Operation and Service Manual

Supra® Series
Truck Refrigeration Unit

SUPRA SERIES

62-11868 Rev G
Change 05.26.2021

Carrier TRANSICOLD

Operation and Service Manual

Supra Series

Truck Refrigeration Units

Manual Revision History: 62-11868

Rev	Date	Reason for Release
	10/11/16	Field Trial version released.
A	03/08/16	Added section 6.6.6.2 (Leak Check Using Pressurized Dry Nitrogen)
B	08/19/19	Section 3: Updated pre-trip test procedure tables per M. Broaddus input; updated cover page and other references to “S Series”, updated Table 3-4; Section 4: 4.4 (updated bullet points), 4.4.1 (corrected setpoint temps), Table 4-1 (added * to first line), 4.8.3 (updated sequencing), 4.9.1 (corrected setpoint temps), 4.10.1 (added Additional Overrides) Section 5: Alarm 00018 (updated suction pressure), 00021 (updated Trigger On conditions), 00029 (updated RAT temp), 00037, 00039 (updated RPMs and deleted step 2a), 00038 (updated RPMs), Added Alarm 00114, 00196 and 000198 (updated Trigger-on conditions), Added Alarm 03003, Added Alarm 05029, 07006 (changed Sensor to Transducer throughout), deleted duplicated 11002, Added Alarm 15001, deleted duplicated 22801 Section 6: 6.5.1 (updated formatting, added noted, added 6.5.1.1 for bleeding instructions), 6.5.4 (updated RPMs), 6.6.5.3 (updated step 12 to add use of stepper tool, deleted step 28), 6.6.7.3 (updated step 4 to add use of stepper tool), Table 6-4 (added Evap2 Temp Control)
C	11/11/19	Table 2-5: Updated D722 engine displacement value; Section 2.6.4.3: Correct 230V full load to 20 amps; corrected labeling Figure 6.12 (C and D reversed)
D	4/24/2020	Section 2.6.4.3: Updated table header (3ph, 60Hz); 440V to 460V; Tables 2-1, 2-2 – Added S10; Section 2.3.1.4 – Added sentence to cover S10; Table 2-5 – Added S10 section; Table 2-8 – Added S10 column; Sections 2.6.4.1, 2.6.4.2, 2.6.4.3, 2.6.4.4 – Added S10 data; Page 3-9: Add S10 to Pretrip test; Section 3.3.1 – Updated last sentence; Alarm 00038 – updated ranges; Alarm 00180 – Updated corrective actions to include check pin to chassis (KS); Table 6-2 – Added data for S10 units; Added Section 6.10.3 (TRU-Tech/TRU-View software upgrade); Update logos and cover
E	10/7/2020	Table 2-5 – Corrected S10 Coolant and Oil capacity numbers; Table 2-8 – Corrected Diesel High Speed (RPM) to 2100; Section 3.4.1 – Update lock/unlock instructions to eliminate reference to function key; Added 4.10.2 Temperature Range Lock 1 and 2; Figure 6.31 - Added Range Lock detail
F	1/8/2021	Section 6.6.3: Added TDS Belt replacement procedure
G	4/27/2021	Section 2.1: Corrected compressor model numbers (Table 2-1); Section 2.6.4: Added S10 model to Evaporator Fan Motor and Compressor Fan Motor part numbers matrix; Swapped out wiring diagram with latest revision
	Change 5/26/2021	Section 3.4.1 change from Rev. E lost between revs. Updated. Relabeled tables at the end of section 6

TABLE OF CONTENTS

SECTION 1
Safety

1.1 Safety Precautions

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. Please stay clear of all moving parts when the unit is in operation and when the main power switch is not in the OFF position.

NOTICE

Under no circumstances should a technician electrically probe the microprocessor at any point, other than the connector terminals where the harness attaches. Microprocessor components operate at different voltage levels and at extremely low current levels. Improper use of voltmeters, jumper wires, continuity testers, etc. could permanently damage the microprocessor.

NOTICE

Most electronic components are susceptible to damage caused by electrical static discharge (ESD). In certain cases, the human body can have enough static electricity to cause resultant damage to the components by touch. This is especially true of the integrated circuits found on the microprocessor.

1.1.1 Automatic Start-Stop

This unit is equipped with auto-start in both Start-Stop and Continuous Operation. The unit may start at any time the main power switch is not in the OFF position. A buzzer will sound for five seconds before the unit is started. When performing any check of the refrigeration unit (e.g., checking the belt, checking the oil), make certain that the main power switch is in the OFF position.

1.1.2 Engine Coolant

The engine is equipped with a pressurized cooling system including a pressurized coolant bottle. Under normal operating conditions, the coolant in the engine and radiator is under high pressure and is very hot. Contact with hot coolant can cause severe burns. Do not remove the cap from a hot radiator or bottle. If the cap must be removed, cover it with a rag and remove very slowly in order to release the pressure without spray.

1.1.3 Refrigerants

The refrigerant contained in the refrigeration system of this 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) Carrier Transicold recommends contacting your nearest Carrier Transicold authorized repair facility whenever service of the refrigerant system is required.

1.1.4 Battery

This unit is equipped with a lead-acid type battery. The battery normally vents small amounts of flammable hydrogen gas. Do not smoke when checking the battery. A battery explosion can cause serious physical harm and/or blindness.

1.1.5 Standby Power

Be aware of HIGH VOLTAGE supplied at the power plug. Even with the unit off, power is present from the plug to the inside of the control box. Whenever practical, disconnect the high voltage source when performing service or maintenance procedures and lockout/tagout the receptacle in accordance with your company's procedures.

1.2 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

Unit may start automatically at any time even if the switch is in the OFF position. Use proper lockout/tagout procedures before inspection/servicing. All unit inspection/servicing by properly trained personnel only.

WARNING

Beware of unannounced starting of the engine, standby motor, evaporator fan or condenser fan. The unit may cycle the engine, standby motor or fans unexpectedly as control requirements dictate.

WARNING

Under no circumstances should ether or any other starting aids be used to start engine.

WARNING

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

WARNING

Do not attempt to connect or remove power plug or perform service and/or maintenance before ensuring the unit RUN/STOP Switch is in the STOP position and the I/O Switch is in the “O” position.

⚠ WARNING

Units equipped with the APX control system may start automatically at any time the main power switch is not in the OFF position. Also, the unit may be fitted with 2-way communication equipment that will allow starting of the unit from a remote location even though the switch is in the OFF position.

⚠ WARNING

Be aware of HIGH VOLTAGE supplied at the power plug. When performing service or maintenance procedures, ensure any two-way communication is disabled in accordance with the manufacturer's instructions, ensure the main power switch is in the OFF position, and whenever practical, disconnect the high voltage source, lockout/tagout the receptacle and disconnect the negative battery connection.

⚠ WARNING

Before servicing the unit, the RUN/STOP switch must be in the STOP position. In addition, the negative battery cable must be disconnected.

⚠ WARNING

Beware of moving belts and belt driven components as the unit may start automatically. When working with belts, beware of pinch points.

⚠ WARNING

Before performing any "hot work," including but not limited to brazing or welding on a unit that has been charged with R-452A, refrigerant must be reclaimed until equipment gauge indicates -20 in HG (-0.67 Bar) of vacuum. Nitrogen purge is also required. Refer to Service Section for recovery procedure.

⚠ WARNING

Ensure power to the unit is OFF and power plug is disconnected or vehicle engine is OFF and negative battery cable is disconnected before replacing the compressor.

⚠ WARNING

Since refrigerant traps a certain quantity of oil, to avoid oil loss during maintenance, add 50 cc of POE oil to the refrigeration system when any evacuation is performed.

⚠ WARNING

Do not use a nitrogen cylinder without a pressure regulator. Cylinder pressure is approximately 2350 psi (165 kg/cm^2). Do not use oxygen in or near a refrigerant system as an explosion may occur. (Figure 6.18)

⚠ WARNING

Beware of unannounced starting of the fans and belts caused by the thermostat and the start/stop cycling of the unit.

⚠ CAUTION

Observe proper polarity when installing battery, negative battery terminal must be grounded. Reverse polarity will destroy the rectifier diodes in alternator. As a precautionary measure, disconnect positive battery terminal when charging battery in unit. Connecting charger in reverse will destroy the rectifier diodes in alternator.

⚠ CAUTION

Under no circumstances should anyone attempt to repair the logic or display boards. Should a problem develop with these components, contact your nearest Carrier Transicold dealer for replacement.

⚠ CAUTION

Use only ethylene glycol anti-freeze (with inhibitors) in system as glycol by itself will damage the cooling system. Always add pre-mixed 50/50 anti-freeze and water to radiator/engine. Never exceed more than a 50% concentration of antifreeze. Use a low silicate anti-freeze.

⚠ CAUTION

When changing oil filter, the new filter should be primed with clean oil. If the filter is not primed, the engine may operate for a period with no oil supplied to the bearings.

⚠ CAUTION

When changing fuel filter, the new filter should be filled with clean filtered fuel.

⚠ CAUTION

Observe proper polarity, reverse polarity will destroy the diodes. As a precaution, disconnect positive terminal when charging.

⚠ CAUTION

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

⚠ CAUTION

Extreme care must be taken to ensure the manifold common connection remains immersed in oil at all times. Otherwise air and moisture will be drawn into the compressor.

⚠ CAUTION

Do not damage or over tighten the enclosing tube assembly. In addition, all parts must be placed on the enclosing tube in proper sequence to avoid premature coil burnout.

⚠ CAUTION

DO NOT attempt to service the microprocessor or the logic or display boards! Should a problem develop with the microprocessor, contact your nearest Carrier Transicold dealer for replacement.

NOTICE

Unit uses R-404A / R-452A and POE oil. The use of inert gas brazing procedures is mandatory for all Carrier Transicold refrigeration units; otherwise compressor failure will occur. For more information, refer to technical procedure 98-50553-00 Inert Gas Brazing.

NOTICE

Refrigerant R-404A / R-452A must be charged as a liquid. Refrigerant R-404A / R-452A is a blend. Charging as a vapor will change the properties of the refrigerant. Only liquid charging through the receiver service valve is acceptable.

NOTICE

Any system that is low on R-452A refrigerant must be fully recovered and recharged.

NOTICE

Under no circumstances should a technician electrically probe the processor at any point, other than the connector terminals where the harness attaches. Microprocessor components operate at different voltage levels and at extremely low current levels. Improper use of voltmeters, jumper wires, continuity testers, etc. could permanently damage the processor.

NOTICE

Most electronic components are susceptible to damage caused by electrical static discharge (ESD). In certain cases, the human body can have enough static electricity to cause resultant damage to the components by touch. This is especially true of the integrated circuits found on the truck/trailer microprocessor.

1.3 Safety Decals

Figure 1.1 Safety Label 62-61655-00

Figure 1.2 Refrigerant Label 62-03797-01

Figure 1.3 Refrigerant Label 62-60063-02

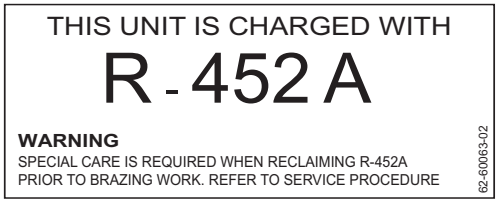


Figure 1.4 Safety Equipment Label 62-61398

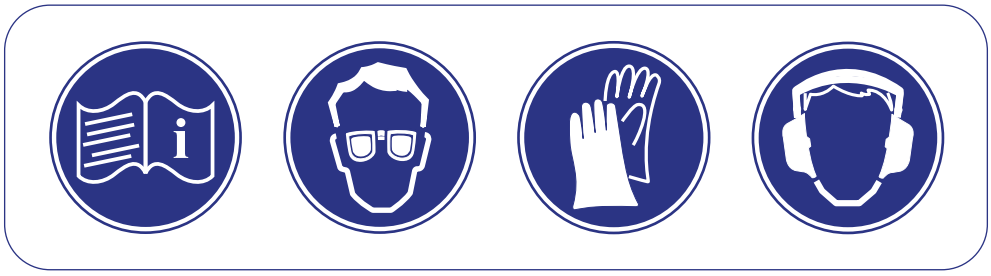


Figure 1.5 Sticker No Modifications 62-61774-00

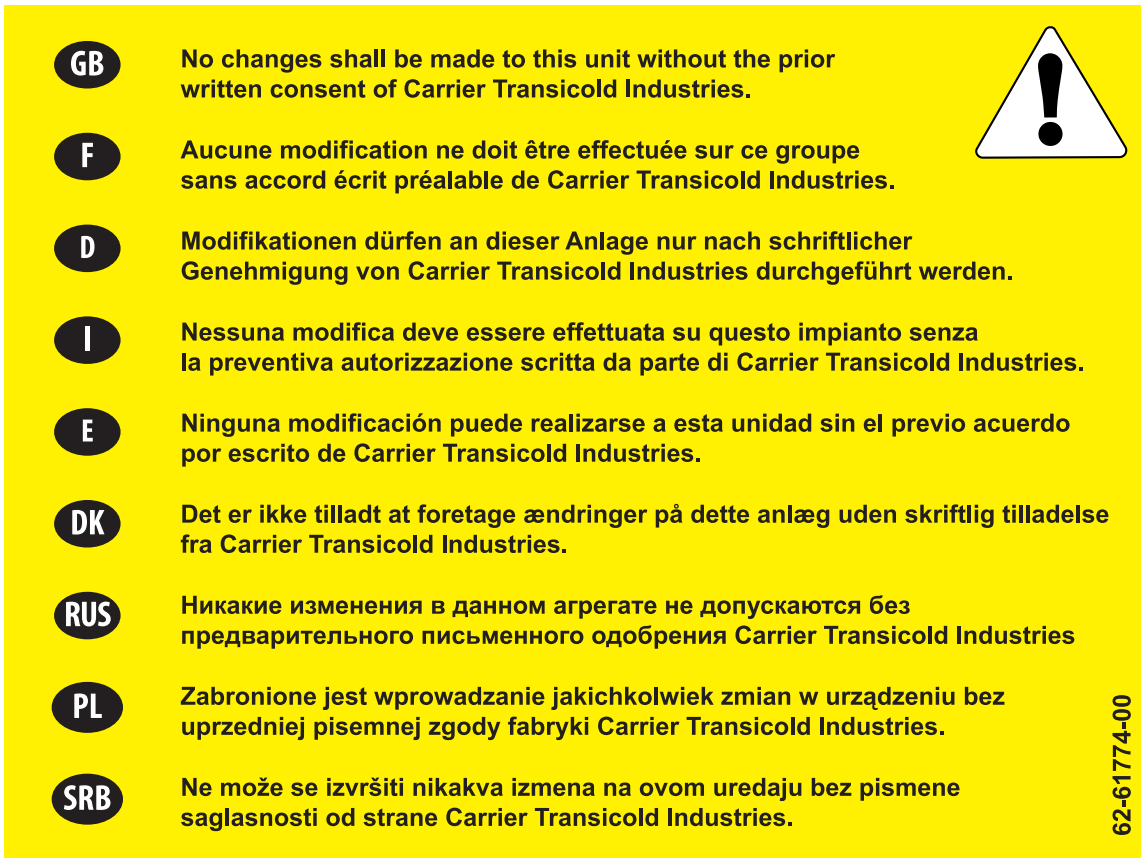


Figure 1.6 R-404A Refrigerant with POE Oil Decal 62-04160-00

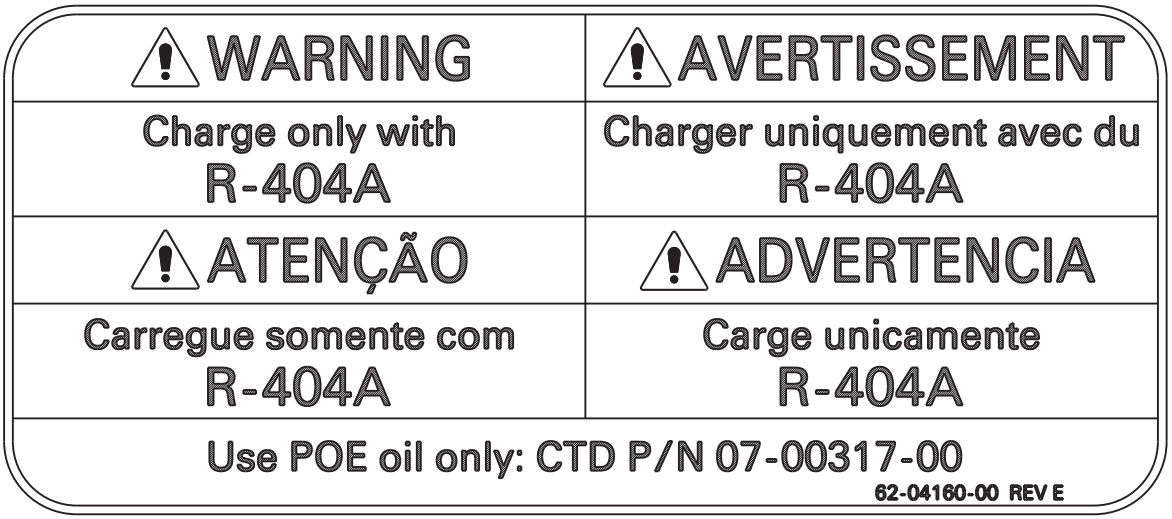


Figure 1.7 R-404A Refrigerant Decal 62-04160-01

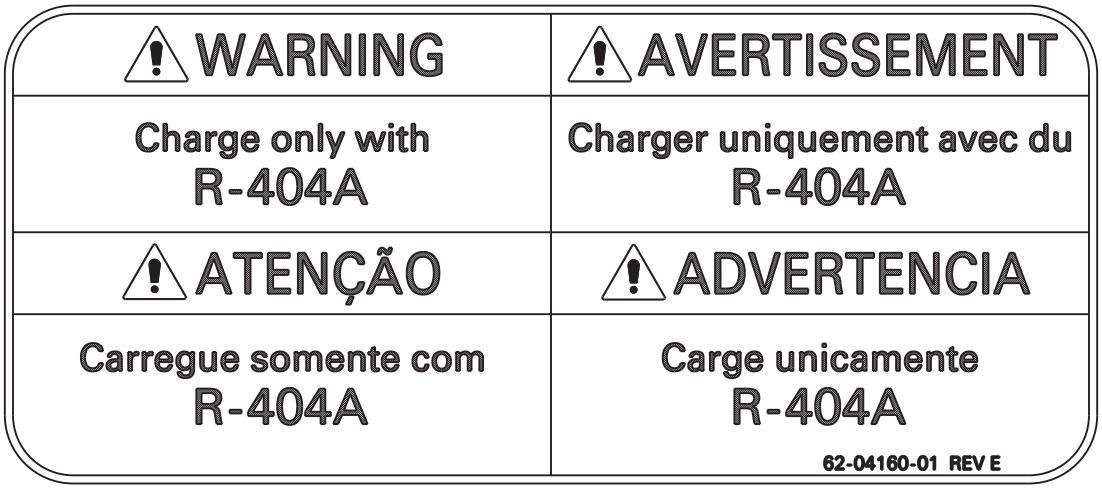


Figure 1.8 R-452A Refrigerant with POE Oil Decal 62-04160-02

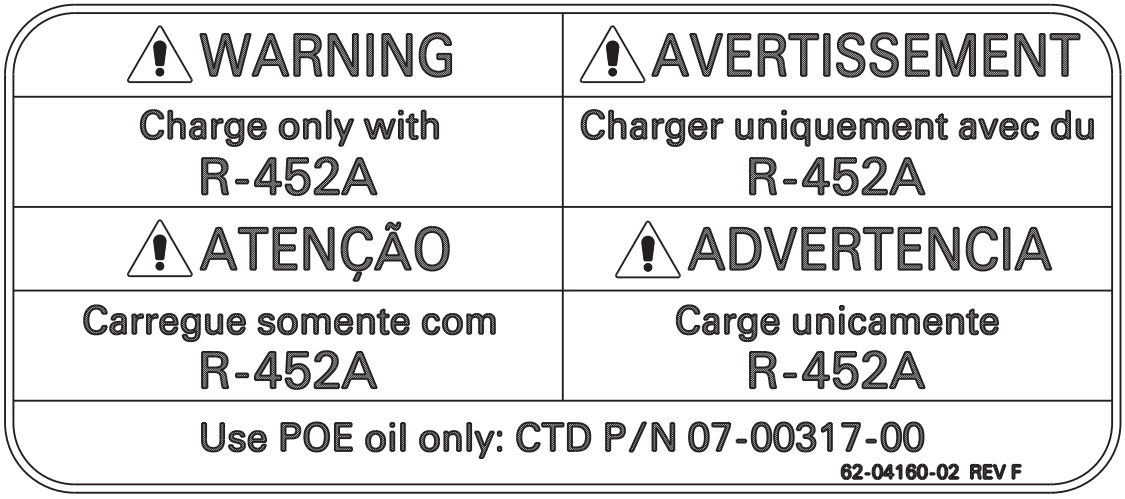
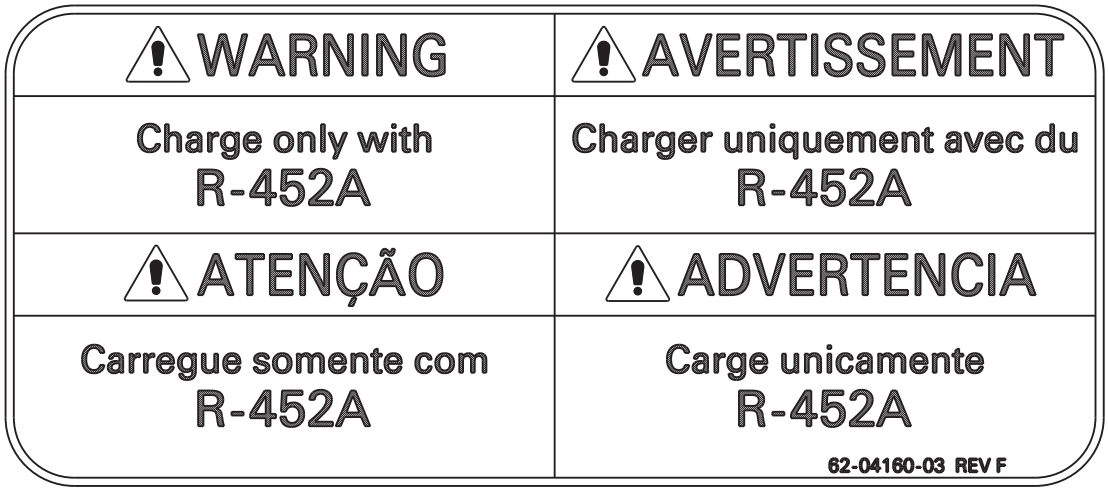


Figure 1.9 R-452A Refrigerant Decal 62-04160-03



SECTION 2
Unit Description

2.1 Introduction

⚠ WARNING

Beware of unannounced starting of the engine, standby motor, evaporator fan or condenser fan. The unit may cycle the engine, standby motor or fans unexpectedly as control requirements dictate.

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

Additional support manuals for this unit are listed in **Table 2–2**.

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

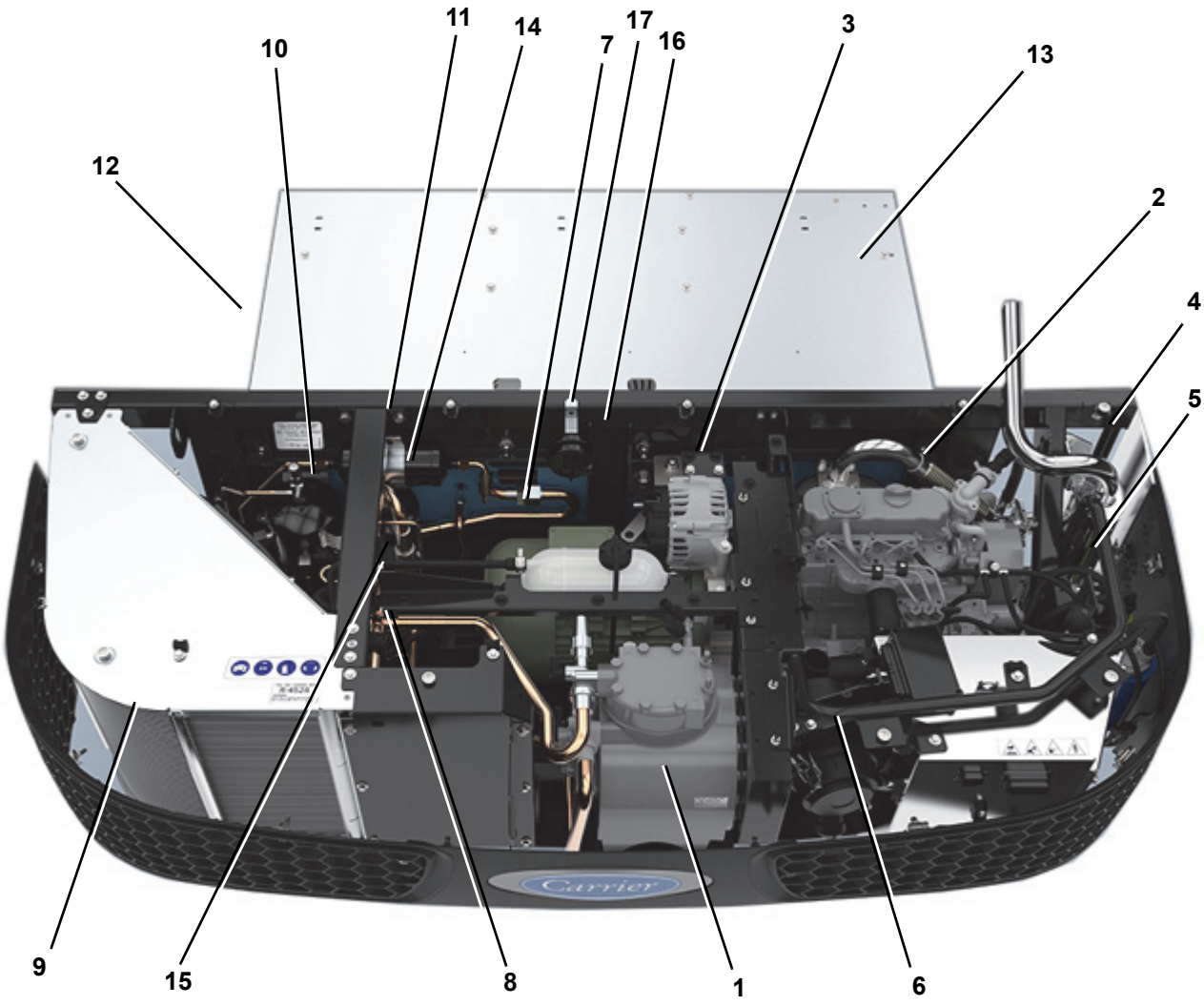
Table 2–1 Model Chart

Model	Refrigerant				Engine	Compressor	Standby Motor
	R-404A		R-452A				
	LB	Kg	LB	Kg			50/60 Hz
S6	6.6	3	6.6	3	Z482	05K12	5.5 kW
S7	6.6	3	6.6	3	D722	05K12	5.5 kW
S8	6.6	3	6.6	3	D722	05K12	5.5 kW
S9	7.1	3.2	7.1	3.2	D722	05K24	5.5 kW
S10	8.2	3.7	8.2	3.7	D1105	05K24	7.5kW

Table 2–2 Additional Support Manuals

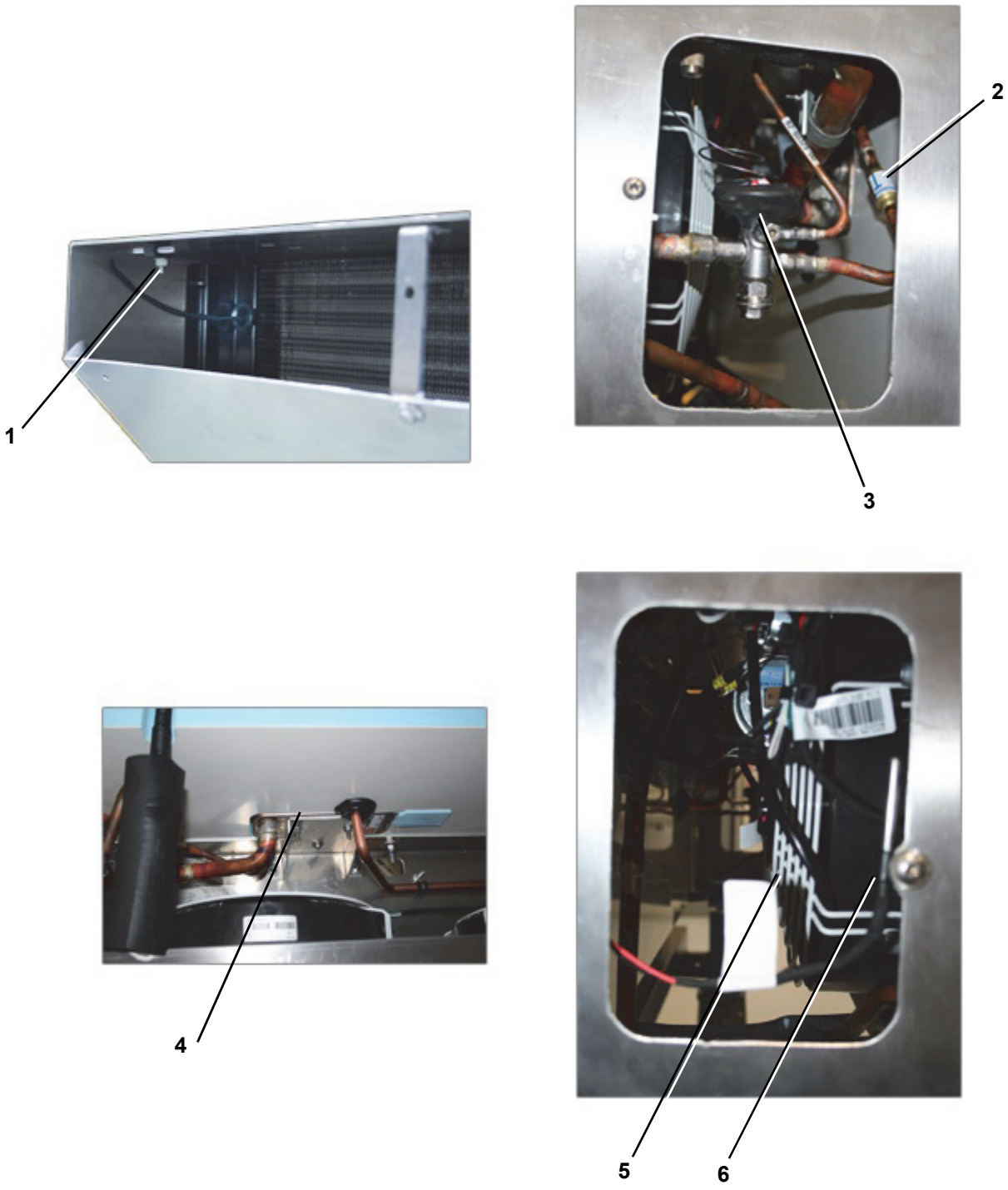
Manual Number	Equipment Covered	Type of Manual
62-02491	Compressor (05K)	Operation and Service
62-02460	Compressor (05K)	Service Parts List
62-11161	Engine (Z482 and D722)	Workshop Manual
62-11167	Engine (D1105)	Workshop Manual

Figure 2.1 Main Components - Top View



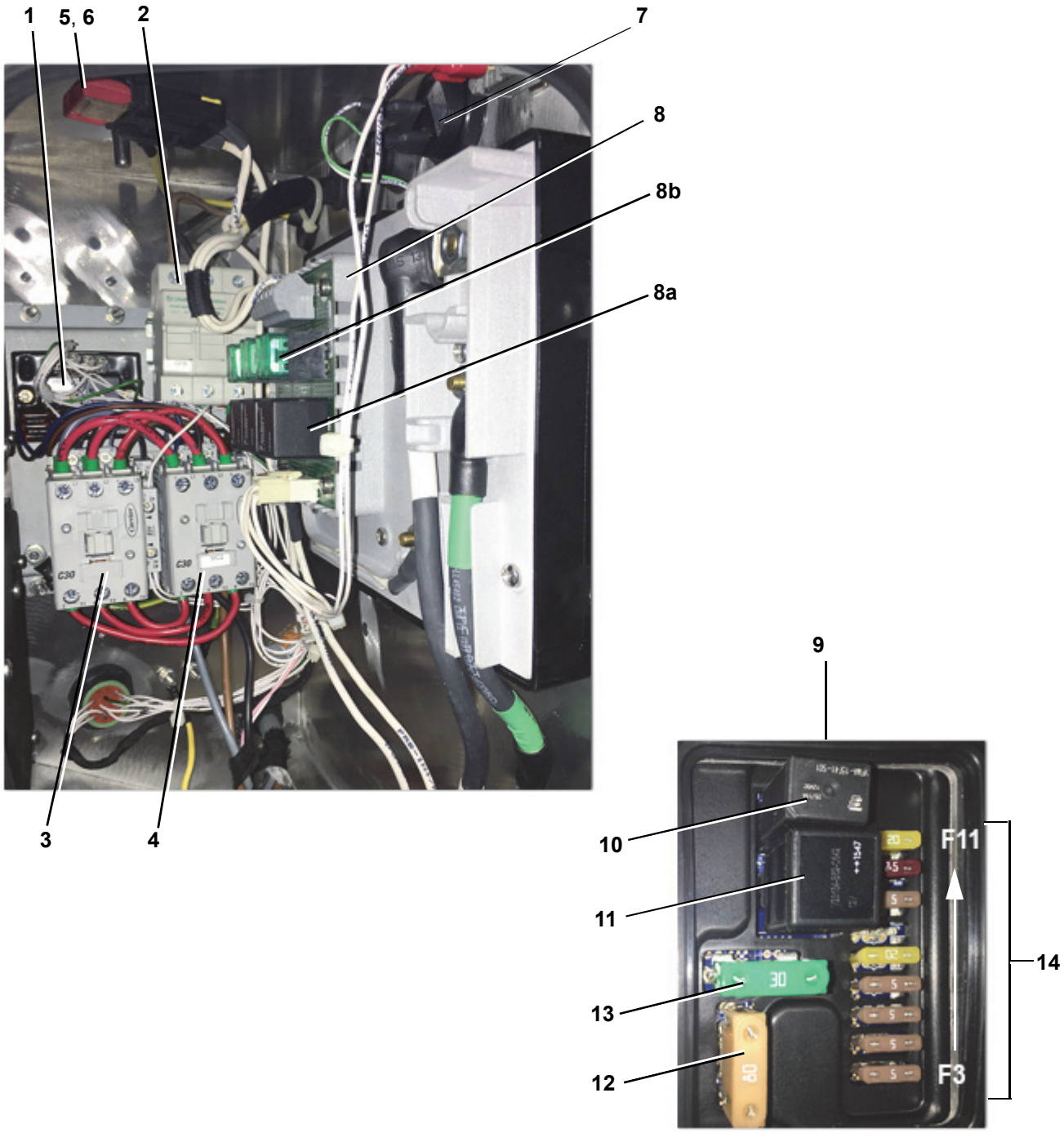
1. Compressor
2. Engine (Refer to **Table 2–1**)
3. Alternator
4. Muffler
5. Fuel Filter
6. Air Cleaner
7. Electric Standby Motor
8. Hot Gas 3-Way Valve (HGS1)
9. Condenser
10. Receiver
11. Filter Drier
12. Thermal Expansion Valve (TXV)
13. Evaporator (Refer to **Figure 2.2** for detail)
14. Accumulator
15. Compressor Suction Modulation Valve (CSMV)
16. Model/Serial Number Plate
17. Defrost Air Switch (DAS)

Figure 2.2 Evaporator



1. Supply Air Sensor
2. Liquid Line Check Valve
3. Thermal Expansion Valve (TXV)
4. Braze Plate Heat Exchanger
5. Evaporator Fan Motor (3)
6. Return Air Sensor (RAS)

Figure 2.3 Control Box



1. Phase Reversal Module
2. High Voltage Fuse Holder
3. Motor Contactor 1
4. Motor Contactor 2
5. F20 Fuse - refer to **Table 2–3**
6. F21 Fuse - refer to **Table 2–3**
7. Warning Buzzer
8. Evaporator Fan Motor Relay Board
   a) Motor Relay
   b) Fuses F22 to F24 - refer to **Table 2–3**
9. Truck Power Control (TPC)
10. Diesel / Electric Relay (DER)
11. Power Enable Relay (PER)
12. F1 Fuse - refer to **Table 2–3**
13. F2 Fuse - refer to **Table 2–3**
14. F3 to F11 Fuses - refer to **Table 2–3**

- - - - -

Table 2–3 Fuse Identification

Fuse	Designation	Amps	Power Source	External Connection Required
Fuses On TPC Board				
F1	Main Fuse	80A	Battery	Yes
F2	PER Relay	30A	F1	No
F3	12V Options	5A	F1	Yes
F4	SIOB Logic Power	5A	F1	No
F5	ENCU (12-00702)	5A	F1	Yes
F6	MCA Logic Power	5A	F1	No
F7	Fuel Heater	20A	F1	Yes
F8	(not used)	5A	PER Relay (F2)	Yes
F9	Automatic Phase Reversal	5A	PER Relay (F2)	Yes
F10	Evaporator Fan Relays	7.5A	PER Relay (F2)	No
F11	TPC FET 12 VDC Supply	20A	PER Relay (F2)	No
Fuses Outside TPC Board				
FCFM1	Condenser Fan (S6 - S9)	40A	+Batt	----
FCFM2	Condenser Fan (S10)	50A	+Batt	----
1EFM1	Evaporator Fan	30A	+Batt	----
2EFM1	Evaporator Fan	30A	+Batt	----
3EFM1	Evaporator Fan	30A	+Batt	
GBF (230VAC)	Standby Motor	25A	PSR	
GBF (440VAC)	Standby Motor	15A	PSR	

Table 2–4 Relay Identification

Relay	Designation
DER	Diesel / Electric Relay (on TPC)
PER	Power Enable Relay (on TPC)

2.2 General Description

The Supra Series models are self-contained, one-piece refrigeration/heating units designed for truck applications. The units consist of a condenser section, located outside the truck body, and an evaporator section, which extends inside the body. Two types of drives may be included.

2.2.1 Road Operation

Units are equipped with an engine. In Road Operation mode, the compressor and alternator are driven by the engine. Units do not have standby motors.

2.2.2 Standby Operation

Units are equipped with an internal combustion diesel engine and an electric standby motor. In Standby Operation, the compressor and alternator are driven by the electric standby motor.

2.3 Condensing Section

The condensing section (see **Figure 2.1**) contains the drive equipment, alternator, high side refrigeration system equipment, engine radiator and refrigerant condenser.

2.3.1 Unidrive

The unidrive includes the engine, engine mounted clutch, air cleaner, muffler, coolant overflow bottle, drive belts and standby motor.

2.3.1.1 Engine

The Supra Series unit is powered by a diesel engine (see **Figure 2.1**) manufactured by Kubota. Engine operation is controlled by an electronic governor. The engine is cooled by a radiator. The cooling system is fitted with a coolant overflow reservoir. Engine air cleaners are dry type.

2.3.1.2 Engine Controls

- Fuel/Speed Actuator (FSA): The FSA combines the fuel shutoff solenoid and speed control solenoid into one component. Fuel supply to the injectors and engine speed is controlled by varying rod position in accordance with the signal from the ENCU. The FSA is located on the injection pump.
- Engine Speed Sensor (ENSSN): The ENSSN provides the ENCU with information on the speed at which the engine is running. The ENSSN is located in the gear case cover under the injection pump.
- Engine Oil Pressure Switch (ENOPS): The ENOPS is normally open and closes on pressure rise to signal to the control system that the engine has sufficient oil pressure for operation. There is a 15 second delay after the engine starts to allow the oil pressure to build up before the control system looks at the input from this switch.
- Engine Coolant Temperature Sensor (ENCT): The ENCT is a thermistor type sensor that provides the control system with engine coolant temperature information to be displayed, recorded in the Main Micro and used to control the refrigeration system. The sensor is located on the cylinder head.

2.3.1.3 Clutch Assembly

The clutch assembly is mounted on the engine crankshaft. Road/Standby units have centrifugal type clutches. Road only units do not have a clutch.

2.3.1.4 Standby Motor

The standby motor operates on nominal 5.5 kW power for S6 - S9 units and 7.5kW power for S10 units.Units are also equipped with an internal protection (IP) and remote standby plug.

2.3.2 Alternator/Regulator

⚠ CAUTION

Observe proper polarity when installing battery - negative battery terminal must be grounded. Reverse polarity will destroy the rectifier diodes in alternator. As a precautionary measure, disconnect positive battery terminal when charging battery in unit. Connecting charger in reverse will destroy the rectifier diodes in alternator.

The alternator supplies power for operation of the system controls, evaporator and condenser fan motors, and for charging of the unit battery, if equipped. The alternator converts mechanical and magnetic energy to alternating current (AC) and voltage by the rotation of an electromagnetic field (rotor) inside a three-phase stator assembly. The alternating current and voltage is changed to direct current and voltage by passing AC energy through a three-phase, full-wave rectifier system. Six silicon rectifier diodes are used.

The voltage regulator is an all-electronic, transistorized switching device, integral to the alternator. It senses the voltage appearing at the auxiliary terminal of the alternator and supplies the necessary field current for maintaining the system voltage at the output terminal. The electronic circuitry should never require adjustment and the solid state active elements used have proved reliable enough to warrant a sealed unit.

2.3.3 Compressor

The compressor assembly consists of the following components: refrigerant compressor, suction and discharge service valves, High Pressure Switch (HP1), Discharge Temperature Sensor (CDT), Discharge Pressure Transducer (CDP) and Suction Pressure Transducer (SPT). The compressor draws 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.

2.3.4 Refrigeration System

The condensing section mounted refrigeration system equipment includes the compressor, condenser/subcooler, accumulator, filter drier, receiver, 3-way valve (HGS1), and suction modulation valve (SMV).

2.3.4.1 Condenser/Subcooler

The condenser is of the micro channel 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 an electric fan(s).

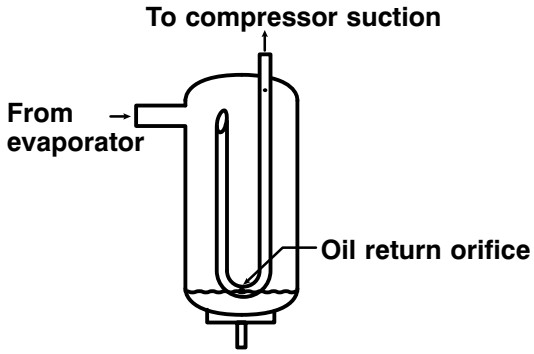
A portion of the condenser is occupied by the subcooler. Refrigerant leaving the receiver is passed through the subcooler where additional heat is removed. Removal of this additional heat helps to ensure that only liquid refrigerant enters the thermal expansion valve.

2.3.4.2 Accumulator

The accumulator is a refrigerant holding tank located in the suction line between the evaporator and compressor. The purpose of the accumulator is to prevent entry of any liquid refrigerant into the compressor.

Refrigerant vapor leaves the accumulator outlet pipe at a point well above any liquid level thus preventing the entrance of liquid. The outlet pipe is equipped with an orifice that controls oil return to the compressor and prevents accumulation of oil within the tank.

Figure 2.4 Accumulator



2.3.4.3 3-Way Valve (HGS)

The 3-way valve (HGS) directs flow of refrigerant through the system. With the solenoid coil de-energized, the valve is in the cool mode (see Figure 2.5) and the compressor discharge gas is delivered to the condenser. With the solenoid coil energized, the valve is in the heat mode (see Figure 2.6) and the compressor discharge gas is diverted to the evaporator.

Figure 2.5 3-way Valve (HGS) - Cool Mode

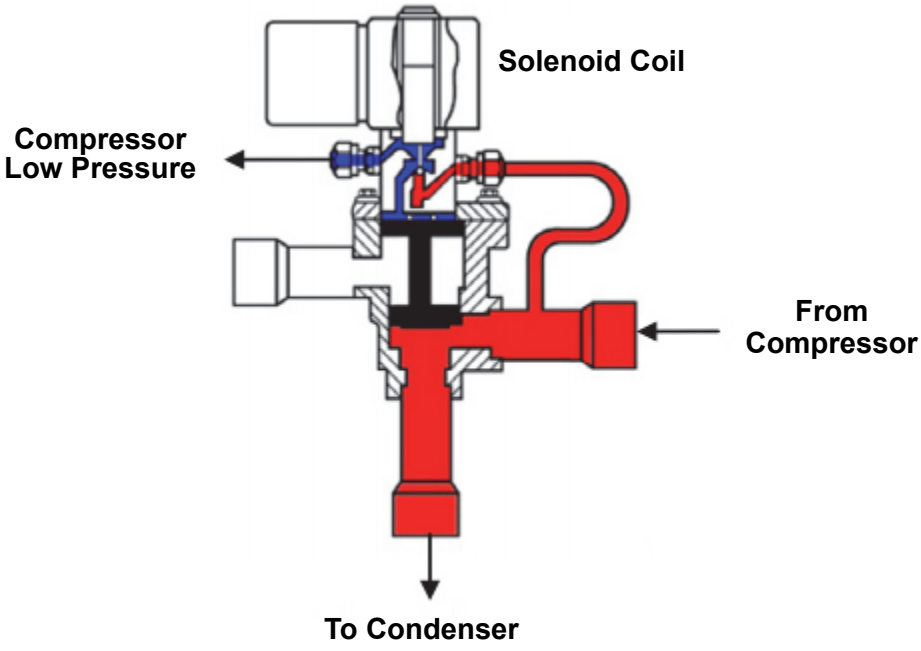
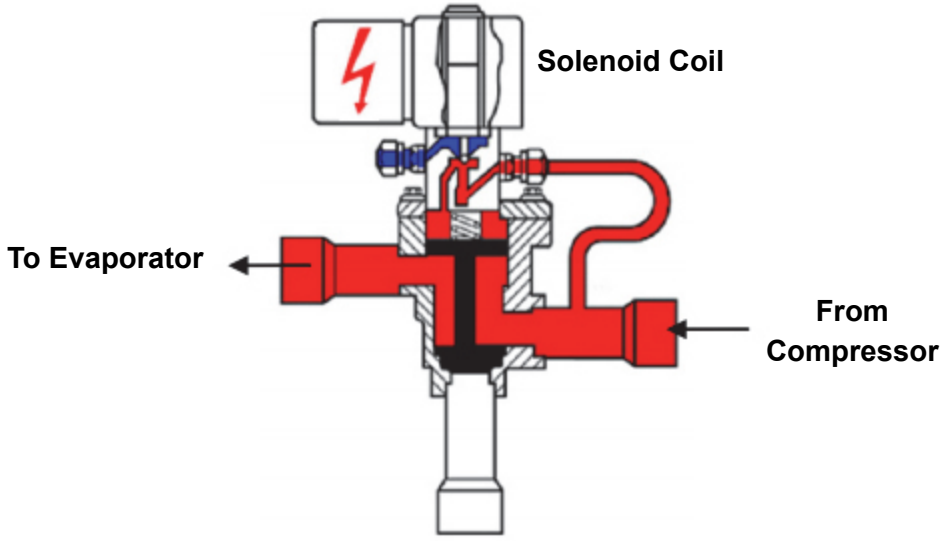


Figure 2.6 3-way Valve (HGS) Heat & Defrost Mode



2.3.4.4 Filter Drier

The drier is cylinder shell containing a drying agent and screen. It is installed in the liquid line and functions to keep the system clean and remove moisture from the refrigerant. A sight glass may also be installed downstream of the drier. The sight glass is fitted with a paper element that changes color to indicate moisture content.

2.3.4.5 Receiver

Liquid refrigerant from the condenser drains into the receiver. The receiver serves as:

- A liquid reservoir when there are surges due to load changes in the system
- A storage space when pumping down the system
- A liquid seal against the entrance of refrigerant gas into the liquid line

The receiver is provided with a sight glass for the observation of liquid level and a pressure relief valve.

2.3.4.6 Cooling Operation (See Figure 2.7)

With the 3-way valve (HGS) solenoid coil de-energized, the valve is in the cool operating mode and the refrigerant gas is diverted to the condenser. The volume directly above the piston assembly is open to suction pressure through the external pilot connection and the volume underneath the piston assembly is open to discharge pressure through the compressor discharge connection. This difference in pressure across the piston assembly results in the piston assembly being shifted upward, shutting the heat and defrost port, opening the condenser port, and allowing refrigerant to flow to the condenser.

2.3.4.7 Heat and Defrost Operation (See Figure 2.8)

When the 3-way valve (HGS) solenoid coil is energized, discharge gas flows to the evaporator for heating or defrost. When energized, the solenoid plunger is lifted, allowing discharge gas to fill the volume above the piston assembly. Discharge gas is also allowed to fill the volume below the piston assembly through the compressor discharge connection. The pressure on both sides of the piston assembly is now equal and the piston spring exerts a force on top of the piston assembly and shifts it downward. The condenser port is now closed and the evaporator port is open. In both the energized and de-energized positions, the bypass of discharge gas to the suction port is prevented.

2.4 Evaporator Section

The evaporator section contains the evaporator coil, thermal expansion valve (TXV), heat exchanger, defrost termination sensor(s), and electrical evaporator fan motors.

2.4.1 Thermal Expansion Valve (TXV)

The TXV is an automatic device which controls the flow of liquid to the evaporator according to changes in superheat to the refrigerant leaving the evaporator. The TXV 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 prevention of liquid return to the compressor.

2.4.2 Heat Exchanger

The heat exchanger is a brazed plate heat exchanger located in the evaporator bulkhead.

2.4.3 Compressor Suction Modulation Valve (CSMV)

The CSMV opens and closes as required for capacity control of the refrigeration system cooling cycle. It is located in the suction line at the exit of the evaporator assembly.

2.4.4 Evaporator Coil

The evaporator coil is a tube and fin type. The operation of the compressor maintains a reduced pressure with 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 three electric fans.

2.5 System Operating Controls and Components

The unit is furnished with a microprocessor control system. Once the set point is entered at the controller, the unit will operate automatically to maintain the desired temperature within very close limits. The control system automatically selects high and low speed cooling or high and low speed heating as necessary to maintain the desired temperature.

Units also have a auto start/stop feature. Auto start/stop operation provides automatic cycling of the diesel engine or standby motor, which in turn offers an energy efficient alternative to continuous operation.

2.5.1 Switches and Controls

Manual control switches are located on the side of the electrical box. Components required for monitoring and controlling the diesel engine and refrigeration system are located on the engine, compressor or system piping.

- **RUN/STOP Switch (RSS):** The RSS controls the supply of power to the microprocessor and cab command. The switch is placed in the ON position to allow manual or automatic unit operation. With the switch in the OFF position, the unit will be shut down and neither manual or automatic starting is allowed.
- **Oil Pressure Safety Switch (OP):** The OP will automatically stop the engine upon loss of oil pressure. The switch is located on the oil filter head.
- **Water Temperature Sensor (ENCT):** The microprocessor will stop the unit when the ENCT signals a high water temperature condition. The sensor is located on the engine cylinder head.
- **High Pressure Cutout Switch (HP1):** HP1 will automatically stop the engine when compressor discharge pressure exceeds the set point. The switch is located on the compressor cylinder head.
- **Compressor Discharge Temperature Sensor (CDT):** The microprocessor will stop the unit when the CDT signals a high discharge temperature condition. The sensor is located on the compressor center head.
- **Compressor Discharge Pressure Transducer (CDP):** The CDP provides a signal to the control system equivalent to pressure leaving the compressor. It is located on the HP line between the compressor and 3-way valve.
- **Compressor Suction Pressure Transducer (SPT):** The SPT signal is used by the microprocessor in the compressor protection logic to protect the compressor from excessively low suction pressure conditions. The sensor is located on the compressor body.
- **Ambient Temperature Sensor (ATS):** The ATS signal is used by the microprocessor in the compressor protection logic to determine expected conditions. It is located between the condenser and the front grille.
- **Temperature Control Sensors:** Box temperature is controlled by one or two sensors:
  - RAS: Measures return air to the evaporator
  - SAS: Measures supply air leaving the evaporator and is also used in heat option kits as an over temperature safety sensor.

2.6 Unit Specifications

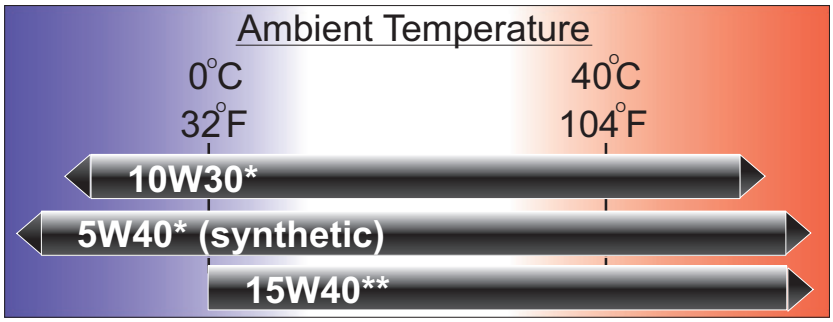
2.6.1 Engine Data

Table 2–5 Engine Data

Unit	Specification
S6	
Engine Model	Z482
Displacement	29.2 in^3 (479 cc)
Number of Cylinders	2
Horsepower	8.5 hp (6.3 kW) @2400rpm
Weight	117 lbs (53 kg)
Coolant Capacity	3.9 quarts (3.7 liters)
Oil Capacity	6.87 quarts (6.5 liters)
Injection Setting	1991 to 2133 psig (135 to 145 bars)
Oil Pressure Switch	Closes at: 18 ± 3 psig (1.2 ± 0.2 bar)
Glow Plug	0.9 ohms @ 68°F (20°C)
S7, S8, S9	
Engine Model	D722
Displacement	43.88 in^3 (719 cc)
Number of Cylinders	3
Horsepower	15.5 hp (11.6 kW) @2400rpm
Weight	117 lbs (53 kg)
Coolant Capacity	3.9 quarts (3.7 liters)
Oil Capacity	9 quarts (8.5 liters)
Injection Setting	1991 to 2133 psi (135 to 145 bars)
Oil Pressure Switch	Closes at: 18 ± 3 psig (1.22 ± 0.2 bar)
Glow Plug	0.9 ohms @ 68°F (20°C)
Fuel Heater Thermostat	Closes on temperature falls at 45 ± 6.5°F (7.2 ± 1.17°C) Opens on temperature rise at 75 ± 6.5°F (24 ± 1.17°C)
S10	
Engine Model	D1105
Displacement	68.52in^3 (719 cc)
Number of Cylinders	3
Horsepower	20 hp (14.9kW) @2400rpm
Weight	214 lbs (97 kg)
Coolant Capacity	5.32 quarts (5.03 liters)
Oil Capacity	9.5 quarts (9.0 liters)
Injection Setting	1991 to 2133 psi (135 to 145 bars)
Oil Pressure Switch	Closes at: 18 ± 3 psig (1.22 ± 0.2 bar)
Glow Plug	0.9 ohms @ 68°F (20°C)
Fuel Heater Thermostat	Closes on temperature falls at 45 ± 6.5°F (7.2 ± 1.17°C) Opens on temperature rise at 75 ± 6.5°F (24 ± 1.17°C)

Table 2–6 Lube Oil Viscosity - North America T/T

Outdoor Temperature	Recommended Oils
Below 32°F or 0°C	10W30, 5W40 (synthetic)
Above 32°F or 0°C	10W30, 5W40 (synthetic), 15W40



*10W30 & 5W40 (synthetic) are recommended for ALL climates
**15W40 is NOT recommended for climates < 32°F (0°C)

Table 2–7 Lube Oil Viscosity - Europe T/T

Outdoor Temperature	Recommended Oils
All temperatures	10W40 (Rubia TIR 8600 or Mobil Delvac XHP Extra)
Very low temperatures	5W40
Oil must be certified ACEA E4 and API CF TBN must be ≥ 10 and adapted regarding the sulfur content of the diesel fuel used. Recommended oils: Mobil XHP Extra, Total Rubia tier 8600, BP Vanellus Max drain	

Table 2–8 Engine RPM

	S6	S7	S8	S9	S10
Engine	Z482	D722	D722	D722	D1105
Diesel high speed (rpm)	2320	2000	2100	2100	2100
Diesel middle speed (rpm)	1800	1800	1800	1800	1800
Diesel low speed (rpm)	1650	1650	1650	1650	1550

2.6.2 Compressor Data

Table 2–9 Compressor Data

Unit	Specification
05K02 - S6, S7, S8	
Displacement	12.2 in^3 (200 cc)
Number of Cylinders	2
Number of Unloaders	0
Weight	84 lbs (38 kg)
Oil Charge	4.0 pints (1.9 L)
Refrigerant	R-404A / R-452A
05K04 -S9, S10	
Displacement	24.4 in^3 (400 cc)
Number of Cylinders	4
Number of Unloaders	0
Weight	108 lbs (49 kg)
Oil Charge	5.5 pints (2.6 L)
Refrigerant	R-404A / R-452A

2.6.2.1 High Pressure Switch (HP1)

- Opens on a pressure rise at: 465 ± 10 psig (32.7 ± 0.7 kg/cm^2)
- Closes on a pressure fall at: 350 ± 10 psig (24.6 ± 0.7 kg/cm^2)

2.6.2.2 Compressor Discharge Temperature Sensor (CDT)

The CDT sensor is a thermistor type sensor located on the compressor discharge cover.

