add oil, (paragraph 1.2.b) through the suction service valve flange cavity or by removing the oil fill plug.



1. High Pressure Switch Connection
2. Low Pressure Switch Connection
3. Suction Service Valve
4. Oil Fill Plug
5. Bottom Plate
6. Oil Drain Plug
7. Oil Sight Glass
8. Oil Pump
9. Unloader Solenoid
10. Discharge Service Valve

Figure 4-13. Compressor - Model O5G

a. To Remove Oil From the Compressor

1. If the oil level recorded in step 4.18.2 is above 1/2 of the sight glass, remove oil from the compressor. If at a full sight glass, remove 2-3/4 pints of oil from the compressor to lower the level to 1/2 of the sight glass.

2. Connect manifold gauges to the compressor.

3. Close suction service valve (frontseat) and pump unit down to 2 to 4 psig (1.4 to 2.8 kg/cm@). Frontseat discharge service valve and slowly bleed remaining refrigerant.

4. 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.

5. Repeat paragraph a.1. to ensure proper oil level.

NOTE

Before opening up any part of the system, *a slight positive pressure should be indicated on both gauges.* If a vacuum is indicated, emit refrigerant by cracking receiver outlet valve momentarily to build up a slight positive pressure.

Table 4-2. R-22 Temperature-Pressure Chart

TEMPERATURE		PRESSURE			TEMPERATURE		PRESSURE		
_F	_C	Psig	Kg/cm@	Bar	_F	_C	Psig	Kg/cm@	Bar
−40	−40	.6	.04	.04	34	1	60.5	4.25	4.17
−36	−38	2.3	.16	.16	36	2	63.3	4.45	4.36
−32	−36	4.1	.29	.28	38	3	66.1	4.65	4.56
−28	−33	6.0	.42	.41	40	4	69	4.85	4.76
−26	−32	7.0	.49	.48	44	7	75.0	5.27	5.17
−24	−31	8.1	.57	.56	48	9	81.4	5.72	5.61
−22	−30	9.2	.65	.63	52	11	88.1	6.19	6.07
−20	−29	10.3	.72	.71	54	12	91.5	6.43	6.31
−18	−28	11.5	.81	.79	60	16	102.5	7.21	7.07
−16	−27	12.7	.89	.88	64	18	110.2	7.75	7.6
−14	−26	14.0	.98	.97	68	20	118.3	8.32	8.16
−12	−24	15.2	1.07	1.05	72	22	126.8	8.91	8.74
−10	−23	16.6	1.17	1.14	76	24	135.7	9.54	9.36
−8	−22	18.0	1.27	1.24	80	27	145	10.19	10.0
−6	−21	19.4	1.36	1.34	84	29	154.7	10.88	10.67
−4	−20	21.0	1.48	1.45	88	31	164.9	11.59	11.37
−2	−19	22.5	1.58	1.55	92	33	175.4	12.33	12.09
0	−18	24.1	1.69	1.66	96	36	186.5	13.11	12.86
2	−17	25.7	1.81	1.77	100	38	197.9	13.91	13.64
4	−16	27.4	1.93	1.89	104	40	209.9	14.76	14.47
6	−14	29.2	2.05	2.01	108	42	222.3	15.63	15.33
8	−13	31.0	2.18	2.14	112	44	235.2	16.54	16.22
10	−12	32.9	2.31	2.27	116	47	248.7	17.49	17.15
12	−11	34.9	2.45	2.41	120	49	262.6	18.46	18.11
14	−10	36.9	2.59	2.54	124	51	277.0	19.48	19.10
16	−9	39.0	2.74	2.69	128	53	291.8	20.52	20.12
18	−8	41.1	2.89	2.83	132	56	307.1	21.59	21.17
20	−7	43.3	3.04	2.99	136	58	323.6	22.75	22.31
22	−6	45.5	3.2	3.14	140	60	341.3	24.0	23.53
24	−4	47.9	3.37	3.3	144	62	359.4	25.27	24.78
26	−3	50.2	3.53	3.46	148	64	377.9	26.57	26.06
28	−2	52.7	3.71	3.63	152	67	396.6	27.88	27.34
30	−1	55.2	3.88	3.81	156	69	415.6	29.22	28.65
32	0	57.8	4.06	3.99	160	71	434.6	30.56	29.96

Table 4-3. R-134a Temperature−Pressure Chart

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

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

SECTION 5
ELECTRICAL SCHEMATIC WIRING DIAGRAM

5.1 INTRODUCTION

This section contains Electrical Schematic Wiring Diagrams covering the Models listed in Table 1-1.

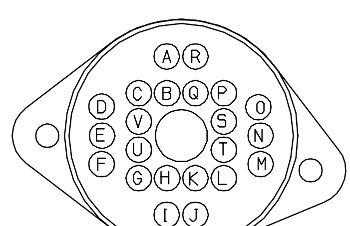
LEGEND

SYMBOL	DESCRIPTION
ACHM	A/C HOURMETER (OPTIONAL)
ACMS	A/C MODE SWITCH
ACR	A/C RELAY
ACSR1	A/C STOP RELAY #1
ACSR2	A/C STOP RELAY #2
BPM	BOOST PUMP MOTOR
BPR	BOOST PUMP RELAY
CB1	15A CIRCUIT BREAKER (WATER PUMP RELAY)
CB2	40A CIRCUIT BREAKER (EVAP MOTOR #2)
CB3	40A CIRCUIT BREAKER (EVAP MOTOR #1 AND 2)
CB4	60A CIRCUIT BREAKER (COND MOTOR #1)
CB5	60A CIRCUIT BREAKER (COND MOTOR #2)
CB6	10A CIRCUIT BREAKER (CLUTCH)
CFS	CONDENSER FAN SPEED SWITCH (360 PSI)
CL	CLUTCH
CM1	CONDENSER FAN MOTOR #1
CM2	CONDENSER FAN MOTOR #2
CR	CLUTCH RELAY
D1-D27	DIODE #1 - DIODE #27
DFS	DEFROST SWITCH (OPTIONAL)
ECS	ENGINE COOLANT SWITCH (OPTIONAL)
EM1	EVAPORATOR FAN MOTOR #1
EM2	EVAPORATOR FAN MOTOR #2
FR	FAULT RELAY
HPS	HIGH PRESSURE SWITCH
HR	HEAT RELAY
HR2	HEAT RELAY #2
LATH	LOW AMBIENT THERMOSTAT (OPTIONAL)
LPS	LOW PRESSURE SWITCH
PTB	POWER TERMINAL BLOCK
RCV	REHEAT COOLANT VALVE
TH	ELECTRONIC THERMOSTAT
UPS1	UNLOADER PRESSURE SWITCH #1
UPS2	UNLOADER PRESSURE SWITCH #2
UPS3	UNLOADER PRESSURE SWITCH #3
UV1	UNLOADER VALVE #1
UV2	UNLOADER VALVE #2

