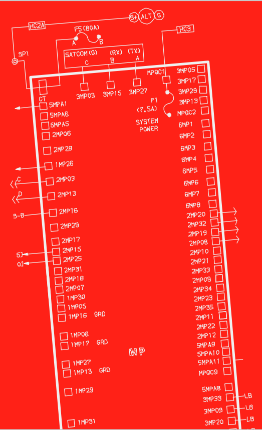
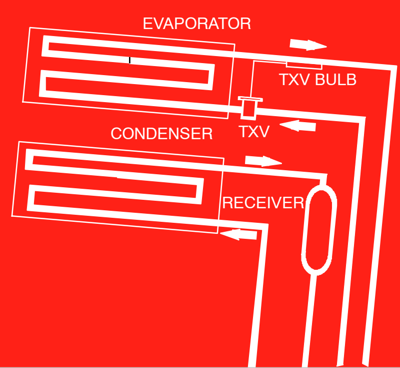
Trailer & Rail Refrigeration





OPERATION & SERVICE

for

X SERIES

Trailer and Rail Refrigeration Units

With Advance™ Microprocessor

62-10683 Rev C Change 09/11

OPERATION AND SERVICE MANUAL

NOSEMOUNT TRAILER AND RAIL REFRIGERATION UNITS

WITH ADVANCE MICROPROCESSOR

How to use this manual

Please take a few minutes to read this page. It explains the content and structure of this manual. This will make it easier for you to find the information that you need.

Section 1 – Safety Precautions
This section contains the Safety Precautions, Safety Decals, and Microprocessor cautions. Read this section before working on the unit.

Section 2 – Unit Description
This section describes the unit listed in the Model Chart Table 2-1.

Section 3 – Operation
This section shows you how to configure and operate the Carrier Advance Microprocessor.

Section 4 – Engine and Standby Motor
This section describes operation of the engine and the standby motor.

Section 5 –Temperature Control
This section describes the temperature control.

Section 6 – Technician Interface
This section describes various testing and downloading functions available to a technician.

Section 7 – Message Center
This section describes all the messages and alarms which can be displayed on the MessageCenter.

Section 8 – Alarm Troubleshooting
This section provides information on the probable causes of the alarm codes given by the microprocessor controller.

Section 9 – Service
This section describes the service procedures for the unit .

Section 10 – Unit Troubleshooting
This section provides information on the probable causes for unit troubleshooting.

Section 11 – Wiring
This section contains Electrical Schematics and Plug Information the model covered in this book.

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SECTION 1

SAFETY PRECAUTIONS

SECTION 1

SAFETY PRECAUTIONS

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 unit main power switch is in the START/RUN position.

CAUTION

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

CAUTION

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.

CAUTION

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.

Auto-Start

Your refrigeration unit is equipped with Auto-Start in both Start-Stop and Continuous Run modes. The unit may start at any time when the START/RUN-OFF switch (SROS) is in the START/RUN 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 belts, checking the oil), make certain that the SROS is in the OFF position.

Engine Coolant

The engine is equipped with a pressurized cooling system. 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. If the cap must be removed, do so very slowly in order to release the pressure without spray.

Refrigerants

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

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.

1.2 SPECIFIC WARNING AND CAUTION 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 – Warns against an immediate hazard which WILL result in severe personal injury or death.

WARNING – Warns against hazards or unsafe conditions which COULD result in severe personal injury or death.

CAUTION – Warns against potential hazard or unsafe practice which could result in minor personal injury, or product or property damage.

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

WARNING

Beware of V-belts and belt driven components as the unit may start automatically. Before servicing unit, make sure the START/RUN-OFF switch is in the OFF position or the unit is in Maintenance mode. Also disconnect the negative battery cable.

WARNING

UNITS EQUIPPED WITH STAR-TRAK TWO WAY COMMUNICATION CAPABILITIES MAY HAVE THE ABILITY TO BE STARTED OR TURNED OFF REMOTELY REGARDLESS OF THE SETTING OF THE START/RUN-OFF SWITCH.

The unit is controlled locally and there can be no two-way communication when the Mode switch on the Remote Monitoring Control Box is in MAINTENANCE MODE. Therefore, when performing maintenance on the unit, place the Mode switch in MAINTENANCE MODE. After the unit is serviced, return the Mode switch to REMOTE ON. (Refer to Section 3.20.3 for more detailed information on two-way communication.)

WARNING

Inspect battery cables for signs of wear, abrasion or damage at every Pre-Trip inspection and replace if necessary. Also check battery cable routing to ensure that clamps are secure and that cables are not pinched or chafing against any components.

WARNING

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

WARNING

Do Not Allow Configuration Jumper Wire To Touch Any Ground.

WARNING

The +5.0 VDC (terminal B) is common between the Compressor Discharge Pressure Transducer, the Compressor Suction Pressure Transducer, and the RPM sensor. If this circuit is shorted to ground (due to one of the mentioned components being defective, or a worn wire) the MessageCenter will show:

- **Suction Pressure: -14.7 PSIG (-1 Bar)**
- **Discharge Pressure: 0 PSIG/Bar**
- **Engine RPM: 0.**

WARNING

Keep hands and arms away from unit when operating without belt guard in place. Never release a unit for service without the belt guard securely tightened in place

WARNING

Do not start unit without installing the evaporator panels as unit damage or body harm may result.

WARNING

Do not use a nitrogen cylinder without a pressure regulator. Cylinder pressure is approximately 2350 psig (159.9 bar). Do not use oxygen in or near a refrigerant system as an explosion may occur. (See Figure 9-26)

WARNING

The Compressor Discharge Pressure Transducer does not have a Schrader valve in the connecting fitting. Any discharge pressure remaining in the compressor will be released when removing the CDP.

WARNING

Carrier Transicold does not recommend allowing the compressor to pull less than 0 PSIG/Bar at any time.

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

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 60% concentration of anti-freeze. Use a low silicate anti-freeze meeting GM specifications GM 6038M for standard life coolant or use Texaco Havoline extended life coolant or any other extended life coolant which is Dexcool approved and has 5/150 (5 years/150,000 miles) on the label.

CAUTION

When changing oil filters, the new filters should be primed (partially filled) with clean oil if possible. If the filters are not primed, the engine may operate for a period with no oil supplied to the bearings.

CAUTION

Service Mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating.

CAUTION

The display and MessageCenter may behave differently during the software loading process, depending on the version of software currently in the controller. DO NOT INTERRUPT THE SOFTWARE INSTALLATION PROCESS ONCE IT HAS STARTED.

CAUTION

It is important that communications between the Micro and the computer are not disturbed during the software loading process. If using a laptop computer, turn all energy saving features off. Turn off any screen saver, or any hard drive time out settings.

CAUTION

Be certain that the clock you are using is accurate, and is showing the correct time. Also, some customers are located in different time zones from where the repair is being made. If you know what time zone they use, enter that time. If you don't, then enter the current time where you are located.

CAUTION

Do not over-torque display screws. Torque all screws to 11in-lbs (1.2 Nm).

CAUTION

Unit uses R404A 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

CAUTION

Do not get anti-seize oil/compound onto clutch contact surfaces. Thoroughly clean off oil/compound with contact or brake cleaner if this occurs.

CAUTION

Only a refrigerant drum containing R404a should be connected to units covered by this manual in order to pressurize the system. Any other gas or vapor will contaminate the system, which will require additional purging and evacuation of the high side (discharge) of the system.

CAUTION

Do not vapor charge R404A systems. Only liquid charging through the receiver outlet (King) valve is acceptable.

CAUTION

Do not over tighten or damage the SV2 or SV4 enclosing tube assembly. Torque to 17-ft pounds (2.4 Mkg). Also make sure all parts are placed on the enclosing tube in proper sequence to avoid premature coil burnout.

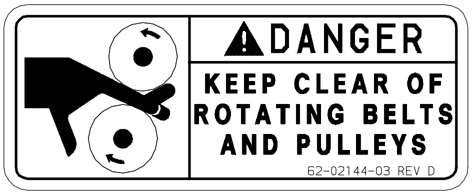
CAUTION

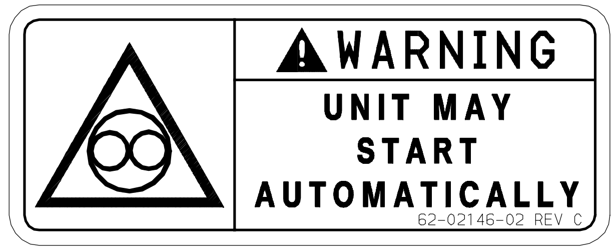
When adding oil to the compressor, extreme care must be taken to ensure the hose is immersed in the oil at all times. Otherwise air and moisture will be drawn into the compressor.

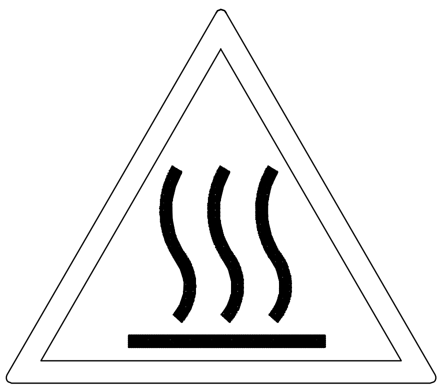
CAUTION

When removing the compressor cylinder head leave two cylinder head bolts loose with threads engaged in the crankcase until cylinder head is completely loosened to prevent any residual crankcase pressure.

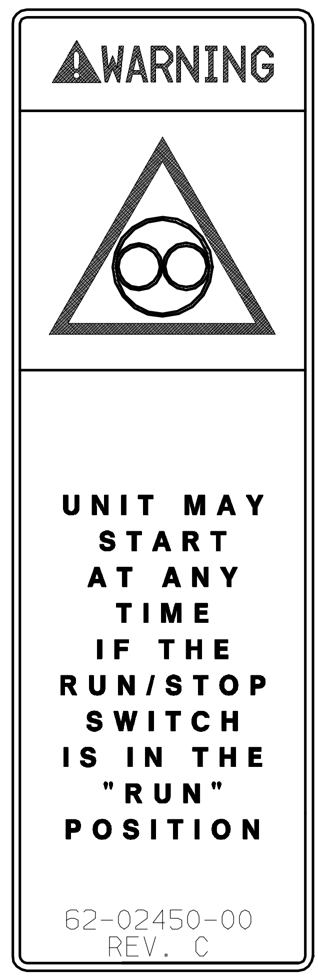
1.3 SAFETY DECALS

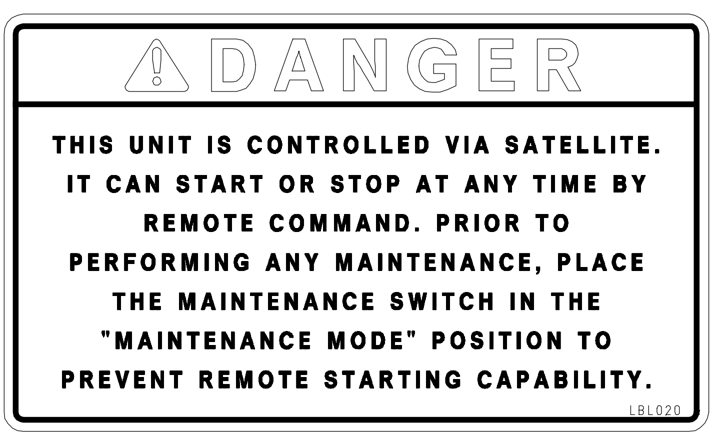




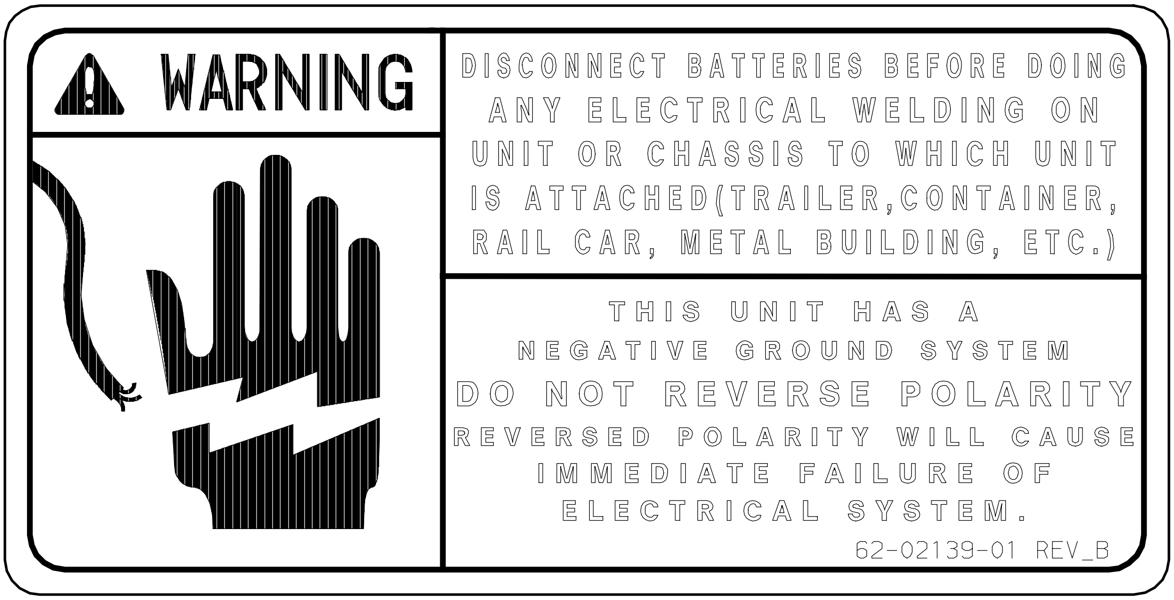


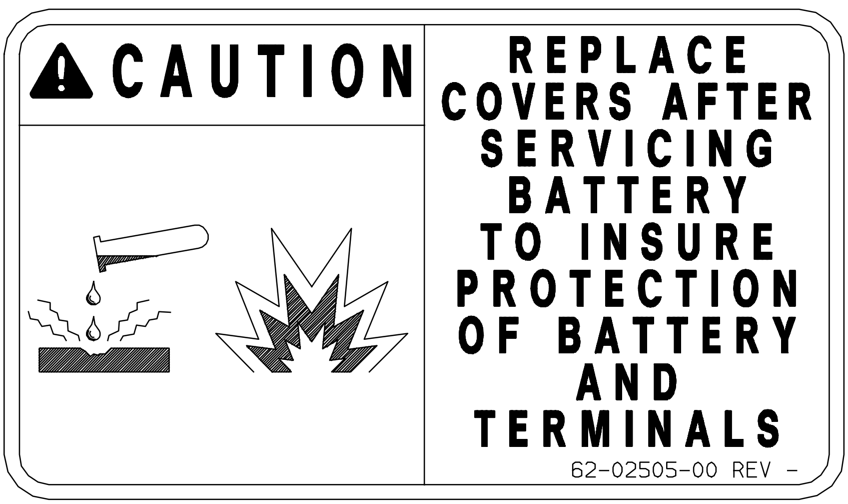
62-03958-00 Heat Warning



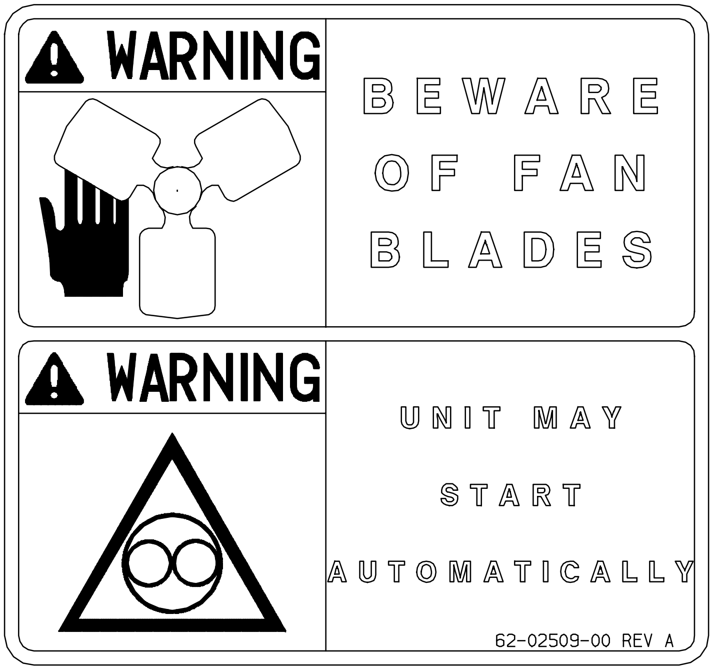


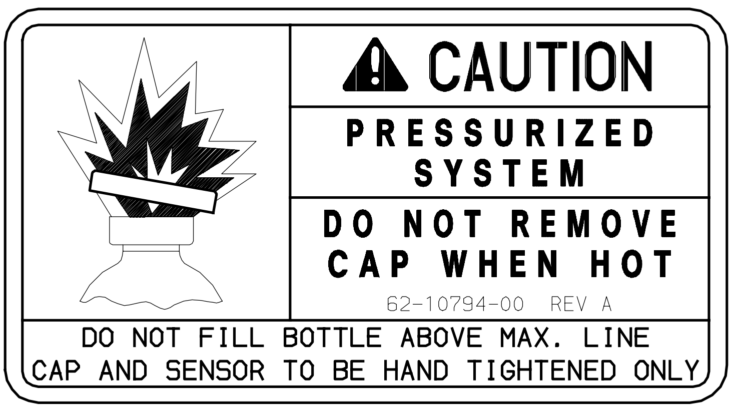
ONLY USED ON UNITS WITH TWO-WAY
COMMUNICATION CAPABILITIES


WARNING
DISCONNECT BATTERIES BEFORE DOING ANY ELECTRICAL WELDING ON UNIT OR CHASSIS TO WHICH UNIT IS ATTACHED(TRAILER,CONTAINER, RAIL CAR, METAL BUILDING, ETC.)
THIS UNIT HAS A NEGATIVE GROUND SYSTEM
DO NOT REVERSE POLARITY
REVERSED POLARITY WILL CAUSE IMMEDIATE FAILURE OF ELECTRICAL SYSTEM.
62-02139-01 REV_B

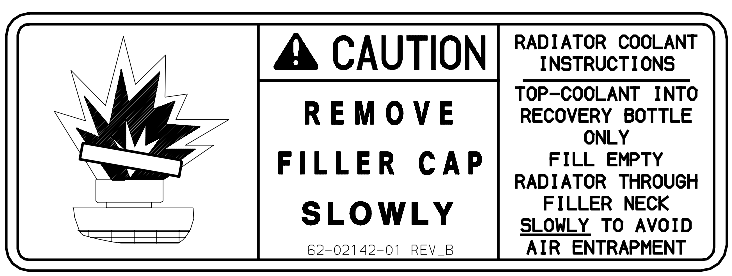

CAUTION
REPLACE COVERS AFTER SERVICING BATTERY TO INSURE PROTECTION OF BATTERY AND TERMINALS
62-02505-00 REV -


WARNING
CONTAINS HOT SURFACES THAT WILL IGNITE COMBUSTIBLES AND FLAMMABLE MATERIALS SUCH AS BIRD NESTS, LEAVES, TREE LIMBS OR MAINTENANCE MATERIALS SUCH AS SHOP RAGS. DO NOT OPERATE WITHOUT INSPECTION.
FIRES AND SERIOUS INJURIES MAY RESULT.
SAFETY INSTRUCTIONS
INSPECT UNIT DAILY PRIOR TO OPERATION. REMOVE ANY COMBUSTIBLE FOREIGN MATERIAL. ENSURE FACTORY INSTALLED ENCLOSURES AND PROTECTIVE EQUIPMENT ARE IN PLACE AND IN WORKING CONDITION.
62-11282-00 REV -


WARNING
BEWARE
OF FAN
BLADES
WARNING
UNIT MAY
START
AUTOMATICALLY
62-02509-00 REV A


CAUTION
PRESSURIZED
SYSTEM
DO NOT REMOVE
CAP WHEN HOT
62-10794-00 REV A
DO NOT FILL BOTTLE ABOVE MAX. LINE
CAP AND SENSOR TO BE HAND TIGHTENED ONLY

OR


CAUTION
REMOVE
FILLER CAP
SLOWLY
62-02142-01 REV_B
RADIATOR COOLANT
INSTRUCTIONS
TOP-COOLANT INTO
RECOVERY BOTTLE
ONLY
FILL EMPTY
RADIATOR THROUGH
FILLER NECK
SLOWLY TO AVOID
AIR ENTRAPMENT

SECTION 2

UNIT DESCRIPTION

SECTION 2

UNIT DESCRIPTION

2.1 INTRODUCTION

WARNING

Beware of V-belts and belt driven components as the unit may start automatically. Before servicing unit, make sure the Start/ Run-Off switch is in the OFF position or the unit is in Maintenance mode. Also disconnect the negative battery cable.

WARNING

UNITS EQUIPPED WITH REMOTE TWO WAY COMMUNICATION CAPABILITIES HAVE THE ABILITY TO BE STARTED OR TURNED OFF REMOTELY REGARDLESS OF THE SETTING OF THE START / RUN-OFF SWITCH.

The unit is controlled locally and there can be no two-way communication when the Mode Switch on the Remote Monitoring Control Box is in MAINTENANCE MODE. Therefore, when performing any work on the unit place the mode switch in MAINTENANCE MODE. After the unit is serviced, return the mode switch to REMOTE ON.

This manual contains Operating Data, Electrical Data and Service Instructions for the refrigeration units listed in Table 2-1.

Additional support manuals are listed in Table 2-2.

The model/serial number plate is located inside the unit on the frame as shown in Figure 2-3.

Table 2-1. Model Chart

Advance Models	R-404A		Compressor	Engine	Engine Speed	
	KG	LB			High	Low
Ultra XTC NDL-93NN	9.1	20	05G 41cfm	CT4-134-DI	1700	1350
Ultra XTC Rail Edition NDL-93NR						
Ultra XTC with Tier 2 Engine NDL-93VN						
Ultima XTC NDL-93PN	9.5	21			2200	1475
Ultima XTC Rail Edition NDX-93PR						
Ultima XTC with Tier 2 Engine NDL-93RN						
X2 2100A and R NDL93S				V2203-DI ESC	1700	1350
X2 2500A and R NDL93U					2200	1450

Table 2-2. Additional Support Manuals

Manual Number	Equipment Covered	Type of Manual
62-10671	Ultra/Ultima XTC	Parts List
62-11171	X2 2100/2500 A AND R	Parts List
62-10646	Units With Advance Microprocessor	Operator’s Manual
62-10682	Units With Advance Microprocessor	Easy To Run
62-10295	Engine V2203-DI	Parts List
62-10863	Engine (Tier 2)	Parts List
62-11168	Engine (Electronic Speed Control)	Parts List
62-10301	Engine V2203-DI	Workshop
62-10865	Engine (Tier 2)	Workshop
62-11167	Engine (Electronic Speed Control)	Workshop
62-10299	Compressor	Parts List
62-11053	Compressor (05G TWINPORT))	Parts List
62-02756	Compressor	Service
62-11052	Compressor (05G TWINPORT)	Service

2.2 GENERAL DESCRIPTION

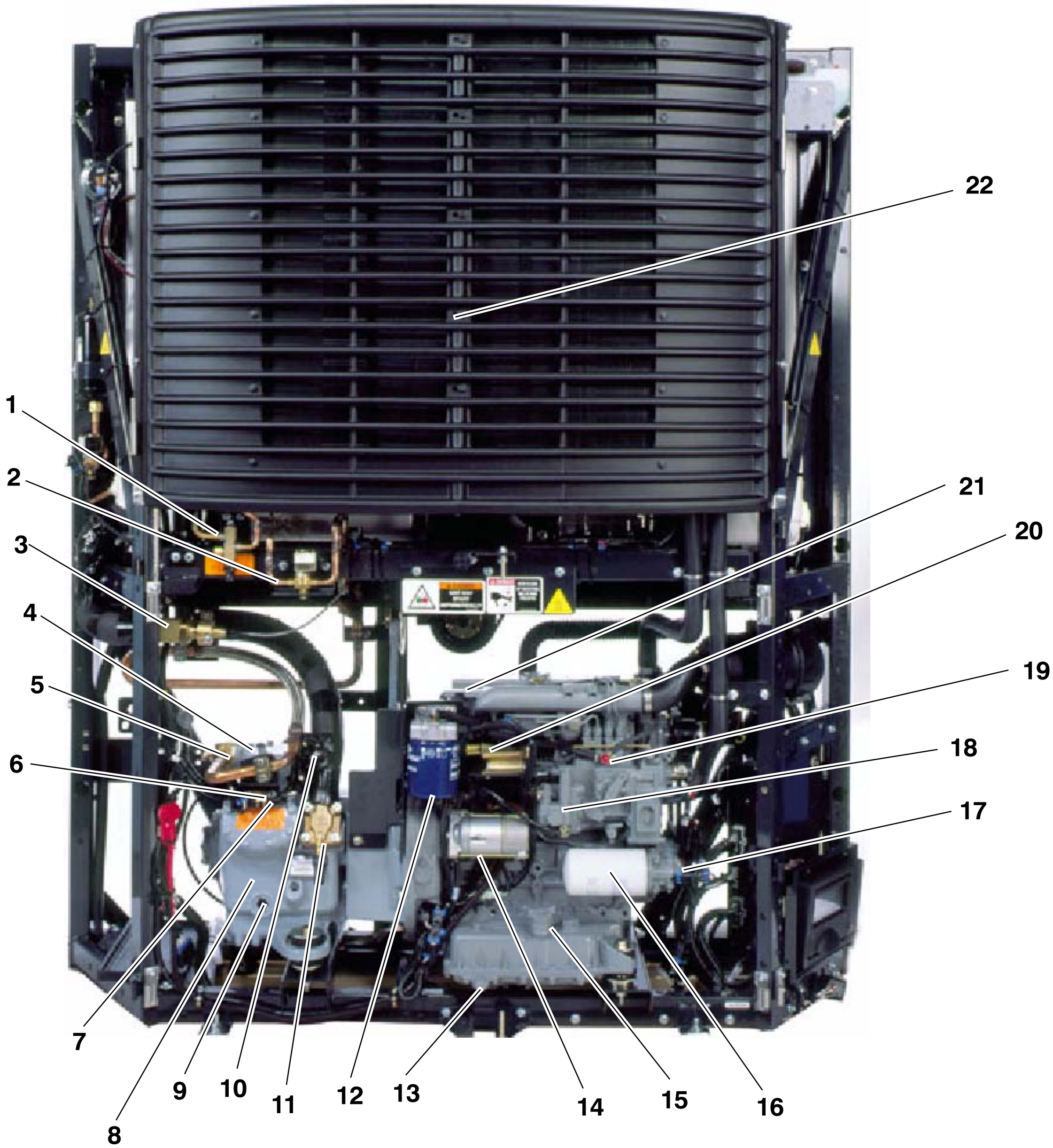
The refrigeration units described in this manual are one-piece, self-contained, fully charged, pre-wired, refrigeration/heating nosemount diesel powered units for use on insulated trailers or rail cars to maintain cargo temperatures within very close limits.

Automatic evaporator coil defrosting is initiated by either sensing the air pressure drop across the coil with a differential air switch or with the defrost timer in the microprocessor.

The control box includes manual switches, microprocessor, fuses, and associated wiring. The unit can be equipped with an optional remote light bar which mounts separately on the front roadside corner of the refrigerated compartment.

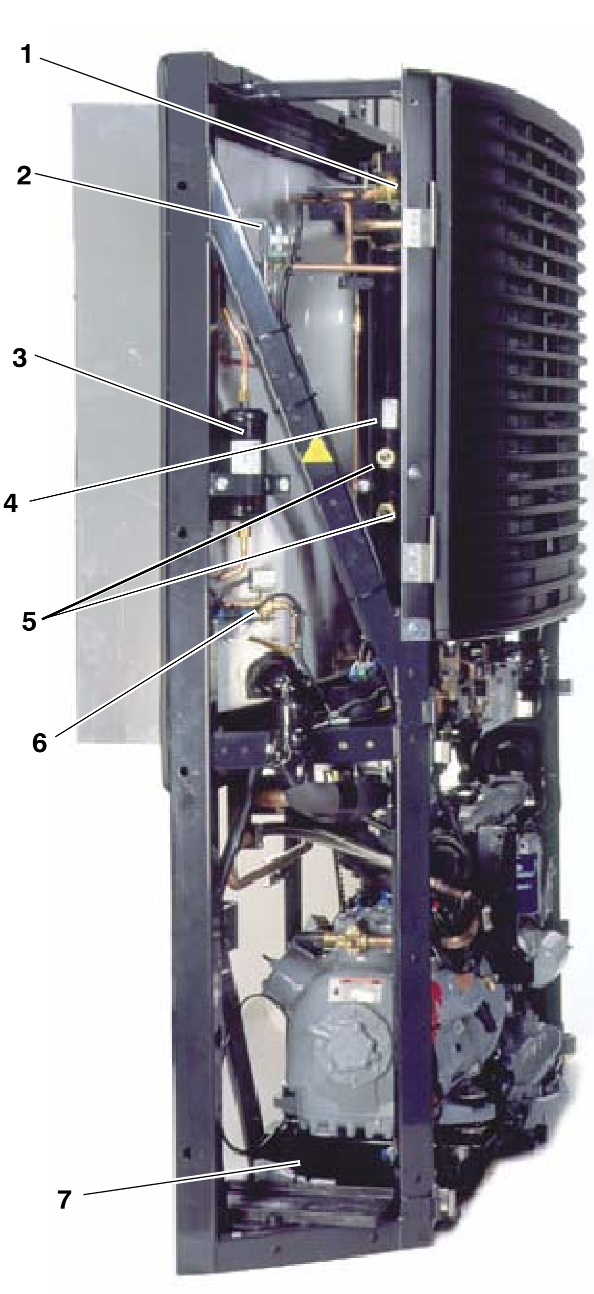
The temperature controller is a solid state microprocessor (Refer to Section 2.5). Once the microprocessor is set at the desired temperature, the unit will operate automatically to maintain the desired temperature within very close limits. The control system automatically selects high and low speed cooling or high and low speed heating as necessary to maintain the desired temperature within the refrigerated compartment.

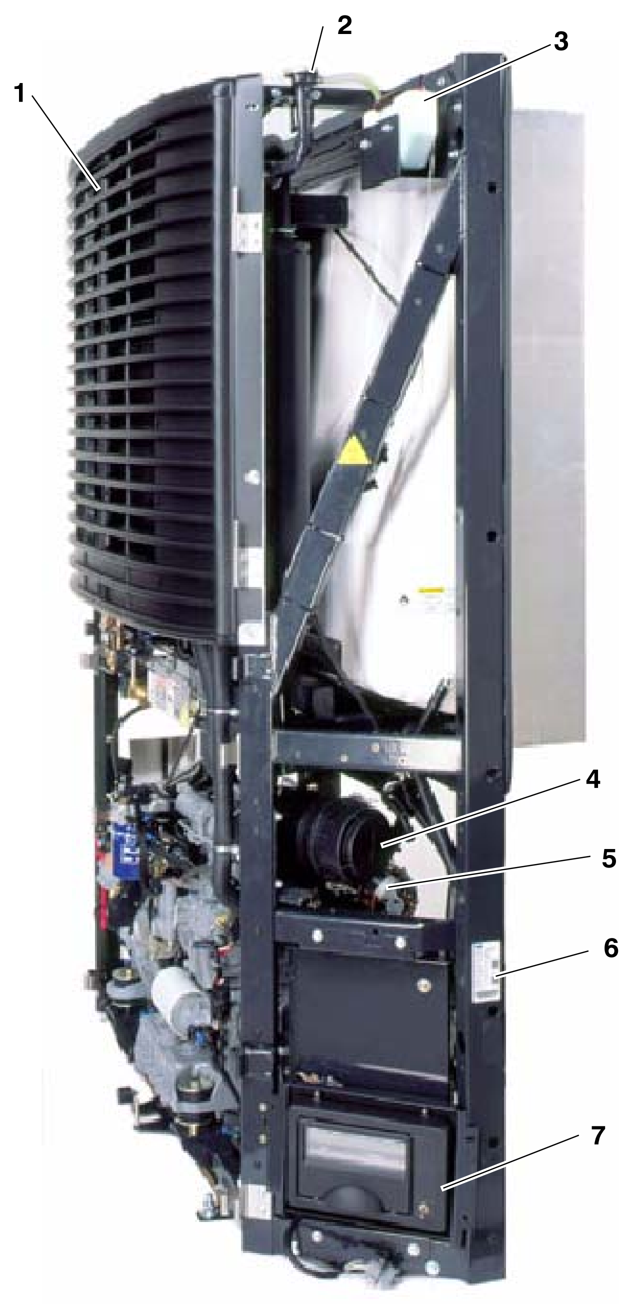
The auto Start-Stop operation provides automatic cycling of the diesel engine, which in turn offers an energy efficient alternative to continuous operation of the engine with control of temperature by alternate cooling and heating of the supply air (evaporator outlet air). The auto Start-Stop feature is standard equipment.