Unit shuts down:

- If ambient is less than 120°F (50°C) and Temperature exceeds 310°F (154°C) for three minutes.
- If ambient is greater than 120°F (50°C) and Temperature exceeds 340°F (171°C) for three minutes.
- Immediately shuts down in all ambients if temperature exceeds 350°F (177°C).

2.6.3 Refrigeration System Data

Defrost Timer	1.5, 3, 6, or 12 hours
Defrost Air Switch Setting	Initiates at 1.40 in hg
Refrigerant Charge	Refer to **Table 2–1**.
Thermal Expansion Valve Superheat	8 – 10°F (5 – 6°C) at 0°F (-18°C) box temp

2.6.4 Electrical Data

2.6.4.1 Evaporator Fan Motors

Model	Evaporator Fan Motor Part Number	Operating Current (Amps)	Voltage
S6, S7, S8, S9	54-00650	9	12
S10	54-00668	9	12

2.6.4.2 Condenser Fan Motor

Condenser fans are variable speed. The speed of the condenser fan will be determined by ambient air temperature, engine cooling temperature, and compressor head pressure.

Model	Evaporator Fan Motor Part Number	Operating Current (Amps)	Voltage
S6, S7, S8, S10*	54-00686	16.7	13
S9, S10*	54-00687	16.7	13

*S10 uses both condenser fans

2.6.4.3 Standby Motors

Thermal protection inside the motor - opens at 320°F (160°C).

Voltage (3ph, 60Hz)	Connection Type	Power (kW)	Full Load Amps
S6, S7, S8, S9			
460V	Y	5.5	12
230V	Delta	5.5	20
S10			
460V	Y	7.5	13
230V	Delta	7.5	25

2.6.4.4 Alternator

Output Amps	Communication
S6, S7, S8, S9	
110	LIN
S10	
150	LIN

2.6.4.5 Solenoids

Description	Amps	Resistance Ω	Voltage
HGS1	1.33	9	12V

2.6.5 Torque Values

Description	ft-lb (Nm)
Standby Motor Pulley	42 - 60.5 (57-62)
Compressor Pulley	28 (38)
Starter Connection	6.6 (9)
Alternator Connection	7.4 - 17.7 (10.1 - 24)
Components Inside Control Box	
Nut B+	4.1 - 5 (5.6 - 6.8)
Card Bracket	2.1 - 4.1 (2.9 - 5.6)
Nut B	2.1 - 4.1 (2.9 - 5.6)
Nut GP	2.1 - 4.1(2.9 - 5.6)
Air Cleaner Bracket	12 - 18 (16.3 - 24.4)
SMV Fixing Screws	7.4 (10)
Hose Clamp	4.4 (6)
Compressor Valves Fixing Screws	22.1 (30)
Coolant Bottle	5.9 (8)
Belt Tensioner	33.2 (45)
Evaporator Fan Fixing Screws	7 (9.5)
Condenser Fan Fixing Screws	7 (9.5)

2.7 Safety Devices

System components are protected from damage caused by unsafe operating conditions by automatically shutting down the unit when such conditions occur. This is accomplished by the safety devices listed in Table 2-10.

Table 2–10 Safety Devices - Microprocessor Controller

Unsafe Condition	Safety Device	Device Setting
Low engine lubricating oil pressure	Oil pressure safety switch (OP) automatic reset	Opens below 18 ± 3 psig (1.2 ± 0.2 Bar)
High engine coolant temperature	Water temperature sensor (microprocessor)	Opens above 230 ± 5°F (110 ± 3°C)
Excessive current draw by glow plug circuit, control circuit or starter solenoid (SS)	Fuse (F1)	Opens at 80 amps
Excessive current draw by PER Contacts	Fuse (F2)	Opens at 30 amps
Excessive current draw by an installed option (Telematics)	Fuse (F3)	Opens at 5 amps
Excessive current draw by ISOB	Fuse (F4)	Opens at 5 amps
Excessive current draw by ENCU	Fuse (F5)	Opens at 5 amps
Excessive current draw by MAC	Fuse (F6)	Opens at 5 amps
Excessive current draw by fuel heater	Fuse (F7)	Opens at 20 amps
Excessive current draw by phase reversal module	Fuse (F9)	Opens at 5 amps
Excessive current draw by evaporator fan relays	Fuse (F10)	Opens at 7.5 amps
Excessive current draw by TPC FETs.	Fuse (F11)	Opens at 20 amps
Excessive compressor discharge pressure	High pressure cutout switch (HP1) automatic reset	Refer to **Section 2.6.2**
Excessive compressor discharge temperature	Compressor discharge temperature sensor (CDT)	Refer to **Section 2.6.2**, item 2.

2.8 Refrigerant Circuit

2.8.1 Cooling (See Figure 2.7)

When cooling, the unit operates as a vapor compression refrigeration system. The main components of the system are the compressor, hot gas 3-way valve, condenser, thermostatic expansion valve and evaporator.

- The compressor raises the pressure and temperature of the vapor, then forces it through the hot gas 3-way valve (HGS1), then into the condenser tubes. The condenser fan circulates surrounding air over the outside of the condenser tubes. The tubes have fins designed to improve the transfer of heat from the vapor to the air. This removal of heat causes the refrigerant to change to a liquid state; thus liquid refrigerant leaves the condenser and through a check valve to the receiver.
- The receiver stores the additional charge necessary for low ambient operation and for the heating and defrost modes. The receiver is equipped with a relief valve which opens if the refrigerant pressure is abnormally high and releases the refrigerant charge.
- The liquid leaves the receiver and flows through the receiver service valve to the subcooler. The subcooler occupies a portion of the main condensing coil surface and gives off further heat to the passing air.
- The liquid then flows through a filter drier where an absorbent keeps the refrigerant clean and dry.
- The liquid then flows through the liquid side of the heat exchanger, where it is further reduced in temperature by giving off some of its heat to the suction gas.
- The liquid then passes through the check valve and on to an externally equalized Thermostatic Expansion Valve (TXV).
- The refrigerant pressure drop caused by the expansion valve is accompanied by a drop in temperature so the low pressure, low temperature liquid that flows into the evaporator tubes is colder than the air that is circulated over the tubes by the evaporator fans. The evaporator tubes have aluminum fins to increase heat transfer; therefore heat is removed from the air circulated over the evaporator. This cold air is circulated throughout the refrigerated compartment to maintain the cargo at the desired temperature. The transfer of heat from the air to the low temperature liquid causes the refrigerant to vaporize.
- This low temperature, low pressure vapor passes through the suction side of the heat exchanger where it absorbs more heat from the high pressure/high temperature liquid and then returns to the accumulator.
- The vapor is drawn out of the accumulator through a pickup tube which is equipped with a metering orifice. This orifice prevents the accumulation of oil in the accumulator tank. The metering orifice is calibrated to control the rate of oil flowing back to the compressor.
- The vapor then enters the Compressor Suction Modulation Valve (CSMV) which regulates refrigerant pressure entering the compressor, where the cycle starts over.

2.8.2 Heat and Defrost (See Figure 2.8)

- When refrigerant vapor is compressed to a high pressure and temperature in a reciprocating compressor, the mechanical energy necessary to operate the compressor is transferred to the vapor 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 cycle.
- When the controller calls for heating or defrost, the 3-way valve (HGS1) solenoid energizes, closing the port to the condenser and opening a port valve, which allows heated vapor to flow through the drain pan heater tube to the evaporator coil.
- The main difference between heating and defrosting is that, when in heating the evaporator fans continue to run, blowing the air over the heated coils to heat the product. When defrosting, the evaporator fans stop, allowing the heated vapor to defrost any ice build-up there may be.

Figure 2.7 Refrigeration Circuit - Cooling

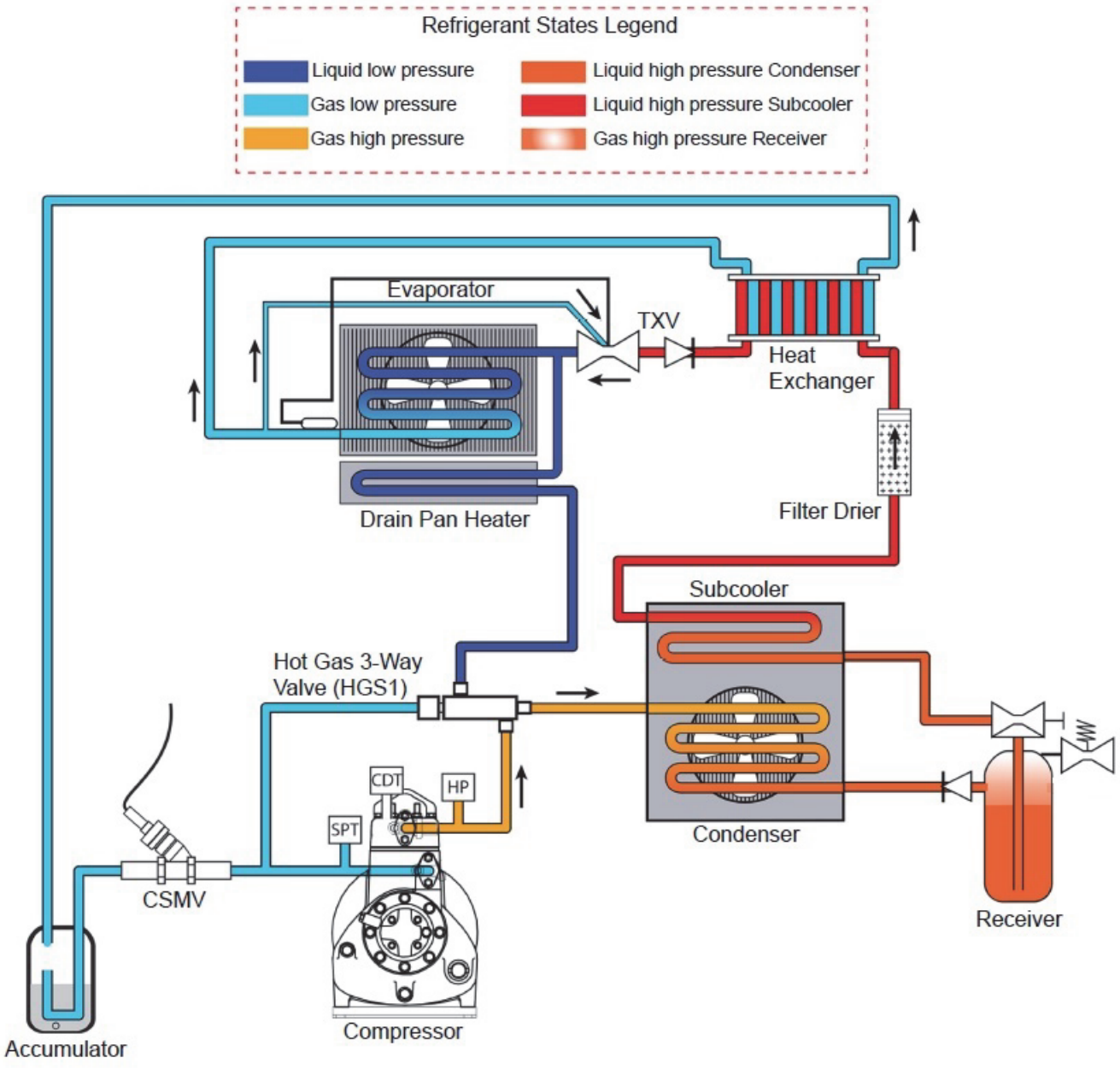
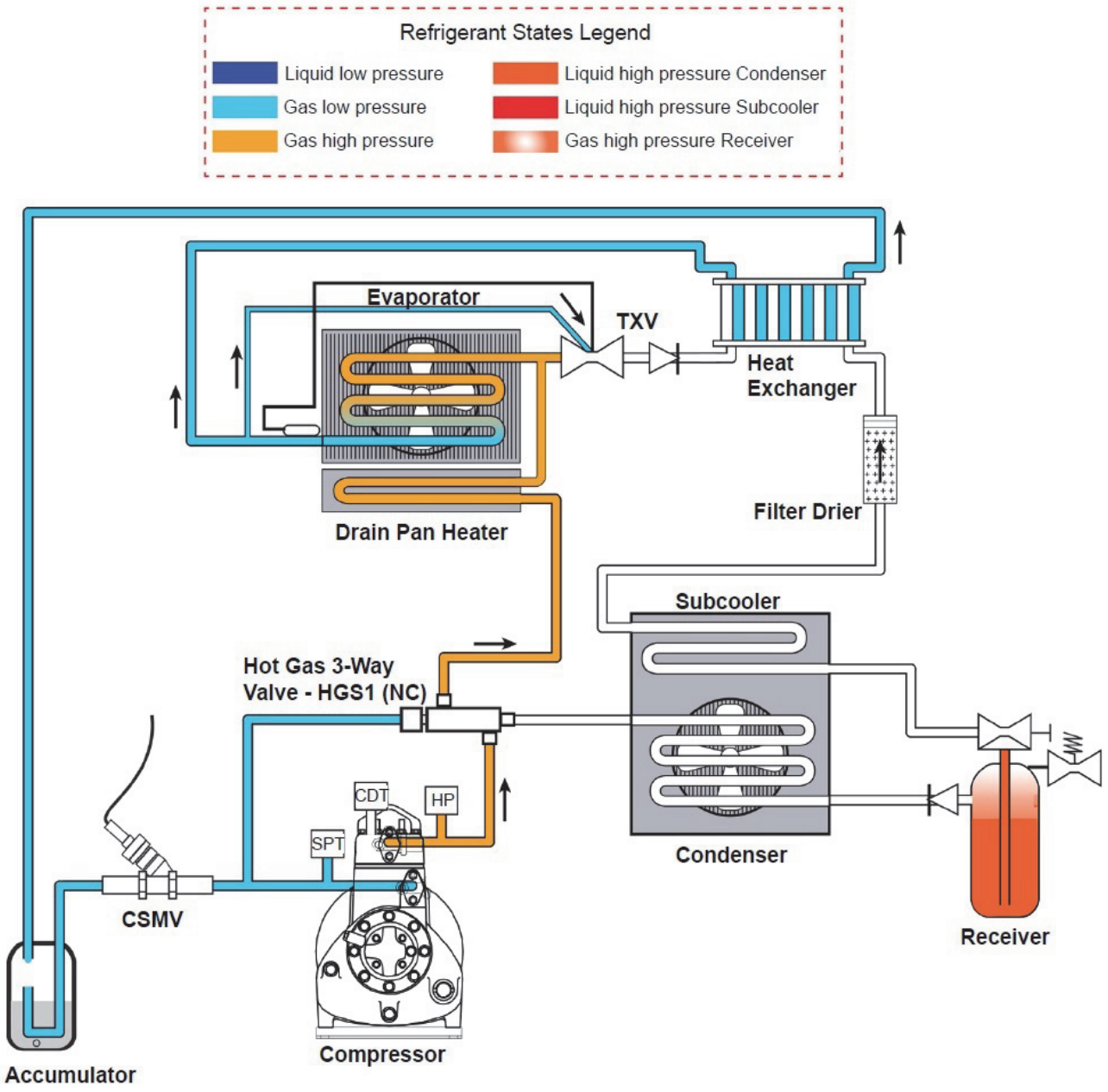


Figure 2.8 Refrigeration Circuit - Heat and Defrost



SECTION 3
Operation

3.1 APX™ Control System

3.1.1 Introduction

⚠ CAUTION

Under no circumstances should anyone attempt to repair any of the Logic or Display boards. Should a problem develop with these components, contact your nearest Carrier Transicold dealer for replacement.

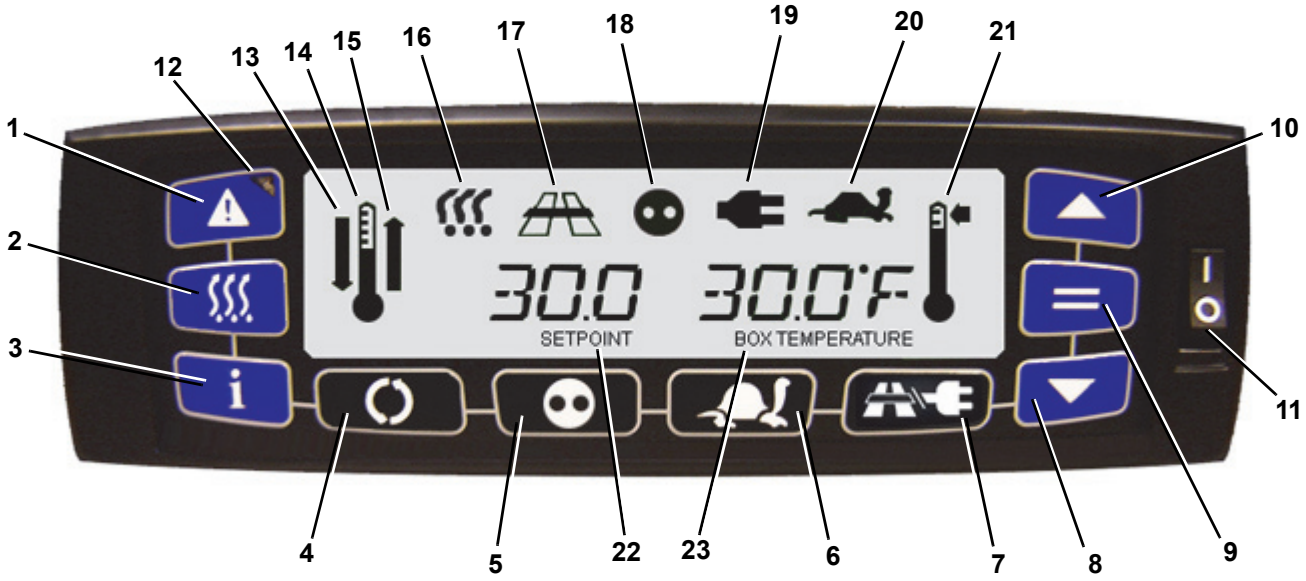
The APX Control System consists of the Main Control Analogic (MCA) module, a Truck Power Control (TPC) module, a Stepper Input Output board (SIOB), the CAB Controller (**Figure 3.1**) and interconnecting wiring.

- The Main Control Analogic (MCA) module includes the temperature control software and necessary input/output circuitry to interface with the unit controls.
- The Truck Power Control (TPC) module contains replaceable relays and fuses.
- The Stepper Input Output Board (SIOB) includes inputs and output to control the stepper valves in the refrigeration system.
- The Cab Controller is remote mounted in the truck. The Cab Controller 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.

The Carrier Transicold APX Control System incorporates the following features:

- Control supply or return air temperature to tight limits by providing refrigeration control, heat and defrost to ensure conditioned air delivery to the load
- Default independent readouts of set point (at the left of the display) and actual supply or return air temperature (at the right)
- Digital readout of unit data points such as pressures, temperatures and other microprocessor inputs
- Digital readout of selectable operating parameters (Function Codes) and the ability to change those settings
- Digital display of Alarm Indications
- A self-test check on program memory and data memory at start-up
- A Pre-Trip checkout of refrigeration unit operation
- An optional RS232 communication port to communicate unit operating data to a mobile satellite transmitter. This information will then be relayed back to the office via a modem to a computer.
- There are several protocols supported. Contact Carrier Transicold for a listing of approved third party communication companies.452A

Figure 3.1 Cab Command



1. Alarm Key
2. Defrost Key
3. Unit Data Key
4. Function Key
5. Auto Start/Stop - Continuous Key
6. City Speed Key
7. Road/Electric Key
8. Down Arrow Key
9. = (Enter) Key
10. Up Arrow Key
11. I/O Switch
12. Fault Light
13. Cool Mode
14. Temperature control active
15. Heat Mode
16. Defrost Mode Icon
17. Road Mode Icon
18. Auto Start/Stop Mode Icon
19. Electric Mode Icon
20. City Speed Mode (Turtle) Icon
21. Temperature out of range
22. Setpoint temperature
23. Box temperature

3.2 Microprocessor Configuration

The microprocessor is configured in accordance with the equipment supplied on an individual unit and the requirements of the original purchase order. The configurations do not require change unless the unit has an equipment change or a change is required by the owner. Although the configurations may not be modified using the keypad, operational differences will be noted throughout the following descriptions and operating procedures.

Some microprocessor settings such as setpoint and functional parameters may be changed at the keypad and are described in the following sections.

3.3 Description of Microprocessor Components

3.3.1 Keypad

The keypad (**Figure 3.1**) has 12 keys which allow the operator to initiate various functions, display operating data, and change operating parameters.

Arrow Keys and = (Enter) Key

The Up and Down Arrow keys are pressed to modify (in increments or decrements) the displayed data. If the unit is in the default display, these keys are pressed to change the setpoint selection. If the Arrow keys remain pressed, the displayed setpoint will change at an accelerated rate.

The = (Enter) key is used to accept a change to a setpoint or a change to a function code. If the = (Enter) key is not pressed after five seconds, the message “NO SP CHG” is displayed for 10 seconds and all LEDs and icons flash.

Refer to **Section 3.4.6** for procedure to change a setpoint.

Defrost Key

The Defrost key is pressed to initiate a defrost cycle. Defrost is an independent cycle overriding cooling and heating functions to de-ice the evaporator as required.

Refer to **Section 3.4.9** for procedure to initiate a Defrost Cycle.

Auto Start/Stop - Continuous Key

The Auto Start/Stop - Continuous key is pressed to change the operating mode from Auto Start/Stop to Continuous Run. Each push of the key will alternate the operating modes. The microprocessor retains the last entered setpoint in memory even if the unit is shut down or a power failure occurs.

Refer to **Section 3.4.7** for procedure to enable Auto Start/Stop mode.

Refer to **Section 3.4.8** for procedure to enable Continuous Run mode.

Function Key

The Function key is pressed to display the function codes. When used in conjunction with the Arrow and = (Enter) keys, the Function key enables the user to change the function parameters. See **Section 3.4.11** for more detailed information.

Unit Data Key

The Unit Data key displays the unit operating data. This key, in conjunction with the Arrow keys, will allow the user to display the unit's operating data values (i.e, coolant temperature, battery voltage, etc.)

Refer to **Section 3.4.12** for more information for Unit Data.

City Speed Key

The City Speed key enables the City Speed mode of operation. In the City Speed mode, the unit will operate in medium speed (1800 rpm). Each push of the key toggles the operating mode between City Speed mode and Not City Speed mode. The microprocessor retains the last entered setpoint in memory even if the unit is shut down or a power failure occurs.

Refer to **Section 3.4.10** for procedure to enable City Speed mode.

Alarm Key

Press and hold the Alarm key to show the alarms codes from latest alarm to first alarm. Both the alarm key and the Arrow keys can be used to go through the alarm code list. Pressing this key stops for 7 to 10 seconds the alarm buzzer on the Cab Command.

Refer to **Section 3.4.13** for more information on Alarms.

Road/Electric Key

The Road/Electric key selects the electric motor operating mode. Each push of the key toggles the unit from Road operation to Electric operation. The microprocessor retains the last entered operation mode in memory even if the unit is shut down or a power failure occurs.

Refer to **Section 3.4.3** for procedure to enable Road Operation.

Refer to **Section 3.4.4** for procedure to enable Electric Operation.

3.3.2 Digital Display

The digital display (see **Figure 3.1**) has nine positions. The default display is setpoint on the left and actual supply or return air temperature on the right. The readout may be set to read in Degrees F or Degrees C.

The display also has symbol-type indicators for the following modes: Cool, Heat, Defrost, Road (Diesel) Operation, Auto Start/Stop mode, Electric mode, City Speed mode and Out-Of-Range operation. The indicator is illuminated to indicate the mode or condition is active.

On each power-up, the microprocessor will perform a self test. Any problems will be displayed by the associated alarm.

3.4 Operation

3.4.1 Lock and Unlock the Cab Controller

From the default screen, prior to engine starting, press and hold the Unit Data key for five to seven seconds.

- “DSP LOCK” will be displayed when locking the display
- “DSP UNLCK” will be displayed when unlocking the display.
- If any key is pressed while the display is locked, “DSP LOCK” displays for 10 seconds and then the display returns to its default.

3.4.2 Pre-Trip Inspection

1. **Pre-Trip Inspection - Before starting engine check the following points:**

   a. Drain water and sediment from fuel tank sump. Then fill tank with diesel fuel.

   b. Drain water from fuel filter separator (if applicable).

   c. Check radiator coolant level. Antifreeze should be adjusted for climate conditions, minimum 50/50 mixture, maximum 60/40 mixture.

   d. Check condenser/radiator coil for cleanliness. Refer to **Section 6.10.2**.

   e. Check air cleaner and hoses. Refer to **Section 6.5.6**.

   f. Check Defrost Air Switch and hoses. Refer to **Section 6.10.5**.

   g. Check engine oil level.

   h. Check condition and tension of all belts. Refer to **Section 6.6**.

   i. Check all idler bearings.

   j. Check door latches and hinges.

   k. Check condition of condenser fan blades.

   l. Check battery fluid level (if applicable).

   m. Check battery cables and terminals.

   n. Check evaporator coil for cleanliness. Refer to **Section 6.10.1**.

   o. Check evaporator fan. Refer to **Section 2.6.4**..

   p. Check air chute (if applicable).

   q. Check bulkhead and return air screens (if applicable).

   r. Check defrost water drains.

   s. Check glow plugs.

2. **Pre-Trip Inspection - Starting**

   a. Start the unit in continuous run. Refer to **Section 3.4.3**.

3. **Pre-Trip Inspection - After starting engine check the following points:**

   a. Check electric fuel pump. Refer to **Section 6.5.7**.

   b. Check fuel lines and filters for leaks. Refer to **Section 6.5.7**.

   c. Check oil lines and filters for leaks.

   d. Check coolant hoses for leaks. Refer to **Section 6.5.1**.

   e. Check exhaust system for leaks.

   f. Check condenser and evaporator fans for proper air flow. Refer to **Section 2.6.4**.

   g. Initiate Pre-Trip and monitor all operating modes. Refer to **Section 3.4.5**.

4. **After operating unit 15 minutes or more:**

   a. Check water temperature. Should be 160° to 175°F (72° to 80°C).

   b. Check refrigerant level. Refer to **Section 6.7.5**.

   c. Check compressor oil level. Refer to **Section 6.9**.

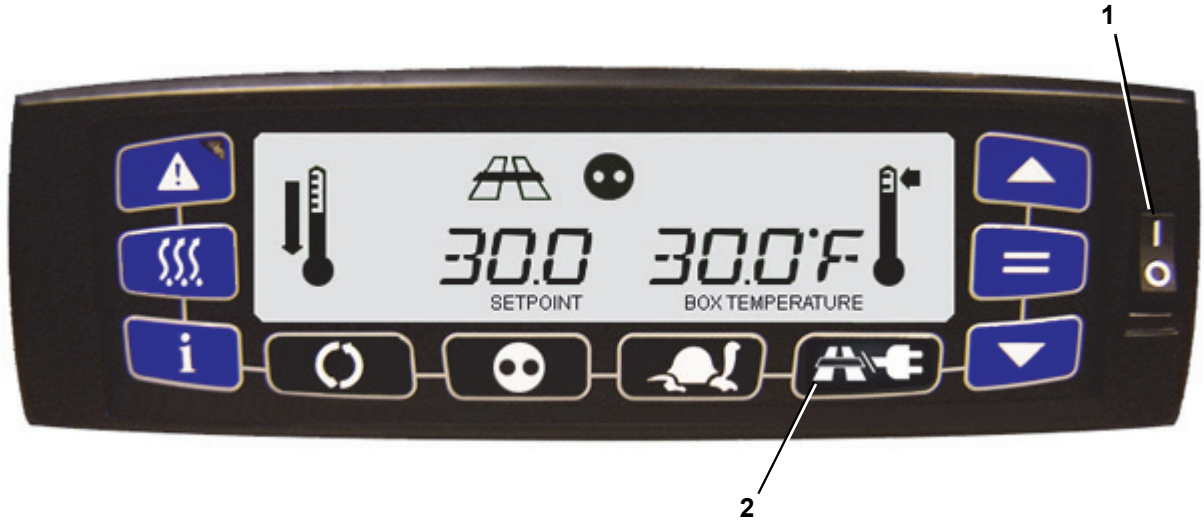
   d. Put unit into manual defrost and monitor. Allow unit to terminate defrost automatically. Refer to **Section 4.8**.

   e. Change over to desired operating mode, enter set point and change functional parameters as required to match the requirements of the load. Refer to **Section 3.4.3** and **Section 3.4.4**.

3.4.3 Starting the Unit - Road Operation

⚠ WARNING

Under no circumstances should ether or any other starting aids be used to start engine.



1. Place the I/O Switch in the I position. Wait for the default display.
2. If the unit has been used previously in the Electric mode, press the Road/Electric key to enable Road mode.

Under normal circumstances this is all that is required to start the unit. The Road mode Icon will be displayed and the message “ROAD” appears for five seconds or more. The display will then revert back to the default.

The unit will perform a complete diagnostic check on the microprocessor controller, pre-heat for the required amount of time based on the engine temperature, and then start automatically.

3.4.4 Starting the Unit - Electric Operation

⚠ WARNING

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

⚠ WARNING

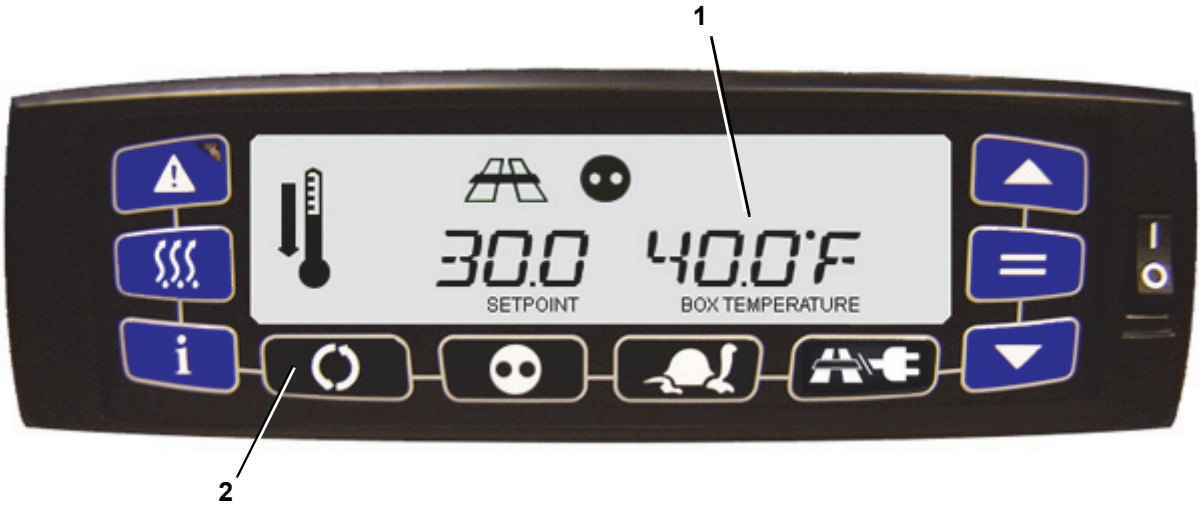
Do not attempt to connect or remove power plug or perform service and/or maintenance before the I/O Switch is in the O position.

1. Place the I/O Switch in the O position.
2. Connect the Unit to the appropriate power source.
3. Place the I/O Switch in the I position. Wait for the default display.
4. Press the Road/Electric key to enable Electric mode.

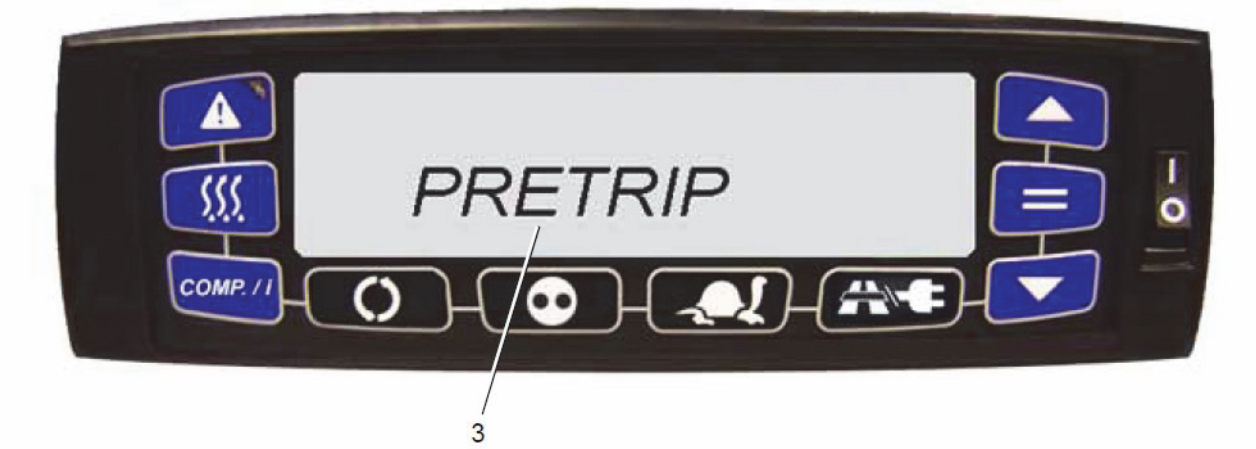
The Electric mode icon is displayed and the message “ELEC” appears for five seconds or more. The display will then revert back to the default. If Electric mode is initiated but no power is available, Alarm 00073 is displayed. The microprocessor will perform a self-test.

3.4.5 Pre-Trip

Pre-Trip is a test sequence that the operator may initiate to check unit operation. When Pre-Trip is enabled, the unit will enter a test sequence to operate the unit in various operating modes. If a failure occurs during Pre-Trip, the microprocessor will generate an alarm.



1. Press the Function key.
2. Use the Arrow keys until PRETRIP is displayed, then press the = (Enter) key.



3. Use the Arrow keys until the value Y (Yes) is on the display. Then, press the = (Enter) key to enable Pre-Trip.

NOTE

If the conditions for Pre-Trip are not met, the unit does not enter Pre-Trip and the display returns to its default condition.

Table 3–1 Pre-Trip Test Sequences (Total duration around 8 minutes)

Test #	Test Description	Alarm if fails	Abort Pre-Trip if fails
1	Lights up all LEDs, annunciators, and the LCD. No alarms will be generated if this test fails, therefore this test must be observed. Pre-trip will not abort if this test fails. .	No	No
2	Checks the current draw of the DC electrical components. If any part of this test fails, an alarm will be generated. The pre-trip will not be aborted and the unit will continue with the rest of the pre-trip.	Yes	No
3	Checks that all temperature sensor readings are obtainable and are within a valid range. If any of the sensors fail this test, alarms will be generated. The pre-trip will not be aborted and the unit will continue on to the next test.	Yes	No
4	Runs the system until normal operating temperatures and pressures are achieved. During this time the suction and discharge pressures are checked as well as the clutch operation. This test is also used to build up pressure for the tests that follow. If any portion of this test fails, the alarm will be generated and the pre-trip will be aborted.	No	Yes (triggers low discharge alarm)
5	Checks engine low speed RPM. If the engine RPM is not within range, the test will fail. An alarm will be generated, but the pre-trip will not be aborted. The low speed RPM range for this test is as follows: The range for all units is 1480 – 1820 rpm.	Yes	No
6	Checks engine high speed RPM. An alarm will be generated if this test fails but, it will not abort the pre-trip. The Supra Series units have three engine speeds - Low, Medium, and High. Current unit conditions determine what speed the engine will be run. For this reason the high speed RPM range for this test is wider than the low speed range and is unit specific. RPM ranges for each unit: • Supra S6 - RPM range is 2120 – 2520 • Supra S7, S8, S9, S10 - RPM range is 1900 – 2300	Yes	No
7	This test checks the engine at medium speed. The RPM range is for all units is 1750 - 1850 rpm. An alarm will be generated if this test fails, but it will not abort the pre-trip.	Yes	No

Table 3–1 Pre-Trip Test Sequences (Total duration around 8 minutes)

Test #	Test Description	Alarm if fails	Abort Pre-Trip if fails
8	Checks the Hot Gas Valve (HGV). The unit will be switched between cool and heat. The supply air temperature sensor (SAT) should vary more than 5.4ºF (3º C). An alarm will be generated if this test fails, but it will not abort the pre-trip.	Yes	No
9	This test is not used and will be skipped.	N/A	N/A
10	Checks the condenser fan. The condenser fan on the Supra Series is a variable speed fan. This test checks to see if the compressor discharge pressure (CDP) increases when the condenser fan speed decreases. If this test fails, alarms will be generated and pre-trip will be aborted.	Yes	No
11	Checks the operation of the Suction Modulation Valve (SMV). The valve will be closed to 0% open. The Compressor Suction Pressure (CSP) value change should be greater than 5 psig within 60 seconds. An alarm will be generated if this test fails but, it will not abort the pre-trip.	Yes	Yes
12	Checks for any other alarms that may be present. The pre-trip will not be aborted and any alarms present would be shown in the pre-trip results.	Yes	No

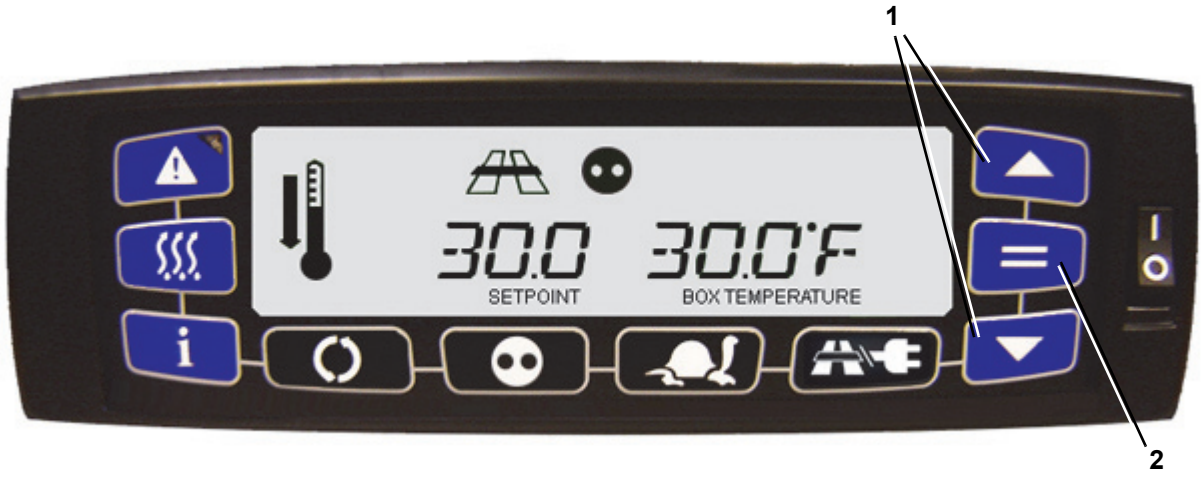
Refer to **Table 3–2** for an explanation for pre-trip result codes.

Table 3–2 Pre-Trip Results

Result	Information
PASS	The unit passed the pre-trip inspection with no faults detected
FAIL C	Pre-trip has been completed but failed. This indicates there were alarms generated that caused th pre-trip to be aborted.
FAIL NC	Pre-trip failed and did not complete the testing. This indicates that there were alarms generated that caused the pre-trip to be aborted.
CANT STRT	All of the conditions required for a pre-trip have not been met and the pre-trip cannot be started.
ABORTED	Pre-trip has been aborted by user key stroke. This indicates that for some reason the user intentionally stopped the pre-trip during the testing process.
NO PDATA	No pre-trip data available.

3.4.6 Changing Setpoint

Setpoints of -22° to +95°F (-30° to +35°C) may be entered via the keypad.



1. With the default screen showing on the display, press the Up or Down Arrow keys to bring the setpoint to the desired reading. The display will flash to indicate that the reading being displayed is a non-entered value.
2. Press the = (Enter) key to activate the new setting. If the = (Enter) key is not pressed after five seconds, the message “NO SP CHG” is displayed for 10 seconds and all LEDs and icons flash. The display will revert to the previous active setting.

NOTE

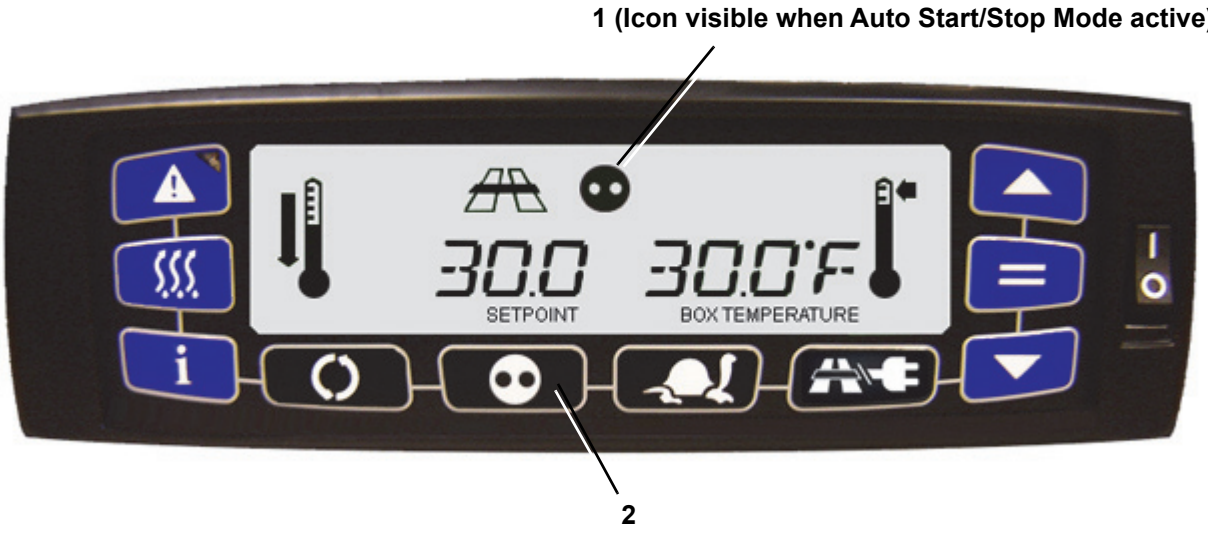
The microprocessor retains the last entered setpoint in memory even if the unit is shut down or a power failure occurs.

NOTE

You cannot change a setpoint when in Pre-Trip or when viewing Unit Data or Functional Parameters.

3.4.7 Start/Stop Operation

Auto-Start/Stop is provided to permit stopping/restarting of the diesel driven compressor as required. This gives the microprocessor automatic control of starting and stopping the diesel engine. The main function of Auto-Start/Stop is to shut off the engine at or near setpoint and then restart the engine when needed. Start-Stop operation is normally used for frozen loads.



1. After start up, verify that the Auto Start/Stop mode Icon is displayed. If it is, then the unit is already in the Auto Start/Stop mode.
2. If it is not displayed, press the Auto Start/Stop - Continuous key to toggle the unit into Auto Start/Stop mode. The message “S/S ON” is displayed for a few seconds.

Whenever the unit starts in Auto Start-Stop, it will run until:

- It has run for the predetermined minimum run time.
- The engine coolant temperature is above 122°F (50°C).
- The box temperature is at or near setpoint.

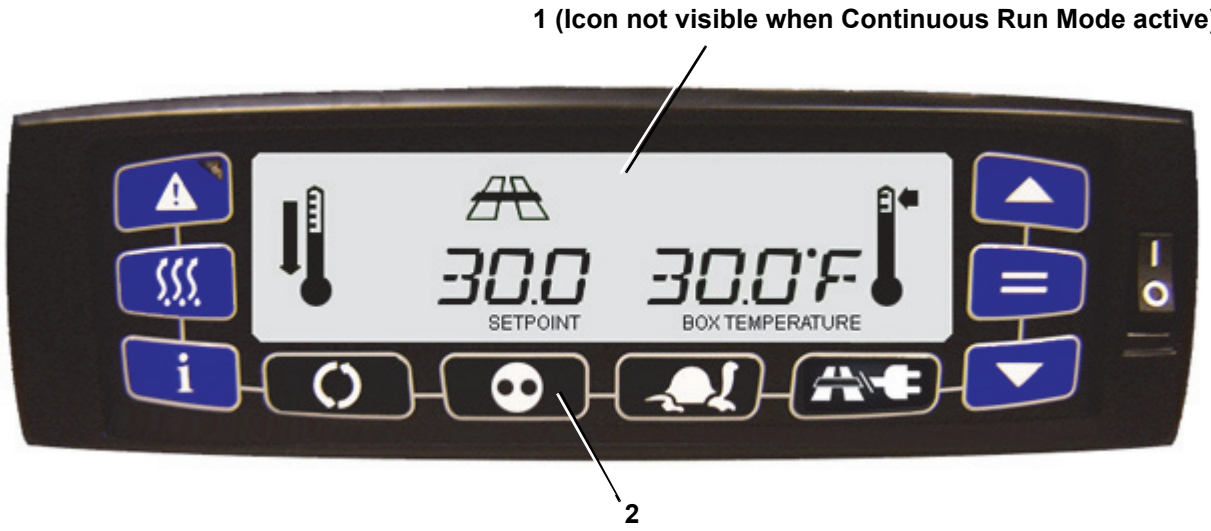
The controller will not shut off the engine if the battery voltage is insufficient to restart it. Battery voltage above approximately 13.4 volts is required for shutdown. This varies depending on ambient temperature. Look at battery voltage in the data list to find out whether shutdown voltage has been reached. If there is a + in front of the number, the voltage is enough to shutdown and restart. If only the number appears, the voltage is still too low for shutdown.

The controller will restart the engine if any of the following criteria have been met:

- Box temperature has changed by the selected override temperature **DURING** minimum off time.
- Box temperature has moved away from setpoint by selected restart temperature **AFTER** minimum off time.
- The battery voltage drops below selected voltage for restart.
- The engine coolant temperature drops below selected range.

3.4.8 Continuous Run Operation

In the Continuous Run mode, the diesel engine will run continuously providing constant air flow and temperature control to the product. Continuous Run operation is normally used for perishable loads.



1. After start up, verify that the Auto Start/Stop mode Icon is not displayed. If it is not, then the unit is already in Continuous Run mode.
2. If it is displayed, press the Auto Start/Stop - Continuous key to toggle the unit into Continuous Run mode (unit will operate continuously after starting). The message “CONT ON” is displayed for a few seconds.

NOTE

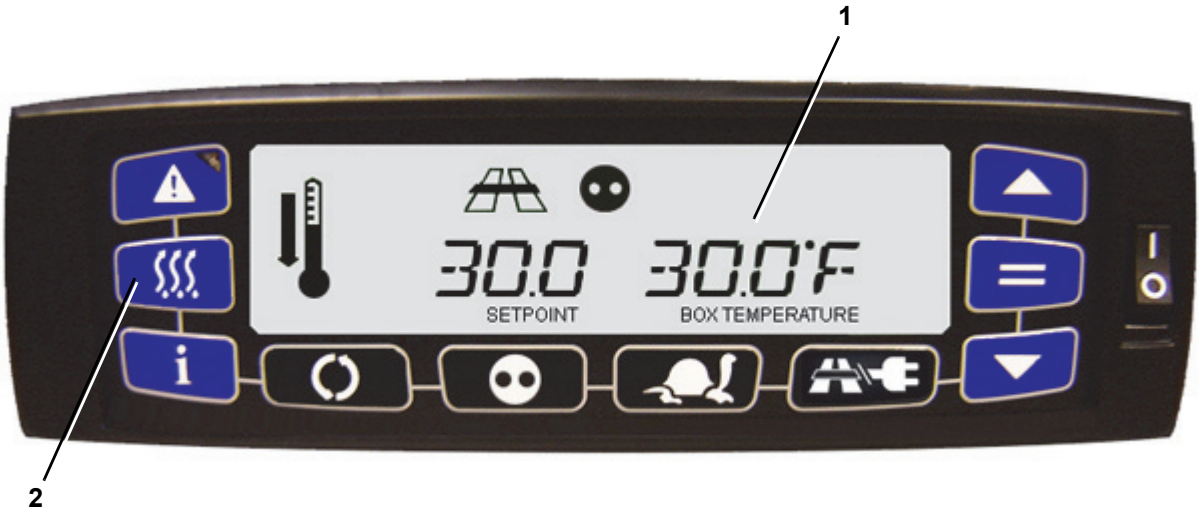
Continuous Operation may be tied to the setpoint ranges for frozen and perishable loads and the Auto Start/Stop - Continuous key may be locked out.

NOTE

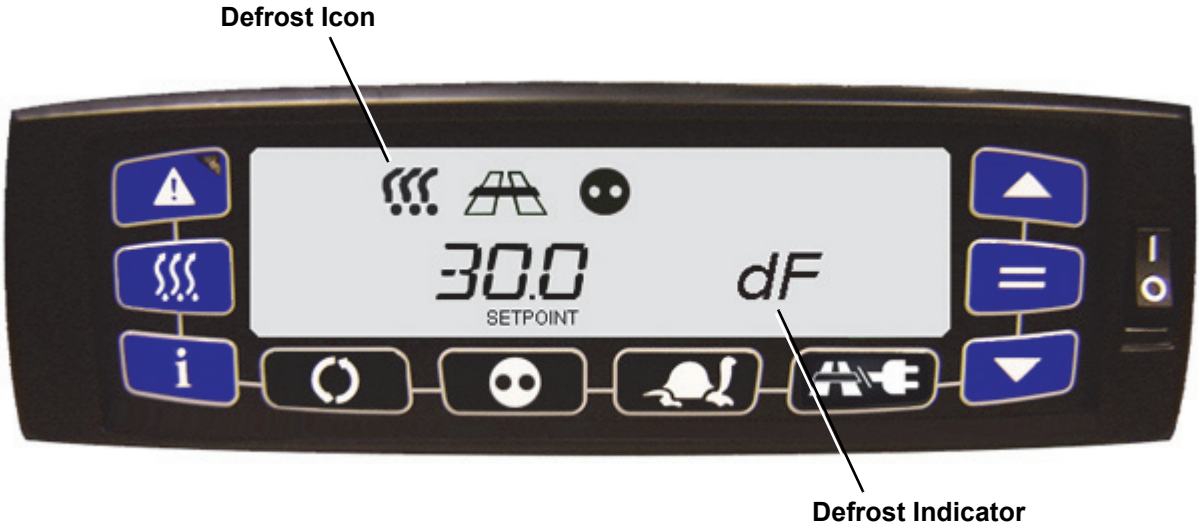
The unit will remain in low speed for 10 minutes after engine start-up when the Continuous Run setpoint is below 10°F (-12°C).

3.4.9 Defrost Cycle

Defrost is an independent cycle overriding cooling and heating functions to de-ice the evaporator as required. Refer to **Section 4.8** for a more detailed description of the defrost cycle.



1. Check that the box temperature on the display is 44°F (6.8°C) or lower.
2. Press the Defrost key to initiate Manual Defrost. The Defrost Icon is displayed, along with a spinning clock icon in the setpoint area while waiting for a response from the main microprocessor.



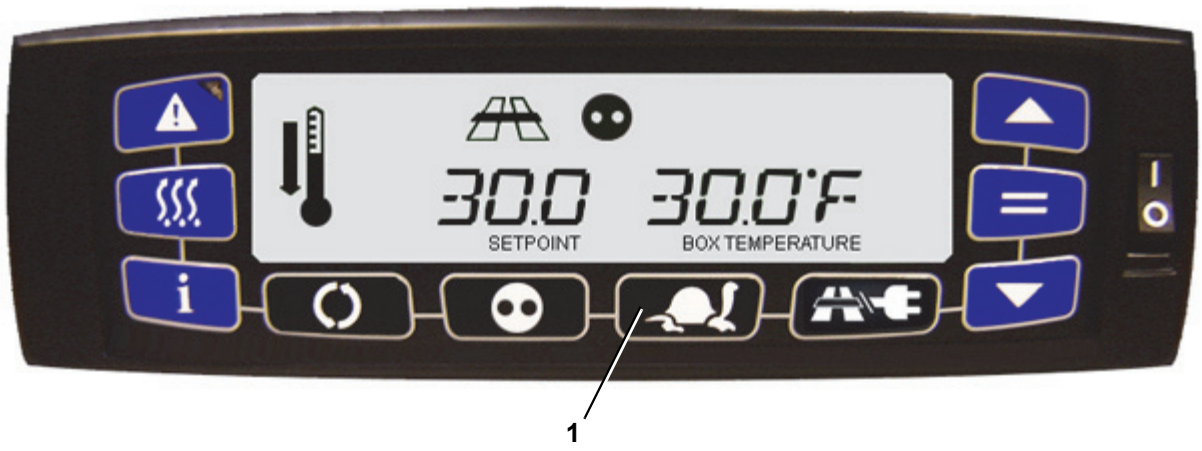
If defrost is initiated successfully, the Defrost icon remains and “dF” is displayed in the Box Temperature area for 10 seconds without box temp and other icons. The Defrost icon and “dF” display remains for the duration of the defrost.

If defrost does not initiate, the Defrost icon turns off and “no dF” is displayed in the Box Temperature area for 10 seconds without box temp and other icons. Then, the default display returns along with a display of box temperature.

In addition to enabling Defrost manually, Defrost may be started by timer initiation or air switch initiation. The Defrost mode terminates when the DTT is > 35.6°F (2.0°C) or when the DTT has risen 9°F (5°C) above initiation temperature and supply air is > 95°F (35°C). The unit runs in cool mode without the evaporator fans for 70 seconds and the fans start after this period.

