Operation and Service Manual

Integra 35X
Beginning with S/N PC710307

TruckRefrigeration Units

35 X

62-12023 Rev E

Carrier
TRANSICOLD

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Operation and Service

For

Integra 35X

Beginning with S/N PC710307

Truck Refrigeration Units

Manual Revision History - 62-12023

Rev	Date	Reason for Release
	09/29/2017	New product – new manual
A	05/23/2018	Updated unit description; wiring harness
B	10/12/2018	Page 2-7 section 2.6.2; Page 2-11, 2-12, 2-13 Add CPR back into line (dlr)
C	10/24/2018	Updated path of flow drawings (pages 2-11, 2-12, 2-13); removed reference to alarms A46 and A47 in several sections (dlr)
D	4/28/2020	Updated covers and logo
E	5/8/2020	Section 2.3 – Remove ref to filter drier, change to drier/receiver; Section 3.8 – updated configuration list; Sections 5.3, 5.3.1 – Remove ref to filter drier; Section 5.5.2 – Remove step 4; Step 5.5.3 – Remove first sentence step 9;

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SECTION 1
Safety Summary

1.1 General Safety Notices

The following general safety notices supplement the specific warnings and cautions appearing elsewhere in this manual. They are recommended precautions that must be understood and applied during operation and maintenance of the equipment covered herein. The general safety notices are presented in the following three sections labeled: First Aid, Operating Precautions and Maintenance Precautions. A listing of the specific warnings and cautions appearing elsewhere in the manual follows the general safety notices.

Your Carrier Transicold refrigeration unit has been designed with the safety of the operator in mind. During normal operation, all moving parts are fully enclosed to help prevent injury. During all pre-trip inspections, daily inspections, and problem troubleshooting, you may be exposed to moving parts. Stay clear of all moving parts when the unit is in operation and when the ON/OFF switch is in the ON position. No work should be performed on the unit until standby and battery power supply is disconnected.

1.2 First Aid

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

1.3 Operating Precautions

- Always wear safety glasses. Wear hearing protection as required.
- Keep hands, clothing and tools clear of the evaporator and condenser fans.
- No work should be performed on the unit until all circuit breakers and the Emergency Switch are turned off, and battery power supply is disconnected.
- Always work in pairs. Never work on the equipment alone.
- In case of severe vibration or unusual noise, stop the unit and investigate.

1.4 Maintenance Precautions

Beware of unannounced starting of the unit. This unit is equipped with Auto-Start in both the road and standby modes. The unit may start at any time.

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

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

When performing any arc welding on the unit or box, container, or trailer, disconnect all wire harness connectors from the microprocessor. Do not remove wire harness from the modules unless you are grounded to the unit frame with a static safe wrist strap. In case of electrical fire, extinguish with CO_2 (never use water).

1.5 Refrigerants

The refrigerant contained in your unit can cause frostbite, severe burns, or blindness when in direct contact with the skin or eyes. For this reason, and because of legislation regarding the handling of refrigerants during system service, we recommend that you contact your nearest Carrier Transicold authorized repair facility whenever your unit requires refrigeration system service.

1.6 Specific Warning, Caution, and Notice Statements

To help identify the label hazards on the unit and explain the level of awareness each one carries, an explanation is given with the appropriate consequences:

DANGER

DANGER − warns against an immediate hazard which WILL result in severe personal injury or death.

WARNING

WARNING − warns against hazards or unsafe conditions which COULD result in severe personal injury or death.

CAUTION

CAUTION − warns against potential hazard or unsafe practices which could result in minor personal injury.

NOTICE

NOTICE − warns against potential product or property damage.

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

WARNING

Beware of unannounced starting of the unit. The unit may cycle the fans and one of the operating compressors unexpectedly as control requirements dictate. To ensure unit is without power, remove power plug and remove battery negative cable.

WARNING

Do not attempt to connect or remove power plug before ensuring the unit is OFF (press OFF key on Cab Command) and external power circuit breaker is open.

WARNING

The power plug must be clean and dry before connecting to any power source.

WARNING

Beware of V-belt and belt-driven components as the unit may start automatically.

WARNING

Do not use a nitrogen cylinder without a pressure regulator. (See Figure 5.4) Cylinder pressure is approximately 2350 psi (160 Bar). Do not use oxygen in or near a refrigerant system as an explosion may occur.

⚠ CAUTION

Under no circumstances should anyone attempt to repair the microprocessor module or either Cab Command module! Should a problem develop with these components, contact your nearest Carrier Transicold dealer for replacement.

⚠ CAUTION

If starting unit for the first time after installation the compressor pressure regulating valve will need to be reset (refer to Section 5.11).

⚠ CAUTION

If starting unit for the first time after installation or starting after adding/removing an optional feature or if Owners operating parameters have changed the Configuration will need to be reset.

⚠ CAUTION

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

⚠ CAUTION

When working with refrigerant use safety glasses and gloves to avoid burns. Hoses and copper tubing can be hot when unit is running.

⚠ CAUTION

Refrigerant R-404A is a blend. Charging as a vapor will change the properties of the refrigerant. Only liquid charging through the king valve is acceptable.

⚠ CAUTION

Do not damage or over tighten the enclosing tube assembly. Also all parts must be placed in the enclosing tube in proper sequence to avoid premature coil burn-out.

SECTION 2
Unit Description

2.1 Introduction

⚠ WARNING

Beware of unannounced starting of the unit. The unit may cycle the fans and one of the operating compressors unexpectedly as control requirements dictate. To ensure unit is without power, remove power plug and remove battery negative cable.

⚠ WARNING

Do not attempt to connect or remove power plug before ensuring the unit is OFF (press OFF key on Cab Command) and external power circuit breaker is open.

This manual contains operating data, electrical data, and service instructions for the Carrier Transicold 35X truck refrigeration units listed in **Table 2–1**.

2.2 General Description

The 35X unit (**Figure 2.1**) is of the split system type with the condenser mounted outside the truck body, evaporator mounted in the body, and a Cab Command controller mounted in the drivers compartment. Two types of compressor drives are available:

- **Road operation**: The compressor is driven by the engine of the vehicle when in operation over-the-road.
- **Road/Standby operation**: With the standby option a second compressor is mounted in the condenser section. This compressor is driven by 115/1/60Hz or 230/1/60Hz or 230/3/60Hz power.

The control system is a microprocessor controller. Once the controller is set at the desired temperature, the system automatically selects cooling and heating cycles as necessary to maintain the desired temperature within very close limits.

The model/serial nameplate is located inside the unit on the frame as shown in **Figure 2.1**.

Table 2–1 Model Chart

Model	Voltage	R-404A	Compressor
Road Only TRC135R03D	12V, No Standby	3.3 lb (1.5 KG)	Series 150
Road and Standby TRS135R53D	115/1/60		
Road and Standby TRS135R13D	230/1/60		
Road and Standby TRS135R23D	230/3/60		

Table 2–2 Additional Support Manuals

Manual Number	Equipment Covered	Type of Manual
62-12032	35X	Parts List
62-10892	20X & 35X Road Only Truck Refrigeration Units with Cab Command Controller	Operator's Manual
62-11045	35X with Standby & 40/50X Truck Refrigeration Units with Cab Command Two Controller	Operator's Manual

Figure 2.1 Main Unit Components

Condenser

Cab Command Two

Cab Command

Evaporator

2.3 Condensing Section

The condenser section (see **Figure 2.2**) contains the condenser fan and coil, receiver/drier, oil separator, condenser pressure control valve, condenser pressure control switch, hot gas valve, high pressure switch and microprocessor. On road/standby units the condenser also houses the standby compressor, control box and rectifier/transformer assembly. In addition, single phase units are fitted with a start box which contains the capacitors and relay.

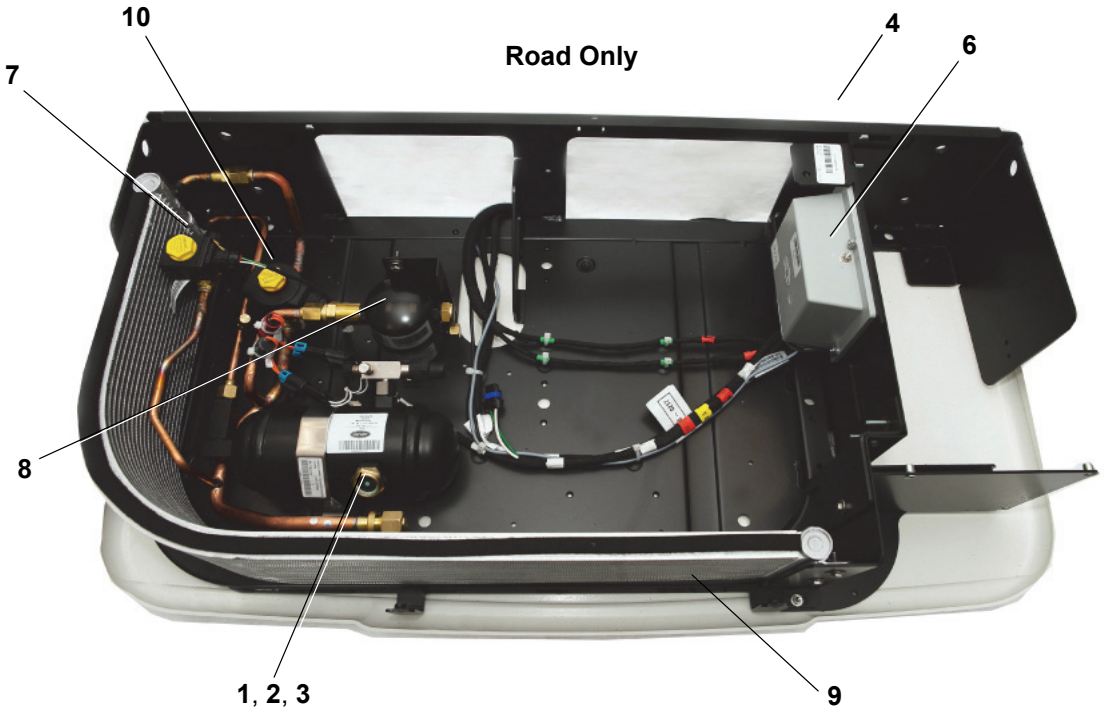
2.3.1 Condenser Coil

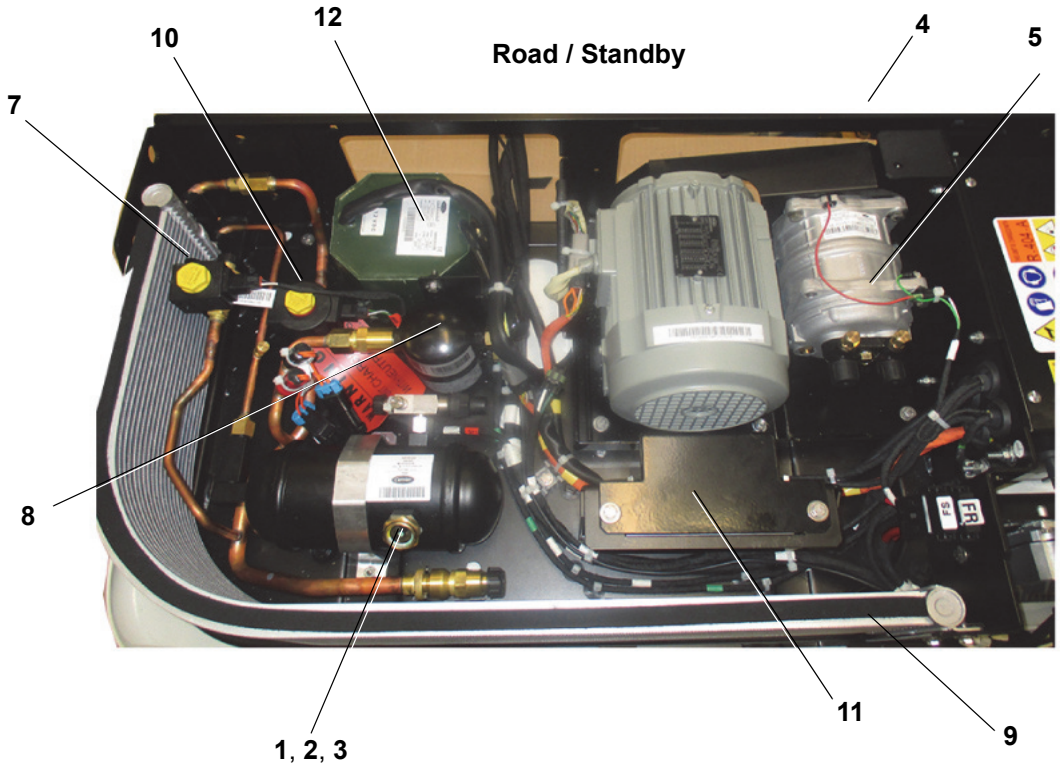
The condenser is of the microchannel type and acts as a heat exchanger in which the compressed refrigerant gas is condensed into a liquid and lowered in temperature. Air movement over the condenser is provided by a fan mounted in the condensing section.

2.3.2 Hot Gas Solenoid Valve (HGS1)

HGS1 is normally closed and prevents discharge gas from entering the evaporator. The valve opens to allow hot gas refrigerant to be delivered from the compressor to the evaporator during heat or defrost modes.

Figure 2.2 Condensing Section





1. Receiver
2. Filter Drier
3. Sight Glass
4. Frame Assembly
5. Standby Compressor
6. Microprocessor
7. Hot Gas Valve (HGS1) and Coil
8. Oil Separator
9. Condenser Coil
10. Condenser Pressure Control Valve (HGS2) & Coil
11. Rectifier
12. Transformer

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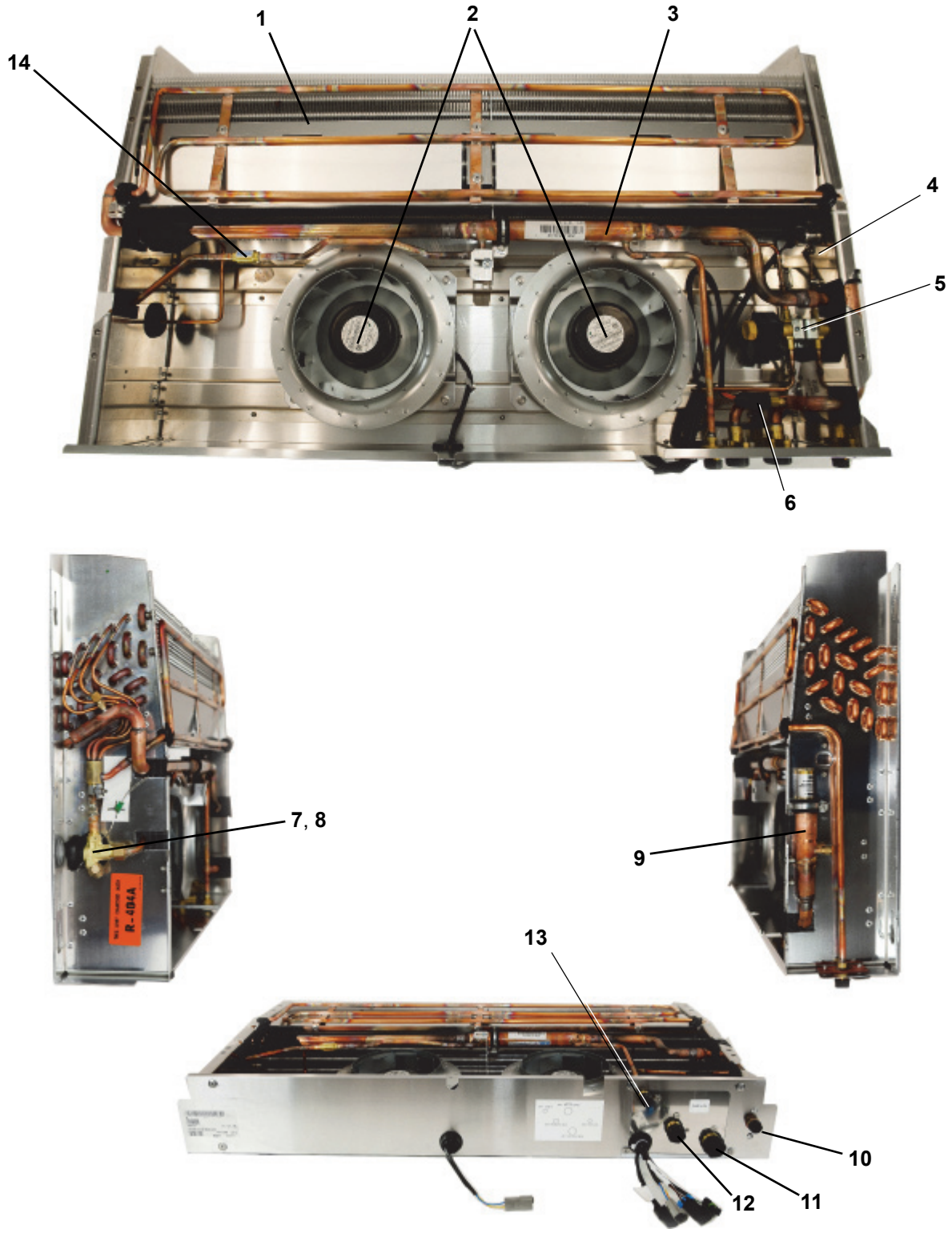
Figure 2.3 Evaporator



1. Evaporator Coil Assembly
2. Evaporator Fan Motor and Blowers (EFM)
3. Heat Exchanger
4. Defrost Termination Thermostat (DTT)
5. Quench Valve (BPV)
6. Low Pressure Switch (LP)
7. Orifice
8. Thermostatic Expansion Valve (TXV)
9. Compressor Pressure Regulating Valve (CPR)
10. Hot Gas Fitting
11. Road Suction Line Fitting
12. Standby Suction Line Fitting
13. Liquid Line Fitting
14. Liquid Line Check Valve

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2.3.3 Condenser Pressure Control Valve (HGS2)

The condenser pressure control valve (or condenser closing valve) is a normally open valve that is powered when the condenser pressure control switch (HP2) is closed. With the solenoid coil de-energized, the valve is in the cool mode and the compressor discharge gas is delivered to the condenser. In the cool mode, heat is removed from the air inside the truck body and rejected to the surrounding air. With the solenoid coil energized, the valve is in the heat mode and the compressor discharge gas is diverted to the evaporator and rejected to the air inside the truck body.

2.3.4 Compressor

The compressor withdraws refrigerant gas from the evaporator and delivers it to the condenser at an increased pressure. The pressure is such that refrigerant heat can be absorbed by the surrounding air at ordinary temperatures.

2.3.5 Receiver / Drier Assembly

Liquid refrigerant from the condenser is delivered to the receiver. The receiver serves as a liquid reservoir when there are surges due to load changes in the system, as a storage space when pumping down the system and as a liquid seal to prevent refrigerant gas from entering into the liquid line.

The drier is a cylindrical shell containing a drying agent and screen. The drier is installed in the liquid line and functions to keep the system clean and remove moisture from the refrigerant.

2.3.6 High Pressure Switch (HP1)

HP1 is a normally closed switch which monitors the system for high pressure and shuts down the unit when pressure rises above a predetermined setting. For HP1 settings see **Section 2.6.2**.

2.3.7 Condenser Pressure Control Switch (HP2)

HP2 is a normally open switch which closes to signal the microprocessor to activate the condenser fan. HP2 also cycles the condenser pressure control valve (HGS2) and the quench valve (BPV) in addition to the condenser fan in order to maintain discharge pressure for heating capacity. For HP2 settings see **Section 2.6.2**.

2.3.8 Standby Motor

The standby motor operates on nominal 115/230V-1ph-60Hz or 230V-3ph-60Hz power. An overload and short cycle protection is provided along with automatic reset. Units are also equipped with a remote mounted power receptacle.

2.4 Evaporator Section

The evaporator assembly (see **Figure 2.1** and **Figure 2.3**) consists of two evaporator blowers, the evaporator coil, thermostatic expansion valve, defrost termination thermostat, compressor pressure regulating valve, low pressure switch and quench valve.

2.4.1 Thermostatic Expansion Valve (TXV)

The thermostatic expansion valve is an automatic device which controls the flow of liquid to the evaporator according to changes in superheat of the refrigerant leaving the evaporator. The thermal expansion valve maintains a relatively constant degree of superheat in the gas leaving the evaporator regardless of suction pressure. Thus, the valve has a dual function; automatic expansion control and preventing liquid from returning to the compressor. For TXV superheat settings see **Section 2.6.2**. To adjust the TXV, refer to **Section 5.12.2**.

2.4.2 Compressor Pressure Regulating Valve (CPR)

The CPR valve is installed on the suction line to regulate the suction pressure entering the compressor. The CPR valve is set to limit the maximum suction pressure. For CPR settings refer to **Section 2.6.2**.

2.4.3 Defrost Termination Thermostat (DTT)

The defrost termination thermostat is a normally closed thermal switch which monitors setpoint. As the evaporator cools to setpoint, the switch closes and signals the microprocessor that defrost may be initiated. The switch terminates defrost by opening at a predetermined setpoint. For DTT settings refer to **Section 2.6.2**.

2.4.4 Quench Valve (BPV)

The quench valve is a normally closed solenoid valve controlled by the quench thermostat (BPT) mounted on the road compressor discharge line. The valve allows metered liquid refrigerant to enter the suction line in the evaporator in order to provide compressor cooling. For BPT settings refer to **Section 2.6.2**.

2.4.5 Evaporator Coil

The evaporator is a tube and fin type. The operation of the compressor maintains a reduced pressure within the coil. At this reduced pressure, the liquid refrigerant evaporates at a temperature sufficiently low enough to absorb heat from the air. Air movement over the evaporator is provided by an electric fan.

2.4.6 Low Pressure Switch (LP)

The low pressure switch is a normally closed switch which signals the microprocessor to shut down the unit when the system is outside the low pressure limit. For LP settings refer to **Section 2.6.2**.

2.5 System Operating Controls and Components

The unit is furnished with a microprocessor control system. Once the setpoint is entered at the Cab Command, the unit will operate automatically to maintain the desired temperature within very close limits. See **Section 3.1.1**.

⚠ WARNING

Beware of unannounced starting of the unit. The unit may cycle the fans and one of the operating compressors unexpectedly as control requirements dictate. To ensure unit is without power, remove power plug and remove battery negative cable.

⚠ CAUTION

Under no circumstances should anyone attempt to repair the microprocessor module or either Cab Command module! Should a problem develop with these components, contact your nearest Carrier Transicold dealer for replacement.