1. Liquid line service valve
2. Hot Gas Solenoid Valve (SV4)
3. Suction Modulation Valve (CSMV)
4. High Pressure Cutout Switch (HPS)
5. Discharge service valve
6. Unloader solenoid valve
7. Compressor Discharge Transducer (CDT)
8. Compressor – 05G
9. Compressor sight glass
10. Suction Pressure Transducer (CSP)
11. Suction service valve
12. Fuel filter
13. Engine oil drain
14. Starter motor
15. Lube oil fill and dipstick
16. Lube oil filter
17. Oil Pressure Switch (OP)
18. Mechanical fuel pump
19. Fuel bleed valve
20. Speed Control Solenoid (SCS)
21. Water Temperature Sensor (WTS)
22. Ambient Temperature Sensor (ATS)

Figure 2-1. Front View Of Unit With Non ESC Engine



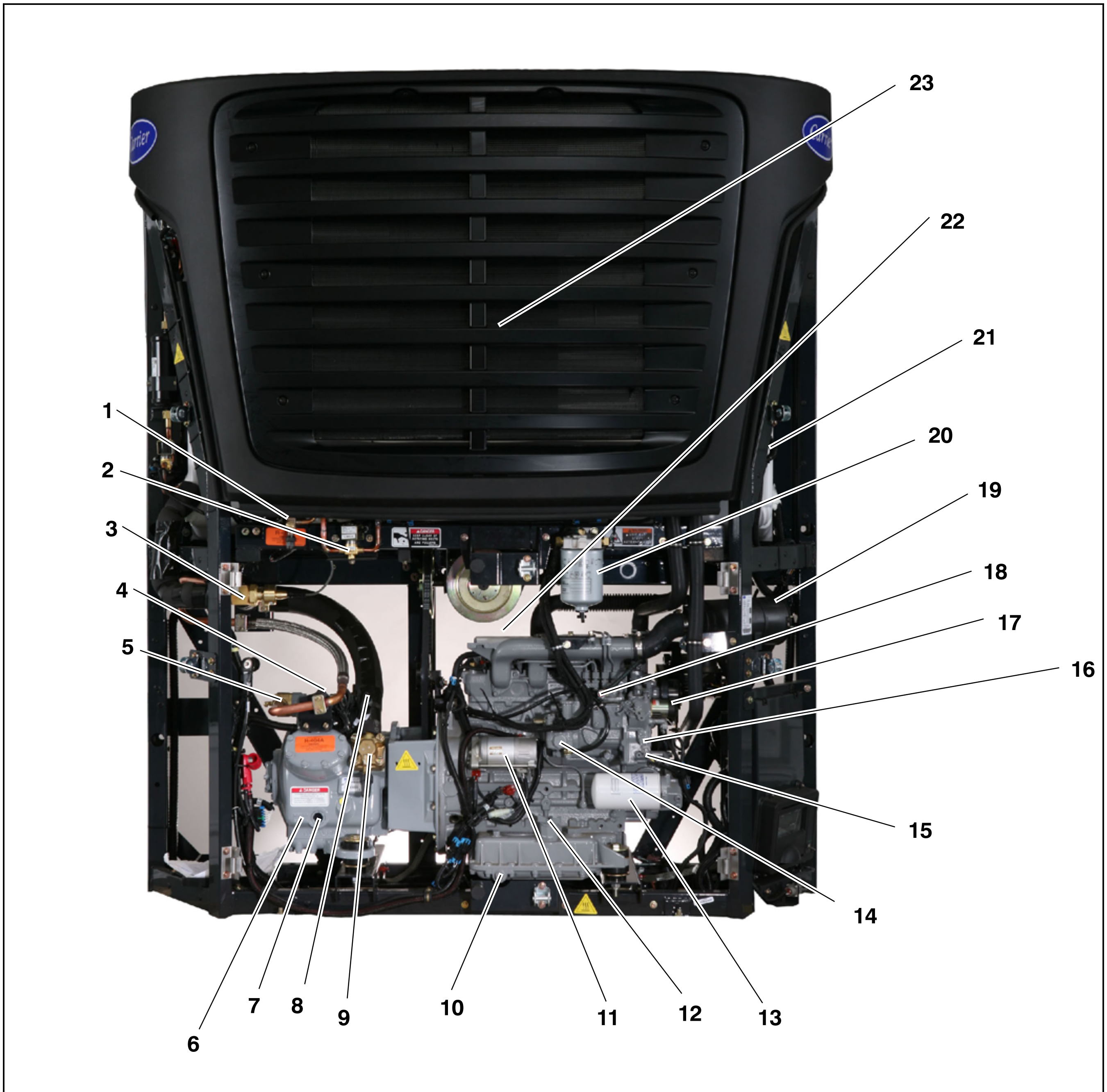


1. Condenser Pressure Control Solenoid Valve (SV1)
2. Defrost Air Switch (DAS)
3. Filter Drier
4. Receiver
5. Receiver sight glass
6. Liquid Line Solenoid Valve (SV2)
7. Battery location

Figure 2-2. Curbside (Non ESC Engine)

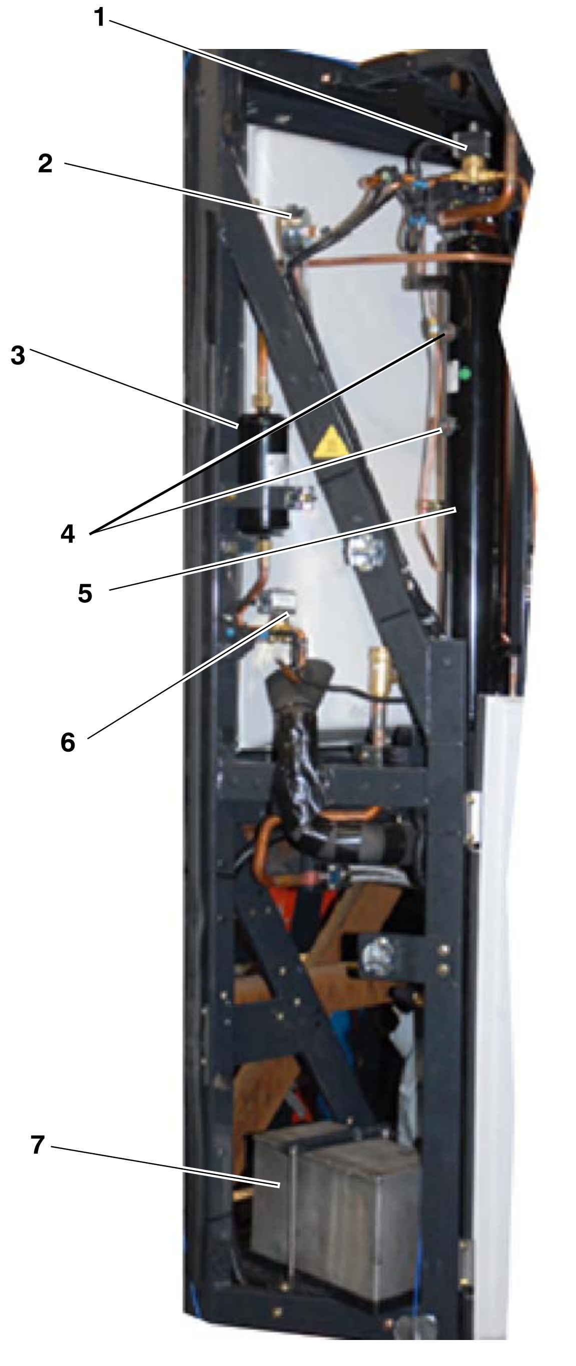
1. Condenser / Radiator
2. Radiator fill neck
3. Radiator overflow reservoir
4. Engine air cleaner
5. Alternator – See Figure 2-11
6. Model / Serial No. Location
7. Control box – See Figure 2-8

Figure 2-3. Roadside (Non ESC Engine)



1. Liquid line service valve
2. Hot Gas Solenoid Valve (SV4)
3. Suction Modulation Valve (CSMV)
4. High Pressure Cutout Switch (HPS), Compressor Discharge Transducer (CDT) and Unloader Solenoid Valve
5. Discharge service valve
6. Compressor - 05G
7. Compressor sight glass
8. Suction Pressure Transducer (CSP)
9. Suction service valve
10. Engine oil drain
11. Starter motor
12. Lube oil fill and dipstick
13. Lube oil filter
14. Mechanical fuel pump
15. Engine Oil Pressure Switch (ENOPS)
16. Engine Speed Sensor (ENSSN)
17. Fuel and Speed Actuator (FSA) and Alternator
18. Fuel bleed valve
19. Engine air cleaner
20. Fuel filter
21. Engine Speed Control Unit (ENSCU)
22 Water Temperature Sensor (WTS
23. Ambient Temperature Sensor (AAT)

Figure 2-4. Front View Of Unit With Electronic Speed Control (Electronic Speed Control)

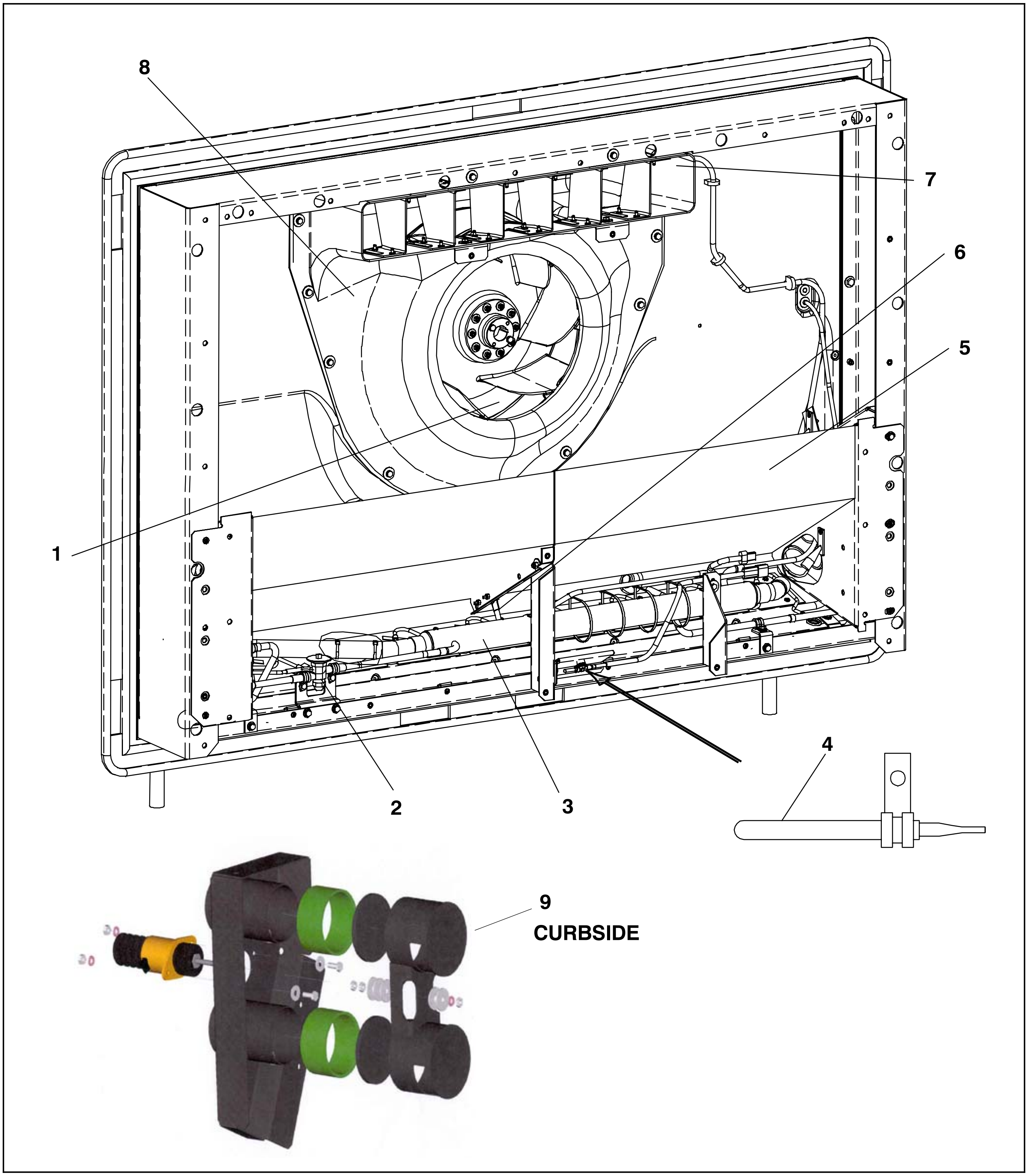


1. Condenser Pressure Control Solenoid Valve (SV1)
2. Defrost Air Switch (DAS)
3. Filter Drier
4. Receiver sight glass
5. Receiver
6. Liquid Line Solenoid Valve (SV2)
7. Battery location

Figure 2-5. Curbside (Electronic Speed Control)

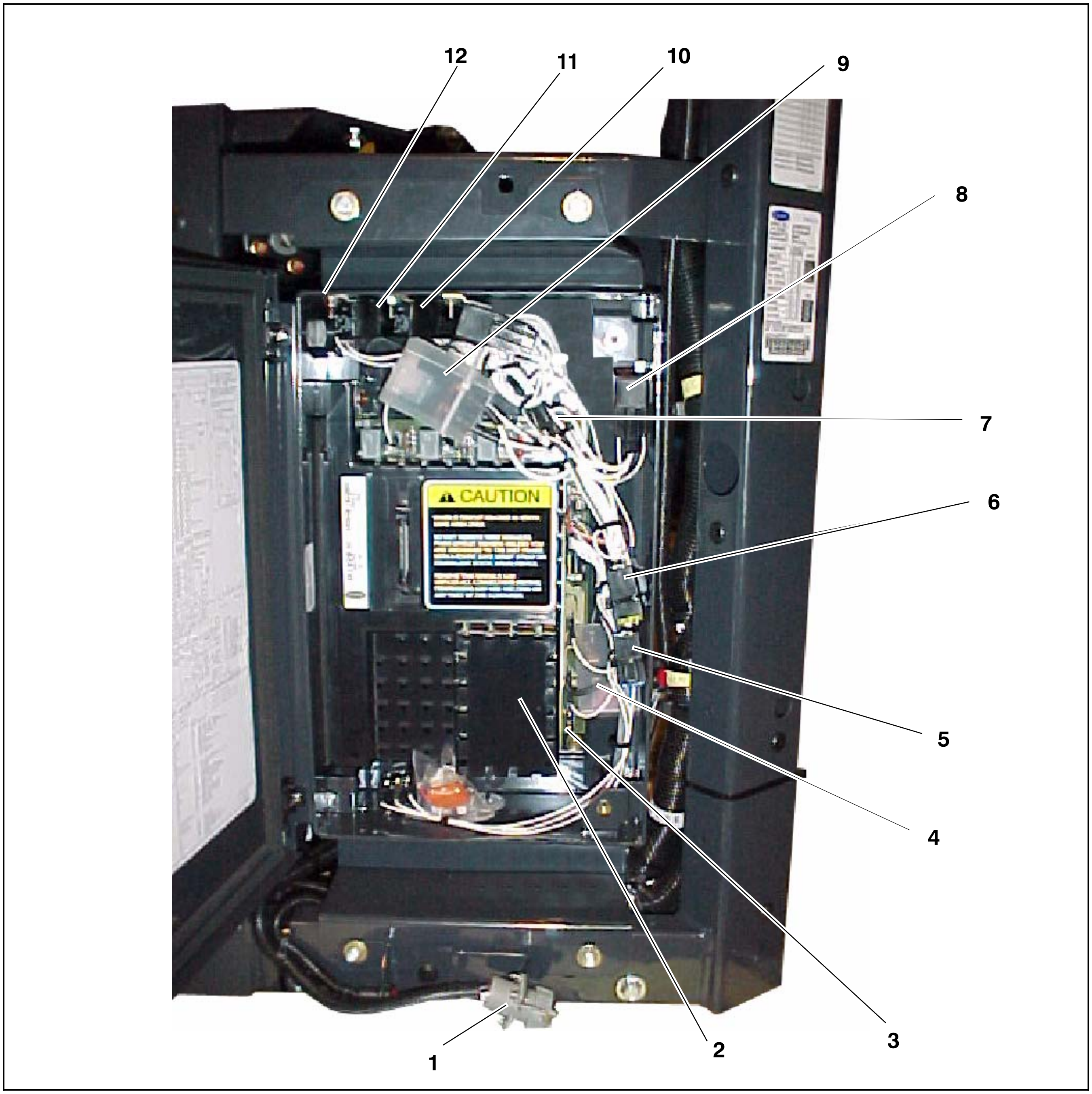
1. Condenser/Radiator
2. Pressurized coolant system
3. Control box – See Figure 2-8
4. Serial Port/Download Plug (SLP)
5. Model/Serial No. Location

Figure 2-6. Roadside (Electronic Speed Control)



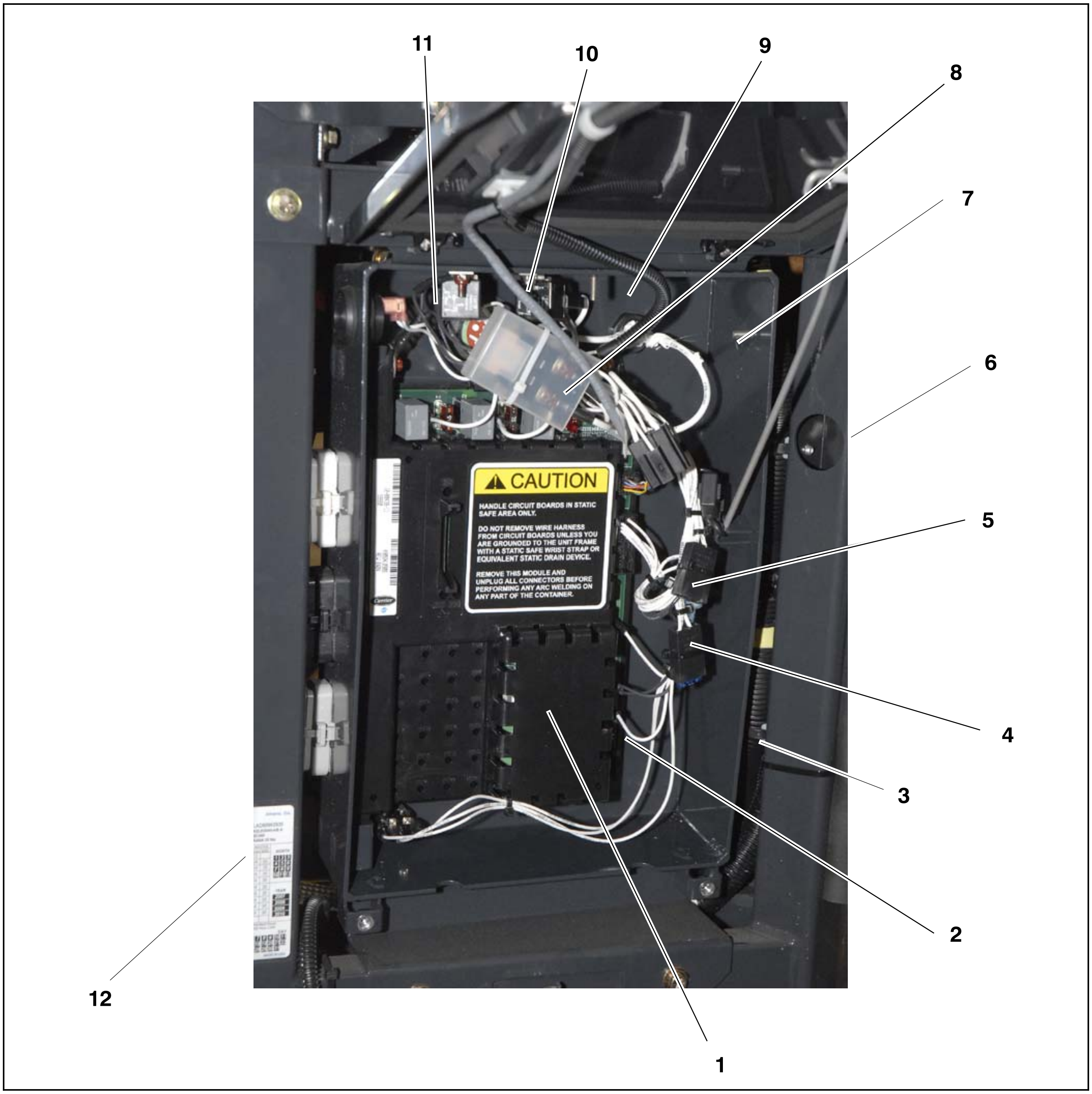
1. Evaporator fan
2. Expansion valve
3. Heat exchanger
4. Return Air Thermistor (RAT)
5. Evaporator coil
6. Defrost Termination Thermostat (DTT)
7. Supply Air Thermistor (SAT)
8. Nozzle cover
9. AutoFresh™ Air Exchange (See Sections 2.4.3 and 3.20.4

Figure 2-7. Evaporator Section – Panels and Grille Removed



1. Serial Port / Download Plug (SLP)
2. Control module (Microprocessor) Refer to Section 2.5.3
3. Fuse (F1) 7.5 Amp
4 Fuse (F10) 40 Amp – Optional Auto Fresh Air Exchange
5. Fuse (F7) 5 Amp
6. Fuse (F6) 15 Amp (Fuel Pump)
7. Fuse (F8) 20 Amp (Optional Fuel Heater)
8. AutoFresh Relay (AFAR)
9. Fuse (F5) 80 Amp
10. Fuel Heater Relay (FHR)
11. Starter Solenoid Relay (SSR)
12. Glow Plug Relay (GPR)

Figure 2-8. Control Box (Short Box)



1. Control Module (Microprocessor) Refer to Section 2.5.3
2. Fuse (F1) 7.5 Amp – Located next to control module
3 Fuse (F10) 40 Amp – Optional Auto Fresh Air Exchange – Location Only
4. Fuse (F6) 15 Amp
5. Fuse (F8) 20 Amp (Optional Fuel Heater)
6. Fuse (F7) 5 Amp
7. AutoFresh Relay (AFAR) – Location Only
8. Fuse (F5) 80 Amp
9. Fuel Heater Relay (FHR) – Location Only
10. Starter Solenoid Relay (SSR)
11. Glow Plug Relay (GPR)
12. Glow Crank Switch (GCS) – on side of box If equipped

Figure 2-9. Control Box (Redesigned Tall Box)

2.3 CONDENSING SECTION

The condensing section consists of an engine-compressor drive package, condenser fan, condenser/radiator coil, refrigerant controls, piping, wiring.

The drive equipment includes the engine, clutch, air cleaner, muffler, coolant overflow bottle, and drive belts.

Refrigeration components mounted in the condensing section include the compressor, defrost air switch, suction modulation valve, filter drier, and receiver.

2.3.1 Condenser Coil

The condenser coil is a tube in fin type and acts as a heat exchanger in which the compressed refrigerant gas is lowered in temperature and condensed into a liquid. Air movement over the condenser is provided by an electric motor driven fan mounted in the condensing section.

2.3.2 Engine

The diesel engine drives the compressor directly through a nylon drive gear and adapter. The adapter also includes a V-belt sheave which drives the gearbox. The condenser/evaporator fan shaft is driven with a V-belt from the gearbox. The water pump V-belt drives the alternator.

a. Engine Transducers and Sensors:

1) Engine RPM Sensor (ENRPM) (Non ESC engines only)

Non ESC Engines: Provides microprocessor with engine RPM information to be displayed and recorded in the DataRecorder. It is located on the rear of the engine in the flywheel housing.

ESC Engines: Provides the ENSCU with the engine RPM information for speed control of the engine. The ENSCU then sends the information to the microprocessor to be displayed in the unit Data List and then to be recorded in the Data Recorder. It is located in the timing case cover of the engine above the oil filter.

2) Engine Oil Pressure Switch (ENOPS)

This normally open switch allows the engine to operate when oil pressure is above 15 $\pm$ 2 PSIG (1.02 $\pm$ 0.1 Bars). The switch will open and automatically stop the engine 5 seconds after pressure drops below 15 $\pm$ 2 PSIG (1.02 $\pm$ 0.1 Bars). There is a 15 second delay after the engine starts to allow the oil pressure to build up before the microprocessor looks at the input from this switch. The switch is located on the front of the engine below the fuel solenoid.

3) Engine Oil Level Switch (ENOLS) (Optional)

ENOLS sets off alarm when oil level is low. Located on the oil pan next to the oil fill.

4) Engine Coolant Temperature Sensor (ENCT)

Provides microprocessor with engine coolant temperature information to be displayed and recorded in the DataRecorder . The sensor is located on the starter side of the engine near the #4 Injector.

5) Engine Coolant Level Sensor (ENCLS) (Optional)

Sets off alarm when coolant level is more than 1 quart low. Located in the coolant bottle.

6) Engine Speed Control Unit (ENSCU) (ESC only) (See Figure 2-10)

The ENSCU is mounted on the roadside frame behind the upper door. (See Figure 2-4). It provides the RPM signal to the microprocessor. The unit has an alarm LED incorporated within it which is used to diagnose failures within the ESC system. See Section 10.4 for information on diagnosing failures.

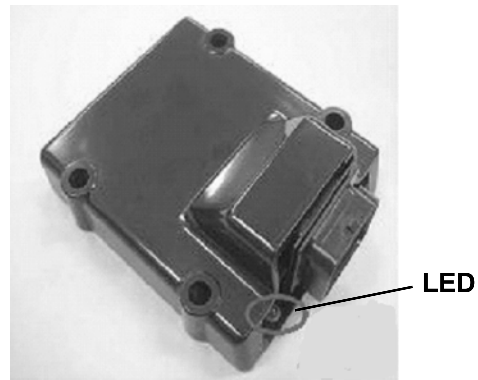


Figure 2-10. Engine Speed Control Unit (ENSCU)

7) Fuel and Speed Actuator (FSA) (ESC only)

The FSA combines the fuel shutoff solenoid and speed control solenoid into one component. Engine speed is controlled by varying rod position.

8) Engine Speed Sensor (ENSSN) (ESC only)

The ENSSN provides the RPM signal to the ENSCU for speed control. It is located on the front of the engine in the gear case cover.

2.3.3 Alternator/Regulator

Electrical power for the control system and for charging the battery is provided by the 12 VDC alternator.

a. Alternator Operation

⚠ CAUTION

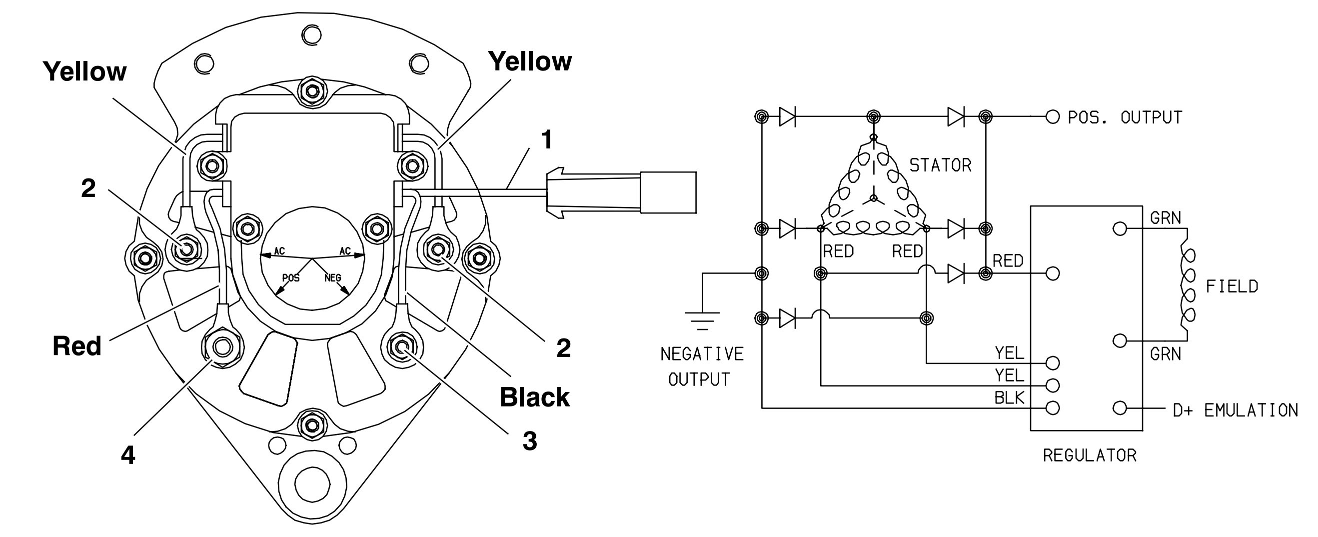
Observe proper polarity when installing battery. Negative battery terminal must be grounded. Reverse polarity will destroy the rectifier diodes in alternator. As a precautionary measure, disconnect positive battery terminal when charging battery in unit. Connecting charger in reverse will destroy the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

The alternator 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 regulator is an electronic switching device. It senses the system voltage level and switches the voltage applied to the field in order to maintain proper system voltage.

b. Integral Voltage Regulator Operation (12 VDC)

The regulator is an all-electronic, transistorized device. No mechanical contacts or relays are used to perform the voltage regulation of the alternator system. The electronic circuitry should never require adjustment and the solid state active elements used have proved reliable enough to warrant a sealed unit. The system is temperature compensated to permit the ideal charging rate at all temperatures.



1. D+ Emulation (Orange) - Not Used on Advance
2. #10-24 AC Terminal
3. #10-24 Ground Screw
4. 1/4-20 Positive Output Cable

Figure 2-11. Alternator and Regulator

2.3.4 Compressor

The compressor assembly includes the refrigerant compressor, suction and discharge service valves, high pressure switch, and the suction and discharge pressure transducers. 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.

2.3.5 Compressor Unloaders

The refrigeration compressor used is a 41 cfm model 05G, equipped with unloaders as standard equipment. Unloaders are used as a compressor capacity control to unload the compressor during periods of reduced loads. This provides closer temperature control and reduces power required to operate the compressor; thus reducing fuel consumption.

a. Major Working Parts

- Solenoid and valve system
- Spring loaded piston type bypass control valve
- Spring loaded discharge check valve

b. Unloaded Operation (Figure 2-12)

Pressure from the discharge manifold (Item 15) passes through the strainer (9) and bleed orifice (8) to the back of the piston bypass valve (7). Unless bled away, this pressure would tend to close the piston (6) against the piston spring (5) pressure.

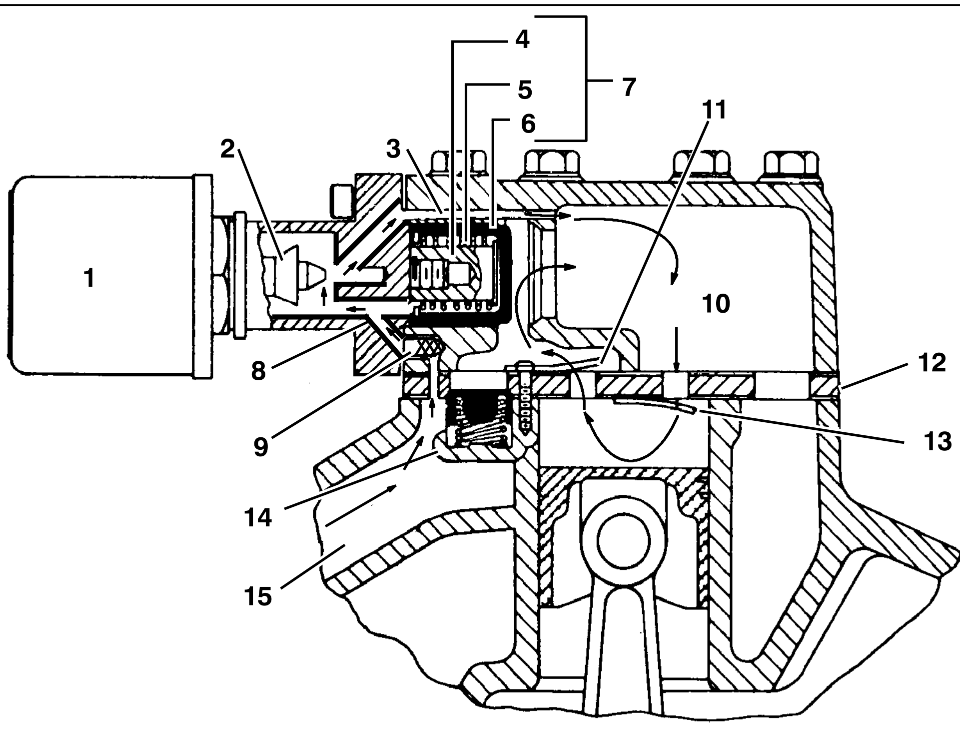
With the solenoid valve (1) *energized*, the solenoid valve stem (2) will *open* the gas bypass port (3).

Refrigerant pressure will be bled to the suction manifold (10) through the opened gas bypass port. A reduction in pressure on the piston bypass valve will take place because the rate of bleed through the gas bypass port is greater than the rate of bleed through the *bleed orifice* (8).

When the pressure behind the piston has been reduced sufficiently, the valve spring will force the piston bypass valve *back*, *opening* the gas bypass from the discharge manifold to the suction manifold.

Discharge pressure in the discharge manifold will close the discharge piston check valve assembly (14) isolating the compressor discharge manifold from the individual cylinder bank manifold.

The *unloaded* cylinder bank will continue to operate *fully unloaded* until the solenoid valve control device is *de-energized* and the gas bypass port is closed.



1. Solenoid Valve
2. Valve Stem
3. Gas Bypass Port
4. Spring Guide
5. Spring
6. Piston
7. Piston Bypass Valve
8. Bleed Orifice
9. Strainer
10. Suction Manifold
11. Cylinder Discharge Valve
12. Valve Plate
13. Cylinder Suction Valve
14. Discharge Piston Check Valve Assembly
15. Discharge Manifold

Figure 2-12. Compressor Cylinder Head Unloaded

c. Loaded Operation (Figure 2-13)

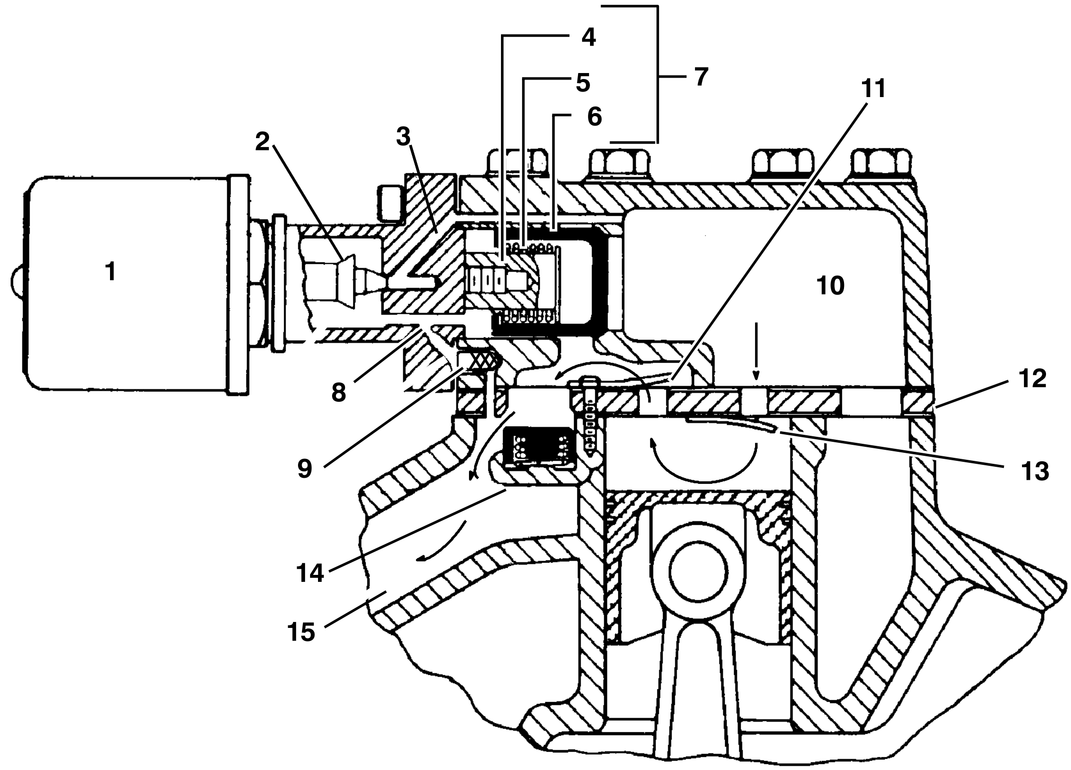
Discharge pressure bleeds from the discharge manifold (Item 15) through the strainer (9) and (8) bleed orifice to the solenoid valve stem (2) chamber and then back of the piston bypass valve (7).