D2	INDICATES PLUG LOCATION ON RELAY BOARD
GRD	INDICATES A WIRE GROUND
	INDICATES CUSTOMER SUPPLIED COMPONENTS & WIRING
	INDICATES A CONNECTION (LUG,SCREW ETC.)
	INDICATES A CONNECTOR
	INDICATES A NORMALLY OPEN CONTACT
	INDICATES A NORMALLY CLOSED CONTACT
L	INDICATES BUS INTERFACE CONNECTOR PIN LOCATION
	INDICATES RELAY BOARD TRACE

NOTES:

1. UNIT SHOWN IS IN THE OFF POSITION.
2. RELAY CONTACTS SHOWN ARE IN THEIR NORMAL UNENERGIZED POSITION.
3. ADDRESS SYSTEM EXAMPLE: CFR22-CM2A2 INDICATES A WIRE BETWEEN COND. FAN RELAY #2 TERMINAL #2 AND COND. MOTOR #2 TERMINAL A2.
4. WIRE IDENTIFICATION SYSTEM:
   COLORS: WHITE - DC CONTROL CIRCUIT
   GREEN - GROUND
   YELLOW - OPTIONAL CIRCUITS
5. UNIT TO BE SET UP FOR REHEAT MODE OF OPERATION.
6. UNIT RUNS IN HIGH SPEED ALL THE TIME EXCEPT IN HEAT MODE.



22 PIN CONNECTOR
WIRING SIDE

Figure 5-1. Electrical Schematic Wiring Diagram, 4-Mode Selector Switch & Rotron Motors Dwg. No. 68RM35-1038-4 Rev D (Sheet 1 of 2)

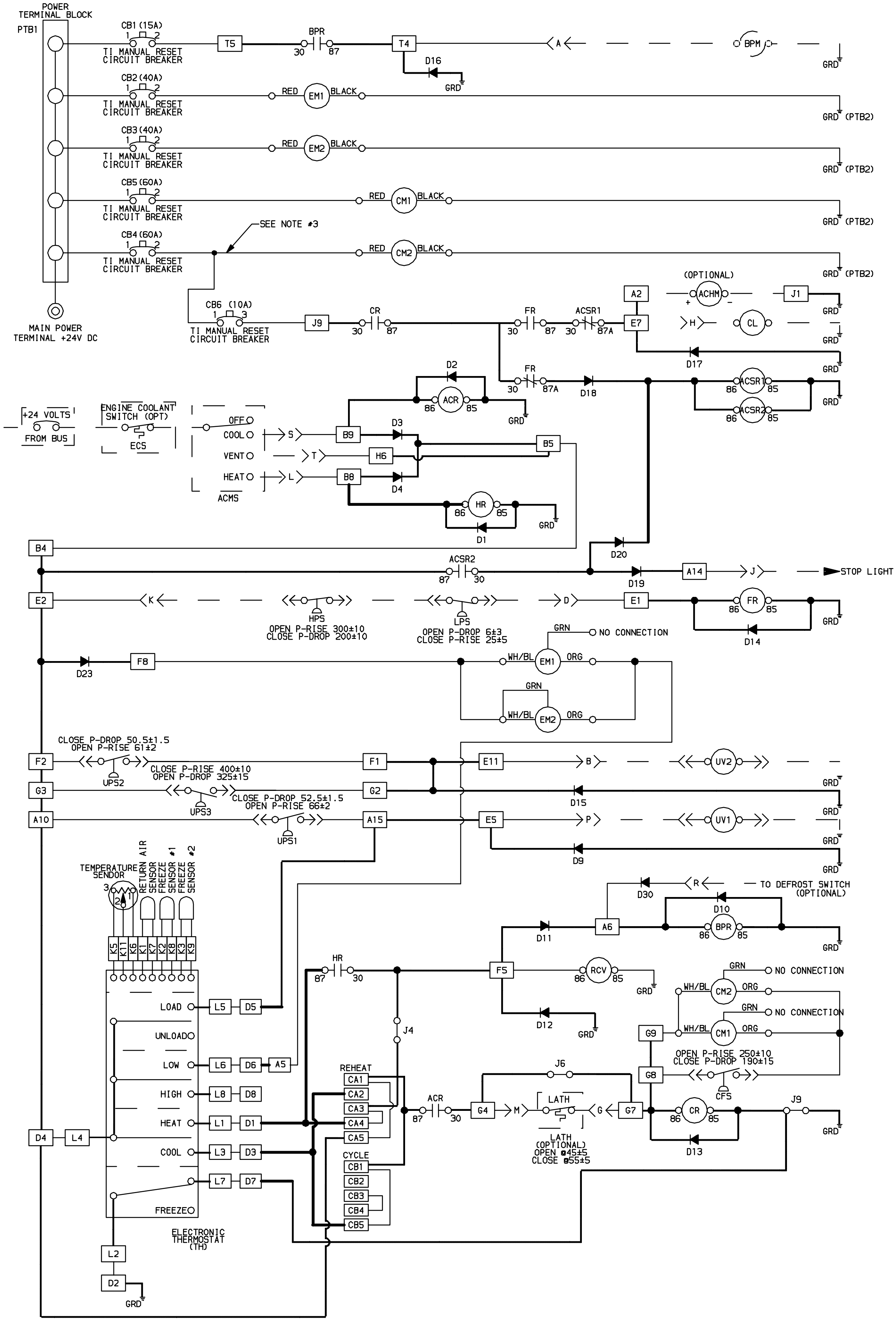


Figure 5-1. Electrical Schematic Wiring Diagram, 4-Mode Selector Switch & Rotron Motors Dwg. No. 68RM35-1038-4 Rev D (Sheet 2 of 2)