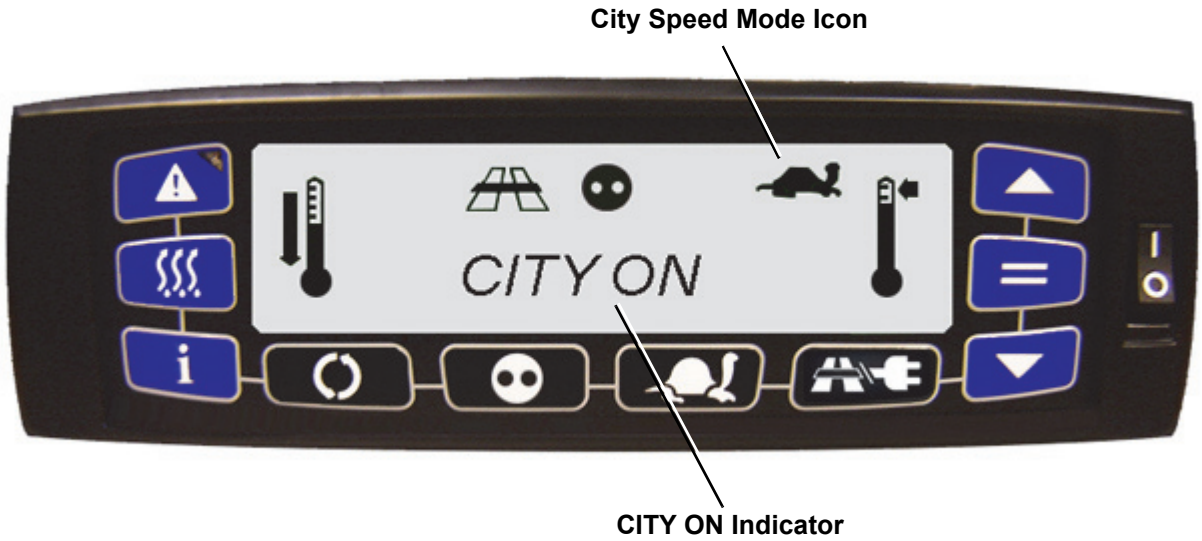
3.4.10 City Speed

The City Speed key enables the City Speed mode of operation, in which the unit will only operate in medium speed.



1. Press the City Speed key to toggle between low speed only and normal operating mode.

- The City Speed mode (Turtle) Icon is displayed and the message “CITY ON” is displayed (or if City Speed disabled, the icon turns off and “CITY OFF” is displayed) in the setpoint area without setpoint or box temperature displayed for 10 seconds.
- If the City Speed Functional Parameter is locked OR all functional parameters are locked, “FN LOCKED” is displayed for 10 seconds and display the appropriate value that is locked in. Then, the display will return to its default state.



- When City Speed is enabled, the City Speed mode (Turtle) Icon is displayed and the message “CITY” is displayed in setpoint while “ON” is displayed in box temperature.
- When City Speed is disabled, the City Speed mode (Turtle) Icon turns off and the message “CITY” is displayed in setpoint while “OFF” is displayed in box temperature.

3.4.11 Function Change

The Function Parameters control selected operating features of the unit. When multiple choices are available, the display will show the function description on the left side with the corresponding function choice on the right side. A function parameter listing is provided in **Table 3–3**.

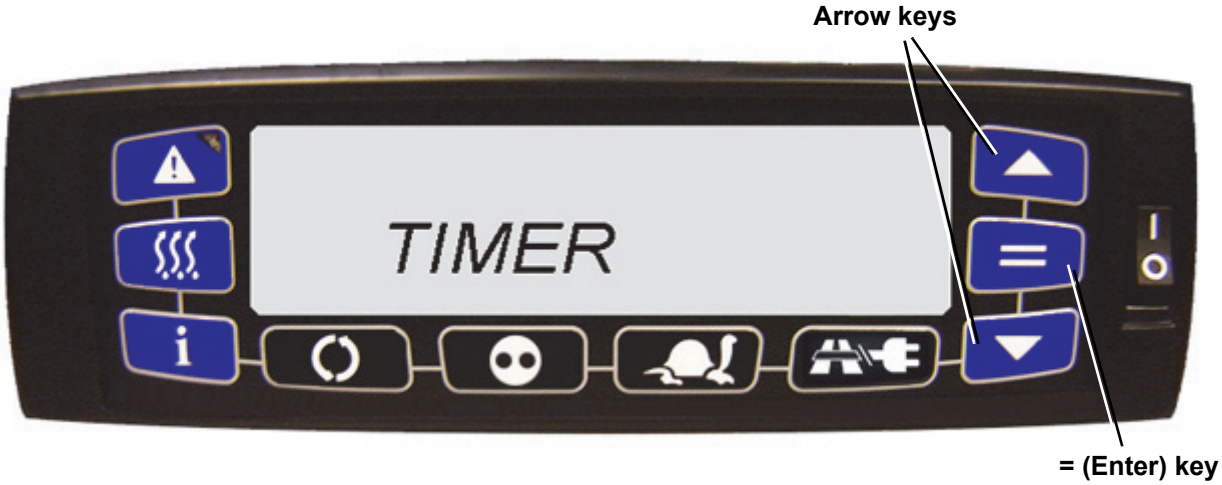
NOTE

Function changes will change the operation of the unit.

NOTE

If functional parameters are locked, the ability to change any functional parameters is disabled.

1. Place the I/O Switch in the I position. Wait for the default display.
2. Press the Function key to enter the Functional Parameters submenus. If no key is pressed for 10 seconds, the display exits the sub menus and returns to the default display. The submenus are PRETRIP, TIMER, TEMP, SETTING, S/S PARAM, MODE, OTHER. Press the Function key to back out of any submenu.



3. Use the Up or Down Arrow keys to scroll through the submenus, and then press the = (Enter) key to open a submenu.
4. Use the Up or Down Arrow keys to scroll through the functions in a submenu, and then press the = (Enter) key to allow editing of the value.
5. Use the Up or Down Arrow keys to toggle through the values, then press the = (Enter) key to confirm the change.

Table 3–3 Functional Parameters

Parameter	Description	Range
PRETRIP		
PRETRIP	Enable or disable Pre-Trip	0 - NO 1 - YES **Default:** NO
TIMER		
SLEEP	Enable or disable Sleep mode.	0 - OFF 1 - ON **Default:** OFF
TEMP		
RSTR	Restart temperature for perishable setpoints in S/S.	0.5° to 18°F in 0.5° increments 0.3° to 10°C in 0.1° increments **Default:** is 7°F (4°C)
PROBE RAT or SAT	This indicates the primary sensor that is used for performing temperature control in the system.	0 - RAT 1 - SAT **Default:** RAT
SETTING		
TEMP	Determines temperature units on display.	0 - Fahrenheit °F 1 - Celsius °C **Default (NAO Region):** Fahrenheit This parameter also defaults to “locked” for NAO Region. **Default (EMEAR Region):** Celsius
PRESS	Determines pressure units on display.	0 - PSI 1 - BAR **Default (NAO Region):** PSI This parameter also defaults to “locked” for NAO Region. **Default (EMEAR Region):** BAR
DATE	Determines date format on display.	0 - MM/DD/YY 1 - DD/MM/YY **Default:** MM/DD/YY
BRIGHT	Determines brightness on display.	Setting is 0 to 100. **Default:** 55
START-STOP PARAMETER		
MINRT	Minimum run time for perishable setpoints in start/stop mode.	4 to 60 minutes, with 1 minute intervals **Default:** 4 minutes
MINOF	Minimum off time for perishable setpoints in start/stop mode.	10 to 90 minutes, with 1 minute intervals **Default:** 10 minutes **Special Note EMEAR Region:** This parameter’s default is based on the operating mode.

Table 3–3 Functional Parameters (Continued)

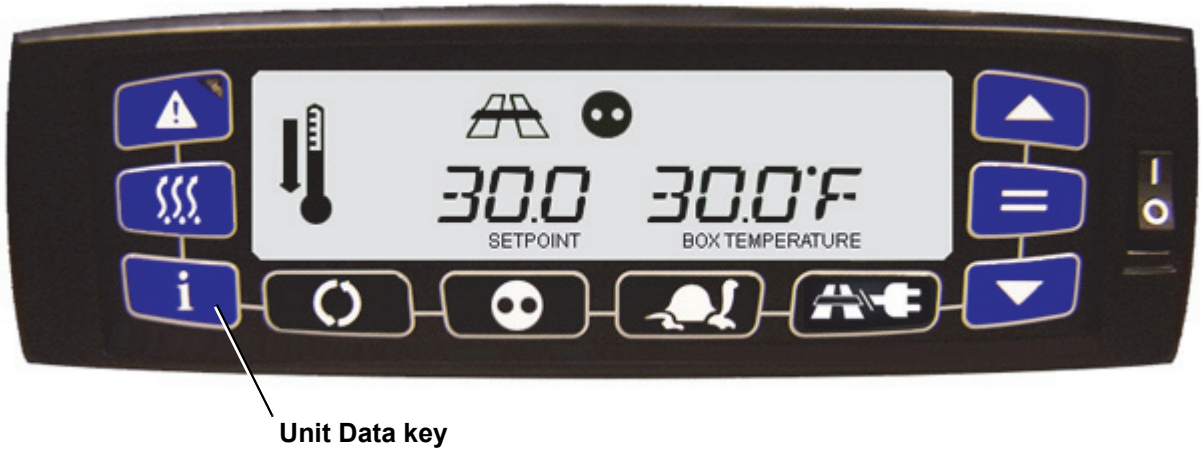
OVER	Defines how far away the active temperature must be away from the setpoint before the minimum off time can be overridden in start/stop mode for perishable setpoints.	4° to 18°F in 0.5° increments 2° to 10°C in 0.1° increments. **Default:** 7°F (4°C) **Special Note EMEAR Region:** This parameter default is based on the operating mode.
MAXOF	Maximum off time for perishable setpoints during start/stop mode.	0 - OFF 1 - 10 to 255 minutes, with 1 minute intervals **Default:** OFF
MODE		
LSCON	Determines the low speed delay adjustment for Continuous.	0 - OFF 1 - 0 to 255 minutes, with 1 minute intervals **Default:** 1 minute
LSSS	Determines the low speed delay adjustment for S/S.	0 - OFF 1 - 0 to 255 minutes, with 1 minute intervals **Default:** 10 minutes
CITY	Disable high speed in the speed control overrides.	0 - NO (OFF) 1 - YES (ON) **Default:** NO Only applies to EMEAR Region
OTHER		
DEFR	The time interval between defrost cycles in hours.	0 - 1.5 hours 1 - 3 hours 2 - 6 hours 3 - 12 hours **Default:** 6 hours
TRANG1	This is the out-of-range temperature tolerance selection.	0 - NO (OFF) 4°F (2°C) 5°F (3°C) 7°F (4°C) **Default:** 7°F (4°C)
OVERRIDES		
ORDOOR	Overrides the door switch alarm	0 - No (N) 1 - Yes (Y) 2 - Yes Reset (YR) automatically reset on a power cycle **Default:** No
ORFUEL	Overrides the fuel shutdown alarm	0 - No (N) 1 - Yes (Y) 2 - Yes Reset (YR) automatically reset on a power cycle **Default:** No

3.4.12 Unit Data

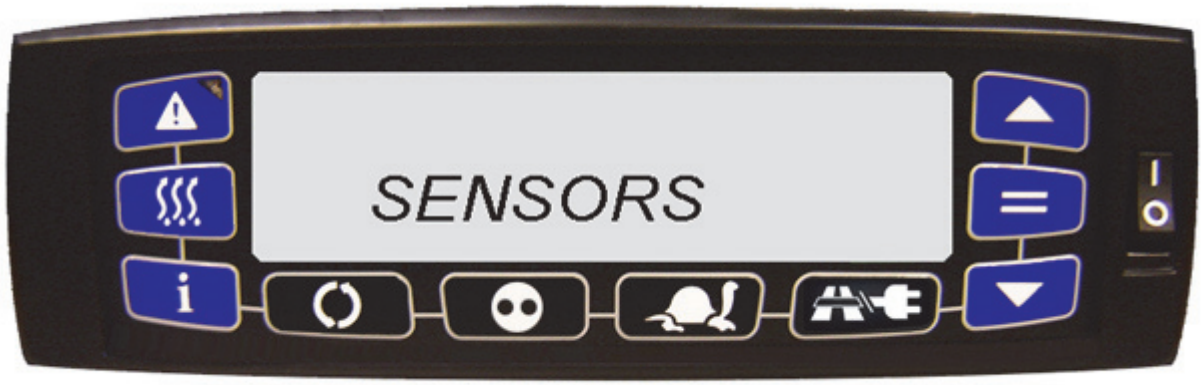
The Unit Data key is used to display the unit operating data. This key, in conjunction with the Arrow keys and = (Enter) key, will allow the user to display the unit's operating data values (hour meters, battery voltage, etc.). Once inside the Unit Data submenus, if no keys are pressed for 10 seconds the display will return to the default display.

NOTE

For all temperature unit data, the values are in °C or °F depending on the configuration and the C or F indicator will be displayed appropriately. Pressures are displayed with a B or P to signify bars or psig.



1. Pressing the Unit Data key will bring up the Unit Data submenu. Users can cycle through the submenu items by using the Arrow keys. The submenus are: SENSORS, METERS, SYSTEM, ENGINE, INFO, and OPTIONS.



2. When a submenu item is displayed, press the = (Enter) key to enter that submenu and then use the Arrow keys to cycle through the items.

3. The display will show the description of the input on the left side with the actual data on the right side. If the Arrow key is held for one second, the list will scroll at a rate of one item every 0.5 seconds. Once the end of the list is reached, the list will scroll back to the first entry.
4. Press the Unit Data key to back out of a submenu. Or, press the = (Enter) key to exit to the default display.

Lock or Unlock the Unit Data Screen:

1. When data is displayed on the screen, push the Enter key for five seconds.
2. Push the Enter key again to return to the data sub-menu.

A Unit Data listing is provided in **Table 3–4**.

Table 3–4 Unit Data

DATA	DEFINITION
SENSORS	
RAT	Return Air Temperature (entering evaporator)
SAT	Supply Air Temperature (leaving evaporator)
DL-T	Delta-T. Supply air temperature minus return air temperature (negative value indicates cooling and a positive value indicates heating).
AAT	Ambient Air Temperature (entering condenser)
DTS	Defrost Termination Temperature
RS1*	Remote Sensor 1
RS2*	Remote Sensor 2
RS3*	Remote Sensor 3
METERS	
ENG	Engine Hour Meter
SBY	Electric Hour Meter
SON	Switch On Hour Meter
HS	High Speed Cycle Counter
STRT	Start Cycle Counter
MENG**	Maintenance Engine Hour Meter
MSBY**	Maintenance Standby Hour Meter
MSON**	Maintenance Switch On Hour Meter
SYSTEM	
CDT	Compressor Discharge Temperature (leaving the compressor)
CDP	Compressor Discharge Pressure (leaving the compressor)

Table 3–4 Unit Data (Continued)

DATA	DEFINITION
CSP	Compressor Suction Pressure (entering the compressor)
CST***	Compressor Suction Temperature (entering the compressor)
SMV	Percentage of SMV Valve Opening
ENGINE	
ENCT	Engine Coolant Temperature
RPM	Diesel Engine Speed
BATT	Battery Volts
DCS	DC Current Sensor displayed in amps
FLS	Fuel Level Percentage. Displayed only if the fuel level sensor is installed.
INFO	
MM/DD/YY	Current Date and Time that the system is using
HH:MM	Hours and Minutes using a 24 hour clock
SER1	Serial Number Characters
SER2	Serial Number Characters
SER3	Serial Number Characters
MOD1	Characters 1-4 of Model Number
MOD2	Characters 5-8 of Model Number
MOD3	Characters 9-12 of Model Number
SWXXXXXXX	Software Revision of the Unit
OPTIONS	
DTRAK	Datatrak is installed.
ADVTRAK	Advanced Datatrak is installed.

* Sensors not active. Only visible if turned on in the configuration.

** Only if activated.

*** Sensor not active. Value is always 32°F (0°C).

3.4.13 Alarm Buzzer and Reset

Alarm Buzzer Silence

When an alarm occurs, the warning buzzer will sound alerting the operator that an alarm has occurred.

To silence the warning buzzer, press and hold the Alarm key for five to seven seconds. The fault light remains illuminated until the alarm is cleared.

Alarm Reset

1. Press the Alarm key to show the alarms codes from latest alarm to first alarm.
2. Press the Up and Down Arrow keys to scroll through the alarm code list until “ALARM RST” is displayed. While “ALARM RST” is displayed, press the = (Enter) key to clear the alarm list. “ALARM CLR” will be displayed for 10 seconds. The unit will restart if the alarm condition has been corrected.

Alternate Alarm Reset

1. Place the I/O switch in the “O” position.
2. The unit can now be restarted after the alarm condition has been corrected.

Inactive Alarms

- Press the Alarm key and Up Arrow key at the same time and hold together for five seconds. This will display the inactive alarm list.
- If there are no inactive alarms, “NO ALARMS” is displayed. If there are active alarms, scrolling is the same as with active alarms. When the end of the list is reached, display will show “ALARM RST” and “ALARM CLR” as with active alarms.

Verifying No Active Alarms

Press the Alarm key. If there are no active alarms, the message displayed is “STATEOK.”

3.4.14 Stopping the Unit

To stop the unit, from any operating mode, place the I/O Switch in the O position. The diesel engine / electric motor will stop. The display will show “OFF” for a few seconds and then will turn off.

3.5 Standby Operation Guidelines

For safe, reliable operation in Standby mode, it is important to follow a few guidelines:

3.5.1 NATT

1. Never plug the unit into the power source with the main switch in the RUN (I) position. The main switch should always be in the STOP (O) position when connecting the unit to the power source.
2. The circuit breaker and extension cable used for Standby operation should conform to the following specifications:

Table 3–5 Unit Specifications for NATT

Operating Voltage	FLA Rating*	Circuit Breaker Capacity	Cable Requirement
208/230 V 60 hz 3 phase	20-35 Amp*	50 A	8/3 with ground (up to 50 ft)
460 V 60 hz 3 phase	10-25 Amp*	30A	10/3 with ground (up to 75 ft)

3. When multiple units are in use, each unit must be operated on its own electrical circuit. *Never* operate more than one unit on a circuit breaker.

NOTE

This information is provided as a guideline only.

When preparing a circuit for operation of the refrigeration unit, a licensed electrician should be contracted. A licensed electrician is familiar with all local ordinances and special requirements for your area, and can ensure that the circuits are properly designed and installed, and that connections are correct.

3.5.2 ETT

1. ALWAYS check that the unit is OFF (Cab command) before connecting or disconnecting it from the power source.
2. The extension cable and fuse used for network connection must comply with the legislation currently applicable on the site of use (minimum H07 RNF CEI 245-4) and with the unit specifications as described in the table below:

Table 3–6 Unit Specifications for ETT

Fuse 200/240/3/50Hz 220/256/3/60Hz	Fuse 350/415/3/50Hz 380/460/3/60Hz	Standard extension cable H.07.RNF	
		230 Volts	400 Volts
25 A	25 A	4 x 6mm2	4 x 6mm2

3. The unit connection cable must be fitted with a ground connection. The cable must be connected to earth.
4. On the 400V supply, the unit MUST BE CONNECTED to a high sensibility (30mA) differential protection.
5. On the 400V supply, operations for the unit must only be carried out by authorized personnel.
6. The user is liable for ensuring that the above measures are taken.

SECTION 4
Control Logic and Temperature Control

NOTE

If the unit is in an alarm condition, the control system alarm response may override the operation described herein. If an alarm is displayed in the Message Center, refer to the specific alarm description in Section 5 Alarm Troubleshooting.

NOTE

With the complex control interactions in use with the APX Control System there are many user selected and preprogrammed software overrides which may change the operation of the unit. Refer to **Section 4.9** and **Section 4.10** for complete descriptions of these features.

4.1 Introduction

This section describes operation of the unit when in Start-Stop Operation and Continuous Operation.

For a description and flow diagram of the refrigerant system component interaction while in cooling, refer to **Section 2.8.1**. For a description and flow diagram of the refrigerant system component interaction while in heating, refer to **Section 2.8.2**.

4.2 Sequence of Operation - Electrical

With the battery connected:

- Power flows from the battery through fuse F1 and fuse F6 to the main microprocessor board, Stepper Input/Output board, Truck Power control board, and display module (MCA, SIO, TPC, DM)
- Power flows through fuse F5 to the engine control unit (ENCU).

Potential power is also established for the Starter Solenoid Contactor (SSC) and, from fuse F11, for TPC outputs like the fuel pump, when the EPR relay is energized. Glow Plugs are controlled with FET transistors.

To start the unit:

1. Place the START/RUN - OFF switch (SROS) in the START/RUN position.
2. Power flows from SROS through high pressure switch (HP) to the power enable relay (PER).
3. Confirmation of power circuits are established from splice point SP-6 back to the main microprocessor at 2-MCA-35 and SP-6.
4. If either or these circuits are broken, the appropriate alarm will be activated.

Energizing PER closes its normally open contacts to provide power through fuse F11 to the DER coil.

During operation the main microprocessor will complete the potential circuits by supplying power, or ground, to energize or de-energize the required components.

Once the SROS is placed in the START/RUN position, the Compressor Suction Modulation Valve (CSMV) will “home” to calibrate its closed position, and then open to 3% before the unit starts.

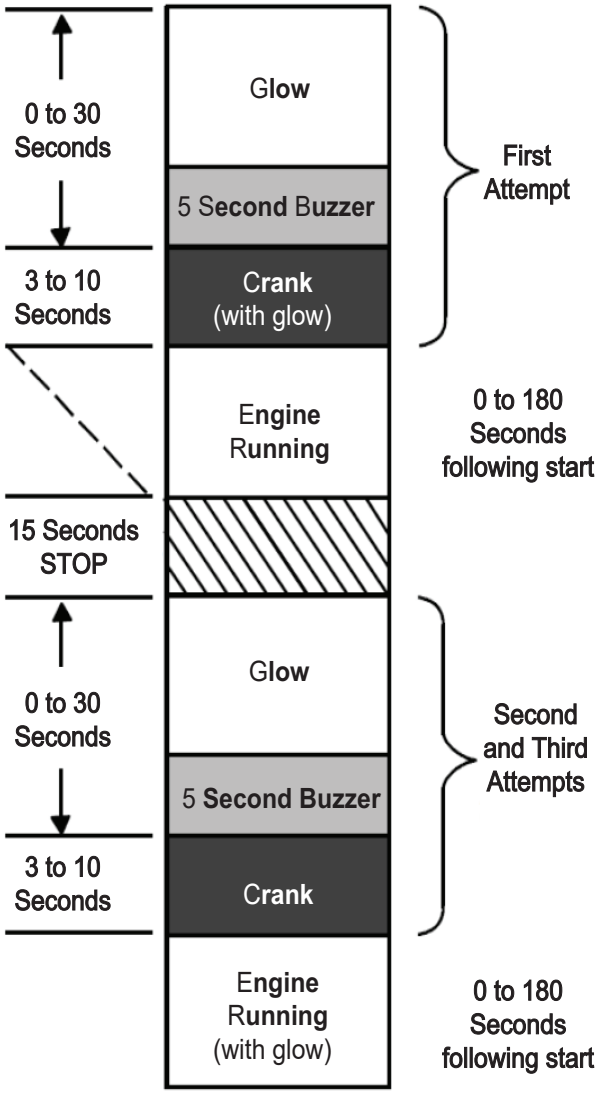
NOTE

The unit will not restart for at least 30 seconds following a shutdown.

4.3 Engine Control

The ENCU begins controlling the fuel solenoid and engine speed when power is supplied to ENCU-22 from TPC-13. Actual speed control is done using CAN feedback on ENCU-24 and ENCU-23.

Figure 4.1 Auto Start Sequence



4.3.1 Engine Start-Up Sequence

On command to perform a Start-Up, the main microprocessor will supply power from TPC-19 to the fuel pump (FP) and from TPC-21 to ENCU-44. This signals the ENCU that engine operation is required. The control system will then enter the engine start sequence. During the start sequence, the engine is operated in high speed. Following start, the refrigeration system will then operate in the mode(s) required for temperature control.

The engine start sequence consists of periods of time with the engine glow plugs and starter energized and de-energized for up to three start attempts.

If the alarm 00129 “COOLANT TEMPERATURE SENSOR CHECK” is active, the ambient temperature sensor will be used. If both the 00129 “COOLANT TEMPERATURE SENSOR CHECK” alarm and 00121 “AMBIENT AIR SENSOR CHECK” alarm are active, the control system assumes a temperature of less than 32°F (0°C) for the glow timing.

During the last five seconds of glow OR for five seconds before a start attempt, the buzzer is energized. Then, the starter solenoid contactor (SSC) will be energized for a maximum of ten seconds while the engine condition is checked every two seconds during the cranking period. The engine is considered to be running and the start sequence will be stopped when engine speed is greater than 1000 rpm and the engine oil pressure switch (ENOPS) is closed.

During the second and third attempts, the control system will monitor additional inputs.

When engine speed reading is less than 1000 rpm, ambient temperature is above 32°F (0°C) and the ENOPS is closed - the Control System will activate alarm 00130 “ENGINE RPM SENSOR CHECK” and the engine will be considered running.

When engine speed reading is less than 1000 rpm, ambient temperature is below 32°F (0°C) and the DC amp draw is more than 2 amps, and the ENOPS is closed - the Control System will activate alarm 00130 “ENGINE RPM SENSOR CHECK” and the engine will be considered running.

During the start sequence the control system monitors engine speed while cranking. If engine speed drops below 50 rpm for three seconds, the starter solenoid contactor will be de-energized and the Control System will activate alarm 00035 “ENGINE FAILED TO CRANK”.

If the unit fails to start after three start attempts, the Control System will activate alarm 00031 “AUTO START FAIL”.

4.4 Modes of Operation

The operational software responds to various inputs. These inputs come from the temperature and pressure sensors, the temperature setpoint, the settings of the configuration variables and the function code assignments. The action taken by the operational software will change if any one of the inputs changes. Overall interaction of the inputs is described as a mode of operation. The modes of operation include cool, heat and defrost. Refer to **Section 2.8** for a description of the refrigeration circuit.

If the unit is operating in AUTO START/STOP, a fourth mode is added: null mode. In Null mode, the unit shuts down until further cooling or heating is required.When in Null mode, two conditions will override normal microprocessor off time and/or temperature control:

- If the battery voltage falls below the configured voltage, the unit will be restarted to recharge the battery.
- If the unit is in Road mode and the engine coolant temperature drops below the predetermined setting in the unit configurations.
- The box temperature has drifted outside of the configured override temperature.

The cooling mode is further divided into the perishable (chill) range operation and frozen range operation. At setpoints above 10.4°F (-12°C), the unit will operate in the perishable range. In perishable range, all modes of operation are available to the microprocessor. At a setpoint of 10.4°F (-12°C) or below, the unit will operate in the frozen range. In frozen range, heat is locked out and only the cool and defrost modes are available to the microprocessor. Heat lockout can be overridden depending on unit configurations (Refer to **Section 6.11.4**).

4.4.1 Pull Down/Pull Up

While in Pull Down or Pull Up, depending on the configuration setting, the refrigeration system will operate in medium speed if the setpoints are above 20°F (-7°C). If the setpoints are below 20°F (-7°C), the refrigeration system will operate in high speed.

Pull Down/Pull Up will be entered:

- Following a Start-Up
- Following a setpoint change
- Following an operational change (Start-Stop Operation vs Continuous Operation)
- When in a Start-Stop ON Cycle and all other Stop Parameters have been met except the compartment temperature Stop Parameter

Pull Down / Pull Up will end when one of the following occurs:

- When the control system is calling for low speed due to an override or Configuration Setting
- When in Start-Stop Operation and the compartment temperature Stop Parameter has been satisfied while one or more of the other Stop Parameters has not
- When in Continuous Operation and the control system has calculated Pull Down or Pull Up is to end

4.4.2 Cool Mode

In Cool Mode, the control system will operate the unit controls as follows:

- The selected temperature control sensor determines if the unit is running high or low speed.
- The 3-way valve flows refrigerant from the compressor discharge directly to the condenser.
- The control system monitors the suction pressure and ambient temperature, and calculates the system load. If required, the system will modulate the CSMV to keep the load within required limits. Refer to Section 4.10.2).

4.4.3 Heat Mode

In Heat mode, the control system will operate the unit controls as follows:

- The 3-way valve is energized to allow hot gas to flow from the compressor discharge to the evaporator coil.
- The CSMV modulates for available power.

4.4.4 FreshProtect Control

FreshProtect limits the supply air to a set amount below (cooling) or above (heating) setpoint to avoid top freezing perishable products.

4.4.5 Defrost

Refer to **Section 4.8** for a description of Defrost.

4.4.6 Overrides

With the complex control interactions in use with the APX Control System, there are many user selected and preprogrammed software overrides and Configuration settings which may change the operation of the unit. Refer to Sections 4.9 and 4.10 for complete descriptions of these features.

4.5 Temperature Control

4.5.1 Temperature Determination

The control system monitors the temperature readings from the supply and return temperature sensors to determine the mode of operation required to maintain compartment temperature in accordance with the setpoint.

The sensor used for temperature control is dependent on the selection made in the TEMP CONTROL Functional Parameter.

- If the selection is RETURN AIR, the Return Air Sensor (RAT) will be used for any setpoint.
- If the selection is SUPPLY AIR, when operating with a perishable setpoint, the control system will switch to the Supply Air Sensor (SAT) and SAT is displayed on the CAB command. When operating with a frozen setpoint, the Return Air Sensor will continue to be used and RAT is displayed on the CAB command. Refer to **Section 4.5.2** for more information on frozen and perishable setpoints.

4.5.2 Perishable and Frozen Setpoint Ranges

There are two ranges defined for setpoint:

- Perishable Range is applicable to setpoints above +10.4°F (-12°C)
- Frozen Range is applicable to setpoints at or below +10.4°F (-12°C)

4.6 Start-Stop Operation

Start-Stop is provided to reduce fuel or power consumption. This feature allows full automatic control of the unit by monitoring compartment temperature, battery condition and engine coolant temperature.

The main function of Start-Stop Operation is to shutdown the engine after certain conditions are met (to provide an efficient temperature control system) and to initiate a restart sequence after certain conditions are met. The Start-Stop/Continuous key is pressed to select between Continuous and Start-Stop Operation. The mode of operation will be indicated in the status bar.

4.6.1 Start-Stop Configuration

Start-Stop operation is determined by the Functional Parameter settings.

The following Functional Parameter values will be available for use:

- MINIMUM RUN TIME (4 to 60 minutes, default = 4 minutes)
- MINIMUM OFF TIME (10 to 90 minutes, default = 10 minutes)
- RESTART TEMPERATURE (0.3 to 10C (0.5 to 18F))
- OVERRIDE TEMP (2 to 10C (3.6 to 18F))
- MAXIMUM OFF TIME (Off or 10 to 255 minutes, off = no maximum off time)
- FROZEN SHUTDOWN OFFSET (0.0 to 0.6C (0 to 1.1F))

4.6.2 Stop Parameters

Whenever the unit starts in Start-Stop Operation, it will remain in the Start-Stop ON cycle until all of the following criteria have been satisfied:

- It has run for the selected Minimum Run Time.
- The MINIMUM RUN TIME is selected in the control system Functional Parameters. The purpose of this is to force the unit to run long enough to completely circulate the air inside the compartment, and to ensure that the product temperature is at setpoint.
- The engine coolant temperature has warmed.
- Each time the unit is started it must continue to run until the coolant temperature rises to 122°F (50°C) to ensure it has fully warmed up before shutdown is allowed.
- The battery is fully charged.,A good battery is defined as having 13.4 VDC at 77°F (25°C). The control system will calculate the equivalent voltage based on the ambient temperature and shutdown will be allowed when battery voltage is at or above the calculated value.

- The compartment temperature requirement is satisfied.

  In Start-Stop Operation, the refrigeration system will operate in Pull Down or Pull Up Mode in order to reach the shutdown condition as quickly as possible.

  Shutdown will be allowed when the compartment temperature is within 0.5°F (0.3°C) of setpoint, for operation in the Perishable Range. In the Frozen Range, shutdown will be allowed when the compartment temperature is calculated to be within 0.3 degrees minus the FROZEN SHUTDOWN OFFSET of setpoint.

4.6.3 Restart Parameters

While the unit is in a Start-Stop OFF Cycle, restart will be initiated when one of the following conditions occurs:

- Engine coolant temperature drops below the selected Configuration value.

The control system will monitor coolant temperature. If coolant temperature drops below the ENGINE TEMPERATURE FOR RESTART Configuration value, the engine will be started. If this is the only reason operation is required, the unit will operate as if it is in Continuous Operation until the requirement has been met.

- Battery voltage falls below selected configuration value.

The control system will monitor battery voltage. If battery voltage is at or below the VOLTAGE FOR START-STOP RESTART configuration value, the engine will be started. If this is the only reason operation is required, the unit will operate as if it is in Continuous Operation until the requirement has been met.

- The Maximum Off Time has expired.

In some ambient conditions there are times when the unit may remain in a Start-Stop Off cycle for extended periods of time. To ensure that the entire load stays within the normal restart temperature range, the MAXIMUM OFF TIME functional parameter may be used to force the unit to restart to circulate air in the compartment. This will ensure there are no hot spots and the temperature sensor reading accurately reflects product temperature. If this is the only reason operation is required, the unit will operate as if it is in Continuous Operation until the requirement has been met.

- The Minimum Off Time has expired.

The MINIMUM OFF TIME functional parameter setting allows the unit to remain off for extended periods of time, maximizing fuel/power economy. The unit may not be restarted until the MINIMUM OFF TIME has expired and the compartment temperature is greater than the PERISHABLE RESTART TEMPERATURE value selected in the Functional Parameters away from setpoint. If this is the only reason operation is required, the unit will operate as if it is in Continuous Operation until the requirement has been met.

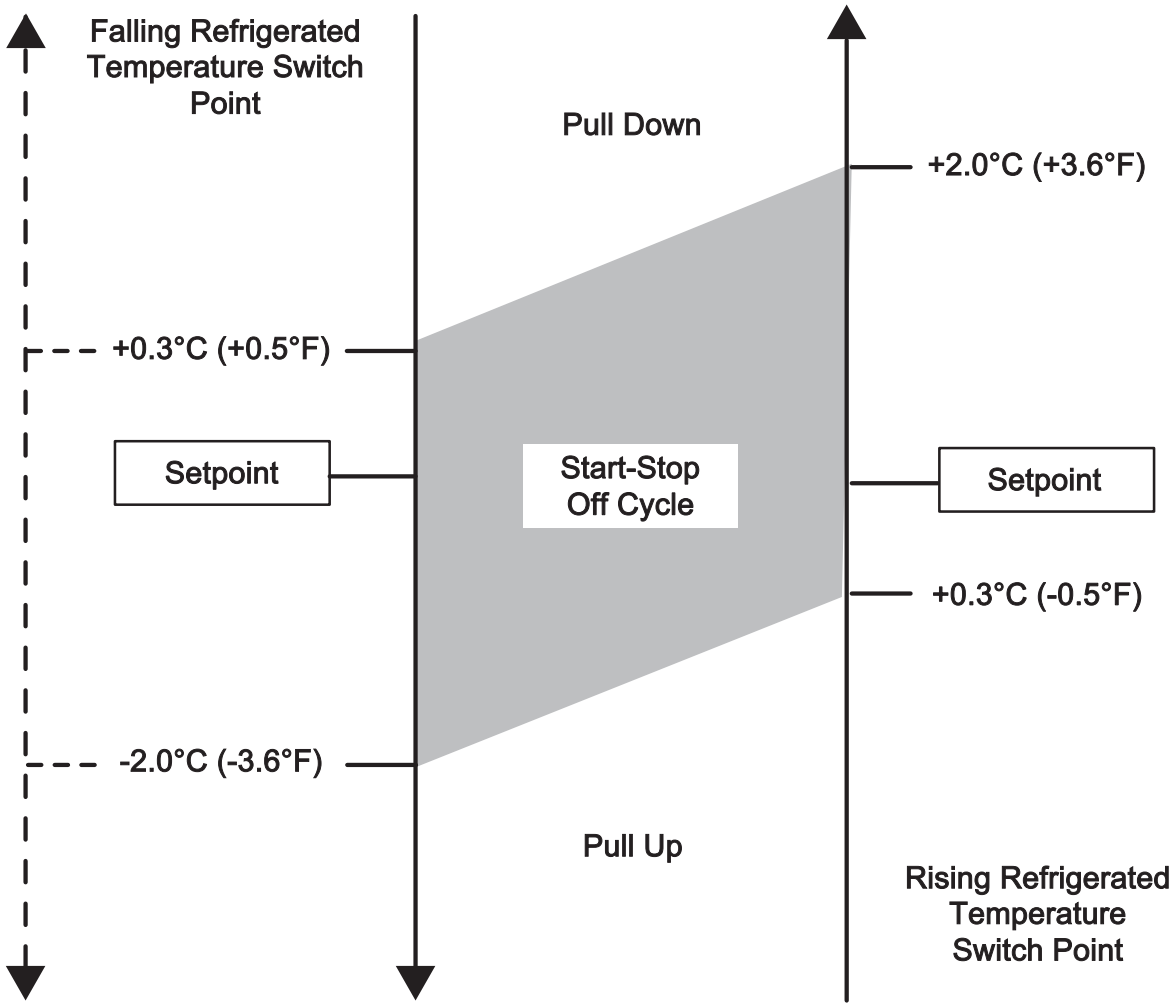
- Compartment temperature has exceeded the Override Functional Parameter value.

During MINIMUM OFF TIME, the control system continually monitors the refrigerated compartment temperature. If the temperature should drift outside the OVERRIDE TEMPERATURE Functional Parameter value the unit will be restarted. The value may be set from 0.5 to 18°F (2° to -10°C) in 0.50 increments. The factory default setting is 12°F (7°C). Whenever the unit restarts, temperature control will be in the Pull down or Pull up mode (refer to Section 4.4.1).

4.6.4 Start-Stop Operating Sequence

The operating sequence for Start-Stop Operation under the default Configuration and Functional Parameter settings is provided in **Figure 4.2**.

Figure 4.2 Start-Stop Default Operating Sequence



Switch Point = Controlling Temperature - Setpoint

(+ results are above setpoint; - results are below setpoint)

NOTE: Switch points are the same for Perishable Range and Frozen Range except in Frozen Range heating may not be allowed depending on configuration settings.

4.7 Continuous Operation

- In Continuous Operation, the unit will not shutdown except in response to a shutdown alarm. Temperature control in the compartment will operate under Pull down, Pull up, Cooling and Heating.
- Continuous Operation is normally used for fresh produce and other sensitive product loads. The Start-Stop/ Continuous key is pressed to switch between Continuous Operation and Start-Stop Operation. The mode of operation will be indicated in the status bar.
- In Continuous Operation, Pull down or Pull up will continue until the control system has calculated it to end. The calculation determines the average temperature using the formula:

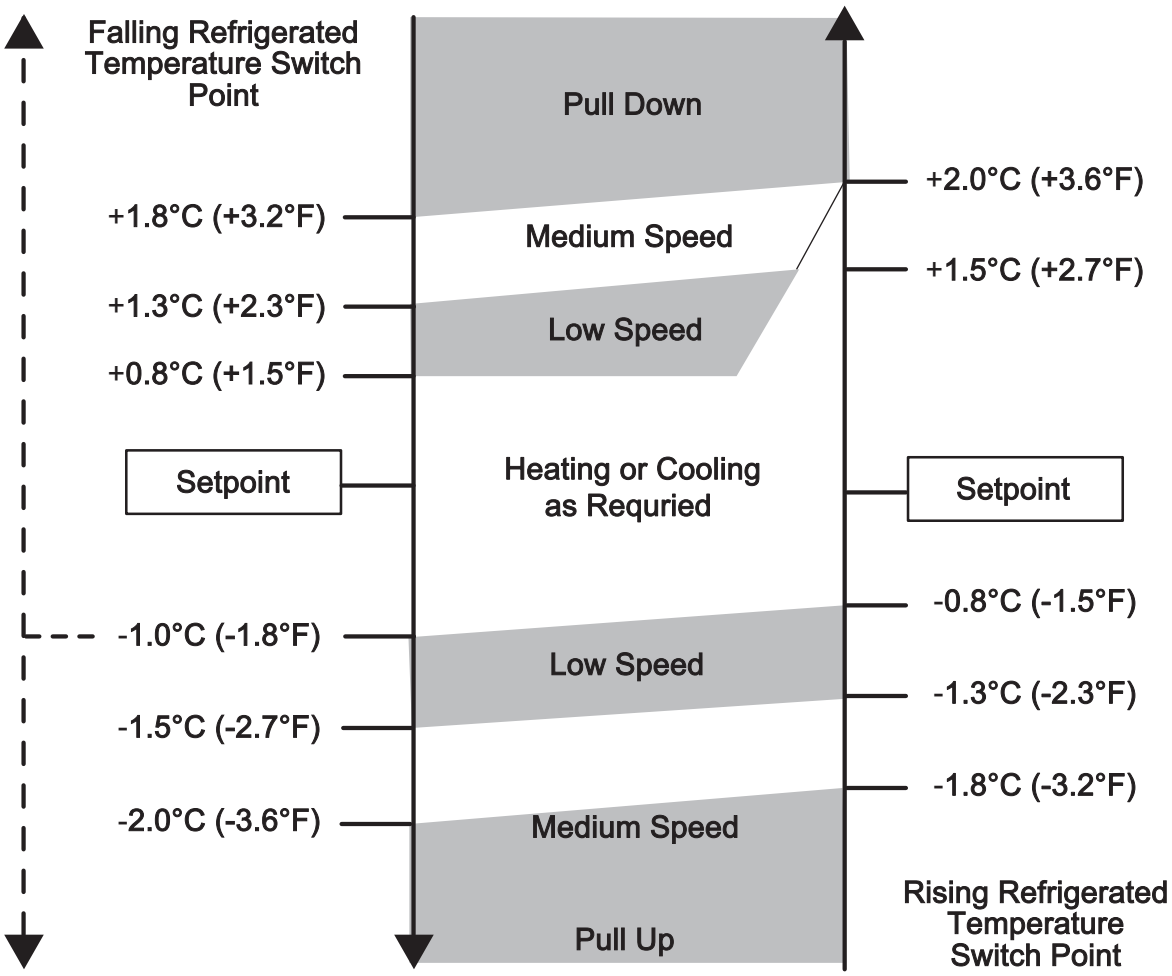
  (SAT - RAT) / 2 = Calculated Average Temperature
- When the Control Temperature is within the calculated average temperature of set point, Pull Down or Pull Up ends. Once Pull Down or Pull Up ends, the system will operate in accordance with **Table 4–1** and **Figure 4.3**.
- The operating sequence for Continuous Operation under the default Configuration and Functional Parameter settings is provided in **Figure 4.3**.

Table 4–1 Continuous Operation Modes

SETPOINT	ALLOWED OPERATION
32°F (0°C) and above	*Cooling and Heating with FreshProtect active
Below 32°F (0°C) and Above 10.4°F (-12°C)	Cooling and Heating
Less than 10.4°F (-12°C)	Cooling (and Heating if configured)

*Refer to Section 4.9.1 for information on FreshProtect.Continuous Default Operating Sequence

Figure 4.3 Continuous Default Operating Sequence



Switch Point = Controlling Temperature - Setpoint
(+ results are above setpoint; - results are below setpoint)

NOTE: Switch points are the same for Perishable Range and Frozen Range except in Frozen Range heating may not be allowed depending on configuration settings.

4.8 Defrost

Defrost is an independent cycle overriding cooling and heating functions in order to de-ice the evaporator. When the unit enters Defrost, the Message Center will display ‘dF’ for the entire cycle. When the unit is in cycle, ‘DEFROST’ is displayed in the Operator Message panel, along with the setpoint. Defrost is allowed when the Defrost Termination Temperature (DTT) is less than 44°F (6.8°C) or the Return Air Temperature (RAT) is less than 45.0°F (7.2°C). In the event that the alarms for both DTT and RAT are activated, defrost can then be initiated when the SAT is less than 45°F (7.2°C).

4.8.1 Defrost Initiation and Start

Defrost can be initiated manually by pressing the MANUAL DEFROST key or automatically by the control system. Control system initiation is based on coil condition or expiration of the defrost timer.

Defrost will be initiated based on a coil condition where blockage is sufficient to cause an air pressure differential across the coil. The differential is great enough to close the contacts of the Defrost Air Switch (DAS).

TIP

Ice is not the only thing that will cause the air differential to increase across the evaporator coil. Shrink wrap, paper, plastic bags, and other such items when caught in the return air stream and pulled up against the evaporator coil or the return air grille can also cause the DAS contacts to close.

NOTE

Time interval between defrosts is selected in the Functional Parameters menu. The parameter value may be set to 1.5, 3, 6, or 12 hours. The factory default setting is three hours.

NOTE

The defrost timer will not count when the unit is in defrost, when the unit is in a Start/Stop Off cycle or when the DTT is greater than 44°F (6.8°C).

4.8.2 Normal Defrost Termination

The Defrost mode terminates when the DTT is > 35.6°F (2.0°C) or when the DTT has risen 9°F (5°C) above initiation temperature and supply air is > 95°F (35°C).

4.8.3 Normal Defrost Termination Sequence

The following sequence will be used to perform a normal defrost termination:

1. The 3-way valve will return to cooling mode.
2. The evaporator fans will cycle for up to 80 seconds.
3. Then, the control system will return to normal temperature control and the data recorder will record the defrost termination event.

4.8.3.1 Fan Sequencing Following Defrost Termination

4.8.4 Wait for 10 seconds.

1. Start Evap Fan1 and Run for five seconds.
2. Start Evap Fan 2 and Run both fans for 15 seconds.
3. Stop Both Fans and wait for 45 seconds.
4. Start Evap Fan 1 and Run for five seconds.
5. Start Evap Fan 2.

4.9 User Selected Override Operation

An optional software override program is available to the user. This program includes FreshProtect. Information on how the unit operates under this program is provided in the following section.

4.9.1 FreshProtect Supply Air Limit Control

FreshProtect operates when all of the following conditions are present:

- The FRESHP Functional Parameter is not OFF
- The setpoint is between 32°F and 95°F (0°C and 35°C)
- The TEMPERATURE CONTROL Functional Parameter is set for Return Air
- The unit is in Continuous Operation with the Return Air Temperature (RAT) less than 10°F (5.6°C) above setpoint. Or, the unit is in Start-Stop Operation with the RAT within 5°F (2.8°C) of setpoint and criteria for shutdown other than compartment temperature has not been met.

4.10 Preprogrammed Software Overrides

4.10.1 Engine Speed Overrides

This section lists the different factors that determine engine speed (high or low) in addition to the speed controls used in temperature control.

Speed Control Overrides in priority order are listed below:

1. City Speed

   The unit will be forced into medium speed any time the city speed (turtle) key is depressed.

2. Door/Remote Switch Configuration

   If the Door/Remote Switch Configuration is set for low speed, the engine will run in low speed when the door/remote switch is open/active.

3. Frozen Setpoint Override

   If the setpoint is in the frozen range and the temperature is below setpoint, the engine will operate in low speed.

4. Start-Stop Frozen Range

   When in Start-Stop Operation with a setpoint in the frozen range and after the minimum run time has expired, the engine will be forced to high speed if the refrigerated compartment temperature is not yet down to setpoint.

Additional Overrides:

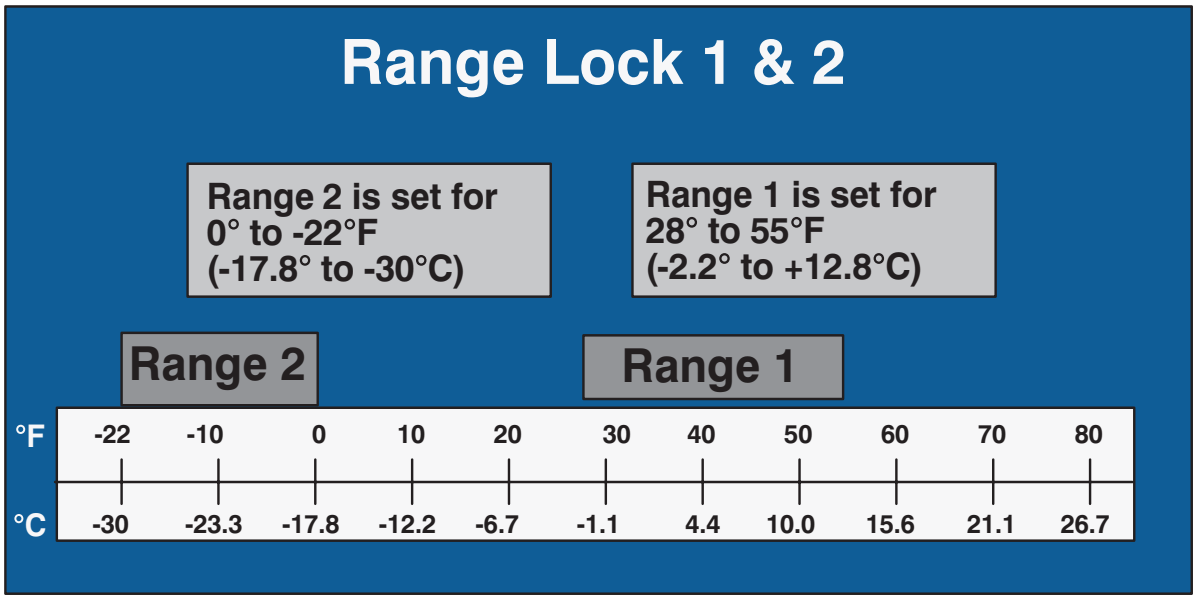
- If the ambient air sensor alarm (00121) is active or the ambient air is >115°F (46°C) force low speed.
- High CDT >340°F (171°C)
- If the setpoint is >20°F (-7°C), the unit will be forced to medium speed for pull down.

4.10.2 Temperature Range Lock 1 and 2

Range Lock is a group of configurations which may be set to lock the unit into Start-Stop or Continuous Operation for various setpoint ranges. Two ranges are available for selection. Each range can be independently set to lock setpoint temperatures into either Start-Stop or Continuous operation.

Each range has a selectable minimum and maximum temperature that define the span of the range. If some set-point temperatures are contained in both ranges due to range overlap, Range 1 will always have priority over Range 2.

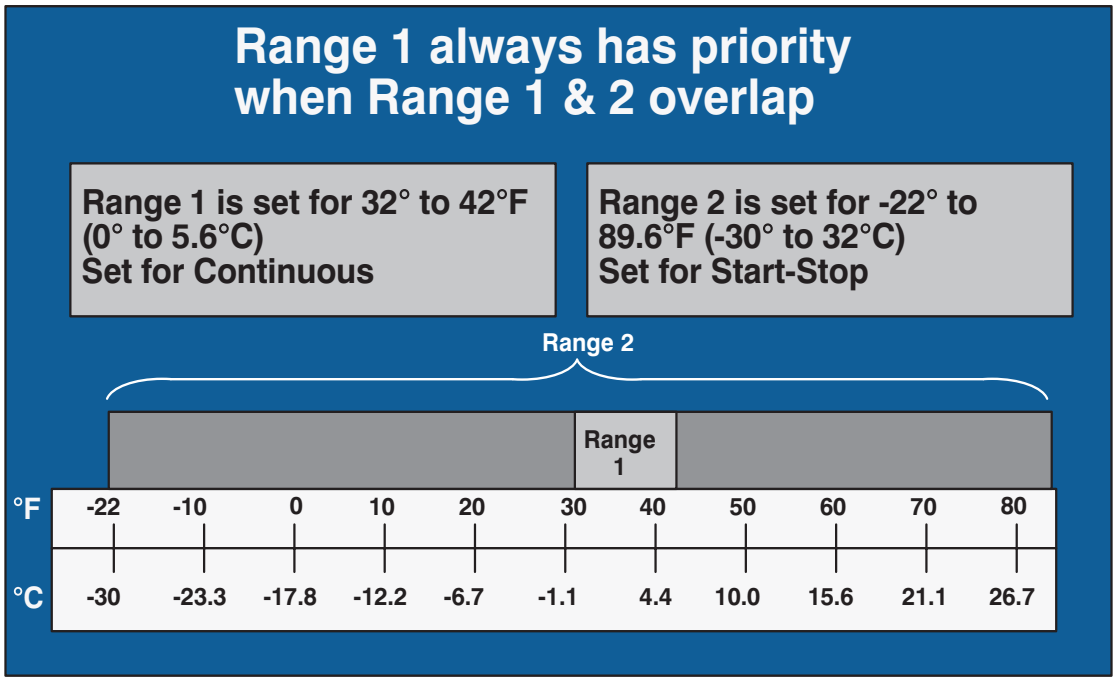
Figure 4.4 Range Lock Settings - Non-Overlapping



Typically, Range 1 and Range 2 are used to control different setpoint ranges when IntelliSet is not active. For units with IntelliSet, because each IntelliSet is generally programmed for a specific product, only Range Lock 1 is used to hold the unit in either the Start-Stop or Continuous Operation, and Range Lock 2 is left OFF.

For example (see **Figure 4.4**), if Continuous Operation is ALWAYS required whenever the setpoint is between 28°F and 55°F (-2.2°C and +12.8°C), Range 1 will be set for Continuous with a Minimum Temperature of 28°F (-2.2°C) and a Maximum Temperature of 55°F (+12.8°C). Should Continuous Operation ALWAYS also be required with setpoints between 22°F and 0°F (-30°C and -17.8°C), then Range 2 will be set for Continuous with a Minimum Temperature of 22°F (-30°C) and a Maximum Temperature of 0°F (-17.8°C). Any setpoint outside of Range 1 or 2 will allow changes between Start-Stop and Continuous.

Figure 4.5 Range Lock Settings - Overlapping



The most important time to determine which should be Range 1 and which should be Range 2 is when the ranges overlap each other.

In example 2 (see **Figure**), the ranges have been set to lock all setpoints into Start-Stop, except for a small range between +32°F and +42°F (0°C and 5.6°C) where the unit will always operate in Continuous. Range 1 Minimum Temperature has been set for +32°F (0°C) and a Maximum Temperature of +42°F (5.6°C). Range 2 has been set for a Minimum Temperature of -22°F (-30°C) and a Maximum Temperature of +89.6°F (32°). The unit will switch to Continuous when the temperature is between +32°F and 42°F (0°C and 5.6°C) because Range 1 settings take priority when the ranges overlap each other.

SECTION 5
Alarm Troubleshooting

⚠ WARNING

APX Control equipped units may start automatically at any time the main power switch is not in the OFF position. Also, the unit may be fitted with two-way communication equipment that will allow starting of the unit from a remote location even though the switch is in the OFF position.

⚠ WARNING

Be aware of HIGH VOLTAGE supplied at the power plug. When performing service or maintenance procedures, ensure any two-way communication is disabled in accordance with the manufacturer's instructions, ensure the main power switch is in the OFF position and, whenever practical, disconnect the high voltage source, lockout/tagout the receptacle and disconnect the negative battery connection. Introduction

This section provides guidance for troubleshooting alarms. The alarm light will be illuminated when there is one (or more) alarm(s) stored in the microprocessor. Instructions for reviewing the alarm list is provided in **Section 5.1**.

- Each alarm begins with the letter A followed by an alarm number and description. Alarms are listed in this guide by alarm number in ascending order.
- Before beginning to actually troubleshoot an alarm, visually inspect the unit, in particular the area of the unit that is causing a problem. In many cases, the cause of the problem will be obvious once a visual inspection is performed. For those cases where the cause of the problem is not obvious, this troubleshooting guide will be of assistance.
- Troubleshooting should begin with the first alarm that appears in the alarm list. The first alarm that appears is the last alarm that was recorded. Other alarms in the list may have contributed to the occurrence of the first alarm.
- The check items in the troubleshooting guide are listed in order of the likeliness of their occurrence and ease of testing. We recommend following the order in which they are presented. However, there may be times when situations or experiences require following a different order. For example, if the truck is loaded, condensing unit checks should be done first, even though some evaporator section checks may be listed before them.
- When the cause of the problem is corrected, it is not necessary to continue through the remainder of the steps. Some active alarms will inactivate themselves automatically once the cause has been corrected. Alarms that do not inactivate themselves automatically must be cleared manually. (See **Section 3.4.11**)
- When repairs are completed, run the unit through a Pretrip cycle and verify that no further alarms occur.
- When working on the refrigeration system, an accurately calibrated manifold gauge set should always be installed. It is not necessary to connect an additional high pressure gauge at the liquid line service valve. The compressor suction pressure, compressor discharge pressure and evaporator outlet pressure can be read in the Unit Data.
- In high or low ambients it may be necessary to cool or warm the refrigerated compartment temperature before performing specific tests providing that the compartment is not loaded with perishable product.