Figure 2.4 Cab Command - Road Only Units

Figure 2.5 Cab Command Two - Standby Units

2.6 Unit Specifications

2.6.1 Compressor Reference Data

Model	Series 150
Displacement	8.91 in^3 (147 cc)
No. Cylinders	6
Weight	9.68 lbs (4.4 kg)
Oil Charge	6oz (180 ml) - Road and Standby
Additional Oil Charge	4.23 oz (123 ml) **NOTE**: Additional oil is only to be charged at installation
Approved oil	POE - Mobil Arctic EAL 68 (Carrier Part Number 46-60002-02)

2.6.2 Refrigeration System Data

Defrost Timer	Automatic triggering or at preset intervals: 0, auto, 1h, 2h, 3h, 4h, 5h, 6h
Defrost Termination Thermostat (Standby Only)	Opens at: 50 ± 5°F (27 ± 3°C); Closes at: 40 ± 5°F (22.2 ± 3°C)
High Pressure Switch (HP1)	Cutout at: 465 ± 10 psig (32 Bar); Cut-in at: 360 ± 10 psig (25 Bar)
Condenser Pressure Switch (HP2)	Cutout at: 245 ± 10 psig[1] (17 Bar); Cut-in at: 320 ± 10 psig (22 Bar)
Refrigerant Charge	Refer to **Table 2–1**
Compressor Pressure Regulating Valve (CPR)	30.5 ± 1 psig (2.1 Bar) @ 2400 rpm
Thermostat Expansion Valve	Superheat at 32°F (0°C) Box, 14.5°F (8°C) Superheat at 0°F (-20°C) Box, 7°F (4°C)
Low Pressure Switch (LP)	Cutout at: 0 ± 6 psig (0 Bar); Cut-in at: 14.5 ± 3 psig (1 Bar)
Quench Valve Thermo-stat (BPT)	Opens at: 220° ± 7°F (105° ± 4°C); Closes at: 248° ± 7°F (120° ± 4°C)

2.6.3 Electrical Data

a. Fan Motors

Evaporator Fan Motor (EFM)		**Condenser Fan Motor (CFM)**	
Bearing Lubrication	Factory Lubricated	Bearing Lubrication	Factory Lubricated
Horse Power	100W		70W
Operating Amps	7-9 amps	Operating Amps	7.5 amps
Speed	2100 rpm (rated)	Speed	2350/2600 rpm

b. Standby Compressor Speed

1760 rpm - 60 hz

c. Standby Motor Ratings

Voltage	kW	HP	Contactor Data - MRA*
115/1/60Hz	1.5	2	23.2A
230/1/60Hz			11.7A
230/3/60Hz			8.9A
* MRA = Maximum Rotor Amps			

c. Road Compressor Clutch (CLHR) Coil

Amp Draw = 3.75A; Resistance = 3.2 Ω

d. Hot Gas Solenoid Valve (HGS1) Coil

Amp Draw = 1330 mAmp; Resistance = 10.1 Ω

e. Condenser Closing Valve (HGS2) Coil

Amp Draw = 1650 mAmp; Resistance = 7.2 Ω

f. Quench Valve (BPV) Coil

Amp Draw = 1160 mAmp; Resistance = 10.3 Ω

2.7 Torques Values Safety Devices

Assembly	Ft-Lbs	N-m
Standby compressor platform	40	7.5
Standby motor platform	40	7.5
Standby motor pulley	40	7.5
Compressor pulley	22	29.8
Evaporator fan motor	13	17.6
Condenser - frame	18	24.4
Mounting bolts	44 to 60	8 to 11

Table 2–3 Safety Devices

Unsafe Conditions	Safety Device	Automatic re-start with fault cleared	Device setting
1 Excessive drop in pressure	Automatic reset of low pressure switch	YES	Cutout: -2.9 psig (-0.2 Bar) Timer 5 min
2 Excessive current draw on all microprocessor outputs (evaporator and condenser fan)	Electronic relay	YES	Self-protected opening
3 Excessive current draw compressor or standby motor	Overload relay	YES	See electrical wiring diagram
4 Excessive compressor discharge pressure	Automatic reset of High pressure switch (HP1, HP3)	YES	Timer 5 min
5 Excessive current draw unit on standby	Standby fuse (FS) (a)	NO	50A
6 Excessive current draw unit on road	Road fuse (FR)	NO	50A
7 Excessive current draw unit on road	Main Road fuse (FR1) (b)	NO	50A
8 Excessive current draw control circuit	Fuse on electronic board (Field Replaceable) (c)	NO	1A (Time Delayed)
9 Connection error on primary transformer	F1 115/1/60	NO	8A (Time Delayed)
	F1 230/1/60		5A (Time Delayed)
	F1 230/3/60		
10 Excessive compressor motor or standby motor winding temperature	Internal Thermal Overload	YES	Self-protected opening
11 Clutch not functioning properly - road (excessive current draw)	Electronic relay	YES	Self-protected opening
12 Clutch not functioning properly - road (insufficient current draw)	Electronic relay	YES	Detection of min. threshold at 750 mA
13 Double power supply (road + standby)	Microprocessor	YES	Display on Cab Command until one of the 2 power supplies have been disconnected.
14 Low battery voltage	Microprocessor	YES	Cutout/cut-in at 10 V
15 Excess current draw of AC circuits	Main Standby Fuse Block (FB) 115/1/60	YES	25A
	Main Standby Fuse Block (FB) 230/1/60		16A
	Main Standby Fuse Block (FB) 230/3/60		12A
16 Excess CFM Amp.		NO	30A

(a) On road / standby unit only
(b) This fuse is located close to the vehicle battery (12 V).
(c) This fuse is located on the logic board inside the microprocessor and protects the microprocessor against reverse polarity on the power supply.

2.8 Refrigerant Circuit

2.8.1 Refrigerant Circuit During Cooling

When cooling (See **Figure 2.9**), the unit operates as a vapor compression refrigeration system. The main components of the system are as follows:

- Reciprocating compressor
- Air-cooled condenser
- Thermostatic expansion valve
- Direct expansion evaporator
- Hot gas solenoid

The compressor raises the pressure and temperature of the refrigerant, and forces it through the discharge check valve and condenser pressure control valve into the condenser tubes. The discharge check valves prevent reverse flow through the non operating compressor.

When operating on the road compressor, the flow also passes through an oil separator where oil is removed and returned to the compressor.

The condenser fan circulates surrounding air over the outside of the condenser tubes. Heat transfer is thus established from the refrigerant gas (inside the tubes) to the condenser air (flowing over the tubes). The condenser tubes have fins designed to improve the transfer of heat. This removal of heat causes the refrigerant to liquefy. Liquid refrigerant flows from the condenser to the receiver.

The receiver stores the additional charge necessary for low ambient operation, and for heating and defrost modes. The refrigerant leaves the receiver and flows through a manual receiver shut-off valve (king valve). The refrigerant then flows through the filter drier, where an absorbent keeps it dry and clean, and then through a sight glass. The sight glass is fitted with an indicator that changes color to indicate moisture content of the refrigerant.

The refrigerant then flows through the liquid line check valve. The check valve serves to prevent reverse flow of refrigerant during the heating/defrost cycle.

The refrigerant then flows to the “Liquid/Suction” heat exchanger. Here, the liquid is further reduced in temperature by giving off some of its heat to the suction gas.

The liquid than enters the thermostatic expansion valve (with external pressure equalizer) which regulates the flow rate of refrigerant towards the evaporator in order to obtain maximum use of the evaporator heat transfer surface.

The evaporator tubes have aluminum fins to increase heat transfer; therefore heat is removed from the air circulated through the evaporator. This cold air is circulated throughout the truck to maintain the cargo at the desired temperature.

The transfer of heat from the air to the low temperature liquid refrigerant causes the liquid to vaporize. The vapor passes through the “Liquid/Suction” heat exchanger where it absorbs more heat from the high temperature liquid.

The vapor at enters the compressor pressure regulating valve (CPR) which regulates refrigerant pressure entering the compressor to prevent overloading of the compressor.

The quench valve (BPV) opens as required to maintain a maximum discharge temperature of 127°C (260°F).

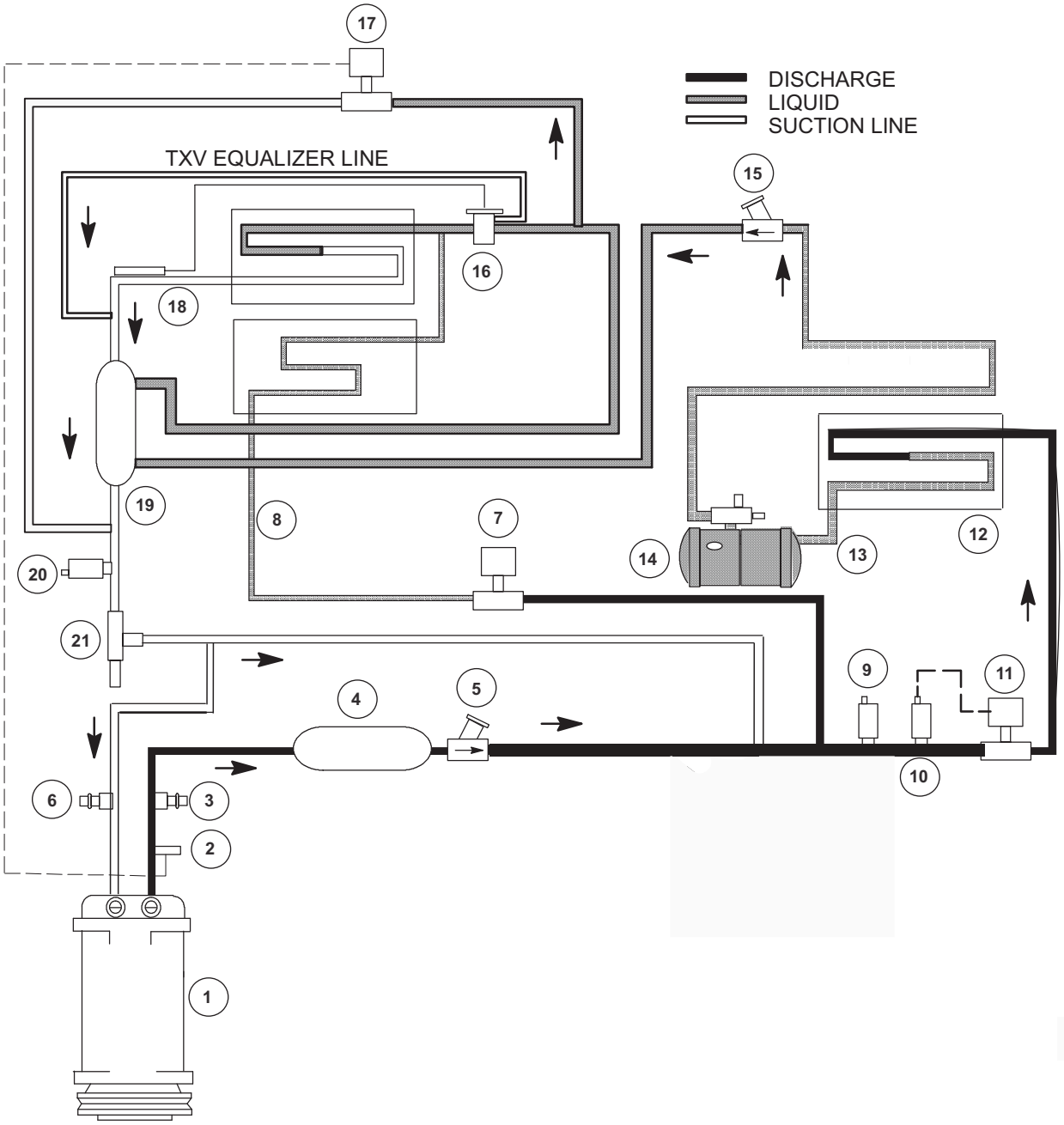
2.8.2 Refrigerant Circuit During Heat And Defrost

When refrigerant vapor is compressed to a high pressure and temperature in a compressor, the mechanical energy necessary to operate the compressor is transferred to the gas as it is being compressed. This energy is referred to as the “heat of compression” and is used as the source of heat during the heating or defrost cycle (See **Figure 2.10** and **Figure 2.11**).

When the microprocessor activates heating or defrost, the hot gas solenoid valve (HGS1) energizes (opens). If the condenser pressure control switch (HP2) is open, the condenser pressure control valve (HGS2) energizes to close the line to the condenser. If pressure rises to the cut-in setting of HP2 (See **Section 2.6.2**), HGS2 de-energizes to pressurize the condenser and force more refrigerant into the circuit, increasing heating capacity.

The main difference between heating and defrosting is that when in heating mode the evaporator fans continue to run circulating the air throughout the truck to heat the product. When defrosting, the evaporator fans stop, allowing the heated vapor to defrost any ice build-up on the coil.

Figure 2.6 Refrigeration Circuit Cooling Cycle - Road



1. Road Compressor
2. Quench Thermostat (BPT)
3. Discharge Charging Port
4. Oil Separator
5. Road Discharge Check Valve
6. Suction Charging Port
7. Hot Gas Solenoid Valve (HGS1)
8. Drain Pan Hot Gas Line
9. High Pressure Switch (HP1)
10. Condenser Pressure Control Switch (HP2)
11. Condenser Pressure Control Valve (HGS2)
12. Condenser Coil
13. Receiver/Drier with sightglass
14. Manual Shut-off Valve (King Valve)
15. Liquid Line Check Valve
16. Thermostatic Expansion Valve
17. Quench Valve (BPV)
18. Evaporator Coil
19. Heat Exchanger
20. Low Pressure Switch (LP)
21. Compressor Pressure Regulating Valve (CPR)

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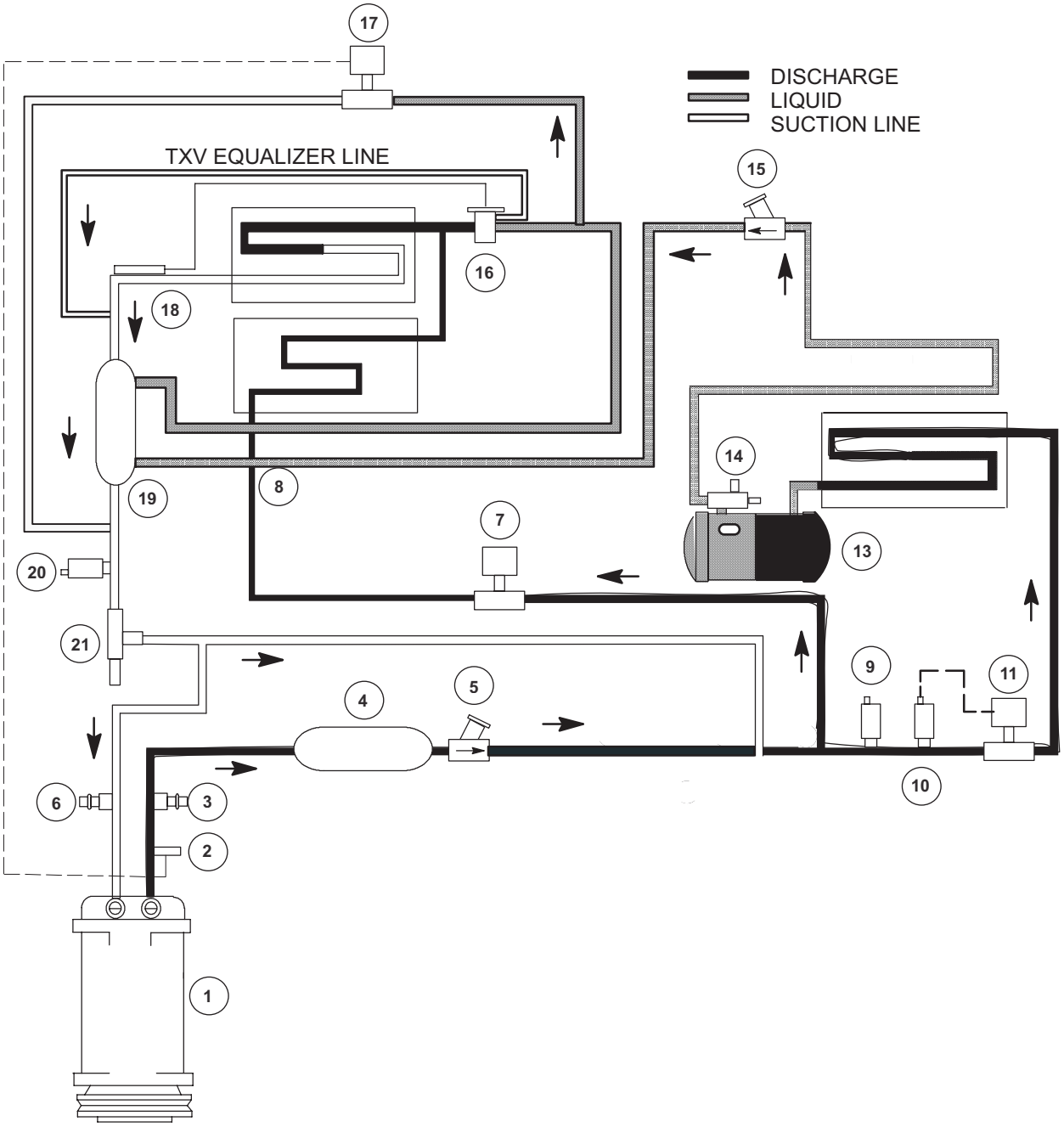
Figure 2.7 Refrigeration Circuit Heat and Defrost Cycle (HGS2 Open) - Road



1. Road Compressor
2. Quench Thermostat (BPT)
3. Discharge Charging Port
4. Oil Separator
5. Road Discharge Check Valve
6. Suction Charging Port
7. Hot Gas Solenoid Valve (HGS1)
8. Drain Pan Hot Gas Line
9. High Pressure Switch (HP1)
10. Condenser Pressure Control Switch (HP2)
11. Condenser Pressure Control Valve (HGS2)
12. Condenser Coil
13. Receiver/Drier w/ sightglass
14. Manual Shut-off Valve (King Valve)
15. Liquid Line Check Valve
16. Thermostatic Expansion Valve
17. Quench Valve (BPV)
18. Evaporator Coil
19. Heat Exchanger
20. Low Pressure Switch (LP)
21. Compressor Pressure Regulating Valve (CPR)

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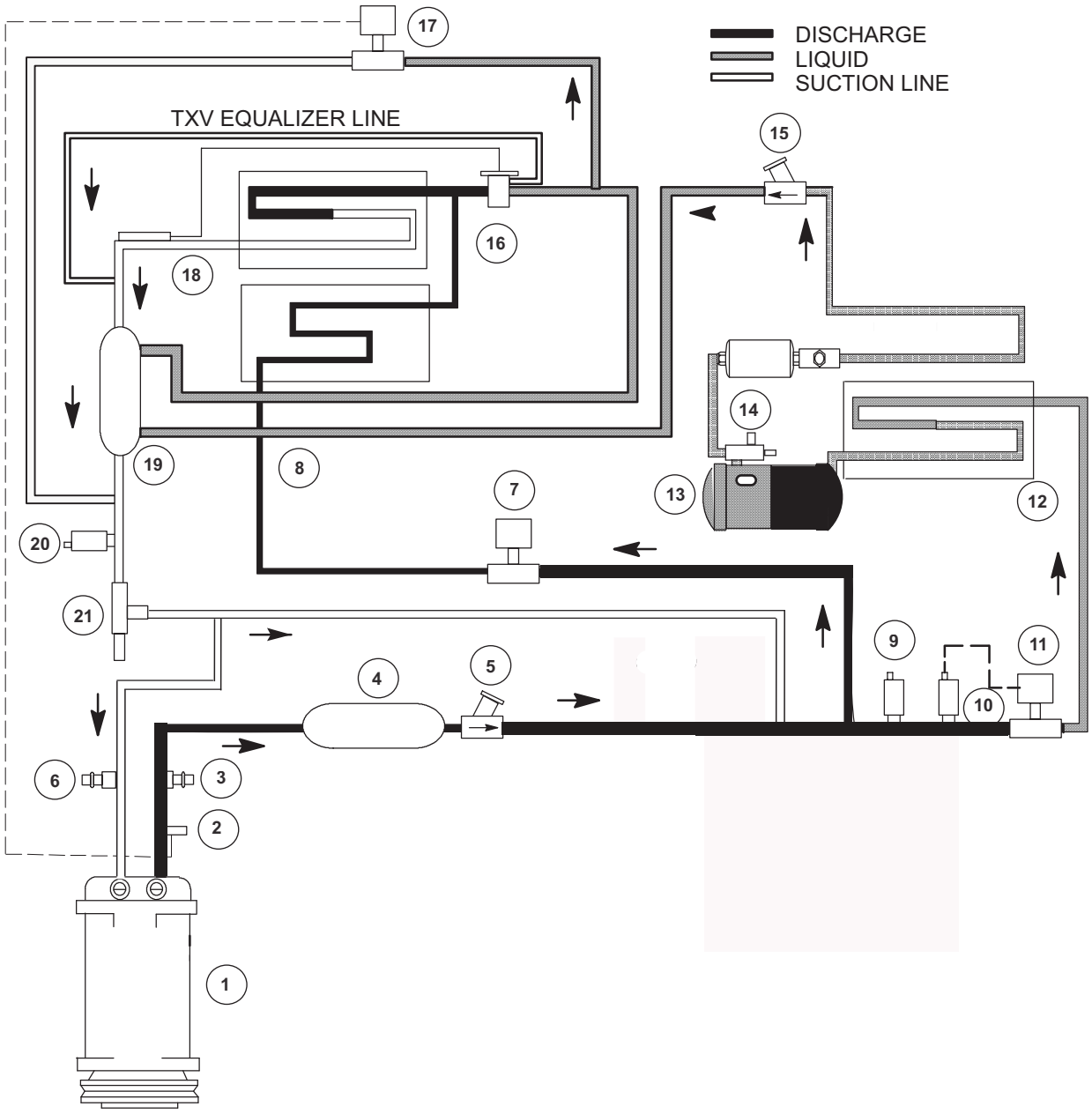
Figure 2.8 Refrigeration Circuit Heat and Defrost Cycle (HGS2 Closed) - Road