LEGEND

SYMBOL	DESCRIPTION
ACHM	A/C HOURMETER (OPTIONAL)
ACMS	A/C MODE SWITCH
ACS	A/C SWITCH (OFF-ON)
ACSR1	A/C STOP RELAY #1
ACSR2	A/C STOP RELAY #2
AHR	AUTOMATIC HEAT RELAY
BPR	BOOST PUMP RELAY
CB1	15A CIRCUIT BREAKER (WATER PUMP RELAY)
CB2	35A CIRCUIT BREAKER (EVAP MOTOR #2)
CB3	35A CIRCUIT BREAKER (EVAP MOTOR #1 AND 2)
CB4	70A CIRCUIT BREAKER (COND MOTOR #1)
CB5	70A CIRCUIT BREAKER (COND MOTOR #2)
CB6	10A CIRCUIT BREAKER (CLUTCH)
CFR1	CONDENSER FAN RELAY #1
CFR2	CONDENSER FAN RELAY #2
CFS	CONDENSER FAN SPEED SWITCH (360 PSI)
CL	CLUTCH
CM1	CONDENSER FAN MOTOR #1
CM2	CONDENSER FAN MOTOR #2
COL1	CONDENSER OVERLOAD #1
COL2	CONDENSER OVERLOAD #2
CR	CLUTCH RELAY
CSR1	CONDENSER SPEED RELAY #1
D1-D27	DIODE #1 - DIODE #27
DFS	DEFROST SWITCH (OPTIONAL)
ECS	ENGINE COOLANT SWITCH (OPTIONAL)
EM1	EVAPORATOR FAN MOTOR #1
EM2	EVAPORATOR FAN MOTOR #2
EFR1	EVAPORATOR FAN RELAY #1
EFR2	EVAPORATOR FAN RELAY #2
EOL1	EVAPORATOR OVERLOAD #1
EOL2	EVAPORATOR OVERLOAD #2
ESR	EVAPORATOR SPEED RELAY
ESS	EVAPORATOR SPEED SWITCH
FHV	FLOW HEAT VALVE
FR	FAULT RELAY
HPS	HIGH PRESSURE SWITCH (425 PSI)
ILR	INTERLOCK RELAY
LATH	LOW AMBIENT THERMOSTAT (OPTIONAL)
LPS	LOW PRESSURE SWITCH
LSR	LOW SPEED RELAY
OR1	EVAPORATOR OVERLOAD RELAY #1
OR2	EVAPORATOR OVERLOAD RELAY #2
PTB	POWER TERMINAL BLOCK
RCV	REHEAT COOLANT VALVE
TH	ELECTRONIC THERMOSTAT
TSP	TEMPERATURE SELECTOR POT.
UPS1	UNLOADER PRESSURE SWITCH #1
UPS2	UNLOADER PRESSURE SWITCH #2
UPS3	UNLOADER PRESSURE SWITCH #3
UV1	UNLOADER VALVE #1
UV2	UNLOADER VALVE #2
WPR	WATER PUMP RELAY

D2 INDICATES RELAY BOARD CONNECTION

INDICATES A WIRE GROUND

INDICATES CUSTOMER SUPPLIED COMPONENTS & WIRING

INDICATES A CONNECTION (LUG,SCREW ETC.)

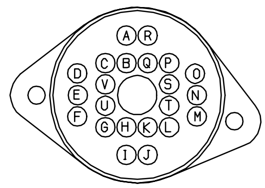
INDICATES A CONNECTOR

INDICATES A NORMALLY OPEN CONTACT

INDICATES A NORMALLY CLOSED CONTACT

L INDICATES BUS INTERFACE CONNECTOR PIN LOCATION

INDICATES RELAY BOARD TRACE



22 PIN CONNECTOR
WIRING SIDE

NOTES:

1. UNIT SHOWN IS IN THE OFF POSITION.
2. RELAY CONTACTS SHOWN ARE IN THEIR NORMAL UNENERGIZED POSITION.
3. ADDRESS SYSTEM EXAMPLE: CFR22-CM2A2 INDICATES A WIRE BETWEEN COND. FAN RELAY #2 TERMINAL #2 AND COND. MOTOR #2 TERMINAL A2.
4. WIRE IDENTIFICATION SYSTEM:
   COLORS: WHITE - DC CONTROL CIRCUIT
   GREEN - GROUND
   YELLOW - OPTIONAL CIRCUITS

Figure 5-2. Electrical Schematic Wiring Diagram, 5-Mode Selector Switch Dwg. No. 68RM35-1038 Rev A (Sheet 1 of 2)