5.1 Alarm Display

When an alarm is generated, the display will alternate between the default display (setpoint/air temperature) and the active alarm(s). Each item will be displayed for 3 to 10 seconds and the display will continue to scroll through the items until the alarms are cleared. Refer to **Section 3.4.13** for the procedure on resetting alarms.

The fault light (FL) will be illuminated when selected alarms are generated. A description of the alarms is provided in the following paragraphs.

00001	Low Fuel Level Warning

- **Trigger-on Condition:**
  The Low Fuel Level is configured to YES and run relay is energized and low fuel level input = low level for 30 seconds and not cranking the engine.

  OR, if the Low Fuel Level is to YES fuel level <= 15% for 30 seconds and run relay is energized and not cranking the engine.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  When the fuel level is above 17% for more than 30 seconds, or when the fuel level input = level okay for 30 seconds.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check for Low Fuel Level: Add fuel as needed to the fuel tank.
2. Check Fuel Level Sensor: Refer to procedure for alarm **00126 Fuel Sensor Check**.

00011 Low Oil Pressure

- **Trigger-on Condition:**
  The system is in Diesel Engine mode AND if Alarm 00041 (Engine Stalled) is NOT active and the oil pressure switch = low pressure for five seconds while the engine is running and not cranking.
- **Control Response:**
  If the system is in Diesel Engine mode and the Unit Operation configuration is Standard. OR, the Unit Operation is Rail and the Test 4 Option is not installed, then a Shutdown is required.

  If the system is in Standby Electric Motor mode OR the Unit Operation Configuration is Rail and the Test 4 Option is installed and the alarm is active, this is a alarm condition only.
- **Trigger-off Condition:**
  If the system is in Diesel Engine mode AND Alarm 00041 is not active AND the Unit Operation configuration is Standard OR Test 4 is not installed AND the alarm minimum off time has been reached.

  OR, if the system is in Diesel Engine mode AND the Unit Operation configuration is Rail AND Test 4 is installed AND engine is running AND oil pressure switch = okay for 10 seconds.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check Engine Oil Pressure Switch (ENOPS) power and wiring:
   a. Inspect switch, connector pins and terminals. Verify no physical damage to switch. Check for damage or corrosion in connections.
   b. Energize the circuit. Check for power at switch connector. There must be a minimum 11 VDC. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.
   c. Check for continuity from switch connector terminals: ENOPS-A to ENCU-15 and ENOPS-B to ENCU-18. If good continuity is not present, then check connectors and wiring between terminals. Verify no damage, moisture or corrosion.
2. Check ENOPS switch: Remove the switch, connect to an external pressure source and test.
   - Contacts close on a pressure rise at 18 +/- 3 psig (1.2 +/- 0.2 bar).
   - Contacts open on a pressure fall at 12 psig (0.82 bar).
3. Check engine oil pressure:
   - Connect mechanical oil gauge.
   - Oil pressure must be greater than 18 psig (1.2 bar).

00012 High Coolant Temperature

- **Trigger-on Condition:**
  The system is in Diesel Engine mode AND the coolant temperature sensor alarm is NOT active while the engine is running and any of the following conditions occur with NO oil pressure failures present:

  Ambient temperature is > 120°F (48.9°C) and engine coolant temperature > 241°F (116°C).

  Ambient temperature is < 120°F (48.9°C) and engine coolant temperature > 230°F (110°C).

  Engine coolant temperature has remained between 230° and 241°F (110° and 116°C) for more than five minutes and ambient temperatures > 120°F (48.9°C).

  Evaporator fan motor speed: Min = 0 RPM, Max = 3500 +/- 8%+/- RPM

- **Control Response:**
  If unit is in Diesel Engine mode, then a Shutdown is required.

  If unit is in Standby Electric mode, then alarm condition only.

- **Trigger-off Condition:**
  If the engine coolant temp falls below 212°F (100°C).

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check coolant level in overflow bottle. Level must be in the normal range.

⚠ WARNING

Do not remove the cap from a hot radiator or bottle; if the cap must be removed, do so very slowly in order to release the pressure without spray.

2. Check Coolant Temperature Sensor (ENCT): Refer to procedure for Alarm **00129 Coolant Temperature Sensor Check**.
3. Check freeze point of coolant: Use Coolant Tester to check concentration of anti-freeze mixture. Must be between 40% to 60% Ethylene Glycol to water mixture.
4. Check water pump belt: Check belt tension and condition. Verify no glazing, cracking, or slipping. Refer to **Section 6.6.2**. Replace if required.
5. Check airflow through radiator and condenser coil:

   a. Inspect the condenser and radiator. Ninety percent or more of the coil surface must be undamaged. The condenser/radiator coil must be clean.

   b. Check airflow (with the unit running). Verify that there is even airflow through the entire coil with no “dead” spots.

   c. Check speed of condenser fan 12V electrical motor. Speed is not constant. Refer to Electrical Data, **Section 2.6.4**.

6. Check engine cooling system:

   a. Compare actual engine temperature to the Unit Data reading. Temperature must be within ± 20°F (±11.1°C).

   b. Test operation of engine coolant thermostat. Must operate correctly.

   c. Check water pump operation. Verify there is no seepage at weep hole, the bearings are tight and quiet, and the impeller is firmly attached to shaft.

   d. Check cooling system for scale, sludge, rust, etc. Coolant must be clean and clear. Verify there are no foreign particles or substances in it. Flush and clean the coolant system as necessary.

   e. Check water pump bypass hose to thermostat housing for internal blockage. Must be clear and open.

00013 High Discharge Pressure

- **Trigger-on Condition:**
  The Compressor High Discharge pressure switch is outside limits while not cranking the engine and the Stop/Run Switch is ON. High Pressure must be sensed for 3 seconds consecutively.

  The high pressure switch is cut out (open) 32. +/- 0.7 bar (465 +/- 10 psig).

  The high pressure switch is cut in (close) 24 +/- 0.7 bar (350 +/- 10 psig).

- **Control Response:**
  Unconditional Shutdown.

- **Trigger-off Condition:**
  If the compressor discharge pressure falls within limits and the Stop/Run Switch is ON.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check system pressures:
   - Install manifold gauge set, and check and compare compressor discharge and suction pressures with those shown on the microprocessor.
   - Suction and Discharge pressures must have the same reading on gauges and on microprocessor display.
   - Pressures must be in the normal range for ambient and refrigerated compartment temperature conditions.
   - If discharge pressure is in normal range, proceed to step 4.

   NOTE

   Microprocessor suction (CSP) readings have a maximum value of 7.5 bars (100 psig) The actual suction pressure must be lower than 7.5 bars in order to perform this test.

2. Check airflow through condenser coil:
   a. Inspect condenser and radiator. Ninety percent or more of the coil surface must be undamaged. Condenser coil and radiator must be clean.
   b. Check airflow (with unit running.) Verify even airflow through the entire coil, with no “dead” spots.
   c. Check condenser fans. The fan should operate correctly. Check rotation, air should be pulled in through the grill, and discharge into the engine compartment.
3. Check for Refrigerant Overcharge: Check refrigerant charge. Refer to **Section 6.7.5**.
4. Check HP1 Switch: Inspect switch and connector pins and terminals. Verify there is no physical damage to switch, and no damage, moisture, or corrosion in connector.
5. Check HP1 switch harness:
   a. Inspect harness and control box connector pins and terminals. (See wiring schematic in Section 9). Verify no physical damage to harness. Verify no damage, moisture, or corrosion in connectors.
   b. Check for shorted circuit in harness, and continuity through the harness. Energize Circuit. (See Note 2, page 5-2.) Check for voltage from SP6 through switch, and from microprocessor terminal TPC 22.
6. Check HP1 Switch: Check switch operation. Test switch, refer to **Section 6.10.4**.

00015 High Battery Voltage Check

- **Trigger-on Condition:**
  Battery voltage > 17 VDC.
- **Control Response:**
  Required shutdown.
- **Trigger-off Condition:**
  If battery voltage is between 11 and 14 VDC.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check battery voltage:
   a. Test voltage at the battery with the unit off. Must be between 11-16 VDC.
   b. Test voltage at the battery with the unit running. Must be between 12-16 VDC.
2. Check alternator voltage:
   a. Test voltage from PIN to ALT L connector with the unit off. Must be between 11-16 VDC.
   b. Test voltage from PIN to ALT L connector with the unit running. Must be between 12-16 VDC.
3. Check voltage at main microprocessor:
   a. Check voltage reading at display. Must be between 11-16 VDC.
   b. Check Unit Data voltage reading. Must be within 0.5 VDC of reading obtained at display.

00016 Low Battery Voltage Check

- **Trigger-on Condition:**
  Battery voltage < 10 VDC for two seconds while not cranking the engine and manual mode is not active.
- **Control Response:**
  Required shutdown. If activated while starting, this is an alarm condition only. Do not crank the engine if the battery voltage is still low.
- **Trigger-off Condition:**
  If battery voltage is between 11-14 VDC and not in manual start.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check battery voltage:
   a. Inspect battery cable ends and posts. Must be clean and tight.
   b. Test voltage at battery with the unit off. Must be above 11 VDC.
   c. Test voltage at battery with the unit running. Must be above unit off reading (alternator charging).
   d. Perform load test on battery. Follow battery manufacturer's procedure.
2. Check connections to main microprocessor:
   a. Check connections from PIN to ALT L connector. Verify no damage or corrosion at connections.
   b. Check voltage reading at display. Must be above 11 VDC.
   c. Check Unit Data voltage reading. Must be 0.5 VDC of reading obtained at display.

00017 High Discharge Temperature

- **Trigger-on Condition:**
  If the Discharge Temperature Sensor Alarm is not active AND any of the following conditions are met:
  - Ambient temperature < 120°F (48.9°C) and discharge temperature > 310°F (164°C) for three minutes.
  - Ambient temperature > 120°F (48.9°C) and discharge temperature > 340°F (171.1°C) for three minutes.
  - Discharge temperature is > 350°F (176.7°C) at any time.
- **Control Response:**
  Required shutdown.
- **Trigger-off Condition:**
  If the Discharge Temperature Sensor is active OR when the discharge temperature falls below 300°F (158°C).

  Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check if alarm occurs during Pretrip Test 13: If alarm occurs during Pretrip Test 13, check the compressor. Perform a compressor test.
2. Check for Alarm **00125 Discharge Temperature Sensor**
3. Check the refrigerant charge by referring to **Section 6.7.5**. Charge must be correct.
4. Check airflow through radiator and condenser coil:
   a. Inspect condenser and radiator. Ninety percent or more of the coil surface must be undamaged. Condenser/Radiator coil must be clean.
   b. Check airflow (with the unit running). Verify even airflow through the entire coil, with no “dead” spots.
   c. Check operation of the condenser fan.
5. Check Compressor Suction Modulation Valve (CSMV).
6. Check system pressures:

   Install manifold gauge set, and check and compare compressor discharge and suction pressures with those shown in Unit Data.
   - Suction and discharge pressures must have the same reading on gauges and Unit Data.
   - Pressures must be in the normal range for ambient and refrigerated compartment temperature conditions.
   - Compressor suction pressure (CSP) reading has a maximum value of 7.5 bars (100 psig) The actual suction pressure must be lower than 100 psig in order to perform this test

7. If alarm occurred during defrost, check DTT:
   a. Visually inspect the mounting of DTT. Must be mounted tightly to the tube sheet, with the center screw properly torqued.
   b. Using a service (test) thermometer, check temperature of the evaporator tube sheet at DTS location and compare with the data list. Must be within ± 2°F (1°C).
8. Check Expansion Valve (TXV):
   a. Visually inspect valve. Bulb must be clamped tightly and insulated.
   b. Check valve superheat. Refer to **Section 6.10.8**.
9. Check compressor cylinder valves and gaskets:
   a. Remove compressor heads and inspect condition of cylinder suction valves, cylinder discharge valves and gaskets. All must be in good condition.
   b. Install new parts and gaskets as required.
10. Check System for Non-Condensables: Check refrigeration system for non-condensable gases. No non-condensable gases may be present.
11. Check Oil Quantity in the Circuit:
    - If there is too much oil in the circuit, it will create high T°.
    - If too much oil is found, clean the circuit with cleaning machine and cleaning product.

00018 Low Pressure Shutdown

- **Trigger-on Condition:**
  If the engine or motor is running and the suction pressure is < -4 psig (0 bar) and if return air temperature is > -10°F (-23.3°C) for more than the low suction pressure delay seconds.
  The shutdown delay values, 0 to 255 seconds, are able to be modified via configurations.
- **Control Response:**
  If the Low Pressure Shutdown is configured for shutdown, then this is a required shutdown.
  If the Low Pressure Shutdown is not configured for shutdown, then this is an alarm condition only.
- **Trigger-off Condition:**
  If suction pressure is more than -2.0 psig (-0.2 bar) or if Return Air Temperature is less than -10°F (-23.3°C).
  Alarm may be manually reset via keypad or by turning the unit OFF and then ON again.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check airflow through evaporator coil/section:
   a. Inspect coil. Ninety percent or more of the coil surface must be undamaged. Coil must be clean.
   b. Check airflow (with the unit running). Verify even airflow through the entire coil, with no “dead” spots.
   c. Check return air bulkhead, air chute. Must be good air flow, and return air not restricted. Verify the air chute is in good condition.
   d. Check the fan motor.
2. Check refrigerant charge. Refer to **Section 6.7.5**.

3. Check system pressures: Install manifold gauge set, and check and compare compressor discharge and suction pressures with those shown in Unit Data.
   - Suction pressure must be above 3 psig (0.2 bar).
   - Suction and discharge pressures readings must be the same on the gauges and Unit Data.

   NOTE

   Compressor suction pressure (CSP) reading has a maximum value of 100 psig (7.5 bars). The actual suction pressure must be lower than 100 psig (7.5 bars) in order to perform this test.
4. Manually defrost unit:
   a. Defrost unit and terminate automatically. A typical defrost cycle time is 5-20 minutes.
   b. Visually verify that all ice is cleared from evaporator coil. Refer to **Section 3.4.9**.
5. Check compressor suction modulation valve (CSWV). Refer to **Section 6.10.7**.
6. Visually inspect unit for damage to the liquid line causing a restriction or any signs of temperature drop at the drier. Ensure all tubing from the receiver to the evaporator section is in good condition, and that there is no temperature drop at the drier or anywhere on the liquid line.
7. Check Expansion Valve (TXV):
   a. Visually inspect valve. Bulb must be clamped tightly and insulated.
   b. Check valve superheat. Refer to **Section 6.10.8**.

00019 Low Fuel Level Shutdown

- **Trigger-on Condition:**
  If the Low Fuel Level is configured as YES and the fuel level is <= 10% for 1 minute, while the run relay is energized and not cranking the engine and Alarm 00126 (Fuel Sensor Check) is not active.
- **Control Response:**
  If the system is in Diesel Engine mode, then this is a required shutdown.

  If the system is in Standby Electric mode and the alarm is active, then alarm condition only.
- **Trigger-off Condition:**
  If the Low Fuel Level is configured YES and the system is in Diesel Engine mode AND low fuel level input = level okay for 30 seconds.

  OR, if the Low Fuel Level is configured as YES and the fuel level > 12% for 1 minute.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check for Low Fuel Level: Check level in the tank. Add fuel as needed.
2. Check Low Fuel Level sensor: Refer to procedure for **00126 Fuel Sensor Check**.

00020 Maximum Compressor Alarms

- **Trigger-on Condition:**
  Alarms 00013 (High Pressure), 00017 (Discharge Temperature), 00018 (Low Pressure Shutdown), 00027 (High Suction Pressure), 00028 (Low Delta Pressure Refrigeration System), or 00029 (Check Heat Cycle) individually occur three times within the last two hours of engine running time. This alarm is enabled by configuring the Compressor Alarm Shutdown to YES and installing the Test 6 Option. Otherwise it is inactive.

  NOTE

  This alarm cannot be cleared from the active queue. If this alarm is activated, both this alarm and the alarm that caused it will remain in the active alarm queue after power cycle.

- **Control Response:**
  Required shutdown.

- **Trigger-off Condition:**
  Reset from inactive alarm list only. Cannot be reset by turning switch OFF and then ON again.

  NOTE

  Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Determine which alarm activated this alarm:
   a. Check active alarm list for Alarm 13, 17, 18, 27, 28, or 29. One or more of these will be present.
   b. Follow the troubleshooting steps for the alarm(s) found, and correct the alarm condition. All alarm conditions must be corrected
2. Reset all inactive alarms. All alarms must be cleared to start unit.

00021 Technician Reset Required

- **Trigger-on Condition:**
  Alarms 00011 (Low Oil Pressure), 00012 (High Coolant Temperature), 00129 (Coolant Temp Sensor Check), 02006 (Started Output Fault) or 03002 (Clutch Slip). Alarms 11, 12 and 03002 are programmable in the unit; configurations 00129 and 02006 are automatic.
- **Control Response:**
  Required shutdown.
- **Trigger-off Condition:**
  Reset from inactive alarm list only. Cannot be reset by turning switch OFF and then ON again.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Determine which alarm activated this alarm:
   a. Check active alarm list for Alarm 0011 or 0012. One or more of these alarms will be present.
   b. Follow the troubleshooting steps for the alarm(s) found, and correct the alarm condition.
2. Reset all inactive alarms. All alarms must be cleared to start unit.

00027 High Suction Pressure

- **Trigger-on Condition:**
  If the system is in Diesel Engine mode and the engine is running and Suction Pressure > 98 psig (6.8 bar) for 10 minutes.

  OR, if the system is in Standby Electric mode and the compressor is running and Suction Pressure > 98 psig (6.8 bar) and in cool for 10 minutes.
- **Control Response:**
  If configured for High Suction Pressure Shutdown, then this is a required shutdown.

  If not configured for High Suction Pressure Shutdown, then this is an alarm condition.
- **Trigger-off Condition:**
  When suction pressure < 75 psig (5.17 bar) for five minutes and configured for Alarm condition only.

  OR, after alarm minimum engine off time and alarm is configured as a Shutdown Alarm.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check System Pressures: Install manifold gauge set, and check and compare compressor discharge and suction pressures with those shown in Unit Data.
   - Suction pressure must be above 3 psig (0.2) bar and should be in the normal range for ambient and refrigerated compartment conditions.
   - Suction and discharge pressures must have the same reading on gauges and Unit Data.

   NOTE

   Compressor suction pressure (CSP) reading has a maximum value of 100 psig (7.5 bars) The actual suction pressure must be lower than 100 psig (7.5 bars) in order to perform this test.
2. Check Compressor Drive Coupling: Verify that compressor coupling is intact and the compressor crankshaft is turning. Repair as required.
3. Check Refrigerant Charge: Charge must be correct. Refer to **Section 6.7.5**.
4. Check Expansion Valve (TXV):
   a. Visually inspect valve. Bulb must be clamped tightly and insulated.
   b. Check MOP of valve.
   c. Check valve superheat. Refer to **Section 6.10.8**.
5. Check Compressor:
   a. Perform Pump-Down Test. Refer to **Section 6.7.5**. Must hold a vacuum and not equalize in a short period of time.
   b. Cover condenser and build-up discharge pressure. Must be able to raise pressure to 400 psig (27.2 bars).
   c. Disassemble and inspect compressor valve plates, cylinder suction valves, cylinder discharge valves and pistons, etc. All must be intact, clean, and in good working order.

00028	Low Delta Pressure Refrigeration System

- **Trigger-on Condition:**
  If the system is in Diesel Engine mode and the engine is running and Discharge Pressure - Suction Pressure < 5 psig (0.34 bar) for 10 minutes.

  OR, If the system is in Standby Electric mode and the compressor is running and Discharge Pressure - Suction Pressure < 5 psig (0.34 bar) for 10 minutes.

- **Control Response:**
  If configured for Check Refrigeration System Shutdown, this is a required shutdown.

  If not configured for Check Refrigeration System Shutdown, this is an alarm condition only.

- **Trigger-off Condition:**
  Alarm is auto reset when (Discharge Pressure - Suction Pressure) > 20 psig (1.26 bars) and alarm condition only.

  OR, if alarm minimum engine off time and alarm shut down.

  Alarm may be manually reset via keypad or by turning the alarm unit off, then back on again.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check Compressor Drive Coupling: Verify that compressor coupling is intact and the compressor crankshaft is turning. Repair as required.
2. Check Sensors and/or Transducers: Using an accurate temperature measurement device or pressure measurement device, check SAT and RAT readings. Must be the same on measurement device as they are in Unit Data.
3. Check compressor:
   a. Perform Pump-Down Test. Refer to **Section 6.7.5**. Must hold a vacuum and not equalize in a short period of time.
   b. Cover condenser and build-up discharge pressure. Must be able to raise pressure to 400 psig (27.2 bars).
   c. Disassemble and inspect compressor valve plates, cylinder suction valves, cylinder discharge valves and pistons, etc. Must be intact, clean, and in good working order.

00029 Check Heat Cycle

- **Trigger-on Condition:**
  If SAT is <= RAT minus 3F (1.5C) for one continuous minute after the initial 10 minute period in Heat mode.
- **Control Response:**
  Required alarm.
- **Trigger-off Condition:**
  Alarm is auto reset after 15 minutes.

  Alarm may be manually reset via keypad or by turning the alarm unit off and then back on again.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Check Refrigeration System Heating: Refer to **Section 7.3.4** Refrigeration System Not Heating.

00030 Min Run Time Fail

- **Trigger-on Condition:**
  The unit has shut down on an alarm three times without having run for at least 15 minutes between each shutdown.
- **Control Response:**
  If Unit Operation configuration parameter is Standard OR if Unit Operation configuration parameter is Rail AND the Rail Shutdown Override is not in effect OR the number of Rail Restarts has been exhausted OR the engine has not been off for 240 minutes, then this is a required shutdown.

  If Unit Operation configuration parameter is Rail and the engine has been off for 240 minutes and the Rail Shutdown Override is in effect and the number of Rail Restarts has not been exhausted, then this is an alarm condition only.
- **Trigger-off Condition:**
  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Check for Alarms: Check for shutdown alarms. Alarm conditions must be corrected and the alarm(s) cleared to continue.

00031 Auto Start Fail

- **Trigger-on Condition:**
  If the system is in Diesel Engine mode AND the engine fails to start on three consecutive attempts while the engine is in Auto Start mode.
- **Control Response:**
  If the system is in Diesel Engine mode, this is a required shutdown if configuration parameter is Standard OR if Unit Operation configuration parameter is Rail AND the Rail Shutdown Override is not in effect OR the number of Rail Restarts has been exhausted OR the engine has not been off for 240 minutes.

  OR, if Unit Operation configuration parameter is Rail and the engine has been off for 240 minutes and the Rail Shutdown Override is in effect and the number of Rail Restarts has not been exhausted, then this is an alarm condition only.

  If the system is in Standby Electric mode and the alarm is active, then this is an alarm condition only.
- **Trigger-off Condition:**
  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check for additional alarms:
   - If this alarm is triggered in conjunction with other alarms (00041, 00071, 00072, 00078, 00079, 00080, 00085 or 00086) check F5 and F10. Fuses must be good.
   - Replace fuse(s) as required, clear alarms, restart and check for repeat alarm(s).
2. Check for low fuel level: Check fuel level in the fuel tank. Add fuel as needed to the fuel tank.
3. Check for Alarms: Check for alarm 00035 (Engine Failed to Crank). Alarm conditions must be corrected and the alarm cleared to continue.
4. Check ENCU and Fuel Speed Actuator:
   a. Check voltage through fuse F5 from TPC-13 to ENCU-22. Verify correct fuse, see **Figure 2.3**. Must have minimum 11 VDC.
   b. Check voltage at ENCU-44. Must have minimum 11 VDC.
   c. Check for ground from terminal 1 and ECU-19 to TPC-25. Verify good ground. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.
   d. Inspect fuel/speed actuator (FSA), engine speed sensor (ENSSN) and engine speed control unit (ENCU) connector pins and terminals. No physical damage to components. No damage or corrosion in connectors.
   e. Check resistance and amp draw of FSA.
   f. Check FSA plunger. Must move in and out freely, refer to engine manual
5. Check engine air-intake system:
   a. Check air cleaner indicator. Flag must not be visible.
   b. Inspect air intake system. Verify hoses and tubes in good condition. Check for kinks or restrictions.

6. Check engine air-intake system:
   a. Check air cleaner indicator. Flag must not be visible.
   b. Inspect air intake system. Verify hoses and tubes in good condition. Check for kinks or restrictions.
7. Check for correct engine oil: The viscosity must be correct for ambient conditions.
8. Check engine exhaust system: Inspect the exhaust system. Must be clear and unobstructed.
9. Check engine: Check engine compression. Refer to Engine Workshop manual.

00034 Engine Failed to Stop

- **Trigger-on Condition:**
  If the system is in Diesel Engine mode AND there is an attempt to shut the engine off after starting or attempting to start. And the Engine RPM > 500 RPM for 20 seconds OR the oil pressure switch is closed for 20 seconds after the unit shutdown or cycle off.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Verify that engine is still running. Engine should not be running.
2. Check Start/Run-Off switch and circuit:
   - Check SROS. Must be in the OFF position.
   - Check two way communication equipment. Must not be wired so unit can start with SROS in the OFF position. Correct wiring.
3. Check for Alarm **00130 Engine RPM Sensor Check**
4. Check for Alarm **00011 Low Oil Pressure**
5. Check Fuel/Speed Actuator (FSA) and Circuit: Check voltage to ENCU. Must be 0 VDC at ENCU 44.
6. Check FSA plunger:
   - Must move in and out freely.
   - Refer to engine manual.

00035 Engine Failed to Crank

- **Trigger-on Condition:**
  If the system is in Diesel Engine mode AND the engine speed fails to reach 50 RPM after two attempts.
- **Control Response:**
  If the system is in Diesel Engine mode, then this is a required shutdown.

  If the system is in Standby Electric mode and the alarm is active, then this is an alarm condition only.
- **Trigger-off Condition:**
  Reset the attempt counter when successful crank of the engine OR when trigger off condition for the alarm has occurred.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check starting sequence: Check to see if engine starts, runs for a few seconds then shuts off.
   - If it does not start, continue with Step 2.
   - If it does start, check engine speed sensor. Refer to the procedure for alarm **00130 Engine RPM Sensor Check**.
2. Check starter solenoid circuit:
   a. Place RSS in the START/RUN position. After buzzer sounds, check for power at the starter solenoid and TPC-19. Verify a minimum 11 VDC. If not, check connectors and wiring between terminals. Check for damage, moisture or corrosion.

   b. Inspect wiring to starter motor. (See wiring schematic in **Section 8**). Verify no physical damage to wiring or battery cable end. Check for damage or corrosion in connections.
3. Check starter:
   a. Inspect starter and wiring. (See wiring schematic in **Section 8**) Check for damage or corrosion. Wiring and battery cable must be clean and tight.

   b. Check voltage to starter motor. Must be above 10 VDC while cranking.

   c. Check resistance of starter motor.

   d. Check amperage draw of starter.
4. Check battery voltage:
   a. Inspect battery cable ends and posts. Must be clean and tight with no corrosion.

   b. Test voltage at battery with unit off. Minimum 11 VDC.

   c. Perform load test on battery. Follow battery manufacturer's procedure.

5. Check ENCU and fuel speed actuator:
   a. Check voltage through fuse F5 fuse from TCP-13 to ENCU-22. Verify correct fuse, see **Figure 2.8**. Must have minimum 11 VDC.
   b. Check voltage at ENCU-44. Must have minimum 11 VDC.
   c. Check for ground from ENSSN terminal 1 and ENCU-19V to TPS-25 to TCP battery ground in control box. Verify a good ground. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.
   d. Inspect fuel/speed actuator (FSA), engine speed sensor (ENSSN) and engine speed control unit (ENCU) connector pins and terminals. Verify that there is no physical damage to components, and no damage or corrosion in connectors.
   e. Check resistance and amp draw of FSA.
   f. Check FSA plunger. Must move in and out freely, refer to engine manual
6. Check for correct engine oil: Check viscosity is correct for ambient conditions. Refer to **Table 2–6**.

00036 Low Coolant Temperature

- **Trigger-on Condition:**
  If the system is in Diesel Engine mode AND the Coolant Temperature Sensor Alarm is not active AND coolant temperature < 32°F (0°C) and the engine has been running for five minutes.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  If the system is in Diesel Engine mode AND coolant temperature > 36°F (2.2°C) AND the Coolant Temperature Sensor Alarm is not active and the engine is running.

  Or, alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check coolant temperature: Check temperature of coolant or upper radiator hose. Must be above 32°F (0°C).
2. Check engine coolant sensor: Refer to procedure for Alarm **00129 Coolant Temperature Sensor Check**.

00037 Check Low Speed RPM

- **Trigger-on Condition:**
  If the system is in Diesel Engine mode AND Alarm 00130 (Engine RPM Sensor Check) is not active AND the unit is running low speed AND engine RPM is valid for 60 seconds, with the engine RPM <1480 or >1820.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  Alarm is auto reset if the system is in Diesel Engine mode AND the unit is running low speed and the engine RPM between 1530 and 1770 (1680 and 1920 for TDx58 - 458A).

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check model number: Verify that the model number on the nameplate matches the model number in the Unit Data. Enter the correct number in Configurations.
2. Force low speed operation: Ensure system is calling for low speed when performing steps 3 and 4.
3. Check engine speed:
   a. Check actual engine speed using hand held tachometer. Speed must be within range shown above for this model.
   b. Compare actual speed with that shown in Unit Data. Readings must be within ± 50 RPM.
4. Check for proper voltage at Engine Speed Control Unit (ENCU):
   a. Check voltage at ENCU-19. Must be 0 VDC. If not, check connectors and wiring between terminals. ENCU19 and TPC25. Verify no damage, moisture or corrosion.
   b. Check ENCU-22. Should be a minimum 11 VDC. If not, check connectors and wiring ENCU and TPC13.
5. Check Fuel/Speed actuator (FSA): Check FSA plunger. Must move in and out freely, refer to engine manual.
6. Inspect air intake system. Verify that the hoses and tubes are in good condition, with no kinks or restrictions.
7. Check engine exhaust system: Must be clear and unobstructed.

00038 Check High Speed RPM

- **Trigger-on Condition:**
  If the system is in Diesel Engine mode and Alarm 00130 (Engine RPM Sensor Check) is not active, this alarm will occur when the unit is running in high speed and engine RPM is valid for 60 seconds and:

  - Unit is TDx56xxxxxxx and engine RPM < 2120 or engine RPM > 2520

  - Unit is TDx57xxxxxxx and engine RPM < 1800 or engine RPM > 2200

  - Unit is TDx58xxx3xxx and engine RPM < 1900 or engine RPM > 2300

  - Unit is TDx59xxxAxxx and engine RPM < 1900 or engine RPM > 2300

  - Unit is TDx5Axxxxxxx and engine RPM < 1800 or engine RPM > 2200

- **Control Response:**
  Alarm condition only.

- **Trigger-off Condition:**
  If control system is calling for high speed operation and the speed is within the range for this unit for 60 seconds.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check model number:

   a. Verify that the model number on the nameplate matches the model number in the Unit Data.

   b. Enter the correct number in Configurations.

2. Force High Speed operation:

   a. Place unit in continuous run, adjust setpoint above 20°F (-7°C) and set the Air Flow Functional Parameter to HIGH.

   b. Reset following testing. System should run in high speed. If not, check speed overrides.

   c. Verify system is calling for high speed when performing steps 3 and 4.

3. Check engine speed:
    a. Check actual engine speed using hand held tachometer. Speed must be within range shown above for this model.
    b. Compare actual speed with that shown in Unit Data. Readings within ± 50 RPM.
4. Check for proper voltage at Engine Speed Control Unit (ENCU):
    a. Check ENCU-19. Must be 0 VDC. If not, check connectors and wiring between terminals ENCU and TPC25. Verify no damage, moisture or corrosion.
    b. Check ENCU-22. Must be minimum 11 VDC. If not, check connectors and wiring between ENCU22 and TPC13.
5. Check Fuel/Speed actuator (FSA): Check FSA plunger.
    - Must move in and out freely.
    - Refer to engine manual.
6. Check Engine Air-Intake system: Inspect air intake system. Ensure the hoses and tubes are in good condition, and there are no kinks or restrictions.
7. Check engine exhaust system: Must be clear and unobstructed.

00039 Check Engine RPM

- **Trigger-on Condition:**
  The system is in Diesel Engine mode and Alarm 00130 (Check Engine Speed Sensor) is not active AND the engine is running AND the engine RPM < 1200 RPM or engine RPM > 2500 RPM for five minutes or <1000 RPM for 30 seconds.
- **Control Response:**
  If the Check Engine RPM Alarm is configured for shutdown AND if the system is in Diesel Engine mode, then this is a required shutdown.

  If the Check Engine RPM Alarm is configured No AND the system is in Diesel Engine mode, then this is an alarm condition only.

  If the system is in Standby Electric mode and the alarm is active, then this is an alarm condition only.
- **Trigger-off Condition:**
  Alarm is auto reset if engine speed is within the specified range for five minutes.

  Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check Fuel/Speed Actuator (FSA): Check FSA plunger. Must move in and out freely, refer to engine manual.
2. Check engine air-intake system: Inspect air intake system. Hoses and tubes in good condition. No kinks or restrictions.
3. Force Low Speed operation:
   a. Set the High Speed Delay functional parameter to 10 minutes and restart unit.
   b. Reset following testing. System should run in low speed. If not, check speed overrides.
   c. Verify system is calling for low speed when performing step 4.
4. Check Low Speed Engine RPM:
   a. Check actual engine speed using hand held tachometer. Speed must be within range. Refer to **Table 2–8**.
   b. Compare actual speed with that shown in Unit Data. Readings within ± 50 RPM.
5. Force High Speed operation: Place unit in continuous run, and adjust setpoint above 11°F (-12°C). The System should run in High Speed. If not, check speed overrides. Verify system is calling for high speed when performing step 6.
6. Check High Speed Engine RPM:
   a. Check actual engine speed using a hand held tachometer. Refer to **Table 2–8**.
   b. Compare actual speed with that shown in Unit Data. Both readings within ± 50 RPM.

00041	Engine Stalled

- **Trigger-on Condition:**
  If the system is in Diesel Engine mode AND if engine running and Alarm 00130 (Check Engine Speed Sensor) is not active and RPM < 700. OR, If the system is in Diesel Engine mode AND If engine running and Alarm 130 is active and oil pressure switch is at low pressure.
- **Control Response:**
  If the system is in Diesel Engine mode, then this is a required shutdown. The engine is considered OFF immediately. If the system is in Standby Electric mode and the alarm is active, then this is an alarm condition only.
- **Trigger-off Condition:**
  When the Alarm Minimum Off Time is met OR on a switch to Electric mode.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check for additional alarms: If this alarm is triggered in conjunction with other alarms, check F5 and F11.
   - Fuses must be good.
   - Replace fuse(s) as required.
   - Clear alarms, restart and check for repeat alarm(s).
2. Check for **00130 Engine RPM Sensor Check**. When alarms 130 and 41 occur at the same time, generally the engine has run out or is running out of fuel. This causes the engine speed to surge and drop. Check fuel tank and add fuel as necessary. Check fuel lines between the fuel tank and the fuel pump inlet for air leakage.
3. Check Start/Run-Off Switch and Circuit: Check SROS. Must be in the START/RUN position
4. Check two-way communication equipment. Must be set to allow operation and calling for operation.
5. Check fuel system:
   a. Check for Alarm **00001 Low Fuel Level Warning**. Fill tank as needed.
   b. Check fuel flow.There must be unrestricted fuel flow through system. Pump screen(s) clean. Fuel not gelled.
   c. Check fuel system prime. Verify no air in the fuel system.

6. Check ENCU and Fuel Speed Actuator:

   a. Check voltage through fuse F5 from TCP-13 to ENCU-22. Verify correct fuse, see **Figure 2.4**. Must have minimum 11 VDC.

   b. Check voltage at ENCU-44. Must have minimum 11 VDC.

   c. Check for ground from ENSSN terminal G and ENCU-19 (including SP-2) to GND1RING2. Verify a good ground. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.

   d. Inspect fuel/speed actuator (FSA), engine speed sensor (ENSSN) and engine speed control unit (ENCU) connector pins and terminals. Verify no physical damage to components, and no damage or corrosion in connectors.

   e. Check resistance and amp draw of FSA.

   f. Check FSA plunger. Must move in and out freely. Refer to engine manual.

7. Check Engine Speed Sensor (ENSSN): Inspect harness, connector pins and terminals (See wiring schematic in Section 9). Verify no physical damage to harness. Verify no damage, moisture, or corrosion in connectors.
8. Inspect engine air-intake system: Verify that the hoses and tubes are in good condition, with no kinks or restrictions.
9. Check engine exhaust system -Must be clear and unobstructed.
10. Check engine:
    - Check Injection pump timing. Timing must be correct.
    - Check engine valve adjustment. Rocker arm clearance must be correct.
    - Check engine compression. Refer to engine manual to verify the Compression values.
11. Check Refrigeration System: Check discharge and suction pressures. Must be within normal operating range for conditions

00053 Temperature Out of Range

- **Trigger-on Condition:**
  If setpoint active probe has been in range of ± 2.7°F (± 1.5°C) for perishable or frozen at least once, and then goes outside the tolerance band for 15 minutes (30 minutes if coming out of defrost) if not configured for shutdown and 45 min if configured for shutdown.

  OR, Inadequate cooling/heating is taking place where: the compartment is in Pulldown AND SAT and RAT alarms are not active AND the temp mode is Cool and SAT>RAT-0.56°C or the temp mode is Heat and SAT ≤ RAT for 30 consecutive minutes.

  The tolerance band is defined in the functional parameters (out of range alarm parameter 2°, 3°, 4°C).

  For frozen setpoints, only activate if temperature is above setpoint.

- **Control Response:**
  If out of range is shutdown is configured YES, then this is a Required Shutdown.

  If out of range shutdown is configured NO, then this is an alarm condition only.

  Energize the Out of Range light when this alarm is active and de-energize the Out of Range light when the alarm is not active.

  If in diagnostic mode or in component test mode or the Start/Stop switch is OFF or if the door alarm is active or (Remote Switch 1 or 2 alarm is active AND the remote switch 1 or 2 is configured as either DOOR OPEN SWITCH OPEN or DOOR OPEN SWITCH CLOSED) OR pretrip is in progress OR setpoint change OR in sleep mode, reset the tolerance band time and in range indication so that the unit must go into tolerance band again before the alarm is activated.

  If the unit shutdowns due to a required or unconditional alarm, allow the timer to continue and set the in range indication so the alarm will trigger on when the timer expires. (unless a door switch or (remote switch and configured as a door switch) shutdown alarm is active).

  If Alarm Reset, do NOT reset the timers and the in-range flag if the alarm was not active unless the unit was shutdown on a shutdown alarm. If alarm reset and unit was shutdown on a shutdown alarm, reset the tolerance band time and the reset the in range indication.

  This alarm will not go in the inactive queue.

- **Trigger-off Condition:**
  When the temperature (setpoint - active probe) is within ± 2.7°F (± 1.5°C) for perishable setpoints or for frozen setpoints. OR, triggered on due to an inadequate heat/cool and any one of those conditions which caused it to no longer exist.

  Alarm be manually reset via keypad or by turning the unit off, then back on again.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check compartment doors: Inspect all compartment doors. Must be closed, with no air leakage.
2. Defrost evaporator: Initiate a manual defrost cycle. Must terminate automatically. All ice is cleared from evaporator coil.
3. Check for any Shutdown Alarm(s): Check the Alarm List for any shut-down alarms. Alarm conditions must be corrected and the alarm cleared to continue.
4. Check for Alarm **00018 Low Pressure Shutdown**. Alarm conditions must be corrected and the alarm cleared to continue.
5. Check refrigerant charge: Refer to **Section 6.7.5** for correct charge information. Must be correct.
6. Check system pressures:
   - Install manifold gauge set, and check and compare compressor discharge and suction pressures with those shown in Unit Data.
   - Pressures must be in the normal range for ambient and refrigerated compartment temperature conditions.
   - Suction and discharge pressures must have the same reading on gauges and in Unit Data.

   NOTE

   Compressor suction pressure (CSP) readings have a maximum value of 100 psig (7.5 bars). The actual suction pressure must be lower than 100 psig (7.5 bars) in order to perform this test.
7. Check for Low Delta-T: Read Delta-T from Unit Data. In Cool, the Delta-T must be greater than -1°F (-0.56°C). In Heat, the Delta-T must be greater than 0 (SAT must be higher than RAT).

8. Check system pressures:
   - Install manifold gauge set, and check and compare compressor discharge and suction pressures with those shown in Unit Data.
   - Pressures must be in the normal range for ambient and refrigerated compartment temperature conditions.
   - Suction and discharge pressures must have the same reading on gauges and in Unit Data.

   NOTE

   Compressor suction pressure (CSP) readings have a maximum value of 100 psig (7.5 bars). The actual suction pressure must be lower than 100 psig (7.5 bars) in order to perform this test.

9. Check for Low Delta-T: Read Delta-T from Unit Data. In Cool, the Delta-T must be greater than -1°F (-0.56°C). In Heat, the Delta-T must be greater than 0 (SAT must be higher than RAT).

00054 Defrost Terminated by Time

- **Trigger-on Condition:**
  The defrost cycle did not complete within 45 minutes.
- **Control Response:**
  Defrost is terminated. This is an alarm condition only.
- **Trigger-off Condition:**
  Alarm is auto reset when the defrost cycle is initiated.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check Refrigerant Charge: Refer to **Section 6.7.5** for Refrigerant Charge procedure. Verify the charge is correct.
2. Check for Alarm **00018 Low Pressure Shutdown**. Alarm conditions must be corrected and the alarm cleared to continue.
3. Check DTS:
   a. Using a service (test) thermometer check temperature of evaporator tube sheet at DTS location and compare with Unit Data. Must be within ±2°F (±1°C).
   b. Check DTS and RAT wiring. Verify that RAT temperature is being displayed as RAT in unit Unit Data and that DTS is being dis-played as DTS. Correct wiring if required.
   c. Check DTS and SAT resistance. 10K Ohms @ 77°F (25°C). Refer to **Table 6.34** for chart of resistances for different sensors.
   d. Inspect DTS. Verify that it is fastened securely in place. The flat area of DTS must be against the metal surface.
4. Check the refrigeration system heating system:
   a. Refer to **Section 7.3.4** to troubleshoot a problem with the Heating function.
   b. If the unit is equipped with LIV, check that this valve is open during a defrost.

00055 Defrost Override

- **Trigger-on Condition:**
  If the external defrost signal goes active within eight minutes of two consecutive defrost terminations. The external defrost signal must be high continuously for 15 seconds before the signal is considered "active."
- **Control Response:**
  Alarm condition and defrost signal not used for defrost initiation. The manual defrost switch can cause a new 45 minute Defrost cycle. The Defrost Interval is set to 1.5 hours.
- **Trigger-off Condition:**
  Alarm is auto reset when the defrost cycle terminates correctly, and the external defrost signal does not activate for eight minutes after a defrost.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check condition of refrigerated compartment and load:
   a. Check condition of the refrigerated compartment doors and seals. Doors must be closed, and the door seals must seal and prevent entrance of outside air.
   b. Check condition of the evaporator. Check for blockage sufficient to cause an air pressure differential across the coil great enough to close the contacts of the defrost air switch. Coil must be free of ice following defrost.
   c. Check condition of product. If product is warm and moist, frequent defrost cycles can be expected.
2. Check DAS power and wiring:
   a. Inspect switch, connector pins and terminals. Verify no physical damage to switch. Verify no damage or corrosion in connections.
   b. Energize the circuit. Check for power at the switch connector. Should be a minimum of 11 VDC. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.
   c. Check for continuity from switch connector plus terminal to 2SIOB-1. Must be good continuity. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.
   d. Check for continuity from switch connector minus terminal to 2SIOB-24. Must be good continuity. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.
3. Check Defrost Air switch and tubing, and perform testing as required.

00059 Data Recorder Memory Fail

- **Trigger-on Condition:**
  If 131,072 bytes or more of consecutive data recorder flash memory cannot be erased or written.
- **Control Response:**
  Alarm only.
- **Trigger-off Condition:**
  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Clear alarm:
   a. Clear active alarms.
   b. Check for active alarm re-occurrence. If inactive, download all data and retain.
2. Main microprocessor defective:
   a. Download previous data using a TRU-Tech. Verify that data retrieval is OK.
   b. Replace and setup the main microprocessor.

00060 Real Time Clock Fail

- **Trigger-on Condition:**
  The checksum of the Real Time Clock is invalid at initialization.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  Alarm is auto reset after Real Time Clock is set. Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check Real Time Clock in the Unit Data, or using TRU-Tech. Must show correct date and time. Change as needed.
2. Reset microprocessor:
   a. Place the RSS in the OFF position for 30 seconds and then return it to the START/RUN position. Verify that the microprocessor powers up OK.
   b. Check for valid Real Time Clock reading in Unit Data. Valid date and time in memory. Alarm is cleared automatically.
   c. Real Time Clock cannot be changed. Proceed to step 3.
3. Main microprocessor defective:
   a. Download previous data using a TRU-Tech. Verify that data retrieval OK.
   b. Replace and setup the main microprocessor.

00061 Door Open

- **Trigger-on Condition:**
  If the door switch configuration parameter is Door Open Switch Open and the Door Switch Input is 0 for five seconds while the engine is not cranking and the Stop/Run Switch is ON and the door switch shutdown configuration parameter does not equal Data Recorder Only.

  OR, if the door switch configuration parameter is Door Open Switch Closed and the Door Switch Input is 1 for five seconds while the engine is not cranking and the Stop/Run Switch is ON and the door switch shutdown configuration parameter does not equal Data Recorder Only.

- **Control Response:**
  If the Door Switch is configured for Unit Shutdown and the Override Door Switch Shutdown Functional Parameter is No and not (sleep mode and the Unit Operation configuration is Rail) and (if the Door Open Unit Shutdown Below configuration is OFF or if NOT off, the ambient < the configuration value), then this is a required shutdown.

  The required shutdown will be the greater of three minutes or the remainder of the 15 minute timer if another shutdown alarm is active.

  Otherwise, alarm condition only.

- **Trigger-off Condition:**
  If the door switch configuration parameter is Door Open Switch Open and the Door Switch Input is 1 for five seconds while the engine is not cranking and Stop/Run Switch is ON.

  OR, if the door switch configuration parameter is Door Open Switch Closed and the Door Switch Input is 0 for five seconds while the engine is not cranking and the Stop/Run Switch is ON.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions if a Switch is Installed

1. Determine What DS1 is activated by: DS1 may be connected to a compartment door. Locate the device used as DS1.
2. Check to See if DS1 has activated: Inspect device used to activate DS1. For example, compartment door must be closed, and switch must be de-activated.
3. Check Configuration for DS1: Verify that Configuration is set for the type of switch being used (i.e. when switch is activated, switch contacts are closed; etc.). Configuration must agree with switch type.
4. Check wiring:

   a. Visually inspect wiring to DS1. Wiring must be connected.

   b. Visually inspect condition of switch. Must not be damaged, wet, corroded, etc.

   c. Check circuit. (See wiring schematic in Section 9) With the switch contacts closed, check for minimum 11 VDC from 2MM-14, through the wiring and switch back to 2SIOB-14 to 2SIOB-25.

Corrective Actions if a Switch is not Installed

1. Check Configurations: Any switch/sensor not present in the unit should not be Configured “ON”. Correct configurations.
2. Check REM Connector:

   a. Locate and inspect the 10-position connector for optional sensors and switches (see wiring schematic in Section 9).

   b. Connector must have a cap on.

   c. Verify there is no corrosion or moisture inside connector. If there is a problem with the connector and there are no remote sensors or switches in the unit, the connector may be removed and each individual wire separated from the others, terminated and insulated with heat shrink.

00073 Standby / No AC Power

- **Corrective Actions if a Switch is Installed:**
  The system is in Standby Electric mode AND the AC power input is not present AND No Power configuration is shutdown or Switch to engine for four seconds.

  A/C Power detection is based off of discrete inputs that read the feedback from both MC1 and MC2.

- **Control Response:**
  If Engine Operation is active, the system will remain in Engine Operation.

  Electric Operation:

  If the “NO A/C POWER” Configuration is set for “Alarm and shutdown” the refrigeration system will shutdown (because of the loss of power) with the alarm on and PSCON still energized.

  If the “NO A/C POWER” Configuration is set to “Switch To Diesel” the unit will remain off for five minutes, then start the engine. The unit will remain in Engine Operation until the minimum run time has expired (regardless if the unit is set for Start Stop or Continuous) and until electric power has been restored continually for five minutes.

- **Trigger-off Condition:**
  This alarm is not allowed to reset if in defrost. This is done to allow defrost to complete before attempting the AC sensing logic. This alarm is cleared per the switch to diesel logic to allow a transition to electric mode to determine if AC is present.

  Alarm may be manually reset via keypad or by turning the unit off, then back on.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check circuit breaker on main external power supply:
   a. Check the 50A supply circuit breaker. It must be on.
   b. Check the voltage in the plug. It must be 200-230/3/50-60Hz.
2. Check power cord:
   a. Inspect connections in the socket and the plug. Connections must be tight.
   b. Inspect the cable. Cable must not be frayed, cut or damaged.
   c. Check for proper power phase position. Manually switch phases if incorrect.
3. Check for power in the control box:
   a. Check for voltage at MC1L1-L2, L2-L3, L1-L3. All three readings must be 230V ±10%.
   b. Check for voltage at MC2 L1-L2, L2-L3, L1-L3. All three readings must be 230V ±10%.
4. Check for bad connections in the control box. Connections and wire crimps must be tight.

00081 Check Fuel Heater Relay

- **Trigger-on Condition:**
  Fuel Heater Relay is Active and Fuel Heater Relay FET is sensed bad (feedback from FET output is low).

  OR, Fuel Heater Relay is Not Active and Fuel Heater Relay FET is sensed bad (feedback from FET output is high).
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  If alarm was activated when Fuel Heater Relay was active, trigger off if Fuel Heater Relay is Active and Fuel Heater Relay FET is sensed good.

  OR, if alarm was activated when Fuel Heater Relay was inactive, trigger off if Fuel Heater Relay is Inactive and Fuel Heater Relay FET is sensed good.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check F11 fuse.
2. Check wire from TPC30 to fuel heater relay 86.
3. Check fuel heater relay ground 85 to SP7.

00084 Check Remote Fault Light

- **Trigger-on Condition:**
  Fault output is active and Fault Output FET is sensed short (feedback from FET output is low).

  OR, Fault Output is not active and Fault Output FET is sensed bad (feedback from FET output is high).
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  If alarm was activated when Fault Output was active, trigger off if Fault Output is Active and feedback from Fault FET output is sensed good becomes inactive.

  OR, if alarm was activated when Fault Output was inactive, trigger off if Fault Output is Inactive and Fault Output FET is sensed good.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check light bar and connector.
2. Check F11 Fuse
3. Check wiring from
   - TPC31 to LBB
   - TPC20 to LBH
   - LBG to SP7

00093 Check Prestart (Check Prestart Buzzer)

- **Trigger-on Condition:**
  The buzzer is shorted or open.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  Auto reset when buzzer amp draw is normal or via keypad or power cycling the unit.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check buzzer and wiring connections. No damage to buzzer or corrosion.
2. Check buzzer resistance. Cannot be open (infinite ohms) or shorted (zero ohms)
3. Check buzzer wiring harness. Verify no pinched or broken wires from buzzer to TPC.
4. Check F6 fuse.

00109 Evap Fan

- **Trigger-on Condition:**
  Evap Fan output is active and Evap Fan (main compartment) Output FET is sensed short (feedback from FET output is low).

  OR, Evap Fan (main compartment) output is not active and Evap Fan output FET is sensed bad (feedback from FET output is high).
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  If alarm was activated when Evap Fan was active, trigger off if Evap Fan Output is Active and Evap Fan Output FET is sensed good.

  OR, If alarm was activated when Evap Fan was inactive, trigger off if Evap Fan is inactive and Evap Fan FET is sensed good.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check fuse, wiring and relay from FRB
2. If all check out okay, the fault can be a defective FET on the SIO board (2SIOB-9).

00114 LIV Circuit

- **Trigger-on Condition:**
  LIV output is active and LIV output FET is sensed shorted or open.
- **Control Response:**
  Alarm only
- **Trigger-off Condition:**
  LIV output is active and LIV output FET is sensed good.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Verify unit is equipped with an LIV

1. If no LIV present, check configuration “Select Byte Configuration” 1 = No LIV and 0 = LIV Present
2. If LIV is present in the unit:
   a. Check for shorted or open coil
   b. Check wiring between 2SIOB9 and LIV coil.

00121 Ambient Air Sensor Check

- **Trigger-on Condition:**
  Ambient Air Temperature Sensor (ATS) is out of range (-53° – 158°F (-47° – 70°C).
- **Control Response:**
  Alarm and a value of 122°F (50°C) will be used for any calculations.
- **Trigger-off Condition:**
  Alarm is auto reset when Ambient Air Temperature Sensor (ATS) is in range.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check sensor:
   a. Inspect sensor and connector. Verify no damage to sensor and no damage, moisture, or corrosion in connector.
   b. Check sensor resistance. Must be 10,000 Ohms @ 77°F (25°C). Refer to **Table 6.34** for chart of resistances for different sensors.
2. Check sensor wiring:
   a. Inspect connector pins and terminals at sensor and connector 2MCA. (See wiring schematic in Section 9). Verify no physical damage to harness and no damage, moisture, or corrosion in connectors.
   b. Place the system in PC mode. Disconnect sensor from harness. Check for 3.0 ± 0.1 VDC at harness plug between pins. Voltage should be 3.0 ± 0.1 VDC volts at harness plug between pins. This verifies microprocessor output and wiring connections to the sensor.

00122	Return Air Sensor Check

- **Trigger-on Condition:**
  Return Air Temperature sensor (RAT) is out of range.
- **Control Response:**

  - If Alarm **00123 Supply Air Sensor Check** is not active: alarm and switch to supply air control.

  - If Alarm **00123 Supply Air Sensor Check** is also active, alarm and the System will enter Cargo Protect mode.
- **Trigger-off Condition:**
  Alarm is auto reset when Return Air Temperature Sensor (RAT) is in range.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check sensor:

   a. Inspect sensor and connector. Verify no damage to sensor and no damage, moisture, or corrosion in connector.

   b. Check sensor resistance. Must be 10,000 Ohms @ 77°F (25°C). Refer to **Table 6.34** for chart of resistances for different sensors.

2. Check sensor wiring:

   a. Inspect connector pins and terminals at sensor and connector 2MCA. (See wiring schematic in Section 9). Verify no physical damage to harness and no damage, moisture, or corrosion in connectors.

   b. Place the system in PC mode. Disconnect the sensor from the harness. Check for 3.0 ± 0.1 VDC at the harness plug between pins. Voltage should be 3.0 ± 0.1 VDC volts at the harness plug between pins. This verifies microprocessor output and wiring connections to the sensor

00123	Supply Air Sensor Check

- **Trigger-on Condition:**
  The Supply Air Temperature sensor (SAT) is out of range
- **Control Response:**
  If Alarm **00122 Return Air Sensor Check** is not active, the Functional Parameter Temperature Control is set for Supply Air and the setpoint is in the perishable range: alarm and switch to return air control.