With the solenoid valve (1) *de-energized,* the solenoid valve stem will *close* the gas bypass port (3).

Refrigerant pressure will overcome the bypass valve spring (5) tension and force the piston (6) *forward closing* the gas bypass from the discharge manifold to the suction manifold (10).

Cylinder discharge pressure will force open the discharge piston check valve assembly (14). Refrigerant gas will pass into the compressor discharge manifold.

The loaded cylinder bank will continue to operate fully loaded until the solenoid valve control device is energized and the gas bypass port is opened. Refer to Section 5.12 for more information on Loaded Operation.



1. Solenoid Valve
2. Valve Stem
3. Gas Bypass Port
4. Spring Guide
5. Spring
6. Piston
7. Piston Bypass Valve
8. Bleed Orifice
9. Strainer
10. Suction Manifold
11. Cylinder Discharge Valve
12. Valve Plate
13. Cylinder Suction Valve
14. Discharge Piston Check Valve Assembly
15. Discharge Manifold

Figure 2-13. Compressor Cylinder Head Loaded

2.3.6 Filter Drier

The drier is a 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.

2.3.7 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; as a storage space when pumping down the system and as a liquid seal against the entrance of refrigerant gas into the liquid line.

The receiver is provided with two sight glasses for the observation of liquid level and a fusible plug.

2.3.8 Compressor Transducers and Sensors

a. Compressor Suction Pressure Transducer (CSP)

Provides microprocessor with suction pressure information to be displayed, recorded in the DataRecorder and used to control the refrigeration system. It cannot be calibrated. It is located near the oil pump on the compressor.

b. Compressor Discharge Pressure Transducer (CDP)

Provides microprocessor with discharge pressure information to be displayed, recorded in the DataRecorder and used to control the refrigeration system. It can be calibrated. It is located on the center cylinder head of the compressor.

c. Compressor Discharge Temperature Sensor Transducer (CDT)

Provides microprocessor with compressor discharge temperature information to be displayed, recorded in the DataRecorder and used to control the refrigeration system. It is located on the center cylinder head of the compressor.

It will shut the unit down if center compressor head discharge temperature reaches 310°F (154°C) for three minutes or 350°F (177°C). If ambient temperature sensor (AAT) is at 120°F (49°C) or higher, the CDT limits are increased to 340°F (171°C) for three minutes.

d. 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 pod.

e. Ambient Air Temperature Sensor (AAT)

AAT is a temperature control probe which provides the microprocessor with ambient air temperature information to be displayed, recorded in the DataRecorder and used to control the refrigeration system. It is located behind the condenser grille.

2.4 EVAPORATOR SECTION

The evaporator fits into a rectangular opening in the upper portion of the front wall of the refrigerated compartment front wall. When installed, the evaporator section is located inside this compartment, and the condensing section is outside.

The evaporator assembly consists of an evaporator coil, an evaporator fan motor, a thermal expansion valve, a heat exchanger, a defrost termination sensor (DTT), supply (SAT) and return (RAT) air sensors (See Figure 2-7.

2.4.1 Thermal Expansion Valve

The thermal expansion valve 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 thermal expansion valve maintains a relatively constant degree of superheat in the gas leaving the evaporator regardless of suction pressure. Thus, the valve has a dual function; automatic expansion control and prevention of liquid return to the compressor.

2.4.2 Heat Exchanger

The heat exchanger is the tube in tube type and is connected in the main suction line and liquid line. The cold suction gas is used to cool the warm liquid refrigerant within the heat exchanger. This results in greater system capacity and efficiency.

2.4.3 Evaporator Coil

The unit evaporator is a tube and fin type. The operation of the compressor maintains a reduced pressure within the coil. At this reduced pressure, the liquid refrigerant evaporates at a temperature sufficiently low enough to absorb heat from the air.

Heating is accomplished by circulating hot gas directly from the compressor to the evaporator coil. Solenoid valves control the refrigerant circuit to operate the heating/cooling system.

Automatic evaporator coil defrosting is initiated by either sensing the air pressure drop across the coil with a differential air switch or with the defrost timer in the microprocessor.

As perishable products respire, they consume oxygen (O_2) and give off carbon dioxide (CO_2). This will eventually cause the atmosphere within a refrigerated compartment to have higher levels of CO_2 and lower levels of O_2. This may adversely affect the shelf life of some sensitive perishable products. When transporting these products, it may be desirable to maintain normal atmospheric conditions (prevent the build up of CO_2 and the depletion of O_2) by using fresh air exchange, in addition to accurate temperature control. AutoFresh Air Exchange provides the ability to control the amount of fresh air without the need for manual intervention while in transit. AutoFresh Air Exchange can also be used to lower the humidity level within a refrigerated compartment IF the ambient air has a lower humidity level.

AutoFresh Air Exchange is a factory-installed option, as it requires a modified evaporator pod. (See Figure 2-7) When AutoFresh Air Exchange is operational and “ON”, two air ports open. The upper port allows fresh ambient air to enter while stale air exits through the lower port. AutoFresh Air Exchange is available for all setpoints at or above +28°F (-2.2°C). AutoFresh Air Exchange is not operational when the setpoint is set below +28°F (-2.2°C) or when the unit is in Defrost, or when the unit has cycled off in Auto Start-Stop. (Refer to Section 3.20.4 for more information on AutoFresh Air Exchange.)

2.4.4 Evaporator Transducers and Sensors

a. Defrost Termination Temperature Sensor (DTT)

The DTT is located on the curbside evaporator support bracket above the coil. It senses the temperature of the evaporator and allows defrost initiation once the temperature falls below 40°F (4.4°C)

b. Return Air Temperature Sensor (RAT)

The RAT is a temperature control probe which provides microprocessor with return air temperature information to be displayed, recorded in the data recorder and used to control the refrigeration system. It is located in the center of the return air grille.

c. Supply Air Temperature Sensor (SAT)

The SAT is a temperature control probe which provides microprocessor with supply air temperature information to be displayed, recorded in the data recorder and used to control the refrigeration system. It is located in the supply air nozzle.

2.5 SYSTEM OPERATING CONTROLS AND COMPONENTS

The temperature controller is a Carrier Transicold Advance Microprocessor (Refer to Section 2.5.3 and 3). Once the microprocessor is set at the desired temperature, the unit will operate automatically to maintain the desired temperature within very close limits.

The microprocessor consists of two modules – the control module (See Figure 2-14) and the display and keypad module (See Figure 2-15). The control box includes manual switches, a microprocessor, fuses, and associated wiring.

Standard equipment includes an Auto Start-Stop feature. This feature provides automatic cycling of the diesel engine, which in turn offers an energy efficient alternative to continuous operation of the engine with control of temperature by alternate cooling and heating of the supply air (evaporator outlet air).

2.5.1 Multiple Languages

Messages in the MessageCenter can be displayed in English, French, Portuguese or Spanish.

Press and hold the Select Key for 6 seconds to view or change the current language selection. See Section 3.16 for more information on Language Selection.

2.5.2 Special Features

The following special features are incorporated into the Carrier Transicold Advance Microprocessor:

- A MessageCenter which clearly displays all information in dot matrix form.
- Unit Operation and Alarms are displayed in English (not in codes)
- UltraFresh 3
- Large LCD display
- Unit Data and Functional Parameters
- Programmable Maintenance hourmeters
- PM Hourmeters are resettable from the keypad
- Bright LED alarm light
- Bright LED mode lights
- Fully automated Pretrip
- Automated microprocessor Self-test
- DataRecorder
- DataRecorder date and time can be set from the keypad
- Auto Start-Stop
- Trip Start to record date/time of trip in DataRecorder memory
- PC card functionality for downloading data, upgrading programming and setting up Configurations. (Refer to Section 2.5.4.)
- FETs (Field Effect Transistors) for switching components on and off, and checking circuit current
- Automatic Engine Starting. Manual engine starting exists in units built before April 2007.
- Functional Parameter locks
- Alarms are stored in microprocessor memory for future reference
- New menu system to simplify keyboard and enhance functionality

2.5.3 Component Description And Location

a. Control Module

The control module is housed in the control box on the lower roadside (right) corner of the unit, just inside the lower roadside door. The control module contains replaceable relays and fuses which are externally accessible. LEDs are located next to the three relays plugged into the control module to indicate relay operation. Additional LEDs indicate operation of the FETs (Field Effect Transistors).

The control module includes the logic board, program memory, FETs, PC card slot, and necessary input/output circuitry to interface with the unit.

The logic board is located within the control module, and does not contain any serviceable components.

CAUTION

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

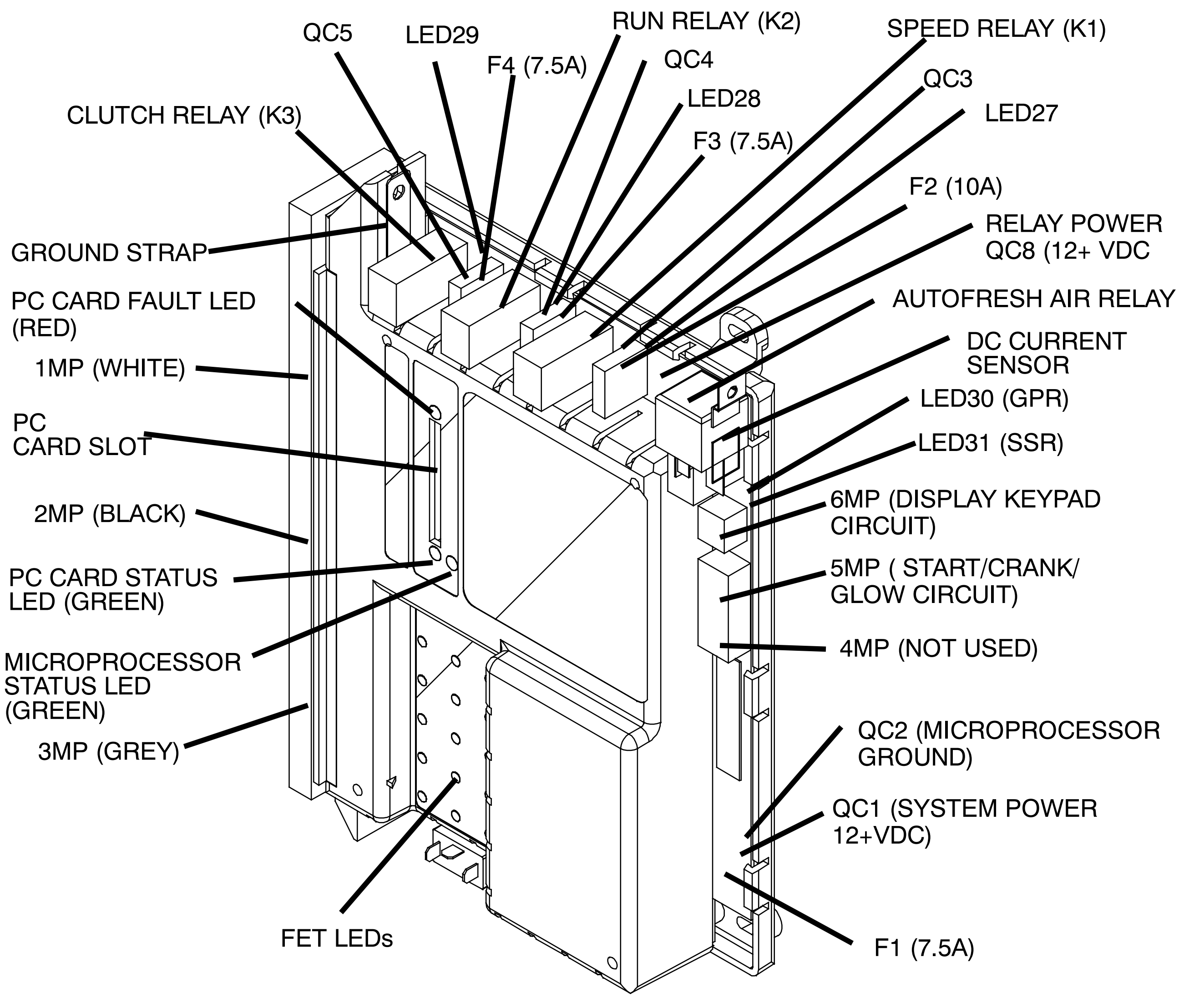


Figure 2-14. Control Module

Figure 2-14 shows the control module. The control module has three relays and four fuses that are user accessible. There are three 7.5 amp fuses and one 10 amp fuse.

The PC card slot is also shown in Figure 2-14. This card slot is used with all Carrier Transicold PC cards. The microprocessor automatically detects the presence and type of PC card inserted and responds accordingly. The different types of PC cards are:

- Download PC card for downloading unit data
- Option PC card for installing optional software programs
- Configuration PC card for setting the microprocessor functions, configurations, and DataRecorder configurations.
- Program PC card for upgrading the microprocessor software.

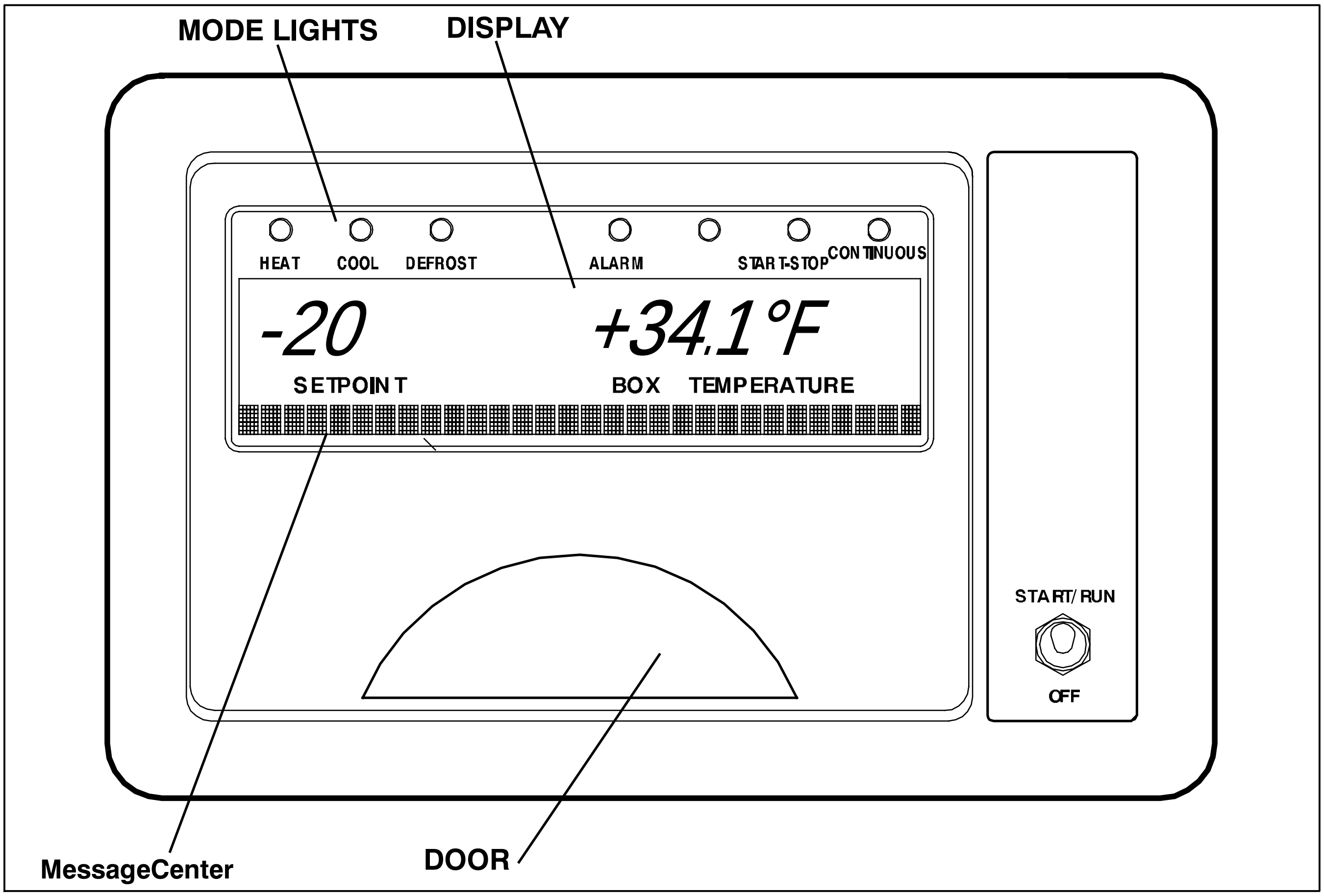
There are three LEDs associated with the function of the PC card slot. These are:

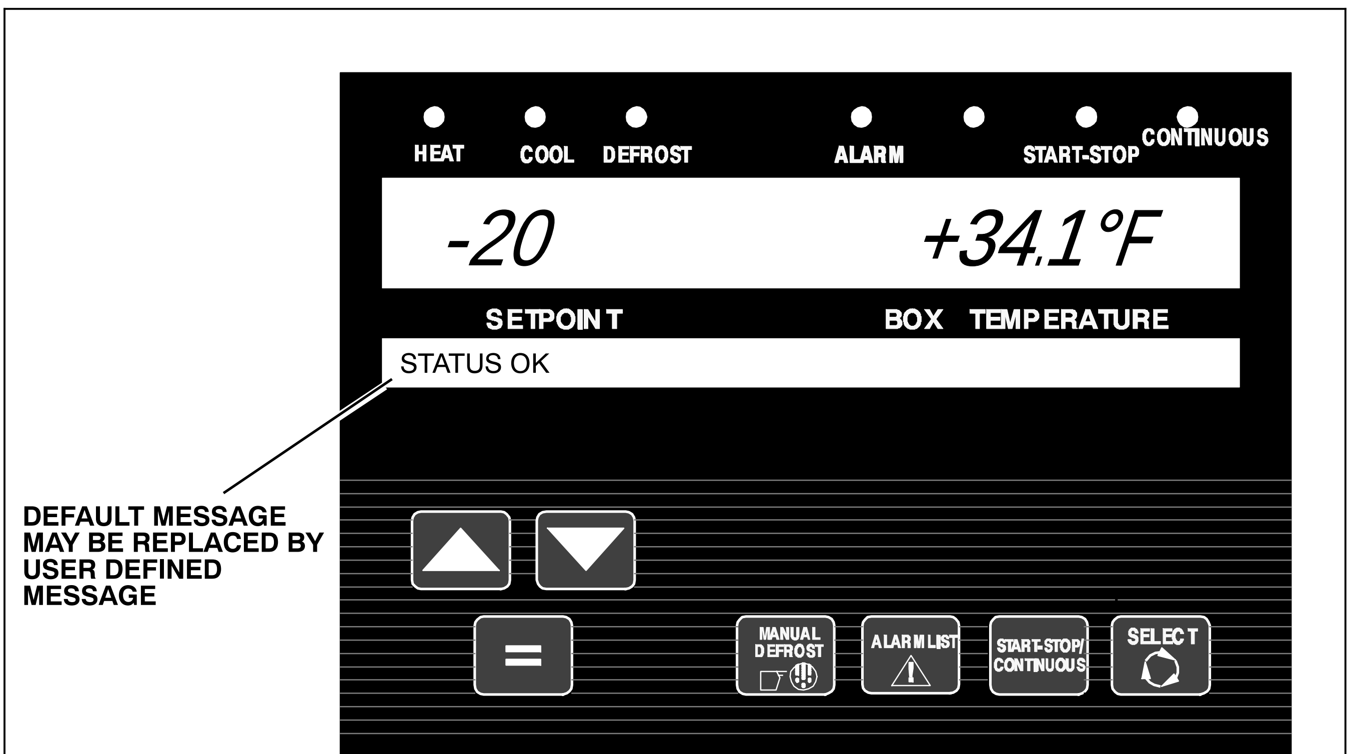
- A green Microprocessor Status LED which will blink steadily once per second indicating that the microprocessor is operating and will blink every 0.5 seconds if there is no software or if it is loading software.
- A green (PC) Card Status LED which comes on when there is a PC card inserted in the slot. This LED will:

1) Blink every 0.5 seconds when data is being transferred to or from the PC card, and will be on steady when the operation is complete and the PC card may be removed.
2) During download, the light will blink once per second and will blink every 1.5 seconds when the download is complete.

- A red (PC) Card Fault LED blinks if there is a problem transferring data from the PC card that has been plugged into the PC card slot. The red LED will continue to blink until the PC card is removed. The LED will also blink if there is an error reading the card. The LED will blink every 0.5 seconds during a software change – either an upgrade or downgrade. It will blink every 1.0 seconds during data download to PC card. It will blink every 2.0 seconds when either the Program or Configuration or Option cards is inserted and no action is taken. Check the MessageCenter for description of error.

b. Display and Keypad





DISPLAY and KEYPAD MODULE

Figure 2-15 Display and Keypad

The Display and Keypad module is located for operator access at the lower roadside corner of the unit.

The display board is mounted in the Keypad and Display module. The display board includes the LCD display, keypad, and keypad interface.

The Display and Keypad module provides the user with a panel to view and control the functions of the refrigeration unit. The module consists of a switch, keypad, MessageCenter, and main display. Setpoints and other system information are selected using the keypad. The previous figure shows the Display and Keypad module.

Display

The main display has nine characters (seven seven-segment characters and two nine-segment characters), two decimal points, two commas, and a degree symbol. The display is used to provide the user a setpoint and refrigerated compartment temperature – either in degrees Centigrade or Fahrenheit. The comma symbols are used as the decimal indicators in Europe. When Metric Units is selected in the Functional Parameters, the two comma icons are used instead of decimal points. When English Units is selected in the Functional Parameters, decimal points are used.

Temperature display is right justified, with unused digits blank. A negative sign will be displayed for all setpoint and refrigerated compartment temperatures below Zero. A positive sign will be displayed for all setpoint and refrigerated compartment temperatures above
0° which will not have a sign in front of it. The resolution for refrigerated compartment temperature in both Centigrade and Fahrenheit is one-tenth degree.

The user has the option as to whether to have the setpoint displayed with a decimal or comma. Only setpoint is affected by this selection. All other temperatures and pressures will continue to be displayed with either a decimal or comma. Refer to Configurations Section 6.2.

Indicator LEDs

The display has six LEDs across the top to indicate operation status. These indicators are:

- Cool Indicator (Green) – Turned on when the unit is in Cool mode.
- Heat Indicator (Amber) – Turned on when the unit is in Heat mode.
- Defrost Indicator (Amber) – Turned on when the unit is in Defrost mode.
- Start-Stop Indicator (Green) – Turned on when the Start-Stop mode has been selected.
- Continuous Indicator (Green) – Turned on when the Continuous mode has been selected.
- Alarm Indicator (Red) – Off or flashes at a rate of 0.5 seconds.

NOTE

When the unit is in PULSED NULL mode (fan only), the mode indicators (COOL, HEAT and DEFROST) are all off.

NOTE

There is an opening between the Alarm and Start-Stop LEDs that is not used at this time.

MessageCenter

The MessageCenter is used to show messages. Details of the messages are described in Section 7.1 MessageCenter.

Switch Descriptions

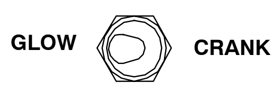
START / RUN-OFF Switch (SROS)

START/RUN-OFF Switch

The START/RUN-OFF switch is a 12 VDC input to the microprocessor. When placed in the **START/RUN** position, this switch provides power to the microprocessor. The microprocessor performs a self-test (all segments of display are illuminated). Then set point and refrigerated compartment temperature are displayed. To stop the unit or remove power from the microprocessor, place the SR0S to the OFF position.

GLOW/CRANK Switch (GCS) (Removed from units built after April 2007)

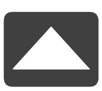
The GLOW/CRANK switch is located on the back of the control box and is easily reachable from under the control box.



NOTE

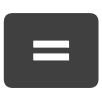
The GLOW/CRANK switch will energize the glow and crank circuits only when the START/RUN-OFF switch is in the RUN position, and after the microprocessor has gone through the self-test.

Key Descriptions



UP ARROW and DOWN ARROW Keys

These keys allow you to change the setpoints or other displayed data of the system. They also allow you to scroll through the Unit Data list, Function Parameters list, Alarm list, etc.



EQUAL Key (ENTER)

The EQUAL key is used for many things, including entering a setpoint, changing a Functional Parameter, clearing alarms, and locking the data menu.

MANUAL DEFROST Key

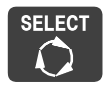
The MANUAL DEFROST key is used to initiate a defrost cycle when the proper conditions are met.

ALARM LIST Key

The ALARM LIST key allows you to view the alarms stored in the microprocessor. The alarm list is displayed in the MessageCenter. Pressing the ALARM LIST key once displays the active alarm list. Each successive press cycles through the list to the end. To view the inactive alarm list, Refer to Section 3.13.

START-STOP/CONTINUOUS Key

This key allows you to change from Start-Stop operation to Continuous Run operation. In Start-Stop operation, when the microprocessor is in Off-Cycle mode, the unit will not be running. During Off-Cycle mode, the microprocessor monitors refrigerated compartment temperature, battery voltage and engine coolant temperature and will restart the unit when needed.



SELECT Key

Press the SELECT key to scroll through the menu selections. One of the five standard and one optional menu selections will appear in the MessageCenter when the SELECT key is pressed.

The five standard selections are:

•**PRESS ↑↓ TO VIEW HOURMETERS**– Displays the hours for individual hour meters. Refer to Section 3.15.

•**PRESS ↑↓ TO START PRETRIP** – Used to initiate a pretrip. Refer to Section 3.4.

•**PRESS ↑↓ TO VIEW DATA** – Displays Unit Data. Refer to Section 3.14.

•**PRESS ↑↓ TO VIEW SETTINGS** – Displays unit Functional Parameter settings. Refer to Section 3.16.

•**PRESS ↑↓ TO MARK TRIP START** – This menu selection is only used with the Data Recorder. It is used to record a Trip Start event which is logged in the Data Recorder. This records the time and date of the beginning of the trip. Data can then be downloaded and reviewed by trip, making data review much easier. Refer to Section 3.11.

•**PRESS ↑↓ TO VIEW PRINT MENU** – Enables the user to use hand–held Strip Print printer kit P/N 12–00543–10.

The optional selection is:

•**PRESS ↑↓ TO VIEW INTELLISETS** – Refer to Section 3.20.1.

Table 2-3. FIELD EFFECT TRANSISTORS (Transistors not listed are spares)

STANDARD	
FET	**DESIGNATION**
FET6	Auto Fresh Air Relay
FET7	Auto Restart Light
FET8	Heat Light
FET9	SV4
FET10	SV1
FET12	Fuel Heater Relay (FHR)
FET14	Fault Light
FET15	Out of Range Light
FET16	Defrost Light
FET17	Cool Light
FET18	Buzzer (B)
FET21	SV2
FET22	Rear unloader (UL2)
FET23	Front unloader (UL1)
LED LIGHT BAR OPTIONS	
FET	**DESIGNATION**
FET14	Fault Light
FET15	Out-Of-Range Light

2.5.4 Handling of PC Cards

PC cards can be used to upgrade software (Section 6.5.2), download recorder data (Section 6.7.1, set configurations (Section 6.2.1) and Functional Parameters (Section 6.7.7) and install optional features.

While these cards are constructed for a rugged environment, they are not intended to be stored in a technician's toolbox.

The label on each card clearly states that the card is to be handled with care - not to be bent, dropped or exposed to impact. Heat, moisture and direct sunlight should be avoided.

PC cards are designed to be used in a wide temperature range of -40 to +185°F (-40 to +85°C). When a PC card is connected to an Advance microprocessor or computer at temperatures outside this range, data transmission between the card and the other device may not be performed correctly.

Retention of programmed data for extended periods of time requires a temperature range of -4 to +149°F (-20 to +65° C). When PC cards are exposed to temperatures outside of this range for several days data contained on the card may be damaged.

PC cards should never be:

- Dropped
- Bent
- Twisted
- Squeezed
- Submersed in any liquid
- Exposed to electrostatic discharge
- Exposed to intense ultraviolet light
- Exposed to nearby magnetic or electromagnetic fields

Low X-Ray exposure, i.e. that experienced while passing through a security screen, should not harm the card data. High X-Ray exposure, i.e. that experienced in a medical or dental environment may damage the card data. PC cards should not be kept in a shirt pocket contained a pocket screwdriver with a magnetic end.

PC cards should be kept in a hard plastic jewel case when not in use. Replacement cases P/N 58-50109-00 are available from Carrier Transicold's Performance Parts Group.

2.6 OPTIONS

2.6.1 Light Bar

The Light Bar is an external set of indicator lights that can be seen in the mirror from the cab of a truck or on the front of a rail car. They are controlled by the microprocessor.

a. Eight-Light Light Bar

These lights correspond to the microprocessor LEDs - HEAT, COOL, DEFROST, START-STOP, and ALARM. The ENGINE-AUTO-START light is only illuminated when the unit is operating in Start-Stop. The OUT-OF-RANGE light is illuminated when the Out-of-Range Alarm is active.

b. Two-Light Light Bar

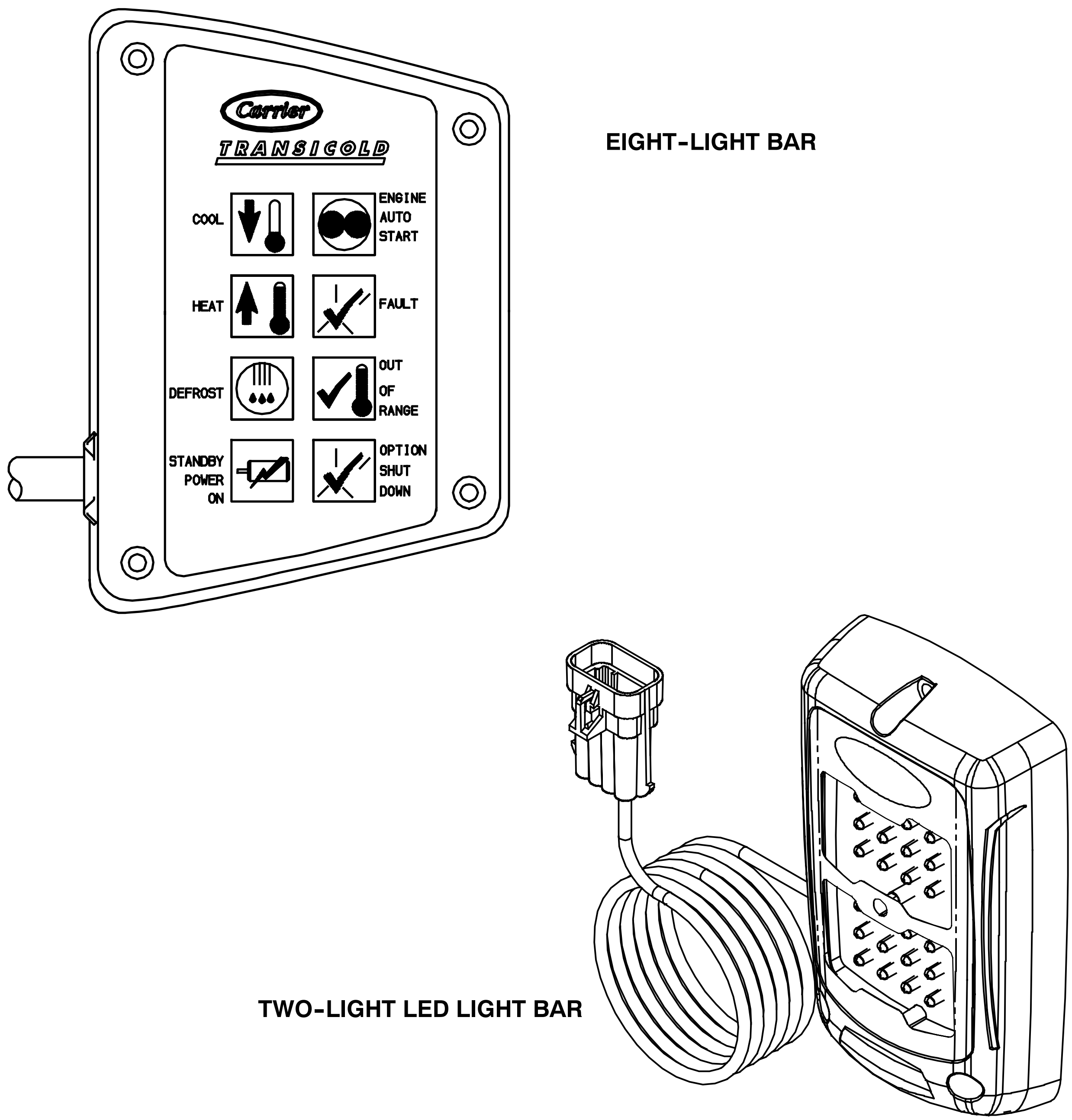
The green LED indicates "STATUS OK". The amber LED indicates "CHECK UNIT". Amber follows the microprocessor fault light and alarms can be read on the microprocessor display.

2.6.2 Door and Remote Switches

A unit has provisions to connect a Door Switch (DS) and/or two remote switches (REMS1 and 2) directly to the microprocessor.