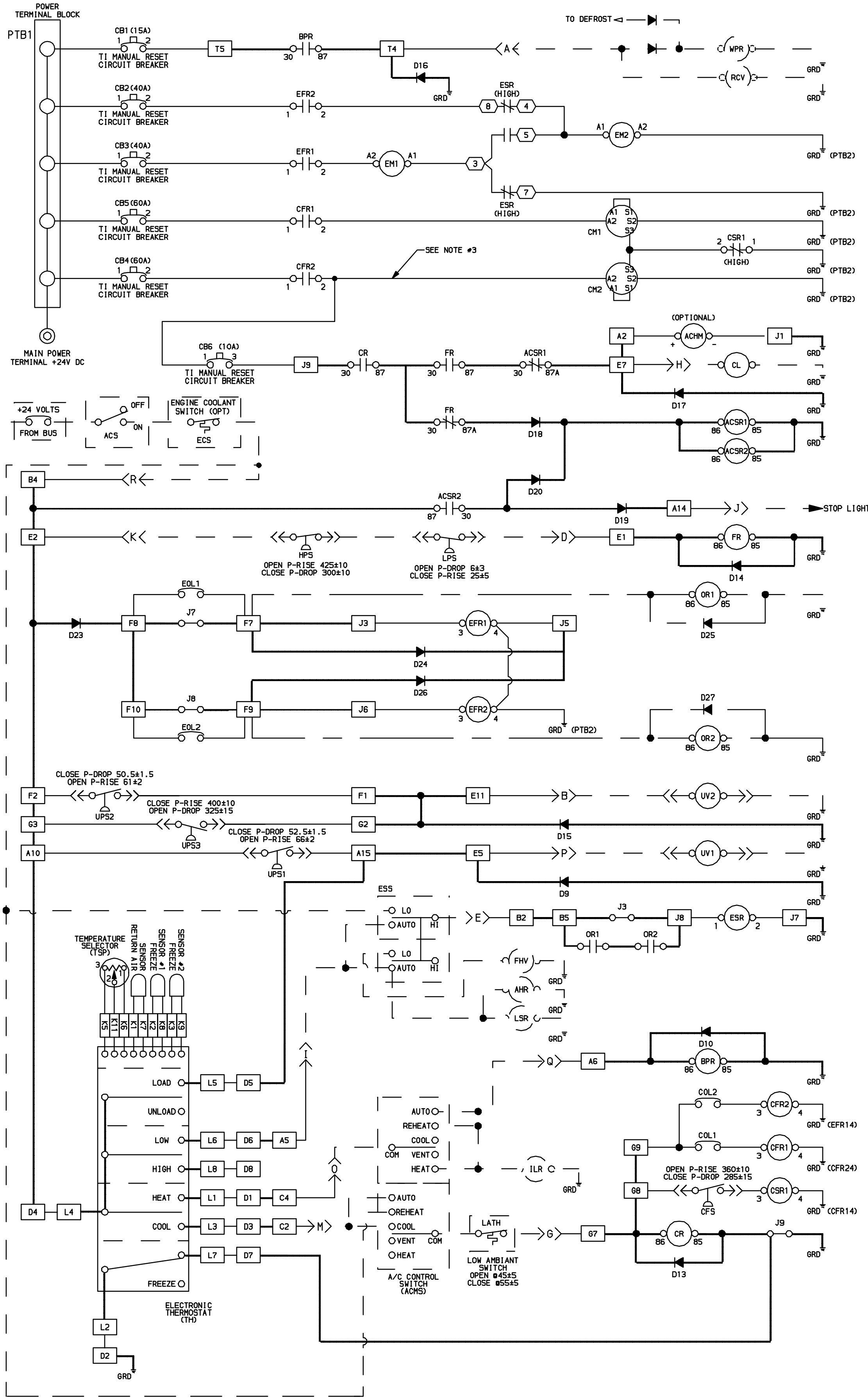


Figure 5-2. Electrical Schematic Wiring Diagram, 5-Mode Selector Switch
Dwg. No. 68RM35-1038 Rev A (Sheet 2 of 2)

LEGEND

SYMBOL	DESCRIPTION
ACHM	A/C HOURMETER (OPTIONAL)
ACS	A/C SWITCH (OFF-ON)
ACSR1	A/C STOP RELAY #1
ACSR2	A/C STOP RELAY #2
BPR	BOOST PUMP RELAY
CB1	15A CIRCUIT BREAKER (WATER PUMP RELAY)
CB2	35A CIRCUIT BREAKER (EVAP MOTOR #2)
CB3	35A CIRCUIT BREAKER (EVAP MOTOR #1 AND 2)
CB4	70A CIRCUIT BREAKER (COND MOTOR #1)
CB5	70A CIRCUIT BREAKER (COND MOTOR #2)
CB6	10A CIRCUIT BREAKER (CLUTCH)
CFS	CONDENSER FAN SPEED SWITCH (360 PSI)
CL	CLUTCH
CM1	CONDENSER FAN MOTOR #1
CM2	CONDENSER FAN MOTOR #2
CR	CLUTCH RELAY
D1-D27	DIODE #1 - DIODE #27
DFS	DEFROST SWITCH (OPTIONAL)
ECS	ENGINE COOLANT SWITCH (OPTIONAL)
EM1	EVAPORATOR FAN MOTOR #1
EM2	EVAPORATOR FAN MOTOR #2
FR	FAULT RELAY
HPS	HIGH PRESSURE SWITCH
LATH	LOW AMBIENT THERMOSTAT (OPTIONAL)
LPS	LOW PRESSURE SWITCH
PTB	POWER TERMINAL BLOCK
RCV	REHEAT COOLANT VALVE
TH	ELECTRONIC THERMOSTAT
UPS1	UNLOADER PRESSURE SWITCH #1
UPS2	UNLOADER PRESSURE SWITCH #2
UPS3	UNLOADER PRESSURE SWITCH #3
UV1	UNLOADER VALVE #1
UV2	UNLOADER VALVE #2
WPR	WATER PUMP RELAY

D2 INDICATES RELAY BOARD CONNECTION

INDICATES A WIRE GROUND

INDICATES CUSTOMER SUPPLIED COMPONENTS & WIRING

INDICATES A CONNECTION (LUG,SCREW ETC.)

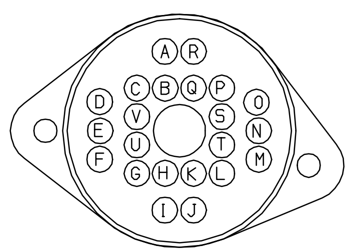
INDICATES A CONNECTOR

INDICATES A NORMALLY OPEN CONTACT

INDICATES A NORMALLY CLOSED CONTACT

L INDICATES BUS INTERFACE CONNECTOR PIN LOCATION

INDICATES RELAY BOARD TRACE



22 PIN CONNECTOR
WIRING SIDE

NOTES:

1. UNIT SHOWN IS IN THE OFF POSITION.
2. RELAY CONTACTS SHOWN ARE IN THEIR NORMAL UNENERGIZED POSITION.
3. ADDRESS SYSTEM EXAMPLE: CFR22-CM2A2 INDICATES A WIRE BETWEEN COND. FAN RELAY #2 TERMINAL #2 AND COND. MOTOR #2 TERMINAL A2.
4. WIRE IDENTIFICATION SYSTEM:
   COLORS: WHITE - DC CONTROL CIRCUIT
   GREEN - GROUND
   YELLOW - OPTIONAL CIRCUITS

Figure 5-3. Electrical Schematic Wiring Diagram, Automatic Operation & Rotron Motors Dwg. No. 68RM35-1038-1 Rev A (Sheet 1 of 2)