1. Road Compressor
2. Quench Thermostat (BPT)
3. Discharge Charging Port
4. Oil Separator
5. Road Discharge Check Valve
6. Suction Charging Port
7. Hot Gas Solenoid Valve (HGS1)
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9. High Pressure Switch (HP1)
10. Condenser Pressure Control Switch (HP2)
11. Condenser Pressure Control Valve (HGS2)
12. Condenser Coil
13. Receiver/Drier w/ sightglass
14. Manual Shut-off Valve (King Valve)
15. Liquid Line Check Valve
16. Thermostatic Expansion Valve
17. Quench Valve (BPV)
18. Evaporator Coil
19. Heat Exchanger
20. Low Pressure Switch (LP)
21. Compressor Pressure Regulating Valve (CPR)

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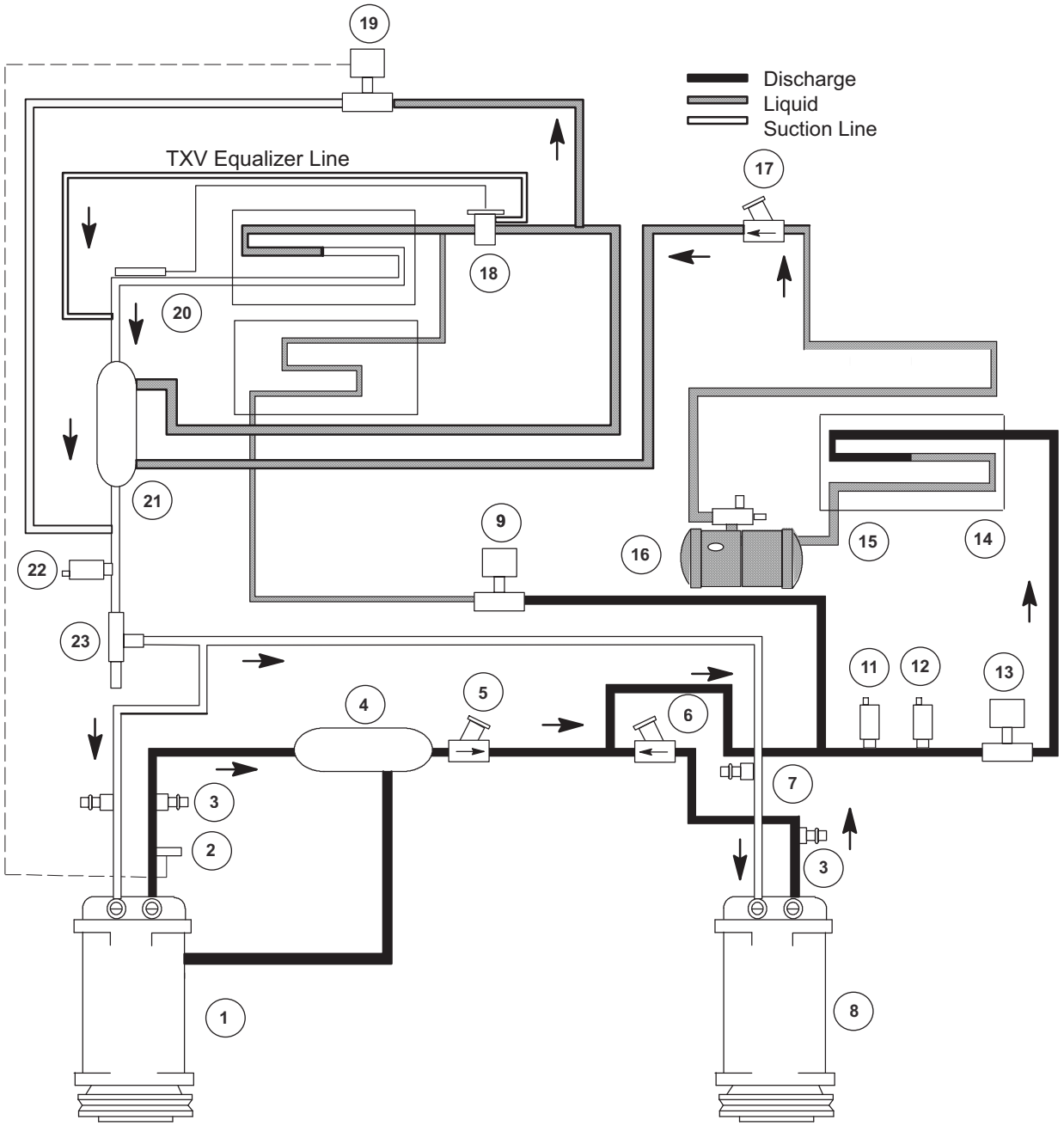
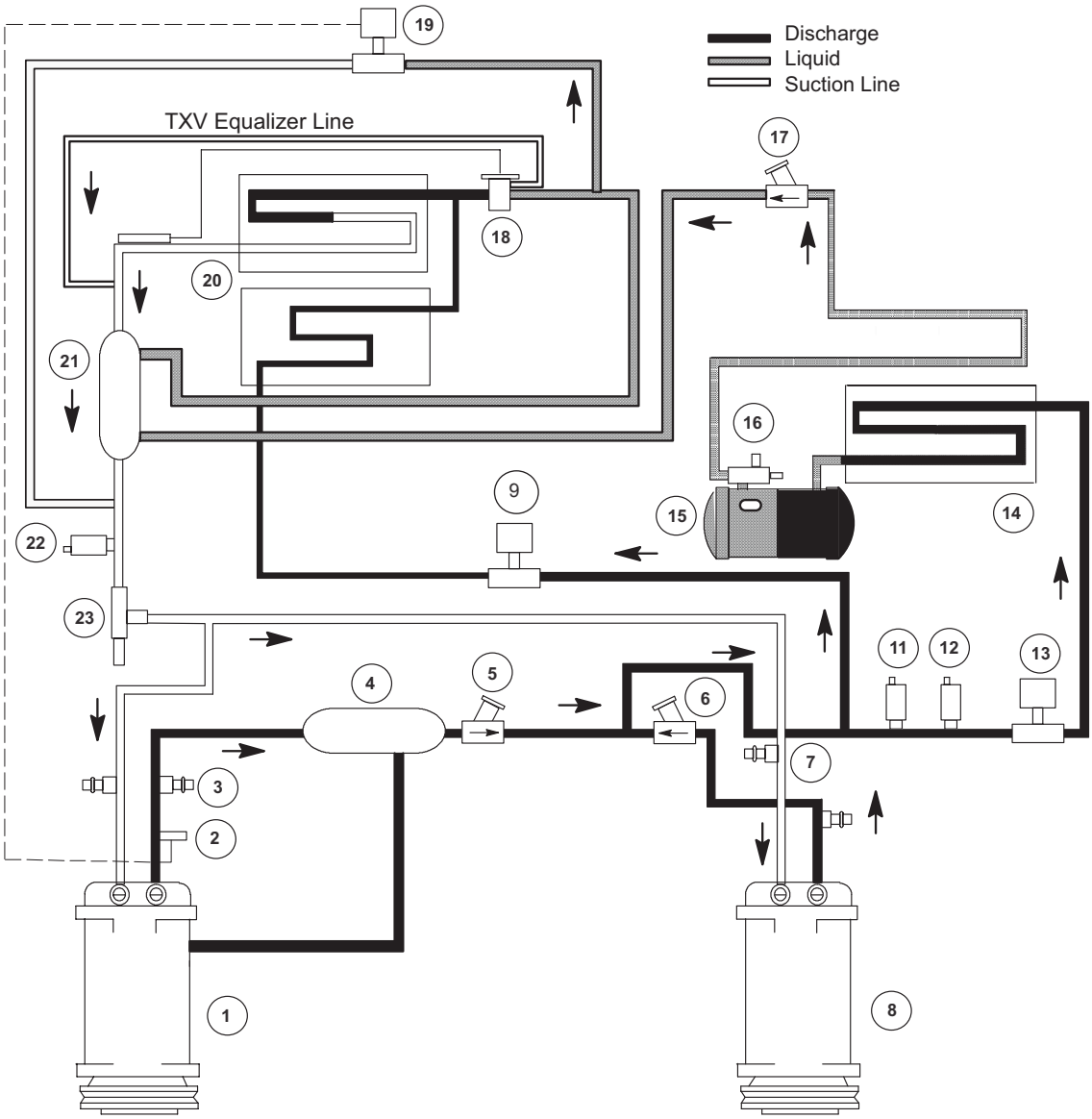
Figure 2.9 Refrigeration Circuit Cooling Cycle - Road and Standby



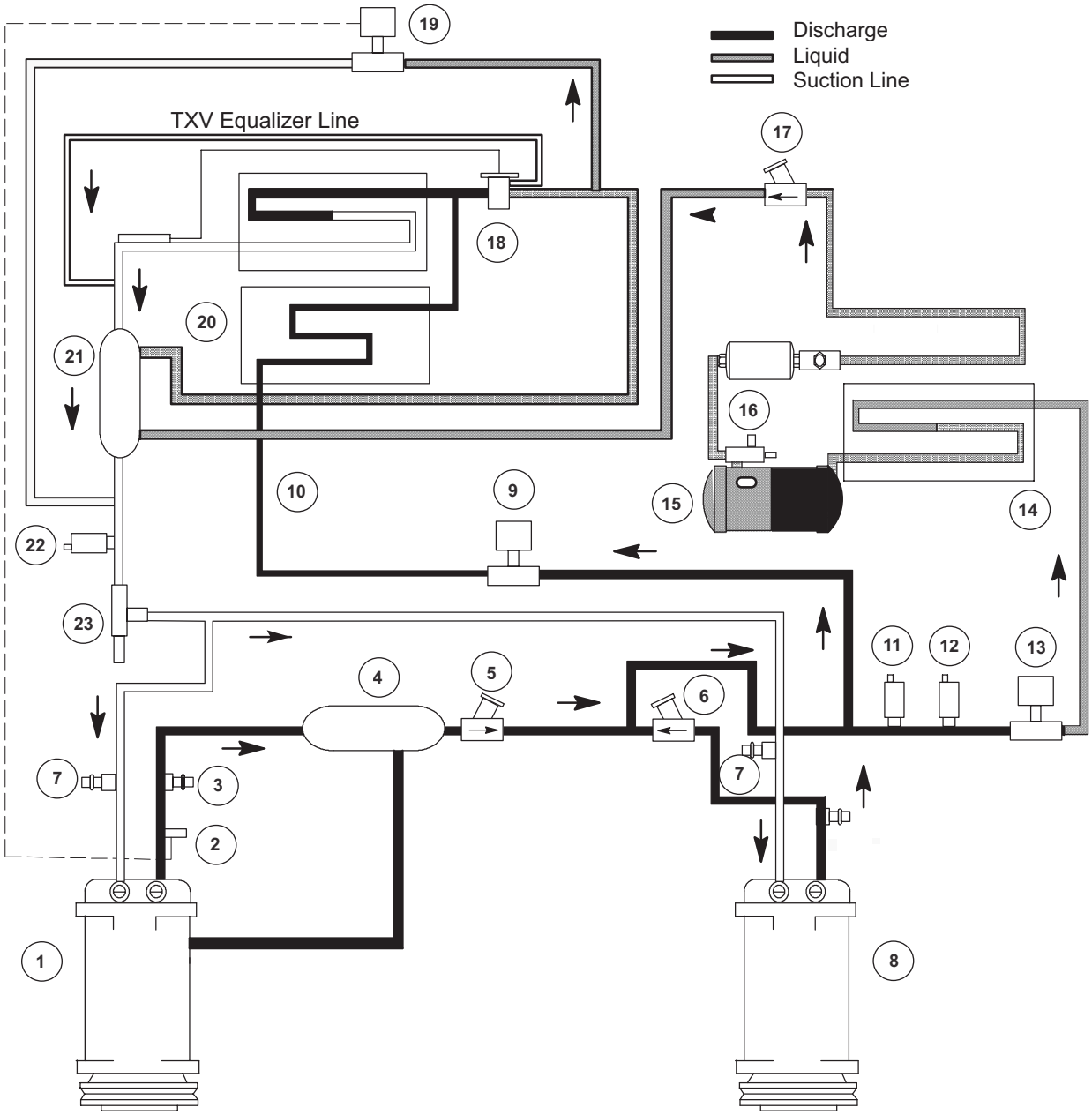
1. Road Compressor
2. Quench Thermostat (BPT)
3. Discharge Charging Port
4. Oil Separator
5. Road Discharge Check Valve
6. Standby Discharge Check Valve
7. Suction Charging Port
8. Standby Compressor
9. Hot Gas Solenoid Valve (HGS1)
10. Drain Pan Hot Gas Line
11. High Pressure Switch (HP1)
12. Condenser Pressure Control Switch (HP2)
13. Condenser Pressure Control Valve (HGS2)
14. Condenser Coil
15. Receiver/Drier w/ sightglass
16. Manual Shut-off Valve (King Valve)
17. Liquid Line Check Valve
18. Thermostatic Expansion Valve
19. Quench Valve (BPV)
20. Evaporator Coil
21. Heat Exchanger
22. Low Pressure Switch (LP)
23. Compressor Pressure Regulating Valve (CPR)

Figure 2.10 Refrigeration Circuit Heating and Defrost Cycle (HGS2 Open) - Road and Standby



1. Road Compressor
2. Quench Thermostat (BPT)
3. Discharge Charging Port
4. Oil Separator
5. Road Discharge Check Valve
6. Standby Discharge Check Valve
7. Suction Charging Port
8. Standby Compressor
9. Hot Gas Solenoid Valve (HGS1)
10. Drain Pan Hot Gas Line
11. High Pressure Switch (HP1)
12. Condenser Pressure Control Switch (HP2)
13. Condenser Pressure Control Valve (HGS2)
14. Condenser Coil
15. Receiver/Drier w/ sightglass
16. Manual Shut-off Valve (King Valve)
17. Liquid Line Check Valve
18. Thermostatic Expansion Valve
19. Quench Valve (BPV)
20. Evaporator Coil
21. Heat Exchanger
22. Low Pressure Switch (LP)
23. Compressor Pressure Regulating Valve (CPR)

Figure 2.11 Refrigeration Circuit Heating and Defrost Cycle (HGS2 Closed) - Road and Standby



1. Road Compressor
2. Quench Thermostat (BPT)
3. Discharge Charging Port
4. Oil Separator
5. Road Discharge Check Valve
6. Standby Discharge Check Valve
7. Suction Charging Port
8. Standby Compressor
9. Hot Gas Solenoid Valve (HGS1)
10. Drain Pan Hot Gas Line
11. High Pressure Switch (HP1)
12. Condenser Pressure Control Switch (HP2)
13. Condenser Pressure Control Valve (HGS2)
14. Condenser Coil
15. Receiver/Drier w/ sightglass
16. Manual Shut-Off Valve (King Valve)
17. Liquid Line Check Valve
18. Thermostatic Expansion Valve
19. Quench Valve (BPV)
20. Evaporator Coil
21. Heat Exchanger
22. Low Pressure Switch (LP)
23. Compressor Pressure Regulating Valve (CPR)

SECTION 3
Operation

⚠ WARNING

Beware of unannounced starting of the unit. The unit may cycle the fans and one of the operating compressors unexpectedly as control requirements dictate.

3.1 Control System

3.1.1 Introduction

⚠ CAUTION

Under no circumstances should anyone attempt to service the microprocessor components or either Cab Command module. Should a problem develop with the control system, contact your nearest Carrier Transicold dealer for replacement components.

The control system consists of the microprocessor (**Figure 2.2**), Cab Command/Cab Command Two (**Figure 3.1**) and interconnecting wiring.

3.1.2 Microprocessor

The microprocessor includes the temperature control software and necessary input/output circuitry to interface with the unit controls and controls the following functions:

- Maintaining the box temperature at setpoint by regulating the cooling, heating, off mode and automatic defrost cycles.
- Displaying the return air temperature permanently and, on request, the setpoint temperature.
- Enabling the operator to digitally display and select data.

For further details on digital message display, see **Section 3.1.4** or **Section 3.1.5**.

3.1.3 Cab Command/Cab Command Two

The Cab Command is mounted in the cab of the truck. The Cab Command includes the LCD display and keypad. The keypad and display serve to provide user access and readouts of microprocessor information. The information is accessed by keypad selections and viewed on the display and allows the driver to carry out the following operations:

- Manual start up and shut-down of the unit
- Automatic start up of the unit
- Adjustment of setpoint
- Initiation of manual defrost

The driver can display the box temperature, and see whether the setpoint is being maintained by checking the green indicator. The indicator lights up red in the event of an alarm.

When the battery voltage is too low, a fail-safe system shuts down the unit. Unit restart is automatic and time-delayed if the voltage rises to the normal level.

3.1.4 Road Only - Cab Command

Figure 3.1 Cab Command - Road Only Units

a. Display

The digital display consists of three alphanumeric characters and three LEDs. The default value displayed is the box temperature. The microprocessor enables selection of the display in degrees Celsius or Fahrenheit. The display also includes sentines for defrost operation (dF).

888	Digital Display
	Standby operation LED (Not applicable for Road Only Units)
	Road operation LED
!	Unit operating LED • Green: cycling (left-hand side) • Red: not functioning properly (right-hand side)

b. Unit operating LEDs

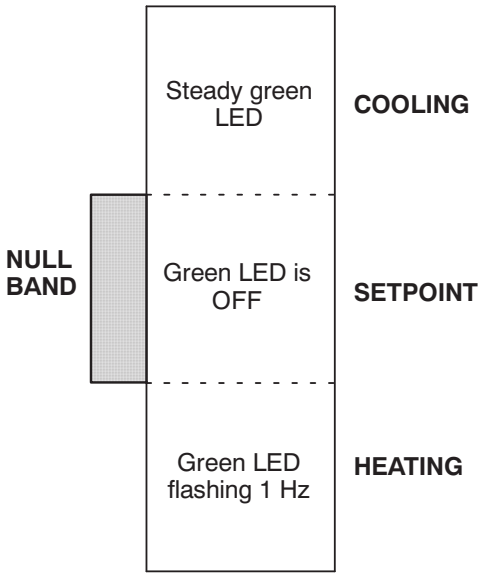
Green Light Status

Under normal operation, the green LED will indicate the temperature control status. Refer to **Figure 3.2** for more detail.

Red Light Status

When an alarm has been detected, the red unit indicating light flashes at 1 Hz. The light will continue to flash at 1 Hz until the alarm is cleared. At that point the steady green indicator light will light and the alarm will become inactive.

Figure 3.2 Green Light Status



c. Keypad

The keypad consists of six keys that enable the operator to activate various functions, display operating data and modify operating parameters.

	Manual defrost control key
	Unit start-up key
	Unit shut-down key The unit can also be shut down with the ignition key.

Unit data and function modification keys

	The SET key, together with the + and - keys, enables display and modification of unit operating data. The display scrolls through parameters each time the SET key is pressed.
	Decrease key for selected data
	Increase key for selected data

3.1.5 Road/Standby - Cab Command Two

Figure 3.3 Cab Command Two

a. Display

The digital display consists of four alphanumeric characters. The default value displayed is the box temperature. The microprocessor enables selection of the display in degrees Celsius or Fahrenheit. The display also includes sentines for defrost operation (dF) and three LEDs:

	Digital Display
	Standby operation LED
	Road operation LED
	Unit operating LED • Green: cycling (left-hand side) • Red: not functioning properly (right-hand side)

During start up the brightness of the display may be adjusted:

ON	Press the Unit start-up key to turn on the unit.
-	Press the - key during the first five seconds to decrease the display brightness.
+	Press the + key during the first five seconds to increase the display brightness.

b. Unit operating LEDs

Green Light Status

Under normal operation, the green LED will indicate the temperature control status. Refer to **Figure 3.4** for more detail.

Red Light Status

For all alarms, except out-of-range alarms A12 and A13 (See **Table 3–1**), the steady red unit indicating LED will light until the alarm is cleared. At that point the steady green indicator LED will light and the alarm will become inactive. When the unit has been running for at least 15 minutes after setpoint has been reached and goes out-of-range, the red LED will flash. Refer to **Figure 3.5** for more detail.

Figure 3.4 Green Light Status

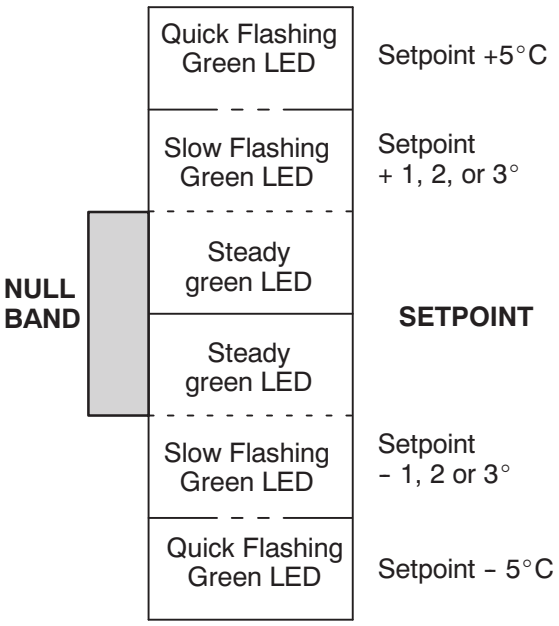
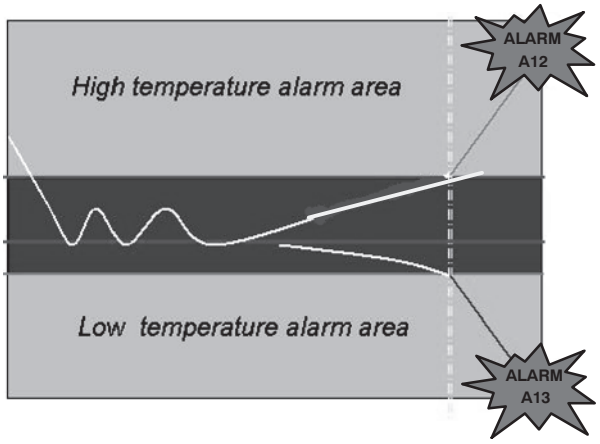


Figure 3.5 Red Light Status



c. Keypad

The keypad consists of six keys that enable the operator to activate various functions, display operating data and modify operating parameters.

	Manual defrost control key
	Unit start-up key
	Unit shut-down key in standby or road mode In road operation, the unit can also be shut down with the ignition key.