The microprocessor will recognize switches with contacts that are either open when the door is open, or that are closed when the door is open. Additionally, the Configuration List gives you the ability to determine whether the switch will: enable the alarm only, enable the alarm and also shut the unit down, enable the alarm and put the unit into low speed while the door is open, or to have no alarm and only record door openings and closings in the Data Recorder.

If the door or remote switch is configured to shut the unit down when the door is open, the unit will shut down for a minimum of three minutes. Additionally, there is an Override Door/Remote Switch in the Functional Parameters (Refer to Functional Parameter List, Section 3.16.) When this parameter is set to YES, the Door/Remote Switch Alarm will come on when the door is open. However, the unit will not shut down. This feature is included in the event of a door switch failure.



2.6.3 Out of Range Alarm

The Out Of Range Alarm is intended to notify the driver when the refrigerated compartment temperature has moved away from set point or when the unit is operating at low cooling capacity, and the compartment temperature is not pulling down toward set point. The Out Of Range Alarm may be configured as an Alarm Only, or as an Alarm and Unit Shutdown. (Refer to Section 6.2 Configuration Mode).

If the unit shuts down due to a shutdown alarm, the Out Of Range Alarm will come on when the refrigerated compartment temperature has been out of range for 30 to 45 minutes regardless if the refrigerated compartment temperature was ever within set point range or not.

Generally, when the unit is running, the refrigerated compartment temperature must have first been In Range before the Out of Range Alarm can be triggered. In Range is defined as the temperature of the refrigerated compartment having been within ± 2.7°F (1.5°C) of set point in the Perishable Range, or within + 2.7°F (1.5°C) of set point in the Frozen Range.

The point at which the actual Out of Range Alarm comes on is determined by the Out of Range Functional Parameter setting. Selections of 4°F (2°C), 5.5°F (3°C), 7°F (4°C), and OFF are available. The OFF setting disables the Out of Range Alarm. All other settings allow the user to determine how far away from set point the refrigerated compartment temperature will move before turning on the Alarm. The alarm will be activated after 30 minutes if the unit is still more than the number of degrees selected in the Functional Parameter list away from set point if the alarm is configured for Alarm Only. The alarm will be activated and the unit will shutdown after 45 minutes if the alarm is configured for Alarm and Shutdown.

In Sleep Mode, Pretrip, Component Test Mode, or if the unit has a Door Switch or Remote Switch configured as a Door Switch, and the door has been opened, the Out of Range Alarm is disabled and will not come on. After exiting any of these modes, or closing the refrigerated compartment door, the refrigerated compartment temperature must again come In Range of the set point before the Out of Range Alarm can be activated.

The internal timer is inactive in Defrost or in a Start-Stop Off Cycle. Once the unit leaves these modes, and goes into a temperature control mode (HEAT, COOL, or PULSED NULL), the Out of Range internal timer not start until the temperature is out of range of set point. Once the compartment temperature is out of range, the timer will start, allowing the unit time to bring the refrigerated compartment temperature into range before the Out of Range Alarm can be activated.

If the unit is not heating or cooling correctly, the Out of Range alarm may come on when:

- The unit is in cool and in pulldown mode (RAT is still far away from set point) and if the Delta-T (SAT minus RAT) is not at least -1.0°F (0.56°C) for 30 minutes OR
- The unit is in pullup mode (RAT is still far away from set point) and the unit is operating in heat and the SAT is the same temperature or colder than RAT.

2.7 ENGINE DATA

Table 2-4. Engine Data

Engine Model	CT4-134DI (V2203-DI-E2B)
	V2203-DI-ESC
Displacement	134 in^3 (2.2 liters)
No. Cylinders	4
Weight	417.8 lbs (189.5 kg)
Coolant Capacity	2 gallons (7.6 liters) (50/50 mix – never to exceed 60/40)
Oil Capacity with Filter	15 quarts (14 liters)
Fuel	Winter: Diesel No. 1 Summer: Diesel No. 2
Glow Plug Amperage	7.0 amps per plug at 10.5 VDC (nominal)

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 60% concentration of anti-freeze. Use a low silicate anti-freeze meeting GM specifications GM 6038M for standard life coolant or use Texaco Havoline extended life coolant or any other extended life coolant which is Dexcool approved and has 5/150 (5 years/150,000 miles) on the label.

CAUTION

When changing oil filters, the new filters should be primed (partially filled) with clean oil if possible. If the filters are not primed, the engine may operate for a period with no oil supplied to the bearings.

2.7.1 Lubrication System

a.Oil Pressure

40 to 60 PSIG (2.7 To 4.1 Bars)

(Engine in high speed)

b.Oil Pressure Safety Switch Setting Closes

15 (± 3) PSIG [1.02(±.2) Bars]

c.Lube Oil Viscosity:

Outdoor Temperature		SAE
Fahrenheit	Centigrade	
Below 32°	Below 0°	10W30 or Mobil Delvac 1 (5W 40)
Above 32°	Above 0°	10W 30 or Mobil Delvac 1 (5W 40or 15W40)

Extended Service Interval (ESI) packages are standard on X units beginning with S/N JAB90602792. The ESI package reduces the frequency of scheduled service intervals. Refer to Section 9.1 for instructions on service intervals.

2.8 ENGINE SCREW THREADS

All threads used on the diesel engine are metric.

2.9 ENGINE AIR SYSTEM

The air cleaner is installed on the engine to prolong its life and performance by preventing dirt and grit from getting into the engine causing excessive wear on all operating parts. It is the responsibility of the operator to give the air cleaner equipment regular and constant attention in accordance with the instructions. (Refer to section 9.8.8)

Clean air is supplied to the engine through the air cleaner. The air is necessary for complete combustion and scavenging of the exhaust gases. As the engine piston goes through the intake stroke, the piston draws clean fresh air down into the cylinder for the compression and power strokes. As the engine goes through its exhaust stroke, the upward movement of the piston forces the hot exhaust gases out of the cylinders through the exhaust valves and the exhaust manifold. If the air filter is allowed to become dirty, the operation of the engine would be impaired.

2.10 COMPRESSOR DATA

Table 2-5. Compressor Data

Compressor Model	05G
No. Cylinders	6
No. Unloaders	2
Weight	137 lbs (62 kg)
Oil Charge	5.5 pints (2.8 L)
Approved OIl	Mobil Arctic EAL 68

2.11 REFRIGERATION SYSTEM DATA

Table 2-6. Refrigeration System Data

Gearbox Oil	Mobil SHC 75-90W: 15oz (0.43 kg)
Fanshaft Oil	Mobil SHC 630: 3.2oz (0.09 kg)

a. Compressor Discharge Pressure Transducer (CDP)

Range: 0 to 500 psig (0 to 34 bar)

b. Compressor Suction Pressure Transducer (CSP)

Range: -29.93 inHg/-14.7 psig to 100 psig (1 to 6.9 bar)

c. Defrost Air Switch (DAS)

Initiates Defrost:

1.40 ± .07 inch (35 ± 1.8 mm) WG

d. Defrost Timer (microprocessor controlled)

1.5h, 3h, 6h, or 12 hours

e. Defrost Termination Thermistor (DTT)

Allows defrost initiation at temperatures below 40°F (4.4°°C)

Terminates defrost cycle at 55° (12.8°C)

f. Receiver Fusible Plug Setting

430°F (221°C) Melting Point

g. High Pressure Switch (HPS)

Opens on a pressure rise at:
465 ± 10 psig (34 ± 0.7 bar)

Closes on a pressure fall at:
350 ± 10 psig (24 ± 0.7 bar)

h. Unit Dry Weight: (Approximate) 1600 lb. (725 kg)

i. Expansion Valve MOP

Ultima and X2 2500 - 105 PSIG (7.1 Bars)

Ultra and X2 2100 - 55 PSIG (3.7 Bars)

j. Expansion Valve Superheat Setting

8 to 10°F (4.4 to 5.6°C) at 0°F (-17.8°C) refrigerated compartment temperature

2.12 SAFETY DEVICES

System components are protected from damage caused by unsafe operating conditions by automatic shut-down of the unit when such conditions occur. This is accomplished by the safety devices listed in Table 2-7.

Table 2-7. Safety Devices

Unit Shutdown Safety Devices		
Unsafe Conditions	**Safety Device**	**Device Setting**
High engine cooling water temperature	Engine coolant temp. (ENCT) (microprocessor reset)	Refer to section 2.7
Excessive current draw by microprocessor	Fuse (F1)	Opens at 7 1/2 amps
Excessive current draw by speed relay	Fuse (F2)	Opens at 10 amps
Excessive current draw by run relay	Fuse (F3)	Opens at 7 1/2 amps
Excessive current draw by clutch relay	Fuse (F4)	Opens at 7 1/2 amps
Excessive current draw by glow plug circuit, control circuit or starter solenoid (SS)	Fuse (F5)	Opens at 80 amps
Excessive current draw by all solenoid valves and unloaders and light bar	Fuse (F6)	Opens at 15 amps
Excessive current draw by glow/crank switch and START/RUN-OFF switch (Glow/ Crank switch removed in units built after April 2007)	Fuse (F7)	Opens at 5 amps
Excessive current draw by fuel heater	Fuse (F8) – Optional	Opens at 20 amps
Excessive current draw by light bar	Fuse (F9)	Opens at 3 amps
Excessive current draw by Fresh Air Relay	Fuse (F10) – Optional	Opens at 40 amps
Excessive compressor discharge pressure	High pressure cutout switch (HPS) automatic reset	Refer to section 2.3.8
Other Safety Devices		
Unsafe Conditions	**Safety Device**	**Device Setting**
Low Engine Oil Level (May be configured for alarm only or alarm and shutdown)	Low Engine Oil Level Switch (ENOLS)	Engine oil level is more than 7 quarts low.
Low Fuel Level (May be configured for alarm only or alarm and shutdown)	Low Fuel Level Switch, or Low Fuel Level Sensor	See Trigger On criteria for alarms 1 and 19 in Section 8

2.13 COMPONENT RESISTANCE AND CURRENT DRAW

Table 2-8. Component Resistance and Current Draw

Component	Ohms	Amps
SV1	7.8 ± 0.3 Ohms	0.10 to 2.0 Amps
SV2 and 4	10.6 ± 0.3 Ohms	0.75 to 2.0 Amps
AFAS (Auto Fresh Air Solenoid)	Pull in - 0.36 Ohms ± 10% Hold - 14.4 Ohms ± 10%	Pull in - 29 Amps Hold - 0.83 Amps
Unloader	10.6 ± 0.3 Ohms	1.0 to 2.0 Amps
Clutch	2.5 ± 0.2 Ohms	3.0 to 5.0 Amps
Speed solenoid (Units without ESC)	1.5 to 2.5 Ohms	3.0 - 8.0 Amps
Fuel solenoid Red-Black wires:	11.1 Ohms to 13.4 Ohms	0.25 to 2.0 Amps
White-Black wires: Can not be accurately measured with Coil Commander in circuit.		30.0 to 40.0 Amps
Engine Speed Sensor (Units with ESC)		22 mAmps Max
12VDC Relay (GPR, SSR, FHR)	72 Ohms ±10%	0.14 - 0.18 Amps
12VDC Relay (RCR)	80 Ohms ±15%	0.12 - 0.17 Amps
Indicator lights (8 Light Bar Only)	4.8 ± 0.2 Ohms	NA
Unit non-running amps (See Note 2 in Section 8.2)		6 - 9 Amps
Glow Plug Amps Each Plug		6 - 9 Amps
Glow Plug Total Circuit		24 - 36 Amps
Starter Amps	NA	270 - 380 amps
Compressor Suction Modulation Valve	Resistance	72 to 84 ohms per winding
		92 ohms (± 10 %) for any two windings.

2.14 REFRIGERANT CIRCUIT DURING COOLING (See Figure 2-16)

When cooling, the unit operates as a vapor compression refrigeration system. The main components of the system are: the (1) reciprocating compressor, (2) air-cooled condenser, (3) expansion valve, and (4) direct expansion evaporator.

The compressor raises the pressure and the temperature of the refrigerant and forces it through the discharge check valve and 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 refrigerant gas to the air. This removal of heat causes the refrigerant to liquify. Liquid refrigerant leaves the condenser and flows through the solenoid valve SV1 (normally open) and 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 fusible plug, which melts if the refrigerant temperature is abnormally high and releases the refrigerant charge.

The refrigerant leaves the receiver and flows through the manual liquid line service valve (King 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 refrigerant then flows through a filter-drier where an absorbent keeps the refrigerant clean and dry; and the electrically controlled liquid line solenoid valve, SV2 (normally closed), which starts or stops the flow of liquid refrigerant.

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

The liquid then flows to an externally equalized thermostatic expansion valve, which reduces the pressure of the liquid and meters the flow of liquid refrigerant to the evaporator to obtain maximum use of the evaporator heat transfer surface.

The refrigerant pressure drop caused by the expansion valve is accompanied by a drop in temperature so the low pressure, low temperature fluid that flows into the evaporator tubes is colder than the air that is circulated over the evaporator tubes by the evaporator fan. 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 refrigerant causes the liquid to vaporize.

This low temperature, low pressure vapor passes through the “suction line/liquid line” heat exchanger where it absorbs more heat from the high pressure/high temperature liquid and then returns to the compressor through the Suction Modulation Valve (CSMV). The CSMV controls the compressor suction pressure thereby matching the compressor capacity to the load.

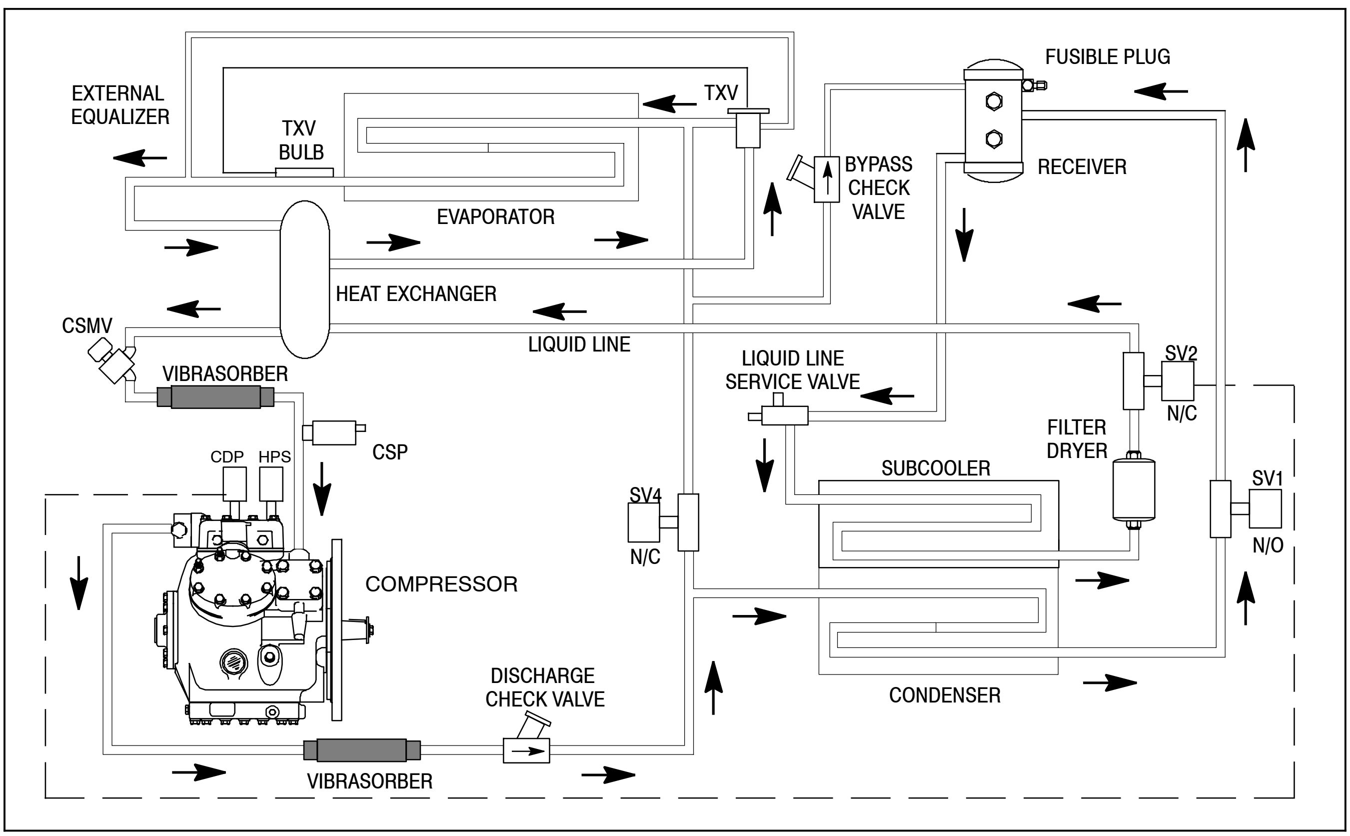


Figure 2-16. Refrigerant Circuit During Cooling

2.15 REFRIGERANT CIRCUIT – HEATING AND DEFROSTING (See Figure 2-17)

When vapor refrigerant is compressed to a high pressure and temperature in a reciprocating compressor, the mechanical energy necessary to operate the compressor is transferred to the gas as it is being compressed. This energy is referred to as the "heat of compression" and is used as the source of heat during the heating cycle.

When the microprocessor calls for heating, the hot gas solenoid valve (SV4) opens and the condenser pressure control solenoid valve (SV1) closes. The condenser coil then fills with refrigerant, and hot gas from the compressor enters the evaporator. Also the liquid line solenoid valve (SV2) will remain energized (valve open) until the compressor discharge pressure increases to a predetermined setting in the microprocessor.

The microprocessor de-energizes the liquid line solenoid valve (SV2) and the valve closes to stop the flow of refrigerant to the expansion valve.

When additional heating capacity is required the microprocessor opens the Liquid Line Solenoid valve (SV2) to allow additional refrigerant to be metered into the hot gas cycle (through the expansion valve).

When in engine operation and the discharge pressure exceeds pressure settings detailed in Section 2.11, the pressure cutout switch (HPS) opens to de-energize the run relay coil (RR). When the RR coil is de-energized, the RR contacts open stopping the engine.

The function of the hot gas bypass line is to raise the receiver pressure when the ambient temperature is low (below -17.8°C/ 0°F) so that refrigerant flows from the receiver to the evaporator when needed.

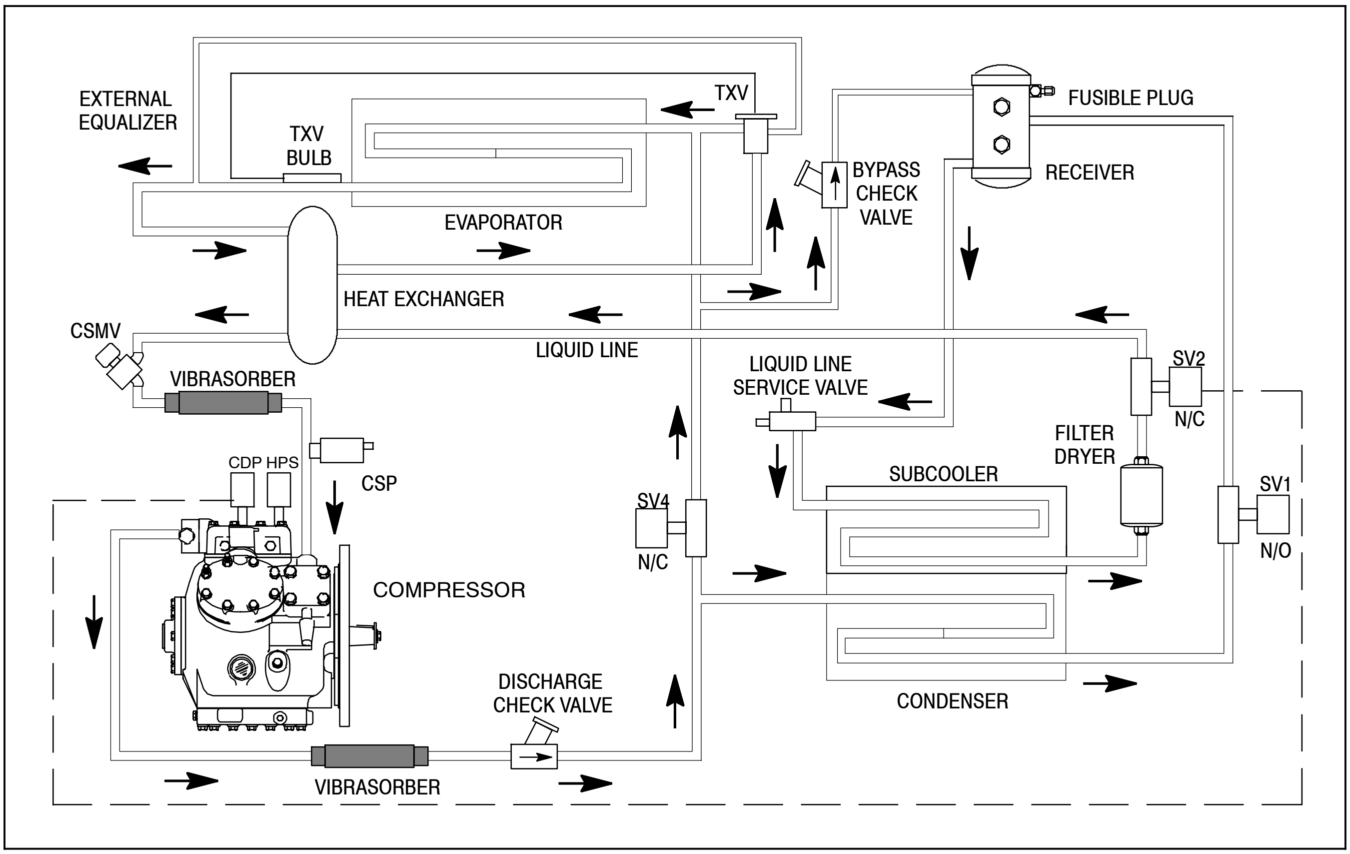


Figure 2-17. Refrigerant Circuit During Heating And Defrost

SECTION 3

OPERATION

PARAGRAPH NUMBER **Page**

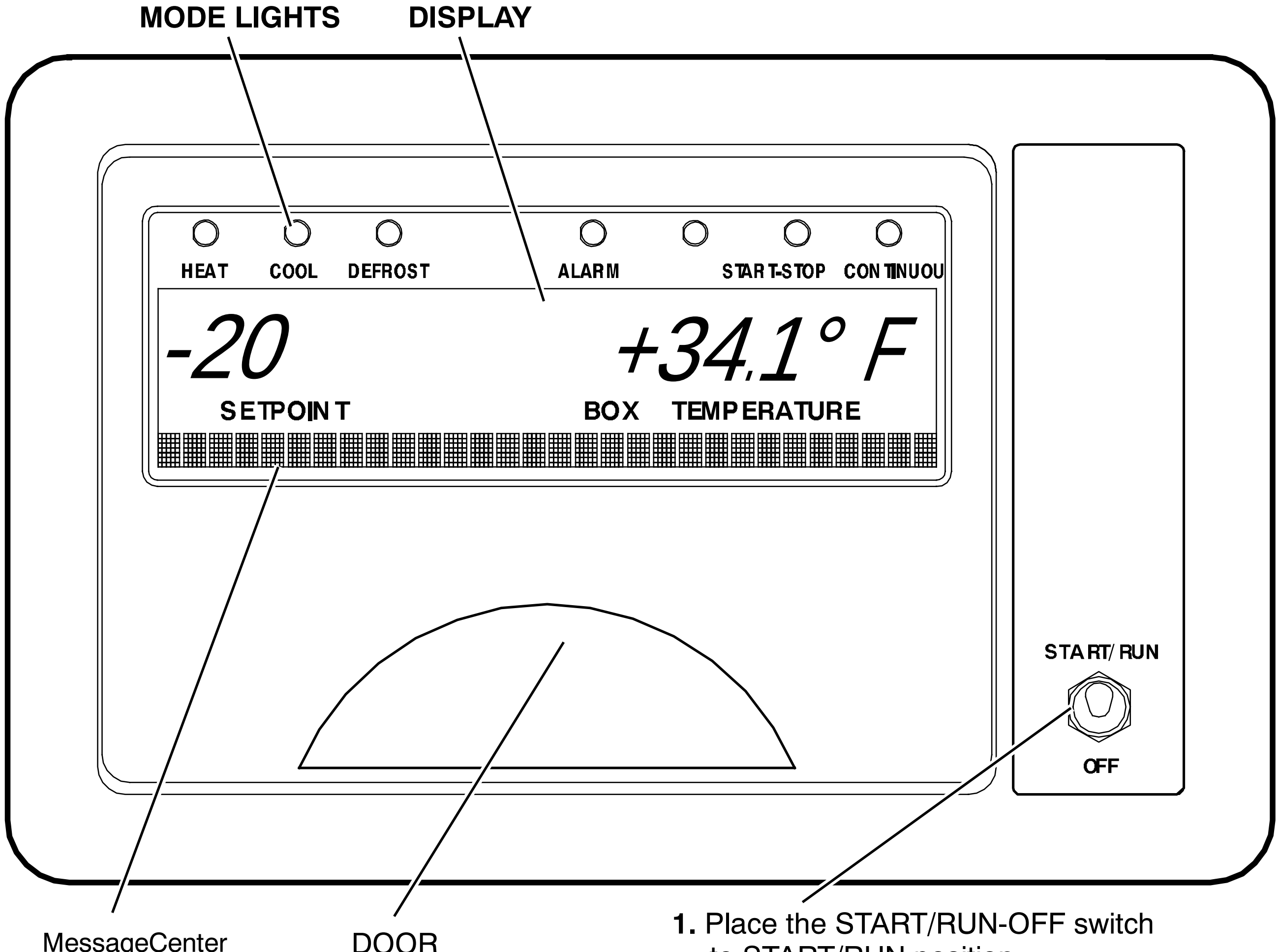
SECTION 3

OPERATION

3.1 STARTING UNIT – AUTO

WARNING

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

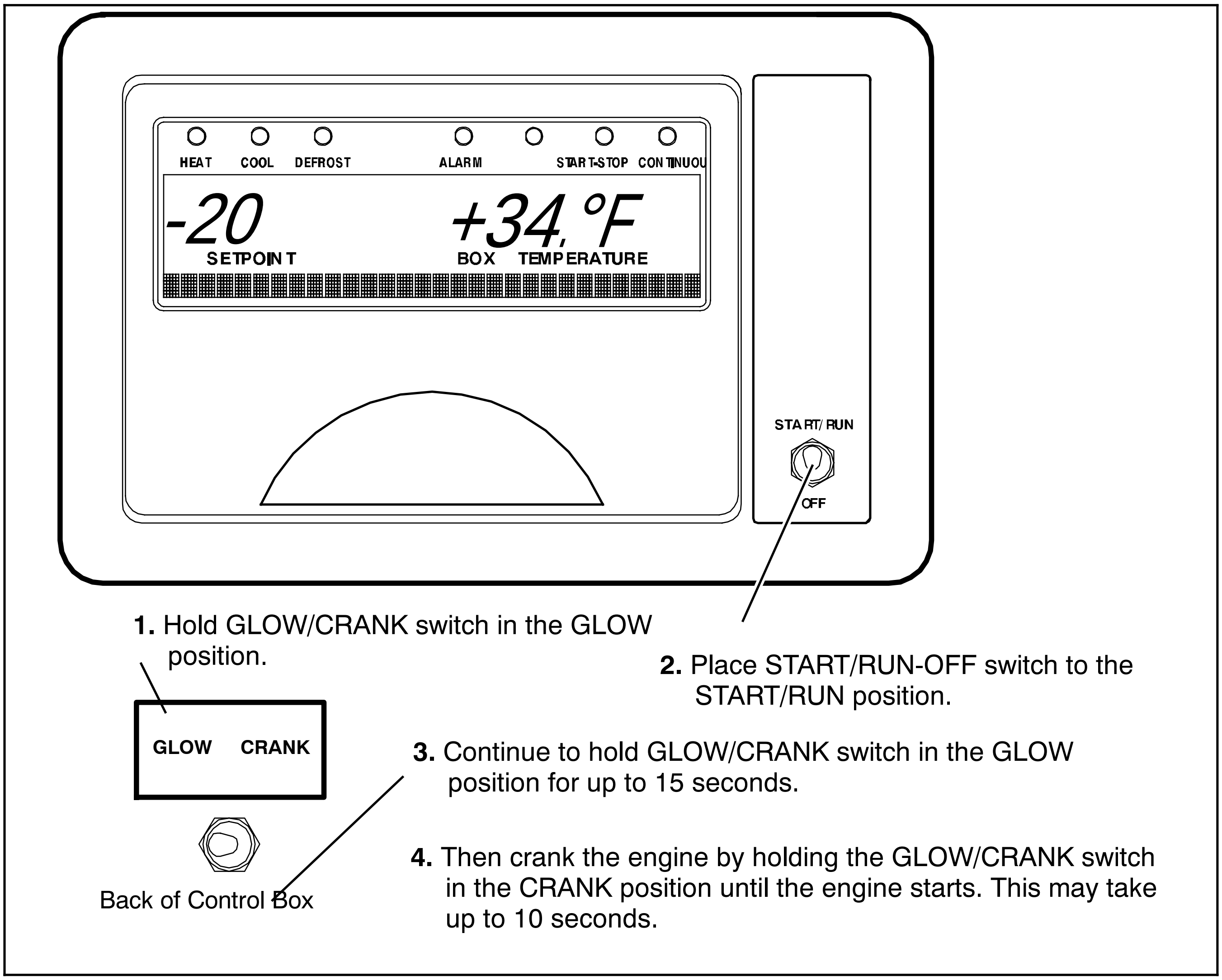


1. Place the START/RUN-OFF switch to START/RUN position.

3.2 MANUAL START – GLOW AND CRANK – IF EQUIPPED*

⚠ WARNING

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



***NOTE**

The GLOW/CRANK switch was removed from units built after April 2007.

When the micro powers up, "MANUAL START MODE SELECTED" will appear in the MessageCenter and the Alarm LED will blink for five seconds.

If the GLOW/CRANK switch is held in the GLOW position before the START/RUN-OFF switch is placed in the START/RUN position, when the START/RUN-OFF switch is in the START/RUN position, the unit Start mode is changed to MANUAL START, and the unit operation mode is set to CONTINUOUS RUN. When the engine is running, this switch is disabled.

The GLOW/CRANK switch, when held in the GLOW position, tells the microprocessor to energize the glow plug relay, which powers the glow plugs in the engine to preheat the combustion chamber. The CRANK position of the switch tells the microprocessor to engage the engine starter. If the switch is held in the CRANK position, the starter will engage after a short delay of up to one second, for a maximum 10 seconds.

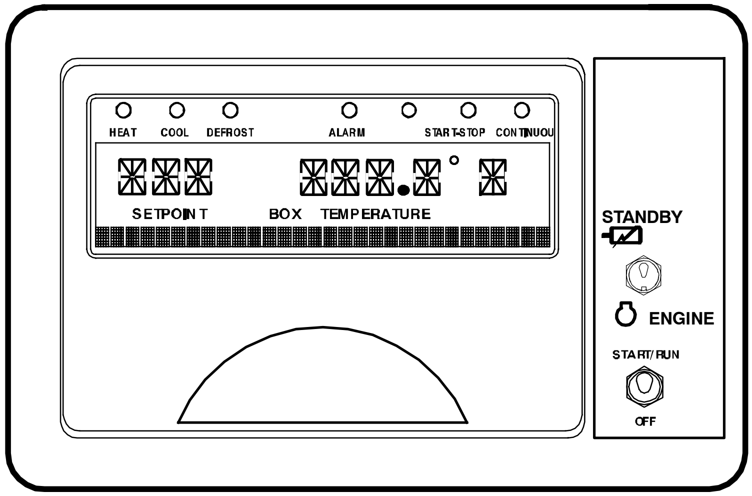
NOTE

Manual Start will automatically put the unit in Continuous Run mode. Placing the unit in Start-Stop will automatically put it back into Auto Start operation.

Manual Start mode will automatically be cancelled when the START/RUN-OFF switch is toggled to OFF and then back to START/RUN.

Refer to Section 4.2.2 for glow times.

3.3 UNIT STARTUP - SELF TEST



SELF TEST

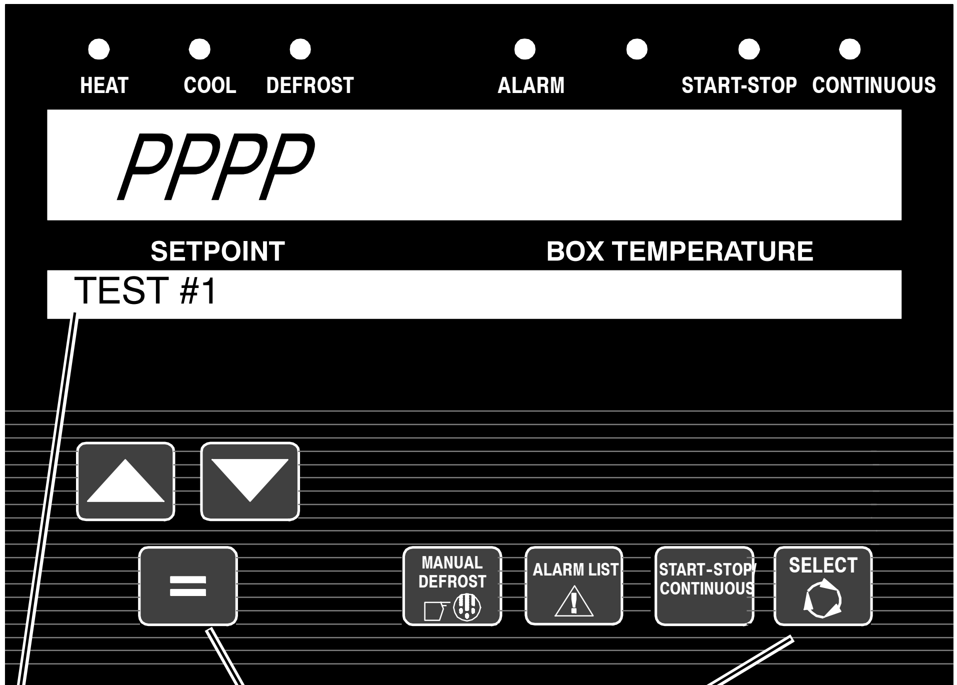
When first powered up:

- The microprocessor will run a self test.
- All of the mode lights will light
- All of the segments on the display will turn on
- All of the Liquid Crystal diodes (LCDs) in the MessageCenter will turn on to verify their operation
- The display will then show the set point temperature in the left four characters and the refrigerated compartment temperature in the right four characters. The last character (after the degree symbol) shows the temperature units as “C” Centigrade or “F” Fahrenheit. When set for °F, there is a decimal in the compartment Temperature. When set for °C, there is a comma in the compartment Temperature.
- The MessageCenter will display the default message, unless there is an alarm(s) stored in the microprocessor. If there is an alarm(s) stored in the microprocessor,
“INACTIVE ALARMS IN MEMORY” will be displayed on the MessageCenter and the Alarm LED will flash for 5 seconds, then turn off.
“CHECK AT NEXT SERVICE INTERVAL” will then be displayed if there are any active non-shutdown alarms present. Any hourmeters that are configured ON will also be displayed.
- The MessageCenter will show “STATUS OK” as the microprocessor begins to position the CSMV to unit starting positions.
- In engine operation, after the refrigeration valves open the intake air heater will energize (as required), the buzzer will sound, and the diesel engine will start.
- The suction modulation valve (CSMV) will go through a procedure to close itself. The microprocessor starts out giving the CSMV the command to close completely. The display will show
“SMV CLOSING: WAIT XX SECONDS” where xx is the number of seconds until the valve is fully closed. The CSMV will then open to a predetermined position according to the ambient and compartment temperatures. The display will show “SETTING SMV XX%.” The start sequence will start at 30%.
- After the CSMV reaches 30%, the glow plugs will energize (as required), the buzzer will sound, and the diesel engine will start.