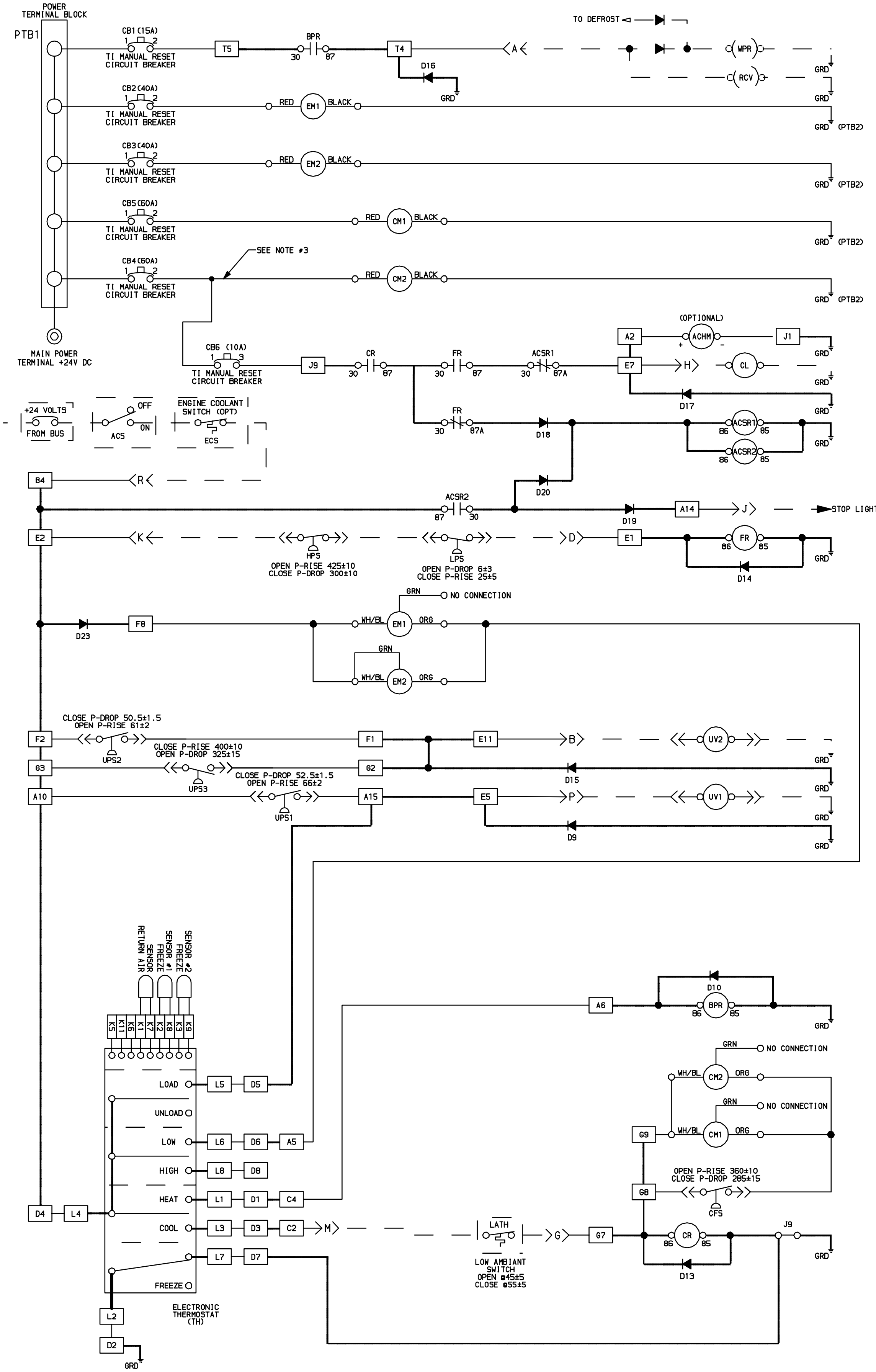
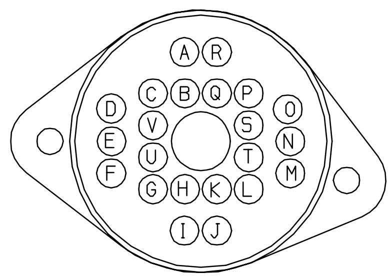


Figure 5-3. Electrical Schematic Wiring Diagram, Automatic Operation & Rotron Motors Dwg. No. 68RM35-1038-1 Rev A (Sheet 2 of 2)

SYMBOL	DESCRIPTION
ACHM	A/C HOURMETER (OPTIONAL)
ACMS	A/C MODE SWITCH
ACS	A/C SWITCH (OFF-ON)
ACSR	A/C STOP RELAY (TIME DELAYED)
BPR	BOOST PUMP RELAY
CB1	15A CIRCUIT BREAKER (WATER PUMP RELAY)
CB2	35A CIRCUIT BREAKER (EVAP MOTOR #2)
CB3	35A CIRCUIT BREAKER (EVAP MOTOR #1 AND 2)
CB4	70A CIRCUIT BREAKER (COND MOTOR #1)
CB5	70A CIRCUIT BREAKER (COND MOTOR #2)
CB6	10A CIRCUIT BREAKER (CLUTCH)
CB7	8A CIRCUIT BREAKER (WATER PUMP)
CFR1	CONDENSER FAN RELAY #1
CFR2	CONDENSER FAN RELAY #2
CFS	CONDENSER FAN SPEED SWITCH (360 PSI)
CL	CLUTCH
CM1	CONDENSER FAN MOTOR #1
CM2	CONDENSER FAN MOTOR #2
COL1	CONDENSER OVERLOAD #1
COL2	CONDENSER OVERLOAD #2
CR	CLUTCH RELAY
CSR1	CONDENSER SPEED RELAY #1
CSR2	CONDENSER SPEED RELAY #2
D1	DIODE #1
D2	DIODE #2
D5	DIODE #5
DFS	DEFROST SWITCH (OPTIONAL)
ECS	ENGINE COOLANT SWITCH (OPTIONAL)
EFM1	EVAPORATOR FAN MOTOR #1
EFM2	EVAPORATOR FAN MOTOR #2
EFR1	EVAPORATOR FAN RELAY #1
EFR2	EVAPORATOR FAN RELAY #2
EOL1	EVAPORATOR OVERLOAD #1
EOL2	EVAPORATOR OVERLOAD #2
ESR	EVAPORATOR SPEED RELAY
ESS	EVAPORATOR SPEED SWITCH
FR	FAULT RELAY
HPS	HIGH PRESSURE SWITCH (425 PSI)
LATH	LOW AMBIENT THERMOSTAT (OPTIONAL)
LPS	LOW PRESSURE SWITCH
OR1	EVAPORATOR OVERLOAD RELAY #1
OR2	EVAPORATOR OVERLOAD RELAY #2
PT1	POWER TERMINAL BLOCK
RCV	REHEAT COOLANT VALVE
REC	RECTIFIER
TC	TERMINAL BLOCK "C"
TD	TERMINAL BLOCK "D"
TH	ELECTRONIC THERMOSTAT
UPS1	UNLOADER PRESSURE SWITCH #1
UPS2	UNLOADER PRESSURE SWITCH #2
UPS3	UNLOADER PRESSURE SWITCH #3
UV1	UNLOADER VALVE #1
UV2	UNLOADER VALVE #2
WPR	WATER PUMP RELAY



22 PIN CONNECTOR
WIRING SIDE

NOTES:
1. UNIT SHOWN IS IN THE OFF POSITION.
2. RELAY CONTACTS SHOWN ARE IN THEIR NORMAL UNENERGIZED POSITION.
3. ADDRESS SYSTEM: EXAMPLE, CB61-CR30 INDICATES A WIRE BETWEEN CIRCUIT BREAKER #6 TERMINAL #1 AND CLUTCH RELAY TERMINAL #30.
4. WIRE IDENTIFICATION SYSTEM:
   COLORS: WHITE - DC CONTROL CIRCUIT
   GREEN - GROUND
   YELLOW - OPTIONAL CIRCUITS
5. THIS SCHEMATIC APPLY'S TO RM35 UNITS WITH SERIAL NUMBERS BEFORE 12-000026.