  OR, if Alarm **00122 Return Air Sensor Check** is also active, alarm and the System will enter Cargo Protect mode.
- **Trigger-off Condition:**
  Alarm is auto reset when the Supply Air Temperature Sensor (SAT) is in range.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check sensor:
   a. Inspect sensor and connector. Verify there is no damage to the sensor, and no damage, moisture, or corrosion in connector.
   b. Check sensor resistance. Must be 10,000 Ohms @ 25°C (77°F). Refer to **Table 6.34** for chart of resistances for different sensors.
2. Check sensor wiring:
   a. Inspect connector pins and terminals at sensor and connector 2MCA. (See wiring schematic in Section 9). Verify no physical damage to harness and no damage, moisture, or corrosion in connectors.
   b. Place the system in PC mode. Disconnect sensor from harness. Check for 3.0 ± 0.1 VDC at harness plug between pins. Voltage should be 3.0 ± 0.1 VDC volts at harness plug between pins. This verifies microprocessor output and wiring connections to the sensor.

00125 Discharge Temperature Sensor

- **Trigger-on Condition:**
  The Discharge Temperature Sensor is out of range (-40° – 392°F (-40° – 200°C)).
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  Alarm is auto reset when the Discharge Temperature Sensor is in range.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check sensor:
   a. Inspect sensor and connector. Verify no damage to the sensor and no damage, moisture, or corrosion in connector.
   b. Check sensor resistance. Must be 10,000 Ohms @ 77°F (25°C). Refer to **Table 6.34** for chart of resistances for different sensors.
2. Check sensor wiring:
   a. Inspect connector pins and terminals at sensor and connector 2MCA. (See wiring schematic in Section 9). Verify no physical damage to the harness and no damage, moisture, or corrosion in connectors.
   b. Place the system in PC mode. Disconnect sensor from harness. Check for 3.0 ± 0.1 VDC at harness plug between pins. Voltage should be 3.0 ± 0.1 VDC volts at harness plug between pins. This verifies microprocessor output and wiring connections to the sensor.

00126 Fuel Sensor Check

- **Trigger-on Condition:**
  If the fuel sensor is configured as YES and the run relay is energized while the engine is not cranking and the fuel level percentage < = 2% for 30 seconds.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  If the fuel sensor is configured as YES and the run relay is energized while the engine is not cranking and the fuel level percentage > 4% for 30 seconds.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check for Low Fuel Level: Check fuel level in tank. Add fuel as needed.
2. Check Sensor Fuse and Wiring: Perform sensor check procedure. If the new sensor is not available, the sensor may be configured OFF temporarily.

00129	Coolant Temperature Sensor Check

- **Trigger-on Condition:**
  The Engine Coolant Temperature sensor (ENCT) is out of range (-58° – 266°F (-50° – 130C)).
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  When the Engine Coolant Temperature sensor (ENCT) is in range.

  :Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check Sensor:
   a. Inspect sensor and connector. Verify no damage to the sensor and no damage, moisture, or corrosion in connector.
   b. Check sensor resistance. Must be 10,000 Ohms @ 77°F (25°C). Refer to **Table 6.34** for chart of resistances for different sensors.
2. Check Sensor Wiring:
   a. Inspect connector pins and terminals at sensor and connector 2MCA. (See wiring schematic in Section 9). Verify no physical damage to the harness and no damage, moisture, or corrosion in connectors.
   b. Place the system in PC mode. Disconnect sensor from harness. Check for 3.0 ± 0.1 VDC at harness plug between pins. Voltage should be 3.0 ± 0.1 VDC volts at harness plug between pins. This verifies microprocessor output and wiring connections to the sensor.

00130 Engine RPM Sensor Check

- **Trigger-on Condition:**
  If the ambient is >32°F (0°C) and this is the second or third start attempt and the engine oil pressure switch is closed and the engine speed is <1000 RPM **OR** if the ambient is <32°F (0°C) and the DC amp draw is > 2 amp and this is the second or third start attempt and the engine speed is sensed < 1000 RPM. This alarm is only activated during the starting sequence of the engine - after crank and before running states.
- **Control Response:**
  Alarm condition and engine is assumed running.
- **Trigger-off Condition:**
  If the system is in Diesel Engine mode and Auto mode and Engine speed > 1000 RPM.

  OR, If the system is in Diesel Engine mode and Manual Start mode and (Oil Pressure Input = OFF OR Engine speed > 1000 RPM).

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check for Alarm 0041 = Engine Stalled:
   a. Check for **00041 Engine Stalled**. When alarms 41 and 130 occur at the same time, generally, the engine has run out or is running out of fuel. This causes the engine to surge.
   b. Check fuel in tank and add fuel as necessary.
   c. Check fuel lines between the fuel tank and the fuel pump inlet to ensure air is not being drawn in.
2. Check Engine Speed Sensor (ENSSN):
   a. Compare actual engine speed with that shown on the display using hand held tachometer. Must be ± 20 RPM. Must be a steady reading.
   b. Inspect sensor, connector pins and terminals. Verify no physical damage to sensor and no damaged or corrosion in connections.
   c. Energize circuit. Check for power from TPC-13 (through fuse F5) to ENCU-22 and from TPC-21 to ENCU-44. (See wiring schematic in Section 9). Minimum 11 VDC. If not check wiring between terminals.
   d. Check for ground at ENSSN-1 and ENCU-19. Verify no broken wires, physical damage or corrosion.
3. Check circuits with test sensor:

   Substitute known good sensor and check Unit Data reading. Must be within ± 50 RPM of reading on tachometer.

00132	Defrost Termination Temp Sensor

- **Trigger-on Condition:**
  Defrost Termination Temperature #2 Sensor is out of range.
- **Control Response:**
  When this alarm is active, the system will use the supply air sensor for defrost initiation. If both this alarm and alarm 00123 are active, the system will use the return air sensor for initiation. In either case defrost will be allowed when the sensor is below 45°F (7°C). Defrost will terminate after 20 minutes.
- **Trigger-off Condition:**
  Evaporator Temperature Sensor is in range.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check Sensor
   a. Inspect sensor and connector.
   b. Check sensor resistance. Must be 10,000 Ohms @ 77°F (25°C).
   c. Refer to **Table 6-4** for chart of resistances for different sensors.
2. Inspect sensor wiring: Check wires from DTS-A to 2MCA-3 and DTS-B to 2MCA-26

00134 Remote Temp Sensor 2

NOTE

The APX control system uses one Defrost Termination Sensor (DTS) and that sensor will activate this "CHECK DEFROST TERM 2 SENSOR" alarm.

- **Trigger-on Condition:** Defrost Termination Temperature Sensor (DTS) is not within the range of -58 to +266°F (-50 to +130°C).
- **Control Response:** When this alarm is active, the system will use only the SAT for defrost initiation. If both this alarm and the **00123 CHECK SUPPLY AIR SENSOR** are active the system will use the RAT for defrost initiation. In either case, defrost will be allowed when the sensor is below 45°F (7.2°C). When this alarm is active defrost will terminate when the SAT reaches 55°F (12.8°C). If both this alarm and **00123 CHECK SUPPLY AIR SENSOR** are both active, defrost will terminate after ten minutes.
- **Trigger-off Condition:** Auto reset when the sensor is in range or, alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions

1. Check Sensor:
   a. Inspect sensor and connector. Verify there is no damage to sensor, and no damage, moisture, or corrosion in connector.
   b. Check sensor resistance. (Refer to Note 3 in **Section 7.2**) 10,000 Ohms @ 77°F (25°C.) See **Section 8.9.21** for complete table of temperatures and resistance values.
2. Check Sensor Wiring:
   a. a. Inspect connector pins and terminals at sensor at connector 2MCA.
   b. Verify there is no physical damage to harness, and no damage, moisture, or corrosion in connectors.

00141 Pretrip Abort

- **Trigger-on Condition:** Pretrip cycle was stopped by user before the Pretrip cycle ended automatically.
- **Control Response:** Alarm Only.
- **Trigger-off Condition:** Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (Refer to Note 1 in **Section 7.2**) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions

1. Check for any Pretrip Alarms:
   a. Check the alarm list for any Active Pretrip alarms.
   b. Alarm conditions must be corrected and the alarm cleared to continue.
2. Rerun Pretrip Check:
   a. Clear Active Alarm List, then run Pretrip & check for any new alarms.
   b. Allow to terminate automatically. Pretrip cycle operates normally.

00151 Check Glow Plugs Circuit

- **Trigger-on Condition:**
  The circuit current draw is outside the normal range. (8 – 24 amp)
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  After Pretrip Initiation.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Check Glow Plug Operation

00152 Check Fuel Solenoid Circuit

- **Trigger-on Condition:**
  The circuit current draw is outside the normal range. (0.1 – 4.0 amp)
- **Control Response:**
  Pretrip will fail.
- **Trigger-off Condition:**
  Auto-rest if pretrip is restarted via keypad or power cycling the unit.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

See alarm 05012

00153 Check Return Temp Sensor

- **Trigger-on Condition:**
  Return Air Sensor is not within the range of -53° – 158°F (-47° – 70°C)
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  After Pretrip Initiation.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

- Check Sensor Operation: Refer to procedure for alarm **00122 Return Air Sensor Check**.
- Alarm condition must be corrected and the alarm cleared to continue.

00154 Check Supply Temp Sensor

- **Trigger-on Condition:**
  Supply Air Sensor is not within the range of -53° – 158°F (-47° – 70°C)
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  After Pretrip Initiation.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

- Check Sensor Operation: Refer to procedure for alarm **00123 Supply Air Sensor Check**.
- Alarm condition must be corrected and the alarm cleared to continue.

00155 Check Coolant Temp Sensor

- **Trigger-on Condition:**
  Coolant temperature sensor is not within the range -58° – 266°F (-50° – 130°C)
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  After Pretrip Initiation.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

- Check Sensor Operation: Refer to procedure for alarm **00129 Coolant Temperature Sensor Check**.
- Alarm condition must be corrected and the alarm cleared to continue.

00160 Check Discharge Temp Sensor

- **Trigger-on Condition:**
  Discharge Temperature Sensor is not within the range of -40° – 392°F (-40° – 200°C)
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  After Pretrip Initiation.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

- Check Sensor Operation: Refer to procedure for alarm **00125 Discharge Temperature Sensor**.
- Alarm condition must be corrected and the alarm cleared to continue.

00174 No Low Speed RPM

- **Trigger-on Condition:**
  See alarm 00037 for ranges for all models
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  After Pretrip Initiation.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Check Low Speed Operation: Refer to procedure for alarm **00037 Check Low Speed RPM**. Alarm condition must be corrected and the alarm cleared to continue.

00175	No High Speed RPM

- **Trigger-on Condition:**
  See alarm 00038 for ranges for all models
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  After Pretrip Initiation.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Check High Speed Operation: Refer to procedure for alarm **00038 Check High Speed RPM**. Alarm condition must be corrected and the alarm cleared to continue

00180 Check Suction Mod Valve

- **Trigger-on Condition:**
  Insufficient reduction in suctions pressure while closing the SMV
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  After Pretrip Initiation.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check wiring to CDP and CSP:
   a. Verify that correct wires are connected to each transducer. Plugs to transducers are the same. The correct wire plug must be connected to the proper transducer. The CDP connector is identified with a red tape band while the CSP connector is identified with a blue band.
   b. Verify that correct transducer is being used in each position. Mechanical connections to transducers are the same. The Discharge Transducer should have a red marking dot on it. The Suction Transducer should have a blue marking dot on it
2. Check compressor operation: If compressor does not pass all tests, repair or replace compressor.
3. Check suction modulation valve:
   a. Visually inspect CSMV. Verify no damage to valve.
   b. Inspect CSMV coil and wire connections. Verify there is no damage to coil, and no damage, moisture, or corrosion in connector.
   c. Check each pin to chassis ground. If any of the pins on the valve gives an ohm reading to chassis ground other than OL (over limit), the valve is shorted internally and should be replaced.
   d. Check CSMV operation. Must perform correctly.
   e. Check wires from CSMV to microprocessor. Verify there is no visual damage to wires. Continuity test verifies that each wire is good.

00190 Check Condenser Fan Motor 1

- **Trigger-on Condition:**
  Failed to raise discharge pressure during Pretrip test 10
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  After Pretrip Initiation.
- Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Check Sensor: Verify proper discharge pressure and fan operation.

00194 High Suction Pressure

- **Trigger-on Condition:**
  This alarm is generated during Pretrip test 4 and the suction pressure is higher than expected.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  After Pretrip Initiation.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check wiring to CDP and CSP:
   a. Verify that correct wires are connected to each transducer. Plugs to transducers are the same. The correct wire plug must be connected to the proper transducer. The CDP connector is identified with a red tape band while the CSP connector is identified with a blue band.
   b. Verify that correct transducer is being used in each position. Mechanical connections to transducers are the same. The Discharge Transducer should have a red marking dot on it. The Suction Transducer should have a blue marking dot on it.
2. Check system pressures:
   a. Install manifold gauge set and check and compare compressor discharge and suction pressures with those shown in Unit Data.
   b. Check transducer operation.
3. Check low side operating conditions: Refer to procedure for alarm **00027 High Suction Pressure**. Alarm condition must be corrected and the alarm cleared to continue.

00195	Low Suction Pressure

- **Trigger-on Condition:**
  This alarm is generated during Pretrip test 4 and the suction pressure is higher than expected.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  After Pretrip Initiation.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check Wiring to CDP and CSP:
   a. Verify that correct wires are connected to each transducer. Plugs to transducers are the same. The correct wire plug must be connected to the proper transducer. The CDP connector is identified with a red tape band while the CSP connector is identified with a blue band.
   b. Verify that correct transducer is being used in each position. Mechanical connections to transducers are the same. The Discharge Transducer should have a red marking dot on it. The Suction Transducer should have a blue marking dot on it.
2. Check system pressures:
   a. Install manifold gauge set and check and compare compressor discharge and suction pressures with those shown in Unit Data.
   b. Check transducer operation.
3. Check low side operating conditions.

00196 High Discharge Pressure

- **Trigger-on Condition:**
  This alarm is generated during Pretrip test 4 and the discharge pressure is higher than expected based on current ambient temperatures.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  After Pretrip Initiation.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check wiring to CDP and CSP:
   a. Verify that correct wires are connected to each transducer. Plugs to transducers are the same. The correct wire plug must be connected to the proper transducer. The CDP connector is identified with a red tape band while the CSP connector is identified with a blue band.
   b. Verify that correct transducer is being used in each position. Mechanical connections to transducers are the same. The Discharge Transducer should have a red marking dot on it. The Suction Transducer should have a blue marking dot on it.
2. Check system pressures: Install manifold gauge set, and check and compare compressor discharge and suction pressures with those shown in Unit Data.
3. Check high side operating conditions: Refer to procedure for alarm **00013 High Discharge Pressure**. Alarm condition must be corrected and the alarm cleared to continue.

00198	Low Discharge Pressure

- **Trigger-on Condition:**
  This alarm is generated during a “Heat” Pretrip and discharge pressure is lower than expected based on current ambient temperatures.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  After Pretrip Initiation.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check wiring to CDP and CSP:
   a. Verify that correct wires are connected to each transducer. Plugs to transducers are the same. The correct wire plug must be connected to the proper transducer. The CDP connector is identified with a red tape band while the CSP connector is identified with a blue band.
   b. Verify that correct transducer is being used in each position. Mechanical connections to transducers are the same. The Discharge Transducer should have a red marking dot on it. The Suction Transducer should have a blue marking dot on it.
2. Check system pressures:
   a. Install manifold gauge set and check and compare compressor discharge and suction pressures with those shown in Unit Data.
   b. Check transducer operation.
3. Check refrigerant charge: Refer to **Section 6.7.5** for refrigerant service procedures.
4. Check SV1.
5. Check compressor:
   a. Check the operation of the high side of the compressor by covering the condenser inlet air. Discharge pressure must rise a minimum of 50 to 100 psig (3.4 to 6.9 bars).
   b. Remove compressor heads and inspect condition of cylinder suction valves, cylinder discharge valves and gaskets. Must be in good condition.

00204 Low Suction Pressure

- **Trigger-on Condition:**
  This alarm is generated during a “Heat” Pretrip and discharge pressure is < suction pressure + 10 psig (0.7 bar).
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  Suction pressure > -2psig.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check airflow through evaporator coil/section:
   a. Inspect coil. Ninety percent or more of the coil surface must be undamaged. Coil must be clean.
   b. Check airflow (with the unit running). Verify even airflow through the entire coil, with no “dead” spots.
   c. Check the fan motor.
2. Check refrigerant charge: Check refrigerant charge. Refer to **Section 6.7.5**.
3. Check system pressures:
   - Install manifold gauge set, and check and compare compressor discharge and suction pressures with those shown in Unit Data.
   - Suction pressure must be above 3 psig (0.2 bar).
   - Suction and discharge pressures readings must be the same on the gauges and Unit Data.

   NOTE

   Compressor suction pressure (CSP) reading has a maximum value of 100 psig (7.5 bars). The actual suction pressure must be lower than 100 psig (7.5 bars) in order to perform this test.
4. Manually defrost unit:
   a. Defrost unit and terminate automatically. A typical defrost cycle time is 5-20 minutes.
   b. Visually verify that all ice is cleared from evaporator coil. Refer to **Section 3.4.9**.
5. Check CSMV:

   Check compressor suction modulation valve. Refer to **Section 6.10.7**.
6. Visually inspect unit:

   Visually inspect unit for damage to the liquid line causing a restriction or any signs of temperature drop at the drier. Ensure all tubing from the receiver to the evaporator section is in good condition, and that there is no temperature drop at the drier or anywhere on the liquid line.
7. Check expansion valve (TXV):
   a. Visually inspect valve. Bulb must be clamped tightly and insulated.
   b. Check valve superheat. Refer to **Section 6.10.8**.

00209 Check Standby Contactor Circuit

- **Trigger-on Condition:**
  The standby contactor is out of the normal range.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  Alarm may be manually reset using the display mounted keys.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Check MC1 and MC2 coil for proper resistance.

00223 Maintenance Hour Meter - Total Diesel

- **Trigger-on Condition:**
  Diesel Engine Hours is greater than the diesel engine maintenance hour meter value.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  Alarm may be manually reset using the display mounted keys.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check unit maintenance records. Schedule unit into service facility for maintenance. Must be done soon!
2. Perform appropriate engine and unit maintenance. Follow instructions on proper maintenance form.
3. Reset engine maintenance hour meter:
   a. Check that the engine maintenance hour meter interval is set for your requirements. Reset configured Interval if required.
   b. Reset engine maintenance hour meter for the next service interval. Hour Meter reset is a Functional Parameter.

00224 Maintenance Hour Meter - Total Electric

- **Trigger-on Condition:**
  Standby Electric Motor Hours is greater than the standby electric motor maintenance hour meter value.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  Alarm may be manually reset using the display mounted keys.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check unit maintenance records: Schedule unit into service facility for maintenance. Must be done soon!
2. Perform appropriate unit maintenance. Follow instructions on proper maintenance form.
3. Reset Engine Maintenance Hour Meter:
   a. Check that the Standby Engine Maintenance hour meter interval is set for your requirements. Reset configured Interval if required.
   b. Reset Standby Engine Maintenance hour meter for the next service interval. Hour meter reset is a Functional Parameter.

00225 Maintenance Hour Meter - Total Switch On

- **Trigger-on Condition:**
  Switch On Hours is greater than the switch on maintenance hour meter value.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  Alarm may be manually reset using the display mounted keys.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check unit maintenance records: Schedule unit into service facility for maintenance. Must be done soon!
2. Perform appropriate engine and unit maintenance. Follow instructions on proper maintenance form.
3. Reset engine maintenance hour meter:
   a. Check that the switch-on maintenance hour meter interval is set for your requirements. Reset configured Interval if required.
   b. Reset switch-on maintenance hour meter for the next service interval. Hour meter reset is a Functional Parameter.

00232 Setpoint NVD Failure

- **Trigger-on Condition:**
  NVD Setpoint is out of range.
- **Control Response:**
  Required shutdown. Setpoint is defaulted.
- **Trigger-off Condition:**
  When a valid setpoint is entered.

  Alarm may be manually reset by turning the unit off, then back on again.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check setpoint: Must be between -22 and +89.6°F (-30 and +32°C).
2. Reset microprocessor:
   a. Place the START/RUN-OFF switch in the OFF position. Disconnect positive battery cable or remove F1 fuse. Wait 20 seconds and reinstall, and then place the START/RUN-OFF back in the START/RUN position. The microprocessor powers up OK and the latest setpoint appears in the display.
   b. Valid setpoint cannot be entered and alarm 232 remains active. Download and replace the main microprocessor module (MCA).

00233 Unit model #NVD Failure

- **Trigger-on Condition:**
  The NVD Unit model Number is out of range.
- **Control Response:**
  Required shutdown. model is set to blank.
- **Trigger-off Condition:**
  When a valid model number is entered via configuration.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check model number:
   a. Check model number in microprocessor. Check model number on nameplate.
   b. Enter correct model Number. Select the correct model number in the “modeL NUMBER” Configuration. If correct model number is not found, install (or have Carrier Transicold dealer install) the latest software revision.
2. Reset microprocessor:
   a. Place the START/RUN-OFF switch in the OFF position. Disconnect the positive battery cable or remove F1 fuse. Wait 20 seconds and reinstall, and then place the START/RUN-OFF back in the START/RUN position. The microprocessor powers up OK and the latest setpoint appears in the display.
   b. Check for valid model number in Unit Data. Valid number is present. Alarm is cleared.
   c. Valid model number cannot be entered and alarm remains active. Download and replace the main microprocessor module (MCA).

00237 Functional Parameters NVD Failure

- **Trigger-on Condition:**
  An NVD Functional Parameter is out of range.
- **Control Response:**
  Required shutdown. Invalid Functional Parameters are set to default. The remainder are left alone.
- **Trigger-off Condition:**
  When a valid Functional Parameter is entered.

  Alarm may be manually reset by turning the unit off, then back on again.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check Functional Parameters: All must be set for selectable values.
2. Check microprocessor software version: Upgrade to the latest version of software. Newer versions may contain functional parameters that were not present in older versions of microprocessor software.
3. Reset microprocessor:

   a. Place the START/RUN-OFF switch in the OFF position. Disconnect the positive battery cable or remove the F1 fuse. Wait 20 seconds and reinstall, and then place the START/RUN-OFF back in the START/RUN position. The microprocessor powers up OK and the latest setpoint appears in the display.

   b. Check for valid Functional Parameters in the Functional Parameters list. Verify that a valid number is set for all parameters. Alarm is cleared.

   c. Valid Functional Parameter(s) cannot be entered and alarm remains active. Download and replace the main microprocessor module (MCA).

00238 Config Parameters NVD Failure

- **Trigger-on Condition:**
  There is an error in the NVD Configuration Parameters stored in the main microprocessor memory.
- **Control Response:**
  Required shutdown.
- **Trigger-off Condition:**
  Only when a valid Configuration Parameter is entered.

  Alarm may be manually reset by turning the unit off, then back on again.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check configurations: All must be set for selectable values.
2. Check software version: Check microprocessor software version. Upgrade to the latest version of software. Newer versions of Reefer Manager may contain Configurations that were not present in older versions of microprocessor software.
3. Reconfigure microprocessor: Send settings to the microprocessor.
   a. Using the latest version of TRU-Tech and a data transfer USB memory device, write the desired Configuration file to the device
   b. Load the file into the microprocessor.
   c. Allow the microprocessor to reboot itself.
4. Reset microprocessor:
   a. Place the START/RUN-OFF switch in the OFF position. Disconnect the positive battery cable or remove the F1 fuse. Wait 20 seconds and reinstall, and then place the START/RUN-OFF back in the START/RUN position. The microprocessor powers up OK and the latest setpoint appears in the display.
   b. The microprocessor powers up OK and the latest setpoint appears in the display.
   c. Check for valid configuration settings in Configuration list. Verify that values are set correctly for all parameters. Alarm is cleared.
   d. Disconnect the positive battery cable from the battery, wait 30 seconds, then reconnect and place the START/RUN-OFF switch in the START/RUN. The microprocessor powers up OK and the latest setpoint appears in the display.
   e. Check for valid configuration settings in the Configuration list. Values are set correctly for all parameters. Alarm is cleared.
   f. Valid configurations cannot be entered and alarm remains active. Download and replace the main microprocessor module (MCA).

00245 NVD Write/Erase Failure

- **Trigger-on Condition:**
  NVD Flash Write or Erase Failure.
- **Control Response:**
  Alarm condition only. Prohibit further NVD Flash writes/erases.
- **Trigger-off Condition:**
  Auto reset with a successful NVD Flash Write or Erase.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check microprocessor software revision. Will be a 6-digit number, upgrade if required.
2. Reset microprocessor:
   a. Place the START/RUN-OFF switch in the OFF position. Disconnect positive battery cable or remove F1 fuse. Wait 20 seconds and reinstall, and then place the START/RUN-OFF back in the START/RUN position. The microprocessor powers up OK and the latest setpoint appears in the display.
   b. Check active alarm list. Alarm is cleared: microprocessor is OK.
   c. Alarm 245 remains active. The unit will operate, but changes to the settings will not be retained in the microprocessor memory. Download and replace the main microprocessor module (MCA).

00246 NVD Checksum

- **Trigger-on Condition:**
  There is an NVD checksum failure.
- **Control Response:**
  Required shutdown. Set all NVD contents to default.
- **Trigger-off Condition:**
  Alarm may be manually reset by turning the unit off, then back on again.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check microprocessor:
   a. Check setpoint setting. Must be between -22 and +89.6°F (-30 and +32°C).
   b. Enter new setpoint. Must be between -22 and +89.6°F (-30 and +32°C).
2. Reset microprocessor:
   a. Place the START/RUN-OFF switch in the OFF position. Disconnect the positive battery cable or remove the F1 fuse. Wait 20 seconds and reinstall, and then place the START/RUN-OFF back in the START/RUN position. The microprocessor powers up OK and the latest setpoint appears in the display.
   b. Alarm 246 remains active. Download and replace the main microprocessor module (MCA).

00248 Controller Info NVD Failure

- **Trigger-on Condition:**
  The NVD Controller Info output is out of range.
- **Control Response:**
  Required shutdown. Set all NVD contents to default.
- **Trigger-off Condition:**
  Only when valid controller information is available for the microprocessor.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check microprocessor:
   a. Check setpoint setting. Must be between -22 and +89.6°F (-30 and +32°C).
   b. Enter new setpoint. Must be between -22 and +89.6°F (-30 and +32°C).
   c. Check Functional Parameters. All settings must be valid.
2. Check software revision:
   a. Check microprocessor software revision. Upgrade to the latest revision of software. The latest revision may contain Configurations that were not present in older revisions.
   b. Check Functional Parameters. All settings must be valid. Send desired settings to microprocessor using the latest version of Reefer Manager or a PC Card. (Do NOT use the keypad.)
   c. Check Configurations. All settings must be valid. Send desired settings to microprocessor using the latest version of Reefer Manager or a PC Card. (Do NOT use the keypad.)
3. Reset microprocessor:
   a. Place the START/RUN-OFF switch in the OFF position. Disconnect positive battery cable or remove F1 fuse. Wait 20 seconds and reinstall, and then place the START/RUN-OFF back in the START/RUN position. The microprocessor powers up OK and the latest setpoint appears in the display.
   b. Alarm 248 remains active. Download and replace the main microprocessor module (MCA).

02000 Software Incompatibility

- **Trigger-on Condition:**
  If the transmitted software version number does not equal the accepted version number pulled from a list of current version. Table is indexed by Application ID. There are two exceptions in which the comparison will not take place:
  1. If the Major revision number is > 30, this indicates a test version of software.
  2. If the node ID that the message is received from is not valid.
- **Control Response:**
  Required shutdown.
- **Trigger-off Condition:**
  Alarm is auto reset when all module software versions are compatible.

  Alarm may be manually reset via keypad or by turning the alarm unit off, then back on again.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Verify Software: Verify the transmitted software version number equals the accepted version number pulled from a list of current version.

03000 Motor Overload #1

- **Trigger-on Condition:**
  The system is in Electric Standby mode and the motor overload is open. Overload opens at 320°F (160°C).
- **Control Response:**
  Unit shutdown.
- **Trigger-off Condition:**
  Auto when overload closes, manually via keypad or power cycling the unit.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Ohm the overload (Open = Infinite Ohms)
2. Check standby motor temp
3. Check standby motor amp draw
4. Ohm the overload (Closed - zero ohms).
5. Check the overload connections: SP15 – 1C2-2 – SBM-IP and SBM IP- 1C2-1 – C14-A – TPC10

03003 Check Medium Speed

- **Trigger-on Condition:**
  Unit running in diesel engine mode and alarm 00130 and 39 are not active and the system is calling for medium speed and RPM is not within the range (<1630 and >1970)
- **Control Response:**
  Alarm only.
- **Trigger-off Condition:**
  Unit is running in diesel engine mode and RPM is within range of medium speed spec 1630 - 1970.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Force medium speed operation by pushing the turtle key.
2. Verify engine RPM with a hand held tachometer.
3. Compare actual speed with unit data RPM, should be within 50 RPM
4. Check for proper voltage at the ENCU

   a. ENCU-19 = 0 VDC

   b. ENCU22 = minimum of 11 VDC
5. Check FSA (Fuel Speed Actuator) Plunger must move in and out freely.
6. Check air intake system for clogged filter or pinched hoses.
7. Check exhaust system, must be clear and unobstructed.

05002 Fuel Pump Relay

- **Trigger-on Condition:**
  The fuel pump output FET is sensed sort or open.
- **Control Response:**
  Alarm only.
- **Trigger-off Condition:**
  If the Fuel Pump Relay is not active.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check the AMP draw of the electric fuel pump (must be <8 amp).
2. Check power reading at TPC-19. Must be above 11VDC.
3. Check fuses F1, F2, F5, F7, F10, F11 and F14 and replace if open.

05003 Diesel / Electric Relay

- **Trigger-on Condition:**
  If the Diesel / Electric Relay is active, and the DER FET is sense short or open.
- **Control Response:**
  Alarm only.
- **Trigger-off Condition:**
  If the Diesel / Electric Relay is not active.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check amp reading at TPC-10 if active during electric standby mode or TPC-21 if active during diesel mode, (must be < 5 amp).
2. Check voltage reading at TPC-21 if active during diesel mode or TPC-10 is active during electric mode. Must be above 11 VDC.
3. Check fuses F1, F2, and F9. Replace if open.
4. Check DER relay for shorted or open coil.

05012 Run Relay Output - Check ENCU Power Circuit

- **Trigger-on Condition:**
  The Run Output is Active and Output Circuit Feedback is sensed out of Active Range.

  OR, the Run Output is Inactive and Output Circuit Feedback is sensed out of Inactive Range.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  If the alarm was activated when Output was Active, trigger off if Output is Active and circuit feedback is sensed in Active range.

  OR, If alarm was activated when Output was Inactive, trigger off if Output is Inactive and circuit feedback is sensed in Inactive range.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check Wiring:
   a. Inspect TPC and ENCU connectors. Verify no damage to the module and no damage, moisture, or corrosion in connector.
   b. Place the SROS and the RSS on the ON position. Check voltage from TPC-21 to ENCU 44 (must be >11VDC).
   c. With the SROS and RSS in the OFF position, check continuity of the wiring from ENCU-19 to the “ENCUGND” connector extending from the battery negative cable connection. Check connectors and wiring between terminals. Verify no damage, moisture or corrosion.
2. Check ENCU.
3. Replace ENCU.

05014 Check Starter Circuit

- **Trigger-on Condition:**
  The Starter Output is Active and Output Circuit Feedback is sensed out of Active Range.

  OR, the Starter Output is Inactive and Output Circuit Feedback is sensed out of Inactive Range.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  If the alarm was activated when Output was Active, trigger off if Output is Active and circuit feedback is sensed in Active range.

  OR, if the alarm was activated when Output was Inactive, trigger off if Output is Inactive and circuit feedback is sensed in Inactive range.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check starter solenoid coil:
   a. Inspect coil and connector terminal. Verify no damage to the coil, the special connector at starter is tight and locked, and the harness connector is not damaged or corroded.
   b. Check resistance of coil. Verify the coil is not open or shorted.
2. Check power and wiring:
   a. Place Start/Run - Off switch in the OFF position and then back into the Start/Run position.
   b. Following the buzzer, check for voltage at SS terminal and TPC-9. Minimum 11 VDC.
   c. If not, check connectors and wiring between terminals.
   d. Verify no damage, moisture or corrosion.

05015 Check Three-Way Valve

- **Trigger-on Condition:**
  The 3-way Valve (Hot Gas Valve) is Active and Output Circuit Feedback is sensed out of Active Range.

  OR, the 3-way Valve (Hot Gas Valve) is Inactive and Output Circuit Feedback is sensed out of Inactive Range.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  If the alarm was activated when Output was Active, trigger off if Output is Active and circuit feedback is sensed in Active range.

  OR, if the alarm was activated when Output was Inactive, trigger off if Output is Inactive and circuit feedback is sensed in Inactive range.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check 3-way valve wiring:
   a. Place the RSS in the OFF position and check:
      - Fuses F1, F4, and F11 in the TPC.
      - Continuity of the wiring from HGV-8 -including SP7 to ground.
      - Continuity of the wiring from HGV-7 to 2SIOB-31
      - Check connections from TPC-4 to 2SIOB-23
   b. Verify correct fuse, see **Figure 2.8**. Check connectors and wiring between terminals. Verify no damage, moisture or corrosion.

05016 Check Remote Lightbar Power

- **Trigger-on Condition:**
  Remote Lightbar Output is Active and Remote Lightbar Output FET is sensed short (feedback from FET output is low).

  OR, the Remote Lightbar Output is Not Active and Remote Lightbar Output FET is sensed bad (feedback from FET output is high).
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  If the alarm was activated when Remote Lightbar was active, trigger off if Remote Lightbar Output is Active and feedback from Remote Lightbar FET output is sensed good becomes inactive.

  OR, if the alarm was activated when Remote Lightbar was inactive, trigger off if Remote Lightbar is Inactive and Remote Lightbar FET is sensed good.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Verify the light bar configuration is set to “2LightBar.”
2. Inspect light bar, harness, and connector to ensure nothing is worn or broken.
3. Check wiring to light bar. TPC31-LBB should have 12VDC and SP7-LBG should be a frame ground.

05017 Check Engine Preheat Enable Circuit

- **Trigger-on Condition:**
  Glow Plug is Active and Output Circuit Feedback is sensed out of Active Range.

  OR, Glow Plug is Inactive and Output Circuit Feedback is sensed out of Inactive Range.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  If the alarm was activated when Glow Plug was Active, trigger off if Glow Plug Relay Output is Active and circuit feedback is sensed in Active range.

  OR, if the alarm was activated when Glow Plug was Inactive, trigger off if Glow Plug is Inactive and circuit feedback is sensed in Inactive range.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Verify glow plugs are not energized when they should not be.
2. Check each glow plug resistance individually - 0.9 ohms at 68°F (20°).

05028 TPC Fuse 2 Alarm

- **Trigger-on Condition:**
  TPC Reports Fuse Status Bad AND SIO Comm Fail Alarm 25800 is active for 15 seconds.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  Activate conditions not true for two seconds.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Check F2 in the TPC.

05029 TPC Fuse 3 / 5/ 7 Alarm

- **Trigger-on Condition:**
  TPC Reports Fuse Status Bad AND SIO Comm Fail Alarm 25800 is active for 15 seconds.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  Activate conditions not true for two seconds.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Check F3, F5, and F7 in the TPC.

05030 TPC Fuse 4 Alarm

- **Trigger-on Condition:**
  TPC Reports Fuse Status Bad for five seconds five seconds AND SIO Comm Fail Alarm 25800 is active.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  Activate conditions not true for two seconds.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Check F4 in the TPC.

05031 TPC Fuse 10 Alarm

- **Trigger-on Condition:**
  Output Power and Power Enable Power detected at TPC AND both Evap Fan Outputs ordered OFF AND Error Reported on both channels for five seconds.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  Activate conditions not true for two seconds.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Check F10 in the TPC.

05032 TPC Fuse 11 Alarm

- **Trigger-on Condition:**
  Output Power and Power Enable Power detected at TPC AND F11 Output Power not detected at TPC for six seconds.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  Activate conditions not true for two seconds.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Check F11 in the TPC.

05033 Power Enable Coil Open Circuited

- **Trigger-on Condition:**
  Power Enable Control is ordered OFF AND TPC reports Output Error on PER channel for six seconds.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  Activate conditions not true for two seconds.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check power enable relay coil 85-86.
2. 0 ohms = shorted closed
3. Infinite ohms = shorted open

05034 Power Enable Contact Fail Alarm

- **Trigger-on Condition:**
  Power Enable Control is ordered ON and Power Enable Power not detected at TPC for six seconds.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  Activate conditions not true for two seconds.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check power enable relay contacts
2. 30-87 = Normally Open contacts (infinite ohms)

06003 Evap Fan 2

- **Trigger-on Condition:**
  Evap Fan #2 Output is Active and Evap Fan #2 Output FET is sensed short (feedback from FET output is low).

  OR, Evap Fan #2 Output is not Active and Evap Fan #2 Output FET is sensed bad (feedback from FET output is high).
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  If alarm was activated when Evap Fan was active, trigger off if Evap Fan (main compartment) Output is Active and Evap Fan Output FET is sensed good.

  OR, If alarm was activated when Evap Fan was inactive, trigger off if Evap Fan (main compartment) is Inactive and Evap Fan FET is sensed good.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check wiring from SIOB 6 to 4J-3 on the fan relay board.
2. Check 3EFM relay coil

07006 Check Suction Pressure Transducer

- **Trigger-on Condition:**
  Suction Pressure Transducer is out of range.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  Suction Pressure Transducer is in range.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Verify suction pressure reading on controller to gauge reading
2. Check transducer, connections and wiring from MCA to CSP
3. Verify 5 VDC supply to transducer on terminal 2

11002 Check Hot Gas Valve

- **Trigger-on Condition:**
  Value out of range in Pretrip Test per Pretrip Diagnostics.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  Pretrip Initiation.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Pretrip alarm: Check resistance of hot gas coil.

11003 Check Evap Fan 1 and 2

- **Trigger-on Condition:**
  Value out of range in Pretrip Test per Pretrip Diagnostics.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  Pretrip Initiation.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Pretrip alarm: Check evaporator fan motor 1 and 2.

11004 Check Evap Fan 3

- **Trigger-on Condition:**
  Value out of range in Pretrip Test per Pretrip Diagnostics.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  Pretrip Initiation.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Pretrip alarm: Check evaporator fan motor 3.

13001 Check Hot Gas Valve Circuit

- **Trigger-on Condition:**
  Value out of range in Pretrip Test per Pretrip Diagnostics.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  Pretrip Initiation.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Pretrip alarm: Check wiring to HGV

15001 No Medium Speed

- **Trigger-on Condition:**
  RPM out of range for medium speed during Pretrip
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  Unit is running in diesel engine mode and RPM is within range of medium speed spec 1630 - 1970.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Force medium speed operation by pushing the turtle key.
2. Verify engine RPM with a hand held tachometer.
3. Compare actual speed with unit data RPM, should be within 50 RPM
4. Check for proper voltage at the ENCU

   a. ENCU-19 = 0 VDC

   b. ENCU22 = minimum of 11 VDC
5. Check FSA (Fuel Speed Actuator) Plunger must move in and out freely.
6. Check air intake system for clogged filter or pinched hoses.
7. Check exhaust system, must be clear and unobstructed.

21100 MMB1 - CAN Fail

- **Trigger-on Condition:**
  MCA cannot communicate with any other module over the CAN lines

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Inspect connector pins on TPC, MCA, and SIOB. Verify no damage or corrosion in connections.
2. Check CAN bus:

   a. Inspect connector pins and terminals on 1MM, 1SM, and DM. Verify no damage or corrosion in connections.

   b. Check display. Look for a LOSS OF COMMUNICATIONS message.

   c. Check for CAN continuity. Look for good continuity. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.

22800	MCA-IN - CAN Fail

- **Trigger-on Condition:**
  No communication from the MCA

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Inspect CAN connections at 1MCA plug
2. Check CAN bus:
   a. Inspect connector pins and terminals on 1MM, 1SM, and DM. Verify no damage or corrosion in connections.
   b. Check display. Look for a LOSS OF COMMUNICATIONS message.
   c. Check for CAN continuity. Look for good continuity. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.

22801 MCA-IN - Low Sensor Voltage

- **Trigger-on Condition:**
  The voltage supply for the pressure sensors on the input board 1 is below the low voltage limit 4.5V.
- **Control Response:**
  Alarm only.
- **Trigger-off Condition:**
  The voltage supply for the pressure sensors on the input board 1 is above the low voltage limit 4.5V.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check 2MCA connector for corrosion or shorted pin connections.
2. Check wiring from 2MCA to unit pressure sensors.
3. Verify voltage to pressure sensors. Must be between 4.5 and 5.5 VDC.

22802 MCA-IN - High Sensor Voltage

- **Trigger-on Condition:**
  The voltage supply for the pressure sensors on the input board 1 is above the high voltage limit 5.5V.
- **Control Response:**
  Alarm only.
- **Trigger-off Condition:**
  The voltage supply for the pressure sensors on the input board 1 is below the high voltage limit 5.5V.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check 2MCA connector for corrosion or shorted pin connections.
2. Check wiring from 2MCA to unit pressure sensors.
3. Verify voltage to pressure sensors. Must be between 4.5 and 5.5 VDC.

22803 MCA-IN - Lost Configuration

- **Trigger-on Condition:**
  MCA-IN hoard reports an invalid configuration checksum.
- **Control Response:**
  Required Shutdown and if alarm remains active for two minutes issue a shutdown command to all modules except the display.
- **Trigger-off Condition:**
  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check all connections to the MCA.
2. Disconnect the battery negative cable for 15 seconds.
3. If alarm remains active, replace the MCA

23800 TPC - CAN Fail

- **Trigger-on Condition:**
  No communications from TPC.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Inspect CAN from the TPC.

23803 TPC - Lost Configuration

- **Trigger-on Condition:**
  TPC board reports an invalid configuration checksum.
- **Control Response:**
  Required shutdown and if alarm remains active for two minutes issue a shutdown command to all modules except the display.
- **Trigger-off Condition:**
  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check all connections to the TPC.
2. Disconnect the battery negative cable for 15 seconds.
3. If alarm remains active replace the TPC

25800 SIO - CAN Fail

- **Trigger-on Condition:**
  No communications from the SIBOB.
- **Control Response:**
  Required shutdown. And if alarm remains active for two minutes issue a shutdown command to all modules except the display.
- **Trigger-off Condition:**
  Sync response received from the SIO Module.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Inspect CAN connections at 1SIOB plug.
2. Check CAN bus:
   a. Inspect connector pins and terminals on 1MCA and 1SIOB. Verify no damage or corrosion in connections.
   b. Check display. Look for a LOSS OF COMMUNICATIONS message.
   c. Check for CAN continuity. Look for good continuity. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.

25801 SIO Over Current

- **Trigger-on Condition:**
  If the stepper current is reported to be too high by SIO (Indicated by Stepper Output Voltage < 5V) for three seconds as timed at stepper board.
- **Control Response:**
  Alarm condition only. Steppers on board with problem disabled (Powered OFF) until good power reported from Stepper Board at which point they are re-enabled.
- **Trigger-off Condition:**
  10 Seconds of good current range reported from all steppers.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check wiring to SMV for physical damage or moisture in connector.
2. Verify voltage at 2SIOB34.

25802 SIO Input Voltage

- **Trigger-on Condition:**
  If the stepper input voltage is reported out of valid range (9V to 17V) by SIO for three seconds as times at stepper board.
- **Control Response:**
  Alarm condition only. Steppers on board with problem disabled (Powered OFF) until good power reported from Stepper Board at which point they are re-enabled.
- **Trigger-off Condition:**
  10 Seconds of good voltage reported from all steppers.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Verify voltage to 2SIOB34 (should be battery voltage)
2. Check F4 fuse
3. Check wiring to SMV
4. Unplug SMV and see if alarm goes away, if it does check power head for damage and replace as needed.

25803 SIO Lost Configuration Voltage

- **Trigger-on Condition:**
  SIO Board reports an invalid configuration checksum.
- **Control Response:**
  Required Shutdown. And if alarm remains active for two minutes issue a shutdown command to all modules except the display
- **Trigger-off Condition:**
  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check all connections to the SIOB.
2. Disconnect the battery negative cable for 15 seconds.
3. If alarm remains active replace the SIOB

26100 ENCU CAN Comm Failure

- **Trigger-on Condition:**
  No ENCU messages received for three seconds when the Run Relay is ON.
- **Control Response:**
  Required shutdown. Set RPM to 0 and Oil Pressure Switch.
- **Trigger-off Condition:**
  When alarm minimum off time has been reached or a switch to Electric mode.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check both active and inactive alarms for other “NO COMM” alarms:
   a. If more than one alarm, record all and proceed to step 2.
   b. If this is the only alarm, check for continuity: ENCU-22 to TPC-13. Look for good continuity. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion
2. Check CAN bus:
   a. Inspect connector pins and terminals on 1MCA and 1SIOB. Verify no damage or corrosion in connections.
   b. Check for CAN continuity. Look for good continuity. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.

26101 Engine Overheat

- **Trigger-on Condition:**
  As indicated by the Kubota ENCU. Engine water temperature ≥ 262 °F (128 °C).
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  If trigger on message not received for five seconds.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Refer to Alarm **00012 High Coolant Temperature**.

26102 Water Temperature Sensor Low

- **Trigger-on Condition:**
  As indicated by the Kubota ENCU. Voltage of water temperature sensor is 0.1 V or less.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  If trigger on message not received for five seconds.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Refer to alarm **00129 Coolant Temperature Sensor Check**

26103 Water Temperature Sensor High

- **Trigger-on Condition:**
  As indicated by the Kubota ENCU. Voltage of water temperature sensor is 4.9V or above.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  If trigger on message not received for five seconds.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Refer to alarm **00129 Coolant Temperature Sensor Check**

26104	Battery Voltage High

- **Trigger-on Condition:**
  As indicated by the Kubota ENCU. ECU recognition of battery voltage is above 18V.
- **Control Response:**
  Required shutdown.
- **Trigger-off Condition:**
  If trigger on message not received for five seconds.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Refer to alarm **00015 High Battery Voltage Check**

26105 Engine Overrun

- **Trigger-on Condition:**
  As indicated by the Kubota ENCU message. Engine speed > 2070 min-1 (RPM).
- **Control Response:**
  Required shutdown.
- **Trigger-off Condition:**
  If trigger on message not received for five seconds.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Refer to alarms **00038 Check High Speed RPM** and **00039 Check Engine RPM**

26106 Sensor Supply Voltage 1: Low

- **Trigger-on Condition:**
  As indicated by the Kubota ENCU. Voltage to sensor is below 4.00V.
- **Control Response:**
  Required shutdown.
- **Trigger-off Condition:**
  If trigger on message not received for five seconds.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check ENSSN connections.
2. Verify voltage from ENCU43 to ENCSSN3 (must be 5.0 VDC).
3. Check wiring from ENCU20 to ENSSN1.
4. Check wiring from ECNU2 to ENSSN2.

26107 Oil Pressure Error

- **Trigger-on Condition:**
  As indicated by the Kubota ENCU. Oil pressure switch ON.
- **Control Response:**
  Alarm condition only.
- **Trigger-off Condition:**
  If trigger on message not received for five seconds.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Refer to alarm **00011 Low Oil Pressure**

26109 Actuator Abnormal

- **Trigger-on Condition:**
  As indicated by the Kubota ENCU. Actuator current > 3.0A or <80mA.
- **Control Response:**
  Required shutdown.
- **Trigger-off Condition:**
  If trigger on message not received for five seconds.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Refer to alarm **00130 Engine RPM Sensor Check**
2. Check voltage from TPC13 to ENCU22.
3. Check voltage from TPC21 to ENCU44.
4. Check for proper ground TPC25 to ENCU19.
5. Check connector for ENCU ENSSN and FSA.
6. Check resistance of FSA.
7. Check FSA plunger.

26110	Engine Speed Sensor Abnormal

- **Trigger-on Condition:**
  As indicated by the Kubota ENCU. Engine speed = 0 min-1 (RPM).
- **Control Response:**
  Required shutdown.
- **Trigger-off Condition:**
  If trigger on message not received for five seconds.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Refer to alarm **00130 Engine RPM Sensor Check**

29000	Alternator Electric Issue

- **Trigger-on Condition:**
  F-EL error occurs on the LIN bus. Alarm is triggered immediately.
- **Control Response:**
  Shutdown alarm.
- **Trigger-off Condition:**
  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check connection from 1MCA13 to “L” terminal on the alternator.
2. Check alternator brush assembly.
3. Check battery voltage.

29001	Alternator High Temperature

- **Trigger-on Condition:**
  F-HT error occurs on the LIN bus. Alarm is triggered in two seconds.
- **Control Response:**
  Shutdown alarm.
- **Trigger-off Condition:**
  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check for proper alternator ventilation.
2. Check cooling fan for damage and proper rotation.

29002	Alternator Belt Broken

- **Trigger-on Condition:**
  F-ROT error occurs on the LIN bus. Alarm is triggered immediately.
- **Control Response:**
  Shutdown alarm.
- **Trigger-off Condition:**
  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Check drive belt.

29003 Alternator Belt Slip

- **Trigger-on Condition:**
  This alarm is only for diesel mode. Alternator RPM does not match engine RPM based on calculation and this occurs three times in a minute time period.

  Prohibit this measure and alarm in engine startup and ramp process.

  Prohibit this measure and alarm when CAN or LIN communication error occur.
- **Control Response:**
  Alarm only.
- **Trigger-off Condition:**
  Less than three slip events in the last three minute time period.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Check and adjust drive belt.

29004 LIN Com. Error

- **Trigger-on Condition:**
  F-CEF = 1 error occurs on the LIN bus. Alarm is triggered immediately.
- **Control Response:**
- **Trigger-off Condition:**
  Five seconds without F-CEF error.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check the LIN connection on alternator “L” to 1MCA13.
2. Replace alternator.

29005 LIN Con Timeout

- **Trigger-on Condition:**
  F-CTO error occurs on the LIN bus. Alarm is triggered immediately.
- **Control Response:**
  Alarm only.
- **Trigger-off Condition:**
  Five seconds without F-CTO error.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check the LIN connection on alternator “L” to 1MCA13.
2. Replace alternator.

29006 No Com to Alternator

- **Trigger-on Condition:**
  Micro cannot communicate with the alternator.
- **Control Response:**
  Shutdown alarm.
- **Trigger-off Condition:**
  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

1. Check the LIN connection on alternator “L” to 1MCA13.
2. Replace alternator.

29007 Can’t Recognize Power Frequency

- **Trigger-on Condition:**
  Unit is in Standby mode AND Logic is not able to recognize either 50Hz OR 60Hz frequency from the Network.
- **Control Response:**
  Alarm only.
- **Trigger-off Condition:**
  Subsequent Standby Startup with good Frequency Detection.

  Alarm may be manually reset via keypad or by cycling power.

NOTE

Follow the steps below as necessary until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs.

Corrective Actions

Verify voltage supply.

SECTION 6

Service

⚠ WARNING

Unit may start automatically at any time even if the switch is in the OFF position. Use proper lockout/tagout procedures before inspection/servicing. All unit inspection/servicing by properly trained personnel only.

⚠ WARNING

Beware of moving belts and belt driven components as the unit may start automatically. When working with belts, beware of pinch points. Before servicing unit, the RUN/ STOP Switch must be in the STOP position. Also, the negative battery cable must be disconnected.

⚠ WARNING

Before performing any "hot work," including but not limited to brazing or welding on a unit that has been charged with R-452A, refrigerant must be recovered until equipment gauge indicates -20 inHG (-0.67 Bar) of vacuum. Nitrogen purge is also required.

⚠ CAUTION

Refrigerant R-404A / R-452A must be charged as a liquid. Refrigerant R-404A / R-452A is a blend. Charging as a vapor will change the properties of the refrigerant. Only liquid charging through the receiver service valve is acceptable.

⚠ CAUTION

Any system that is low on R-452A refrigerant must be fully recovered and recharged.

NOTE

To avoid damage to the Earth's ozone layer, use a refrigerant recovery system whenever removing refrigerant from a refrigeration system. When working with refrigerants, you must comply with all local government environmental laws, U.S.A. EPA section 608.

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 **Evacuation and Dehydration** procedure)

6.1 Section Layout

Service procedures are presented herein under the following major sections:

- Scheduled Maintenance - **Section 6.2**.
- Pre-Trip Inspection - **Section 6.3**.
- Engine and Engine Related Components - **Section 6.5**.
- Poly-V belts - **Section 6.6**
- Compressor - **Section 6.8**.
- Compressor Oil Level - **Section 6.9**
- Refrigerant System Components - **Section 6.10**.
- Electrical System Components- **Section 6.11**.

Refer to the Table of Contents or bookmarks to locate specific topics.

6.2 Scheduled Maintenance

For the most reliable operation and for maximum life, your unit requires regular maintenance, including oil and filter changes, fuel and air filter replacement, coolant replacement and pre-trip inspections. Maintenance is to be performed in accordance with the procedures provided in **Table 6–1**.

6.3 Pre-Trip Inspection

Pre-Trip inspection should be performed before every trip and at regular maintenance intervals. Pre-Trip procedures are provided in **Section 3.4**.

6.4 Maintenance Schedule

For the most reliable operation and maximum life, your unit requires regular maintenance, including oil and filter changes, fuel and filter replacement and coolant system maintenance. Maintenance should be performed on the following schedule.

Service	Hours
Initial Service	1,000
Service A	2,000
Service B	4,000

Range	Initial	Check Up	Service A	Service B
Before running				
Report any sign of damage on vehicle/ body/ refrigeration unit.	O	O	O	O
Check coolant level, report strength.	O	O	O	O
Write down hourmeter diesel and standby.	O	O	O	O
Visual check the tightness of fixing bolts/screws and frame	O	O	O	O
Check software revision. Write it down.	O	O	O	O
Check exhaust system security and visually check for signs of corrosion including sections where exhaust insulation is installed (silent-city units).	O	O	O	O
Visual check - shaft seal + oil level in compressor.	O	O	O	O

Range	Initial	Check Up	Service A	Service B
Check routing of electrical wires, harnesses, fuel lines (repair or replace if needed), cab command routing, plug from standby module, check oil tubes routing and security Check battery security, lubricate terminals against corrosion, check battery cables routing.	O	O	O	O
Check fuel tank straps integrity, fixing bolts, cap. Drain water from fuel tank if applicable.		O	O	O
Connect manifold gauges and start the engine				
Check operator panel, display, light, switches	O	O	O	O
Check all sensors, transducers consistency between each others			O	O
Check glow plug operation, connections, secure the wire	O	O	O	O
Perform pull down test	O	O	O	O
Check on sight glass level	O	O	O	O
Check coolant system temperature, thermostat, leaks	O	O	O	O
Initiate manual defrost and confirm termination, check defrost drain pipes and water evacuation	O	O	O	O
Check the engine speeds			O	O
In heat mode, check hot gas valve functionality.			O	O
Check battery state of charge		O	O	O
Check alternator charge output			O	O
Stop the engine. Lockout / Tagout.				
Check fuel pump filter, clean if necessary, replace bowl gasket		O	O	
Check oil level and refill if required. Check for oil leak	O	O		
Drain and refill oil			O	O
Replace oil filter and bypass filters, fuel filter, air filter			O	O
Check air filter element. Replace if necessary	O		O	O
Check all belts (wear + tension)	O	O	O	O
Check clutch and connections, pulleys, standby motor, and alternator, (noise test).			O	O
Replace all belts				O
Check operation of evaporator fan (bearing/noise)			O	O
Check high and low voltage wiring and connections into control box, corrosion, chafing and signs of heat build up	O	O	O	O
Check cleanliness of condenser (visual), clean if necessary	O	O	O	O
Check cleanliness of evaporator (visual), clean if necessary	O	O	O	O
Check air switch calibration				O
Check alternator brushes			O	O
Check and lubricate all linkages, hinges and lock mechanisms				O
EU 517/2014 Compliant Leak Check (See F-Gas regulation for requirements)				O

Range	Initial	Check Up	Service A	Service B
Reconnect battery clamps. Start the unit on standby.				
Perform run test (diesel and electrical)	O	O	O	O
Program service interval	O		O	O
Check internal clock and date of temperature recorder.	O	O	O	O
Check and confirm all current product upgrades have been completed	O		O	O
Replace maintenance sticker and clean unit of marks made during service	O		O	O
Every five years or 12,000 hours				
Replace coolant and coolant bottle cap				
Every 6000 hours				
Inspect the evaporator fan motor.				
Check valve clearance of diesel engine -adjust if necessary (Refer to engine technical manual)				

These maintenance schedules are based on the use of approved oils and filters, and regular pre-Pre-Trip inspections of the unit. Failure to follow the recommended maintenance schedule may affect the life and reliability of the refrigeration unit. All units are shipped with Extended Life Coolant; replace every two years.