Unit Data and Function Modification Keys

	The SET key, together with the + and - keys, enables display and modification of unit operating data. The display changes parameters each time the SET key is pressed.
	Decrease key for selected data
	Increase key for selected data

NOTE

If no keys are pressed within five seconds of pressing the ON key, the system reverts to box temperature.

d. Additional Key Functions

To access additional key functions, press and hold the SET key for five seconds. The microprocessor will provide a set of additional functions as the SET key is pressed additional times after the five-second hold. The sequence for the additional functions is as follows:

	1. Press SET for five seconds. This enables access to the alarm codes.
	2. Press to display the alarm list.
	3. Press SET again to display software versions.
	4. Press + to display the cab command software version.
	5. Press SET again to display road hour meter (Road LED ON).
	6. Press SET again to display standby hour meter (Standby LED ON).
	7. Press DEFROST to display the present interval between defrosts (min) as calculated by the microprocessor.
	8. Press DEFROST to display the elapsed time (min) since the last defrost.
	9. Press SET to return to box temperature.

NOTE

If no keys are pressed within five seconds of pressing the ON key, the system reverts to box temperature.

3.2 Start-Up

3.2.1 Inspection

Before starting the truck engine or connecting standby power check the following:

- Check condenser coil for cleanliness.
- Check condition of refrigerant hoses.
- Check condition and tension of compressor belt(s).
- Check condition of condenser fan blade, motor and brushes.
- Check truck battery fluid level.
- Check truck battery and terminal connections - clean and tighten as necessary.
- Check defrost water drains from evaporator.
- Check evaporator coil for cleanliness.
- Check condition of evaporator blower wheels and motor.

3.2.2 Starting - Road Only Units - Cab Command

⚠ CAUTION

If starting unit for the first time after installation the compressor pressure regulating valve will need to be set (refer to Section 5.11).

⚠ CAUTION

If starting unit for the first time after installation or starting after adding/removing an optional feature or if owner's operating parameters have changed the configuration will need to be reset.

1. Start the vehicle engine.
2. Press the ON key to start the unit. After a 40 second delay, the unit starts up. The digital display of the Cab Command displays the box temperature.
3. Press the SET key and then check that temperature setpoint is correct. The setpoint temperature is highlighted on the digital display.

3.2.3 Starting - Road/Standby Units - Cab Command Two

1. Depending on desired mode of operation, either start the vehicle engine or connect the standby power plug.
2. Press the ON key to start the unit. After a 40 second delay, the unit starts up. The digital display of the Cab Command displays the box temperature.
3. Press the SET key and then check that temperature setpoint is correct. The setpoint temperature is highlighted on the digital display.

NOTE

During start up, the evaporator motor speed increases continuously to selected speed over a 30 seconds time period.

3.2.4 Connect Power for Standby

⚠ WARNING

Do not attempt to connect or remove power plug before ensuring the unit is OFF (press OFF key on Cab Command) and external power circuit breaker is open.

⚠ WARNING

The power plug must be clean and dry before connecting to any power source.

If the unit is to be operated in the standby mode, connect power as follows:

1. Check that the external power source corresponds to the characteristics of the unit (see **Section 2.6.3**). The external power source circuit breaker must be open.
2. The unit must be turned OFF by pressing the OFF button on the Cab Command Two.
3. Plug the power cord into unit receptacle.
4. Close external power source circuit breaker.

3.2.5 Start-Up Process

Start-up on Road with cool setpoint and box temp > -5°F (-20.6°C):

a. 0 time: ON key pushed

b. 20 seconds: HGS1 ON (pressure equalization)

c. 40 seconds: CLHR ON (Road clutch)

d. 50 seconds: HGS1 OFF/ fans ON (unit in cool)

Start-up on Standby with cool setpoint and box temp > -5°F (-20.6°C):

a. 0 time: ON key pushed

b. 15 seconds: HGS1 ON (pressure equalization)

c. 40 seconds MC ON (Standby contactor coil)

d. 50 seconds: HGS1 OFF/ fans ON (unit in cool)

Start-up on Road with heat setpoint and box temp > -5°F (-20.6°C):

a. 0 time: ON key pushed

b. 20 seconds: HGS1/ HGS2/ CLHR ON

c. 45 seconds: fans/ BPV ON (unit in heat)

Start-up on Standby with heat setpoint and box temp > -5°F (-20.6°C):

a. 0 time: ON key pushed

b. 10 seconds: HGS1/ HGS2 ON

c. 20 seconds: MC/ fans/ BPV ON (unit in heat)

Start-up on Road with cool setpoint and box temp < -5°F (-20.6°C):

a. 0 time: ON key pushed

b. 20 seconds: CLHR / fans ON (unit in cool)

Start-up on Standby with cool setpoint and box temp < -5°F (-20.6°C):

a. 0 time: ON key pushed

b. 10 seconds: MC/ fans ON (unit in heat)

Start-up on Standby with heat setpoint and box temp < -5°F (-20.6°C):

a. 0 time: ON key pushed

b. 10 seconds: HGS1/ HGS2/ MC ON

c. 15 seconds: fans/ BPV ON (unit in heat)

Start-up on Road with heat setpoint and box temp < -5°F (-20.6°C):

a. 0 time: ON key pushed

b. 20 seconds: HGS1/ HGS2/ CLHR ON

3.2.6 Minimum Shut-Down Time on Standby

The minimum shut-down for the standby compressor is five minutes after reaching setpoint.

After this minimum shut-down period, the unit restarts when the temperature goes out of the cycling range by ± 1.8. 3.6 or 5.4°F (± 1, 2 or 3°C).

3.3 Setpoint Adjustment

3.3.1 Road Only and Road/Standby Units - Cab Command and Cab Command Two

It is possible to increase or decrease the setpoint by whole numbers until the required setpoint is displayed. If display stays highlighted, this indicates the setpoint displayed has not been validated.

The new setting for the setpoint is validated by pressing the SET key.

	Displays the set-point temperature
	Decrease the set-point
	Increase the set-point
	Validates set-point temperature. Returns to display of the box temperature.

3.4 Defrost

Defrost is fully automatic and managed by the integrated microprocessor but can be manually controlled if authorized by the defrost thermostat. During the defrost phase, the evaporator fan shuts down and the condenser fan is controlled by the microprocessor. During the defrost phase, the readout of the cab command indicates “dF”.

The end of the cycle is controlled by the defrost termination thermostat (DTT). The defrost interval timer is reset to zero when the defrost cycle is terminated.

a. Manual Defrost

1. Check that box temperature is 40°F (4.4°C) or lower.
2. Press the MANUAL DEFROST key to initiate manual defrost.

b. Defrost Termination Safety

If the defrost cycle does not terminate after 45 minutes, the cycle terminates automatically and displays alarm code A14.

3.5 Alarm Display

In the event of an alarm, the unit will be shut down and the Cab Command/Cab Command Two will immediately display an error message. The message will remain displayed until the alarm is corrected. If standby power is connected and the alarm is such that standby operation can be allowed, the unit will start in the standby mode. A listing of the error messages and alarm codes is provided in **Table 3–1**.

3.5.1 Accessing Alarm Messages

Current alarms will be displayed with an “A” preceding the alarm number while past alarms will be displayed with a “P” preceding the alarm number. To access the alarm messages:

1. Press the SET key for five seconds to enable access to alarm messages.
2. Or, in the event of more than one alarm, press the + or - keys to list them.

3.5.2 Low Battery Voltage Alarms

There is a 40 second time delay during start-up. After this delay if the battery voltage drops below 10.5V ±0.5V, the microprocessor will react 20 seconds later and the unit will go out of temperature control mode. The microprocessor will check the voltage after another 20 seconds. If battery voltage still has not risen, the unit will remain out of temperature control mode for another 10 minutes, the battery alarm will be activated and the Cab Command will display the message “bAt”. Unit will return to temperature control mode if battery voltage has risen after 10minutes. If the battery voltage has not risen after this 10 minute period the unit will remain out of temperature control mode another two minutes and the microprocessor will check the battery voltage every two minutes. Unit will return to temperature control mode in its current configuration when battery voltage rises to 10.5V ±0.5V.

Table 3–1 Alarm Messages

Road Only	Standby	Alarm Codes	Description
X	X	A00	Red LED flashes No alarm Unit in operation
X		A01/A02	High or Low pressure switch
	X	A01	Low pressure switch (LP)
	X	A02	High pressure switch
	X	A03	Standby compressor thermal overload open
X	X	A04	Road compressor clutch (CLHR) not functioning properly
	X	A05	Standby contactor (MC) high amp draw
X	X	A06	Condenser fan motor (CFM) high amp draw
X	X	A07	Evaporator Fan low rotational speed
		A08	(Not applicable)
X	X	A09	Hot gas valve (HGS1) high amp draw
X	X	A10	Quench valve (BPV) high amp draw
X	X	A11	Condenser pressure control valve (HGS2) high amp draw
X	X	A12	High temperature alarm
X	X	A13	Low temperature alarm
X	X	A14	Defrost cycle is greater than 45 minutes
X	X	A15	Setpoint adjusted out of the range -20.2 to 86°F (-29°C/+30°C) or below the programmed low threshold
	X	A16	Evaporator drain line heater (DWR) not functioning properly (option)
	X	A17	Transformer/Rectifier thermal overload (RBT) open
	X	A18	Control fault, electric heat (option)
	X	A20	Low pressure switch jumper (microprocessor terminal 6 to SP2) open
	X	A21	Compressor contactor (MC) open circuit
	X	A22	Condenser fan motor (CFM) open circuit
	X	A23	Hot water solenoid valve (HWV) open circuit (option)
	X	A24	Hot gas valve (HGS1) open circuit
	X	A25	Quench valve (BPV) open circuit
	X	A26	Condenser Pressure Control Valve (HGS2) open circuit
	X	A27	Evaporator drain line heater (DWR) open circuit (option)

Table 3–1 Alarm Messages (Continued)

Road Only	Standby	Alarm Codes	Description
	X	A28	Relay fault, electric heat (option)
	X	A45	EPROM Failure
X	X	BAT	Low battery voltage
X		2EP	Functional parameters have not been set or have been lost. Press and hold the SET key to clear the alarm. Refer to Section 2.7.1 to set parameters.
X	X	EE	Probe not functioning properly or evaporator temperature out of limits [-49° to 174°F (-45° to 79°C)]
X	X	Err	Programming error on part of operator
X	X	---	Setpoint lower than maximum setpoint but in the range of -20°F to 86°F.
	X	--- --- ---	Dual power supply (road and standby units only - Cab Command Two)

3.5.3 Clearing Past Alarm Messages

The alarm list provides information on current alarms and past alarms which may be helpful in trouble shooting unit problems. Once all the alarm information has been noted and service is complete, the alarm list may be cleared.

a. To clear the past alarm messages:

1. Press the ON, the + and the - keys at the same time.

b. To clear the active alarm messages:

1. Turn unit OFF and then back ON.

3.6 Checking the EPROM Version

1. Press the Unit start-up key to turn on the unit.
2. Press the SET key for five seconds.
3. Press the SET key again to display EPROM version number.
4. Press the SET key again to return to the normal display of box temperature.

3.7 Modification of Functional Parameters

3.7.1 Road Only Units - Cab Command

The procedure for adjusting the functional parameters is as follows:

1. The temperature display is selectable between Fahrenheit and Celsius. Units are configured for Celsius from the factory. To set the display to Fahrenheit, the selection jumper must be removed and discarded.
2. Press the Unit shut-down key to turn off the unit.
3. The following steps must be performed with the unit OFF:
   a. Hold both DEFROST and ON keys momentarily in order to display parameters.
   b. Use the + and - keys to modify parameters as needed.
   c. Press the SET key to confirm a change.

NOTE

If no buttons are depressed within five seconds of pressing the DEFROST and ON keys or modifying parameters, the Cab Command reverts to box temperature display and the configuration procedure is aborted.

- The defrost duration parameter is displayed. This setting determines the length of time in minutes the unit will remain in defrost once defrost is initiated. The defrost duration can be selected by scrolling through available options (10, 20, 25, 30 or 45 minutes) using the (+) or (-) keys. Selection MUST be validated by pressing the SET key.
- The defrost interval parameter is displayed next. This setting determines the time between defrosts in hours. The defrost interval can be selected by scrolling through available options (0, 1, 1.5, 2, 2.5, 3, 4, 5, 6 hours) using the (+) or (-) keys. Selection MUST be validated by pressing the SET key.

4. Press the Unit start-up key to turn on the unit.
5. The next steps must be performed with the unit ON:
   a. Press the +, then -, then DEFROST keys. All keys should be held momentarily after pressing in the correct sequence.
   b. Press the + or - keys to modify parameters.

NOTE

If no buttons are depressed within five seconds of pressing the ON key or modifying parameters, the Cab Command reverts to box temperature display and the configuration procedure is aborted.

- The minimum setpoint parameter is displayed. The minimum setpoint can be selected by scrolling through available options [-20°F (-28.9°C), -4°F (-20°C), 32°F (0°C)] using the (+) or (-) keys. Factory setting is -20°F. Selection MUST be validated by pressing the SET key.
- The null mode differential temperature is displayed next. This setting determines the temperature difference between box temperature and setpoint that controls compressor cycling. The differential can be selected by scrolling through available options [1.8°F (1°C), 3.6°F (2°C), or 5.4°F (3°C)] using the (+) or (-) keys. Factory setting is 3.6°F (2°C). Selection MUST be validated by pressing the SET key.
- The ON/OFF (Continuous airflow) parameter for the evaporator fan is displayed next. This feature determines whether the evaporator fan is on or off when the unit cycles off upon reaching setpoint. The factory setting is OFF. Change setting by using the (+) or (-) keys. Selection MUST be validated by pressing the SET key.
- The return air temperature will be displayed after the above sequence.

3.7.2 Road/Standby Units - Cab Command Two

The procedure for adjusting the functional parameters is as follows:

1. Press the ON key of the controller.
2. To adjust the brightness of the display at this time, press the + or - keys within five seconds of pressing the ON key.
3. Press and hold the +, -, and then DEFROST keys n the correct sequence.
4. Press the + or - keys to modify parameters.
5. Press the SET key to confirm a change. The display will return to box temperature.
   - The minimum setpoint parameter is displayed. The minimum setpoint can be selected by scrolling through available options [-20.2°F (-29°C), 68°F (20°C), 32°F (0°C)] using the (+) or (-) keys. Factory setting is -20°F. Selection MUST be validated by pressing the SET key.
   - The maximum setpoint parameter is displayed. The maximum setpoint can be selected by scrolling through available options [68°F (20°C), 86°F (30°C)] using the (+) or (-) keys. Factory setting is 68°F. Selection MUST be validated by pressing the SET key.
   - The null mode differential temperature is displayed next. This setting determines the temperature difference between box temperature and setpoint that controls compressor cycling. The differential can be selected by scrolling through available options [1.8°F (1°C), 3.6°F (2°C), or 5.4°F (3°C)] using the (+) or (-) keys. Factory setting is 3.6°F (2°C). Selection MUST be validated by pressing the SET key.
   - The ON/OFF (Continuous airflow) parameter for the evaporator fans is displayed next. This feature determines whether the evaporator fan is on or off when the unit cycles off upon reaching setpoint. The factory setting is OFF. Change setting by using the (+) or (-) keys. Selection MUST be validated by pressing the SET key.

- The return air temperature will be displayed after the above sequence.

Adjusting Defrost Parameters:

1. Press the Unit shut-down key to turn off the unit.
2. Hold both DEFROST and ON keys momentarily in order to display parameters.
3. Use the + and - keys to modify parameters as needed.
4. Press the SET key to confirm a change. The display will return to box temperature.

NOTE

If no buttons are depressed within five seconds of pressing the DEFROST and ON Keys or when modifying parameters, the Cab Command reverts to box temperature display and the procedure is aborted. Only validated changes are recorded.

5. The defrost interval parameter is displayed next. This setting determines the length of time between defrosts:
   - **0**: complete deletion of defrost.
   - **AUT:** The microprocessor calculates the time - factoring in length of last defrost, time between two defrost cycles in relation to setpoint and cargo.
   - **0.5 to 0.9**: decreases the microprocessor calculated time between defrosts by 1/2 normal to 9/10 normal.
   - **1.1 to 1.5**: increases the microprocessor calculated time between defrosts by 1.1 times normal to 1 1/2 times normal.
   - **1 H, 2 H,... 6 H**: Forced interval between each defrost expressed in hours.

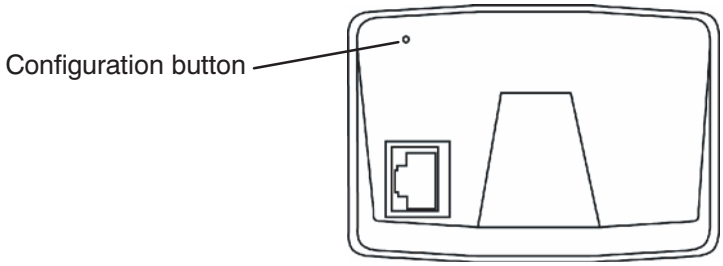
3.8 Microprocessor Configuration - Road / Standby Only (Cab Command Two)

⚠ CAUTION

If starting unit for the first time after installation or starting after adding/removing an optional feature or if Owners operating parameters have changed, the Configuration will need to be reset.

To access the configuration menu, use a small tool, such as a paper clip, to press the configuration button located inside the hole on the rear of the Cab Command Two module (see Figure 3.6). Press the button only once to enter the menu. All changes are made with the keypad.

Figure 3.6 Configuration Button



Temperature Unit	Ut°C: Celsius degree display Ut°F: Fahrenheit degree display 1. Press the + or - keys to change Ut°C or Ut°F. 2. Press the SET key to validate and go to the next configuration
Unit Voltage	PS12: unit voltage 12 V PS24: unit voltage 24 V 1. Press the + or - keys to change PS12 or PS24. 2. Press the SET key to validate and go to the next configuration.
Number of Evaporator Fans	FAn1: 1 fan FAn2: 2 fans FAn3: 3 fans 1. Press the + or - keys to change FAn1, FAn2 or FAn3. 2. Press the SET key to validate and go to the next configuration.
Fan Speed	SPd–: 1st speed mini SPd=: 2nd speed medium SPd=: 3rd speed maxi 1. Press the + or - keys to change SPd–, SPd= or SPd= 2. Press the SET key to validate and go to the next configuration.
2 or 3 ET Mode	2 Et: cool, null 3 Et: cool, null, heat 1. Press the + or - keys to change 2 Et or 3 Et. Note: 35X - 3ET 2. Press the SET key to validate and go to the next configuration.
Optional Road Heating Kit	hrOF: option road heating kit not installed hrOn: option road heating kit installed 1. Press the + or - keys to change hrOF or hrOn. 2. Press the SET key to validate and go to the next configuration.
Optional Standby Heat Kit	hSOF: standby heating kit not installed hSOn: standby heating kit installed 1. Press the + or - keys to change hrOF or hrOn. 2. Press the SET key to validate and go to the next configuration.
Suction Bypass Valve (Integra 50X only)	SbOF: SBPV is not active and remains closed in all modes. SbOn: SPBV is active 1. Press the + or - keys to change SbOF or SbOn. 2. Press the SET key to validate and go to the next configuration.
Drain Line Heater (option)	drOF: drain heater not installed drOn: drain heater installed 1. Press the + or - keys to change drOF or drOn. 2. Press the SET key to validate and go to the next configuration.
Door Switch (option)	drOF: door switch not installed drOn: door switch installed 1. Press the + or - keys to change dOFF or d On. 2. Press the SET key to validate and go to the next configuration.

Hybrid Unit (option)	EUOF: Adjusting Standby set-point identical to road set-point EUOn: Set-point locked at -31°F (-35°C) in standby mode 1. Press the + or - keys to change EUOFF or EUOn. 2. Press the SET key to validate and go to the next configuration.
Setpoint Lock (option)	SPOF: setpoint lock option is not active SPON: setpoint lock option is active 1. Press the + or - keys to change the setting to desired selection. 2. Press the SET key to validate and go to the next configuration.
Pump Down (option)	PdOF: Pump down option disactivated PdON: Pump down option activated 1. Press the + or - keys to change the setting to desired selection. 2. Press the SET key to validate and go to the next configuration. If Pump Down option is activated, the following 2 configurations are then available:
Compressor shutdown delay (Negative box temperature)	t-.40 up to t-.10: Adjustable on a 30secs range 1. Press the + or - keys to change the setting to desired selection. 2. Press the SET key to validate and go to the next configuration.
Compressor shutdown delay (Positive box temperature):	t.120 down to t.10: Adjustable on a 110secs range 1. Press the + or - keys to change the setting to desired selection. 2. Press the SET key to validate and go to the next configuration.

NOTE

If no key is activated after validating a configuration, the system reverts to box temperature display and the configuration procedure is aborted. Only validated changes are recorded.

3.9 Stopping the Unit

Press the OFF key or turn the ignition key to the off position.

SECTION 4
Temperature Control

4.1 Sequence Of Operation

General operation sequences for cooling, null, and heating are provided in the following paragraphs. The microprocessor automatically selects the mode necessary to maintain box temperature at setpoint.

4.1.1 Cooling Mode

a. With return air temperature above setpoint and decreasing, the unit will be cooling with the compressor and evaporator fans operating. (See **Section 2.8.1** for a description of the refrigeration circuit during cooling.) The condenser fan will operate under the control of the condenser pressure control switch (HP2). The green unit operating LED will operate in accordance with **Figure 3.2**. If discharge pressure rises to HP2 setting (See **Section 2.6.2**), the condenser fan motor (CFM) will turn on for a minimum of three minutes.

b. If discharge temperature increases to the setpoint of the quench thermostat (BPT), the thermostat will close, energizing the quench valve (BPV). This will allow liquid into the suction line in order to cool the compressor. Once the discharge temperature decreases to the setpoint of the BPT, the thermostat will open, DE-energizing the BPV.