INDICATES A WIRE GROUND

INDICATES CUSTOMER SUPPLIED COMPONENTS & WIRING

INDICATES A CONNECTION (LUG,SCREW ETC.)

INDICATES A CONNECTOR

INDICATES A NORMALLY OPEN CONTACT

INDICATES A NORMALLY CLOSED CONTACT

L INDICATES BUS INTERFACE CONNECTOR PIN LOCATION

Indicates Load Motor & Coils

Temperature Switch Opens on Rise in Temperature

Pressure Switch Opens on Rise in Pressure

Pressure Switch Opens on Drop in Pressure

Figure 5-4. Electrical Schematic Wiring Diagram, Non-Relay Board 22-Pin Connector
Dwg. No. 68RM35-1114 Rev C (Sheet 1 of 2)

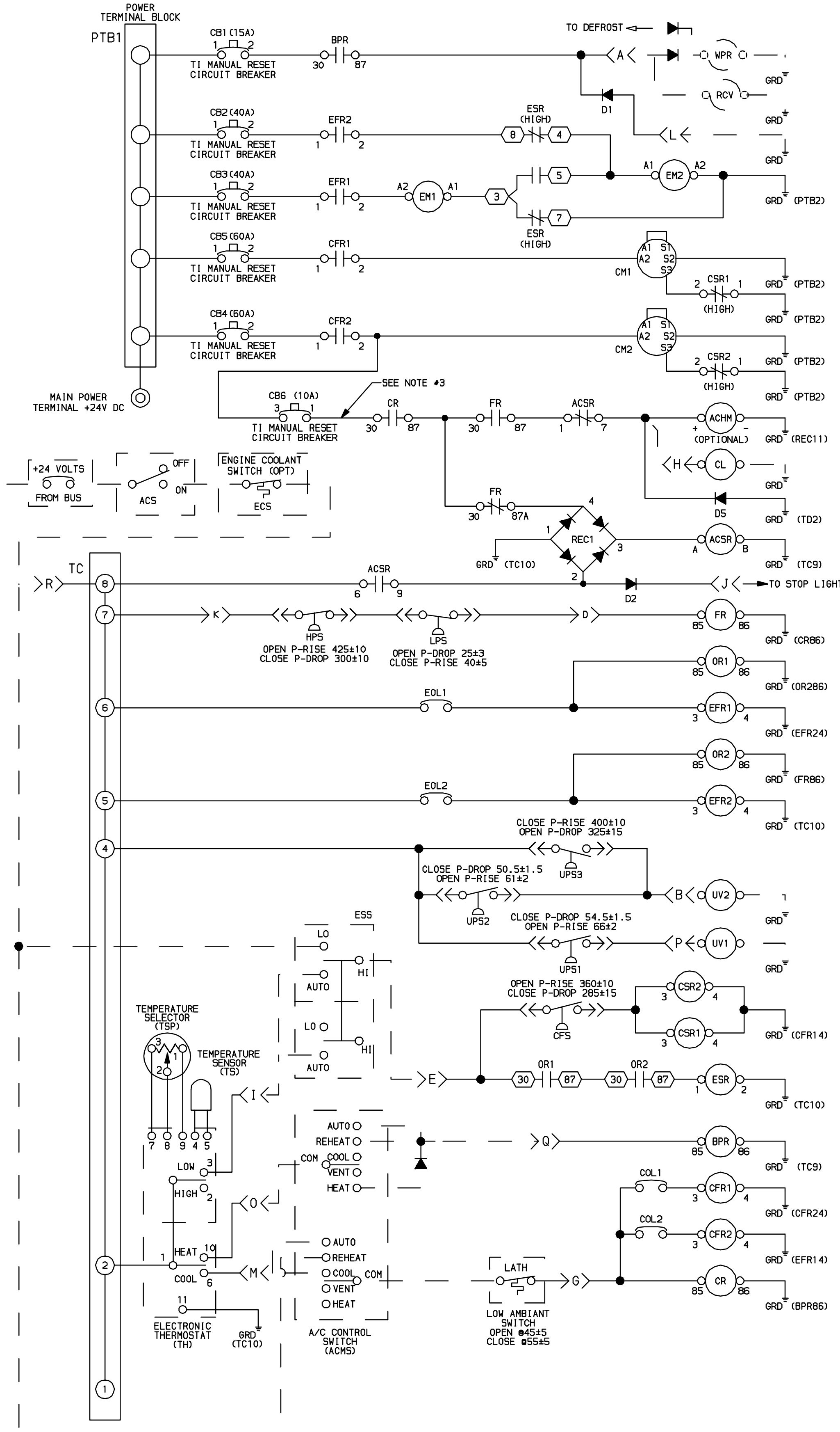


Figure 5-4. Electrical Schematic Wiring Diagram, Non-Relay Board 22-Pin Connector Dwg. No. 68RM35-1114 Rev C (Sheet 2 of 2)