6.5 Servicing Engine and Engine-Related Components

Procedures for servicing the engine, fuel system, engine cooling system, engine control system, and air cleaner are provided in the following sub-paragraphs.

6.5.1 Cooling System

The condenser and radiator can be cleaned at the same time. The radiator must be cleaned internally as well as externally to maintain adequate cooling. See **Figure 6.1**.

The condenser and radiator are incorporated into a single assembly. The condenser fans draw the air through the condenser and radiator coil. To provide maximum air flow, the condenser fan should be checked periodically for proper operation.

⚠ CAUTION

Use only ethylene glycol antifreeze (with inhibitors) in system as glycol by itself will damage the cooling system.

Always add premixed 50/50 antifreeze to radiator/engine. Never exceed more than a 50% concentration of antifreeze. Use a low silicate antifreeze.

1. Remove all foreign material from the radiator/condenser coil by reversing the normal air flow. (Air is pulled in through the front and discharges over the standby motor.)

NOTE

Rinsing with a hose or water is the best option. Use a mild detergent if necessary, but do not use any harsh coil cleaners.

2. Drain coolant by removing the lower radiator hose and radiator cap.
3. Reinstall hose and fill system with clean, untreated water to which three to five percent of an alkaline based radiator cleaner should be added (six ounces - dry 151 grams to one gallon = 3.78 liters).

NOTE

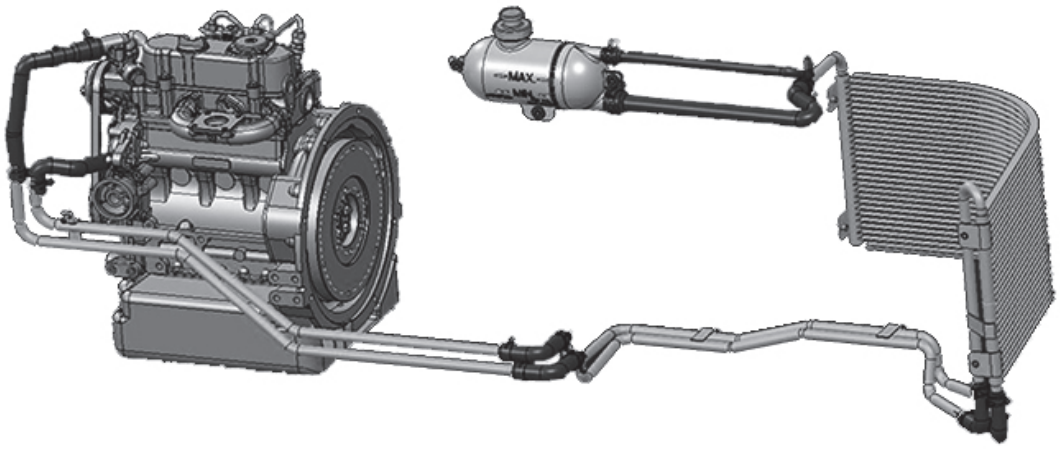
Do not start engine without bleeding the air out of the system. See section **Section 6.5.1.1**.

4. Run engine 6 to 12 hours and drain system while warm. Rinse system three times after it has cooled down. Refill the system with water.
5. Run engine to operating temperature. Drain system again and fill with treated water/antifreeze. (see Caution and refer to **Section 1.2**)

NOTICE

NEVER POUR COLD WATER INTO A HOT ENGINE.

Figure 6.1 Coolant System



6.5.1.1 Bleeding Air from Coolant System

NOTE

Damage to the engine can occur if the engine runs with air trapped in the coolant system of the engine block.

To bleed the air from the coolant system:

1. Remove or loosen the bleeder set screw from the top hose on the thermostat housing. In some instances, it may be more efficient to remove the thermostat housing.
2. Slowly pour the coolant into the system until you see coolant come out of the bleed screw or the top of the thermostat's housing.

NOTE

This process can be expedited by installing a coolant pressurization tester and forcing the coolant through the system. Adapter part number 07-00468-00 will fit the coolant bottle.

3. Reinstall or tighten the bleed screw or reinstall the top part of the thermostat housing.
4. Fill the system to the MAX line on the coolant tank.
5. Run the unit in medium speed (press the turtle key) while monitoring the engine coolant temperature (available in the unit data on cab command).
6. When the temperature reaches 170°F (76°C), shut the unit down for two minutes to allow the thermostat to open completely and force all remaining air out of the engine block and cylinder head.
7. After two minutes, restart the unit and run for 15 minutes. Check the coolant level in the coolant tank and top off as necessary.
8. Install the coolant tank cap and shut down the unit for 15 minutes.
9. Recheck coolant level.

⚠ WARNING

Failure to follow this procedure can result in permanent damage to the engine. The high coolant temperature safety may not protect the engine if there is air trapped inside the engine.

6.5.2 Changing Lube Oil and Lube Oil Filter

⚠ CAUTION

When changing oil filter, the new filter should be primed with clean oil. If the filter is not primed, the engine may operate for a period with no oil supplied to the bearings.

After warming up the engine, stop engine, remove drain plug from oil reservoir and drain engine lube oil.

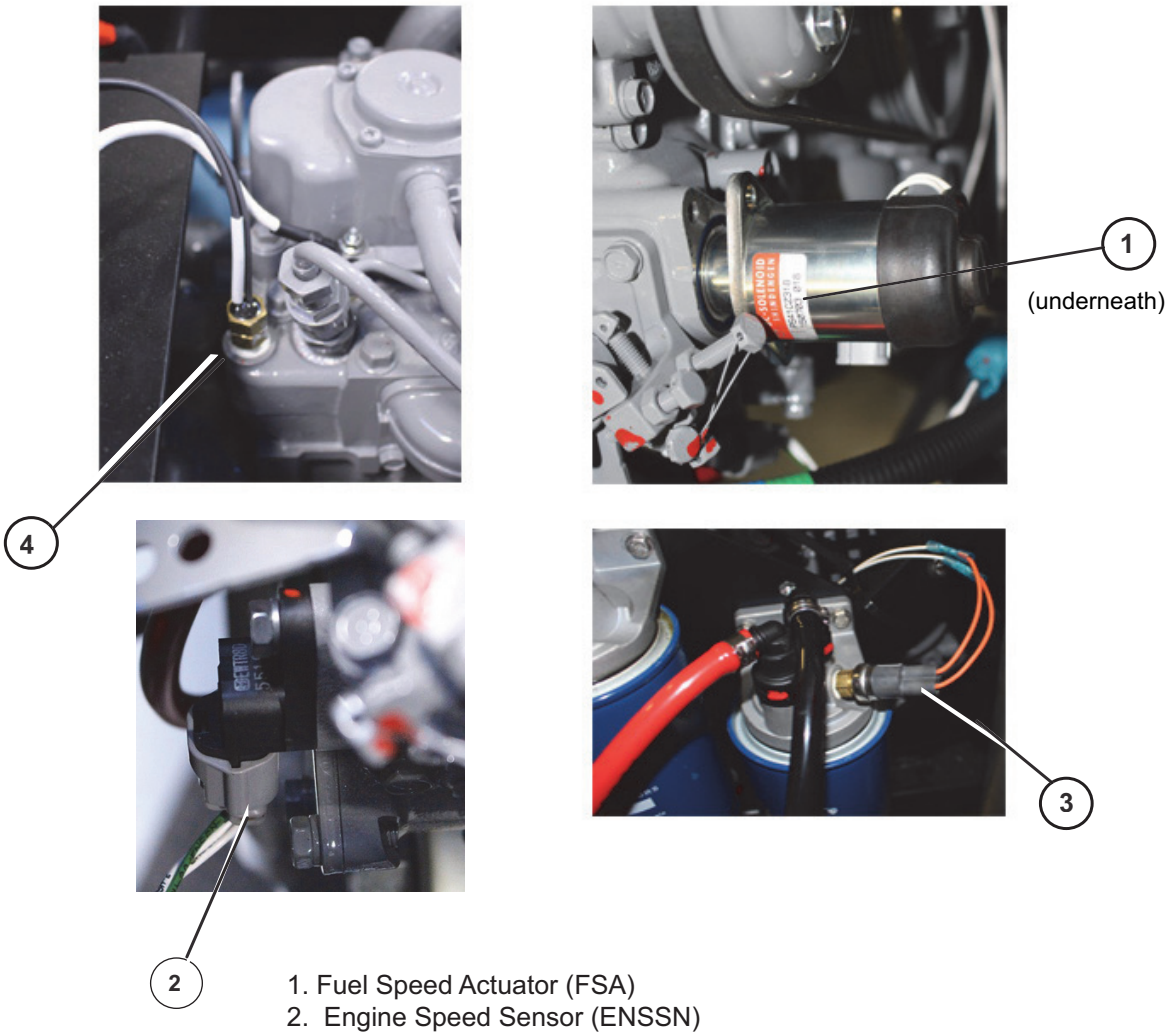
Replace filter, lightly oil gasket on filter before installing and add lube oil. (Refer to **Figure 2.6.1** for Engine Data) Warm up engine and check for leaks.

6.5.3 Engine Control System

Engine speed is controlled by three components: the Engine Control Unit (ENCU), the Fuel/Speed Actuator (FSA) and the Engine Speed Sensor (ENSSN).

- The ENSSN provides the speed signal to the ENCU.
- The ENCU starts, stops and controls the speed of the engine by varying the position of the FSA rod. It also provides a speed signal to the control system.
- The FSA combines the fuel shutoff solenoid and speed control solenoid into one component.

Figure 6.2 Speed Control System



1. Fuel Speed Actuator (FSA)
2. Engine Speed Sensor (ENSSN)
3. Engine Oil Pressure Switch (ENOPS)
4. Engine Coolant Temperature Sensor (ENCT)

6.5.4 Engine Speed

1. Engine speed may be determined using a strobe tachometer. (Carrier Transicold Part No. 07-00206) or by checking the Unit Data “ENGINE RPM” reading (refer to **Table 2–8** in Section 2.6.1). To use a strobe; with the engine stopped, place a mark (white paint for example) on the crankshaft sheave.
2. Engine speed will be based on unit model number (refer to **Table 2–8** in Section 2.6.1).
3. To check medium speed, place the machine into Silent mode by pressing the CITY SPEED key.
4. Engine speed should be 1800 RPM.
5. Start the unit in Cool mode.

6.5.5 Engine Speed Sensor

1. Verify that the wiring to sensor ENSSN is correct. Refer to wiring schematics in **Section 8**.
2. Check voltage at the RPM Sensor connector with the Run Relay energized. Refer to wiring schematics in **Section 8**.
3. Voltage between ENCU-20 and ENCU-43 should be 5.0 VDC.
4. Check continuity between ESSN2 and ENCU2.

6.5.6 Engine Air Cleaner - Inspection

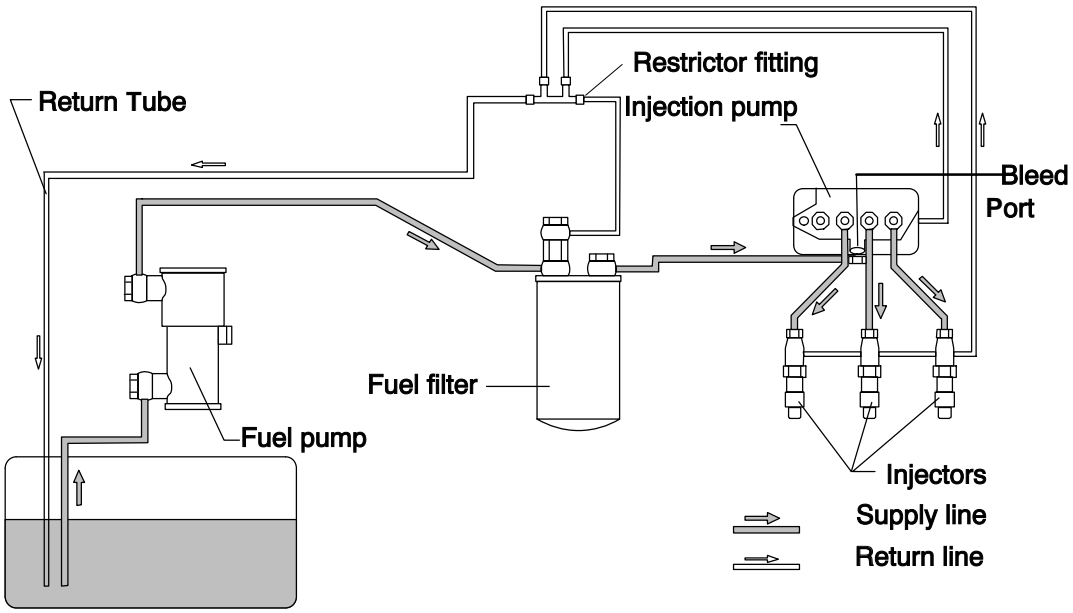
The air cleaner, hose and connections should be inspected for leaks. A damaged air cleaner or hose can seriously affect the performance and life of the engine. If housing has been dented or damaged, check all connections immediately.

1. Stop engine.
2. Remove air filter.
3. Install new air filter.

When inspecting air cleaner housing and hoses, check the connections for mechanical tightness, and look for fractures in the inlet and outlet hoses. When leakage occurs and adjustment does not correct the problem, replace necessary parts or gaskets. Swelled or distorted gaskets must always be replaced.

6.5.7 Fuel Filter and Fuel Circuit

Figure 6.3 Fuel System



6.5.7.1 Checking Fuel Circuit

- The engine must run with bleed port slightly unscrewed. This indicates that the injection pump pressure is greater than 1.47 psig (0.1 bar). Check for air leakages and clean fuel lines if pressure isn't correct.
- The electrical pump is designed to deliver 10.30 psig (0.7 bar). The fuel circuit flow rate in the return line is about 1.32 gallons (5 liters) per hour.

6.5.7.2 Changing the Fuel Filter in Electric Pump

⚠ CAUTION

When changing the fuel filter, the new filter should be filled with clean filtered fuel.

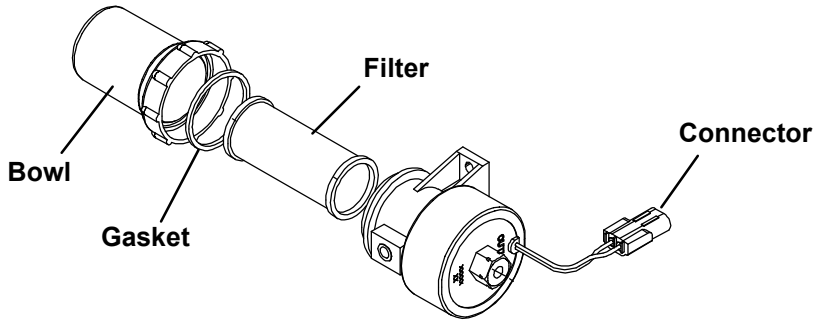
1. Remove the bowl (cover), gasket and filter.

⚠ CAUTION

When the bowl has been removed, always replace the gasket at that time.

2. Wash the filter in cleaning solvent and blow it out with air pressure.
3. Clean the bowl.
4. To install, reverse the above steps.
5. After changing the fuel filter, operate the electrical pump to bleed the fuel circuit properly before starting the engine.
6. Open the circuit output of the pump when the pump runs to evacuate the air in the circuit.

Figure 6.4 Electric Fuel Pump



6.5.7.3 Verify Fuel Pump Capability

1. Remove fuel pump from the system. Connect a manometer to pump outlet. Energize fuel pump with a small quantity of fuel.
2. At zero flow, the fuel pump should provide about 10.30 psig (0.7 bar) of pressure at the pump outlet.

- Pulsation frequency high - fuel circuit has low pressure drop/high flow.
- Pulsation frequency low (or null) - high pressure drop inside the circuit - low or zero flow. Check for restriction inside the circuit.

6.5.8 Servicing Glow Plugs

When servicing, the glow plug is to be fitted carefully into the cylinder head to prevent damage to glow plug. Testing will require an in-line Ammeter and a 12VDC source.

6.5.8.1 Checking Glow Plug Voltage

1. Connect a voltmeter between the glow plug wiring lead to a ground on the engine block.
2. Activate preheating.

NOTE

The engine temperature must be lower than 80°F (26°C) for the preheating.

3. During preheating, check the glow plug voltage on the voltmeter. Should be between 11V and 12.8V.
4. Check the glow plug voltage during the starting of the unit. Should be between 11V and 12.8V.
5. If voltage values are not within spec, then the battery, wiring harness, or switches may be faulty.

6.5.8.2 Checking Glow Plug Resistance:

1. Connect an Ohmmeter between the glow plug wiring lead and a ground on the engine block.
2. Measure the internal resistance between the glow plug terminal and engine body. Should be between 0.9 and 1.2 Ohms. Glow plugs must be checked individually.
3. If the value is not within the specified range, then the glow plug is faulty and should be replaced.
4. If 0 Ohms are indicated, then the glow plug may be short-circuited and should be replaced.

6.5.8.3 Checking Glow Plug Amperage

1. Place an Ammeter on the power cable for the glow plugs.
2. Activate preheating.
3. During preheating, check the glow plug amperage readings. Readings should be between 30A and 32A for 3-cylinder diesel and 20A to 22A for 2-cylinder diesel. During preheating, the value of the consumption decreases.

6.5.9 Alternator

⚠ CAUTION

Observe proper polarity, reverse polarity will destroy the diodes. As a precaution, disconnect positive terminal when charging.

The alternator and regulator are housed in a single assembly. A diagram for alternator troubleshooting or replacement is provided below (see **Figure 6.5**).

6.5.9.1 Inspection

Verify tightness of connections. If excitation wire is disconnected the unit will display ALT AUX and battery will not recharge during unit operation.

6.5.9.2 Brushes (Refer to Maintenance Schedule 6.4)

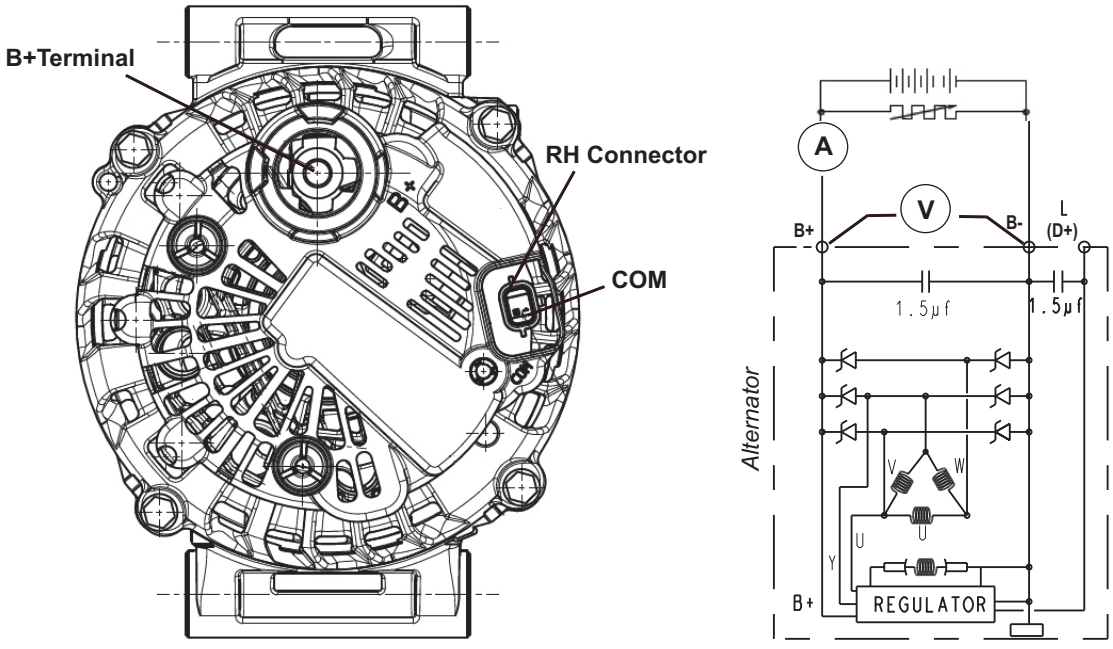
1. Disconnect battery terminals and alternator exciter cable.
2. Remove the three screws holding the regulator.
3. Replace the brushes.
4. Reassemble the regulator.

6.5.9.3 Voltage Control

1. Power up the unit.
2. Press the UNIT DATA key until the voltage measurement output is displayed. Refer to **Section 2.6.4** for Electrical Data.

For alternator troubleshooting, refer to **Section 7.2**

Figure 6.5 Alternator (P/N 30-60147-01)



6.6 Servicing and Adjusting Unit Belts

⚠ WARNING

Beware of moving belts and belt driven components as the unit may start automatically. When working with belts, beware of pinch points.

6.6.1 Belt Tensioner

Use an electronic belt tensioner (see **Figure 6.7**) when replacing or adjusting belts. The belt tensioner provides an accurate and easy method of adjusting belts to their proper tension. Properly adjusted belts give long lasting and efficient service. Too much tension shortens belt and bearing life, and too little tension causes slippage and excessive belt wear. It is also important to keep belts and sheaves free of any foreign material which may cause the belts to slip.

The belt tensioner can be used to adjust the belt. The readings which we specify for Carrier Transicold units are applicable only for our belts and application as the tension is dependent on the size of the belt and distance between sheaves. When using the belt tensioner, it should be placed as close as possible to the midpoint between two sheaves (See **Figure 6.6**). The Poly-V belts must be kept in good condition with the proper tension to provide adequate air movement across the coils.

When installing any new belts, preset the tension to the setting specified in the First Mounting Tension column. After initial run in, check the tension. It should settle to the setting specified in the Stabilized Tension column. If the run tension is below the Stabilized Tension range, re-tighten the belt to a value within this range. Refer to **Table 6–1**.

Figure 6.6 V-Belt Arrangement

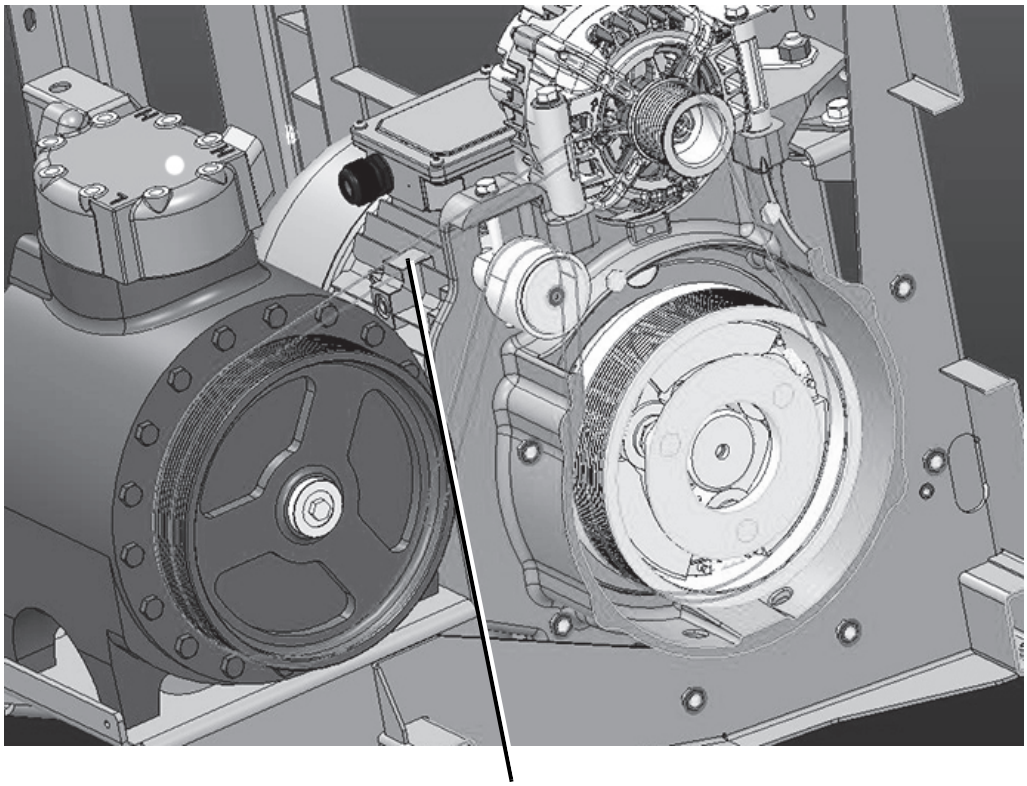


Table 6–1 Belt Tension

	Initial Tension	Run-In Tension	Minimum Tension
Drive Kit (S6 - S10)	120 Hz ± 6 Hz	100 Hz ± 5 Hz	85 Hz ± 4 Hz
Water Pump (S6)	171 Hz ± 15 Hz		
Water Pump (S7 - S9)	150 Hz ± 15 Hz		
Water Pump (S10)	95 Hz + 15 Hz		

Figure 6.7 Belt Tensioner (PN 07-60113-01)

6.6.2 Water Pump Belt Replacement

To replace the water pump Poly V elastic belt (fleXonic), perform the following steps:

1. Using the proper size socket, slowly rotate the crank by turning the crank pulley nut. At the same time, use a flat, blunt object to guide the belt off the crank pulley. Be careful not to damage grooves on the pulley.
2. Replace the Poly-V belt by positioning the belt on the water pump pulley, and while rotating the engine (as in step 1), use a flat, blunt object to guide the belt onto the crank pulley. Be careful not to damage grooves on the pulley or belt.

6.6.3 TDS Belt Replacement Procedure

Table 6–2 CTD Kit 76-61533-00

Quantity	Part Description
3	Guide Rods
3	Guide Block Brackets (two right and one left)
3	Securing Wing Bolts

⚠ WARNING

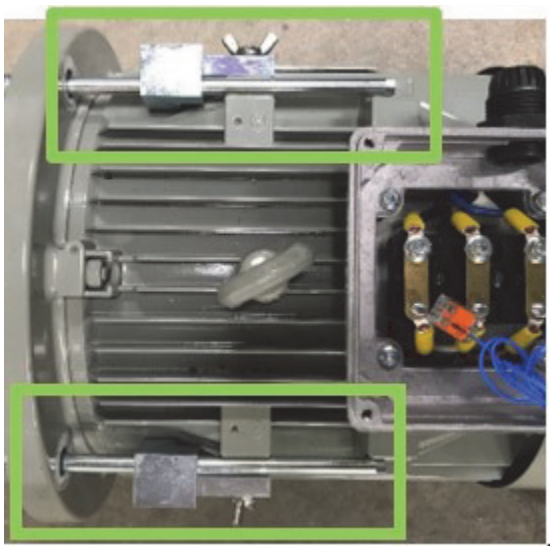
Unit may start automatically at any time even if the switch is the OFF position. Use proper lock-out/tagout procedures before inspection or servicing. All unit inspection/servicing by properly trained personnel only.

⚠ CAUTION

Before performing any work, ensure the unit start-run off switch (SROS) is in the OFF position, the negative battery cable is disconnected, and any external shore power is removed. Proper lockout / tag out procedures MUST be followed.

1. Remove top grille, bottom panel, and unit skin.
2. Remove all drive belt guards and related tie wraps.
3. Loosen belt tensioner
4. Remove alternator. Disconnect LIN wire. The Alt+ wire does not need to be removed. Place alternator out of the way and disconnect the DAS harness.
5. Remove coolant bottle cross bar and move to the side. DO not remove coolant bottles or hoses from cross bar.
6. Remove two top standby motor mount bolts.
7. Insert guide rods into guild blocks and install two of these assemblies on the tabs closest to bell housing on the standby motor using two of the wing bolts (refer to Figure 6.8)

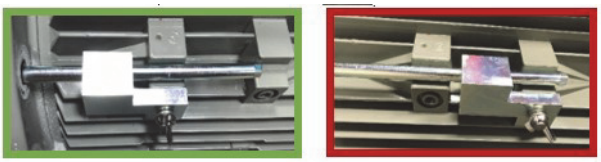
Figure 6.8 Guide Block Installation



NOTE

All three guide blocks MUST be installed correctly to allow for proper movement of the standby motor. See Figure 6.9 for correct placement.

Figure 6.9 Correct Guide Block Placement



Correct Incorrect

8. Remove bottom outside engine mount bolt.
9. Remove bottom outside standby motor mount bolt. Install guide bolt with guide block.
10. Remove remaining standby motor mount bolt.
11. Slide standby motor back towards condenser.
12. Slide belt out between clutch and pulley.
13. Install new belt.
14. Slide standby motor back into place.
15. Install rear standby motor mount belt and hand tighten.
16. Remove each guide bolt and replace motor mount bolt one by one.
17. Torque standby motor mount bolts to 50 -55 ft-lbs (68-75 Nm).
18. Install bottom outside engine mount bolt and torque to 30-35 ft-lbs (4147 Nm).
19. Install alternator, torque to 15-20ft-lbs (20-27Nm). Reconnect LIN wire.
20. Tension belt to initial tension setting (120 +/- 6 Hz) using electronic tension gauge. Turn the compressor drive pulley over by hand and recheck tension.

21. Install coolant bottle cross bar, torque to 5-10ft-lbs (7-14Nm).
22. Install belt guards, torque to 5-10ft-lbs (7-14Nm).
23. Tie wrap harness back into place.
24. Reconnect battery and run unit to seat belt.
25. Check belt tension again. Set to run-in tension (100 +/- 5 Hz),
26. Install top grille, bottom panel, and skin.

6.7 Servicing Refrigerant System

6.7.1 Refrigerant System Service Connections

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 or 07-00294-00 for R-134A or 07-00314-00 for R-452A. Refer to **Figure 6.10**).

Figure 6.10 4-Port Manifold Gauge Set

Before manifold installation, ensure that the following conditions are true:

- Compressor service valves are backseated
- Receiver king valve is backseated
- Manifold gauge valves and hose service valves are closed
- Before calibrating gauges, the pressure must be 0 inHG (0 bar)

6.7.2 Preparing Manifold Gauge / Hose

If the manifold gauge/hose set is new or was exposed to the atmosphere, then it will need to 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 appropriate refrigerant cylinder.
3. Evacuate to 10 inHg (.34 bar).
4. Charge with appropriate refrigerant to a slightly positive pressure of 1.0 psig (0.07 bar).
5. Front seat both manifold gauge set hand valves and disconnect from the cylinder. The gauge set is now ready to use.

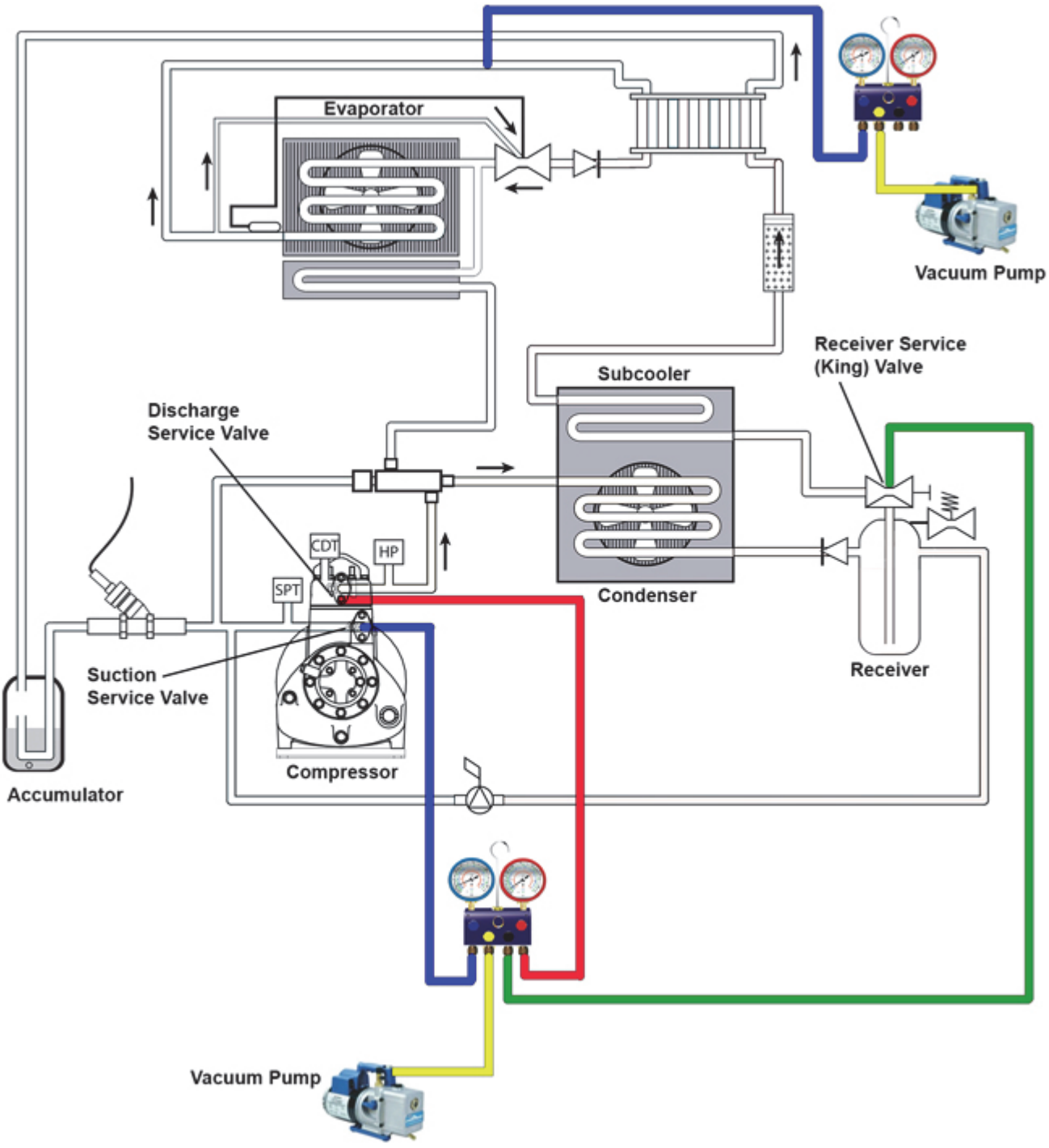
6.7.3 Connecting Manifold Gauge/Hose Set

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

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

When performing service on the refrigerant system, you must evacuate a manifold gauge before every recovery. This ensures that no remaining air or refrigerant remains inside the hoses. Refer to **Figure 6.11**.

Figure 6.11 Connections for Evacuation of Manifold Gauges



1. Connect a manifold gauge set to the unit with connections to the following equipment:
   - Suction (LP) service valve
   - Vacuum pump
   - Discharge (HP) service valve
   - Receiver service valve
2. Start the vacuum pump.
3. Open all of the manifold gauge valves.
4. Open the hose service valve for the vacuum pump connected hose. Wait for one minute.
5. Check the manifold gauge values. They must be at the lowest value and stable.
6. Close the hose service valve for the vacuum pump connected hose.
7. Stop and disconnect the vacuum pump.
8. Connect a manifold gauge to the evaporator with connections to the following equipment:
   - Evaporator connection port
   - Vacuum pump
9. Start the vacuum pump.
10. Open the manifold gauge valves.
11. Open the hose service valve for the vacuum pump connected hose. Wait for one minute.
12. Check the low pressure manifold gauge value. It must be at the lowest value and stable.
13. Close the hose service valve for the vacuum pump connected hose.
14. Stop and disconnect the vacuum pump.

6.7.4 Removing 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).

6.7.5 Servicing Refrigerant Charge

⚠ WARNING

Before performing any "hot work," including but not limited to brazing or welding on a unit that has been charged with R-452A, refrigerant must be recovered until equipment gauge indicates -20 inHG (-0.67 Bar) of vacuum. Nitrogen purge is also required. Refer to Service Section for recovery procedure.

⚠ CAUTION

Refrigerant R-404A / R-452A must be charged as a liquid. Refrigerant R-404A / R-452A is a blend. Charging as a vapor will change the properties of the refrigerant. Only liquid charging through the receiver service valve is acceptable.

NOTE

Any system that is low on R-452A refrigerant must be fully recovered and recharged.

NOTE

To avoid damage to the earth's ozone layer, use a refrigerant recovery system whenever removing refrigerant from a refrigeration system. When working with refrigerants you must comply with all local government environmental laws, U.S.A. EPA section 608.

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 **Evacuation and Dehydration** procedure).

6.7.5.1 Checking the Refrigerant Charge

For most accurate results, perform this when ambient temperature is at 68°F (20°C). This is the optimal temperature for correct head pressure.

1. Start the unit in cooling mode and run for approximately ten minutes.
2. Partially block off air flow to the condenser coil so discharge pressure rises to 210 psig (14.8 bar).
3. The unit is correctly charged when the receiver sight glass is not full and not empty. Or, when sub-cooling is between 5.4° and 12.6°F (-14.8° and -10.8°C).

6.7.5.2 Pumping Down the Unit

To service the filter drier, expansion valve, CSMV valve or evaporator coil, pump most of the refrigerant into the condenser coil and receiver with the instructions below. This will put into a vacuum the circuit from the king valve to the suction service valve.

1. Backseat (turn counterclockwise) the suction and discharge service valves to close off the gauge connection and attach manifold gauges to the valves.

NOTE

Open the valves two turns clockwise and then purge the gauge lines. However, if local regulations state that hoses must be evacuated, refer to **Evacuation and Dehydration** procedure.

2. Close the receiver service valve by turning clockwise. Start the unit and run in high speed cooling. Place RUN/STOP Switch in the STOP position when the unit reaches the low pressure switch cut-off.
3. Frontseat (close) suction service valve and the refrigerant will be trapped between the compressor suction service valve and the receiver service valve.
4. Before opening up any part of the system, a slight positive pressure should be indicated on the pressure gauge.
5. 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.
6. Replace the filter drier and O-ring and vacuum.
7. When service has been completed, backseat (open) the receiver service valve and midseat the suction service valve.
8. Leak check connections with a leak detector. Refer to **Refrigerant Leak Checking** procedure. Start the unit in cooling. Check the pressure and do an analysis of the unit while it is operating.
9. Check the refrigerant charge. Refer to **Checking the Refrigerant Charge** procedure.

6.7.5.3 Recovery Procedure to Remove the Refrigerant Charge

Connect a refrigerant recovery unit and a clean refrigerant recovery cylinder to the unit to remove refrigerant charge. Refer to instructions provided by the manufacture of the refrigerant recovery system. View **Figure 6.12** for diagram of connections.

NOTE

To avoid damage to the Earth's ozone layer, use a refrigerant recovery system whenever removing refrigerant from a refrigeration system. When working with refrigerants you must comply with all local government environmental laws, U.S.A. EPA section 608.

NOTE

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

Materials Needed:

- Personal Protection Equipment
- Manifold gauges
- Refrigerant recovery device (Reclaim pump)
- Clean, evacuated refrigerant recovery cylinder that can hold nameplate charge
- Electronic scale

Procedure:

1. Backseat the suction and discharge service valves.
2. Backseat the receiver service valve (king valve).
3. Connect the manifold gauge set to the suction and discharge service valves, and to the receiver service valve (king valve) connection plug.

NOTE

If local regulations state that hoses must be evacuated, then refer to refer to **Evacuation and Dehydration** procedure.

4. Connect the refrigerant recovery device input to the manifold gauge hose.
5. Connect the refrigerant recovery device output to the liquid valve of the refrigerant recovery cylinder.
6. Tare the electronic scale to set it to zero.
7. Install the recovery cylinder onto the electronic scale. Note the weight.
8. Midseat the suction service valve and discharge service valve.
9. Midseat the receiver service valve (king valve).
10. Open the hose service valves for suction, discharge, and receiver (king) connections.
11. Open the liquid valve of the recovery cylinder.
12. Place the unit in Recovery / Vacuum mode. The SMV must be opened manually using the stepper tool (CTD part number 07-00375-00SV).
13. Start the recovery device. Refer to instructions provided by the recovery device manufacturer for operating procedures.
14. Open the hose service valve for the recovery device connection.
15. Open the appropriate manifold gauge valves to direct refrigerant from the unit Receiver into the recovery cylinder.
16. Check the weight displayed on the scale and note the refrigerant charge recovered.
17. Close the hose service valve for the recovery device connection.
18. Stop the recovery device.
19. Close the liquid valve of the recovery cylinder.
20. Disconnect the recovery cylinder from the recovery device.
21. Connect the recovery device output to the vapor valve of the recovery cylinder.
22. Open the vapor valve of the recovery cylinder.
23. Start the recovery device.
24. Open the hose service valve for the recovery device connection.
25. Open the appropriate manifold gauge valves to direct refrigerant vapor from the Compressor into the recovery cylinder. All manifold gauges are now open.
26. Check the pressure valves indicated on the manifold gauges. Wait until the needle on the Low side manifold gauge shows a sufficient vacuum.
    - For R-404A, pressure must be 0 inHG (0 bar).
    - For R-452A, pressure must be -20 inHG (-0.67 bar). Do not continue with this procedure until the pressure specified has been reached.

⚠ WARNING

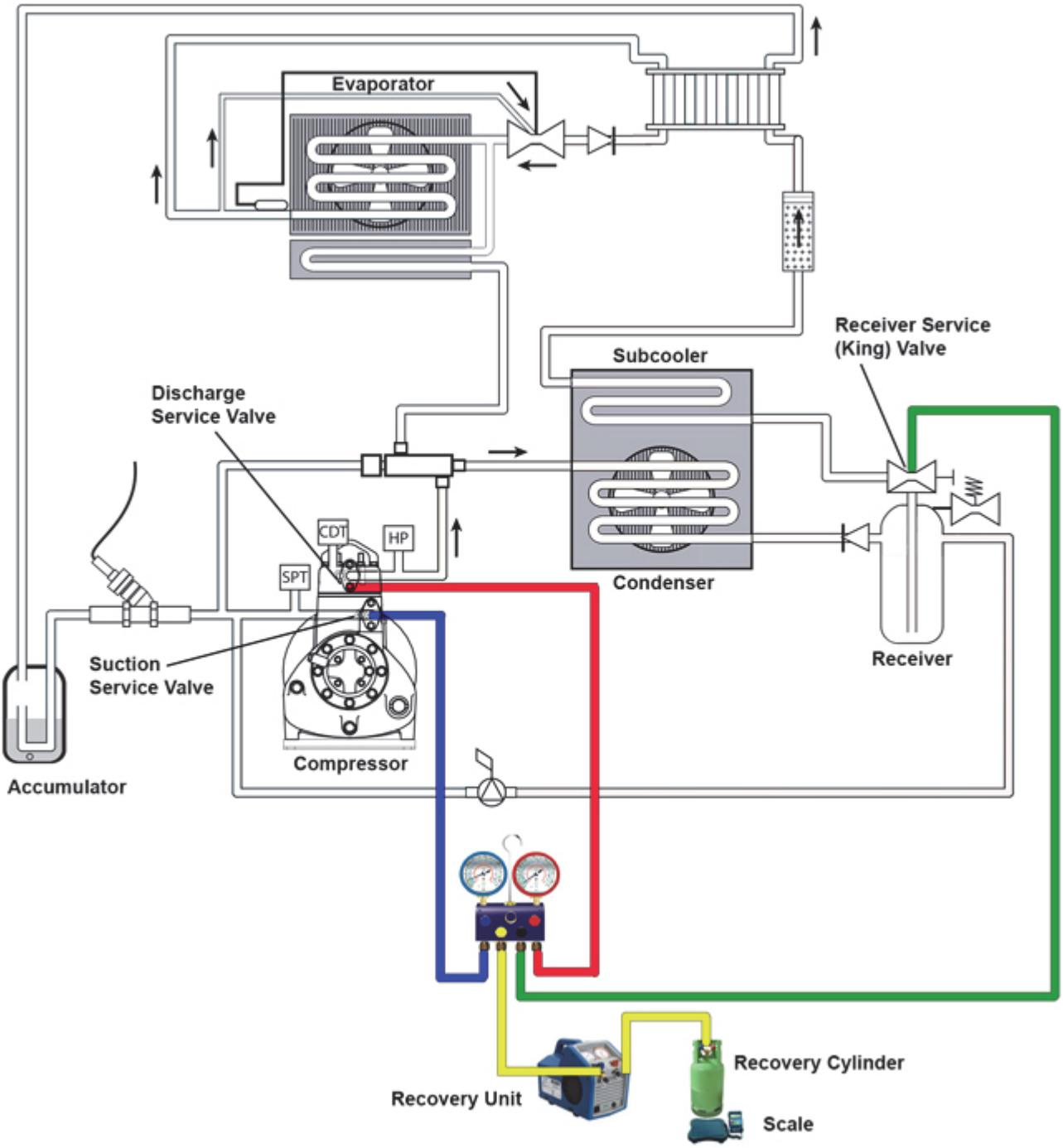
Before performing any "hot work," including but not limited to brazing or welding on a unit that has been charged with R-452A, refrigerant must be recovered until equipment gauge indicates -20 inHG (-0.67 Bar) of vacuum. Nitrogen purge is also required. Refer to Service Section for recovery procedure.

27. Frontseat the suction and discharge service valves.
28. Stop the recovery device.
29. Close the vapor valve of the recovery cylinder.
30. Disconnect the recovery machine.
31. Dispose of the recovery cylinder according to local regulations.
32. If performing any hot work and refrigerant is R-452A, a nitrogen purge is required.

    If performing any hot work and refrigerant is R-404A, a nitrogen purge is not required.

    During the hot work, a small amount of nitrogen (1 to 3 liters) must be added to the circuit. Otherwise, there will be black smoke and oxidation in the circuit.
33. After making any necessary repairs, leak check, evacuate and then recharge the system.

Figure 6.12 Connections for Refrigerant Recovery



6.7.6 Refrigerant Leak Checking

If system was opened and repairs completed, leak check the unit.

6.7.6.1 Standard Leak Check

⚠ WARNING

Use only the correct refrigerant to pressurize the system. To increase the pressure, dry nitrogen may be used. Any other gas or vapor will contaminate the system which will require additional purging and evacuation of the high side (discharge) of the system.

1. The recommended procedure for finding leaks in a system is with an electronic leak detector (Carrier p/n 07-00295-00). Testing joints with soapsuds is satisfactory only for locating large leaks.
2. If system is without refrigerant, charge system with refrigerant to build up pressure between 30 and 50 psig (2.1 and 3.4 bar). Remove refrigerant cylinder and leak check all connections.
3. Remove refrigerant using a refrigerant recovery system and repair any leaks.
4. Evacuate and dehydrate the unit. (Refer to **Evacuation and Dehydration** procedure)
5. Charge unit with refrigerant. (Refer to **Servicing Refrigerant Charge** procedure)

6.7.6.2 Leak Check Using Pressurized Dry Nitrogen

Under most conditions, the use of a Halogen leak detector is sufficient to find the refrigerant leak in the system. However, there may be times when additional pressure is required to pinpoint the leak. In this case, dry nitrogen is recommended to pressurize the system. One should never use pressurized air or other gases. The following instructions are the optimal method for leaking checking with pressurized nitrogen.

⚠ WARNING

Unit may start automatically at any time even if the switch is in the OFF position. Use proper lockout/tagout procedures before inspecting/servicing. All unit inspection/servicing may be done my properly trained personnel only.

⚠ CAUTION

Before performing any work, ensure the unit start-run off switch (SROS) is in the OFF position, the negative battery cable is disconnected, and any external shore power is removed. Proper lockout / tag out procedures MUST be followed.

1. Connect manifold gauge set to the refrigeration unit. A three-point connection is recommended - compressor suction and discharge service ports, as well as the receiver tank outlet service valve (King valve).

NOTE

When possible, place the unit in SERVICE MODE via the microprocessor.

2. Recover remaining refrigerant from the system.
3. Add one pound of refrigerant back into the system. This amount of refrigerant is sufficient to activate the halogen leak detector.
4. Connect the service hose to an approved nitrogen pressure regulator. See **Figure 6.13** for an example of a nitrogen regulator.

Figure 6.13 Nitrogen Pressure Regulator

5. Close the regulator (turn fully counterclockwise) to prevent any pressure from being added to the system.
6. Open the nitrogen cylinder and gradually open the regulator (turn clockwise) until the outlet pressure gauge reads 20 to 150 psi. This is a sufficient amount of pressure to find any leak.
7. Open the manifold gauge set and allow pressure to stabilize between the nitrogen bottle and the refrigeration unit.
8. Once the pressure has stabilized, close off the manifold gauge set and nitrogen cylinder. Disconnect the service hose from the nitrogen cylinder.
9. Proceed with using the halogen leak detector around solder joints or potential leak points. Applying a soapy solution may be necessary to pin point the source of the leak.
10. After the leak is detected, remove the nitrogen from system prior to performing any repairs.
11. When all leaks have been repaired, follow proper evacuation and charge procedures.

6.7.7 Evacuation and Dehydration

6.7.7.1 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.

6.7.7.2 Preparation

1. Evacuate and dehydrate only after pressure leak test. (Refer to **Refrigerant Leak Checking** procedure)
2. Essential tools to properly evacuate and dehydrate any system include a good vacuum pump (5 cfm = 8m^{3}H volume displacement, P/N 07-00176-11) and a good vacuum indicator such as a thermocouple vacuum gauge (vacuum indicator). (Carrier p/n 07-00414-00).

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 be fore moisture removal is complete. Heat lamps or alternate sources of heat may be used to raise system temperature.

6.7.7.3 Evacuating and Dehydrating System

1. Remove refrigerant using a refrigerant recovery system. Refer to **Recovery Procedure to Remove the Refrigerant Charge** procedure.
2. The recommended method to evacuate and dehydrate the system is to connect three evacuation hoses to the vacuum pump and refrigeration unit. Do not use standard service hoses, as they are not suited for evacuation purposes. Also, connect an evacuation manifold, with evacuation hoses only, to the vacuum pump, electronic vacuum gauge, and refrigerant recovery system.
3. With the unit service valves closed (backseated) and the vacuum pump and electronic vacuum gauge valves open, start the pump and draw a deep vacuum. Shut off the pump and check to see if the vacuum holds. This operation is to test the evacuation setup for leaks, repair if necessary.
4. Midseat the refrigerant system service valves. Check to ensure the CSMV is open. The CSMV can be opened manually using the stepper tool (CTD part number 07-00375-00SV).
5. Then open the vacuum pump and electronic vacuum gauge valves, if they are not already open. Start the vacuum pump. Evacuate the 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 clean dry nitrogen through the discharge service valve. Raise system pressure to approximately 2 psig (0.1 bar).
7. Remove refrigerant using a refrigerant recovery system.
8. Repeat steps 5 through 7 one time.
9. Evacuate the unit to 500 microns. Close off the vacuum pump valve and stop the pump. Wait five minutes to see if the vacuum holds. This checks for residual moisture 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. The correct amount of refrigerant may be added by observing the scales.

6.7.8 Charging the Refrigeration System

⚠ CAUTION

Refrigerant R-404A / R-452A must be charged as a liquid. Refrigerant R-404A / R-452A is a blend. Charging as a vapor will change the properties of the refrigerant. Only liquid charging through the receiver service valve is acceptable.

6.7.8.1 Adding a Complete Charge

1. Dehydrate the unit and leave in a deep vacuum. (Refer to **Evacuation and Dehydration** procedure)
2. Place the refrigerant cylinder on scale and connect the charging line from the cylinder to the receiver service valve. Purge the charging line at the outlet valve.

   However, if local regulations state that hoses must be evacuated, then refer to **Evacuation and Dehydration** procedure.
3. Note the weight of the refrigerant cylinder.
4. Open the liquid valve on the refrigerant cylinder. Open the receiver service valve halfway and allow the liquid refrigerant to flow into the unit until the correct weight of refrigerant has been added as indicated by scales. Correct charge will be found in **Section 2.6**, Unit Specifications.
5. When refrigerant cylinder weight (scale) indicates that the correct charge has been added, close the liquid line valve on the cylinder and backseat the receiver service valve.
6. Evacuate the liquid which is in the manifold tubes with the suction of the compressor.

6.7.8.2 Adding a Partial Charge

NOTE

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

1. Place drum of refrigerant on the scale and note the weight.
2. Backseat the discharge and suction service valves and install a manifold gauge set in order to monitor system. Purge the lines. However, if local regulations state that hoses must be evacuated, then refer to **Evacuation and Dehydration** procedure.
3. Connect the discharge gauge of a second manifold test set to the receiver service valve.
4. Connect the suction pressure hose to the manifold dead head port.
5. Connect a charging line between the center tap of the second gauge set and refrigerant drum.
6. Midseat discharge knob.
7. Open the liquid valve on drum and purge all hoses.
8. Frontseat discharge knob.
9. Start the unit in cooling mode only (high speed).
10. Check the sight glass to determine charge. The unit is correctly charged when the lower receiver sight glass is full and no refrigerant is in the upper receiver sight glass. Or, when subcooling is between 37° and 44°F (3° and 7°C)
11. Frontseat the receiver service valve. Monitor the second set of manifold gauges. When the receiver service valve pressure drops below the pressure in the refrigerant drum, midseat the manifold gauge set discharge valve and allow liquid refrigerant to flow into the system.
12. While monitoring the sight glass, carefully weigh refrigerant into the system. It is not possible to accurately determine when the system is full because unit is in discharge state; therefore, never allow more than 1 lb. (0.45 kg) of refrigerant into the system at a time.
13. After monitoring 1 lb. (0.45 kg) of refrigerant into the system, close the valve of the manifold gauge set connected to the receiver service valve. Open the receiver service valve and allow the system to balance out to determine charge.
14. Follow the procedures of **Servicing Refrigerant Charge** and repeat above procedure as required to clear the sight glass.
15. Start unit and check for non-condensables.

6.7.9 Refrigerant Recovery Prior to Unbrazing Operation for R-452A Units

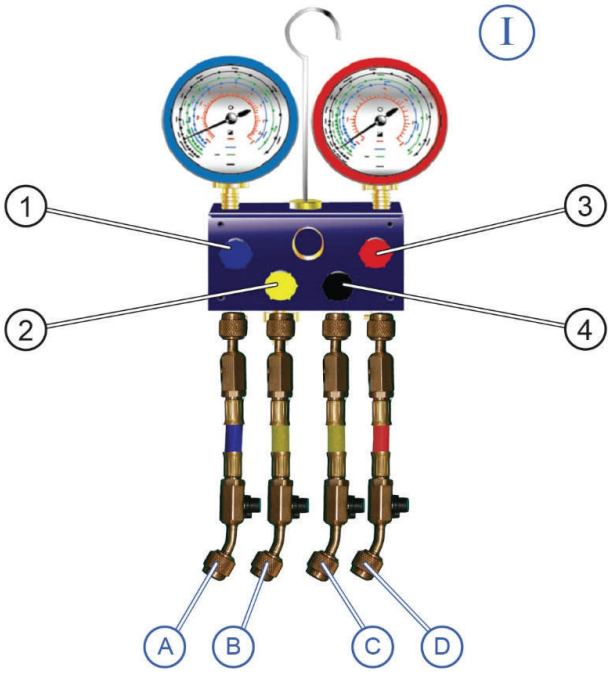
⚠ WARNING

R-452A refrigerant is an A1 non-flammable refrigerant blend which includes some mildly flammable constituents. As such, please follow all proper service and maintenance procedures. Ensure that proper evacuation procedure is strictly followed before performing any "hot work," including, but not limited to brazing or welding, on these units to prevent flare-up of residual refrigerant.