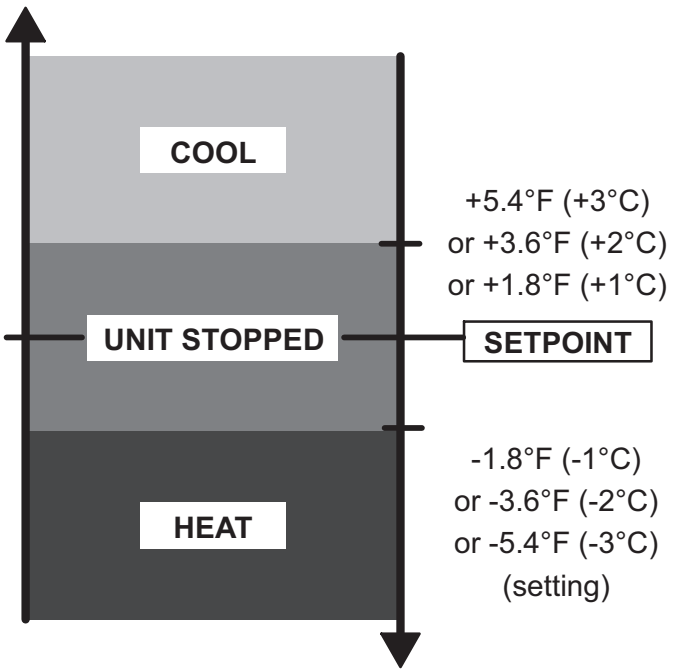
c. Once temperature decreases to the setpoint the unit will enter the null mode. If the continuous air flow parameter is set to ON, the evaporator fans will continue to operate with all other components OFF. If the continuous air flow parameter is OFF, the evaporator fans and all other components will be OFF. A five minute delay is required before restart is allowed.

d. If temperature increases during the null mode, the unit will restart in cooling.

4.1.2 Heating Mode

If temperature continues to decrease the unit will enter the heating mode with the compressor and evaporator fans operating, the hot gas solenoid valve (HGS1) energized (open), the condenser pressure control valve (HGS2) energized (closed) and the quench valve (BPV) energized (open). If discharge pressure rises to the HP2 setting (See **Section 2.6.2**) HGS2 will de-energize (open) and BPV will de-energize (closed) for a minimum of one minute. If discharge pressure remains the same or rises the condenser fan motor (CFM) will turn on. (See **Section 2.8.2** for a description of the refrigeration circuit during heat and defrost.)

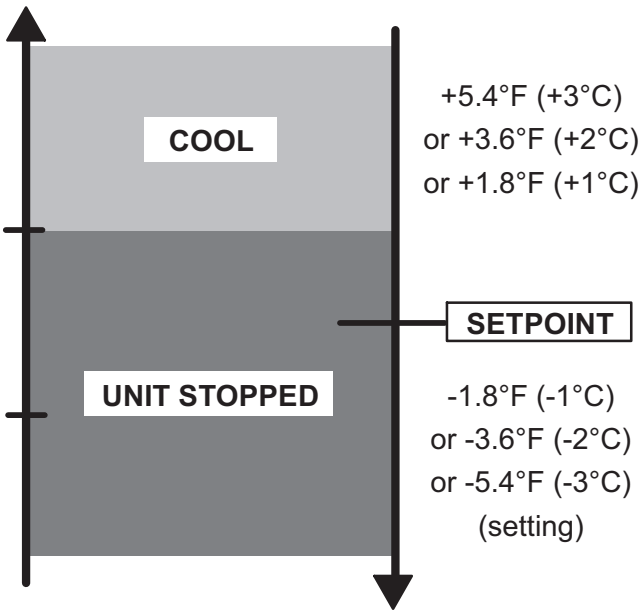
Figure 4.1 Operating Sequence - Perishable Mode



4.1.3 Frozen Mode

The unit operates in the frozen mode with setpoints at or below 10°F (-12°C).Operation in the frozen mode is the same as in the perishable mode except no heating takes place.

Figure 4.2 Operating Sequence - Frozen Mode



4.2 Defrost Cycle

Defrost is an independent cycle overriding cooling and heating functions to melt frost and ice from the evaporator when necessary. Defrost may be initiated by the microprocessor or manually by the operator once the defrost termination thermostat has closed at approximately 38°F (3.3°C). In defrost mode, the microprocessor displays “dF” on the cab command and set-point is no longer displayed.

During defrost, the evaporator fans shut down and operation of the condenser fan is controlled by the microprocessor. For road only units, the end of the defrost cycle is time based only. For standby units, the end of the cycle is controlled by the opening of the defrost termination thermostat (See **Section 2.6.2** for DTT settings. The same logic for component control that applies to heating also applies to defrost. (See **Section 2.8.2** for a description of the refrigeration circuit during heat and defrost.)

4.3 Minimum Off Time

Once the unit has cycled off, it will remain off for the minimum off time of five minutes. This prevents rapid cycling due to changes in air temperature. Air temperature in the box changes rapidly but it takes time for the product temperature to change.

SECTION 5
Service

⚠ WARNING

Beware of unannounced starting of the unit. The unit may cycle the fans and one of the operating compressors unexpectedly as control requirements dictate. To ensure unit is without power, remove power plug and remove battery negative cable.

5.1 Maintenance

Regular servicing is required in order to optimize the life and reliability of your unit. The recommended scheduled maintenance intervals and categories are provided in Table 5–3, while descriptions of the service procedures to be carried out under each category are provided in Table 5–5.

Table 5–1 Maintenance After Start-up

Check condenser and evaporator fan rotation and proper air flow.
Check cab command for proper unit cycling and correct display of all indicator lights.
Check for unusual noise or vibration
Check that refrigerant is visible in liquid line sight-glass.

Table 5–2 Maintenance After 15 Minutes or More of Operation

Check that refrigerant is visible in liquid line sight-glass.
Check compressor oil level
Check for proper temperature control
Check temperature cycling operation
Put unit into manual defrost mode.
Verify unit terminates defrost mode.

Table 5–3 Preventive Maintenance Schedule - Road

Miles	Service A	Service B	Service C	Service D
3000	•			
18000	•	•		
36000	•	•	•	
54000	•	•		
72000	•	•	•	•
90000	•	•		
108000	•	•	•	
126000	•	•		

Table 5–4 Preventive Maintenance Schedule - Standby

Hours	Service A	Service B	Service C	Service D
100	•			
1000	•	•		
2000	•	•	•	
3000	•	•		
4000	•	•	•	•
5000	•	•		
6000	•	•	•	
7000	•	•		

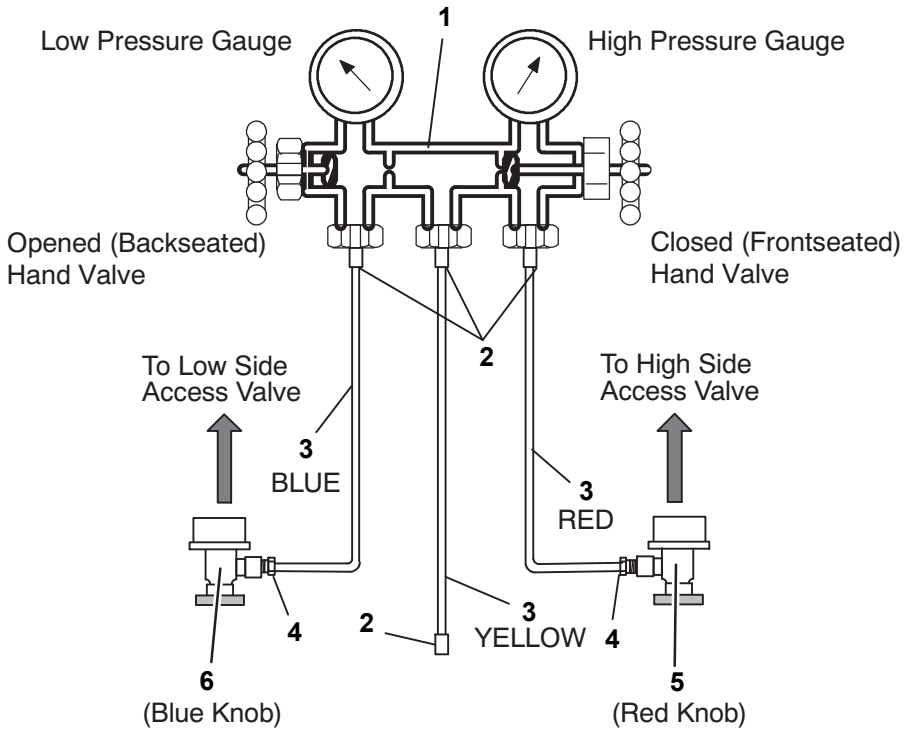
Table 5–5 Service Category Descriptions

Service A	1. Check the tension of the alternator belt(s). 2. Check that the vehicle engine runs correctly at low speed, and that the compressor mounting kit is correctly tightened and the belt tension is correct. 3. Check the tightness of bolts and screws and that the unit is correctly fastened onto the box. 4. Check tension of alternator/compressor belt.
Service B	1. Clean condenser and the evaporator coils. (**Section 5.16** and **Section 5.17**) 2. Replace the road compressor belt. 3. Check, and if required, replace the filter drier. (**Section 5.8**) 4. Check the operation of cab command. 5. Check the defrost: • Cut-in • Fan shut-down • Cut-out • Defrost water drain(s)
Service C	1. Check the operation of the evaporator and condenser fans. Change the condenser motor brushes. The evaporator of this unit is equipped with brushless fan motors therefore, brush maintenance is not required. 2. Change the compressor oil. Use polyol ester oil (POE) approved by CARRIER. Refer to **Section 2.6.1**.
Service D	1. Change the removable fuses and capacitors (if any) in the control box.

5.2 Installing R-404A Manifold Gauge Set

A manifold gauge/hose set is required for service of models covered within this manual. The manifold gauge/hose set is available from Carrier Transicold. (Carrier Transicold P/N 07-00314-00, which includes items 1 through 4, **Figure 5.1**). To perform service using the manifold gauge/hose set, do the following:

Figure 5.1 Manifold Gauge Set (R-404A)



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

- - - - -

5.2.1 Preparing Manifold Gauge/Hose Set for Use

If the manifold gauge/hose set is new or was exposed to the atmosphere, it must be evacuated to remove contaminants and air as follows:

1. Connect high and low side hoses to blank connections on back of manifold gauge set and midseat both hand valves.
2. Connect the yellow hose to a vacuum pump and an R-404A cylinder.
3. Evacuate to 10 inHg (254 mmHg) and charge with R-404A to a slightly positive pressure of 1.0 psig (0.07 Bar).
4. Frontseat both manifold gauge set hand valves, and disconnect from cylinder. The gauge set is now ready for use.

5.2.2 Connecting Manifold Gauge/Hose Set

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

1. Remove service valve stem cap and check that it is backseated. Remove access valve cap.
2. Connect the refrigeration hose (see **Figure 5.1**) to the access valve.
3. Read system pressures.
4. Repeat the procedure to connect the other side of the gauge set.

5.2.3 Removing the Manifold Gauge Set

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

⚠ CAUTION

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

3. Backseat the low side service valve. Frontseat both manifold set hand valves. Remove the refrigeration hoses from the access valves.
4. Install both service valve stem caps (finger-tight only).

5.3 Pumping Down or Removing the Refrigerant Charge

⚠ CAUTION

When working with refrigerant use safety glasses and gloves to avoid burns. Hoses and copper tubing can be hot when unit is running.

NOTE

Once the system is open, it must be evacuated and dehydrated (see **Section 5.5**).

NOTE

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

Pumping the Unit Down

To service the expansion valve, CPR valve or evaporator coil, pump most of refrigerant into condenser coil and receiver as follows:

1. Backseat suction and discharge service valve (turn counterclockwise) to close off gauge connection, and attach manifold gauges to valves.
2. Open valves two turns (clockwise). Purge gauge line.
3. Close the receiver outlet (king) valve by turning clockwise. Start unit and run in high speed cooling. Place Run-stop switch in the STOP position when unit reaches 0.1 kg/cm^2 (1 psig).
4. Frontseat (close) suction service valve and the refrigerant will be trapped between the compressor suction service valve and the manual shutoff (King) valve.
5. Before opening up any part of the system, a slight positive pressure should be indicated on the pressure gauge.
6. 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.
7. When service has been completed. Open (backseat) King valve and midseat suction service valve.
8. Leak check connections with a leak detector (refer to **Section 5.4**).
9. Start the unit in cooling and check for noncondensibles.
10. Check the refrigerant charge (refer to **Section 5.6.1**).

NOTE

Store the refrigerant charge in an evacuated container if the system must be opened between the compressor discharge valve and receiver.

NOTE

Whenever the system is opened, it must be evacuated and dehydrated (refer to section **Section 5.5.3**).

Removing the Refrigerant Charge

Connect a refrigerant recovery system [Carrier P/N MVS-115-F-L-CT (115V) or MVS-240-F-L-CT (240V)] to the unit to remove refrigerant charge. Refer to instructions provided by the manufacturer of the refrigerant recovery system.

5.3.1 Pumping the Unit Down If Standby Is Available

To service the moisture liquid indicator, liquid line check valve, expansion valve, quench valve, evaporator coil, compressor pressure regulating valve, or suction bypass valve, pump the refrigerant into the high side as fol-lows:

1. Attach manifold gauge set to standby compressor service valves.
2. Start the unit and run in standby cooling mode for 10 to 15 minutes.
3. Frontseat the king valve. Place the emergency switch in the OFF position when the suction reaches a positive pressure of 1.0 psig (0.01 Bar).
4. Frontseat the standby suction service valve. The refrigerant will be trapped between the standby compressor suction service valve and the liquid line valve.
5. Before opening up any part of the system, a slight positive pressure should be indicated on the pressure gauge. If a vacuum is indicated, emit refrigerant by cracking the liquid line valve momentarily to build up a slight positive pressure.
6. 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.
7. After repairs have been made, perform a refrigerant leak check (refer to **Section 5.4**), and evacuate and dehydrate the low side (refer to **Section 5.6**).
8. Check refrigerant charge (refer to **Section 5.6.1**).

5.4 Refrigerant Leak Checking

⚠ CAUTION

Refrigerant R-404A is a blend. Charging as a vapor will change the properties of the refrigerant. Only liquid charging through the king valve is acceptable.

NOTE

Only refrigerant 404A should be used to pressurize the system. Any other gas or vapor will contaminate the system which will require additional purging and evacuation of the system.

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:

1. The recommended procedure for finding leaks in a system is with an electronic leak detector (Carrier Transicold P/N 07-00295-00). Testing joints with soapsuds is satisfactory only for locating large leaks.
2. If system is without refrigerant or the low side has been pumped down, charge with refrigerant R-404A to build up pressure between 30 and 50 psig (2 to 3.4 Bar). Remove refrigerant cylinder and leak check all connections.
3. Remove test refrigerant using a refrigerant recovery system and repair any leaks. Evacuate and dehydrate the unit or low side as applicable (refer to **Section 5.5**).

5.5 Evacuation and Dehydration

5.5.1 General

Moisture can seriously damage refrigerant systems. The presence of moisture in a refrigeration system can have many undesirable effects. The most common are copper plating, acid sludge formation, “freezing-up” of metering devices by free water, and formation of acids, resulting in metal corrosion.

5.5.2 Preparation

1. Evacuate and dehydrate only after pressure leak test (refer to **Section 5.4**).
2. Essential tools to properly evacuate and dehydrate any system include a good vacuum pump (5 cfm = 8m^{3}H volume displacement, P/N07-00176-01) and a good vacuum indicator such as a thermocouple vacuum gauge (vacuum indicator). (Carrier P/N 0700414-00).

NOTE

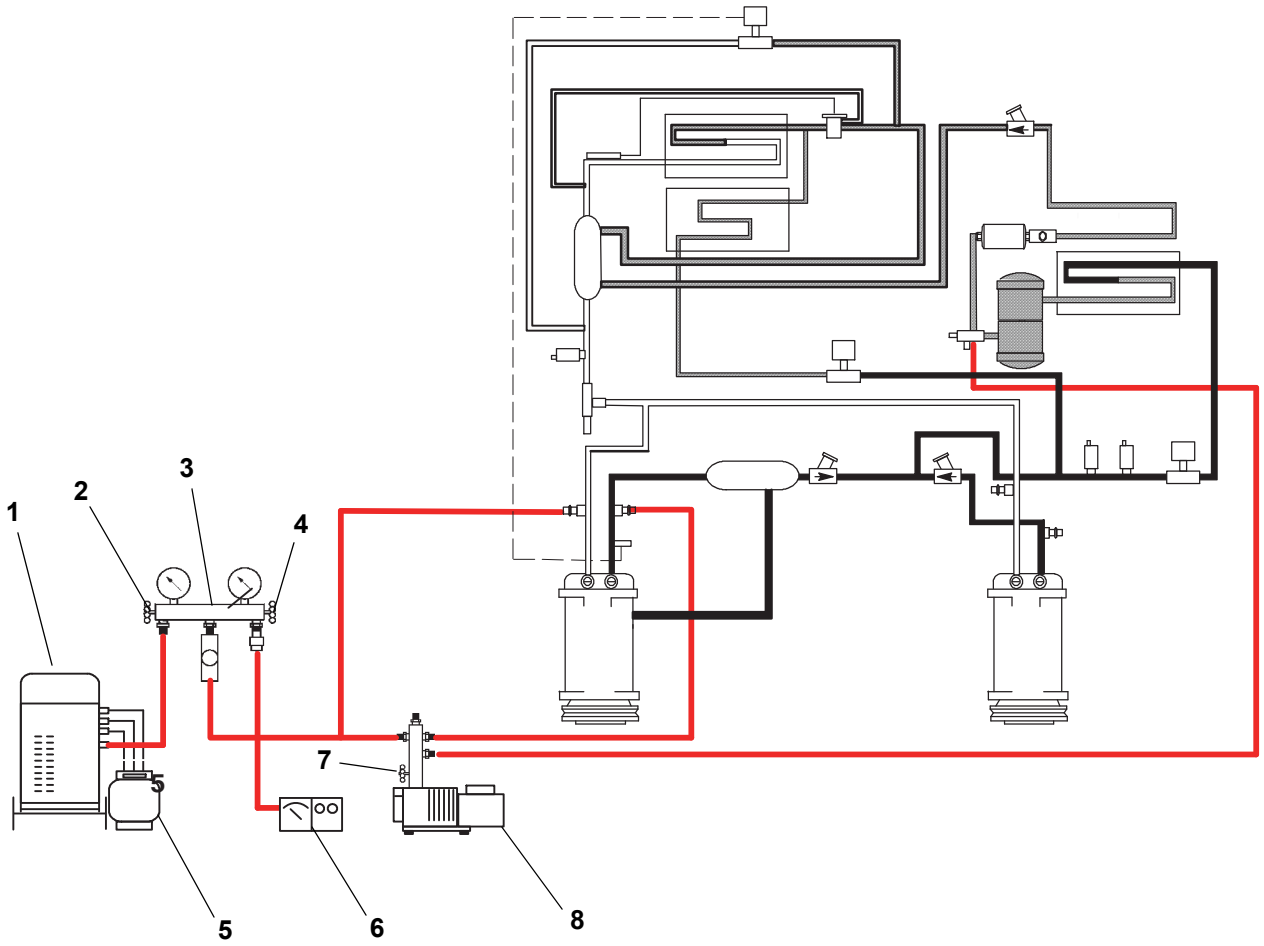
Use of a compound gauge is not recommended because of its inherent inaccuracy.

3. Keep the ambient temperature above 60°F (15.6°C) to speed evaporation of moisture. if ambient temperature is lower than 60°F (15.6°C), ice might form before moisture removal is complete. Heat lamps or alternate sources of heat may be used to raise system temperature.

5.5.3 Evacuation and Dehydration - Complete System

1. Remove refrigerant using a refrigerant recovery system.
2. The recommended method to evacuate and dehydrate the system is to connect three evacuation hoses to the vacuum pump and refrigeration unit as shown in **Figure 5.2** (do not use standard service hoses as they are not suited for evacuation purposes). Connect an evacuation manifold with special evacuation hoses to the vacuum pump, to the electronic vacuum gauge and to the refrigerant recovery system.
3. Test the evacuation system for leaks by backseating the unit service valves, and drawing a deep vacuum with the vacuum pump and gauge valves open. Shut off the pump and check to see if the vacuum holds. Repair leaks if necessary.
4. Midseat the refrigerant system service valves.
5. Open the vacuum pump and electronic vacuum gauge valves, if they are not already open. Start the vacuum pump. Evacuate unit until the electronic vacuum gauge indicates 2000 microns. Close the electronic vacuum gauge and vacuum pump valves. Shut off the vacuum pump. Wait a few minutes to be sure the vacuum holds.
6. Break the vacuum with refrigerant 404A. Raise system pressure to approximately 2 psig (0.14 Bar).

Figure 5.2 Vacuum Pump Connection



1. Refrigerant Recovery Unit
2. Suction Valve (Low Side)
3. Manifold Gauge Set
4. Discharge Valve (High Side)
5. Refrigerant Cylinder
6. Electronic Vacuum Gauge
7. Vacuum Pump Valve
8. Vacuum Pump

7. Remove refrigerant using a refrigerant recovery system.
8. Repeat steps 5 to 7.
9. Evacuate unit to 500 microns. Close off vacuum pump valve and stop pump.Wait five minutes to see if vacuum holds. This checks for residual mois-ture and/or leaks.
10. With a vacuum still in the unit, the refrigerant charge may be drawn into the system from a refrigerant container on weight scales. See **Table 2–1** for correct charge. Continue to **Section 5.6.2**.

5.6 Charging the Refrigeration System

⚠ CAUTION

Refrigerant R-404A is a blend. Charging as a vapor will change the properties of the refrigerant. Only liquid charging through the king valve is acceptable.

5.6.1 Checking the Refrigerant Charge

Start unit in cooling mode. Run approximately ten minutes. Partially block off air flow to condenser coil increase the area blocked until compressor discharge pressure is raised to approximately 325 psig (22 Bars).

The charge is correct if there are no bubbles at the liquid line sight glass.