LEGEND

SYMBOL	DESCRIPTION
ACHM	A/C HOURMETER (OPTIONAL)
ACMS	A/C MODE SWITCH
ACS	A/C SWITCH (OFF-ON)
ACSR	A/C STOP RELAY (TIME DELAYED)
BPR	BOOST PUMP RELAY
CB1	15A CIRCUIT BREAKER (WATER PUMP RELAY)
CB2	35A CIRCUIT BREAKER (EVAP MOTOR #2)
CB3	35A CIRCUIT BREAKER (EVAP MOTOR #1 AND 2)
CB4	70A CIRCUIT BREAKER (COND MOTOR #1)
CB5	70A CIRCUIT BREAKER (COND MOTOR #2)
CB6	10A CIRCUIT BREAKER (CLUTCH)
CB7	8A CIRCUIT BREAKER (WATER PUMP)
CFR1	CONDENSER FAN RELAY #1
CFR2	CONDENSER FAN RELAY #2
CFS	CONDENSER FAN SPEED SWITCH (360 PSI)
CL	CLUTCH
CM1	CONDENSER FAN MOTOR #1
CM2	CONDENSER FAN MOTOR #2
COL1	CONDENSER OVERLOAD #1
COL2	CONDENSER OVERLOAD #2
CR	CLUTCH RELAY
CSR1	CONDENSER SPEED RELAY #1
CSR2	CONDENSER SPEED RELAY #2
D1	DIODE #1
D2	DIODE #2
D3	DIODE #3
D4	DIODE #4
D5	DIODE #5
DFS	DEFROST SWITCH (OPTIONAL)
ECS	ENGINE COOLANT SWITCH (OPTIONAL)
EFM1	EVAPORATOR FAN MOTOR #1
EFM2	EVAPORATOR FAN MOTOR #2
EFR1	EVAPORATOR FAN RELAY #1
EFR2	EVAPORATOR FAN RELAY #2
EOL1	EVAPORATOR OVERLOAD #1
EOL2	EVAPORATOR OVERLOAD #2
ESR	EVAPORATOR SPEED RELAY
ESS	EVAPORATOR SPEED SWITCH
FR	FAULT RELAY
HPS	HIGH PRESSURE SWITCH (425 PSI)
LATH	LOW AMBIENT THERMOSTAT (OPTIONAL)
LPS	LOW PRESSURE SWITCH
OR1	EVAPORATOR OVERLOAD RELAY #1
OR2	EVAPORATOR OVERLOAD RELAY #2
PT1	POWER TERMINAL BLOCK
RCV	REHEAT COOLANT VALVE
REC	RECTIFIER
TC	TERMINAL BLOCK "C"
TH	ELECTRONIC THERMOSTAT
UPS1	UNLOADER PRESSURE SWITCH #1
UPS2	UNLOADER PRESSURE SWITCH #2
UPS3	UNLOADER PRESSURE SWITCH #3
UV1	UNLOADER VALVE #1
UV2	UNLOADER VALVE #2
WPR	WATER PUMP RELAY
	INDICATES A WIRE GROUND
— ——	INDICATES CUSTOMER SUPPLIED COMPONENTS & WIRING
	INDICATES A CONNECTION (LUG,SCREW ETC.)
	INDICATES A CONNECTOR
TA#	INDICATES TERMINAL BLOCK "A"
TB#	INDICATES TERMINAL BLOCK "B"
	INDICATES A NORMALLY OPEN CONTACT
	INDICATES A NORMALLY CLOSED CONTACT

NOTES:

1. UNIT SHOWN IS IN THE OFF POSITION.
2. RELAY CONTACTS SHOWN ARE IN THEIR NORMAL UNENERGIZED POSITION.
3. ADDRESS SYSTEM: EXAMPLE, CB61-CR30 INDICATES A WIRE BETWEEN CIRCUIT BREAKER #6 TERMINAL #1 AND CLUTCH RELAY TERMINAL #30.
4. WIRE IDENTIFICATION SYSTEM:
   COLORS: WHITE - DC CONTROL CIRCUIT
   GREEN - GROUND
   YELLOW - OPTIONAL CIRCUITS
5. THIS SCHEMATIC APPLY'S TO RM35 UNITS WITH SERIAL NUMBERS AFTER 12-000026.

Figure 5-5. Electrical Schematic Wiring Diagram, Non-Relay Board Terminal Strip Connections Dwg. No. 68RM35-1114-3 Rev C (Sheet 1 of 2)