NOTE

Placing the unit in either Continuous Run or-Start-Stop will automatically put the unit into Auto Start operation.

3.4 PRETRIP



1. Press the SELECT key until the MessageCenter displays “PRESS THE = KEY TO START PRETRIP.”
2. Press the = key to start PRETRIP.
3. Verify that during TEST#1 the complete display is turned on, that the buzzer comes on and that all lights on the Light Bar come on.
4. The remainder of Pretrip will take 7 to 15 minutes, and will run itself automatically.

The PRETRIP mode is for checking unit operation and evaluating operation of all modes. It will indicate a failure when one is detected.

TIP

A Pretrip can be started when the refrigerated compartment is at any temperature.

The MessageCenter displays the current test and the % complete of the test. When the Pretrip tests are complete the MessageCenter will display one of three different messages:

- “PRETRIP PASS” OR
- “PRETRIP FAIL IN TEST X” OR
- “PRETRIP FAILED & COMPLETE”. Alarm light will be on.

Press the ALARM LIST key to review the alarms triggered by the Pretrip tests.

TIP

The Pretrip test “PASS” results message will stay displayed until a key is pressed, or until the Start/Run-Off switch is placed in the OFF position.

The Pretrip test “FAIL” results message will stay displayed until the alarms are cleared

Once Pretrip is started, the control panel keys are disabled until Pretrip is completed.

TIP

If “CAN NOT START PRETRIP” is displayed in the MessageCenter, check to see if the unit is in PC mode, Defrost (Refer to Section 6.1) or check the alarm list (Section 3.12) for active shutdown alarms.

NOTES

NOTE 1: Pretrip may be initiated any time the unit is running, or when the unit is off but the START/RUN-OFF switch is in the START/RUN position. Pretrip will not start if there is an active shutdown alarm, or if the unit is in PC mode or in defrost.

NOTE 2: Pretrip will run until completed, unless an alarm occurs that causes Pretrip to be aborted. Only alarms that will result in other erroneous alarms or will affect future Pretrip tests will allow Pretrip to be aborted.

TIP

Pretrip may be stopped by the user by either turning the unit off then back on again, or by pressing and holding the = key for five seconds. “PRETRIP STOPPED BY USER” will appear in the MessageCenter.

Once Pretrip is started: If the unit is running, the microprocessor will shut the unit down.

If the unit is not running and the suction modulation valve (CSMV) has reached its fully closed position, Pretrip will begin.

NOTE

Before completing PreTrip, the microprocessor looks at the status of alarms and if certain alarms are active (for example: Low Fuel Warning, Check Engine Oil Level, Check Coolant Level, Check Coolant Temperature, PreTrip will show “FAILED”, indicating that the unit is not ready to be sent out for a load, but that the alarm list should be checked and all present alarm situations corrected.

TIP

It is always a good idea to clear all alarms from both Alarm Lists before starting Pretrip. The technician will then know that any alarms present following Pretrip occurred during Pretrip, and are not old alarms that had not been cleared.

NOTE

The operator MUST be present and validate this test by watching the microprocessor display during Test 1 - Display Test. The microprocessor will turn on all segments of the LCD and LED display.

Test 1 - Display And Sound Test

The microprocessor activates the LCD/LED display, and all lights on the Light Bar. This test will last five seconds. All segments of the display, all LEDs on the microprocessor, all lights of the Light Bar, and the buzzer will be on during this test. This is the only portion of the Pretrip check that requires the operator to determine PASS or FAIL. A defective display and sound test is indicated if: any LCD/LED segments are not visible, any LEDs or lights do not come on, or the buzzer does not sound. Anything that fails during this test should be repaired at the conclusion of the Pretrip cycle. Pretrip will continue regardless of the outcome of this test. A faulty display, light bar or buzzer will not affect the operation of the unit, but will affect what is displayed during unit operation.

Test 2 - Amperage Check of Electrical Components

Check the amperage (current) draw of the following components:

- Battery DC Current (All Components Turned Off)
- Auto Fresh Air Solenoid
- Auto Fresh Air Solenoid
- Evap/Cond Fan Clutch
- UL1 Front Unloader
- UL2 Rear Unloader
- Speed Solenoid (or ESC module)
- SV1
- SV2
- SV4
- Glow Plugs
- Fuel Solenoid (or ESC module)

Most components will be energized for four seconds at which time the amperage reading is taken. There is a two second rest period between each component. The glow plugs will be energized for 15 seconds, at which time the amperage reading is taken. Test 2 will last approximately two minutes. If a problem is detected with any of the listed components, the corresponding alarm will be displayed.

Test 3 - Temperature and Pressure Sensor Check

Check the condition of the following sensors:

- Return Air Sensor
- Supply Air Sensor
- Engine Coolant Sensor
- Battery Voltage Sensor
- Ambient Air Sensor
- Defrost Termination Sensor
- Compressor Discharge Sensor

Test 3 will last approximately five seconds. If a problem is detected with any of the listed components, the corresponding alarm will be displayed.

Test 4 – Warm Up

The engine is started automatically and the ambient air sensor is read.

The Pretrip splits into two modes at this point as the engine and compressor are allowed to run and be warmed up. If the ambient temperature is above +32°F (0°C), the unit will operate in the “Cool Pretrip” mode. If the ambient temperature is at or below +32°F (0°C), the unit will operate in the “Heat Pretrip” mode.

In the *Cool Pretrip* mode, the unit will operate in two cylinder Low Speed Cool. The compressor suction and discharge pressures will be tested. Appropriate alarms will be displayed if any problem is detected. Test 4 in Cool Pretrip will last approximately 60 seconds.

In the *Heat Pretrip* mode, the unit will operate in four cylinder Low Speed Heat. The micro will check for a rise in compressor discharge pressure, fan clutch operation, and SV1 operation. Appropriate alarms will be displayed if any problem is detected. Test 4 in Heat Pretrip may last up to 12 minutes depending on ambient and compartment temperatures and unit condition. For very low compartment temperature, the unit may operate in six cylinder low speed heat.

Test 5 – UL2 (Rear) Unloader

With the unit still running the same as it was in Test 4, the operation of UL2 Unloader is tested. If suction and discharge pressures do not change when UL2 is energized and de-energized, the “CHECK UL2” alarm will be displayed. Test 5 will last about 20 seconds.

Test 6 – UL1 (Front) Unloader

With the unit still running the same as it was in Test 5, the operation of UL1 is tested. If suction and discharge pressures do not change when UL1, the “CHECK UL1” alarm will be displayed. Test 6 will last about 20 seconds.

Test 7, 8, and 9 – Engine High and Low Speeds

The engine will go from Low Speed to High Speed, then back to Low Speed during these tests. Engine RPM will be checked. If the engine is not operating within the operating range, either the “CHECK LOW SPEED RPM,” or “CHECK HIGH SPEED RPM” alarm will be displayed. Tests 7, 8, and 9 will last about 30 seconds.

Test 10 – Check Suction Modulation Valve (CSMV)

This test ensures that the CSMV is opening and closing properly. If suction pressure doesn’t change as expected with CSMV closed then “CHECK SUCTION MOD VALVE” alarm will be displayed. This test may take several minutes.

Test 11 – SV1 (Cool Pretrip Only)

With the unit running in two cylinder Low Speed Cool, the operation of SV1 will be tested for opening and closing. If the valve does not operate correctly, the “CHECK SV1 VALVE” alarm will be displayed. This test may last up to three minutes.

Test 12 – Check SV4

NOTE

The Cool and Heat Pretrip modes will merge together at this step.

With the unit running in two cylinder, Low Speed Heat, SV4 is tested for opening and closing. If the valve does not operate correctly, the “CHECK SV4” VALVE alarm will be displayed. This test may last up to eight minutes.

Test 13 – Low Side Pump Down

With the unit running in two cylinder Low Speed, SV2 and SV4 will all be closed to pump the low side of the unit down. If a problem is detected, the alarm “CANNOT PUMP DOWN LOW SIDE” will be displayed. Test 13 may last up to eight minutes.

Test 14 – High to Low Side Leakage

The unit will shut down, and check for pressure equalization between the high and low sides. If any leakage is detected, the HIGH SIDE LEAK alarm will be displayed. This test will last one minute.

Test 15 – Check Discharge Check Valve

With the unit off, the discharge check valve is checked for leakage. If any leakage is detected, the “CHECK DISCHARGE CHECK VALVE” alarm will be displayed. Test 15 will last 40 seconds.

Test 16 – Check for Other Alarms

The alarm list is checked for any non-pretrip alarms that may have occurred during the Pretrip test. If any operational alarms occurred, Pretrip will show FAIL, and the technician will need to review the Alarm List and take necessary and appropriate action to clear them (see list below). Test 16 will last about five seconds.

Test 16 – Check For Other Alarms That May Be Present:

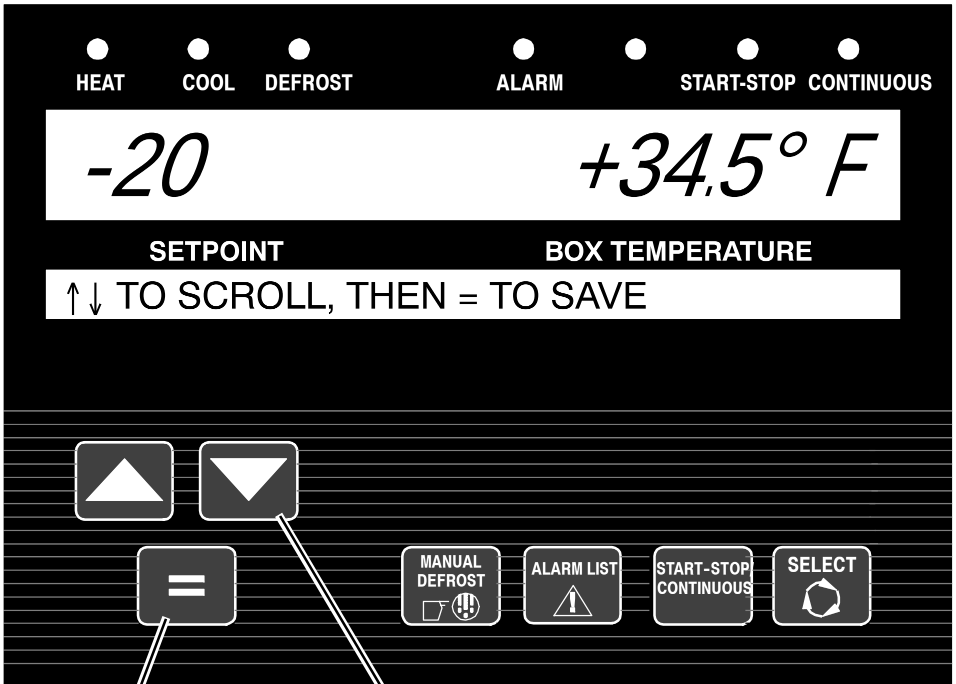
Check for the following alarms:

Alarm No.	Alarm Description
1	LOW FUEL LEVEL WARNING (for units with Low Fuel Level switch/no fuel level display in Data List)
	LOW FUEL LEVEL WARNING (for units with Low Fuel Level 0% to 100% Sensor / fuel level is displayed in Data List)
2	LOW ENGINE OIL LEVEL
3	LOW COOLANT LEVEL
18	LOW REFRIGERANT PRESSURE
27	HIGH SUCTION PRESSURE
28	CHECK REFRIGERATION SYSTEM
34	ENGINE FAILED TO STOP
36	CHECK COOLANT TEMPERATURE
51	ALTERNATOR NOT CHARGING
54	DEFROST NOT COMPLETE
55	CHECK DEFROST AIR SWITCH
59	DATALOGGER NOT RECORDING
60	DATALOGGER TIME WRONG
71	BAD F2 OR F3 FUSE
81	CHECK FHR CIRCUIT
82	CHECK REMOTE OUT-RANGE LIGHT
223 thru 230	If any Maintenance alarms are active, Pretrip will not pass.
232 thru 249	If any Microprocessor alarms are active, Pretrip will not pass.

Pretrip Termination

When the Pretrip cycle is completed, the unit will return to normal temperature control operation.
“PRETRIP PASS” will be shown in the display until the operator presses any key. In the event that the Pretrip test triggered an alarm(s), the display will show either “PRETRIP FAIL and COMPLETE” (if the entire Pretrip cycle was completed), or “PRETRIP FAIL IN TEST——,” (if the Pretrip cycle was aborted by an alarm before it was completed).

3.5 CHANGING SET POINT



1. With the setpoint displayed, press the UP ARROW or DOWN ARROW key to change the setpoint to the desired value. The MessageCenter will show "↑↓ TO SCROLL, THEN = TO SAVE."

2. Press the = key to save the new setpoint.

Set points of -22°F to +89.6°F (-30°C to +32°C) may be entered via the keypad. The microprocessor always retains the last entered set point in memory. Depending on microprocessor set-up, the set point may be changed up or down in either 0.1° (one-tenth of a degree) or 1° (one full degree) increments by pressing and releasing either the UP ARROW or DOWN ARROW key

NOTE

The microprocessor Configurations allow a minimum and maximum setpoint to be entered so that only set points within that range may be selected. "MAX SETPOINT HAS BEEN REACHED" or "MIN SETPOINT HAS BEEN REACHED" will appear in the MessageCenter when either of these conditions are met.

Set point may be changed any time the Start/Stop-Off switch is in the START/RUN position, or when the unit in PC Mode EXCEPT when:

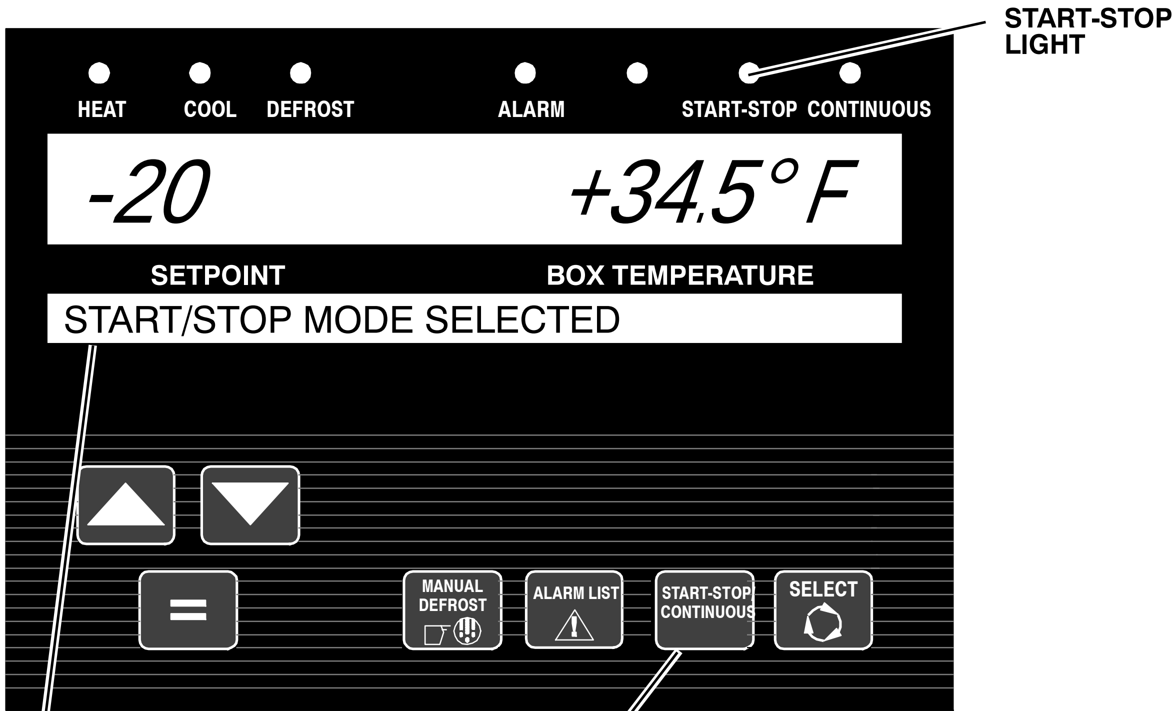
- Viewing the Alarm List, Data List or Functional Parameters OR
- When the unit is in PreTrip OR
- When the unit is in Sleep Mode

Pressing the = key will cause the new displayed set point value to become active and "SETPOINT CHANGED" will be displayed. If the = key is not pressed and there is no keyboard activity for 5 seconds the entire display and Light Bar will flash for 15 seconds and "SETPOINT NOT CHANGED" will be displayed. The microprocessor setting will then revert back to the last entered set point. All other keys are active while the display is flashing and if pushed while the display is flashing, will cause the flashing to stop and perform the requested function.

TIP

The set point may be changed quickly by pressing and holding the UP ARROW or DOWN ARROW key. The longer the key is held, the faster the setting will change.

3.6 START-STOP OPERATION



1. Press the START-STOP/CONTINUOUS key until the START-STOP Light on the controller illuminates.

2. Verify that "START/STOP MODE SELECTED" is displayed on the MessageCenter and that the Start-Stop light is illuminated. The unit is now in Start-Stop operation.

Automatic Start-Stop is provided to permit starting/stopping/restarting of the unit as required. This feature allows full automatic control of the engine or compressor starting and stopping by monitoring refrigerated compartment temperature, battery charging amps, battery voltage and engine coolant temperature (Engine/Road only). The main function of automatic cycling is to turn off the refrigeration system near set point to provide an energy efficient temperature control system and to initiate a restart sequence when certain conditions are met. The Start-Stop / Continuous key is pressed to select between Continuous Run and Start-Stop operating modes. Refer to Section 4.3.1 for more detailed information on Start-Stop Mode.

If the unit fails to start after three start attempts, the "FAILED TO START-AUTO MODE" alarm will be activated. While running, if the unit shuts down on a safety, or fails to run for the minimum run time, three consecutive times, the
"FAILED TO RUN MINIMUM TIME" Alarm will be activated. The shutdown counter is cleared when the unit has run for 15 minutes, or when the unit cycles off normally.

NOTE

FreshProtect is not enabled in Start-Stop mode. See Functional Parameters List – Table 3-3.

3.6.1 Start-Stop Parameters

The selectable Start-Stop parameters in the Functional Parameter list can be applied to Start-Stop operation so that:

- The same settings apply to any set point, or
- The settings can be specified to be different, depending on whether the set point is in the perishable range or in the frozen range.

The decision as to whether the same settings will be used together for all set points or if they will be separated between Perishable and Frozen is made in the Configuration List. (Refer to Section 6.2.)

If **TOGETHER** is selected in the Configuration List, then the following Functional Parameter values will be available for use:

- MINIMUM RUN TIME
- MINIMUM OFF TIME
- OVERRIDE TEMP
- MAXIMUM OFF TIME
- FROZEN SHUTDOWN OFFSET

If **SEPARATE** is selected in the Configuration List, then the following Functional Parameter values will be available for use:

- PERISHABLE MINIMUM RUN TIME
- PERISHABLE MINIMUM OFF TIME
- PERISHABLE OVERRIDE TEMP
- PERISHABLE MAXIMUM OFF TIME
- FROZEN MINIMUM RUN TIME
- FROZEN MINIMUM OFF TIME
- FROZEN OVERRIDE TEMP
- FROZEN MAXIMUM OFF TIME
- FROZEN SHUTDOWN OFFSET

NOTE

In the event that the Configuration is changed from Separate to Together, the values from the Perishable Functional Parameters are the ones that will be used.

3.6.2 Charging Amps

A Configuration for Start-Stop Shutoff exists which allows the microprocessor to monitor battery charging amperage in addition to battery voltage. The battery charging rate (as seen in the Data List) must be below the selected amp setting to allow the unit to cycle off.

The Configuration may be set from 1.0 to 10.0 Amps in 0.5 amp increments. A weak or defective battery may show a suitable voltage charge while the alternator is putting a high charging rate into it, then not be sufficiently charged to restart the engine at the end of a Start-Stop Off Cycle.

The factory setting for this configuration is 6.5 amps. This is a general setting that may need to be adjusted for the operating environment of the unit. Units operated in colder ambient temperatures may want to decrease this setting to force a higher charge in the battery prior to Start-Stop Off Cycle. Units operated in warmer ambient temperatures may use a higher setting.

As a battery ages, it is normal for it to require longer recharging periods. If the running time is gradually increasing in Start-Stop operation due to the battery requiring a longer charging period, this run time may be shortened by raising the amp setting. (This may be seen by reviewing downloaded data and looking at the amp reading during prolonged engine Start-Stop On Cycles.)

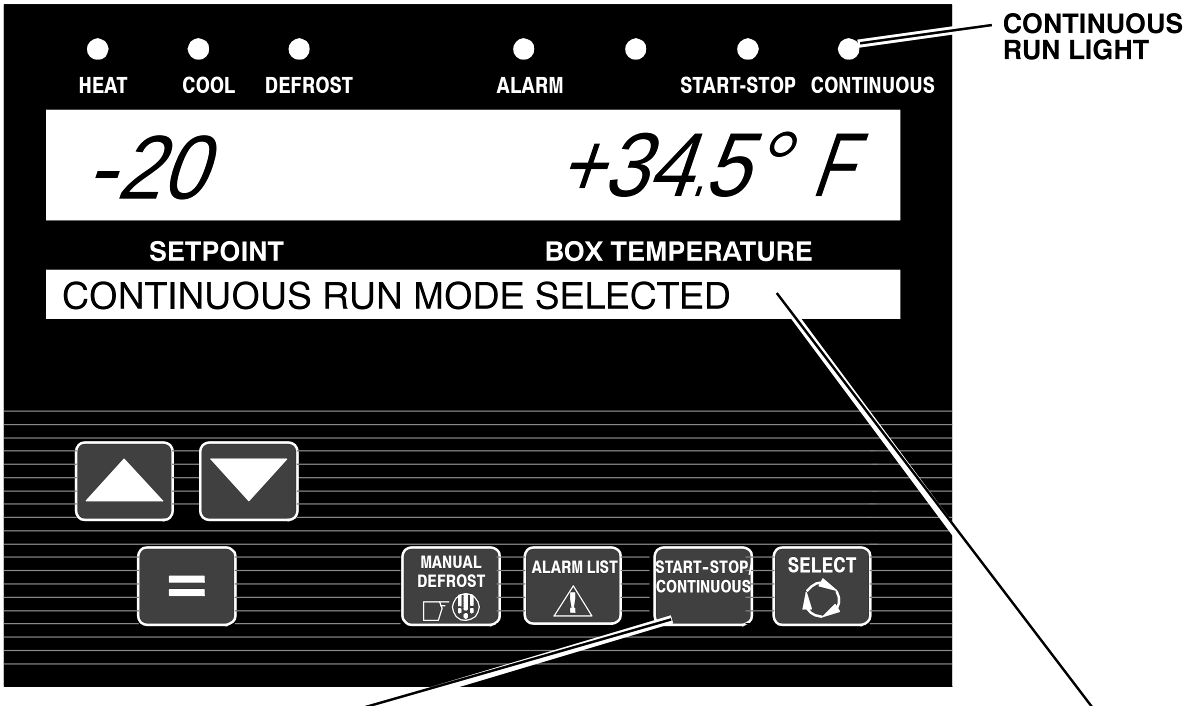
3.6.3 Restart Voltage

A configuration for Start-Stop Restart on Battery Voltage allows the microprocessor to restart the unit when the voltage selection has been reached.

The Configuration may be set from 12.0 to 12.8 Volts in 0.1V increments. The factory setting for this configuration is 12.2V.

A lower voltage selection may result in a longer off cycle (based on battery voltage) and possibly overall shorter battery life. A higher voltage selection may result in a shorter off cycle (based on battery voltage) and possibly overall longer battery life.

3.7 CONTINUOUS RUN OPERATION



1. Press the START-STOP/CONTINUOUS key until the CONTINUOUS RUN Light on the microprocessor illuminates.

2. Verify that "CONTINUOUS RUN MODE SELECTED" is displayed on the MessageCenter and that the CONTINUOUS RUN light is illuminated. The unit is now in Continuous Run operation.

In the Continuous Run mode, the unit will not shut down except for safeties or if the engine stalls. Refer to Section 4.3.2 for more detailed information on Continuous Run operation.

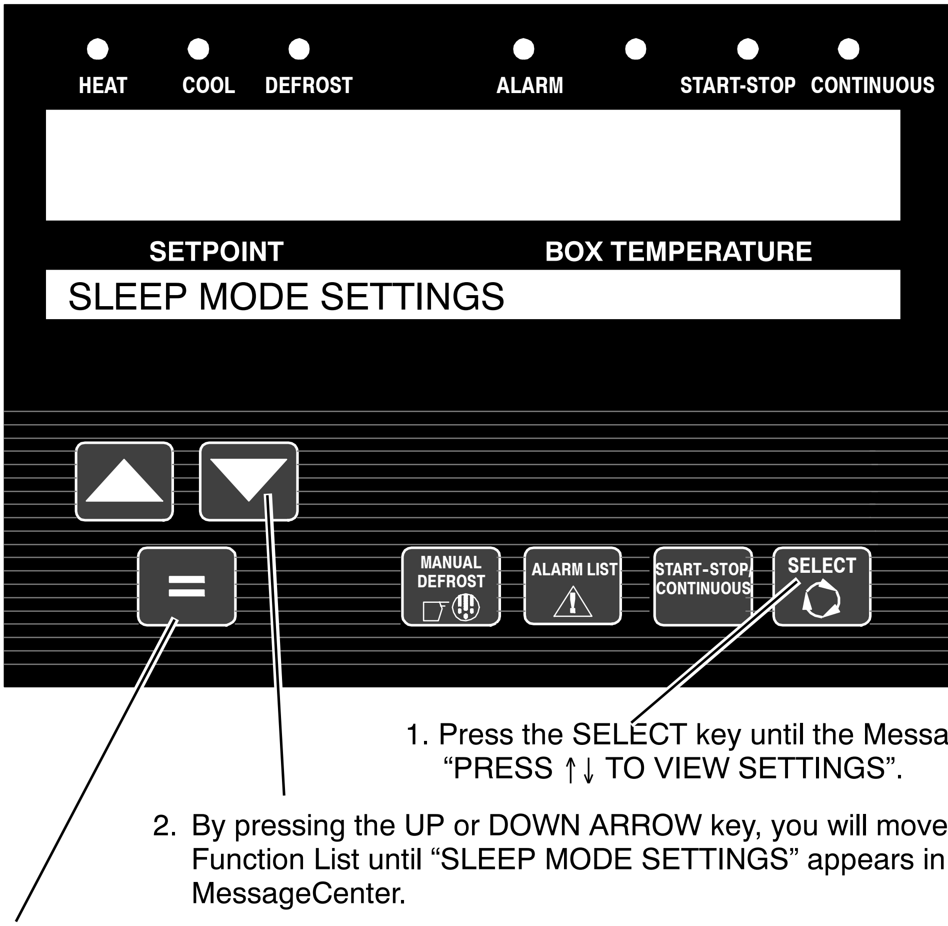
Start-Stop and Continuous operation may be tied to the set point ranges for frozen and perishable loads. The START-STOP/CONTINUOUS key is locked out if "START-STOP LOCKED" appears in the MessageCenter when the key is pressed and the unit is in Start-Stop mode or "CONTINUOUS LOCKED" appears in the MessageCenter when the key is pressed and the unit is in Continuous Run mode. Refer to the configuration table Section 6.2.

If the unit fails to start after three start attempts, Alarm 31 – "FAILED TO START–AUTO MODE" will be activated. While running, if the unit shuts down, an internal counter keeps track of the shutdowns. Should the unit shut down three consecutive times without running a minimum of 15 minutes between shutdowns, the Alarm 30 "FAILED TO RUN MINIMUM TIME" Alarm will be activated. The shutdown counter is cleared when the unit has run for 15 minutes.

NOTE

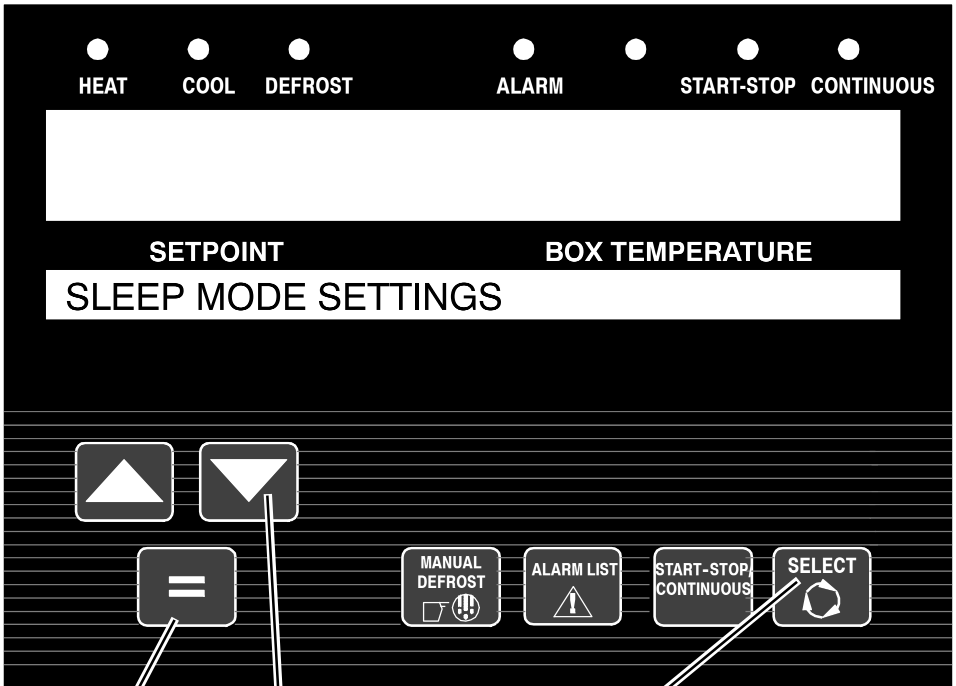
FreshProtect is enabled in Continuous Run mode. See Functional Parameters List – Table 3-3.

3.8 SLEEP MODE ON



1. Press the SELECT key until the MessageCenter displays “PRESS ↑↓ TO VIEW SETTINGS”.
2. By pressing the UP or DOWN ARROW key, you will move through the Function List until “SLEEP MODE SETTINGS” appears in the MessageCenter.
3. Press the = key. “↑ ↓ TO SCROLL, THEN = TO SAVE” will show in the MessageCenter.
4. Press the = key to select Sleep Mode Settings.
5. “SLEEP MODE: YES OR NO” will show in the MessageCenter. Press either UP or DOWN ARROW key to change the Sleep Mode to “YES”.

3.9 SLEEP MODE OFF



1. Press the SELECT key until the MessageCenter displays "PRESS ↑↓ TO VIEW SETTINGS".

2. By pressing the UP or DOWN ARROW key, you will move through the Function List until "SLEEP MODE SETTINGS" appears in the MessageCenter.

3. Press the = key. "↑ ↓ TO SCROLL, THEN = TO SAVE" will show in the MessageCenter.

4. Press the = key to select Sleep Mode Settings.

5. "SLEEP MODE: YES OR NO" will show in the MessageCenter. Press either the UP or DOWN ARROW key to change the Sleep Mode to "NO".

OR

Sleep Mode OFF

1. To take the unit out of Sleep Mode, place the START/RUN - OFF switch to the OFF position, then back to Start/Run.

NOTE

If IntelliSleep is active the only way to exit Sleep Mode is to activate another IntelliSet.

SLEEP MODE ON (Continued)

No further menu selections are available when NO is selected from the
"SLEEP MODE: YES OF NO" menu. The following sub menus are available when YES is selected:

1. "WAKE UP TIME"

   a. When "WAKE UP TIME" is set to NO the unit will remain in Sleep Mode until it is taken out manually per Section 3.9

   b. When "WAKE UP TIME" is set to YES the "SET WAKEUP TIME" menu will become available.

Pressing the = key will allow the user to select the time the unit is to automatically wake up. The wake up time must be at least 1 hour and no more than 8 days from the time the clock is set. The following information can be entered:

- Month
- Day
- Year
- Hour
- Minute

NOTE

The clock is a 24 hour clock. Hours 1 thru 12 are AM and hours 13 thru 24 are PM.

2. "RUN PRETRIP TEST AT WAKE"

   a. When "PRETRIP TEST AT WAKE" is set to NO the unit will wake up at the designated time and control to setpoint.

   b. When "PRETRIP TEST AT WAKE" is set to YES. the unit will wake up at the designated time, automatically run Pretrip and then control to setpoint. "PRETRIP PASS/FAIL" will remain in the MessageCenter until it is manually cleared.