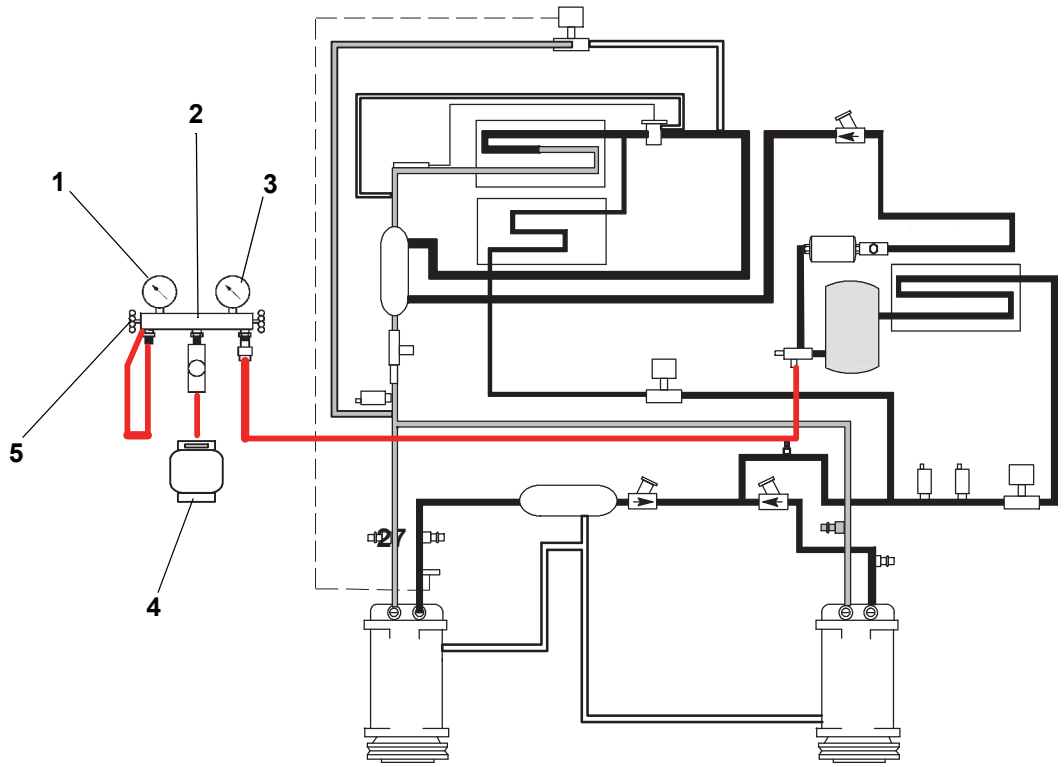
5.6.2 Installing a Complete Charge

NOTE

The ambient (air entering the condenser) air temperature should be above 40°F (4.4°C)

1. Evacuate the refrigeration circuit and leave in a deep vacuum (refer to **Section 5.5**).
2. Place refrigerant 404A cylinder on scale. Connect the discharge gauge field coupler of the manifold test set to the king valve access port. Connect the suction pressure hose of the manifold gauge set to the manifold dead head port. Connect a charging line between the center tap of the second gauge set and the refrigerant drum. Midseat discharge knob. Open the liquid valve on the drum and purge all hoses. Frontseat discharge knob. See **Figure 5.3**.
3. Note weight of refrigerant cylinder.
4. Open liquid valve on refrigerant cylinder. Open king valve half way and allow the liquid refrigerant to flow into the unit until the correct weight of refrigerant has been added as indicated by scales. (See **Section 2.6.1** for correct charge.)
5. If scale indicates the correct charge has been added, close liquid line valve on drum and manifold valves.
6. Backseat the king valve, remove charging hoses and check charge in accordance with **Section 5.6.1**.
7. Check for noncondensibles.

Figure 5.3 Procedure for Adding A Complete Charge



1. Suction Valve (Low Side)
2. Manifold Gauge Set
3. Discharge Valve (High Side)
4. Refrigerant Cylinder
5. Dead Head Port

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5.7 Checking for Non-Condensables

To check for non-condensables, proceed as follows:

1. Stabilize system to equalize pressure between the suction and discharge side of the system.
2. Check temperature at the condenser and receiver.
3. Check pressure at the king valve access port or the liquid line charging port.
4. Check saturation pressure as it corresponds to the condenser/receiver temperature using the Temperature-Pressure Chart, **Table 5–6**.
5. If gauge reading is 3 psig (0.2 Bar) or more than the calculated P/T pressure in step 4, non-condensables are present.
6. Remove refrigerant using a refrigerant recovery system (refer to **Section 5.3**).
7. Evacuate and dehydrate the system
8. Charge the unit (refer to **Section 5.6**.)

5.8 Checking and Replacing Filter Drier

5.8.1 Checking Filter Drier

Check for any obstruction of the filter drier by feeling the inlet and outlet connections of the liquid line on the filter cartridge. If the temperature of the outlet connection seems lower than the temperature of the inlet connection, replace the filter drier.

5.8.2 Replacing the Filter Drier

Remove refrigerant charge (see **Section 5.3**). Remove the drier mounting clip, then replace the filter drier. Following drier replacement, evacuate and recharge unit (refer to **Section 5.5** and **Section 5.6**).

5.9 High, Condenser, and Low Pressure Control Switch (HP1, HP2, LP)

5.9.1 Removing Switches

1. A schraeder valve is located under each switch to allow removal and installation without removing the refrigerant charge.
2. Remove switch and test in accordance with **Section 5.9.2**.
3. Replace or reinstall switch.

5.9.2 Checking Switches

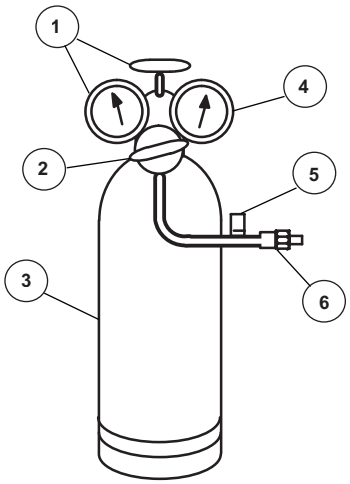
⚠ WARNING

Do not use a nitrogen cylinder without a pressure regulator (see Figure 5.4). Cylinder pressure is approximately 2350 psi (160 Bar).Do not use oxygen in or near a refrigerant system as an explosion may occur.

1. Remove switch as outlined in **Section 5.9.1**.
2. For high pressure and condenser pressure control switches connect switch to a cylinder of dry nitrogen (see **Figure 5.4**). For the low pressure switch, also connect to a vacuum pump and gauge. Test both low and high pressure switches using method described in the following steps.
3. Set nitrogen pressure regulator or vacuum pump and gauge higher than cut-out or cut in point on switch being tested. Pressure switch settings points are provided in **Section 2.6.2**.
4. Close valve on cylinder and open bleed-off valve.

5. Open cylinder valve. While observing indicator (light or meter), slowly close bleed-off valve and increase pressure until the switch opens or closes. Slowly open bleed-off valve (to decrease pressure) until switch reverts to normal position.
6. If switch does not activate within tolerances provided, replace switch. Test new switch before installation.

Figure 5.4 Typical Setup For Testing Pressure Switches HP1, HP2 and LP



1.Cylinder valve and gauge
2.Pressure regulator
3.Nitrogen cylinder
4. Pressure gauge (0 to 400 psig = 0 to 28 Bars)
5. Bleed-off valve
6. 1/4 inch connection

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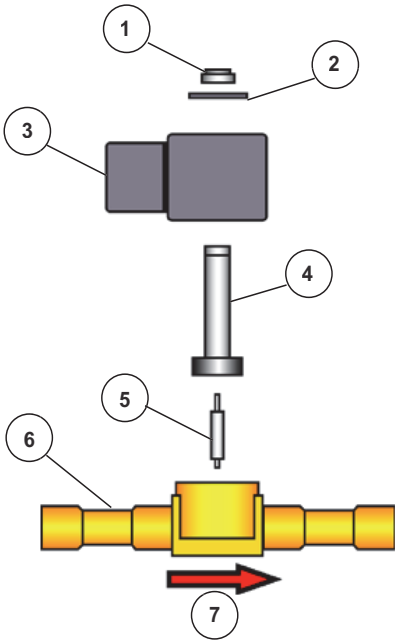
5.10 Hot gas, Condenser, and Low Pressure Control Switch (HGS1, HGS2, BPV)

5.10.1 Replacing Solenoid Coil

It is not necessary to remove the refrigerant charge when replace the coil (see **Figure 5.5**).

Figure 5.5 Hot Gas Valve, Condenser Pressure Control Valve or Quench Valve (Hot Gas Valve Shown)



1. Snap Cap
2. Voltage Plate
3. Coil Assembly
4. Enclosing Tube
5. Plunger Assembly
6. Valve Body Assembly
7. Direction of Flow

1. Remove coil snap cap, voltage plate and coil assembly. Disconnect leads and remove coil junction box if necessary.
2. Verify coil type, voltage and frequency. This information appears on the coil voltage plate and the coil housing.
3. Place new coil over enclosing tube and then install voltage plate and snap cap.

5.10.2 Replacing Valve Internal Parts

1. Remove the refrigerant charge for high side components or pump down to receiver if servicing low side components. (Refer to **Section 5.3**).
2. Remove coil snap cap, voltage cover and coil assembly. Remove the enclosing tube.
3. Check for foreign material in valve body.
4. Check for damaged plunger and O-ring. If O-ring is to be replaced, always put refrigerant oil on O-rings before installing.

⚠ CAUTION

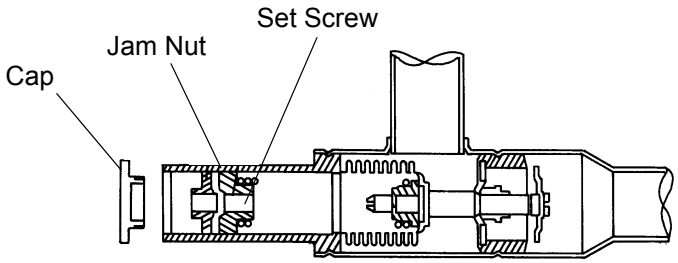
Do not damage or over tighten the enclosing tube assembly. Also, place all parts in the enclosing tube in proper sequence to avoid premature coil burn-out.

5. Tighten enclosing tube. If valve has been removed from the circuit, check for leaks.
6. Install coil assembly, voltage cover and snap cap.
7. Evacuate, dehydrate and recharge unit. Refer to paragraphs **Section 5.5.3** and **Section 5.6.2**.
8. Start unit and check operation.

5.11 Adjusting the Compressor Pressure Regulating Valve (CPR)

When adjusting the compressor pressure regulating valve (CPR) (see **Figure 5.6**), the unit must be running in heating or defrost mode. This will ensure a suction pressure above the proper CPR setting. To adjust the CPR valve, proceed as follows:

Figure 5.6 Compressor Pressure Regulating Valve (CPR)



1. Install a gauge on the suction line.
2. Remove cap from CPR valve.
3. With an 8 mm Allen wrench, loosen the jam nut.
4. Using the 8mm Allen wrench, adjust the set screw.
   - To raise the suction pressure turn the set screw clockwise
   - To lower the suction pressure, turn counterclockwise. Refer to section 2.5.2 for CPR valve setting.
5. When the setting has been adjusted, tighten the jam nut securely against the set screw. This will prevent any movement of the set screw due to vibrations in the unit. Replace the cap.

5.12 Thermostatic Expansion Valve

MOP expansion valve characteristics:

- In order to avoid compressor overcharge, an MOP expansion valve (with limited flow) is used.
- Operating: the expansion valve will not open more than the MOP setpoint. Any temperature increase at the bulb should not open the expansion valve further.

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 requires no adjustment, but maintenance must be done every year in order to clean the orifice strainer. Refer to **Section 5.12.3**.

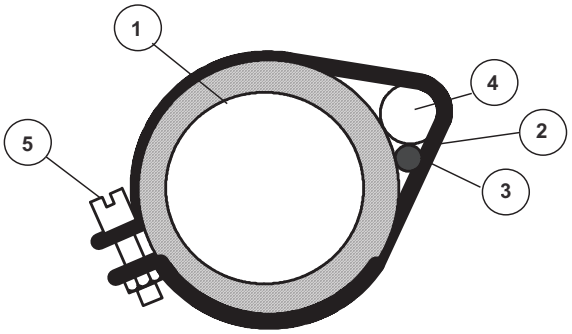
5.12.1 Replacing Expansion Valve

1. Pump the unit down. Refer to paragraph **Section 5.3.1**.
2. Remove insulation from expansion valve bulb and then remove bulb from suction line.
3. Loosen inlet nut and unbraze equalizer line and outlet line from expansion valve.
4. The thermal bulb is located below the center of the suction line. This area must be clean to ensure positive bulb contact. Strap thermal bulb to suction line and insulate both.
5. Braze the equalizer tubes to expansion valve.
6. Evacuate, dehydrate and recharge unit.
7. Check superheat (refer to **Section 2.6.2**).

5.12.2 Measuring Superheat

1. Remove insulation from expansion valve bulb and suction line. See **Figure 5.7**.

Figure 5.7 Thermostatic Expansion Valve Bulb And Thermocouple



1. Suction Line (end view)
2. TXV Bulb Clamp
3. Thermocouple
4. TXV Bulb
5. Nut and Bolt (Clamp)

- - - - -

2. Loosen one TXV bulb clamp and check that the area under clamp (above TXV bulb) is clean.
3. Place thermocouple above (parallel to) the TXV bulb and then secure loosened clamp making sure both bulbs are firmly secured to suction line as shown in **Figure 5.7**.
4. Connect an accurate gauge to the ¼" port on the suction service valve.
5. Run unit until stabilized at -4°F (-20°C) box temperature.
6. From the temperature/pressure chart (**Table 5–6**), determine the saturation temperature corresponding to the evaporator outlet pressure.

7. Note the temperature of the suction gas at the expansion valve 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. Refer to **Section 2.6.2** for superheat setting.
9. If required adjust superheat by turning the adjusting screw located under the cap on the side of the valve.

5.12.3 Checking The TXV Orifice Strainer

Pump the unit down (refer to **Section 5.3.1**). Remove the bottom connection on the TXV. Remove the strainer and check for obstruction or damage. Clean or replace strainer assembly and tighten connection at bottom of valve. Evacuate unit (refer to **Section 5.6**).

5.13 Compressor Oil Type

The compressor(s) are supplied with CARRIER POLYESTER (POE) oil. Ensure compressor is marked with a factory sticker indicating the correct oil has been installed. Oils of PAG type are strictly incompatible with the operation of this unit, never use an oil other than that approved by CARRIER.

5.14 Diagnostic Tool

Figure 5.8 Cab Command/Cab Command Two Diagnostic Tool (CTD P/N 07-00440-00)

Primary Tool **Remote Tool**

1. Testing a cab command cable that is already installed on the unit and routed into the truck cab requires the use of both pieces of the diagnostic tool.
2. Unplug the cab command cable from the microprocessor and also from the back of the cab command module.
3. Plug one end of the cable into the primary tool and the other end into the remote tool.
4. Begin the test by turning on the power switch and observing the sequence of green lights. As each circuit is tested, the corresponding light is illuminated. If a fault is found in the cable, the light that corresponds to that particular circuit is not illuminated.
5. To test a cable that is not installed on a unit, simply plug each end of the cable into the primary tool and perform the test as above.

5.15 Microprocessor

Although there is less danger of electrical static discharge (ESD) damage in the outdoor environment, where the processor is likely to be handled, proper board handling techniques should be stressed. Boards should always be handled by their edges, in much the same way one would handle a photograph. This not only precludes the possibility of ESD damage, but also lowers the possibility of physical damage to the electronic components. Although the microprocessor boards are fairly rugged when assembled, they are more fragile when separated and should always be handled carefully.

When welding is required on the unit frame, or on the front area of the trailer, ALL wiring to the microprocessor MUST be disconnected.When welding is performed on other areas of the truck and van, the welder ground connection MUST be in close proximity to the area being welded. It is also a good practice to remove both battery cables before welding on either the unit frame or the truck to prevent possible damage to other components such as the alternator and voltage regulator.

5.16 Evaporator Coil Cleaning

The use of recycled cardboard cartons is increasing. The recycled cardboard cartons create much more fiber dust during transport than “new” cartons. The fiber dust and particles are drawn into the evaporator where they lodge between the evaporator fins. If the coil is not cleaned on a regular basis, sometimes as often as after each trip, the accumulation can be great enough to restrict air flow, cause coil icing, repetitive defrosts and loss of unit capacity. Due to the “washing” action of normal defrost, the fiber dust and particles may not be visible on the face of the coil but may accumulate deep within.

It is recommended to clean an the evaporator coil on a regular basis, not only to remove cardboard dust, but to remove any grease oil film which sometimes coats the fins and prevents water from draining into the drain pan.

Cardboard fiber particles after being wetted and dried several times can be very hard to remove. Therefore, several washings may be necessary.

1. Spray coil with a mild detergent solution such as any good commercial-grade automatic dish washer detergent and let the solution stand for a few minutes. Reverse flush (opposite normal air flow) with clean water at mild pressure. A garden hose with spray nozzle is usually sufficient. All drain lines must be clean.
2. Run unit until defrost mode be initiated to check for proper draining from drain pan.

5.17 Condenser Coil Cleaning

Remove all foreign material from the condenser coil by reversing the normal air flow. (Air is pulled in through the front.) Compressed air or water may be used as a cleaning agent. It may be necessary to use warm water mixed with any good commercial dishwasher detergent. Rinse coil with fresh water if a detergent is used.

Table 5–6 R-404A Temperature-Pressure Chart

Temperature		Pressure		
°F	°C	Psig	Kg/cm^2	Bar
-40	-40	4.5	0.32	0.31
-35	-37	7.1	0.50	0.49
-30	-34	9.9	0.70	0.68
-25	-32	12.9	0.91	0.89
-20	-29	16.3	1.15	1.12
-18	-28	17.7	1.24	1.22
-16	-27	19.2	1.35	1.32
-14	-26	20.7	1.46	1.43
-12	-24	22.3	1.57	1.54
-10	-23	23.9	1.68	1.65
-8	-22	25.6	1.80	1.77
-6	-21	27.3	1.92	1.88
-4	-20	29.1	2.05	2.01
-2	-19	30.9	2.17	2.13
0	-18	32.8	2.31	2.26
2	-17	34.8	2.45	2.40
4	-16	36.8	2.59	2.54
6	-14	38.9	2.73	2.68
8	-13	41.1	2.89	2.83
10	-12	43.3	3.04	2.99

Table 5–6 R-404A Temperature-Pressure Chart (Continued)

Temperature		Pressure		
°F	°C	Psig	Kg/cm^2	Bar
12	-11	45.6	3.21	3.14
14	-10	48.0	3.37	3.31
16	-9	50.4	3.54	3.47
18	-8	52.9	3.72	3.65
20	-7	55.5	3.90	3.83
22	-6	58.1	4.08	4.01
24	-4	60.9	4.28	4.20
26	-3	63.7	4.48	4.39
28	-2	66.5	4.68	4.59
30	-1	69.5	4.89	4.79
32	0	72.5	5.10	5.00
34	1	75.6	5.32	5.21
36	2	78.8	5.54	5.43
38	3	82.1	5.77	5.66
40	4	85.5	6.01	5.90
42	6	89.0	6.26	6.14
44	7	92.5	6.50	6.38
46	8	96.2	6.76	6.63
48	9	99.9	7.02	6.89
50	10	103.7	7.29	7.15
55	13	115.4	8.11	7.96
60	16	126.1	8.87	8.69
65	18	137.4	9.66	9.47
70	21	149.4	10.50	10.30
75	24	162.1	11.40	11.18
80	27	175.5	12.34	12.10
85	29	189.6	13.33	13.07
90	32	204.5	14.38	14.10
95	35	220.2	15.48	15.18
100	38	236.8	16.65	16.33
105	41	254.2	17.87	17.53
110	43	272.4	19.15	18.78
115	46	291.6	20.50	20.11
120	49	311.8	21.92	21.50
125	52	332.9	23.41	22.95
130	54	355.0	24.96	24.48
135	57	378.1	26.58	26.07

Table 5–6 R-404A Temperature-Pressure Chart (Continued)

Temperature		Pressure		
°F	°C	Psig	Kg/cm^2	Bar
140	60	402.3	28.28	27.74
145	63	427.6	30.06	29.48
150	66	454.0	31.92	31.30

Table 5–7 Sensor Resistance (RAS) Standby Only

Temperature		RAS Resistance In Ohms
°F	°C	
-20	-28.9	165,300
-10	-23.3	117,800
0	-17.8	85,500
10	-12.2	62,400
20	-6.7	46,300
30	-1.1	34,500
32	0	32,700
40	4.4	26,200
50	10.0	19,900
60	15.6	15,300
70	21.1	11,900
77	25	10,000
80	26.7	9,300
90	32.2	7,300
100	37.8	5,800
110	43.3	4,700
120	48.9	3,800
194	90	915
212	100	680
266	130	301
302	150	186

SECTION 6
Troubleshooting

⚠ WARNING

Beware of unannounced starting of the unit. The unit may cycle the fans and one of the operating compressors unexpectedly as control requirements dictate. To ensure unit is without power, remove power plug and remove battery negative cable.

⚠ CAUTION

Under no circumstances should anyone attempt to service the microprocessor (see Section 5.15) or either Cab Command module. Should a problem develop with the microprocessor, contact your nearest Carrier Transicold dealer for replacement.