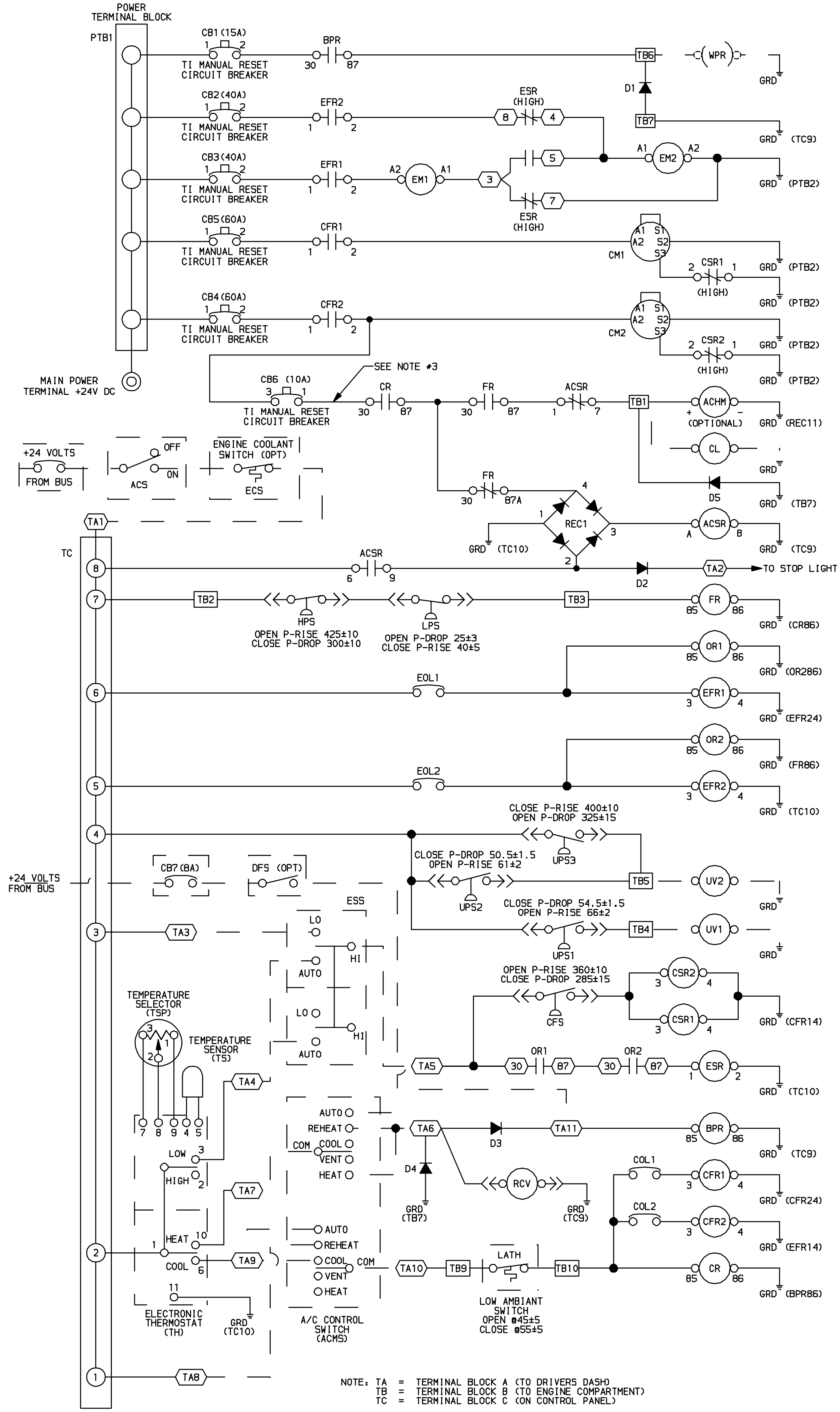
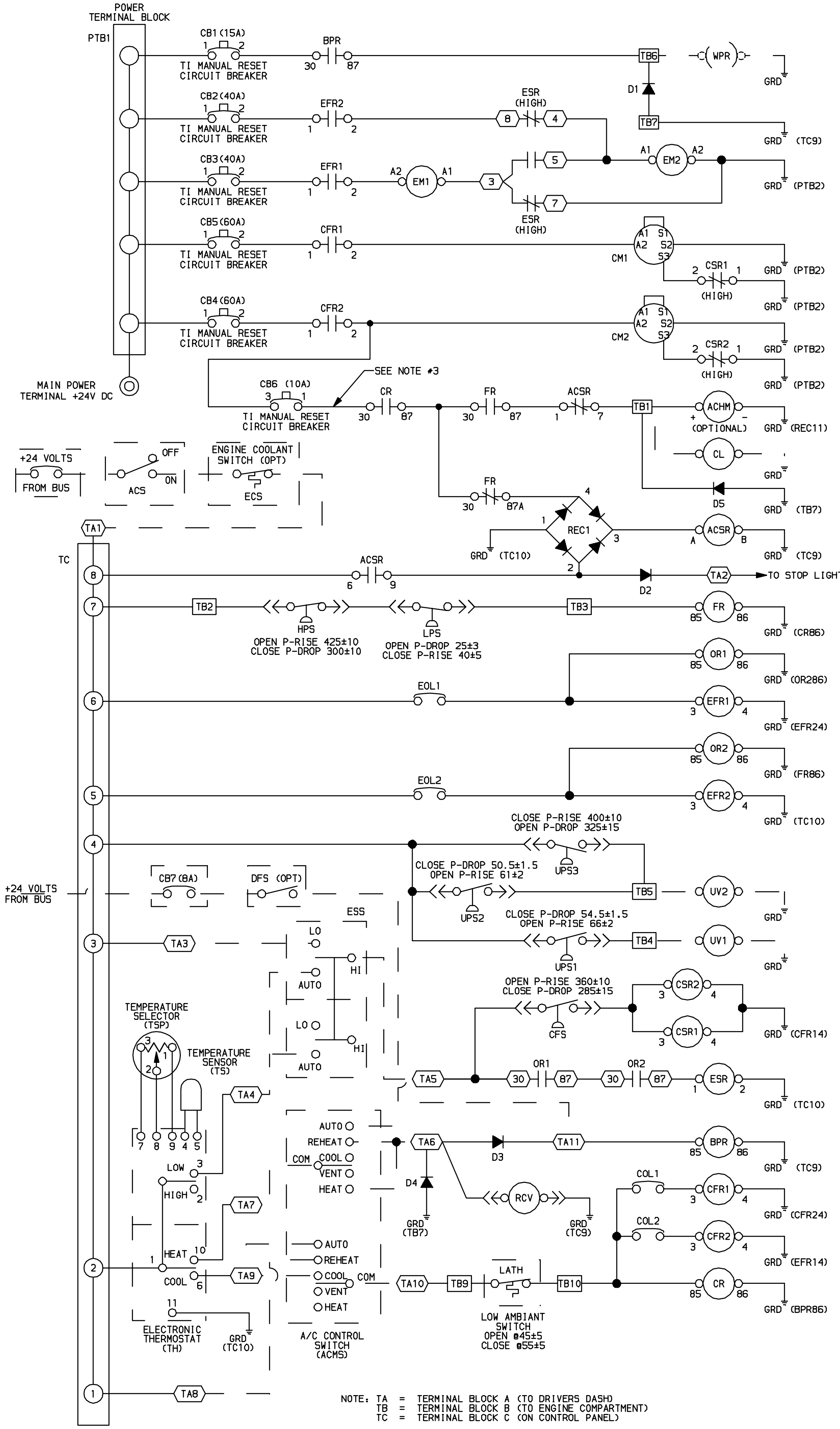


Figure 5-5. Electrical Schematic Wiring Diagram, Non-Relay Board Terminal Strip Connections Dwg. No. 68RM35-1114-3 Rev C (Sheet 2 of 2)


POWER TERMINAL BLOCK
PTB1
CB1 (15A)
TI MANUAL RESET CIRCUIT BREAKER
BPR
WPR
D1
CB2 (40A)
EFR2
ESR (HIGH)
CB3 (40A)
EFR1
EM1
EM2
CB5 (60A)
CFR1
CM1
CSR1 (HIGH)
CB4 (60A)
CFR2
CM2
CSR2 (HIGH)
MAIN POWER TERMINAL +24V DC
CB6 (10A)
SEE NOTE #3
CR
FR
ACSR
ACHM (OPTIONAL)
CL
D5
REC1
+24 VOLTS FROM BUS
ACS
OFF
ON
ENGINE COOLANT SWITCH (OPT)
ECS
TC
TO STOP LIGHT
D2
HPS
OPEN P-RISE 425±10
CLOSE P-DROP 300±10
LPS
OPEN P-DROP 25±3
CLOSE P-RISE 40±5
OR1
EOL1
OR2
EOL2
CLOSE P-RISE 400±10
OPEN P-DROP 325±15
UPS3
CLOSE P-DROP 50.5±1.5
OPEN P-RISE 61±2
UPS2
CB7 (8A)
DFS (OPT)
UV2
CLOSE P-DROP 54.5±1.5
OPEN P-RISE 66±2
UPS1
UV1
ESS
LO
HI
AUTO
OPEN P-RISE 360±10
CLOSE P-DROP 285±15
CFS
TEMPERATURE SELECTOR (TSP)
TEMPERATURE SENSOR (TS)
LOW
HIGH
HEAT
COOL
ELECTRONIC THERMOSTAT (TH)
REHEAT
VENT
COM
A/C CONTROL SWITCH (ACMS)
D3
D4
RCV
COL1
COL2
LATH
LOW AMBIANT SWITCH
OPEN ø45±5
CLOSE ø55±5
GRD
NOTE: TA = TERMINAL BLOCK A (TO DRIVERS DASH)
TB = TERMINAL BLOCK B (TO ENGINE COMPARTMENT)
TC = TERMINAL BLOCK C (ON CONTROL PANEL)