If Sleep Mode is selected when the unit is not running (Start-Stop OFF Cycle), any remaining Minimum Off Time will be ignored and the engine will start. It will run for four minutes (minimum), until the engine coolant temperature is above 122°F (50°C), and the battery is fully charged (O.K. appears in the Data list voltage line, and charging amps are less than amps set in the Configuration list). While the unit is running in Sleep mode, "SLEEP WARNING: NO TEMP CONTROL" will flash in the MessageCenter, and the main display (set point and compartment temperature) will be turned off. This is because the refrigerated compartment temperature does not have to be at set point to allow the unit to cycle off (go to sleep).

If the unit is already running when Sleep Mode is selected, it will continue to run until the conditions described above are met, then shut off (go to sleep).

There is **NO TEMPERATURE CONTROL** in Sleep Mode and it should never be used for hauling perishable or frozen products.

While the unit is cycled off in Sleep mode, "SLEEP MODE, OFF/ON TO WAKE" will be displayed in the MessageCenter. The display backlight will turn off after five minutes. Sleep Mode may be exited by either turning the Start/Run-Off switch to the OFF position, then back to the START/RUN position, or by accessing the Functional Parameter list, and selecting "SLEEP MODE: OFF".

While in Sleep mode, the Unit Data and Alarm lists may be viewed, and Functional Parameters may be viewed and changed as necessary. However, Start-Stop /Continuous Run selections, and set point can not be changed. Manual Defrost and Pretrip can be initiated.

The unit will restart when engine coolant temperature drops below 34°F (1°C) or if the battery voltage drops below the battery restart value selected in the configurations (See 6.2.1)

Sleep mode is generally used in cold ambients when the trailer or rail car may be parked or not used and the unit is OFF for an extended period of time (one day to several weeks) with no product inside the refrigerated compartment. Many times units are very difficult to start due to a discharged battery, thickened engine oil, etc. after that time in cold ambients. In Sleep mode the unit will "Wake Up" periodically and run to keep the battery charged and the engine warm.

In Sleep Mode the unit will "Wake Up" periodically and run to keep the battery charged and the engine warm.

NOTE

In the event that the Engine Coolant Temperature sensor fails, Sleep mode will operate as follows:

In ambients above +32°F (0°C), the unit will run as above, and will monitor battery voltage and charging amps only (according to the configuration setting).

In ambients below +32°F (0°C), the unit will run for 20 minutes minimum run time, then restart every 60 minutes (maximum off time). Battery voltage and amperage will be monitored normally.

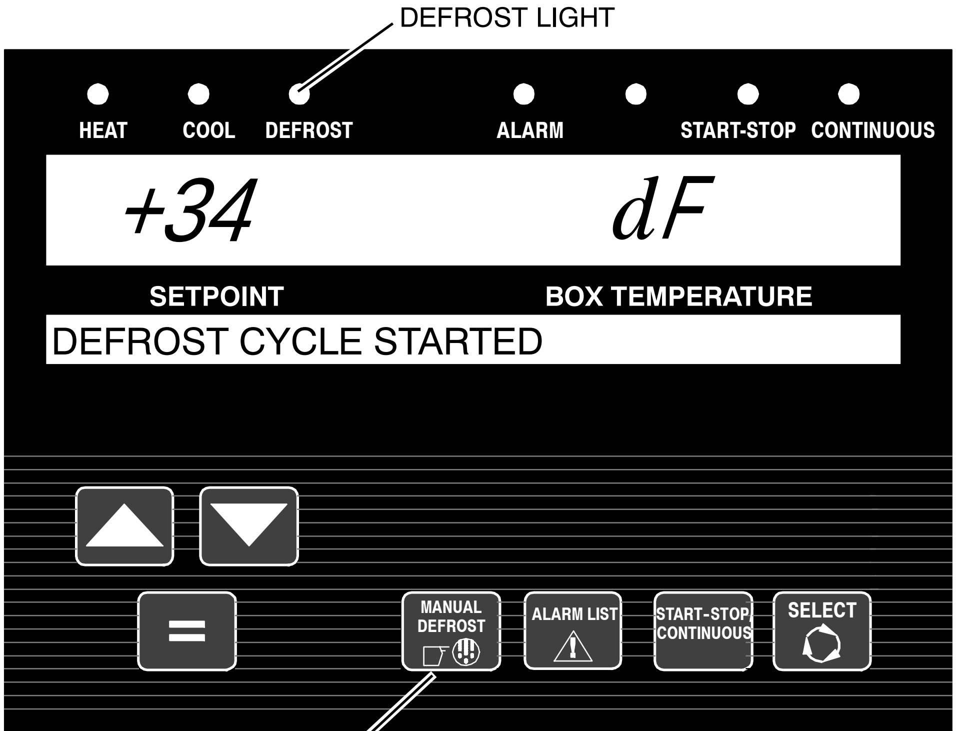
NOTE

Units equipped with IntelliSet option can select Sleep Mode by choosing IntelliSleep. (See Section 3.20.1).

IntelliSleep can ONLY be exited by selecting a different IntelliSet.

3.10 DEFROST

3.10.1 Manual Defrost



1. Press the MANUAL DEFROST key. The DEFROST light will come on and the MessageCenter will display “DEFROST CYCLE STARTED” for five seconds, or flash “CANNOT START DEFROST CYCLE” for five seconds.

When Defrost mode CANNOT be manually initiated “CANNOT START DEFROST CYCLE” is displayed in the MessageCenter. This will occur when:

- DTT2 is above 40°F (4.4°C), and SAT is above 45°F (7.2°C), OR
- The engine has not run a minimum of15 seconds after starting OR
- The unit is in PC mode OR
- The unit is in Pretrip OR
- There is an active shutdown Alarm.

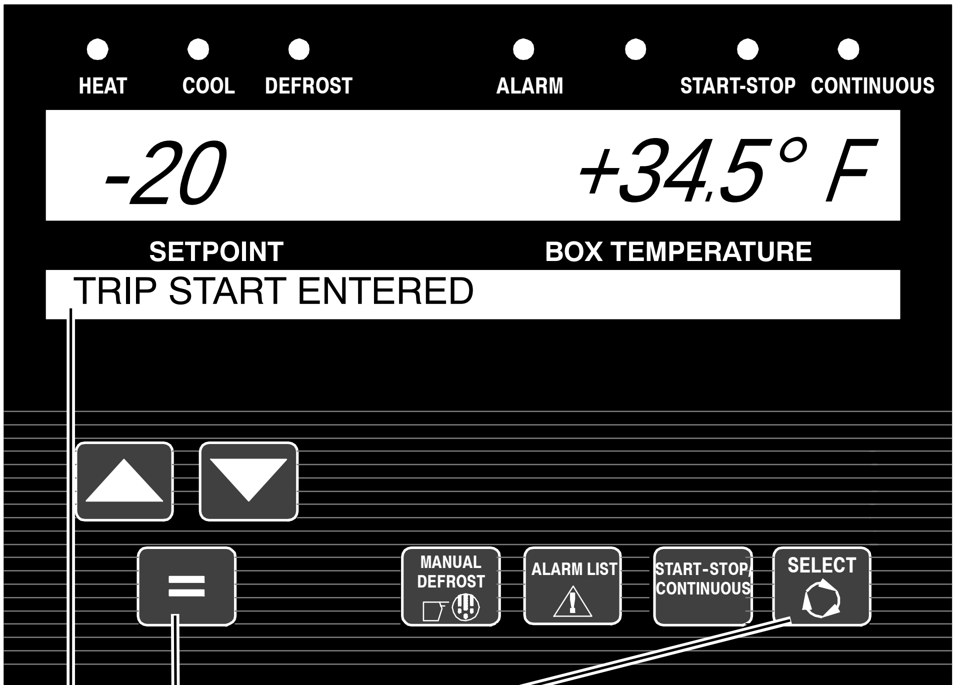
NOTE

Refer to Section 5.11 for more detailed information on manual and automatic defrost initiation and termination.

TIP

The Manual Defrost Key can be used at any time to start a Defrost Cycle.

3.11 TRIP START



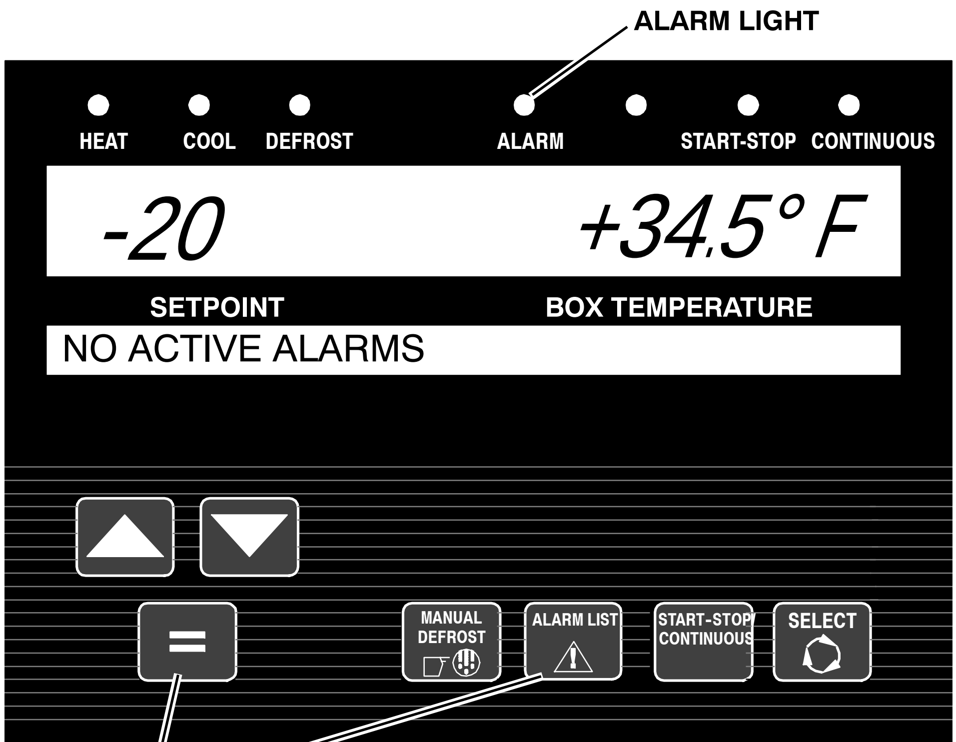
1. To mark the start of a trip in the data recorder, press the SELECT key until The MessageCenter displays “PRESS = TO ENTER TRIP START.”

2. Press the = key.

3. If trip start is acknowledged by the data recorder, “TRIP START ENTERED” will be displayed for five seconds and then the display will revert back to the normal display. Otherwise “CANNOT ENTER TRIP START” will flash and then the display will revert back to the normal display.

Trip Start places a time stamped events in the data recorder memory to allow easy review of the data from the last trip, and to allow downloading data from a specific trip. A trip begins at a Trip Start and ends at the next Trip Start. Trip Start tells the data recorder that the present date and time is the beginning of a new trip.

3.12 VIEW ACTIVE ALARMS



1. Press the ALARM LIST key. If there are no active alarms, the display will say “NO ACTIVE ALARMS” for five seconds.
2. If there are active alarms, the display will be ‘A’ and the alarm number and message. The last alarm that occurred will be the first alarm displayed and so on.
3. Press the ALARM LIST or UP ARROW key to scroll through the list of alarms.
4. When you reach the end of the alarm list, “LIST END, = TO CLEAR ALARMS” is displayed for five seconds.
5. To clear the active alarm list, press the = key while “LIST END, = TO CLEAR ALARMS” is being displayed. “ACTIVE ALARMS LIST CLEAR” is displayed. This will move all Alarms to the Inactive Alarm list.

Alarms are stored in the Alarm list in the microprocessor. Stored alarms may be viewed on the MessageCenter.

For a complete list of alarms, their meanings, and troubleshooting refer to Section 8.1.

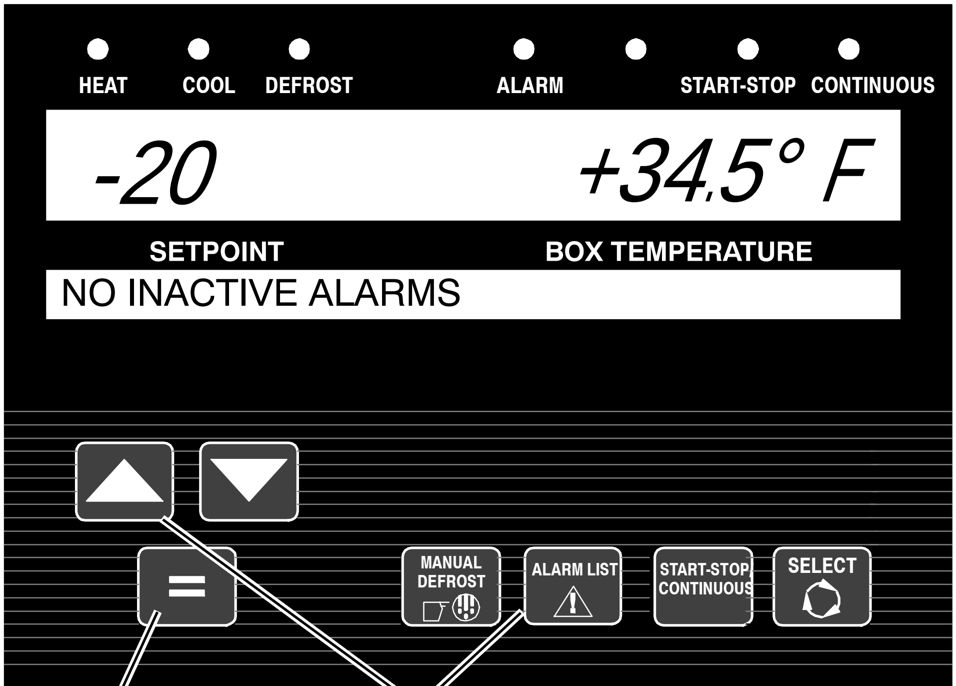
TIP

Another way to clear active alarms is to turn the microprocessor OFF and then back ON using the START/RUN-OFF switch.

TIP

The message “CHECK MICROPROCESSOR” (on earlier microprocessors) or “CHK WIRES FROM MICRO TO KEYPAD” (on newer microprocessors) means there is a wiring problem between the microprocessor and the display module.

3.13 VIEW INACTIVE ALARMS



1. Press and hold both the ALARM LIST key and the UP ARROW key for six seconds. If there are no inactive alarms, the display will read "NO INACTIVE ALARMS" for five seconds.
2. If there are inactive alarms, the display will be 'I' and the alarm number and message.
3. Press the ALARM LIST or UP or DOWN key to scroll through the list of alarms.
4. When you reach the end of the alarm list, "LIST END, = TO CLEAR ALARMS" is displayed for five seconds.
5. To clear the active and inactive alarm list, press the = key while "LIST END, = TO CLEAR ALARMS" is being displayed. "ALL ALARMS CLEAR" is displayed.

The microprocessor can hold up to 16 alarms in the combined Active and Inactive Alarm lists. The lists can be read via the MessageCenter or using the ReeferManager PC program. There are two sections in the Alarm list, an Active Alarm section and Inactive Alarm section. Alarms in these sections are in the order in which the alarms activate and deactivate, respectively. On startup, all alarms are marked as inactive in the entire list. If an inactive alarm becomes active, the alarm is moved from the Inactive Alarm list to the Active Alarm list.

As additional alarms occur, they will be placed first in the Active Alarm list. Each alarm can only be present in either the Active or Inactive Alarm List at any given time. As conditions change, alarms may be moved from the Active Alarm list to the Inactive alarm list and back.

Alarms are also recorded in the data recorder. They are recorded at the time they occur (become active), and the time they become inactive.

For a complete list of alarms and troubleshooting information refer to Section 8.1.

TIP

When alarms are cleared from the Inactive Alarm list, both active and inactive alarm lists are cleared.

If there is a safety shutdown, "UNIT SHUTDOWN - SEE ALARM LIST" will be shown. Pressing the Alarm List key will bring any Active Alarms into the MessageCenter. Refer to Section 8 for a complete list of Alarms and their descriptions.

NOTE

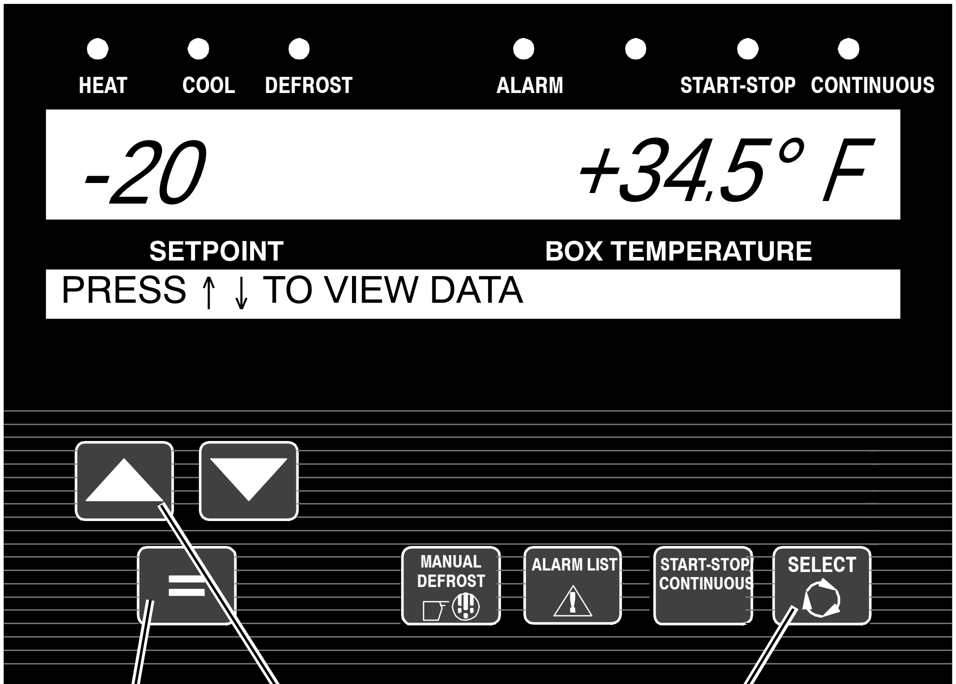
The Inactive Alarm list is also called the Technicians List. Only qualified refrigeration technicians should access the inactive list. It is not intended for the use of drivers or operators.

Table 3-1. Shutdown Alarms

SHUTDOWN ALARMS			
		SHUTDOWN	**ALARM ONLY** or may be configured as SHUTDOWN (see configuration list Section 6.2.1)
2	Low Oil Level		X
11	Low Engine Oil Pressure	X	
12	High Coolant Temperature	X	
13	High Discharge Pressure	X	
15	Battery Voltage Too High	X	
16	Battery Voltage Too Low	X	
17	High Comp Discharge Temp	X	
18	Low Refrigerant Pressure		X
19	Low Fuel Shutdown		X
20	Maximum Compressor Alarms (Optional)	X	
27	High Suction Pressure		X
28	Check Refrigeration System		X
29	Check Heat Cycle	X	
30	Failed To Run Minimum Time	X	
31	Failed to Start – Auto Mode	X	
32	Failed to Start – Manual	X	
35	Check Starter Circuit	X	
39	Check Engine RPM		X
41	Engine Stalled	X	
51	Alternator Not Charging		X
53	Compartment Temp Out-of-Range		X
56	Check Evaporator Airflow	X	
57	Check Remote Switch 1		X
58	Check Remote Switch 2		X
61	Door Open		X
72	Bad F4 or F6 Fuse	X	
♦122	Check Return Air Sensor	♦	
♦123	Check Supply Air Sensor	♦	
204	Low Suction Pressure	X	
232	Setpoint Error	X	
233	Model # Error	X	
237	Function Parameter Error	X	
238	Configurations 1 Error	X	
242	DIS PRESS Calibrate Error	X	
243	SUCT/EVAP Calibrate Error	X	
246	EEPROM Write Failure	X	
248	Config Mode/HP2 Error	X	
249	Microprocessor Error	X	

♦If Alarms 122 and 123 are both active and setpoint is in the perishable range [10.4°F(-12°C)] and higher – the unit will shut down. Otherwise, alarm only.

3.14 UNIT DATA



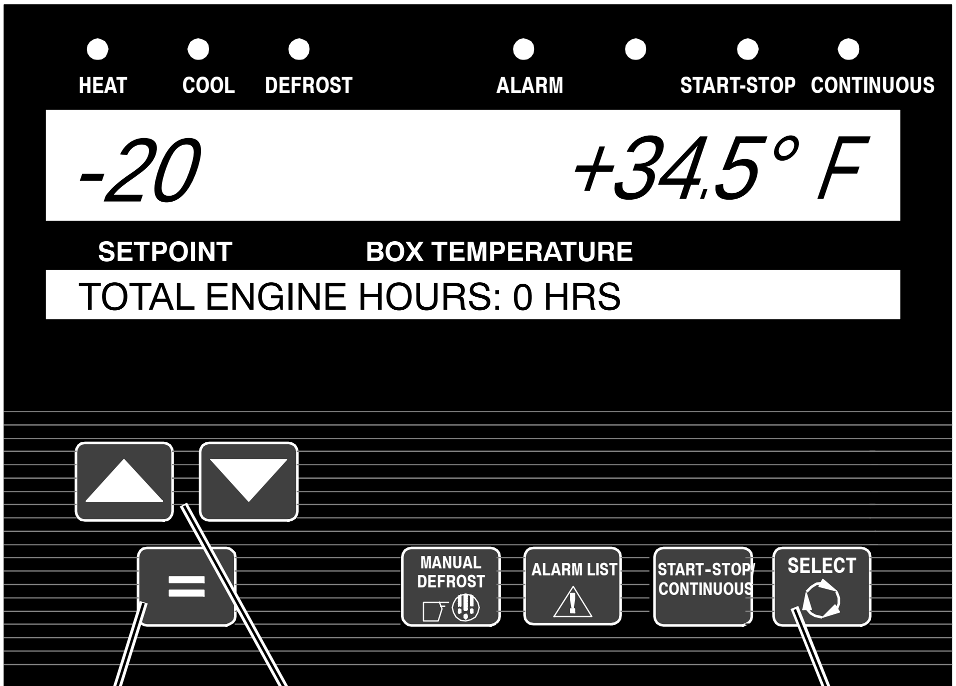
1. Press the SELECT key until the MessageCenter displays "PRESS ↑↓ TO VIEW DATA."
2. By pressing the UP ARROW key, you will move through the Data List beginning at the top and moving toward the bottom, or by pressing the DOWN ARROW key, you will move through the Data List beginning at the bottom, and moving toward the top.
3. The selected Data Item will remain in the MessageCenter for ten seconds, then the default message ("STATUS OK" or other customer specified message) will appear.
4. To lock an item in the MessageCenter for continuous viewing, press the = key. The Data item will flash continuously to indicate it is locked.
5. Pressing the UP or DOWN ARROW key will unlock that item and move to the next data item. Pressing the = key will unlock the item. After ten seconds the default message will be displayed.

Table 3-2. UNIT DATA		
* Also appear in Configurations		
+ May or may not be displayed depending on functional parameter settings		
	SUCTION PRESSURE	Compressor suction pressure
	DISCHARGE PRESSURE	Compressor discharge pressure
	ENGINE COOLANT TEMP	Engine coolant temperature
	RETURN AIR TEMP	Return (air entering evaporator) air temperature
	SUPPLY AIR TEMP	Supply (air leaving evaporator) air temperature
	DELTA-T	Supply air temperature minus Return air temperature.
	AMBIENT AIR TEMP	Ambient (air entering condenser) air temperature
	DEFROST TERM TEMP 2	Defrost termination temperature
	EVAP OUTLET TEMP	Suction line temperature at the evaporator outlet
	BATTERY	Battery voltage
	CURRENT DRAW	Battery charging or discharging amps
	ENGINE RPM	Engine revolutions per minute
	FUEL LEVEL	% of fuel in tank. (This is only shown when 0%-100% sensor is configured ON.)
	SUCTION MOD VALVE	% open of CSMV
	START MODE	AUTO if the engine will start automatically MANUAL if the engine must be started manually
	INSTALLED OPTIONS INTELLISET INSTALLED DATATRAK INSTALLED COMPRESSOR ALARM SHUTDOWN	Applies only if unit has any one or more of these options installed
	SOFTWARE REVISION	Revision of the software that is operating the microprocessor
	DISPLAY SOFTWARE REV	Revision of the software that is operating the display
	CONTROL SERIAL #	Serial Number of the microprocessor
*	ID #	ID (as entered by the user) – Trailer, Car or Asset ID
*	UNIT SERIAL #	Unit serial number
*	UNIT MODEL #	Unit model number (selected through configurations)
+	HOURS TO ENGINE MAINT	Number of engine hours until the next programmed engine maintenance

Table 3-2. UNIT DATA		
*** Also appear in Configurations**		
+ May or may not be displayed depending on functional parameter settings		
+	HOURS TO UNIT MAINT	Number of switch-on hours until the next programmed general unit maintenance
+	TIME LEFT TO PM (1-5)	Number of hours until the next programmed maintenance
*	PRODUCTSHIELD SETUP:	Indicates that unit has IntelliSet installed and displays ProductShield settings.
	PRODUCTSHIELD ECONO:	Indicates if ProductShield Econo is **OFF** OR **Go To Start-Stop** OR **Go To Continuous Run**
	ECONO MIN TEMP	Minimum ambient temperature of range for activation of ProductShield Econo (Will only be displayed if Econo is **NOT OFF**)
	ECONO MAX TEMP	Maximum ambient temperature of range for activation of ProductShield Econo (Will only be displayed if Econo is **NOT OFF**)
	ECONO DELTA-T	Delta-T value for activation of ProductShield Econo (Will only be displayed if Econo is **NOT OFF**)
	PRODUCTSHIELD HIGH AIR:	Indicates if Product Shield High Air is **ON** or **OFF**
	HIGH AIR MIN TEMP	Minimum ambient temperature of range for activation of Product Shield High Air (Will only be displayed if High Air is **ON**)
	HIGH AIR MAX TEMP	Maximum ambient temperature of range for activation of Product Shield High Air (Will only be displayed if High Air is **ON**)
	HIGH AIR DELTA-T	Delta-T value for activation of Product Shield High Air (Will only be displayed if High Air is **ON**)
	PRODUCTSHIELD: WINTER - xx°	Indicates the ambient temperature that is controlling ProductShield Winter (Will only be displayed if WINTER is **NOT OFF**)
* +	RANGE 1 LOCK	OFF – Temperature Range 1 Lock is turned off CONTINUOUS – The unit is set to operate only in Continuous Run when the set point is set between Range 1 Minimum and Maximum Temperatures START-STOP – The unit is set to operate only in Start-Stop when the set point is set between Range 1 Minimum and Maximum Temperatures
* +	RANGE 1 MINIMUM TEMP	This is the lower limit for Range 1.
* +	RANGE 1 MAXIMUM TEMP	This is the upper limit for Range 1.
* +	RANGE 2 LOCK	OFF – Temperature Range 2 Lock is turned off. CONTINUOUS – The unit is set to operate only in Continuous Run when the setpoint is set between Range 2 Minimum and Maximum Temperatures START-STOP – The unit is set to operate only in Start-Stop when the setpoint is set between Range 2 Minimum and Maximum Temperatures
* +	RANGE 2 MIN. TEMP	This is the lower limit for Range 2.
* +	RANGE 2 MAX. TEMP	This is the upper limit for Range 2.

Table 3-2. UNIT DATA		
* Also appear in Configurations		
+ May or may not be displayed depending on functional parameter settings		
* +	REMOTE SENSOR (1-3)	This is the temperature at remote Temperature Sensor 1, 2, and 3. (These sensors are optional, and may not be applicable to your unit. Up to three remote sensors may be listed.)
*	DATALOGGER	This is the current Date and Time that the DataRecorder is using. This may be different than your actual time, depending on the Time Zone and Daylight Savings Time selections made by the owner of the unit

3.15 VIEW HOURMETERS

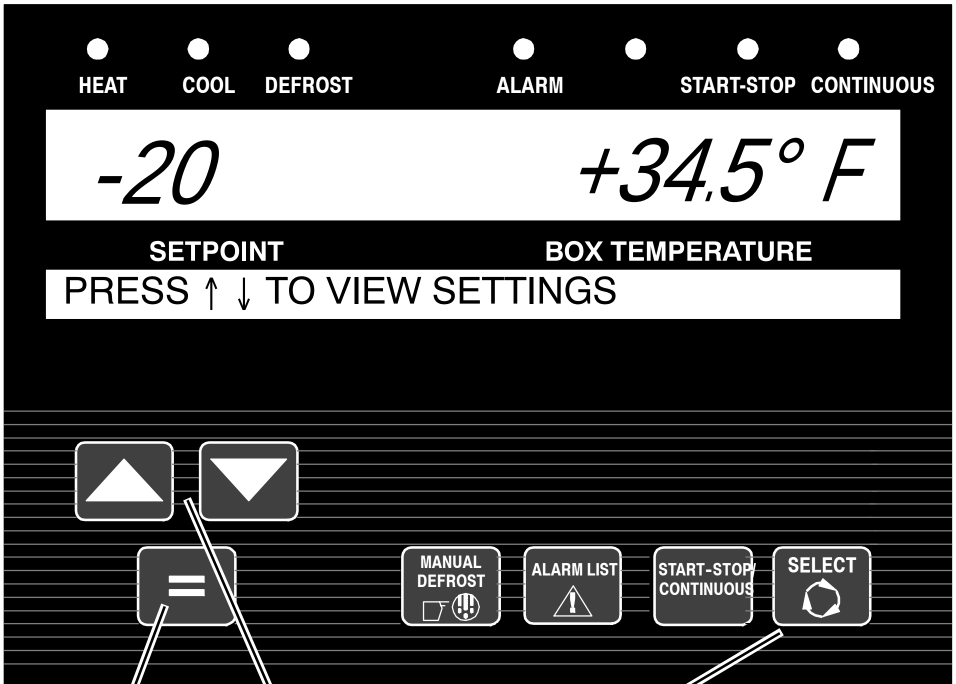


1. Press the SELECT key until the MessageCenter displays "PRESS ↑↓ TO VIEW HOURMETERS."
2. Press the UP or DOWN ARROW key to move through the Hourmeter List.
3. Displayed hourmeters will depend on unit configurations (See Section 6.2.1). Typical displayed meters are: "TOTAL ENGINE HOURS" and "TOTAL SWITCH ON HOURS."
4. Pressing the = key will access all other meters and display "OTHER METERS AND COUNTERS"
5. The selected hourmeter will remain in the MessageCenter for 10 seconds and then the default message ("STATUS OK" or other customer specified message) will appear.
6. To lock an hourmeter in the MessageCenter for continuous viewing, press the = key. The hourmeter will flash continuously to indicate it is locked.
7. Pressing any key on the keypad will unlock the item. Pressing the UP or DOWN ARROW key will move to the next hourmeter.

Hourmeters available when "OTHER METERS AND COUNTERS" is chosen are:

- Meters listed in Step 3 above that were not previously displayed.
- Engine Protect Hours
- Switch On Protect Hours
- Engine Sleep Hours
- High Speed Hours
- Clutch Cycles
- Start Cycles

3.16 FUNCTIONAL CHANGE (PARAMETERS)



1. Press the SELECT key until the MessageCenter displays "PRESS ↑↓ TO VIEW SETTINGS."

2. By pressing the UP ARROW key, you will move through the Function List beginning at the top or by pressing the DOWN ARROW key, you will move through the Function List beginning at the bottom.

3. To change one of the functions, bring the function you wish to change into the MessageCenter, and press = key. "↑ ↓ TO SCROLL, THEN = TO SAVE" will show in the MessageCenter. Pressing either the UP or DOWN ARROW key will begin to change the function setting. The MessageCenter will flash, indicating that a change has been made that has not been entered into memory.

4. Continue pressing the UP or DOWN ARROW key until the desired value is displayed, then press the = key. The MessageCenter will stop flashing. The new value is now in memory. If the = key is not pressed within 10 seconds, the MessageCenter will change to "FUNCTION NOT CHANGED". This will appear for five seconds, then return to the last Functional Parameter displayed. If no further keys are pressed, the default message will be displayed after 10 seconds.

NOTE

Any function that is shown with a padlock symbol cannot be changed from the keypad.

Table 3-3. Functional Parameters

FUNCTIONAL PARAMETER	SELECTIONS	DESCRIPTION
DEFROST TIMER SET FOR	1.5HRS 3HRS **6HRS** 12HRS	The defrost timer will automatically put the unit into the defrost cycle at the interval selected if evaporator is below 40°F (4.4°C). Shorter times are generally used for warm, humid products like produce. Longer times can be used for dry and frozen products.
SET S/S PARAMETERS (These may be displayed individually (8 parameters) as PERISH and FROZEN, or combined (4 parameters) with no designation.)		Time and Temperature values that control the Automatic Start-Stop operation are set in this section. When "TOGETHER" is selected in Configurations, only Perishable Settings are used.
• (PERISH / FROZEN) MIN RUN TIME:	**4MINS** TO 60MINS (in one minute increments)	This determines the minimum length of time the unit will run every time the unit starts in Auto Start-Stop modes.
• (PERISH / FROZEN) MIN OFF TIME:	10MINS TO 90MINS **20MINS** (in one minute increments)	This determines the minimum length of time the unit will remain off whenever the unit cycles off in Auto Start-Stop modes.
• (PERISH / FROZEN) OVERRIDE TEMP:	3.6°F (2°C) TO 18°F (10°C) **11°F (6°C)** (in 0.5°F or C increments)	This selects the override restart temperature for the Auto Start-Stop Off Cycle. During the Minimum Off Time, should the refrigerated compartment temperature drift this far above or below setpoint in the Perishable Range, or above set point in the Frozen Range, the unit will override the Minimum Off Time, and restart.
• (PERISH / FROZEN) MAX OFF TIME:	**OFF**	OFF – There is no maximum off time.
	10MINS TO 255MINS (in one minute increments)	When a minute value is selected, this is the longest amount of time the unit will remain off during a (Perishable or Frozen or both) Auto Start-Stop Off Cycle. When this time expires, the unit will restart and run for the Minimum Run Time, regardless of any temperature change inside the refrigerated compartment.
FROZEN SHUT-DOWN OFFSET	**0°F (0°C)** TO 3.6°F (2°C)	This only applies to Frozen set points in Start-Stop operation. This offset is the number of degrees below set point that the unit will run before cycling off. This will allow for a lower average refrigerated compartment temperature when considering temperature rises during off cycles.
TEMP CONTROL:	**RETURN AIR** / SUPPLY AIR	The unit has both a Return Air Sensor and a Supply Air Sensor. This selection determines which sensor temperature will be used for set point selections above 10.4°F (-12°C) to determine when set point is reached.
		Return Air is generally selected for most products. Products that are sensitive to small temperature changes may use the Supply Air setting.
		Supply Air limits the temperature of the air leaving the evaporator to the setpoint setting.
NOTE: Whenever the setpoint is below +10.4°F(-12°C), the unit will ALWAYS be controlled by the Return Air Sensor, regardless of the selection made here.		