- Refrigerant must be recovered until equipment gauge indicates -20 inHG (-0.67bar/ -9,82 PSIA) of vacuum.
- This specific risk has to be taken into account especially in case of work at height (fall risk).
- To correctly perform this procedure and allow a correct R-452A receiver, ensure that the ambient temperature around the unit is 68°F (20°C)
- Before intervention, check that the Start-Stop function is off.
- After any service on the unit, do not forget to reinstall any doors or panels that were removed.
- In case of leak on the refrigeration circuit, please ensure the minimum pressure is reached per the recovery machine and ensure a proper nitrogen purge during the unbrazing operation.
- In the event of unbrazing on the evaporator side, store the refrigerant in the condensing unit and apply the following procedure on the evaporator side.
- For environment, health and safety concerns, this procedure MUST be followed to avoid any leaks or refrigerant blocks.
- Performing "hot work" on a unit without having followed this procedure may lead to personal injury.

6.7.9.1 Unit Connection

Figure 6.14 Unit Connection



Connect the manifold

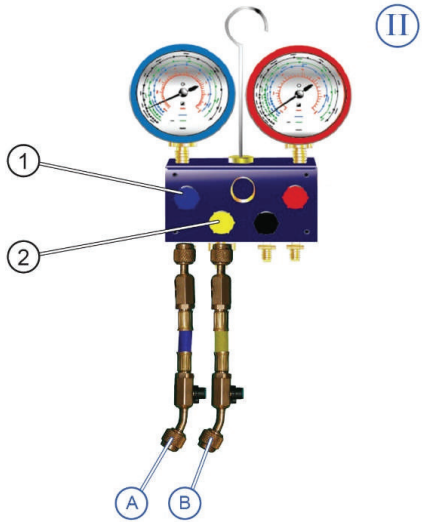
- Hose A to low-pressure compressor service valve
- Hose B to vacuum pump
- Hose C to high-pressure receiver tank king valve
- Hose D to high-pressure compressor service valve

1. Start the vacuum pump.
2. Open the manifold gauge valves (1,2,3,4).
3. Open the hose B service valve and wait for one minute.
4. Check the manifold gauge values. Readings must be at the lowest and most stable.
5. Close hose B service valve.
6. Stop the vacuum pump.
7. Disconnect the vacuum pump.

The manifold gauge (I) is installed

6.7.9.2 Evaporator Connection

Figure 6.15 Evaporator Connection



1. Connect the manifold gauge (II) to the evaporator. Refer to **Figure 6.15**.
   - Hose A to the evaporator connection port.
   - Hose B to the vacuum pump
2. Start the vacuum pump.
3. Open the manifold gauge valves (1,2).
4. Open the hose service valve (B) and wait for one minute.
5. Check the low-pressure manifold gauge value. It must be at the lowest and most stable.
6. Close the hose (B) service valve.
7. Stop the vacuum pump and disconnect.

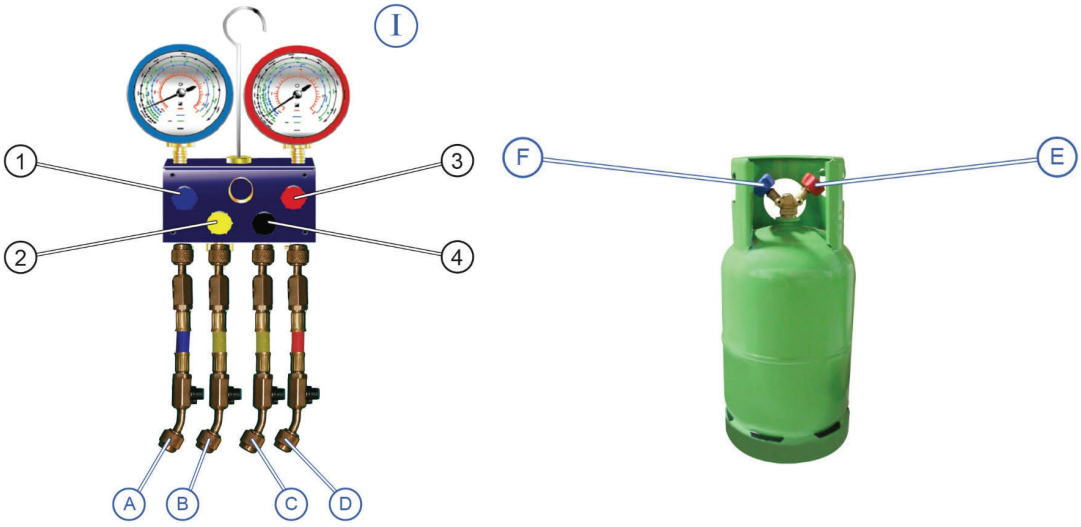
The manifold gauge (II) is installed

Before continuing with the next steps:

- Ensure the manifold installation procedure is completed correctly.
- Ensure all unit valves are opened
- Ensure there are no refrigerant traps

6.7.9.3 Recovery System Installation

Figure 6.16 Recovery System



1. Connect recovery machine to hose (B).Refer to **Figure 6.16**.
2. Place the R-452A recovery bottle onto the scale and note the weight.
3. Check the admissible charge indicated in the R-452A recovery bottle information.
4. Connect the liquid valve (E) of the R-452A recovery bottle to the recovery machine.
5. Adjust high- and low-pressure compressor service valves to the mid-seat position.
6. Adjust receiver king valve (liquid line service valve) to the mid-seat position.
7. Open hoses A,B,C,D service valves.

The system is ready for recovery.

6.7.9.4 R-452A Liquid Recovery

1. Open liquid valve (E) and start the recovery machine. Refer to **Figure 6.16**.
2. Open hose B service valve.
3. Open the manifold gauge valve (2,3). The R-452A liquid will be transferred from the unit receiver to the R-452A recovery bottle.
4. Check weight on the scale. The R-452A recovery bottle weight must be stable.
5. Close hose B service valve.
6. Stop the recovery machine. Close liquid valve (E).

The R-452A liquid is recovered

1. Disconnect the R-452A recovery bottle from the recovery machine.
2. Connect the vapor valve (F) of the R-452A recovery bottle to the recovery machine.

The system is ready for vapor recovery

6.7.9.5 R-452A Vapor Recovery

1. Open vapor valve (F).
2. Start the recovery machine.
3. Open hose B service valve.
4. Open the manifold gauge valve (1,4). The R-452A vapor will be transferred from the compressor to the R-452A recovery bottle.
5. Check the pressure values indicated on the two manifold gauges.
   - Wait until the dials from the two manifold gauges indicate -0,67 bar (-20 inHg)
   - In order to prevent flare-up or residual refrigerant, do not move to the next step before reaching -0,67 bar (-20 inHg). This specific effect must be taken into consideration especially in cases of working in heights where there may be a fall risk.

The R-452A is recovered

6. Close hose B service valve.
7. Close the two manifold gauge service valves.
8. Stop the recovery machine.
9. Wait for 15 minutes.
   - If after 15 minutes the pressure has risen, repeat the recovery procedure starting with step 1.
   - If -0,67 bar (-20 inHg) is maintained, proceed to step 10.
10. Disconnect the recovery machine and dispose of the R-452A recovery bottle according to local regulation.

End of recovery procedure

11. Purge with Nitrogen.

For more information about nitrogen instruction, refer to Carrier Transicold document #98-60068-00 (Brazing Instructions).

The refrigerant circuit is ready for unbrazing operation. Perform unbrazing operation under nitrogen.

6.8 Replacing the Compressor

⚠ WARNING

Ensure power to the unit is OFF and power plug is disconnected or vehicle engine is OFF and negative battery cable is disconnected before replacing the compressor.

⚠ WARNING

Unit may start automatically at any time even if the switch is in the OFF position. Use proper lockout/tagout procedures before inspection/servicing. All unit inspection/servicing by properly trained personnel only.

6.8.1 Removing

If compressor runs, pump down the unit. (Refer to **Section 6.7.5.2**). If compressor is inoperative and unit still has refrigerant pressure:

- If the issue is external to the compressor, frontseat the suction and discharge service valves to isolate the compressor from the unit.
- If the issue is internal to the compressor, recover all the gas in the circuit and then clean the circuit.

1. Recover refrigerant from compressor with a refrigerant recovery system.
2. Remove bolts from suction and discharge service valve flanges.
3. Remove skin and bottom panel.
4. Disconnect wiring to compressor sensors and switches.
5. Release idler pulleys and remove belts.
6. Remove the four bolts holding the compressor to the frame. Remove the compressor from the frame.
7. Remove the pulley and all the brackets from the compressor.
8. Drain oil from defective compressor before shipping. Check the oil level and note the quantity.

6.8.2 Installing

1. To install the compressor, reverse the procedure out lined when removing the compressor. Refer to **Section 2.6.5** for torque values.

NOTE

The service replacement compressor is sold without shutoff valves (but with valve pads). Customer should retain the original capacity control valves for use on replacement compressor. Check oil level in service replacement compressor. (Refer to sections **2.6.2**, and **6.9**)

2. Attach two lines (with hand valves near vacuum pump) to the suction and discharge service valves. Dehydrate and evacuate compressor to 500 microns (29.90 Hg vacuum = 75.9 cm Hg vacuum). Turn off valves on both lines to pump.
3. Fully open (backseat) both suction and discharge service valves.
4. Remove vacuum pump lines and install manifold gauges.
5. Check refrigerant level (Refer to **Section 6.7.5**)

NOTE

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

6. Check compressor oil level. (Refer to **Section 6.9**) Add oil if necessary.
7. Check refrigerant cycles.

6.9 Compressor Oil Service

6.9.1 Checking Oil Level - Method 1

1. Operate the unit in high speed cooling for at least 20 minutes.
2. Check the oil sight glass on the compressor to ensure that no foaming of the oil is present after 20 minutes of operation. If the oil is foaming excessively after 20 minutes of operation, check the refrigerant system for flood-back of liquid refrigerant. Correct this situation before performing step 3.
3. Check the level of the oil in the sight glass with the compressor operating. The correct level should be between bottom and 1/4 of the sight glass. If the level is above 1/4, oil must be removed from the compressor. To remove oil from the compressor, follow **Section 6.9.5** If the level is below sight glass, add oil to the compressor following **Section 6.9.4**.

6.9.2 Checking Oil Level - Method 2

1. Operate the unit in heat mode for at least 20 minutes.
2. Check the oil sight glass on the compressor to ensure that no foaming of the oil is present after 20 minutes of operation. If the oil is foaming excessively after 20 minutes of operation, check the refrigerant system for flood-back of liquid refrigerant. Correct this situation before performing step 3.
3. Stop the unit.
4. Check the level of the oil in the sight glass with the compressor operating. The correct level should be between 1/4 and 3/4 of the sight glass. If the level is above 3/4, oil must be removed from the compressor. To remove oil from the compressor, follow **Section 6.9.5** If the level is below sight glass, add oil to the compressor following **Section 6.9.4**.

6.9.3 Adding Oil with Compressor in System

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

6.9.3.1 Oil Pump Method

One compressor oil pump that may be purchased is a Robinair, P/N 14388. This oil pump adapts to a one U.S. gallon (3.785 liters) metal refrigeration oil container and pumps 2.5 ounces (0.0725 liters) per stroke when connected to the suction service valve port. Also there is no need to remove pump from can after each use.

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

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

6.9.3.2 Closed System Method

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

⚠ CAUTION

Extreme care must be taken to ensure the manifold common connection remains immersed in oil at all times. Otherwise air and moisture will be drawn into the compressor.

Connect the suction connection of the gauge manifold to the compressor suction service valve port, and immerse the common connection of the gauge manifold in an open container of refrigeration oil. Crack the suction service valve and gauge valve to vent a small amount of refrigerant through the common connection and the oil to purge the lines of air. Close the gauge manifold valve.

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

6.9.4 Adding Oil to Service Replacement Compressor

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

If compressor is without oil: Add correct oil charge by removing the oil fill plug (See **Figure 6.17**).

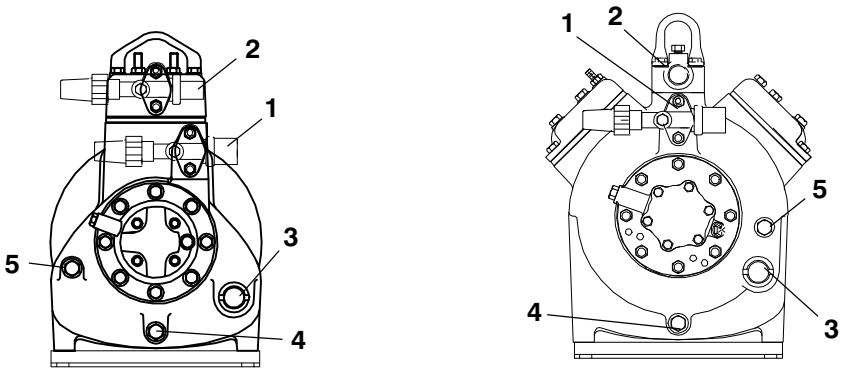
6.9.5 Remove Oil from the Compressor

1. Close suction service valve (frontseat) and pump unit down to 2 to 4 psig (0.1 to 0.3 kg/cm^2). Frontseat discharge service valve and slowly bleed remaining refrigerant.
2. Remove the oil drain plug from compressor and drain the proper amount of oil from the compressor. Replace the plug securely back into the compressor.
3. Open service valves and run unit to check oil level, repeat as required to ensure proper oil level.

⚠ WARNING

Since refrigerant traps a certain quantity of oil, to avoid oil loss during maintenance, add 50 cc of POE oil to the refrigeration system when any evacuation is performed.

Figure 6.17 Compressor



2-Cylinder **4-Cylinder**

1. Suction Service Valve
2. Discharge Service Valve
3. Oil Level Sight Glass
4. Oil Drain Plug
5. Oil Fill Plug

6.10 Servicing the Refrigerant System Components

6.10.1 Evaporator Coil Cleaning

The use of recycled cardboard cartons is increasing across the country. 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 the evaporator coil on a regular basis, not only to remove cardboard dust, but to remove any grease or 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. Remove rubber check valves (Kazoo) from drain lines.
2. Spray coil with a mild detergent solution such as Oakite 164 or any good commercial grade automatic dish washer detergent such as Electrosol or Cascade and let the solution stand for a few minutes and re verse flush (opposite normal air flow) with clean water at mild pressure. A garden hose with spray nozzle is usually sufficient. Drain lines MUST be clean.
3. Run unit until defrost mode can be initiated to check for proper draining from drain pan.

6.10.2 Condenser Coil Cleaning

Refer to **Section 6.5.1**.

6.10.3 Checking and Replacing Filter Drier

6.10.3.1 Check Filter Drier

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

6.10.3.2 Replace Filter Drier

1. Pump down the unit per **Section 6.7.5**. Remove bracket, then replace drier and O-ring.
2. Check refrigerant level. (Refer to **Section 6.7.5**)

6.10.4 Checking and Replacing High Pressure Switch

6.10.4.1 Replacing High Pressure Switch

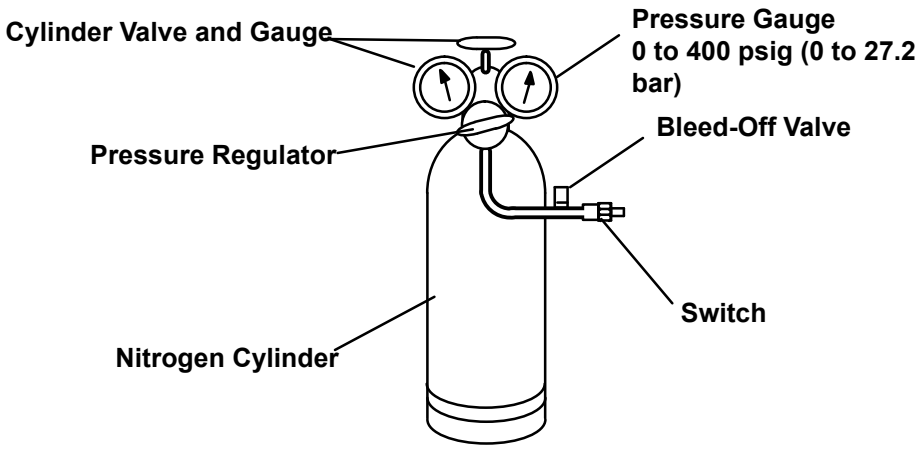
1. Pump down the unit. (Refer to **Section 6.7.5**) Frontseat both suction and discharge service valves to isolate compressor.
2. *Slowly* release compressor pressure through the service valve gauge ports to refrigerant recovery device.
3. Disconnect wiring from defective switch. The high pressure switch is located near the top of the compressor.
4. Install new cutout switch after verifying switch settings.
5. Evacuate and dehydrate the compressor. (Refer to **Section 6.7.7**)

6.10.4.2 Checking High Pressure Switch

⚠ WARNING

Do not use a nitrogen cylinder without a pressure regulator. Cylinder pressure is approximately 2350 psi (162 bar). Do not use oxygen in or near a refrigerant system as an explosion may occur. (See Figure 6.18)

Figure 6.18 Setup for Testing High Pressure Switch



1. Remove switch as outlined in **Section 6.10.4**.
2. Connect ohmmeter or continuity light across switch terminals. Ohmmeter will indicate resistance and continuity light will be lighted if switch closed after relieving pressure.
3. Connect switch to a cylinder of dry nitrogen. (See **Figure 6.18**)
4. Set nitrogen pressure regulator higher than open setting for switch being tested. Pressure switch settings are shown in **Section 2.6.2**.
5. Close valve on cylinder and open the bleed-off valve.
6. Open cylinder valve. Slowly close bleed-off valve and increase pressure until the switch opens. If light is used, light will go out and if an ohmmeter is used, the meter will indicate open. Close the cylinder valve. Slowly open the bleed-off valve (to decrease pressure) until the switch closes (light will illuminate or ohmmeter will indicate open).

6.10.5 Checking Calibration of the Defrost Air Switch

1. Check that the magnehelic gauge is in proper calibration.

NOTE

The magnehelic gauge may be used in any position, but must be re-zeroed if position of gauge is changed from vertical to horizontal or vice versa. USE ONLY IN POSITION FOR WHICH IT IS CALIBRATED.

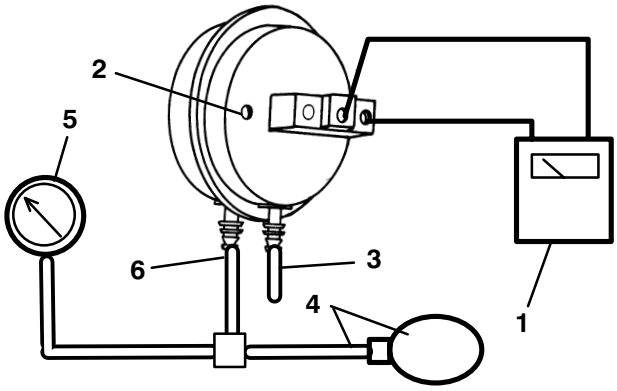
2. With air switch in vertical position, connect high pressure side of magnehelic gauge to high side connection of air switch. (See **Figure 6.19**)
3. Install tee in pressure line to high side connection. Tee should be approximately halfway between gauge and air switch or an improper reading may result.
4. Attach an ohmmeter to the air switch electrical con tacts to check switch action.

NOTE

Use a hand aspirator (P/N 07-00177-01), since blowing into tube by mouth may cause an incorrect reading.

5. With the gauge reading at zero, apply air pressure very slowly to the air switch. An ohmmeter will indicate continuity when switch actuates.
6. Refer to **Section 2.6.3** for switch settings. If switch fails to actuate at correct gauge reading, adjust switch by turning adjusting screw clockwise to increase setting or counterclockwise to decrease setting.
7. Repeat checkout procedure until switch actuates at correct gauge reading.
8. After switch is adjusted, place a small amount of paint or glycerol on the adjusting screw so that vibration will not change switch setting.

Figure 6.19 Defrost Air Switch Test Setup

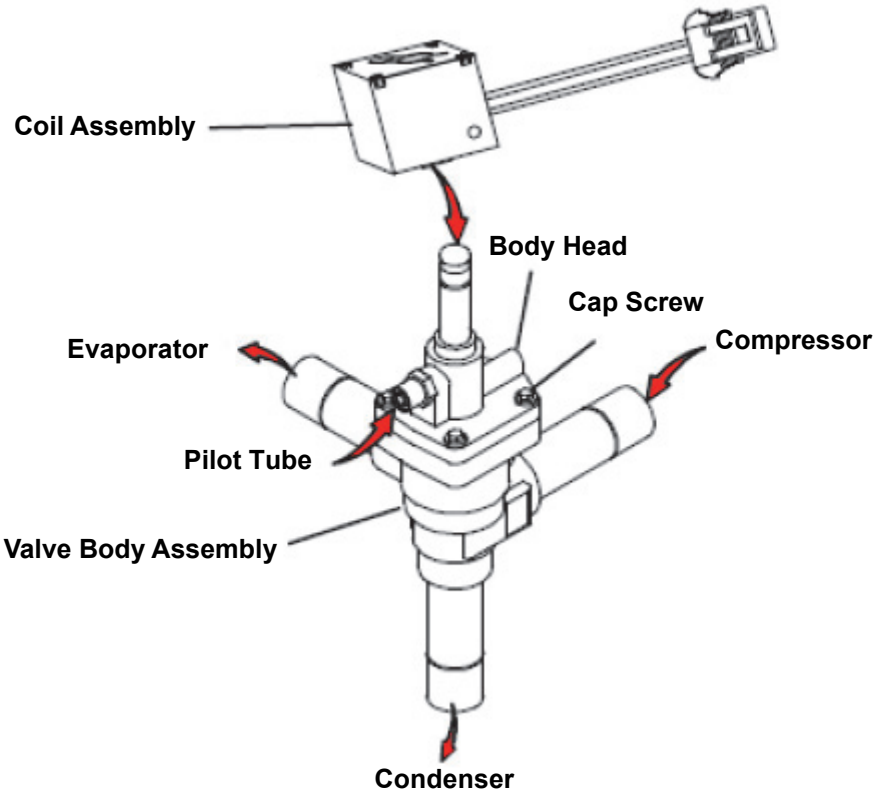


1. Ohmmeter or Continuity Device
2. Adjustment Screw (0.050 socket head size)
3. Low Side Connection
4. Pressure Line or Aspirator Bulb (P/N 07-00177-01)
5. Magnehelic Gauge (P/N 07-00177)
6. High Side Connection

6.10.6 Solenoid Valves

6.10.6.1 Hot Gas 3-Way Valve (HGS)

Figure 6.20 Hot Gas 3-Way Valve (HGS1)



6.10.6.2 Replacing Solenoid Coil

It is not necessary to pump the unit down to replace the coil. (See **Figure 6.20**)

1. Remove snap cap to remove coil. Disconnect from harness.
2. Verify the coil type and voltage. 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.

6.10.6.3 Replacing Solenoid Valve

1. Remove and store the refrigerant charge in an evacuated container (Refer to **Section 6.7.5**).
2. Remove snap cap to remove coil.
3. Replace Valve Assembly
4. Install coil assembly, voltage plate and cap.
5. Leak check, evacuate and dehydrate the unit.
6. Install a complete refrigerant charge.
7. Start unit and check operation.

6.10.6.4 Replacing Solenoid Valve Internal Parts

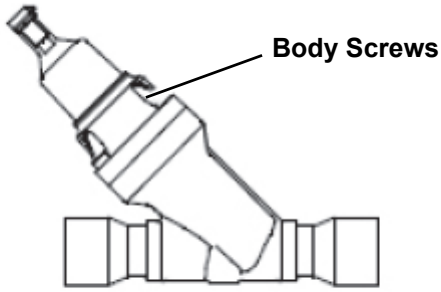
If the valve is to be replaced or the internal parts serviced, the refrigerant charge must be removed.

1. Remove and store the refrigerant charge in an evacuated container (refer to **Section 6.7.5**).
2. Remove coil snap cap, voltage cover and coil assembly. Remove the valve body head.
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 be fore installing.
5. Tighten enclosing tube assembly. If the valve has not been removed from the unit, leak check the valve.
6. Install coil assembly, voltage cover and cap.
7. Evacuate and dehydrate the unit.
8. Install a complete refrigerant charge.
9. Start unit and check operation.

6.10.7 Compressor Suction Modulation Valve (CSMV)

The purpose of the CSMV is to maintain the compressor within its operating envelope and maximize unit capacity and fuel economy.

Figure 6.21 Compressor Suction Modulation Valve (CSMV)



14-00410 Series

6.10.7.1 Diagnostics - Control System or Wiring

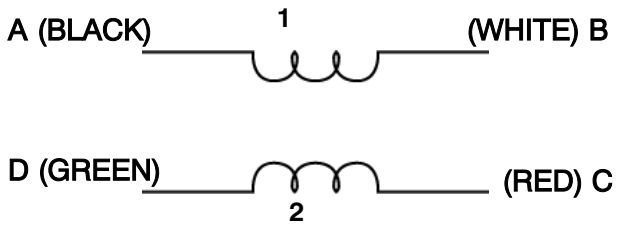
1. Disconnect the CSVM connector.
2. Place the STOP/RUN-OFF switch in the START/ RUN position, DO NOT ALLOW THE UNIT TO START. Immediately after switch “ON“, measure the AC voltage on the harness side of the connector between pins A and B and then between C and D. A voltage (10to 16 VAC) should be read by the digital voltmeter for each pair of wires. If the reading is present on all of the wire pairs there is a good signal coming from the control system.
3. If the reading is not present on one or more of the wire pairs, check the wiring between the control system and the CSMV connector, or check the control system for proper model number Configuration.

6.10.7.2 Diagnostics - Stepper Motor

The valve stepper motor may be tested using a stepper motor drive tester or ohmmeter.

1. To test with a stepper motor drive tester (Carrier Transicold part number 07-00375-00), connect the 4-pin test cable supplied with the tester to the valve connector, refer to **Figure 6.22** and the cable wires to the tester in accordance with wire and terminal color.
2. Set the step rate to 200 steps per second and either open or close the valve. Each red LED should light sequentially until all four are illuminated. Any LED failing to illuminate indicates an open on that leg and a need to replace the piston and drive motor assembly.
3. To test with an ohmmeter, check the winding resistance between connector pin A and B and then between C and D (see **Figure 6.22**). In normal ambient - 70° - 80°F (21° - 27°C) - the resistance between the pins should be 72 to 84 ohms. If an out of tolerance or zero reading is observed, the piston and drive motor assembly is to be replaced.
4. Check each pin to chassis ground while the component is installed on the unit. If any of the pins on the valve gives an ohm reading to chassis ground other than OL (over limit), the valve is shorted internally and should be replaced.

Figure 6.22 CSMV Coil



6.10.7.3 Diagnostics - Valve

1. To test the valve internal mechanism, install a manifold gauge set on the suction service valve and a stepper motor drive tester.
2. Start the unit, set the step rate to 200 steps per second and close the valve while watching the suction pressure. Within one minute the suction pressure should begin to fall. Place the STOP/RUN-OFF switch in the OFF position before the reading enters a vacuum.
3. If the suction pressure does not change, this is an indication the valve is stuck and the internal motor/piston assembly is to be replaced.

6.10.7.4 Replacing the Internal Motor/Piston Assembly

1. Pump down the low side. Refer to **Section 6.7.5.2**.
2. Remove internal motor/piston assembly and replace with a new assembly and gasket. The motor/piston assembly should be set to 100% open when received from the warehouse. This is to ensure the Teflon valve seal is not damaged when it is installed. Ensure the valve is fully open by using the stepper motor tester to manually open the valve to 100% before it is installed. Torque the nut 47.5 to 54.2 Nm (35 to 40 ft/lb) or body screws 9 to 11 Nm (80 to 97 inch/ lbs) as applicable.

3. Leak check, evacuate and dehydrate, and charge system as required. Refer to **Section 6.7.6**, **Section 6.7.7** and **Section 6.7.5**.

6.10.8 Thermal Expansion Valve (TXV)

The thermal expansion valve (see **Figure 6.23**) is an automatic device which maintains constant superheat of the refrigerant gas leaving the evaporator regardless of suction pressure.

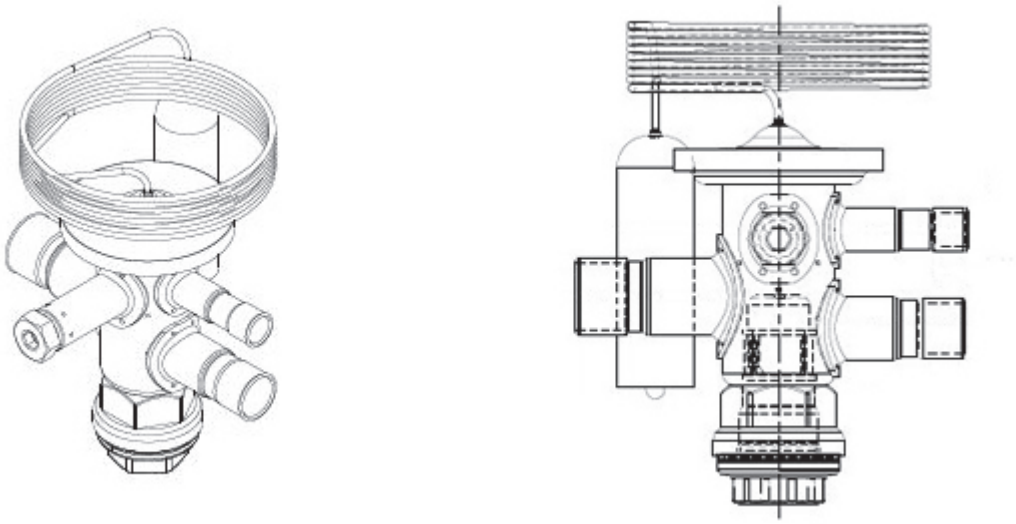
The valve functions are:

(a) automatic response of refrigerant flow to match the evaporator load and

(b) prevention of liquid refrigerant entering the compressor.

During normal operation, the valve should not require any maintenance. If service is required, it should be performed only by trained personnel.

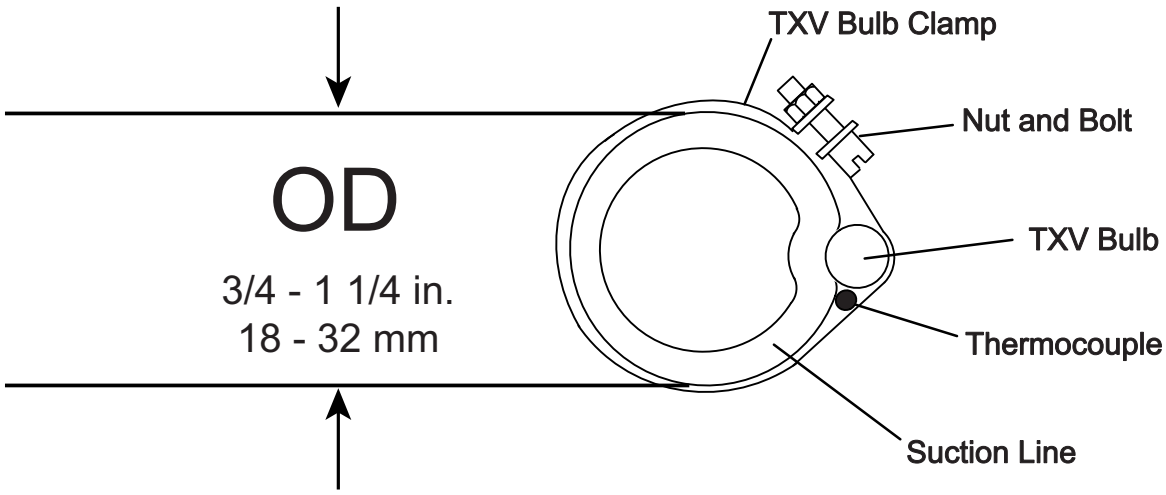
Figure 6.23 Thermostatic Expansion Valve



6.10.8.1 Measure Superheat

1. Ensure that the charge level is correct (refer to **Section 6.7.5.1**).
2. Remove insulation from expansion valve bulb and suction line. Ensure bulb and attachment area on suction line are clean.
3. Place thermocouple above (parallel to) the TXV bulb and then secure clamps making sure both the bulb and thermocouple are firmly secured to the suction line as shown in **Figure 6.24**. Reinstall insulation covering both bulb and sensor.
4. Connect an accurate gauge to the 1/4 port on the suction service valve.
5. In order to ensure the pressure at the expansion valve is stable enough for this procedure, operate the unit in high speed cooling until the box temperature is below 20°F (-6.7°C). Partially block off air flow to the condenser coil to raise discharge pressure to 210 psig (14.5 bar). Bring the setting to greater than 10 degrees below box temperature to ensure the unit remains in high speed cool with the unloaders de-energized.
6. Note the average temperature of the suction gas at the expansion valve bulb and average pressure on the gauge.
7. From the temperature/pressure chart, determine the saturation temperature corresponding to the suction pressure.
8. Subtract the saturation temperature determined in step 7 from the average temperature measured in step 6. The difference is the superheat of the suction gas. Refer to **Section 2.6.3** for required setting.

Figure 6.24 Thermostatic Expansion Valve Bulb and Thermocouple



6.10.8.2 Replacing Expansion Valve

1. Check superheat in accordance with the preceding steps. If valve requires replacement, pump down the unit. (Refer to **Section 6.7.5**.)
2. Remove insulation from expansion valve bulb and then remove bulb from suction line.
3. Using inert gas brazing procedures (refer to Technical Procedure 98-50553-00), unsolder the outlet, the equalizer and then the inlet lines to the TXV. Remove the old TXV from the unit.
4. Using inert gas brazing procedures (refer to Technical Procedure 98-50553-00), solder the replacement valve in place.
5. Strap thermal bulb to suction line and insulate both. It is recommended that the thermocouple required to check superheat be reinstalled at this time.
6. Leak check and evacuate low side by connecting at the suction and discharge service valve. Refer to sections **6.7.6** and **6.7.7**. for general procedure.
7. Re-check superheat.

6.10.9 Suction Pressure Transducer

Before installing a new suction pressure transducer it must be calibrated.

The calibration will not be performed if the run relay is energized. This prevents the operator from calibrating the unit with the sensor in the system. The reading of the sensor must be at atmospheric pressure (0 psig or 14.7 psi). If the sensor reading is greater than 20 psig (34.7 psi) or less than -6.7 psig (8 psi) it can not be calibrated. Once the micro is calibrated, the display will readout the actual value.

a. Turn power off and remove starter solenoid wire, then let unit fail to start. This will de-energize run relay.

b. Connect wiring to new suction pressure transducer. Before installing suction pressure transducer into unit, display the suction pressure via the unit status display. While the suction pressure is being displayed press the Enter Key for three seconds, the display should read 0. If display reads 0 install suction pressure transducer into unit.

6.11 Servicing the Electrical System Components

Procedures for servicing or maintaining the electrical system components are provided in the following sub-paragraphs.

NOTE

When any module is replaced, software should be upgraded before switching the unit on. This will ensure software compatibility of all modules.

6.11.1 Microprocessor Controller

NOTICE

Under no circumstances should a technician electrically probe the processor at any point, other than the connector terminals where the harness attaches. Microprocessor components operate at different voltage levels and at extremely low current levels. Improper use of voltmeters, jumper wires, continuity testers, etc. could permanently damage the processor.

As mentioned above, some microprocessor inputs operate at voltage levels other than the conventional 12 VDC. Connector points and the associated approximate voltage levels are listed below for reference only. Under no circumstances should 12 VDC be applied at these connection points.

Grounded wrist cuffs are available from Carrier (P/N 07-00304-00). These should be worn whenever handling a microprocessor.

NOTICE

Most electronic components are susceptible to damage caused by electrical static discharge (ESD). In certain cases, the human body can have enough static electricity to cause resultant damage to the components by touch. This is especially true of the integrated circuits found on the truck/trailer 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 always 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, truck, body, 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 trailer, 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.

6.11.1.1 Hour Meters

The hour meter can be set to any value via TRU-Tech, if the meter has less then 24 hours on it. This allows a replacement MCA to be set to the same hours as the MCA it is replacing.

6.11.2 MCA Replacement and Configuration

6.11.2.1 Remove and Replace MCA Logic Board

1. Before removing the MCA, disconnect the negative battery cable and attach a grounded wrist strap (part number 07-00304-00) to your wrist and ground it to a good unit frame ground.
2. Remove the front grille cover of the control box mounted in front of the engine.
3. Unplug the connectors on the front of the control box cover. Remove the front cover of the control box and remove the retaining bolts securing the MCA to the cover.
4. Take the new MCA from the anti-static bag and install in the control box following the above steps in reverse order.
5. Place the removed MCA back into the anti-static bag and part box for return.

NOTE

BEFORE STARTING THE UNIT: When replacing a MCA it is important to upload the most current software and set the customer configurations and functions.

6.11.3 Upgrading Supra Series Software via TRU-Tech / TRU-View

Tools Required		
Quantity	**Part Number**	**Part Description**
1	07-68002-00	CANBUS Interface
1	22-01690-03	CAN Com Cable Adapter
1	N/A	TRU-Tech/TRU-View (version 01.10.00 or later

⚠ WARNING

Unit may start automatically at any time even if the switch is in the OFF position. Use proper lockout/tagout procedures before inspection / servicing. All unit inspection / serving by properly trained personnel only.

NOTE

Before starting this procedure, you must first download the latest version of the TRU-Tech and TRU-View software from TransCentral™.

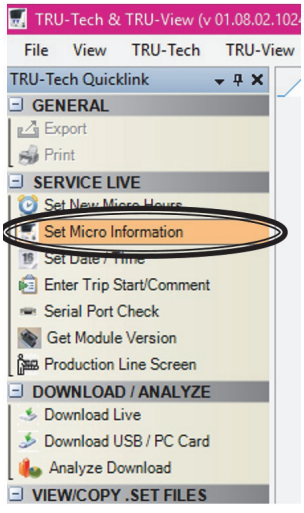
1. Connect the laptop to the unit using the CAN-BUS interface and the CAN com adapter. Connections are available in the cab command cable or in the unit harness near the compressor belt guard.
2. Power up the laptop and open the TRU-Tech program (version 01.10.00 or later).
3. Switch the unit ON at the cab command.

NOTE

The unit must remain powered up prior to an during the software loading process.

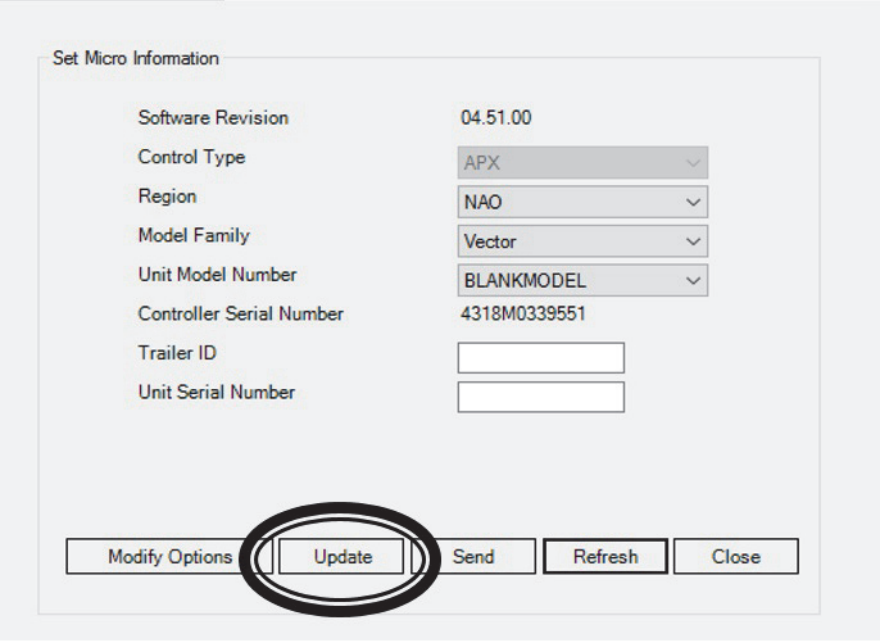
4. Click the “Set Micro Information” tab on the TRU-Tech tool bar (see **Figure 6.25**).

Figure 6.25 TRU-Tech Tool Bar



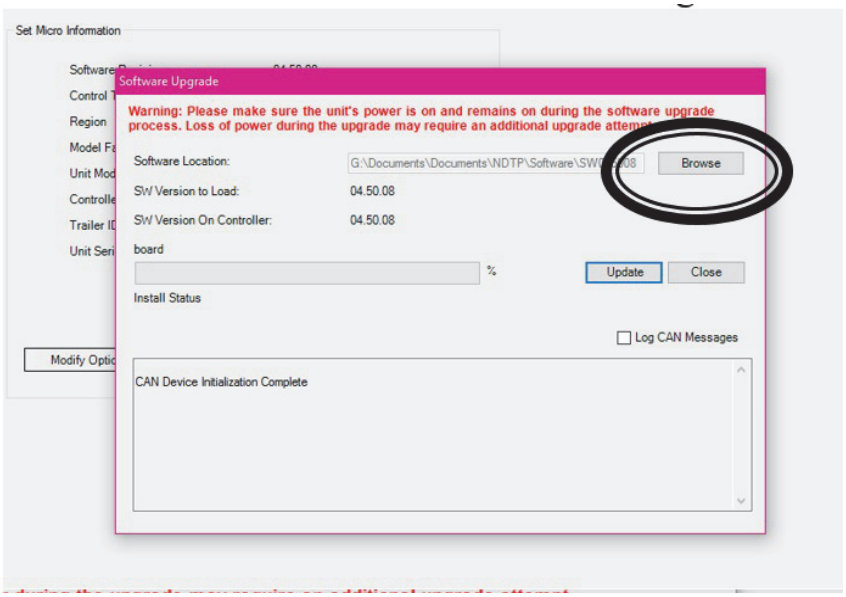
5. In the pop-up window, click the “Update” button (see **Figure 6.26**).

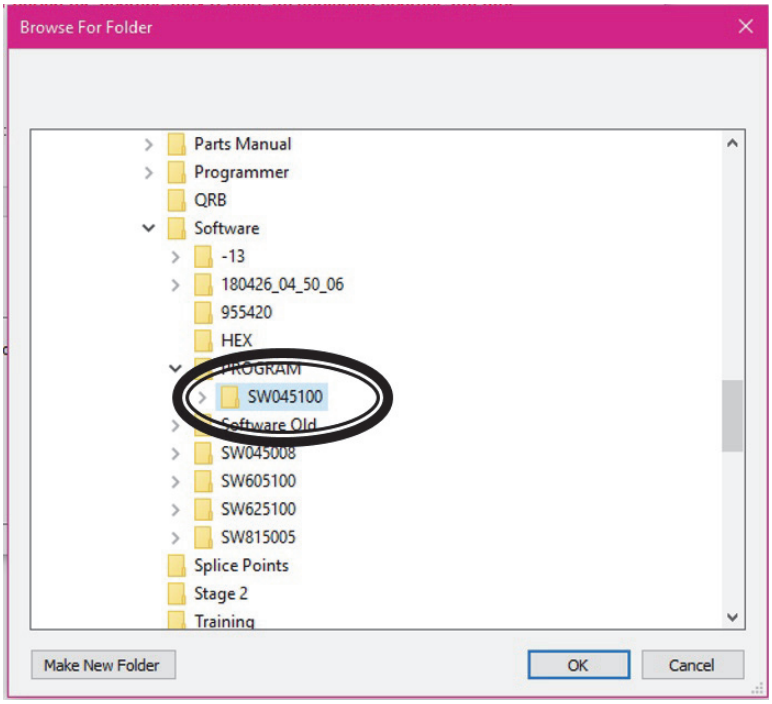
Figure 6.26 Update Button



6. Another pop-up will appear. Click the “Browse” button and locate the software that was downloaded from TransCentral (see **Figure 6.27**).

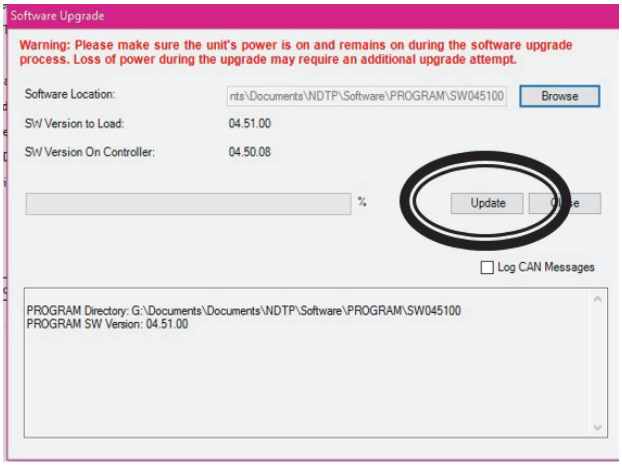
Figure 6.27 Browse Button





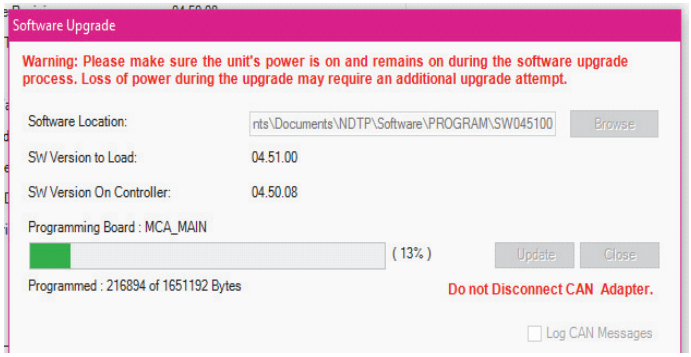
7. When the “Software Upgrade” screen reappears, confirm you have selected the correct software. The selected version will be displayed in the SW Version to Load line of the screen. After confirming the correct version is selected, click the “Update” button (see **Figure 6.28**).

Figure 6.28 Software Upgrade



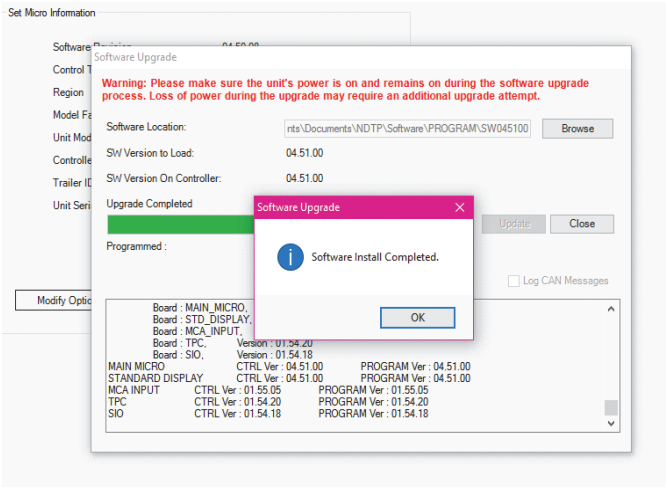
8. The program will scan the unit for the correct modules and then start the upload process. The progress bar will show you the percentage loaded (see **Figure 6.29**).

Figure 6.29 Software Upload



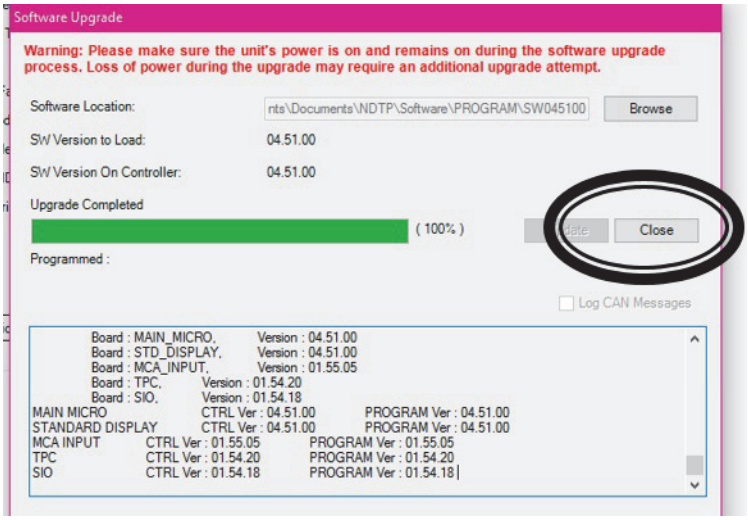
9. After the installation has completed, a pop up will appear telling you the installation was successful. Click the "OK" button (see **Figure 6.30**).

Figure 6.30 Installation Complete



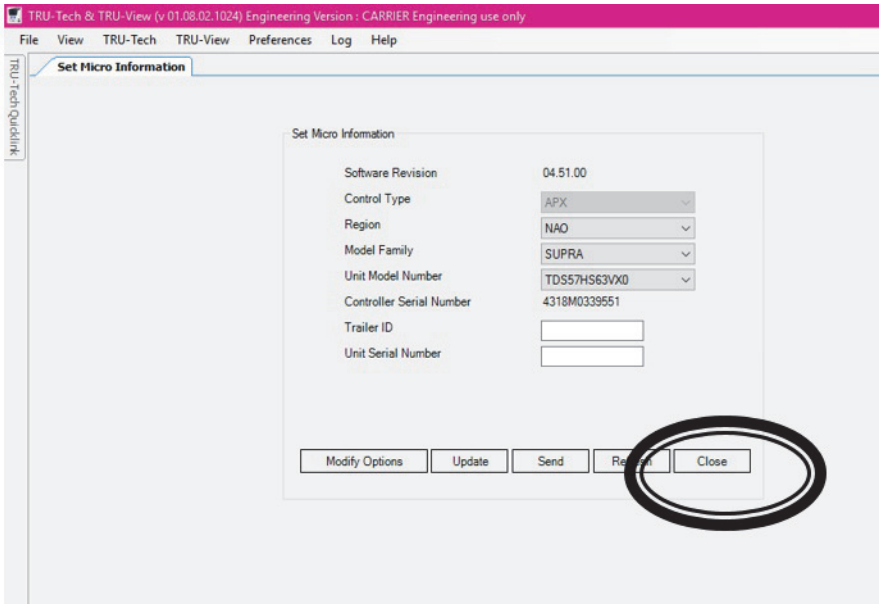
10. The Software Upgrade screen will refresh showing the new version of software on the controller. At this point, click the "Close" button and the "Set Micro Info" screen will reappear displaying the new information (see **Figure 6.31**).

Figure 6.31 Close Button and Set Micro Info



11. The software upgrade is now finished and it is safe to Click the “Close” button (see Figure 8) and shut down the TRU-Tech program and switch of the cab command (see **Figure 6.32**).