6.1 Introduction

Table 6–1 Alarm Indications

Alarm	Description	Corrective Action	Reference
A00	No Alarms	All components functioning normally	-
A01 (A02 - Alternating Alarm) Road Only	Low Pressure Switch (LP) Open	Unit undercharged	Section 5.6.1
		Liquid line filter drier restricted	Section 5.8.1
		TXV strainer plugged with foreign material/ice	Section 5.12
		TXV not functioning properly	Section 5.12
		Verify operation of evaporator fans	--
		Failed switch	Section 5.9.2
	High Pressure Switch (HP1) Open	Unit overcharged	Section 5.6.1
		Verify operation of condenser fan	--
		Noncondensibles in system	Section 5.8
		Failed switch	Section 5.9.2
A01	Low Pressure Switch (LP) Open (Road)	Unit undercharged	Section 5.6.1
		Liquid line filter drier restricted	Section 5.8
		TXV strainer plugged with foreign material/ice	Section 5.12.3
		TXV not functioning properly	Section 5.12
		Verify operation of evaporator fans	--
		Failed switch	Section 5.9.2
A02	High Pressure Switch (HP1) Open	Unit undercharged	Section 5.6.1
		Verify operation of condenser fan	--
		Noncondensibles in system	Section 5.7
		Discharge check valve failed closed (standby or road)	Replace
		Failed switch	Section 5.9.2
A03	Standby Compressor Thermal Overload open	Check liquid injection valve	
		Electric line voltage low	Section 2.6.3

Table 6–1 Alarm Indications (Continued)

A04	Road Compressor Clutch (CLHR) not functioning properly	Current draw of road clutch coil either high or low	Replace
A05	Standby Contactor (MC) high amp draw	Current draw of contactor coil high or low (0.2 amps - 3 phase; 0.5 amps - 1 phase)	--
		Verify plunger moves freely	--
		Replace contactor	--
A06	Condenser Fan Motor (CFM) high amp draw	Verify motor rotates freely	--
		Verify condition of brushes	**Section 5.16**
		Replace motor	--
A07	Evaporator Fan Speed	Verify microprocessor configuration	--
		Check fan motor output wires Verify fan motor rotation	--
A08	Hot Water Solenoid (HWV) high amp draw	Current draw of coil high or low	--
		Replace coil	--
A09	Hot Gas Valve (HGS1) high amp draw	Current draw of coil high or low (approx 1.6 amp)	--
		Replace coil	**Section 5.10.1**
A10	Quench Valve (BPV) high amp draw	Current draw of coil high or low (approx 1.2 amp)	--
		Replace coil	**Section 5.10.1**
A11	Condenser Pressure Control Valve (HGS2) high amp draw	Current draw of coil high or low (approx 1.6 amp)	--
		Replace coil	**Section 5.10.1**
A12	Out-of-Range - High Temperature	Unit out of range for 15 minutes	Verify Setting
		Verify cooling operation of unit	--
		Hot gas solenoid open	**Section 5.10**
A13	Out-of-Range - Low Temperature	Unit out of range for 15 minutes	Verify Setting
		Verify heating operation of unit	--
		Heating option not active (Set Configuration)	--
A14	Defrost Cycle > 45 minutes	Unit terminated defrost after 45 minutes	--
		Verify HGS1/HGS2 valve operation	**Section 5.10**
A15	Setpoint out of range	Operator entered invalid setpoint (outside of range)	**Section 3.3**
		Verify configuration settings	--
A16	Evaporator drain line heater (DWR) not functioning properly	Replace heater High amp draw	--
A17	Transformer/Rectifier Thermal Overload (RBT) Open	Line voltage low	Correct
		Transformer winding open	Replace
		High load on rectification system	Correct
A18	Electrical Heating Relay (Future)	Relay shorted	Replace
		Wiring shorted	Correct

Table 6–1 Alarm Indications (Continued)

A21	Compressor Contactor (MC) Open Circuit	Contactor coil open circuit	Replace
		Wiring to coil open	Check
A22	Condenser Fan Motor (CFM) Open Circuit	Condenser fan motor defective	**Section 5.16**
		Wiring to motor open	Check
A23	Hot Water Solenoid Valve (HWV) Open Circuit	Valve coil shorted	Replace
		Wiring to coil open	Check
A24	Hot Gas Valve (HGS1) Open Circuit	Valve coil shorted	**Section 5.10.1**
		Wiring to coil open	Correct
A25	Quench Valve (BPV) Open Circuit	Valve coil shorted	Replace
		Wiring to coil open	Correct
A26	Condenser Pressure Control Valve (HGS2) Open Circuit	Valve coil shorted	**Section 5.10.1**
		Wiring to coil open	Correct
A27	Evaporator Drain Line Heater (DWR) Open Circuit	Evaporator drain heater shorted	Replace
		Verify wiring to heater	Correct
A28	Heating Relay (EHR) Open Circuit (Future)	Relay open circuit	Replace
		Wiring to coil open	Correct
A45	EPROM Failure	Disconnect/Reconnect cables to vehicle battery	Replace
		Replace microprocessor	Correct
EE	Return Air Sensor	Return air sensor defective	Replace
bAt	Low Battery Voltage	Vehicle battery voltage low	Correct
Err	Setpoint above maximum	Programming error, reset	**Section 3.3**
---	Setpoint below minimum	Programming error, reset	**Section 3.3**

Table 6–2 Mechanical Indications

Indication/Trouble	Possible Causes	Reference
6.2 Refrigeration		
6.2.1 Unit Will Not Cool		
Compressor not functioning properly	Compressor drive (clutch) defective Compressor defective	Replace
Refrigeration system	Defrost cycle has not terminated Abnormal pressure Hot gas solenoid not functioning properly (HGS1)	**Section 6.2.5** **Section 6.2.6** **Section 5.10**
6.2.2 Unit Runs But Has Insufficient Cooling		
Compressor	Compressor defective	Replace
Refrigeration system	Abnormal pressure Expansion valve not functioning properly No or restricted evaporator airflow	**Section 6.2.6** **Section 6.3.1** **Section 6.3**
6.2.3 Unit Operates Long or Continuously in Cooling		
Box	Hot Load Defective box insulation or air leak	Insufficient pull down time Correct
Refrigeration system	Abnormal pressure Temperature controller not functioning properly	**Section 6.2.6** **Section 6.2.8**
Compressor	Defective	Replace
6.2.4 Unit Will Not Heat or Heating Insufficient		
Refrigeration	Abnormal pressure Temperature controller not functioning properly Hot gas solenoid not functioning properly (HGS1)	**Section 6.2.6** **Section 6.2.8** **Section 5.10**
Compressor	Compressor drive (clutch) defective Compressor defective	Check Replace
6.2.5 Defrost		
Automatic defrost will not initiate	Defrost thermostat (DTT) open or defective Hot gas valve not functioning properly Defrost disabled through cab command	Replace **Section 5.10** **Section 3.4**
Manual defrost will not initiate	Microprocessor defective Defrost thermostat (DTT) open or defective	Replace Replace
Defrost cycle initiates but does not defrost	Hot gas solenoid not functioning properly (HGS1) Condenser Pressure Control valve not functioning properly (HGS2)	**Section 5.10** **Section 5.10**
Frequent defrost	Wet load Defrost settings set to low	-- **Section 3.4**
Does not terminate or cycles on defrost	Defrost thermostats (DTT) shorted closed	Replace

Table 6–2 Mechanical Indications (Continued)

6.2.6 Abnormal Pressure		
Cooling		
High discharge pressure	Condenser coil dirty Noncondensibles or refrigerant overcharge Condenser fan/motor defective	**Section 5.17** **Section 5.6.1** **Section 5.16**
Low discharge pressure	Compressor defective Hot gas solenoid not functioning properly Low refrigerant charge	Replace **Section 5.10** **Section 5.6.1**
High suction pressure	Compressor defective Hot gas solenoid not functioning properly Compressor pressure regulator mis-adjusted (CPR)	Replace **Section 5.10** **Section 5.11**
Low suction pressure	Filter drier partially plugged Low refrigerant charge Expansion valve not functioning properly No evaporator air flow or restricted air flow Excessive frost on coil	**Section 5.8** **Section 5.6.1** **Section 6.3.1** **Section 6.3** Check
Suction and discharge pressures tend to equalize when unit is operating	Compressor defective Hot gas solenoid not functioning properly	Replace **Section 5.10**
Heating		
High discharge pressure	Overcharged system Condenser fan or HP2 pressure switch defective Noncondensibles in system Condenser motor/fan defective HGS2 closed	**Section 5.6.1** **Section 5.9** **Section 5.6** **Section 5.16**
Low discharge pressure	Compressor defective Hot gas valve not functioning properly	Replace **Section 5.10**
Low suction pressure	Low refrigerant charge Compressor pressure regulating valve mis-adjusted (CPR) Condenser Pressure Regulating valve fault (HGS2)	**Section 5.6.1** **Section 5.11** **Section 5.10**
6.2.7 Abnormal Noise		
Compressor	Loose mounting bolts Worn bearings Worn or broken valves Liquid slugging Insufficient oil	Tighten Replace Replace **Section 6.3.1** Check
Condenser or evaporator fan	Loose shroud Bearings defective Fan loose on shaft Bent shaft	Check Check Check
6.2.8 Cab Command /Cab Command Two		
Cab Command Not Functioning Properly	Microprocessor fuse open Microprocessor not functioning properly Microprocessor/Cab command cable	Replace Replace Check

Table 6–2 Mechanical Indications (Continued)

6.3 No Evaporator Air Flow or Restricted Air Flow		
Evaporator coil blocked	Heavy frost on coil Coil dirty	Check **Section 5.16**
No or partial evaporator air flow	Evaporator fan loose or defective Evaporator fan rotating backwards Evaporator air flow blocked in box Fan motor(s) not functioning properly	Check Check Check Replace
6.3.1 Expansion Valve		
Low suction pressure with high superheat	Low refrigerant charge External equalizer line plugged Ice wax, oil or dirt plugging valve strainer Broken capillary Superheat setting too high	**Section 5.6.1** Repair **Section 5.12.3** Repair **Section 5.12.2**
Low superheat and liquids lugging in compressor	Superheat setting too low External equalizer line plugged Pin and seat of expansion valve eroded or held open by foreign material	**Section 5.12.2** Repair **Section 5.12**
Fluctuating suction pressure	Improper bulb location or installation Insulation missing from sensing bulb Low superheat setting	**Section 5.12** Replace **Section 5.12.2**
High superheat	Expansion valve setting	**Section 5.12.2**
6.3.2 Hot Gas Solenoid or Condenser Pressure Regulating Valve		
Valve does not function properly	No power to valve Improper wiring or loose connections Valve improperly assembled Coil or coil sleeve improperly assembled Movement of plunger restricted due to: a. Corroded or worn parts b. Foreign material lodged in valve c. Bent or dented enclosing tube	Check Check **Section 5.10**
Valve shifts but refrigerant continues to flow	Foreign material lodged under seat Defective seat	**Section 5.10**
6.3.3 Standby Compressor		
Standby compressor fails to start	Motor contactor defective Motor Overload open Improper power supply 5-minute timer active	Replace Check Correct Check
Standby compressor fails to start single-phase Only	Defective start capacitor Defective start relay	Check/Replace Replace
Standby motor starts, then stops	Motor Overload open	Check
Standby motor starts, then stops - single-phase Only	Defective start capacitor Defective start relay	Check/Replace Replace

SECTION 7

Schematic Diagrams

⚠ WARNING

Beware of unannounced starting of the unit. The unit may cycle the fans and one of the operating compressors unexpectedly as control requirements dictate. To ensure unit is without power, remove power plug and remove battery negative cable.

⚠ CAUTION

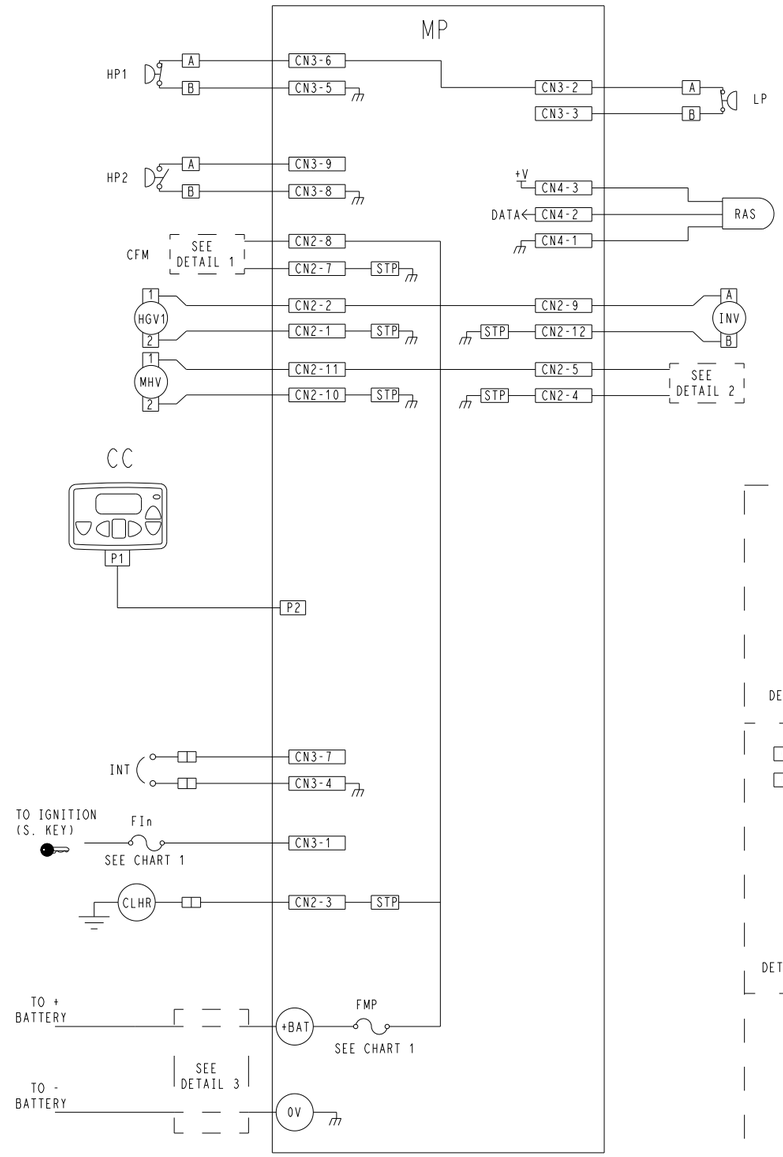
Under no circumstances should anyone attempt to service the microprocessor (see Section 5.15) or either Cab Command Module. Should a problem develop with the microprocessor, contact your nearest Carrier Transicold dealer for replacement.

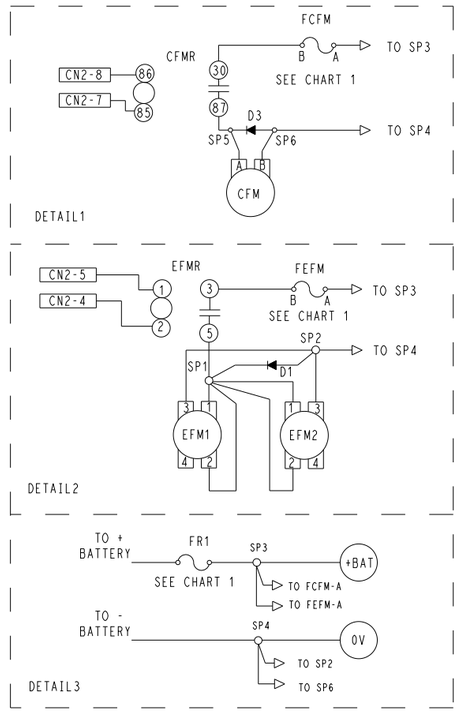
7.1 Introduction

Schematic diagrams for the unit models listed in Table 2–1 are provided herein.

INTEGRA 35X

ROAD ONLY
12VDC





LOCATION	SYMBOL	DESCRIPTION	LOCATION IN FRAME
B-6	CC	CAB COMMAND	CAB
B-4/M-8	CFM	CONDENSER FAN MOTOR	CONDENSER
L-7	CFMR	RELAY FOR CFM	ELECTRICAL BOX
B-11	CLHR	ROAD ELECTROMAGNETIC CLUTH	ENGINE COMPARTMENT
N-10	D1	DIODE FOR EFM'S	HARNESS
M-7	D3	DIODE FOR CFM	HARNESS
M-11/N-11	EFM1,2	EVAPORATOR FANS MOTORS	EVAPORATOR
L-9	EFMR	RELAY FOR EFM	ELECTRICAL BOX
N-9	FEFM	FUSE FOR EFM1, 2	ELECTRICAL BOX
N-6	FCFM	FUSE FOR CFM	ELECTRICAL BOX
B-10	FIn	FUSE FOR IGNITION	CAB
E-12	FMP	FUSE FOR MICROPROCESSOR BOARD	ELECTRICAL BOX
M-12	FR1	FUSE ROAD (DC VOLTAGE)	ENGINE COMPARTMENT
B-4	HGV1	HOT GAS VALVE	CONDENSER
B-2	HP1	SECURITY SWITCH PRESSURE	CONDENSER
B-3	HP2	REGULATION PRESSURE SWITCH FOR FAN CONDENSER	CONDENSER
A-10	IGNITION	SWITCH KEY INFORMATIN(IGNITION)	CAB
B-9	INT(BPT)	INJECTION THERMOSTAT	ENGINE COMPARTMENT
J-4	INV(BPV)	INJECTION VALVE	CONDENSER
J-2	LP	LOW PRESSURE SWITCH	CONDENSER
B-5	MHV(HGS2)	MAIN HEAT VALVE (OPTION)	CONDENSER
F-1	MP	MICROPROCESSOR BOARD	CONDENSER
J-3	RAS	RETURN AIR SENSOR	EVAPORATOR

NOTES:

1. UNIT SHOWN "OFF" POSITION.
2. WIRE INDENTIFICATION SYSTEM:

DC CIRCUITS	
COLOR	USE FOR
WHITE	DC CONTROLS CIRCUITS
GREEN	DC GROUNDS
RED	DC BATTERY PLUS
BLACK	DC BATTERY MINUS

3. ADDRESS SYSTEM: EXAMPLE: CN3-2/LP-A,INDICATES A WIRE BETWEEN CONNECTOR CN2 PIN3 (MICROPROCESSOR MP) AND CONNECTOR LP PIN A.

SP INDICATES A SOLDERED SPLICE POINT.
T1 PIN CONNECTION.
LIGHT LINES INDICATES WIRES IN THE SYSTEM.
NORMALLY CLOSED CONTACTS.
NORMALLY OPEN CONTACTS.
HC-F2 MULTIPLE PLUG CONNECTION NUMBER.
B1 D JUNCTION BLOCK CONNECTION.

SWITCH SYMBOL INDICATES MOMENTARY CONTACTS.
INDICATES A WIRE GROUND.
INDICATES A CHASSIS GROUND (NO WIRE).
INDICATES OPTIONS.
INDICATES A CONNECTION,WIRE,LUG,ETC.
INSULATING PLUG
1 COMPONENT CONNECTION NUMBERR OR LETTER.
STP SWITCH THERMAL PROTECTOR (TOPFET)
S SWITCH THERMAL PROTECTOR (TOPFET)

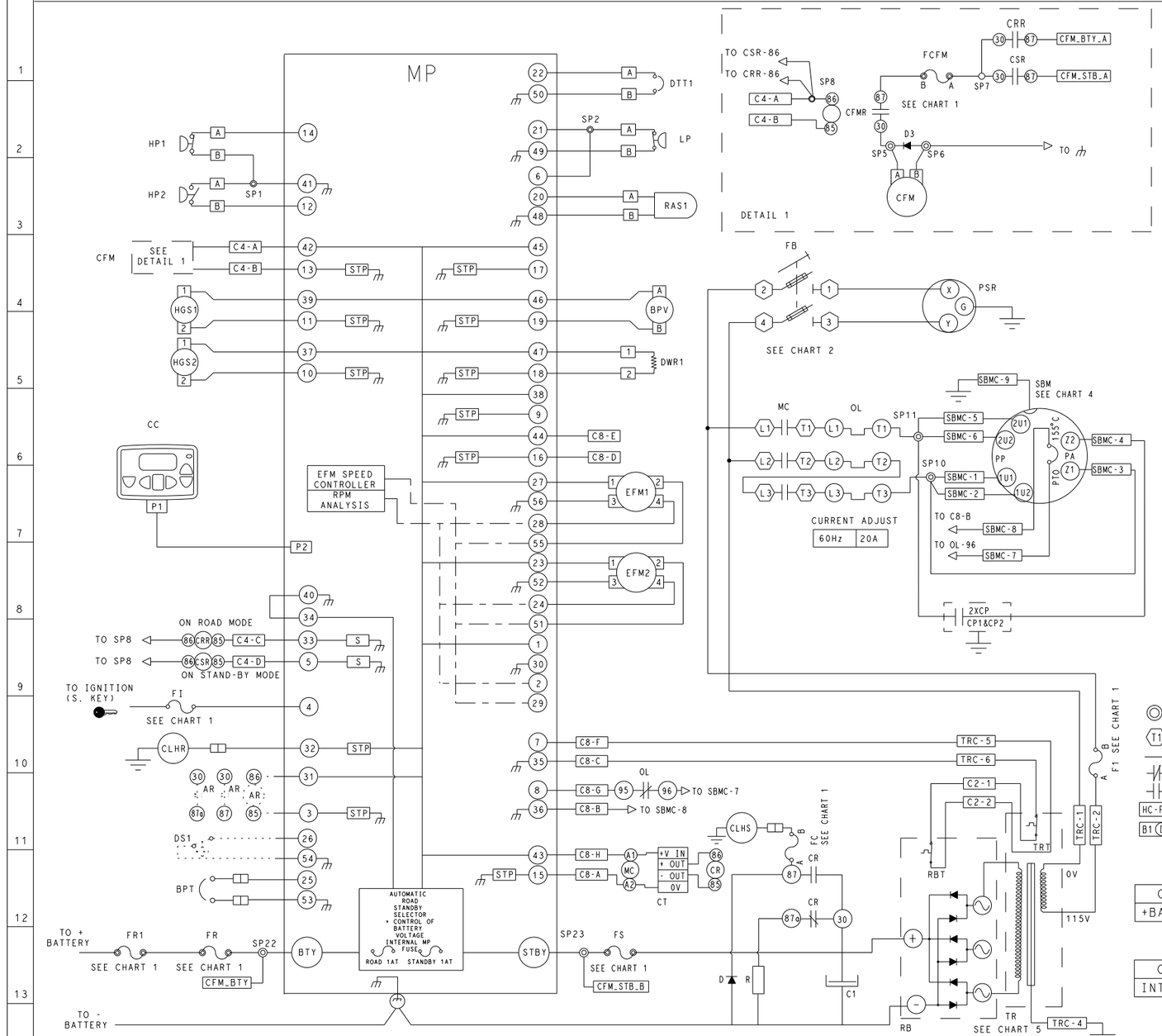
CHART 1	FIn	FR1	FEFM	FCFM	FMP
INTEGRA 35X HA 12VDC	1A	50A	20A	30A	10A

DECAL NO. A62-61679-00

DATE	ARTWORK No.	REV
2017-08-14	62-61679-ART1	C
INTEGRA 35X SERIES (ROAD CIRCUITS)		