<table>
<tr><th>FUNCTIONAL PARAMETER</th><th>SELECTIONS</th><th>DESCRIPTION</th></tr>
<tr><td>DISPLAY TEMPS IN FAHRENHEIT/CELCIUS</td><td>ENGLISH UNITS
METRIC UNITS</td><td>Temperatures will display in either English (°F) or Metric (°C)</td></tr>
<tr><td>DISPLAY PRESSURE IN PSIG/BAR</td><td>ENGLISH UNITS
METRIC UNITS</td><td>Pressures will display in either English (psig) or Metric (bar)</td></tr>
<tr><td colspan="2">*RESET PM HOURMETERS</td><td>Maintenance hourmeters that have expired will appear in this list.</td></tr>
<tr><td>• ENGINE</td><td rowspan="3">RESET</td><td rowspan="3">If there are no active maintenance hourmeters, this menu item will not appear in the Functional Parameters.
If there are active maintenance hourmeters and none have expired and turned the alarm on, the MessageCenter will display “NO HOURMETERS TO RESET.”
When any maintenance hourmeter has timed out, and preventative maintenance has been performed, selecting RESET and pressing the = key will de-activate the alarm, and reset the hourmeter for the next service interval.</td></tr>
<tr><td>• SWITCH ON</td></tr>
<tr><td>• PM 1 Thru 5</td></tr>
<tr><td>OUT OF RANGE ALARM:</td><td>English Metric
OFF OFF
4°F 2°C
5°F 3°C
7°F 4°C</td><td>Once the unit is at set point, then drifted away for more than 15 minutes, an Out-Of-Range Alarm will come on. (Or, if configured for Out Of Range Shutdown, after 45 minutes the unit will shut down.) This setting determines how far away from set point the temperature must move before the timer is started. 4°F may be used for very critical temperature products, 7°F may be used for less critical products. The alarm may be turned off by selecting the OFF setting.</td></tr>
</table>

FUNCTIONAL PARAMETER	SELECTIONS	DESCRIPTION
AIR FLOW	**NORMAL** HIGH	The NORMAL selection allows the unit to cycle from High Speed to Low Speed, depending on how close the compartment temperature is to setpoint. Some products generate a considerable amount of heat (heat of respiration) during transportation. This frequently occurs with produce.
		The HIGH selection can be used for these loads, since continuous high air flow may be required to keep the entire load at a constant temperature. The engine will remain in High Speed when High is selected.
AIR FLOW	**NOTE:** HIGH AIR FLOW does not work with set points below +10.4°F (-12.0°C).	
FRESH PROTECT	**OFF**	OFF – Fresh Protect is turned off
	A = 2 TO 5°F (1.1 TO 2.8°C) B = 4 TO 7°F (2.2 TO 3.9°C) C = 6 to 9°F (3.3 TO 5.0° C) D = 8 to 11°F (4.4 TO 6.1 ° C) E = 10 to 13°F (5.6 TO 7.2° C)	A thru E determines the allowable temperature SAT can go below setpoint when the unit is operating in Continuous Run Cool. FreshProtect does not operate in Start-Stop. (See Section 5.8.)
AUTO FRESH AIR	**0 = CLOSED** 1 = OPEN 2 = CFM CONTROL	**CLOSED** – AutoFresh Air Exchange assembly will be closed except for pretrip and component test mode.
		OPEN – Assembly will be open if the engine is running and the setpoint is greater than 28°F (-2.2°C) and the unit is not defrosting
		CFM CONTROL – Assembly will be cycled open and closed over a 20 minute time period. The length of time the assembly is opened or closed is based on the Auto Fresh Air Control Functional Parameter. The CFM CONTROL will only be active for setpoints greater than 28°F (-2.2°C) and in Continuous Run mode or Auto Start-Stop mode when the engine is running. The assembly will be closed when the setpoint is less than 28°F (-2.2°C) or during defrost or during the off cycle of Start-Stop mode.
AUTO FRESH AIR CONTROL	5 TO 50 CFM IN 5 CFM INCREMENTS **25 CFM**	When CFM CONTROL is selected, this parameter is visible. When CFM CONTROL is used, the solenoid will open and close in 20-minute time blocks to control the amount of air being exchanged, so that the amount of air exchanged averages the CFM setting. During the first portion of the 20-minute block, the solenoid will be open, allowing fresh air in and exhausting stale air. Once sufficient air has been exchanged, the solenoid will close until the beginning of the next 20-minute block.

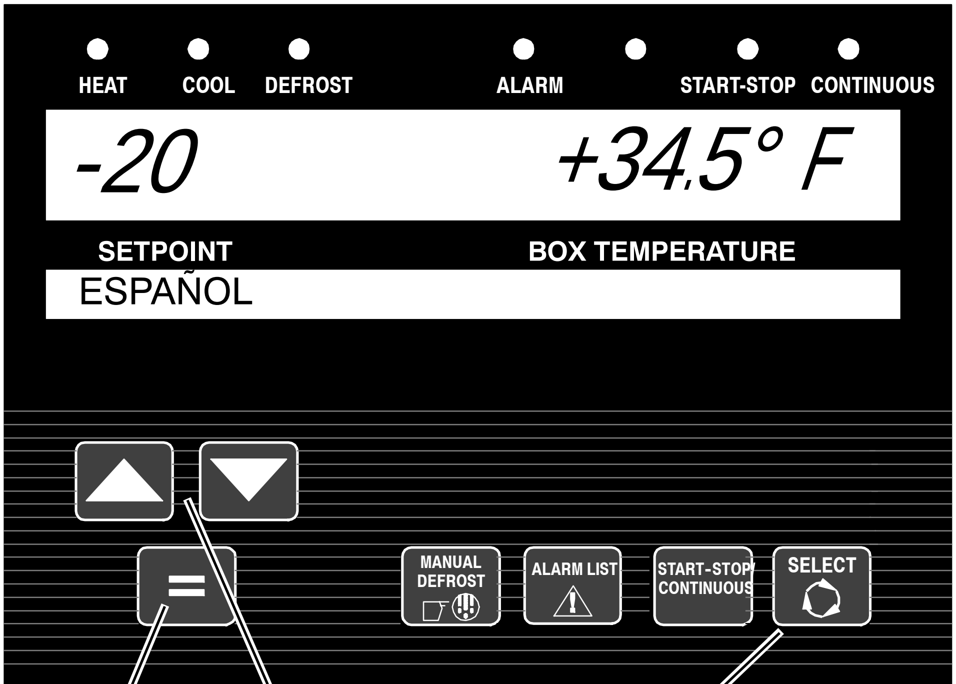
FUNCTIONAL PARAMETER	SELECTIONS	DESCRIPTION
LOW SPEED START-UP MINUTES		Allows user to set the number of minutes the unit will run in low speed every time the engine starts.
-CONTINUOUS:	**OFF** or 1 to 255 minutes	
-START-STOP	OFF or 1 to 255 minutes (**10 min**)	
UNLOADER PRESSURE CONTROL	**Std** -5 +5	The recommended setting for this is Std. This setting should not be changed unless discussed with a Carrier Transicold Factory Service Engineer or Field Service Engineer.
SLEEP MODE SETTINGS The following sub menus determine whether sleep mode is to be used and what the settings will be.		
• SLEEP MODE The following two sub menu selections will be available if YES is selected.	**NO** YES	NO - is the normal operating selection and no further selections will be available.
		YES- selects Sleep Mode. In this mode the unit will operate only as needed to keep the engine warm, and the battery charged. There is NO TEMPERATURE CONTROL in Sleep Mode.
The following Sleep Mode parameters were added in Software Version 04.07.00		
• WAKE UP TIME	**NO** YES	NO - the unit will remain in Sleep Mode until it is taken out manually. This can be accomplished either through the Functional Parameter list or by turning the START / RUN-OFF switch to OFF and then back to START/RUN.
		YES- the SET WAKE UP TIME sub menu will be available
SET WAKE UP TIME		This setting is used to set Sleep Mode wake up time. The clock is a 24 hour clock. Hours 1 thru 12 are AM and 13 thru 24 are PM. The wake up time must be at least 1 hour and no more than 8 days from the time the clock is set
• MONTH	1-12	Select the correct month of the year.
•DAY	1-31	Select the correct day of the month.
•YEAR	1998 - 2037	Select the correct year.
•HOURS	0-23	Select the correct hour (0-11 is AM / 12-23 is PM)
•MINUTES	0-59	Select the correct minute.

FUNCTIONAL PARAMETER	SELECTIONS	DESCRIPTION
• RUN PRETRIP AT WAKE	**NO** YES	NO – The unit will wake up at the designated time and control to set-point. YES – The unit will wake up at the designated time, automatically run Pretrip and then control to set point. The Pretrip Pass/Fail message will remain in the MessageCenter until the message is manually cleared.
* OVERRIDE DOOR SHUTDOWN	This will only appear when a compartment door switch is configured "ON" in the Configuration List.	
	NO YES	NO – Allows the door switch to shut the unit down whenever the compartment door is opened and the door switch is configured for shutdown. YES – Allows operator to over-ride the compartment door shutdown switch, and allow the unit to continue to run, even with the compartment door open.
* OVERRIDE REMS (1-2) SHUTDOWN	NOTE: This will only appear when a remote switch (REMS1 or REMS2) is configured "ON" in the Configuration List.	
	NO YES	NO – Allows remote switch (1 and/or 2) to shut the unit down whenever door is open or the switch is turned ON. YES – Allows operator to override remote switch (1 and/or 2), and allow the unit to continue to run, even with the remote switch in the ON position or the door is open.
LANGUAGE:** IDIOMAS: LANGUE: LINGUAGEM:	**ENGLISH**	ENGLISH – All information displayed in the MessageCenter will be shown in English.
	FRANÇAIS	FRANÇAIS – All information displayed in the MessageCenter will be shown in French.
	ESPAÑOL	ESPAÑOL– All information displayed in the MessageCenter will be shown in Spanish.
	PORTUGUÊS	PORTUGUÊS – All information displayed in the MessageCenter will be shown in Portuguese.
	NOTE: This parameter can be quickly accessed by pressing and holding the Select key for six seconds.	
Selections in **BOLD** are the factory settings.		
* This Functional Parameter may not appear in the list for your unit, depending on how the microprocessor has been configured.		

NOTE

**If the padlock is visible when accessing language from the Functional Parameter List, the language cannot be changed. However, when accessing the language using the "hot key" (press and hold the Select Key for 6 seconds) the language can be changed regardless if the padlock is shown or not.

3.17 LANGUAGE SELECTION



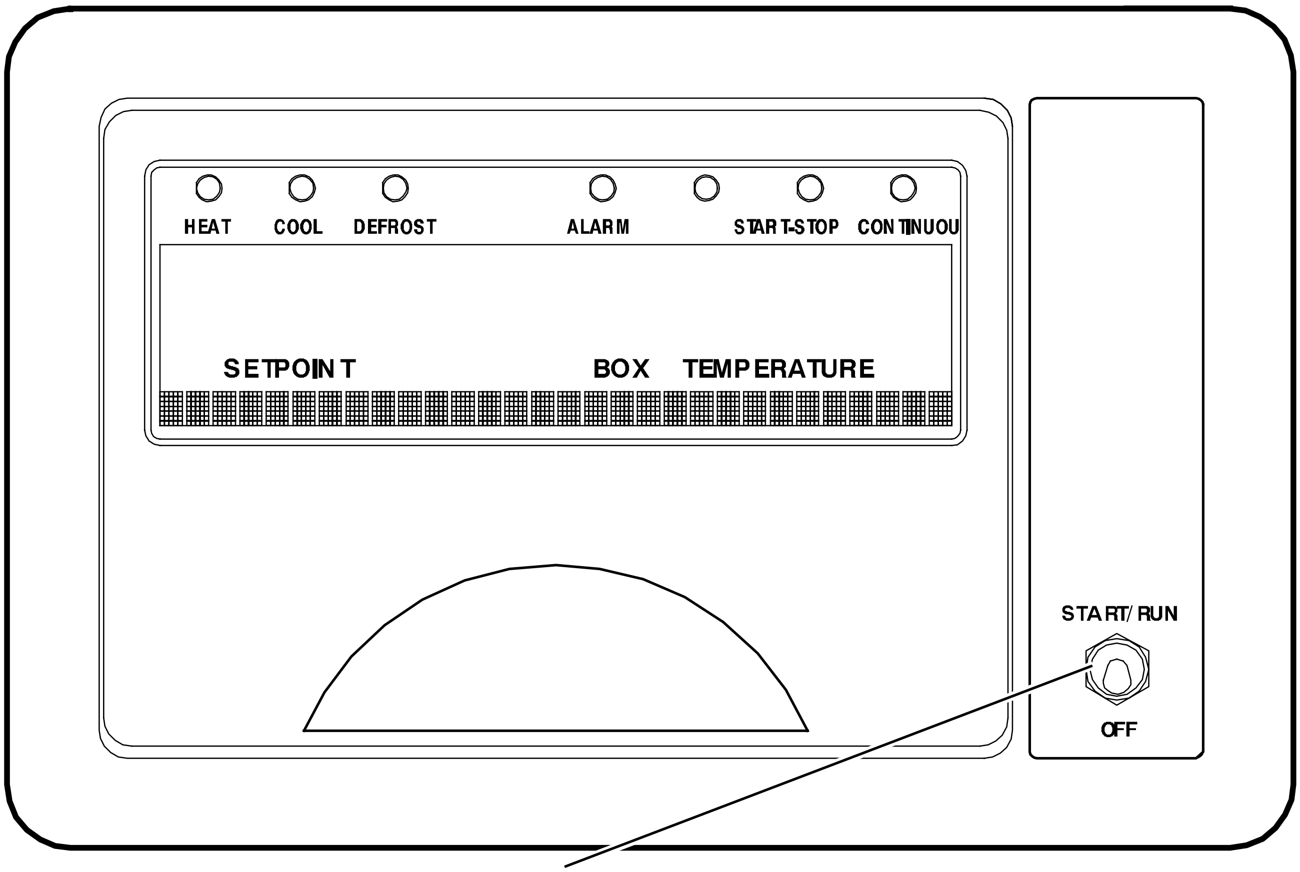
1. Press and hold the SELECT key for six seconds until MessageCenter displays current language (ENGLISH, ESPAÑOL, FRANÇAIS or PORTUGUÊS).

2. Press the UP or DOWN ARROW key until the MessageCenter indicates the desired language. Press the = key. The new language will now be active.
If the = key is not pressed within 10 seconds, the MessageCenter will change to "FUNCTION NOT CHANGED." This will flash for five seconds, then return to the current language. If no further keys are pressed, the default display will return in another 10 seconds.

TIP

If the language is set to one that the user does not understand, press and hold the "SELECT" key for 6 seconds to bring up the Language Parameter so that it can be changed.

3.18 STOPPING UNIT



1. To stop the unit, place the START/RUN - OFF switch in the OFF position.

The diesel engine will stop and the microprocessor will turn off. The Microprocessor Main Display, MessageCenter, and all indicator LEDs will also turn off.

NOTE

Due to internal processing within the microprocessor, turning the START/RUN-OFF switch OFF then back to START/RUN will result in a 4 to 50 second delay between the display going off and coming back on again.

NOTE

The CSMV will close to 0% when START/RUN-OFF switch is switched to OFF.

3.19 DATA RECORDING

The Advance microprocessor contains a built-in DataRecorder with 512K of memory. The recorded data can be downloaded from the DataRecorder using either ReeferManager, a PC software program, or a Download PC card.

The DataRecorder reads the same input information as the microprocessor (Functional Parameters, Configurations, and Unit Data) at all times. The DataRecorder records events as they occur, such as set point changes and Defrost Initiation and Termination, and also records all data values including temperature and pressure sensors in either averaged or snapshot format. The details are provided below.

3.19.1 Microprocessor Information

The microprocessor Information that is available to be recorded is as follows:

- DataRecorder Setup Sensor Being Recorded (Logging Intervals, Events and Sensors)
- DataRecorder Time Clock Date / Time
- Setpoints (And all setpoint changes.)
- ID Number
- Unit Serial Number
- Unit Model Number
- Current System Mode
- Functional Parameters
- Microprocessor Configurations

3.19.2 Data Recording

The DataRecorder data comes from four general categories of information:

a. Microprocessor Information as described in Section 3.19.1 above.

b.Sensor Data

This information is recorded at predetermined intervals as a snapshot of the sensor at the time of the recording, or an averaged reading of the sensor readings since the last recording. The user can determine which sensor(s) will be recorded, at what intervals, and whether snapshot or averaged readings are preferred. Snapshot readings of sensors are also taken at the time of a shutdown alarm.

c.Event Occurrences

This information is any additional data that is recorded on a “when it occurs” basis. Events are recorded by the recorder as they occur. An Event is defined as something that happens (i.e. set point changed, Defrost Cycle Started, or Main Power On, etc.) Hourmeters are recorded at midnight or the first time of day the switch is turned to the ON position.

d.User Area Data

The user or service technician is able to enter a comment into the DataRecorder using the ReeferManager program.

3.19.3 Sensor and Event Data

Sensors

The following sensors may be recorded either with an averaged reading, or snapshot or may not be recorded at all.

- Return Air Temperature
- Supply Air Temperature
- Ambient Air Temperature
- Compressor Discharge Temperature
- Engine Coolant Temperature
- Compressor Discharge Pressure
- Compressor Suction Pressure
- Battery Voltage
- Battery DC Current
- Engine RPM

Events (Selectable)

User may determine whether the following events are recorded. All other events such as ON / OFF, Defrost start will be recorded.

- Pretrip Start
- Pretrip End
- Trailer ID
- Unit S/N
- Unit Mode
- Control Mode
- Transducer Calibration

Optional Sensors and Events

In addition to the above Sensors and Events, the DataRecorder also has the capabilities to record the following:

- Remote Temperature Sensor 1
- Remote Temperature Sensor 2
- Remote Temperature Sensor 3
- Remote Switch 1
- Remote Switch 2
- Door Switch
- Fuel Tank % Level

Time Intervals

The following intervals are available for sensor recording:

- 2 Minutes
- 5 Minutes
- 10 Minutes
- 15 Minutes
- 30 Minutes
- 1 Hour
- 2 Hours
- 4 Hours

3.19.4 Data Downloading

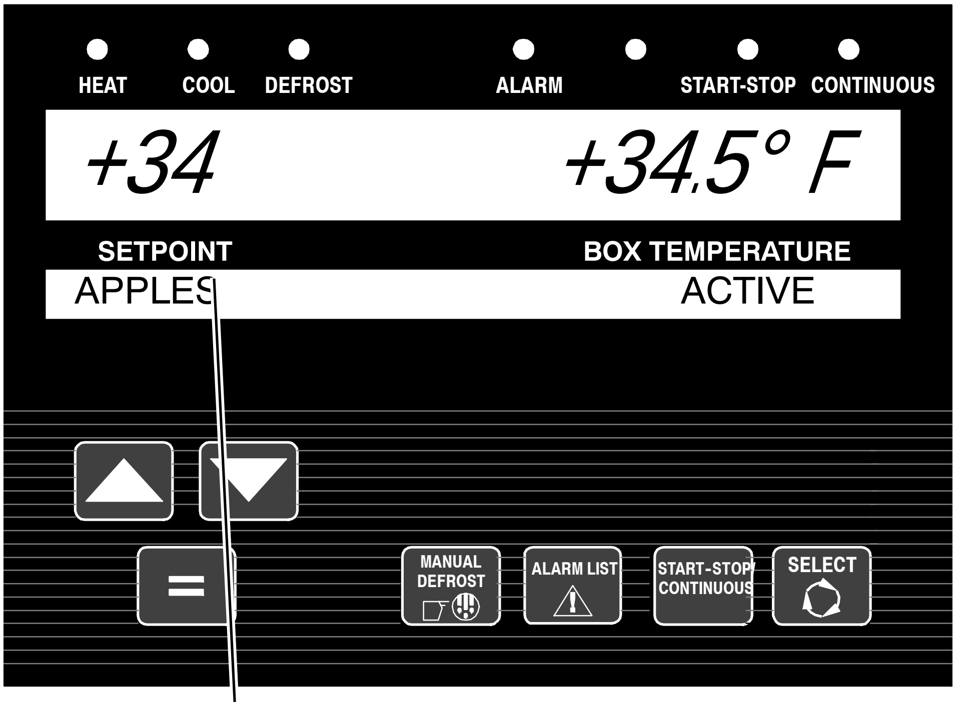
The data within the DataRecorder can be downloaded from the DataRecorder by using either the ReeferManager, (a PC software program) and a download cable connected to the download port (refer to Section 6.1) or with a Download PC card (refer to Section 6.4) If a PC card is used, the ReeferManager program is then used to extract the data from the PC card, and place it on the computer hard disk.

3.19.5 DataRecorder Power-Up

The DataRecorder records data the entire time the START/RUN-OFF switch is in the Run position. A configuration exists which allows the user to select either an additional eight hours of data to be recorded after the START/RUN-OFF switch is placed in the OFF position, or to stop recording at the same time the START/RUN-OFF switch is turned to the Off position. The factory setting is to include the additional 8 hours of data. (See Configuration List Section 6.2.1.)

3.20 OPTIONS

3.20.1 IntelliSet



DURING START UP

Observe the MessageCenter during the power up process. If the unit is equipped with IntelliSet, the name of the active or modified IntelliSet will be displayed for approximately 10 seconds before the engine starts.

DURING OPERATION

Press the SELECT key to view current IntelliSet. You will be prompted to press either the "=" key or the UP or DOWN ARROW Key to scroll through list of IntelliSets. The current IntelliSet will have either the word ACTIVE or MODIFIED after it. MODIFIED indicates that one or more of the IntelliSet settings (other than set point) have been changed. To change MODIFIED to ACTIVE, press = key while the IntelliSet is shown in the MessageCenter.

The Advance Microprocessor offers over 48 parameters that may be set depending on the product being carried. IntelliSet allows the owner to pre-program specific product settings into the microprocessor and give the settings a name. The operator may then call up these settings by simply selecting the IntelliSet name.

For example: Apples may require continuous operation at 35°F (1.7°C) with a defrost every 3 hours while a load of cheese may require the same operation with set points ranging from 35°F to 42°F (1.7°C to 5.6°C) and a load of ice cream requires Start-Stop operation at -22°F (-30°C) with defrost at 12 hour intervals. The settings required for each product may be entered into the microprocessor and then locked so they cannot be changed. In the case of the cheese, the range of set points may be locked, leaving the operator the ability to change the set point within the locked range.

When a load of apples is going to be picked up, the operator simply selects "APPLES" from the IntelliSet menu; for cheese, "CHEESE" is selected ; for ice cream, "ICE CREAM" is selected. With each selection, the microprocessor automatically re-programs the settings to provide the best temperature control, fuel economy, and performance for that particular product.

NOTE

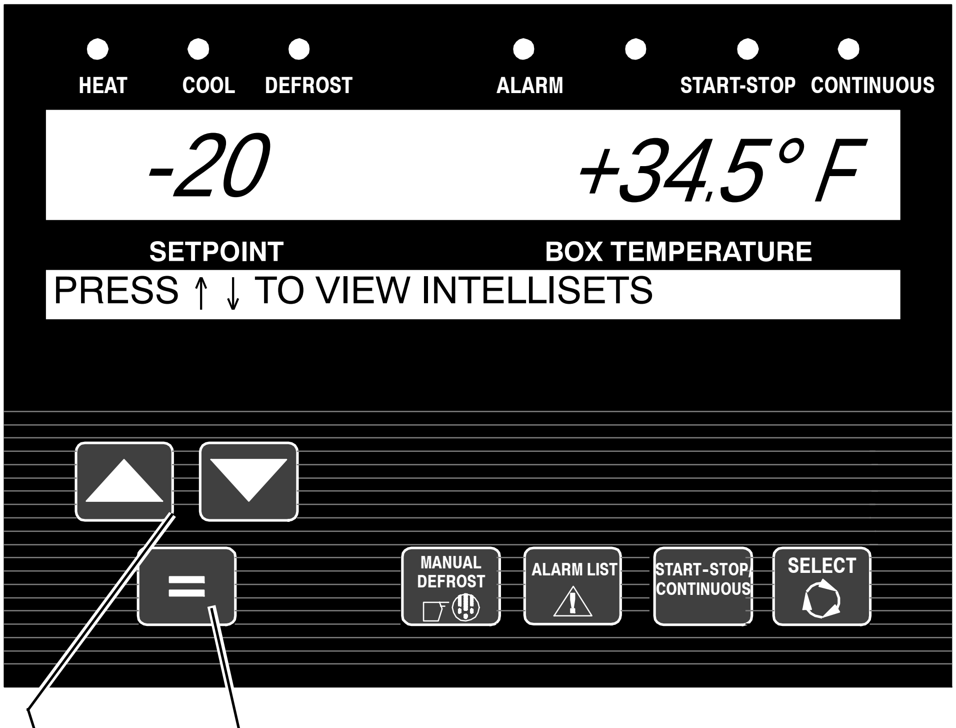
IntelliSet #31 is pre-programmed as "IntelliSleep" which allows Sleep Mode (See Section 3.8) to be entered by simply changing to that IntelliSet.

The ONLY way to exit from IntelliSleep is to select a different IntelliSet.

NOTE

The above settings are **examples** of possible settings. Factory IntelliSets are available from the Information Website through your authorized Truck/Trailer dealer.

a. Changing IntelliSets



1. PRESS = Key to display current IntelliSet. (Enable IntelliSet at = Key must configured ON. See Section 6.2.1.) If the = Key is not enabled, press the Select Key until the MessageCenter shows PRESS ↑ ↓ TO VIEW INTELLISETS.

2. Press the UP or DOWN ARROW key, to move through the IntelliSet List. The current IntelliSet will have either ACTIVE or MODIFIED to the right of the name.

3. To use a different IntelliSet or to change the current IntelliSet from “MODIFIED to “ACTIVE,” bring the IntelliSet you wish to use into the MessageCenter and press = Key.

3.20.2 DataTrak™ for Advance Microprocessors

DataTrak allows remote communication providers (cellular, satellite, etc) to request data from the Advance microprocessor and have it transmitted via their equipment to another location. This is typically done via the internet to any destination in the world. Some providers can also send commands via their equipment to the Advance microprocessor to change settings and the way the controller is operating the unit.

DataTrak is an optional feature. The DataTrak option is installed by inserting a DataTrak PC Card into the PC Card slot of the microprocessor and following the on-screen instructions on the keypad.

The DataTrak Option installation can be confirmed by scrolling through the Unit Data List (see Section 3.14). DataTrak will be listed under the Installed Options heading if it is installed.

Once DataTrak is installed, the Advance Microprocessor must be properly configured for the provider that will be connecting to it. This is done in the configuration list (see section 6.2.1.) The Satellite Com configuration can be set for “Qualcomm” or “Other”. If the provider is “Qualcomm” then this selection must be made. All other communications providers use the “Other” selection.

Carrier Transicold has worked with approved communication providers with recommended installation locations, and wiring connections to Carrier units. Instructions for installing this equipment is supplied by individual providers, and not by Carrier Transicold. Communications electrical harnesses and serial port splitters are available from Carrier Transicold Performance Parts Group (PPG).

Communication Providers will connect into the wiring harness at the SATCOM port, and possibly at the J1 connector. Testing the SATCOM port may be done using a serial port to PC cable (22-01690-00) and the ReeferManager program. If ReeferManager can communicate with the microprocessor the unit wiring and microprocessor are performing normally and any communication problem is with the provider’s equipment.

3.20.3 Two-Way Remote Communication

There are several different Telematics providers whose systems are approved for one-way or possibly two-way communications with Carrier Transicold Truck/Trailer/Rail refrigeration equipment. Current information on each of these systems is available on the Carrier Transicold TransCentral Information Center. Please visit www.transcentral.carrier.com.

3.20.4 AutoFresh Air Exchange

To activate AutoFresh operation, the AutoFresh Air Exchange configuration needs to be set (See Section 6.2.1). A second configuration, AutoFresh Air Delay, can be used to delay the start of AutoFresh operation by up to 48 hours after engine start-up.

Two functional parameters (See Table 3-3) are used to choose the type of fresh air exchange. The AutoFresh Air Exchange parameter is used to choose the type of fresh air control. The AutoFresh Air Control parameter is used to select the cycling of the assembly if CFM CONTROL has been set.

The air exchange rate can be adjusted from zero to the maximum at the microprocessor. Maximum rate is 50 CFM.

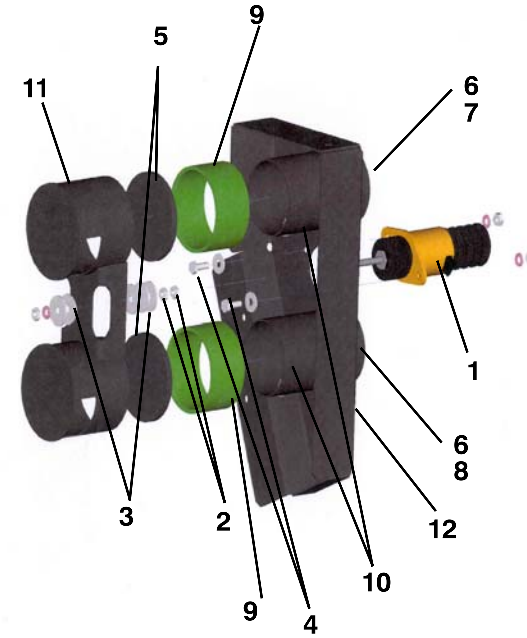
AutoFresh Air Exchange controls the amount of CFM exchanged based on a 20-minute duty cycle. The duty cycle timer is reset whenever the START/RUN-OFF switch is turned OFF, then back ON, or if the unit is shut down by either a Door or Remote switch shutdown.

When the ambient air temperature is below 36°F (2.2°C) and the AutoFresh Air Exchange functional parameter is set for OPEN, the AutoFresh Solenoid (AFAS) will always be closed for the last 15 seconds of each 20-minute time block and then reopen. Closing and opening the vent periodically prevents ice buildup from freezing the solenoid or air door into the open position.

The AutoFresh solenoid current draw is tested during Pretrip Test #2; however, it is a good idea for the technician to visually verify that the solenoid actually pushes the air assembly open, then closed again. This operation is visible from ground level, by looking up at the curbside of the unit. See Figure 3-2 and Figure 3-3.

With the introduction of unfiltered air into the refrigerated compartment, "dirty" air may be drawn into the air stream and be deposited onto the fan blades, reducing the airflow and ventilation. Periodically, the fan blades must be inspected and cleaned, if necessary, to maintain optimum air flow and air exchange performance.

ITEMS 6, 7 AND 8 ARE NOT ACTUALLY SHOWN . ONLY LOCATIONS ARE INDICATED.



1. Solenoid
2. Jam Nut
3. Washer
4. Cap Screw
5. Gasket
6. Hose Clamp
7. Inlet Hose
8. Outlet Hose
9. Sleeve
10. Push-In Fastener
11. Rail Cap Assembly
12. Rail Bracket Assembly

Figure 3-1. AutoFresh Air Exchange

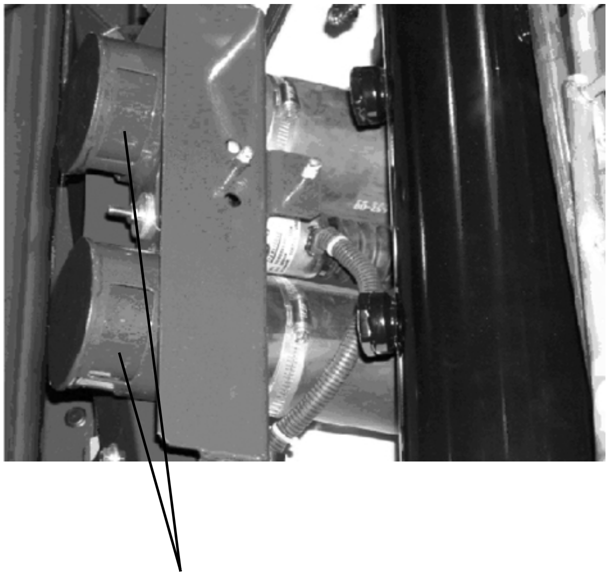


Figure 3-2. AutoFresh in Closed Position

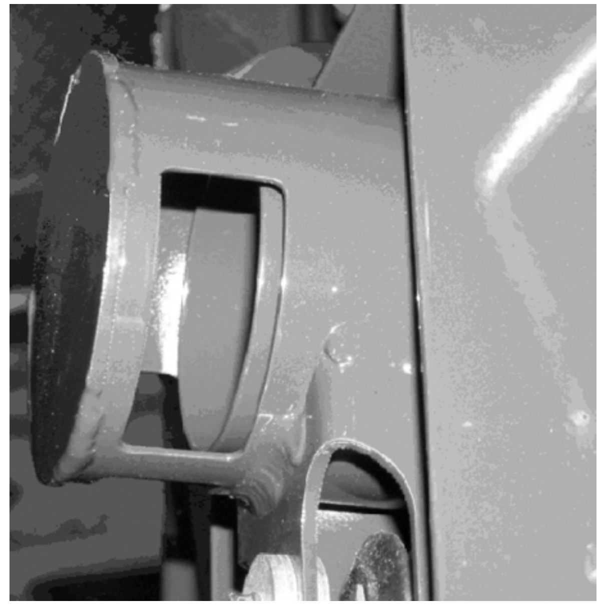


Figure 3-3. AutoFresh in Open Position

SECTION 4

ENGINE

PARAGRAPH NUMBER **Page**

4

SECTION 4

ENGINE

4.1 INTRODUCTION

This section describes the engine operation and the refrigeration system running modes known as automatic Start-Stop and Continuous Run.