Figure 6.32 Close Button



6.11.4 Configuration Table

Table 6-3 System Configuration Summary

Configuration	Description	Range
Setpoint (s) and Range Locks		
Decimal	Displayed **Not Displayed**	Displayed: Setpoint will be shown with a decimal and temperatures may be selected to a tenth of a degree. Not Displayed: Setpoint will not be shown with a decimal. All other temperatures will still be displayed with a decimal.
Setpoint	Main Compartment Setpoint	-22°F to + 90°F with interval of 1°F (-30°C to +32° with interval of 1°C) Default: 32°F (0°C)
Min Setpoint	Indicates to the main microprocessor the minimum allowable setpoint	-22°F to +90°F (-30°C to +32°C) in 0.1°F or °C increments
Max Setpoint	Indicates to the main microprocessor the maximum allowable setpoint.	-22°F to +90°F ((-30°C to +**32**°C) in 0.1°F to °C increments
RANGE 1 LOCK OR RANGE 2 LOCK	**OFF** START-STOP CONTINUOUS	OFF = If both Range Locks are OFF, the unit will operate normally. If either Range 1 or Range 2 is not OFF, the unit will operate as selected whenever the setpoint is within that range. START-STOP = The unit will always operate in Start-Stop whenever the setpoint is between the minimum and maximum temperatures for that range (refer to the following sub-configurations). CONTINUOUS = The unit will always operate in Continuous Run whenever the setpoint is between the minimum and maximum temperatures for that range (refer to the following sub-configurations).
RANGE 1 (or 2) MINIMUM TEMPERATURE	-22°F TO **90°F** (-30C to **32°C**) (in 0.1°F or °C increments)	Select the lowest temperature desired for this range.
RANGE 1 (or 2) MAXIMUM TEMPERATURE	-22°F TO **90°F** (-30C to **32°C**) in 0.1°F or °C increments	Select the highest temperature desired for this range
Continuous Run or Start-Stop	If the setpoint for the main compartment falls in range, change the run in the defined mode.	0: OFF 1: Start Stop - run in Start-Stop mode 2: Continuous - run in Continuous Run mode **Default:** 0

Start-Stop Settings		
Voltage for Start/Stop Restart	In start-stop, if the engine is off (stop) and the voltage falls below this value, the engine will turn on in order to charge the battery.	12V to 12.8V, with an interval of 0.1V **Default:** 12.2V
Engine Temperature for Start/Stop Restart	Sets the Engine Coolant Override Temperature that the engine restarts in Start Stop Mode.	-10ºF to 32ºF (-12.2ºC to 0ºC) **Default:** -10ºF
Engine Settings		
Glow Time	Indicates to the controller which engine is in the system and which glow time should be used.	0 - Short 1 - Long 2 - Intake Heater **Default**: Short
Tech Reset - High Engine Temperature	If Set to Yes, AL 21 Techinician Reset Required alarm is enabled.	0 - No 1 - Yes **Default:** Yes
Coolant Sensor Shutdown	If set to yes, Alarm 00129 will shut down.	0 - No (disabled) 1 - Yes (enabled) **Default:** No
Tech Reset - Engine Oil Pressure	If Set to Yes, AL 21 Technician Reset Required alarm is enabled.	0 - No 1 - Yes **Default:** Yes
Fuel Level Sensor	Indicates if Fuel Sensor is installed.	0 - No 1 - Yes 2 - Third Party **Default:** No
Low Fuel	Configures the control response for Low Fuel Level Alarm (Alarm 19).	0 - Alarm Only 1 - Unit Shutdown **Default:** Alarm Only
Fuel Heater	Indicates if a fuel heater is installed.	0 - Not Installed 1 - Installed **Default:** Not Installed

Alarm Settings		
Out of Range Shutdown	Indicates to the controller if the out of range alarm shuts unit down after 45 minutes.	0 - No; will not shutdown unit 1 - Yes; will shutdown unit **Default:** No
RPM Alarm Shutdown	Shutdown unit if Check Engine RPM alarm is active.	0 - No; will not shutdown unit. 1 - Yes; will shutdown unit. **Default:** Yes
Low Pressure Shutdown	Shutdown unit if Compressor Suction Low Pressure alarm is active.	0 - No; will not shutdown unit. 1 - Yes; will shutdown unit. **Default:** Yes
Low Suction Pressure Shutdown Delay	Time delay before unit shutdown after a low suction pressure condition exist if suction pressure input in this unit333	**Range:** 0 to 255 seconds, with interval of 1 second **Default:** 255 seconds
High Suction Pressure Shutdown	Shutdown unit if suction pressure is high.	0 - No; will not shutdown unit. 1 - Yes; will shutdown unit. **Default:** No
Refrigeration System Shutdown	Shutdown unit if the low delta pressure condition.	0 - No; will not shutdown unit. 1 - Yes; will shutdown unit. **Default:** Yes
Compressor Alarm Shutdown	Shutdown unit if alarms 13, 17, 18, 27, 28 or 56 occur three times individually within two hours.	0 - No; do not shutdown unit 1 - Yes; shutdown the unit **Default:** Yes
Clutch Slip Alarm	Enables or disables Clutch Slippage Alarm	0 - No (disabled) 1 - Yes (enabled) **Default:** Yes
Compressor Protect Shutdown	If set to yes, Alarm 06002 will be a shut down alarm. If set to no, Alarm 06002 will be alarm only under all conditions.	0 - No (disabled) 1 - Yes (enabled) **Default:** No
Meters		
Display Total Engine Hours	Indicates if this hour meter should be displayed in the Hour Meters menu and during the start up messaging sequence.	0 - No 1 - Yes **Default:** Yes

Display Total Switch On Hours	Indicates if this hour meter should be displayed in the Hour Meters.	0 - No 1 - Yes **Default:** Yes
Display Standby Run Hours	Indicates if this hour meter should be displayed in the Hour Meters menu.	0 - No 1 - Yes **Default:** Yes
Diesel Reset Value	Sets the alarm trigger point for the hour meter. The reset value is added to the current alarm trigger point.	0 to 30,000 hours, with intervals of 50 hours **Default:** 0
Standby Reset Value	Sets the alarm trigger point for the hour meter. The reset value is added to the current alarm trigger point.	0 to 30,000 hours, with intervals of 50 hours **Default:** 0
Switch On Reset Value	Sets the alarm trigger point for the hour meter. The reset value is added to the current alarm trigger point.	0 to 30,000 hours, with intervals of 50 hours **Default:** 0
PM1 Reset Value	Sets the alarm trigger point for the hour meter. The reset value is added to the current alarm trigger point.	Range: 0 to 30,000 hours with increments of 50 hours **Default:** 0 hours
PM2 Reset Value	Sets the alarm trigger point for the hour meter. The reset value is added to the current alarm trigger point.	Range: 0 to 30,000 hours with increments of 50 hours **Default:** 0 hours
PM3 Reset Value	Sets the alarm trigger point for the hour meter. The reset value is added to the current alarm trigger point.	Range: 0 to 30,000 hours with increments of 50 hours **Default:** 0 hours
PM4 Reset Value	Sets the alarm trigger point for the hour meter. The reset value is added to the current alarm trigger point.	Range: 0 to 30,000 hours with increments of 50 hours **Default:** 0 hours
PM5 Reset Value	Sets the alarm trigger point for the hour meter. The reset value is added to the current alarm trigger point.	Range: 0 to 30,000 hours with increments of 50 hours **Default:** 0 hours
Remote Sensors and Switches		
Door Switch	Indicates if the Door switch discrete input is installed and type of switch if installed.	0 - Not Installed 1 - Door Open Switch Open 2 - Door Open Switch Closed 3 - Third Party **Default:** Not Installed

Door Switch Shutdown	Shutdown unit or compartment if Door Switch Alarm is active.	0 - Alarm Only 1 - Unit Shutdown 2 - Data Recorder Only 3 - Low Engine Speed **Default:** Alarm Only
Unit Shutdown Below	If the Door switch is installed and Door switch is configured for Shutdown, this configuration is available, this will determine unit shutdown. If OFF and Door Opens, unit shutoff. If NOT OFF, Ambient < config value, unit shutoff. Otherwise, do not shutdown and determine engine speed.	121°F (49.4°C) = Off -20°F to 120°F (-28.9°C to 48.9°C) **Default:** Off
Engine Speed	If the Door switch is installed and Door switch is configured for Shutdown and Door Open Unit Shutdown Temp is not OFF, this configuration is available – this will control the speed when the door is open.	0 - Normal 1 - Low Speed Only **Default:** Normal
Run Low Speed Below	If the Door switch is installed and Door switch is configured for Low Speed, this configuration is available, this will control the speed when the door is open.	121°F (49.4°C) = Off -20°F to 120°F (-28.9°C to 48.9°C) **Default:** Off
Other Settings		
Enable Advanced User	When activated, advanced mode will be the default user mode.	0 - No 1 - Yes **Default:** No
8 Hr Additional Data	Data Recorder wakeup per recording interval for an additional eight hours when the Stop-Run Switch is off.	0 - No 1 - Yes **Default (EMEA Region):** No **Default (other):** Yes
Satellite Comm	Indicates which protocol and baud rate to use based on the type of satellite communication.	0 - Qualcomm 1 - Other 9600 Bps / 14400 Bps / 19200 Bps / 28800 Bps / 38400 Bps / 56000 Bps / 57600 Bps **Default:** Other
Light Bar	Indicates the type of light bar installed.	0 - No Light Bar 1 - 2 Light Bar 2 - 2 Light Bar - No Alarm **Default:** No Light Bar

No A/C Power	Indicates if switch to diesel mode when alarm is active or shutdown.	0 - Not Installed 1 - Alarm and Shutdown 2 - Alarm and Switch to Engine 3- Switch to Engine **Default:** Alarm and Shutdown
Standby Startup Delay	Used in starting the system in standby from power up. This helps prevent multiple units on the same power drop from restarting at the same time.	0 - Off 1 - Random 2 - 5-20 Seconds **Default:** Off
Number of Comm Modules	If set to 1, this enables Alarm 26200 and detects a CAN Communication failure.	0 - Not Installed 1 - 1 Optional Comm Module Installed **Default:** Not Installed
Evap 2 Temp Control	ON = Shuts off evaporator fan 2 when close to setpoint OFF = All evaporator fans run all the time	0 - Off 1 - On **Default:** On
Number of Remote Panels	If set to 1, this enables Alarm 20101 and detects CAN Communication failure with Remote Panel. If set to 0 and a remote panel is connected, the remote panel will display a message indicating that the configuration must be changed and will not operate until then. **NOTE:** If set to 1, and number of comm modules is set to 0, the number of comm modules is automatically increased to 1 on the main micro. A remote panel will not be operable without a comm.	0 - Not Installed 1 - 1 Remote Panel Installed **Default:** Not Installed
High Speed Pulldown	When set to “ON” the unit is forced into high speed for the first pulldown regardless of setpoint.	0 - Off 1 - On **Default:** Off

Table 6-4 Resistance - Micro Units

Temperature		AAT, DTS, ENCT, RAT, RRAT, SAT, SSAT Resistance In Ohms	CDT Resistance In Ohms
°F	°C		
-20	-28.9	165,300	1,653,000
-10	-23.3	117,800	1,178,000
0	-17.8	85,500	855,000
10	-12.2	62,400	624,000
20	-6.7	46,300	463,000
30	-1.1	34,500	345,000
32	0	32,700	327,000
40	4.4	26,200	262,000
50	10.0	19,900	199,000
60	15.6	15,300	153,000
70	21.1	11,900	119,000
77	25	10,000	100,000
80	26.7	9,300	93,000
90	32.2	7,300	73,000
100	37.8	5,800	58,000
110	43.3	4,700	47,000
120	48.9	3,800	38,000
194	90	915	9,150
212	100	680	6,800
266	130	301	3,010
302	150	186	1,860
325	163	-	1,358
350	177	-	1,202

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

Temperature		Pressure			Temperature		Pressure		
°F	°C	Psig	Kg/cm^2	Bar	°F	°C	Psig	Kg/cm^2	Bar
-40	-40	4.5	0.32	0.31	32	0	72.5	5.10	5.00
-35	-37	7.1	0.50	0.49	34	1	75.6	5.32	5.21
-30	-34	9.9	0.70	0.68	36	2	78.8	5.54	5.43
-25	-32	12.9	0.91	0.89	38	3	82.1	5.77	5.66
-20	-29	16.3	1.15	1.12	40	4	85.5	6.01	5.90
-18	-28	17.7	1.24	1.22	42	6	89.0	6.26	6.14
-16	-27	19.2	1.35	1.32	44	7	92.5	6.50	6.38
-14	-26	20.7	1.46	1.43	46	8	96.2	6.76	6.63
-12	-24	22.3	1.57	1.54	48	9	99.9	7.02	6.89
-10	-23	23.9	1.68	1.65	50	10	103.7	7.29	7.15
-8	-22	25.6	1.80	1.77	55	13	115.4	8.11	7.96
-6	-21	27.3	1.92	1.88	60	16	126.1	8.87	8.69
-4	-20	29.1	2.05	2.01	65	18	137.4	9.66	9.47
-2	-19	30.9	2.17	2.13	70	21	149.4	10.50	10.30
0	-18	32.8	2.31	2.26	75	24	162.1	11.40	11.18
2	-17	34.8	2.45	2.40	80	27	175.5	12.34	12.10
4	-16	36.8	2.59	2.54	85	29	189.6	13.33	13.07
6	-14	38.9	2.73	2.68	90	32	204.5	14.38	14.10
8	-13	41.1	2.89	2.83	95	35	220.2	15.48	15.18
10	-12	43.3	3.04	2.99	100	38	236.8	16.65	16.33
12	-11	45.6	3.21	3.14	105	41	254.2	17.87	17.53
14	-10	48.0	3.37	3.31	110	43	272.4	19.15	18.78
16	-9	50.4	3.54	3.47	115	46	291.6	20.50	20.11
18	-8	52.9	3.72	3.65	120	49	311.8	21.92	21.50
20	-7	55.5	3.90	3.83	125	52	332.9	23.41	22.95
22	-6	58.1	4.08	4.01	130	54	355.0	24.96	24.48
24	-4	60.9	4.28	4.20	135	57	378.1	26.58	26.07
26	-3	63.7	4.48	4.39	140	60	402.3	28.28	27.74
28	-2	66.5	4.68	4.59	145	63	427.6	30.06	29.48
30	-1	69.5	4.89	4.79	150	66	454.0	31.92	31.30

Table 6-6 R-452A Temperature/Pressure Chart

Temperature		Liquid		Vapor		Temperature		Liquid		Vapor	
°F	°C	psig	bar	psig	bar	°F	°C	psig	bar	psig	bar
-29.2	-34	10.4	0.72	6.5	0.45	68	20	144.6	9.97	128.6	8.87
-25.6	-32	12.7	0.87	8.5	0.58	71.6	22	153.5	10.59	136.9	9.44
-22	-30	15.1	1.04	10.6	0.73	75.2	24	162.8	11.23	145.6	10.04
-18.4	-28	17.6	1.21	12.8	0.88	78.8	26	172.4	11.89	154.7	10.67
-14.8	-26	20.3	1.40	15.2	1.05	82.4	28	182.4	12.58	164.1	11.32
-11.2	-24	23.2	1.60	17.7	1.22	86	30	192.8	13.29	174.0	12.00
-7.6	-22	26.2	1.81	20.4	1.41	89.6	32	203.6	14.04	184.2	12.71
-4	-20	29.5	2.03	23.3	1.61	93.2	34	214.8	14.81	194.9	13.44
-0.4	-18	32.9	2.27	26.3	1.82	96.8	36	226.4	15.61	206.0	14.21
3.2	-16	36.5	2.52	29.6	2.04	100.4	38	238.4	16.44	217.5	15.00
6.8	-14	40.4	2.78	33.0	2.28	104	40	250.9	17.30	229.5	15.83
10.4	-12	44.4	3.06	36.6	2.53	107.6	42	263.8	18.19	242.0	16.69
14	-10	48.7	3.36	40.5	2.79	111.2	44	277.1	19.11	255.0	17.59
17.6	-8	53.2	3.67	44.5	3.07	114.8	46	291.0	20.07	268.5	18.51
21.2	-6	57.9	3.99	48.8	3.36	118.4	48	305.3	21.06	282.5	19.48
24.8	-4	62.9	4.34	53.3	3.68	122	50	320.1	22.08	297.0	20.48
28.4	-2	68.1	4.70	58.0	4.00	125.6	52	335.4	23.13	312.1	21.52
32	0	73.6	5.08	63.0	4.35	129.2	54	351.2	24.22	327.7	22.60
35.6	2	79.4	5.48	68.3	4.71	132.8	56	367.6	25.35	344.0	23.72
39.2	4	85.4	5.89	73.8	5.09	136.4	58	384.4	26.51	360.9	24.89
42.8	6	91.7	6.33	79.6	5.49	140	60	401.8	27.71	378.4	26.10
46.4	8	98.4	6.78	85.7	5.91	143.6	62	419.8	28.95	396.7	27.36
50	10	105.3	7.26	92.1	6.35	147.2	64	438.4	30.23	415.7	28.67
53.6	12	112.5	7.76	98.7	6.81	150.8	66	457.5	31.55	435.4	30.03
57.2	14	120.0	8.28	105.7	7.29	154.4	68	477.2	32.91	456.1	31.45
60.8	16	127.9	8.82	113.0	7.79	158	70	487.4	34.30	477.6	32.94
64.4	18	136.1	9.39	120.6	8.32						

SECTION 7
Troubleshooting

⚠ CAUTION

DO NOT attempt to service the microprocessor or the logic or display boards! Should a problem develop with the microprocessor, contact your nearest Carrier Transicold dealer for replacement.

7.1 Diesel Engine

Indication/Troubles	Possible Causes	Reference Section
7.1.1 Engine Will Not Start		
Starter motor will not crank or low cranking speed	Battery insufficiently charged	Check
	Battery terminal post dirty or defective	Check
	Bad electrical connections at starter	Check
	Starter motor malfunctions	7.1.3
	Starter motor solenoid defective	Engine Manual
	Open starting circuit	7.1.4
	Incorrect grade of lubricating oil	2.6
Starter motor cranks but engine fails to start	No fuel in tank	Check
	Air in fuel system	Check
	Water in fuel system	Drain Sump
	Plugged fuel filters	Replace
	Plugged fuel lines to injector (s)	Check
	Fuel control operation erratic	Engine Manual
	Glow plug(s) defective	6.5.8
	Fuel pump (FP) malfunction	6.5.7
Starter cranks, engages, but dies after a few seconds	Engine lube oil too heavy	2.6
	Voltage drop in starter cable(s)	Check
7.1.2 Engine Starts Then Stops		
Engine stops after several rotations	Fuel supply restricted	Check
	No fuel in tank	Fill Tank
	Leak in fuel system	Repair
	Faulty fuel control operation	Engine Manual
	Fuel filter restricted	6.5.7
	Injector nozzle(s) defective	Engine Manual
	Injection pump defective	Engine Manual
	Air cleaner or hose restricted	6.5.6
	Safety device open	2.7
	Fuel pump (FP) malfunction	6.5.7

7.1.3 Starter Motor Malfunction		
Starter motor turns but pinion does not engage	Pinion or ring gear obstructed or worn	Clean both, remove burrs, or replace; apply grease
Starter motor does not disengage after switch was depressed	Starter motor solenoid defective	Engine Manual
Pinion does not disengage after engine is running	Defective starter	Engine Manual
7.1.4 Malfunction In the Engine Starting Circuit		
No power to starter motor solenoid (SS)	Battery defective Loose electrical connections	Check Tighten

7.2 Alternator (Automotive Type)

Alternator fails to charge	Limited charging system operating time Battery condition Alternator belt loose/broken Loose, dirty, corroded terminals, or broken leads Excessively worn, open or defective brushes Open blocking diode Regulator faulty Open isolation diode Open rotor (field coil)	Check Check **6.6** Check/Repair Check Check Check Check Replace
Low or unsteady charging rate	Alternator belt loose Loose, dirty, corroded terminals, or broken leads Excessively worn, sticky or intermittent brushes Faulty regulator Grounded or shorted turns in rotor Open, grounded or shorted turns in stator	**6.6** Check/Repair Check Check Check Replace
Excessive charging rate (as evidenced by battery requiring too frequent refilling) or charge indicator shows constant charge with engine idling	Regulator leads loose, dirty, corroded terminals, or wires broken Defective regulator	Clean/Repair Check
Noisy alternator	Defective or badly worn belt Worn bearing(s) Misaligned belt or pulley Loose pulley	**6.6** Replace **6.6** Tighten

7.3 Refrigeration

7.3.1 Unit Will Not Cool		
Diesel engine	Malfunction(s)	7.1
Compressor malfunction	Compressor drive defective Compressor defective	6.8 6.8
Refrigeration system	Defrost cycle did not terminate Abnormal pressure Hot Gas 3-way valve (HGS1) malfunction	7.3.5 7.3.6 7.3.12
7.3.2 Unit Runs But Has Insufficient Cooling		
Compressor	Compressor valves defective	6.8
Refrigeration system	Abnormal pressure Expansion valve malfunction No or restricted evaporator airflow	7.3.6 7.3.11 7.3.10
Engine does not develop full rpm	Engine malfunction	7.1
7.3.3 Unit Operates Long or Continuously in Cooling		
Container	Hot Load Defective box insulation or air leak	Allow time to pull down Correct
Refrigeration system	Abnormal pressure Temperature controller malfunction	7.3.6 7.3.9
Compressor	Defective	6.8
7.3.4 Unit Will Not Heat or Has Insufficient Heating		
Refrigeration	Abnormal pressure Temperature controller malfunction Hot Gas 3-way valve (HGS1) malfunction	7.3.6 7.3.9 7.3.12
Compressor	Compressor drive defective Compressor defective	6.8 6.8
Engine does not develop full rpm	Engine malfunction	7.1

7.3.5 Defrost Cycle Malfunction		
Will not initiate defrost automatically	Defrost air switch (DA) out of calibration Defrost thermostat (DTS) open or defective Defrost air switch (DA) defective Loose terminal connections Air sensing tubes defective or disconnected	**6.10.5** Replace **6.10.5** Tighten Check
Will not initiate defrost manually	Microprocessor defective Loose terminal connections Defrost thermostat (DTS) open or defective	Replace Tighten Replace
Initiates but does not defrost	Hot Gas 3-way valve (HGS1) malfunction	**7.3.12**
Frequent defrost	Defrost air switch (DA) out of adjustment Wet load	**6.10.5** Normal
Does not terminate or cycles on defrost	Defrost thermostat (DTS) shorted closed Defrost air switch (DA) out of adjustment	Replace **6.10.5**
7.3.6 Abnormal Pressure, Cooling		
High discharge pressure	Condenser coil dirty Condenser fan defective Non-condensibles or refrigerant overcharge	**6.10.2** Check Replace
Low discharge pressure	Compressor valve(s) worn or broken Hot Gas 3-way valve (HGS1) malfunction	**6.8**
High suction pressure	Compressor valve(s) worn or broken Compressor gasket(s) defective Hot Gas 3-way valve (HGS1) malfunction Defective SMV	**6.8** **6.8** **7.3.12** **6.10.7**
Low suction pressure	Defective SMV Suction service valve partially closed King valve partially closed Filter drier partially plugged Low refrigerant charge Expansion valve malfunction No evaporator air flow or restricted air flow Excessive frost on coil	**6.10.7** Open Open **6.10.3** **7.3.11** **7.3.10** Check
Suction and discharge pressures tend to equalize when unit is operating	Compressor valves defective Hot Gas 3-way valve (HGS1) malfunction	**6.8** **7.3.12**

7.3.7 Abnormal Pressure, Heating		
High discharge pressure	Overcharged system Non-condensibles in system	 Check
Low discharge pressure	Compressor valve(s) worn or broken Hot Gas 3-way valve (HGS1) malfunction Low refrigerant charge	6.8 7.3.12
Low suction pressure	Refrigerant shortage Suction service valve partially closed Defective SMV	 Open 6.10.7
7.3.8 Abnormal Noise		
Compressor	Loose mounting bolts Worn bearings Worn or broken valves Liquid slugging Insufficient oil	Tighten 6.8 6.8 7.3.10 6.9
Condenser or evaporator fan	Loose or striking shroud Bearings defective Bent shaft	Check Check Check
Belt	Cracked or worn	6.6
7.3.9 Control System Malfunction		
Will not control	Sensor defective Relay(s) defective APX control malfunction	6.11.4 Check 6.11.1
7.3.10 No Evaporator Air Flow or Restricted Air Flow		
Evaporator coil blocked	Frost on coil Dirty coil Fan motor(s) malfunction	Check 6.10.1 Replace
No or partial evaporator air flow	Evaporator fan loose or defective Evaporator fan rotating backwards Evaporator air flow blocked in trailer (box) Fan motor(s) malfunction	Check Check Check Replace

7.3.11 Expansion Valve Malfunction		
Low suction pressure with high superheat	Low refrigerant charge External equalizer line plugged Ice formation at valve seat Wax, oil or dirt plugging valve or orifice Broken capillary Power assembly failure or partial Loss of element/bulb charge Superheat setting too high	**6.7.5** / Clean **6.10.8** **6.10.8** **6.10.8** Replace Replace **6.10.8**
Low superheat and liquid slugging in compressor	Superheat setting too low External equalizer line plugged Ice holding valve open Foreign material in valve Pin and seat of expansion valve eroded or held open by foreign material	**6.10.8** Open **6.10.8** Clean **6.10.8**
Fluctuating suction pressure	Improper bulb location or installation Low superheat setting	**6.10.8** **6.10.8**
High superheat	Broken capillary	**6.10.8**
7.3.12 Hot Gas 3-Way Valve (HGS1) Malfunction		
Valve does not function properly	No power to valve Improper wiring or loose connections Coil defective Valve improperly assembled Coil or coil sleeve improperly assembled Temperature controller malfunction Movement of plunger restricted due to: Corroded or worn parts Foreign material lodged in valve Bent or dented enclosing tube	Check Check Replace
Valve shifts but refrigerant continues to flow	Foreign material lodged under seat Defective seat	

7.4 Standby Motor Malfunction

Standby motor fails to start	Motor contactor (MC) defective Motor Overload (OL) open Improper power supply Oil pressure switch (OPS) open Cab Command defective	Replace Replace motor **2.6.4** Check Replace
Standby motor starts, then stops	Motor Overload (OL) open High amperage draw	**2.6.4** Check

SECTION 8

Electrical Schematic and Wiring Diagram

8.1 Introduction

NOTE

All illustrations provided in this Section are looking at the connector connection end (with the wires in the back).

⚠ WARNING

Beware of unannounced starting of the fans and V-belts caused by the thermostat and the start/stop cycling of the unit.

⚠ WARNING

Under no circumstances should ether or any other starting aids be used to start engine.

⚠ CAUTION

Under no circumstances should anyone attempt to repair the Logic or Display Boards! Should a problem develop with these components, contact your nearest Carrier Transicold dealer for replacement.

⚠ CAUTION

Observe proper polarity when installing battery, negative battery terminal must be grounded. Reverse polarity will destroy the rectifier diodes in alternator. As a precautionary measure, disconnect positive battery terminal when charging battery in unit. Connecting charger in reverse will destroy the rectifier diodes in alternator.

NOTICE

Under no circumstances should a technician electrically probe the processor at any point, other than the connector terminals where the harness attaches. Microprocessor components operate at different voltage levels and at extremely low current levels. Improper use of voltmeters, jumper wires, continuity testers, etc. could permanently damage the processor.

NOTICE

Most electronic components are susceptible to damage caused by electrical static discharge (ESD). In certain cases, the human body can have enough static electricity to cause resultant damage to the components by touch. This is especially true of the integrated circuits found on the truck/trailer microprocessor.

8.2 Pin Connections

TPC	
Component	**Terminal**
1MCA-10	1
Not Used	2
SP12	3
2SIOB-23	4
SP13	5
SP18	6
Not Used	7
Not Used	8
SP8	9
SP19	10
C14-d	11
SP21	12
ENCU-22	13
SP12	14
2SIOB-34	15
Not Used	16
Not Used	17
PWR-OPT-A	18
FP-A	19
LB-H	20
ENCU-44	21
HP-B	22
SP20	23
1MCA-1	24
ENCU-19	25
SP11	26
SP16	27
2SIOB-11	28
FHR	29
Not Used	30
LB-B	31
Not Used	32
Not Used	33
C14-E	34
Not Used	35
Not Used	36

2MCA	
Component	**Terminal**
AAT-A	1
Not Used	2
DTS-A	3
SAT-A	4
RRAT-A	5
RSAT-A	6
Not Used	7
Not Used	8
SP3	9
FLS-C	10
Not Used	11
FLS-A	12
CDT-A	13
Not Used	14
RAT-A	15
SAT-B	16
RSAT-B	17
Not Used	18
Not Used	19
CDP-3	20
CSP-3	21
Not Used	22
Not Used	23
AAT-B	24
CDT-B	25
DTS-B	26
RAT-B	27
RRAT-B	28
Not Used	29
Not Used	30
CDP-1	31
SCP-1	32
FLS-B	33
Not Used	34
SP6	35
	36

1MCA	
Component	**Terminal**
TPC-24	1
1SIOB-2	2
SP21	3
CANOPT-1	4
SATCOM-A	5
1SIOB-4	6
1SIOB-6	7
CANOPT-2	8
SATCOM-B	9
TPC-1	10
1SIOB-1	11
SP21	12
ALT-L	13
Not Used	14

ENCU			
Component	**Terminal**	**Component**	**Terminal**
ENCT-B	1	SP9	23
ENSSN-2	2	SP10	24
Not Used	3	Not Used	25
Not Used	4	Not Used	26
Not Used	5	Not Used	27
ENCT-A	6	Not Used	28
Not Used	7	Not Used	29
Not Used	8	Not Used	30
Not Used	9	Not Used	31
Not Used	10	Not Used	32
Not Used	11	Not Used	33
Not Used	12	Not Used	34
Not Used	13	Not Used	35
Not Used	14	FSA-1	36
ENOPS-A	15	Not Used	37
Not Used	16	Not Used	38
Not Used	17	Not Used	39
ENOPS-B	18	Not Used	40
TPC-25	19	FSA-2	41
ENSSN-1	20	Not Used	42
SP8	21	ENSSN-3	43
TPC-13	22	TPC-21	44

2SIOB	
Component	**Terminal**
DAS-1	1
Not Used	2
C14-B	3
Not Used	4
CSMV-C	5
C14-J	6
Not Used	7
Not Used	8
Not Used	9
Not Used	10
SP17	11
Not Used	12
SP5	13
DS	14
Not Used	15
CSMV-B	16
SP4	17
Not Used	18
Not Used	19
Not Used	20
Not Used	21
SP16	22
TPC-4	23
DAS-2	24
DS	25
Not Used	26
CSMV-A	27
CSMV-D	28
SP14	29
C14-M	30
HGV-1	31
Not Used	32
Not Used	33
TPC-15	34
Not Used	35
Not Used	36

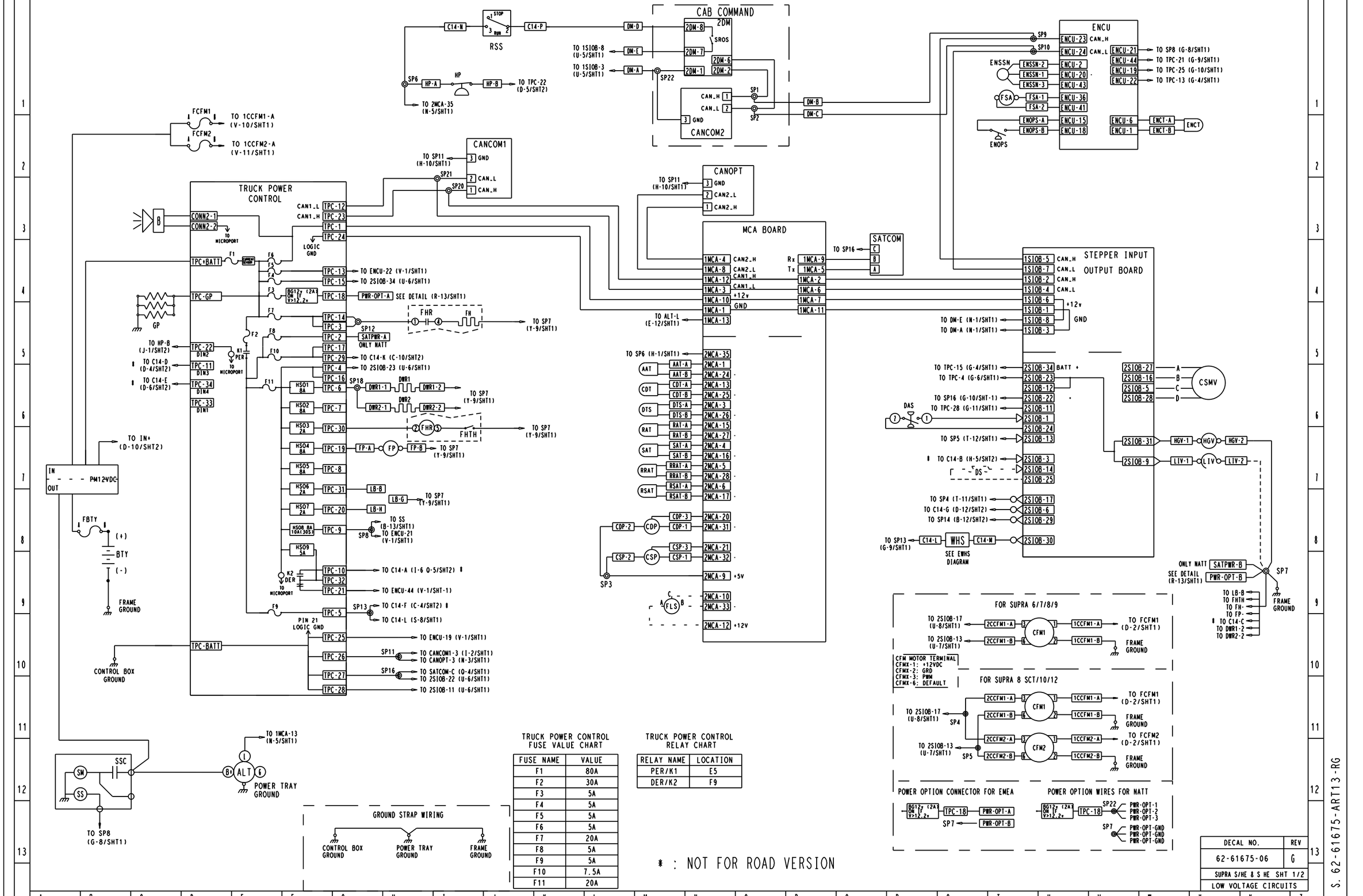
1SIOB	
Component	**Terminal**
1MCA-11	1
1MCA-2	2
DM-A	3
1MCA-6	4
SP10	5
1MCA-7	6
SP9	7
DM-E	8
Not Used	9
Not Used	10

C14		
Component	**Terminal**	**Component**
TPC-10	A	1C2-1
2SIOB-3	B	SP15
SP7	C	PRM
TPC-11	D	MC2AUX-12
TPC-34	E	MC1AUX-12
SP13	F	PRM+
SP14	G	FRB4J-2
SP14	H	FRB 4J-1
Not Used	I	Not Used
2SIOB-6	J	FRB 4J-3
TPC-29	K	FRB 4J-4
SP13	L	EWHS SW-5
2SIOB-30	M	HWS-/EHC-A1
SP6	N	RSS-3
Not Used	O	Not Used
DM-D/2DM-8	P	RSS-2

Cab Control		
Terminal	**Harness**	**Component**
2DM-1	SP22/DM-A	1SIOB-3
2DM-2	SP1/DM-B	SP9/ENCU-23
2DM-3	Not Used	Not Used
2DM-4	Not Used	Not Used
2DM-5	Not Used	Not Used
2DM-6	SP2/DM-C	SP10/ENCU-24
2DM-7	DM-E	1SIOB-8
2DM-8	DM-D	C14-P

8.3 Wiring Schematic

The wiring schematics are provided on the following pages.



TRUCK POWER CONTROL FUSE VALUE CHART

FUSE NAME	VALUE
F1	80A
F2	30A
F3	5A
F4	5A
F5	5A
F6	5A
F7	20A
F8	5A
F9	5A
F10	7.5A
F11	20A

TRUCK POWER CONTROL RELAY CHART

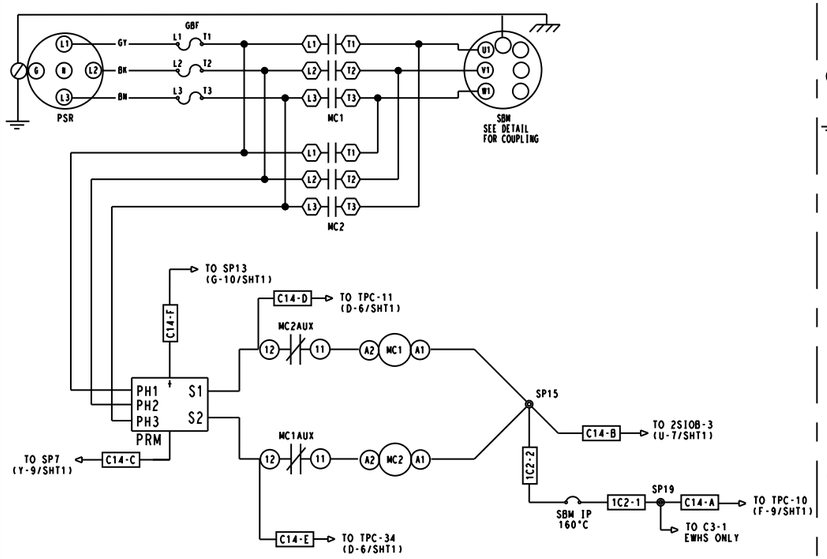
RELAY NAME	LOCATION
PER/K1	E5
DER/K2	F9

DECAL NO.	REV
62-61675-06	G
SUPRA S/HE & S HE SHT 1/2	
LOW VOLTAGE CIRCUITS	

S. 62-61675-ART13-RG

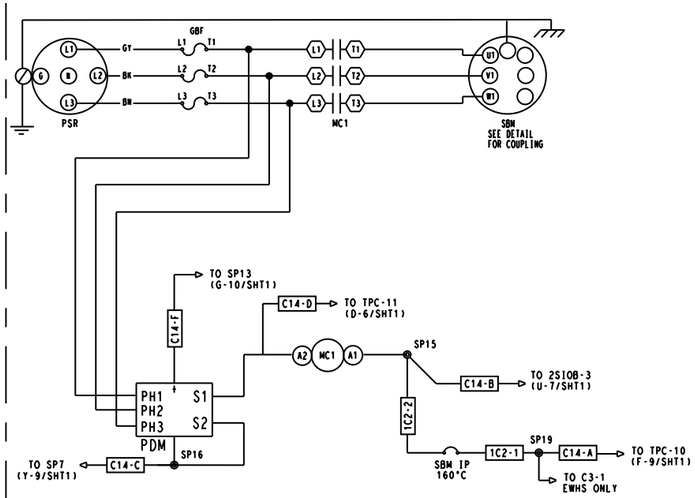
NOT FOR ROAD VERSION

PHASE REVERSAL



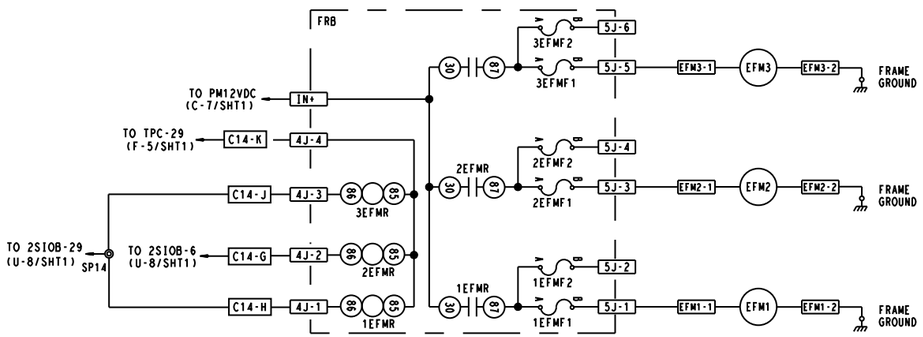
NOT FOR ROAD VERSION

PHASE DETECTOR



LOCATION	SHEET	SYMBOL	DESCRIPTION
M-7	1	AAT	AMBIENT AIR TEMPERATURE
E-12	1	ALT	ALTERNATOR
G-4	1	BUZZER	BUZZER
B-9	1	BTY	BATTERY
S-7/T-7	1	C2	CONNECTOR 2 WAYS FOR EWHS
N-1	1	CAB COMMAND	CAB COMMAND
M-1/L-7	1	CANCOM1/2	CAN BUS CONNECTOR FOR DIAG
P-3	1	CANOPT	CAN OPTION
M-12	1	CDP	COMPRESSOR DISCHARGE PRESSURE
M-8	1	CDT	COMPRESSOR DISCHARGE TEMPERATURE SENSOR
U-10/U-11	1	CFM1/2	CONDENSER FAN MOTOR 1/2
X-6	1	CSMV	COMPRESSOR SUCTION MODULATION VALVE
M-12	1	CSP	COMPRESSOR SUCTION PRESSURE
S-5	1	DAS	DEFROST AIR SWITCH
N-1	1	DM	DESPLAY MODULE
T-6	1	DS	DOOR SWITCH (OPTION)
M-8	1	DTS	DEFROST TEMPERATURE SENSOR
H-6	1	DWR1/2	DRAIN WATER RESISTANCE 1/2
J-8/10/11	2	EFM1/2/3	EVAPORATOR FAN MOTOR 1/2/3
T-2	1	ENCT	ENGINE COOLANT TEMPERATURE
U-1	1	ENCU	ENGINE CONTROL UNIT
T-2	1	ENOPS	ENGINE OIL PRESSURE SWITCH
T-1	1	ENSSN	ENGINE SPEED SENSOR
S-8	1	EWHS	ELECTRICAL WATER HEATER (OPTION)
F-13	1	FCFM1/2	FUSE FAN CONDENSER 1/2
I-5/I-7	1	FH	FUEL HEATER (OPTION)
M-12	1	FLS	FUEL LEVEL SENSOR (OPTION)
G-7	1	FP	FUEL PUMP
F-8	2	FRB	FAN RELAY BOARD
T-1	1	FSA	FUEL AND SPEED ACTUATOR
E-1	2	GBF	GENERAL FUSE BLOCK
C-5	1	GP	GLOW PLUG (2 FOR SUPRA 6, 3 FOR OTHERS)
X-7	1	HGV	HOT GAZ VALVE
I-1	1	HP	HIGH PRESSURE CUT-OUT SWITCH
X-4	1	LBPV	LIQUID BY-PASS VALVE
G-8	1	LIGHT BAR	LIGHT BAR CONNECTOR (OPTION)
X-7	1	LIV	LIQUID INJECTION VALVE (OPTION)
G-2/3/H-5/6/G-5/6	2	MC1/2	MOTOR CONTACTOR 1/2
P-4	1	MCA	MAIN CONTROL ANALOGIC
B-7	1	PM12VDC	POWER MODULE 12VDC
E-3	1	PCM	POWER CONTROL MODULE
C-5/I-5	2	PRM/PDM	PHASE REVERSAL / DETECTOR MODULE
C-2	2	PSR	POWER SUPPLY RECEPTACLE
G-5/X-9	1	PWR-OPT	POWER OPTION CONNECTOR
M-9	1	RAT	RETURN AIR TEMPERATURE
M-10	1	RRAT	REDUNDANT RETURN AIR TEMPERATURE
J-1	1	RSS	RUN START SWITCH
M-10	1	SAT	SUPPLY AIR TEMPERATURE
L-4	1	SATCOM	SATELLITE COMMUNICATION CONNECTOR
J-2	2	SBM	STANDBY MOTOR
K-7	2	SBM-IP	STANDBY MOTOR INTERNAT PROTECTION
V-3	1	SIOB	STEPPER INPUT OUTPUT BOARD
B-12	1	SM	STARTER MOTOR
M-10	1	SSAT	REDUNDANT SUPPLY AIR TEMPERATURE
B-12	1	SS	STARTER SOLENOID
B-12	1	SSC	STARTER SOLENOID CONTACTOR

EVAPORATOR FANS WIRING



GBF (C-1/SHT 2)

SUPRA S6/7/8/9 440V 60Hz	SUPRA S6/7/8/9 230V 60Hz SUPRA HE 6/8/9 380V 50Hz	SUPRA S10 230V 60Hz	SUPRA HE 11/13 380V 50Hz SUPRA S10 440V 60Hz
16 Amps	25 Amps	32 Amps	25 Amps

FUSE VALUE CHART

FUSE NAME	VALUE	LOCALISATION
FBTY	225A	B-9/SHT1
FCFM1	50A	D-2/SHT1
FCFM2	50A	D-2/SHT1
1EFM1	30A	G-12/SHT2
2EFM1	30A	G-11/SHT2
3EFM1	30A	G-10/SHT2

NOTES :

1. UNIT SHOWN "OFF" POSITION.
2. WIRE IDENTIFICATION SYSTEM:
   COLOR: WHITE - DC CONTROL CIRCUITS
   GREEN - DC GROUNDS
   RED - POSITIVE BATTERY CIRCUIT
   BLACK - NEGATIVE BATTERY CIRCUIT
   GREEN/YELLOW - AC EARTH
   FOR AC CIRCUIT WITH ROTATING SENSE
   GREY - AC CIRCUIT PHASE 1
   BLACK - AC CIRCUIT PHASE 2
   BROWN - AC CIRCUIT PHASE 3
   FOR OTHER AC CIRCUIT
   RED/ORANGE - AC CIRCUIT
3. ADDRESS SYSTEM: EXAMPLE: 1MCA-10/PCM-1 INDICATES A WIRE BETWEEN PLUG 1MCA PIN 10 OF MICRO MODULE AND PLUG PCM PIN 1 OF PCM MODULE.
4. VOLTAGE BELOW 12 VOLTS. REFER TO OWNERS MANUAL FOR TROUBLESHOOTING PROCEDURE.

(L1) OR (1) COMPONENT CONNECTION NUMBER OR LETTER.

SP SPLICE POINT.

INDICATES A WIRE EARTH.

INDICATES A WIRE GROUND.

INDICATES STD OPTIONS.

LIGHT LINES INDICATES WIRES IN THE SYSTEM.

NORMALLY CLOSED CONTACT.

NORMALLY OPEN CONTACT.

CDT-A MULTIPLE PLUC CONNECTION.

XX-XX ACTIVE OUTPUT HIGH LEVEL.

XX-XX ACTIVE OUTPUT LOW LEVEL.

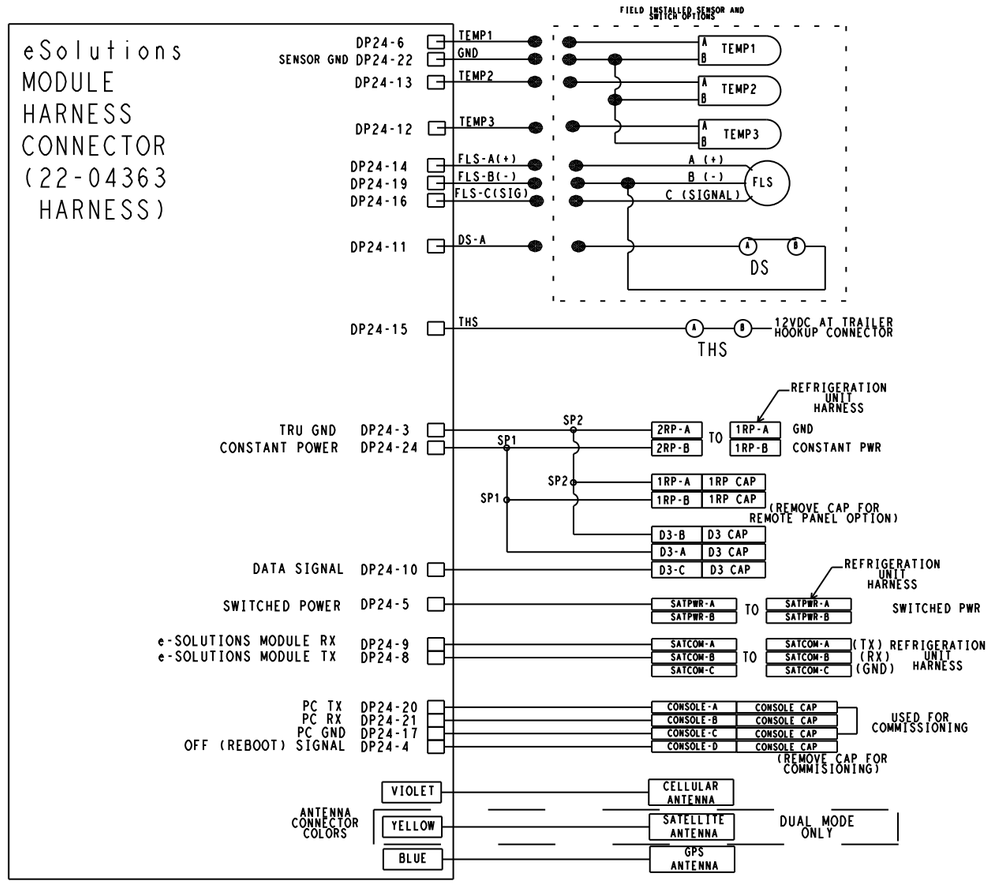
XX-XX INPUT HIGH LEVEL.

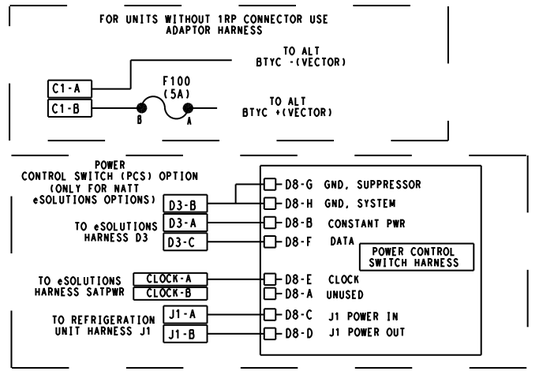
(B) XX (A) JUNCTION BLOCK CONNECTION

DECAL NO.	REV
62-61675-06	G
SUPRA S/HE & S HE SHT 2/3	
HIGH VOLTAGE CIRCUITS	

S.62-61675-ART14-RG

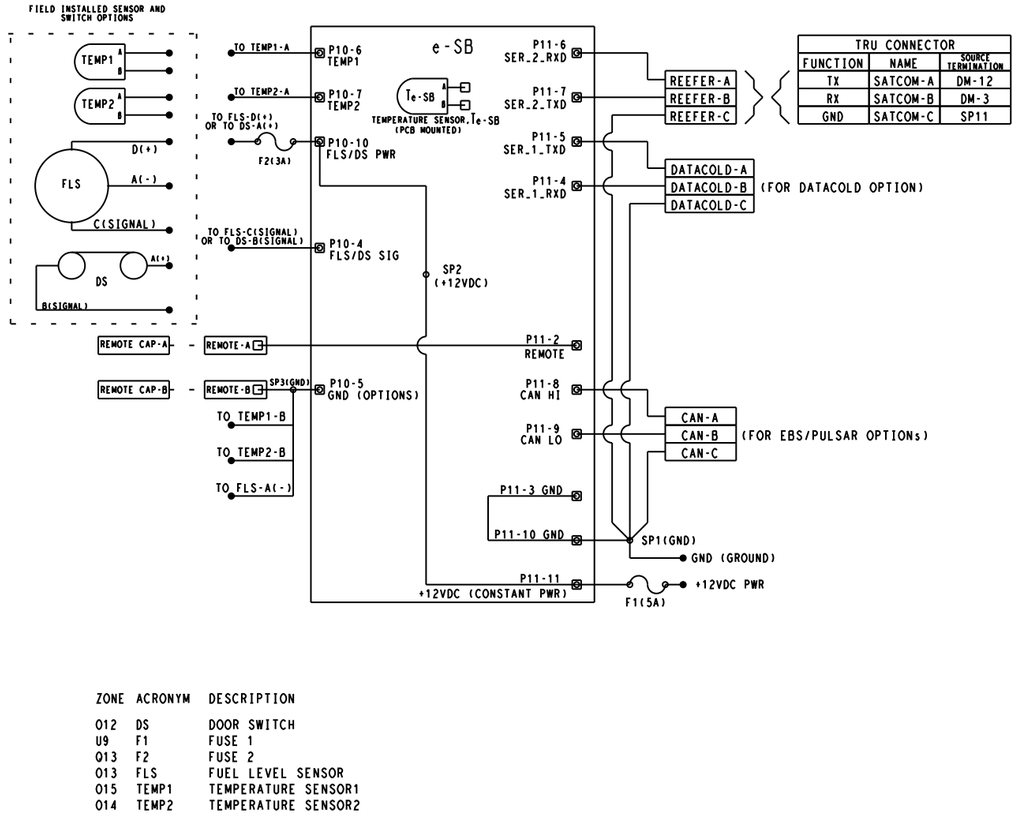
12-00843-00 NATT eSOLUTIONS OPTION





ZONE	ACRONYM	DESCRIPTION
J13	DS	DOOR SWITCH
J14	FLS	FUEL LEVEL SENSOR
I15	TEMP1	E-SOLUTIONS TEMP SENSOR
I15	TEMP2	E-SOLUTIONS TEMP SENSOR
I14	TEMP3	E-SOLUTIONS TEMP SENSOR
I12	THS	TRAILER HOOK "SWITCH"

12-00832-00, -01 ETT eSOLUTIONS e-SB OPTION



TRU CONNECTOR		
FUNCTION	NAME	SOURCE TERMINATION
TX	SATCOM-A	DM-12
RX	SATCOM-B	DM-3
GND	SATCOM-C	SP11

ZONE	ACRONYM	DESCRIPTION
O12	DS	DOOR SWITCH
U9	F1	FUSE 1
Q13	F2	FUSE 2
O13	FLS	FUEL LEVEL SENSOR
O15	TEMP1	TEMPERATURE SENSOR1
O14	TEMP2	TEMPERATURE SENSOR2

SYMBOL KEY

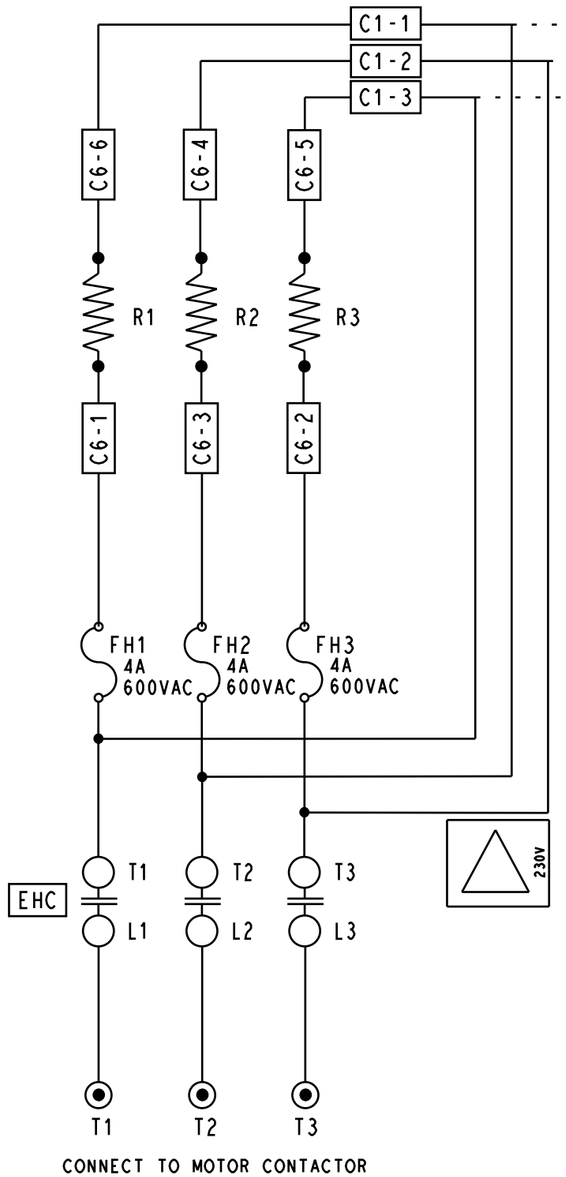
- FIELD SPLICE POINT
- SPLICE POINT
- STANDARD OPTION
- PLUG CONNECTION
- PIN CONNECTION
- COMPONENT CONNECTION
- WIRE GROUND
- CHASSIS GROUND
- WIRE GROUND (PE)

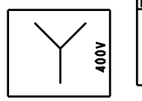
DECAL NO.	REV
62-61675-06	G
SUPRA S/HE & S HE SHT 3/3	
E-SOLUTION CIRCUITS	

S.62-61675-ART15-RG

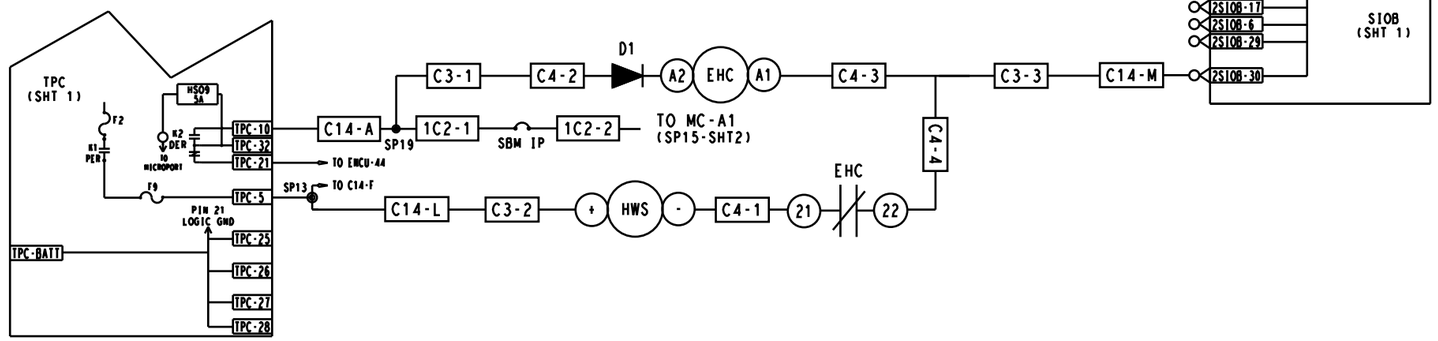
HEAT SYSTEM

LOCATION	SYMBOL	DESCRIPTION	LOCATION IN FRAME
P-5	D1	DIODE	CONTROL BOX
F-8/O-5	EHC	ELECTRIC HEAT RELAY	CONTROL BOX
B-6	FH1	FUSE HEATER L1	CONTROL BOX
C-6	FH2	FUSE HEATER L2	CONTROL BOX
D-6	FH3	FUSE HEATER L3	CONTROL BOX
O-6/O-9	HWS	HEAT WATER SOLENOID	ENGINE
B-4	R1	RESISTOR L1	EVAPORATOR
D-4	R2	RESISTOR L2	EVAPORATOR
E-4	R3	RESISTOR L3	EVAPORATOR

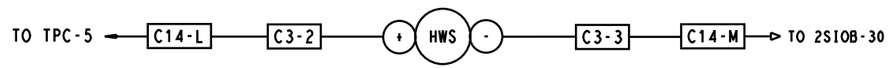




EWHS WIRING FOR STBY VERSION



EWHS WIRING FOR ROAD ONLY VERSION



NOTES :
1. UNIT SHOWN "OFF" POSITION.
2. WIRE IDENTIFICATION SYSTEM:
   COLOUR:WHITE - DC CONTROL CIRCUITS RED - AC CIRCUIT
   GREEN - DC GROUNDS CIRCUITS GREEN/YELLOW- AC EARTH
3. ADDRESS SYSTEM: EXAMPLE: MP-34/2J-14, INDICATES A WIRE BETWEEN MICROPROCESSOR PLUG MP (PIN34) AND PLUG 2J (PIN 14).
4. VOLTAGE BELOW 12 VOLTS, REFER TO OWNERS MANUAL FOR TROUBLESHOOTING PROCEDURE.
5. REFER TO UNIT ELECTRICAL DIAGRAM FOR TPC AND SIO BOARDS

- INDICATES A SOLDERED SPLICE POINT.
- PIN CONNECTION.
- LIGHT LINES INDICATES WIRES IN THE SYSTEM.
- NORMALLY CLOSED CONTACTS.
- NORMALLY OPEN CONTACTS.
- MULTIPLE PLUG CONNECTION NUMBER.
- 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
- COMPONENT CONNECTION NUMBER OR LETTER.

DECAL NO.	REV
62-61492-01	D
NDTP	
ELECTRICAL CIRCUITS	

S.62-61492-ART3 REV: D

⚠ **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

North America
Carrier Transicold
700 Olympic Drive
Athens, GA 30601
USA

Central America and Mexico
Carrier Transicold
Ejercito Nacional 253-A Piso 5
Colonia Anahuac 11320
Mexico D.F.