INTEGRA 35X

ROAD 12VDC
115V/1/60Hz



LOCATION	SYMBOL	DESCRIPTION	LOCATION IN FRAME
C-11	AR	ALARM RELAY (OPTION)	EXTERNAL
B-12	BPT	INJECTION KLIXON	ROAD COMPRESSOR
J-5	BPV	INJECTION VALVE SOLENOID	EVAPORATOR
M-13	C1	CAPACITIOR (SMOOTHING)	STANDBY BOX
B-6	CC	CAB COMMAND	CAB
A-4/N-3	CFM	CONDENSER FAN MOTOR	CONDENSER
D-13/O-1	CFM_BTY	BATTERY SUPPLY FOR CFM	CONDENSER
I-13/Q-2	CFM_STB	STANDBY SUPPLY FOR CFM	CONDENSER
M-2	CFMR	CONDENSER FAN MOTOR RELAY	STANDBY BOX
B-10	CLHR	ROAD ELECTROMAGNETIC CLUTH	ENGINE COMPARTMENT
K-11	CLHS	STANDBY ELECTROMAGNETIC CLUTH	CONDENSER
O-8	CP1/CP2	PERMANET CAPACITOR 1&2	STANDBY BOX
K-12/L-12	CR	CLUTCH RELAY	STANDBY BOX
B-9/K-1/P-1	CRR	CFM ROAD RELAY	STANDBY BOX
B-9/K-1/P-1	CSR	CFM STANDBY RELAY	STANDBY BOX
J-12	CT	CLUTCH TIMER	STANDBY BOX
K-13	D	DIODE FOR STANDBY CLUTCH	STANDBY BOX
N-2	D3	DIODE FOR CFM	CONDENSER
B-11	DS1	DOOR SWITCH (OPTION)	EVAPORATOR
J-2	DTT1	DEFROST KLIXON	EVAPORATOR
J-5	DWR1	DRAIN WATER RESISTOR (OPTION)	EVAPORATOR
J-7/J-8	EFM1,2	EVAPORATOR FANS MOTORS	EVAPORATOR
Q-10	F1	FUSE FOR PRIMARY SOLENOID TRANSFORMER	STANDBY BOX
L-4	FB	FUSE BLOCK	STANDBY BOX
L-11	FC	FUSE CLUTCH STANDBY	STANDBY BOX
N-1	FCFM	FUSE CONDENSER FAN MOTOR	STANDBY BOX
B-9	FI	FUSE IGNITION	ENGINE COMPARTMENT
A-13/C-13	FR1,FR	FUSE ROAD (DC VOLTAGE)	CONDENSER
I-13	FS	FUSE STANDBY (DC VOLTAGE)	CONDENSER
B-2	HP1	SECURITY SWITCH PRESSURE	CONDENSER
B-3	HP2	REGULATION PRESSURE SWITCH FOR FAN CONDENSER	CONDENSER
B-4	HGS1	HOT GAZ SOLENOID DEFROST	CONDENSER
B-5	HGS2	HOT GAZ SOLENOID HEATING (OPTION)	CONDENSER
A-9	IGNITION	SWITCH KEY INFORMATIN	ENGINE COMPARTMENT
J-2	LP	LOW PRESSURE SWITCH	EVAPORATOR
L-6/I-12	MC	MOTOR CONTACTOR	STANDBY BOX
F-1	MP	MICROPROCESSOR BOARD	CONDENSER
M-6/J-11	OL	OVERLOAD RELEAY	STANDBY BOX
O-4	PSR	POWER SUPPLY RECEPTACLE	EXTERNAL
L-13	R	RESISTOR FOR DISCHARGE C1	STANDBY BOX
J-3	RAS1	RETURN AIR SENSOR	EVAPORATOR
N-13	RB	RECTIFIER BRIDGE	CONDENSER
N-12	RBT	RECTIFIER BRIDGE THERMISTOR	CONDENSER
P-6	SBM	STANDBY MOTOR	CONDENSER
P-13	TR	TRANSFORMER	CONDENSER
P-11	TRT	TRANSFORMER THERMISTOR	STANDBY BOX

NOTES:

1. UNIT SHOWN "OFF" POSITION.
2. WIRE INDENTIFICATION SYSTEM:

DC CIRCUITS		AC CIRCUITS	
COLOR	USE FOR	COLOR	USE FOR
WHITE	DC CONTROLS CIRCUITS	ORANGE	AC CONTROLS CIRCUITS
GREEN	DC GROUNDS	GREEN/YELLOW	AC EARTH
RED	POSITIVE BATTERY CIRCUIT	BLUE	AC CIRCUITS NEUTRAL
BLACK	NEGATIVE BATTERY CIRCUIT	BROWN	AC CIRCUITS PHASE

3. ADDRESS SYSTEM: EXAMPLE: MP-43/C8-H,INDICATES A WIRE BETWEEN MICROPROCESSOR MP (PIN43) AND PLUG C8 (PIN H).

- SP — INDICATES A SOLDERED SPLICE POINT.
- T1 — PIN CONNECTION.
- LIGHT LINES INDICATES WIRES IN THE SYSTEM.
- NORMALLY CLOSED CONTACTS.
- NORMALLY OPEN CONTACTS.
- HC-F2 — MULTIPLE PLUG CONNECTION NUMBER.
- B1 D — JUNCTION BLOCK CONNECTION.
- SWITCH SYMBOL INDICATES MOMENTARY CONTACTS.
- INDICATES A WIRE GROUND.
- INDICATES A CHASSIS GROUND (NO WIRE).
- INDICATES OPTIONS.
- INDICATES A CONNECTION,WIRE,LUG,ETC.
- INSULATING PLUG
- 1 — COMPONENT CONNECTION NUMBERR OR LETTER.
- STP — SWITCH THERMAL PROTECTOR (TOPFET)
- S — SWITCH THERMAL PROTECTOR (TOPFET)

CHART 1	FI	FR	FR1	FS	F1	FC	FCFM
+BAT = +12V	1A	50A	50A	50A	8AT	5A	30A

CHART 2	FB
f=60Hz	25A

CHART 4	SBM
INTEGRA 35X	1.5KW

CHART 5	TR 12V
INTEGRA 35X	590VA

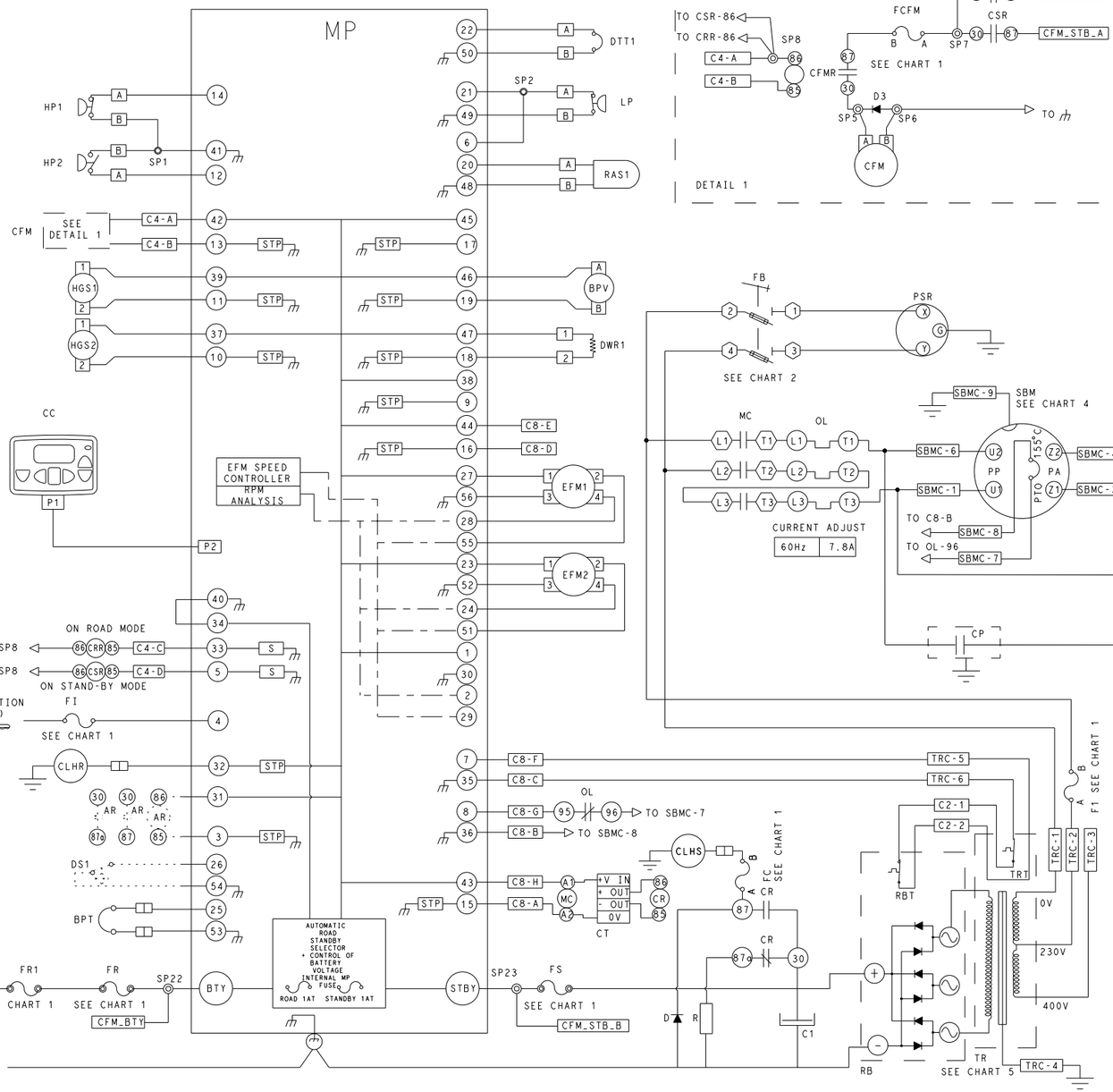
DECAL NO. A62-61677-00

DATE	ARTWORK No.	REV
2017-07-31	62-61677-ART1	C

INTEGRA 35X SERIES (ROAD CIRCUITS)

INTEGRA 35X

ROAD 12VDC
230V/1/60Hz



LOCATION	SYMBOL	DESCRIPTION	LOCATION IN FRAME
C-11	AR	ALARM RELAY (OPTION)	EXTERNAL
B-12	BPT	INJECTION KLIXON	ROAD COMPRESSOR
J-5	BPV	INJECTION VALVE SOLENOID	EVAPORATOR
M-13	C1	CAPACITIOR (SMOOTHING)	STANDBY BOX
B-6	CC	CAB COMMAND	CAB
A-4/N-3	CFM	CONDENSER FAN MOTOR	CONDENSER
B-13/Q-1	CFM_BTY	BATTERY SUPPLY FOR CFM	CONDENSER
I-13/Q-1	CFM_STB	STANDBY SUPPLY FOR CFM	CONDENSER
M-2	CFMR	CONDENSER FAN RELAY	STANDBY BOX
B-10	CLHR	ROAD ELECTROMAGNETIC CLUTH	ENGINE COMPARTMENT
K-11	CLHS	STANDBY ELECTROMAGNETIC CLUTH	CONDENSER
O-9	CP	PERMANET CAPACITOR	STANDBY BOX
K-12/L-12	CR	CLUTCH RELAY	STANDBY BOX
B-9/L-1/P-1	CRR	CFM ROAD RELAY	STANDBY BOX
B-9/L-1/P-1	CSR	CFM STANDBY RELAY	STANDBY BOX
J-12	CT	CLUTCH TIMER	STANDBY BOX
K-13	D	DIODE FOR STANDBY CLUTCH	STANDBY BOX
N-2	D3	DIODE FOR CFM	CONDENSER
B-11	DS1	DOOR SWITCH (OPTION)	EVAPORATOR
J-2	DTT1	DEFROST KLIXON	EVAPORATOR
J-5	DWR1	DRAIN WATER RESISTOR (OPTION)	EVAPORATOR
J-7/J-8	EFM1,2	EVAPORATOR FANS MOTORS	EVAPORATOR
O-11	F1	FUSE FOR PRIMARY SOLENOID TRANSFORMER	STANDBY BOX
L-4	FB	FUSE BLOCK	STANDBY BOX
L-11	FC	FUSE CLUTCH STANDBY	STANDBY BOX
N-1	FCFM	FUSE CONDENSER FAN MOTOR	STANDBY BOX
B-9	FI	FUSE IGNITION	ENGINE COMPARTMENT
A-13/C-13	FR1,FR	FUSE ROAD (DC VOLTAGE)	CONDENSER
I-13	FS	FUSE STANDBY (DC VOLTAGE)	CONDENSER
B-2	HP1	SECURITY SWITCH PRESSURE	CONDENSER
B-3	HP2	REGULATION PRESSURE SWITCH FOR FAN CONDE	NSER CONDENSER
B-4	HGS1	HOT GAZ SOLENOID DEFROST	CONDENSER
B-5	HGS2	HOT GAZ SOLENOID HEATING (OPTION)	CONDENSER
A-9	IGNITION	SWITCH KEY INFORMATIN	ENGINE COMPARTMENT
J-2	LP	LOW PRESSURE SWITCH	EVAPORATOR
L-6/I-12	MC	MOTOR CONTACTOR	STANDBY BOX
F-2	MP	MICROPROCESSOR BOARD	CONDENSER
M-6/J-11	OL	OVERLOAD RELEASY	STANDBY BOX
O-5	PSR	POWER SUPPLY RECEPTACLE	EXTERNAL
L-13	R	RESISTOR FOR DISCHARGE C1	STANDBY BOX
J-3	RAS1	RETURN AIR SENSOR	EVAPORATOR
N-13	RB	RECTIFIER BRIDGE	CONDENSER
O-12	RBT	RECTIFIER BRIDGE THERMISTOR	CONDENSER
P-6	SBM	STANDBY MOTOR	CONDENSER
P-13	TR	TRANSFORMER	CONDENSER
P-11	TRT	TRANSFORMER THERMISTOR	CONDENSER

NOTES:

1. UNIT SHOWN "OFF" POSITION.
2. WIRE INDENTIFICATION SYSTEM:

DC CIRCUITS		AC CIRCUITS	
COLOR	USE FOR	COLOR	USE FOR
WHITE	DC CONTROLS CIRCUITS	ORANGE	AC CONTROLS CIRCUITS
GREEN	DC GROUNDS	GREEN/YELLOW	AC EARTH
RED	POSITIVE BATTERY CIRCUIT	BLUE	AC CIRCUITS NEUTRAL
BLACK	NEGATIVE BATTERY CIRCUIT	BROWN	AC CIRCUITS PHASE

3. ADDRESS SYSTEM: EXAMPLE: MP-43/C8-H,INDICATES A WIRE BETWEEN MICROPROCESSOR MP (PIN43) AND PLUG C8 (PIN H).

SP	INDICATES A SOLDERED SPLICE POINT.
T1	PIN CONNECTION.
	LIGHT LINES INDICATES WIRES IN THE SYSTEM.
	NORMALLY CLOSED CONTACTS.
	NORMALLY OPEN CONTACTS.
HC-F2	MULTIPLE PLUG CONNECTION NUMBER.
B1 D	JUNCTION BLOCK CONNECTION.
	SWITCH SYMBOL INDICATES MOMENTARY CONTACTS.
	INDICATES A WIRE GROUND.
	INDICATES A CHASSIS GROUND (NO WIRE).
	INDICATES OPTIONS.
	INDICATES A CONNECTION,WIRE,LUG,ETC.
	INSULATING PLUG
1	COMPONENT CONNECTION NUMBERR OR LETTER.
STP	SWITCH THERMAL PROTECTOR (TOPFET)
S	SWITCH THERMAL PROTECTOR (TOPFET)

CHART 1	FI	FR	FR1	FS	F1	FC	FCFM
+BAT = +12V	1A	50A	50A	50A	5AT	5A	30A

CHART 2	FB
f=60Hz	16A

CHART 4	SBM
INTEGRA 35X	1.5KW

CHART 5	TR 12V
INTEGRA 35X	560VA

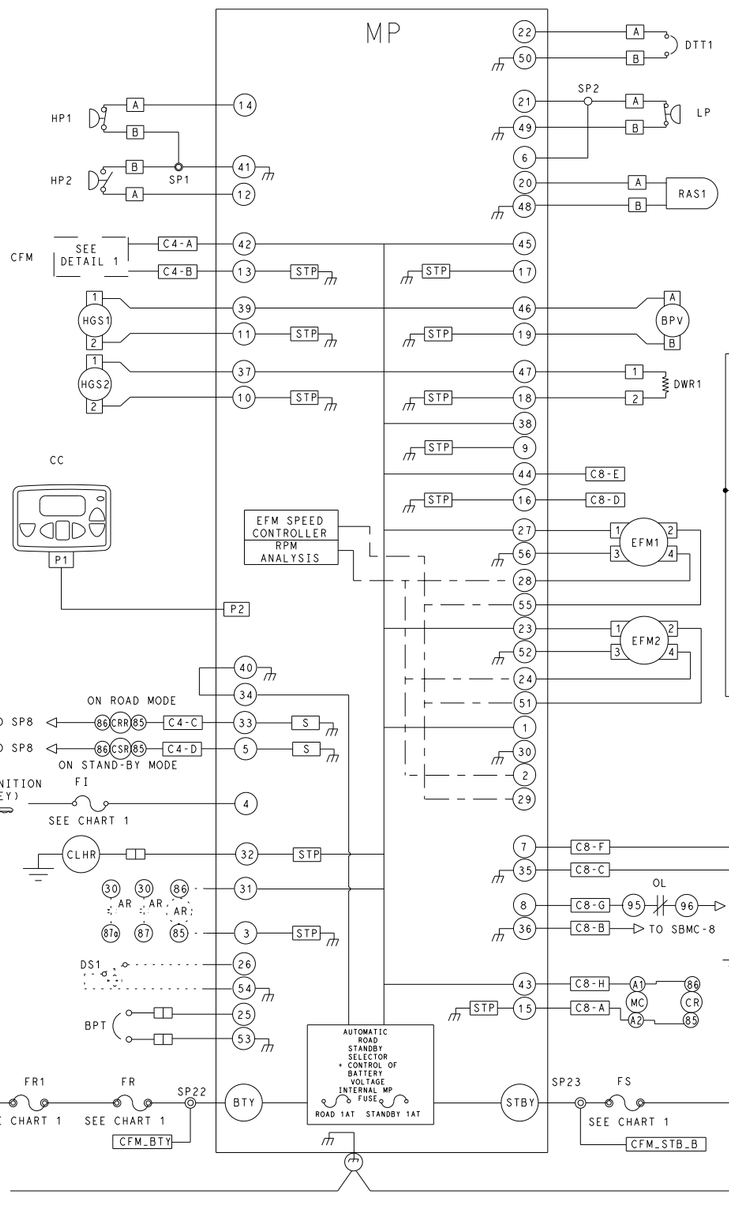
DECAL NO. A62-61677-01

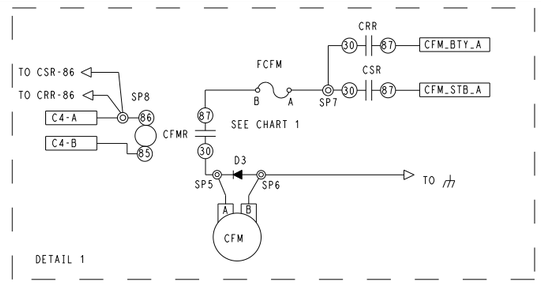
DATE	ARTWORK No.	REV
2017-08-01	62-61677-ART2	C

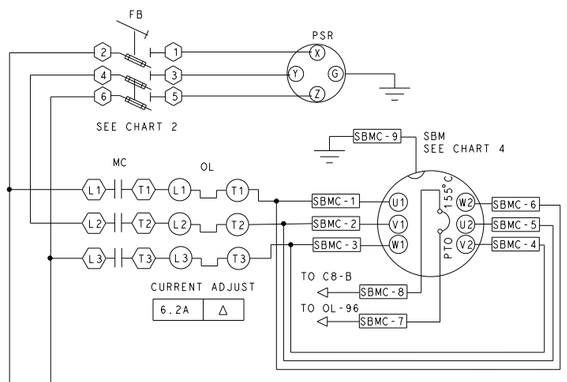
INTEGRA 35X SERIES(ROAD-STBY CIRCUITS)

INTEGRA 35X

ROAD 12VDC
230V/3/60Hz







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D-13/Q-1	CFM_BTY	BATTERY SUPPLY FOR CFM	CONDENSER
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B-11	DS1	DOOR SWITCH (OPTION)	EVAPORATOR
J-1	DTT1	DEFROST KLIXON	EVAPORATOR
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I-13	FS	FUSE STANDBY (DC VOLTAGE)	CONDENSER
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A-9	IGNITION	SWITCH KEY INFORMATIN	ENGINE COMPARTMENT
J-2	LP	LOW PRESSURE SWITCH	EVAPORATOR
L-6/I-12	MC	MOTOR CONTACTOR	STANDBY BOX
F-1	MP	MICROPROCESSOR BOARD	CONDENSER
M-6/J-11	OL	OVERLOAD RELEAY	STANDBY BOX
O-5	PSR	POWER SUPPLY RECEPTACLE	EXTERNAL
K-13	R	RESISTOR FOR DISCHARGE C1	STANDBY BOX
J-3	RAS1	RETURN AIR SENSOR	EVAPORATOR
N-13	RB	RECTIFIER BRIDGE	CONDENSER
N-12	RBT	RECTIFIER BRIDGE THERMISTOR	CONDENSER
P-6	SBM	STANDBY MOTOR	CONDENSER
P-13	TR	TRANSFORMER	CONDENSER
P-11	TRT	TRANSFORMER THERMISTOR	CONDENSER

NOTES:

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- T1 PIN CONNECTION.
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- NORMALLY OPEN CONTACTS.
- HC-F2 MULTIPLE PLUG CONNECTION NUMBER.
- B1(D) JUNCTION BLOCK CONNECTION.
- SWITCH SYMBOL INDICATES MOMENTARY CONTACTS.
- INDICATES A WIRE GROUND.
- INDICATES A CHASSIS GROUND (NO WIRE).
- -- INDICATES OPTIONS.
- INDICATES A CONNECTION,WIRE,LUG,ETC.
- INSULATING PLUG
- (1) COMPONENT CONNECTION NUMBERR OR LETTER.
- STP SWITCH THERMAL PROTECTOR (TOPFET)
- S SWITCH THERMAL PROTECTOR (TOPFET)

CHART 1	FI	FR	FR1	FS	F1	FC	FCFM
+BAT = +12V	1A	50A	50A	50A	5AT	5A	30A

CHART 2	FB
f=60Hz	12A

CHART 4	SBM
INTEGRA 35X	1.5KW

CHART 5	TR 12V
INTEGRA 35X	560VA

DECAL NO. A62-61577-02

DATE	ARTWORK No.	REV
2017-08-01	62-61677-ART3	C

INTEGRA 35X SERIES(ROAD-STBY CIRCUITS)

INDEX

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⚠ **WARNING:** Breathing diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

- Always start and operate engine in a well-ventilated area.
- If in an enclosed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system.
- Do not idle the engine except as necessary.

For more information, go to www.P65warnings.ca.gov/diesel

Carrier TRANSICOLD

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