4.2 ENGINE START-UP

4.2.1 Engine Cranking

When the starting conditions are met the start sequence will begin by fully closing (0% Open) the Compressor Suction Modulation Valve (CSMV). The CSMV will then open. When it reaches 30% the starting sequence continues by energizing the Run and Clutch relays, along with the solenoid valve (SV2) and both unloaders (UL1 and UL2.) After 5 seconds the Glow Plug Relay (GPR) will energize to supply power to the glow plugs and the buzzer will sound for 5 seconds before the starter is energized. On initial power-up, there will be a 5 second delay before the starting sequence begins. If the required glow time is zero (warm engine, short glow time), the microprocessor will energize the starter after a 5 second delay. The engine will crank for a maximum of 10 seconds or until the engine is "running". The glow relay will also be de-energized at the same time the starter disengages. If the engine does not start, a 15 second rest period will elapse before the next start attempt. The Run Relay, Clutch Relay, both unloaders and SV2 will remain energized and CSMV will remain in pre-start position until the next starting sequence.

Before beginning another starting sequence, the oil pressure is checked to determine if the engine is running or the RPM sensor has failed. For the second and third start attempts the glow time is increased by 5 seconds over the glow time of the first attempt listed below. The microprocessor allows three start attempts (without the engine starting) before the starting is locked out and the Failed To Start – Auto Mode alarm is activated.

NOTE

If the Engine Coolant Temperature Sensor alarm is Active, the glow time for temperatures less than 32°F (0°C) will be used.

4.2.2 Variable Glow Time

The glow time for the first start attempt will vary in duration based on engine coolant temperature and how the microprocessor is configured: Short or Long as follows:

Table 4-1. Glow Time

Engine Coolant Temperature	Glow Time in Seconds	
	Short (Default)	Long
Less than 32°F (0°C)	15	55
33°F to 50°F (1°C to 10°C)	10	40
51°F to 77°F (11°C to 25°C)	5	25
Greater than 78°F (26°C)	0	10

The second start attempt has five seconds of glow time added to the time shown in the table. The third start attempt will have 10 seconds added. If the coolant temperature sensor is defective, the microprocessor assumes a temperature of less than 32°F (0°C) for the glow timing.

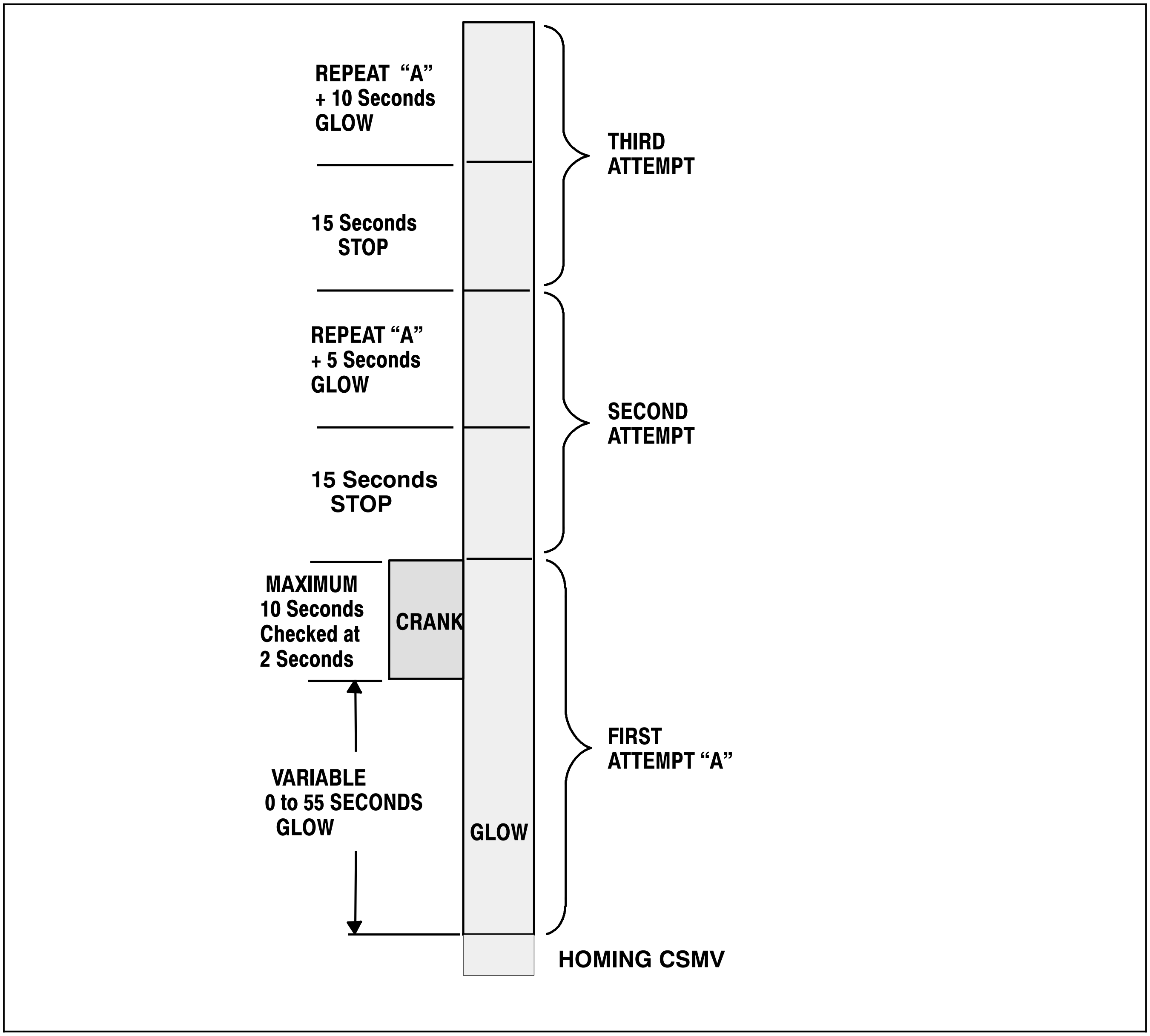


Figure 4-1. Auto Start Sequence

4.2.3 Engine Running

The engine is considered to be running when:

a.Engine RPM are greater than 1000, and

b.The engine oil pressure switch contacts are closed within 15 seconds of the engine starting.

OR if the RPM sensor is not reading correctly, and the engine is being started for the second or third attempt, the engine is considered to be running when:

a.For ambient temperatures at or above 32°F (0°C) the engine oil pressure switch contacts are closed.

b.For ambient temperatures below 32°F (0°C) the alternator charging amps are more than 2 amps.

NOTE

If either of these two cases occurs, alarm 130 - CHECK ENGINE RPM SENSOR will be activated.

NOTE

While the starter is engaged, if the engine speed is less than 50 RPM for more than 3 seconds, the SSR will de-energize to stop the starter.

4.2.4 Initial Engine Operation

If a unit is started when the Engine Coolant Temperature is 79°F (26°C) or below, after the engine starts, the unit will immediately go to low speed 4 cylinder operation until the water temperature reaches 79°F (26°C) or for a minimum of 15 seconds. The CSMV will control suction pressure to 78 PSIG (5.3 Bars) Max. during low speed 4 cylinder operation. (Refer to Chart, Section 5.18). Once the water temperature is greater than 79°F (26°C), the unit will run at high speed 4 cylinder operation and the CSMV will control to a maximum suction pressure of 42 PSIG (2.9 Bars). (Refer to chart). When the RAT reaches 50°F (10°C), the unit will go to 6 cylinder cool operation and the CSMV will control to a maximum suction pressure of 27 PSIG (1.8 Bars). The unit will continue in high speed 6 cylinder cool until the controlling temperature is 3.2°F (1.8°C) away from setpoint. The microprocessor will then follow the operating sequence logic on Figure 5-2.

4.3 RUNNING MODES

Two running modes are possible: automatic Start-Stop and Continuous Run modes. The user can toggle between the two modes by pressing the appropriate key on the keypad. (Refer to Sections 3.6 and 3.7.)

NOTE

The microprocessor may be locked so that the unit will always operate in Start-Stop whenever the set point is within a specific range. Refer to Range Lock (Section 5.15) and ProductShield (Section 5.16) for additional information.

4.3.1 Start-Stop Mode

Start-Stop mode is provided to allow fuel-efficient control of refrigerated compartment temperature, while insuring that the refrigerated compartment temperature does not drift too far away from set point. When the refrigerated compartment temperature gets close the set point, the refrigeration system will shut off. This allows the diesel engine to shut down, saving fuel. As the refrigerated compartment temperature drifts away from set point, the refrigeration system and the engine will turn back on.

a. Start-Stop Mode Cycle Off Conditions

Whenever the unit starts in Start-Stop Mode, it will continue to run until all five of the following criteria have been satisfied.

1) The refrigerated compartment temperature is near set point.

After the Minimum Run Time expires, the unit will go into an Off Cycle when the compartment temperature is within ±0.5°F (±0.3°C) of setpoint for set points in the Perishable range or is less than +0.5°F (+0.3°C) above set point for set points in the Frozen range.

2) The unit has run for the Minimum Run Time.

The Minimum Run Time is selected in the microprocessor Functional Parameter List. (Refer to Section 3.16). The default setting is 4 minutes. 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 set point.

3) The engine coolant temperature is above 122°F (50°C).

The engine coolant temperature is above 122°F (50°C). If the unit can not cycle off, it will operate as if in Continuous Run mode. The engine coolant temperature will override the minimum off time and out-of-range condition to force engine restarting when the engine coolant temperature drops below 34°F (1°C). If the engine coolant sensor alarm is active and the ambient temperature is above 32°F (0°C), the engine coolant temperature will be ignored for the OFF cycle. If the engine coolant sensor alarm is active and the ambient temperature is below 32°F (0°C) or the ambient temperature sensor alarm is also active, the unit will run for a minimum of 20 minutes before allowing an OFF cycle.

4) The battery voltage is high enough

Provisions are made to sense when the battery voltage is correct. A good battery is defined as having 13.4 VDC at 75°F (23.9°C). This voltage varies with ambient temperature.

5) The battery charging amps are low enough

Provisions are made to sense when the battery charging amps are low enough to indicate that the battery is sufficiently charged. The battery is sufficiently charged when the charging rate is below that selected in the Configuration List. The selectable range is 1.0 to 10.0 amps in 0.5A increments. The factory setting is 6.5 Amps. (See Section 3.6.2).

NOTE

When conditions 3) thru 5) are met, “OK” will appear in the Unit Data List for battery voltage.

b. Start-Stop Mode Cycle On Conditions

A restart will be initiated when one of the following conditions occurs:

1) Normal restart 1: The Refrigerated Compartment Temperature Has Exceeded Selectable Override Temperature

The microprocessor continually monitors the refrigerated compartment temperature during the Minimum Off Time. The unit will restart if the refrigerated compartment temperature goes beyond the Override Temperature (above or below set point in the Perishable range or above set point in the Frozen range). The Minimum Off Time and the Override Temperatures are selected in the microprocessor Functional Parameter List (Refer to Section 3.17). The default value is 20 minutes for the Minimum Off Time and 11.0°F (6°C) for the Override Temperature.

2) Normal restart 2: The Refrigerated Compartment Temperature Has Exceeded Standard Override Temperature

After the Minimum Off Time has expired, the microprocessor continually monitors the refrigerated compartment temperature. If the refrigerated compartment temperature goes more than +3.6°F(+2.0°C) away from set point (above or below set point in the Perishable range or above set point in the Frozen range), the unit will restart. The Minimum Off Time is selected in the microprocessor Functional Parameter List (Refer to Section 3.17). The default setting is 20 minutes.

3) Engine coolant temperature drops below 34°F (1°C).

If the Engine Coolant Temperature drops below 34°F (1°C), the unit will restart, and will run until all conditions for shutdown are met.

If Alarm 129 CHECK ENG COOLANT SENSOR is active, the unit will restart if the ambient air temperature drops to 32°F(0°C) after the unit has been in the OFF cycle for 60 minutes. If the unit restarts due to this condition, the Minimum Run Time will be at least 20 minutes, regardless of the setting in the Functional Parameter list.

4) Battery voltage falls below voltage selected in the configuration list. (See Section 6.2.1)

The selectable range is between 12.0 to 12.8 VDC. The factory setting is 12.2 VDC.

TIP

While the unit is running, the status of the unit battery can be readily checked by reading the Battery Voltage in the Data List. If “O.K.” appears after the voltage reading, battery volts is sufficient to allow the unit to cycle off. If “O.K.” does not appear, this condition has not been met, and the unit is not ready to cycle off.

5) The Maximum Off Time has expired.

In some ambient conditions, there are times when the unit may be off for very long periods of time. To ensure that the load stays within safe temperature ranges, the Maximum Off Time may be used to force the unit to restart regardless of any change in refrigerated compartment temperature. Maximum Off Time is selected in the microprocessor Functional Parameter List. The default setting is OFF.

NOTE

The unit may remain in low speed for some time after engine start-up when in the Start-Stop Mode due to the High Speed Delay Functional Parameter. The High Speed Delay is selected in the microprocessor Functional Parameter List (Refer to Section 3.17). The default value is 10 minutes.

c. Start-Stop Indicator

To indicate that the unit is in the Start-Stop mode, the Start-Stop LED indicator on the keypad will be illuminated.

d. Failed To Start – Auto Mode

If the unit fails to start after three start attempts, the Alarm A31 –FAILED TO START–AUTO MODE will appear in the MessageCenter, and the Alarm LED on the Keypad will flash on and off once a second.

NOTE

X2 units only – During a Start–Stop OFF cycle, the micro continues to monitor the ambient air temperature. If the ambient air temperature rises to115°F (46°C), SV4 will energize for 45 seconds to equalize the refrigeration system pressures. This will occur only once during an Off Cycle, but may be repeated during subsequent Off Cycles.

4.3.2 CONTINUOUS RUN MODE

In the Continuous Run mode, the engine will not shut down except for shut down alarms or if the engine stalls. Continuous Run mode is normally used for fresh produce and other temperature sensitive product loads. The Start-Stop /Continuous key is pressed to switch between Continuous Run and Start-Stop operating modes.

NOTE

The microprocessor may be locked so that the unit will always operate in Start–Stop or in Continuous Run whenever the set point is within a specific range. Refer to Section 5.15 – Range Lock for additional information.

NOTE

The unit will remain in low speed until the engine coolant temperature reads 79°F (26°C) in Continuous Run Mode. High Speed Delay can be changed from OFF or from 1 to 255 minutes. Refer to Functional Parameters in Section 3.16.

4.4 SPEED CONTROL OVERRIDES

NOTE

With the complex control systems in use with the Advance Microprocessor, there are many different reasons the engine may be operating in either High Speed or Low Speed besides how far the refrigerated compartment temperature is away from set point. This section lists the different factors that determine the speed of the engine, in the order of their priority.

Speed Control Solenoid Overrides in priority order:

a. High Ambient:

If ambient temperature is 120°F (48.9°C) or above, the unit will run in low speed for a minimum of 2 minutes and until the ambient drops below 110°F (43.3°C). *This applies to Heat and Cool modes only - not Defrost.*

b. Low Suction Pressure/High Discharge Pressure:

If UL1 has been energized (unloaded) and the suction pressure is less than 0 PSIG/Bar for at least 30 seconds or the discharge pressure is greater than 435 PSIG (29.6 Bars) for more than five seconds, the engine will be forced to run in low speed for a minimum of five minutes. After five minutes, the engine can return to high speed if suction pressure is greater than 5 PSIG (0.34 Bar) for 30 seconds or discharge pressure is less than 410 PSIG (28.0 Bar) for 30 seconds.

c. Low Speed Engine Coolant Warm-up:

If engine Coolant Temperature Sensor Alarm is not active the engine will run in low speed until the coolant is above 79°F (26°C).

The engine will run in low speed (while the engine warms up) until the coolant is above 79°F (26°C).

d. Defrost:

The unit Is generally in High Speed but will run in low speed during Stage 1 (pump-down mode) of High Ambient Defrost. It will also run at low speed at the end of the defrost cycle when the clutch is re-engaged

e. Door/Remote Switch Configurable for Low Speed Alarm:

The unit will be forced into low speed if the (optional) door switch, Remote Switch 1, or Remote Switch 2 alarm is active and is configured for the unit to operate in Low Speed when the door is open

f. Cargo Protect Mode:

If the setpoint is in the frozen range i.e. below +10.4°F (-12°C), and both RAT and SAT sensor alarms are active, the unit will run in low speed cool.

g. Frozen Setpoint:

If the setpoint is in the frozen range i.e. below +10.4°F (-12°C), and the refrigerated compartment temperature is below setpoint, the unit will run in low speed

h. High Air Flow:

For Perishable setpoints, the AIR FLOW Functional Parameter will force the unit to operate in continuous High Speed operation when AIR FLOW: HIGH is selected. (When AIR FLOW: NORMAL is selected, the unit will cycle normally between high and low speeds.) High Air is NOT available for setpoints in the frozen range i.e. below +10.4°F (-12°C).

i. Product Shield High Air:

The engine is forced to High Speed if Product Shield High Air Configuration is set to "ON" and the ambient temperature falls outside the selected range and the temperature difference between the supply air and the return air is greater than the selected value (Refer to Section 5.16 for more information on Product Shield).

j. Adjustable High Speed Delay on Engine Start-up:

Whenever the engine starts, the unit will remain in low speed according to the selection made in the Functional Parameter list for High Speed Delay for Continuous or Start-Stop modes. A different setting is allowed for each mode. (Refer to Functional Parameters, Section 3.16. for additional information)

k. Start-Stop Frozen Range:

In Start-Stop Mode with the setpoint in the frozen range i.e. below +10.4°F (-12°C) and minimum run time has expired and the refrigerated compartment temperature is not yet down to setpoint, the engine will be forced to high speed operation.

l. High Speed Delay: When operating in low speed, there is a delay when switching to high speed. The default delay is one minute. Refer to Configuration Mode, Section 6.2.

Whenever the unit is operating in low speed, there may be a delay before switching to high speed. This delay is selected in the Configuration List. (Refer to Configuration Mode, Section 6.2.)

SECTION 5

TEMPERATURE CONTROL

SECTION 5

TEMPERATURE CONTROL

5.1 INTRODUCTION

Temperature control is achieved by controlling engine speed, compressor UL1 and UL2 unloaders, and solenoid valves (SV1, SV2, SV4, and the CSMV).

Temperature control attempts to maintain the compartment temperature at the chosen set point. At times the compartment temperature may not be equal to the set point. This may be due to:

- the unit is still in the process of pulling down or up to set point OR
- the unit is in Start-Stop OFF mode
- the unit has recently terminated defrost
- the compartment door is open
- the product was not at set point when loaded

5.2 PERISHABLE AND FROZEN SET POINT RANGES

There are two ranges defined for set point.

a. Setpoints above +10.4°F (-12°C) are considered Perishable.

b. Setpoints of +10.4°F (-12°C) or below are considered Frozen.

	Perishable	Frozen
Temperature Control	When the compartment temperature is near setpoint, the unit will cycle from Heat to Cool to Heat to maintain temperature.	When the compartment temperature is near setpoint, the unit will operate in Cool with UltraFreeze operating at compartment temperatures more than 3°F (1.7°C) below setpoint.
High Air Flow	Continuous High Air Functional Parameter is Available ProductShield High Air is Available	Continuous High Air Flow is not allowed when the compartment temperature is less than 3.2F (1.8C) above setpoint. ProductShield High Air is available.
Start/Stop Off Cycle	Compartment temperature criteria is satisfied when the temperature is 0.5°F (0.3°C) above or below setpoint.	Compartment temperature criteria is satisfied when the temperature is within 0.5°F (0.3°C) above setpoint.
Start/Stop Restart	Unit will restart when compartment temperature is above or below setpoint by the restart value. Restart value during the Minimum Off Time is the Override Temperature selected in the Functional parameter list. Restart value following the Minimum Off Time is 3.6F (2.0C).	Unit will restart when compartment temperature is above setpoint by the restart value. Restart value during the Minimum Off Time is the Override Temperature selected in the Functional parameter list. Restart value following the Minimum Off Time is 3.6F (2.0C).
Cargo Protect Mode (Both RAT and SAT sensor alarms are active.)	Unit will shut down.	Unit will operate in low speed six cylinder cool.

5.3 PULLDOWN / PULL-UP MODE

During pulldown mode the unit will run in high speed and high speed capacity (unless there is a high speed override – Refer to Section 4.4)

5.3.1 Pulldown or Pull-up will be initiated in any of the following conditions:

a. At engine start

b. Set point change

c. Operational mode change such as: Start-Stop, Continuous Operation

d. Defrost termination

e. If the system is running in Start-Stop Run Mode, the minimum run time has expired, and other conditions for shutdown are met except that the compartment temperature has not reached set point.

f. Pretrip termination

5.3.2 Pulldown or Pull-up will end in the following conditions:

a. For Continuous Run Mode:

•When the RAT and SAT are equally spaced above and below set point AND ($\frac{\text{SAT - RAT}}{2}$) equals set point for set points below 65°F (18.4°C), AND both supply and return air sensors are good.

b. For START-STOP Mode:

When the selected Control Probe Temperature is within ± 0.5°F (0.3°C) of set point.

NOTE

When the system leaves Pulldown (COOL) or Pull–up (HEAT) modes, it will enter UltraFresh 3 temperature Control Mode (see Section 5.6) when the set point is between +10.4°F and 65°F (–12°C to 18.4°C). For set points at or below +10.4°F (–12°C), the unit will operate in COOL and UltraFreeze (see Section 5.6). For set points above 65°F (18.4°C), the unit will operate in COOL, HEAT and PULSED NULL modes but will not operate in UltraFresh 3.

5.4 HEAT MODE OPERATION

In HEAT Mode, the microprocessor will operate the unit controls as follows:

SV1	SV2	SV4	Engine Speed	Clutch Output	UL1	UL2	CSMV
CLOSE	Refer to SV2 Operation	OPEN	Refer to Section 5.10	ENGAGE	Refer to UL1 Operation	Refer to UL2 Operation	100% Open

HEAT mode is not used for frozen set points.

5.5 COOL MODE OPERATION

In COOL Mode, the microprocessor will operate the unit controls as follows:

SV1	SV2	SV4	Engine Speed	Clutch Output	UL1	UL2	CSMV
OPEN	OPEN	CLOSE	Refer to Section 5.10	ENGAGE	Refer to UL1 Operation	Refer to UL2 Operation	Refer to CSMV Control

NOTE

The CSMV maintains the maximum suction pressure of the refrigeration system. The selected controlling sensor determines if the unit is running in high speed or low speed and six or four or two cylinders. The controlling sensor may be RAT or SAT depending if the the microprocessor is configured for Return Air Control or Supply Air Control. Refer to Chart in Section 5.18 for maximum suction pressure limits during each mode of operation in Cool Mode.

5.6 UltraFresh 3 TEMPERATURE CONTROL

UltraFresh 3 is an advanced method of temperature control for set points in both Perishable and Frozen ranges. It produces a reduced capacity state by: throttling down the CSMV and pulsing the SV4 valve (SV4 Pulse Mode), or mixing heating and cooling modes (Pulsed Null Mode).

UltraFresh 3 uses the supply or return air sensor to control compartment temperature, while insuring that the supply air temperature does not get too cold when a perishable set point is chosen.

The sensor that is selected under the Functional Parameters for temperature control is shown below as the selected probe. The Temperature Control Probe is the sensor actually used by the microprocessor to perform the temperature control. In the case of a bad probe, the remaining probe will be used for temperature control. If both probes are bad the unit will run in Cargo Protect Mode.

SELECTED PROBE	TEMPERATURE CONTROL PROBE
Return Air Sensor	Return Air Sensor - for perishable and frozen set points
Supply Air Sensor	Supply Air Sensor for perishable set points
	Return Air Sensor for frozen set points

5.6.1 Heat/Cool/Null Switching Operation

There are three possible modes for UltraFresh 3 control temperatures. These are HEAT, COOL and NULL. (Refer to Sections 5.4 and 5.5 for descriptions of HEAT and COOL modes.) When not in pulldown, UltraFresh 3 controls the unit based on the following: (Refer to the temperature control operating sequence diagrams).

a. To exit NULL and enter COOL while in Continuous Run, the control temperature must be greater than or equal to 3.6°F (2°C) above set point.

b. To exit NULL and enter COOL while in Start-Stop, the control temperature must be greater than or equal to 1.8°F (1°C) above set point.

c. To exit COOL and enter NULL while in either Continuous Run or Start-Stop, the control temperature must be less than 1.5°F (0.8°C) above set point.

d. To exit NULL and enter HEAT, the control temperature must be more than or equal to 1.8°F (1°C) below set point.

e. To exit heat and enter NULL the control temperature must be less than 1.5°F (0.8°C) below set point.

5.6.2 Null Mode Operation

Null Band consists of:

a. Pulsed Null Mode Operation

Reduced capacity is produced between the HEAT and COOL Modes by a mode known as Pulsed-Null. This mode is not a constant operating mode, but only operates for a few seconds at a time. During Pulsed-Null, the HEAT and COOL valves are opened simultaneously to reduce either the heating or cooling capacity. In the Null Mode (Refer to the following charts), the unit will pulse between COOL and NULL, or HEAT and NULL in 10 second increments. The capacity in the NULL Mode is varied by adjusting the pulse rate.

- **Cool Mode**

SV1	SV2	SV4	Engine Speed	Clutch Output	UL1	UL2	CSMV
OPEN	OPEN	CLOSED	LOW	ENGAGE	UNLOAD	UNLOAD	Refer to CSMV Control

- **Null Mode**

SV1	SV2	SV4	Engine Speed	Clutch Output	UL1	UL2	CSMV
OPEN	OPEN	OPEN	LOW	ENGAGE	UNLOAD	UNLOAD	Refer to CSMV Control

- **Heat Mode**

SV1	SV2	SV4	Engine Speed	Clutch Output	UL1	UL2	CSMV
CLOSED	Refer to SV2 Opera-tion Section 5.14	OPEN	LOW	ENGAGE	UNLOAD	UNLOAD	Refer to CSMV Control

Pulsed Null Mode operation will modify the length of each Mode in 10 second cycles. That is, if the unit is in the COOL NULL Pulse band, the unit may run in COOL for up to nine seconds, then NULL for one second, if the Control Temperature is away from set point. As the Control Temperature comes closer to set point, the length of COOL time will decrease, and the amount of NULL time will increase. However, the combination of the two will always equal 10 seconds. The same is true for the HEAT NULL Pulse band.

b. CSMV Control:

The CSMV will automatically go to 30% when it enters Ultra Fresh 3 at 1.5°F (- 0.8°C) above set point. The CSMV will usually control between 30% and 4% depending on the controlling probe and Suction Pressure. However, it can go above 30% for short periods of time. For example, high ambients and low set points may cause the CSMV to open higher than 30%.

5.7 UltraFreeze TEMPERATURE CONTROL

For frozen setpoints, a modified UltraFresh 3 temperature control is used to keep the unit from over cooling and driving the box temperature far below setpoint. UltraFreeze operates similar to UltraFresh 3 except as noted in this section. UltraFreeze control will be used anytime a frozen setpoint is selected in both continuous and start/stop operation. When UltraFreeze is active it is normal to hear the refrigerant solenoid valves energize and de-energize every few seconds.

5.7.1 UltraFreeze Offset

In UltraFreeze the unit will control the box temperature between setpoint and up to 3° F (1.6° C) below setpoint while the unit is running.

5.7.2 UltraFreeze Start/Stop

In start/stop operation the micro will control to setpoint by cycling the unit off when the box temperature is within 0.5° F (0.3° C) of setpoint. Should the unit be required to continue to run after the box temperature is satisfied - due to either low battery voltage or low engine coolant temperature - the UltraFreeze logic will control to the 3° F (1.6° C) below set-point offset until all conditions for an off cycle are met and the unit cycles off.

For frozen set points, a modified UltraFresh 3 temperature control is used to keep the unit from over cooling and driving the compartment temperature far below set point. Except as noted in this section UltraFreeze operates the same as UltraFresh. UltraFreeze control will be used anytime a frozen set point is selected in either continuous or Start-Stop operation.

5.8 FreshProtect™ SUPPLY AIR CONTROL

FreshProtect operates between set points of +32.0°F (0° C)and 65.1°F (18.4° C) **only**.

When the unit is operating in Start-Stop, FreshProtect is only functional after the Return Air Temperature is within 0.5 °F of set point, and criteria for shutdown other than compartment temperature has not yet been reached.

When the unit is operating in **Continuous Run**, FreshProtect becomes functional once the Return Air Temperature (RAT) is approximately 10°F (5.6°C) above setpoint.

NOTE

FreshProtect only operates when the unit is set for Return Air Control. (See Table 3-3 for more information on setting controls.) It does not operate when the unit is in Supply Air Control nor when the unit is in Heat or Defrost cycles.

FreshProtect places a flexible limit on how far below setpoint the SAT can drop while the unit is operating in Cool Mode. Table 4-2 below shows the functional parameter settings and the corresponding ranges below setpoint that the Supply Air Temperature can go, when the RAT is 10°F (5.6°C) or less above setpoint. Whenever the RAT is more than 10°F (5.6°C) above setpoint, it is possible for the SAT to be lower than the shown range since the air temperature within the cargo area is a considerable distance from its desired point and additional cooling capacity is required.

Table 4-2: FreshProtect
For Return Air Temperatures less than 10°F (5.6° C) above set point.

FreshProtect Setting	Supply Air Range (Below Setpoint)
A	2 TO 5°F (1.1 TO 2.8°C)
B	4 TO 7°F (2.2 TO 3.9°C
C	6 to 9°F (3.3 TO 5.0° C
D	8 to 11°F (4.4 TO 6.1 ° C
E	10 to 13°F (5.6 TO 7.2° C)
OFF	NO LIMIT

The process of refrigeration causes the cargo area air to be drawn into the Return Air inlet of the evaporator section. From there it is directed through the evaporator coil, where it is cooled off, then discharged through the Supply Air blower housing, and back into the cargo area. The warmer the Return Air temperature is in relationship to setpoint, the more cooling capacity is needed to bring the air temperature down to setpoint. As cooling capacity is increased, the Supply Air temperature drops, as additional heat is removed from the air. If left uncontrolled, the Supply Air temperature can fall as much as 20°F (11.1°C) or more below the Return Air temperature.

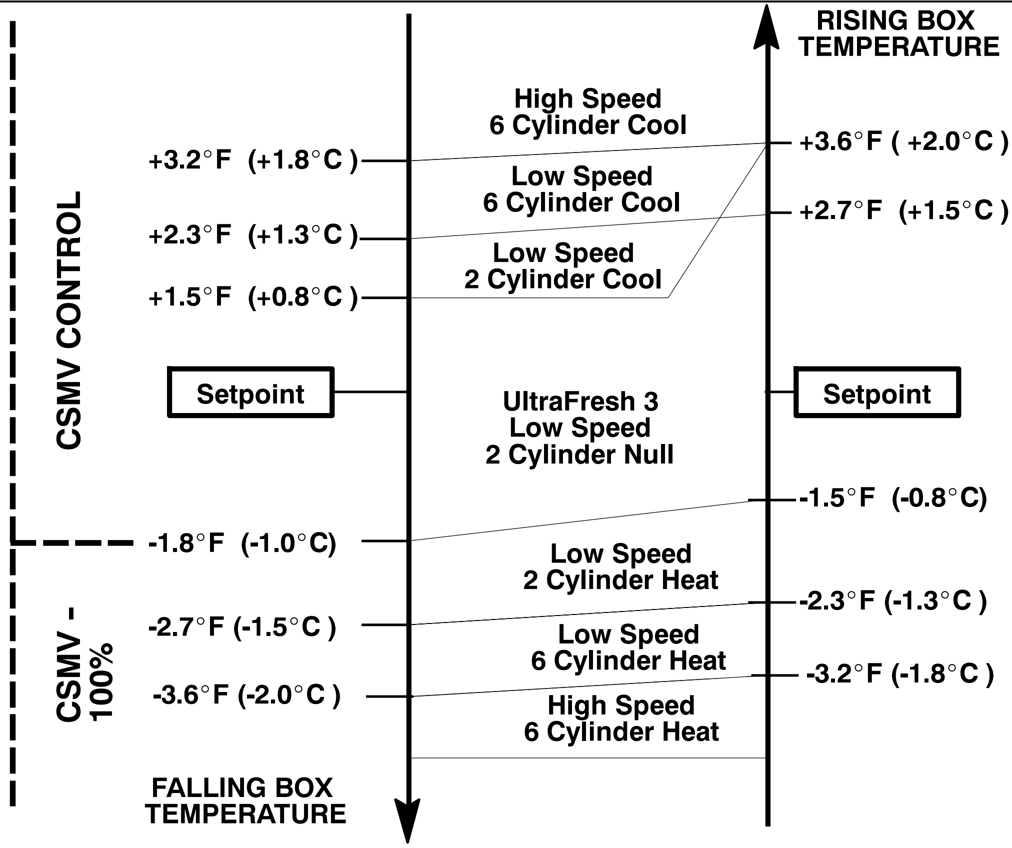
When the RAT approaches setpoint, the SAT will also approach setpoint. The SAT may then be closer to setpoint than shown in Table 4-2.

When FreshProtect is set for OFF, the system runs with FreshProtect off, and the SAT will operate as far below setpoint as needed to bring the RAT to setpoint as quickly as possible. All other FreshProtect settings enable FreshProtect Supply Air Temperature control, and the controller watches the Supply Air Temperature as well as the Return Air Temperature while the system is operating in the Cool Mode.

5.9 CARGO PROTECT MODE

When both the return air sensor (RAT) alarm and the supply air sensor (SAT) alarm are active, the unit will enter Cargo Protect Mode for temperature control. When the set point is in the frozen set point range, the unit will run low speed loaded cool. WARNING:NO TEMP CONTROL will be displayed in the MessageCenter. The unit will shutdown when the set point is in the perishable range. (See section 5.2 for definition of perishable & frozen set points).

Note: The following temperature control operating sequence diagrams are after pulldown and do not show overrides.



Note: System can change from Low Speed 2 Cylinder Cool to Low Speed 6 Cylinder Cool when the box temperature rises. However, once the unit enters UltraFresh 3 Mode, it will remain in that mode until the box temperature rises to 3.6° F (2.0° C) above setpoint at which point it will go to High Speed 6 Cylinder Cool

Figure 5-1. Continuous Run Temperature Control Operating Sequence - Perishable Range

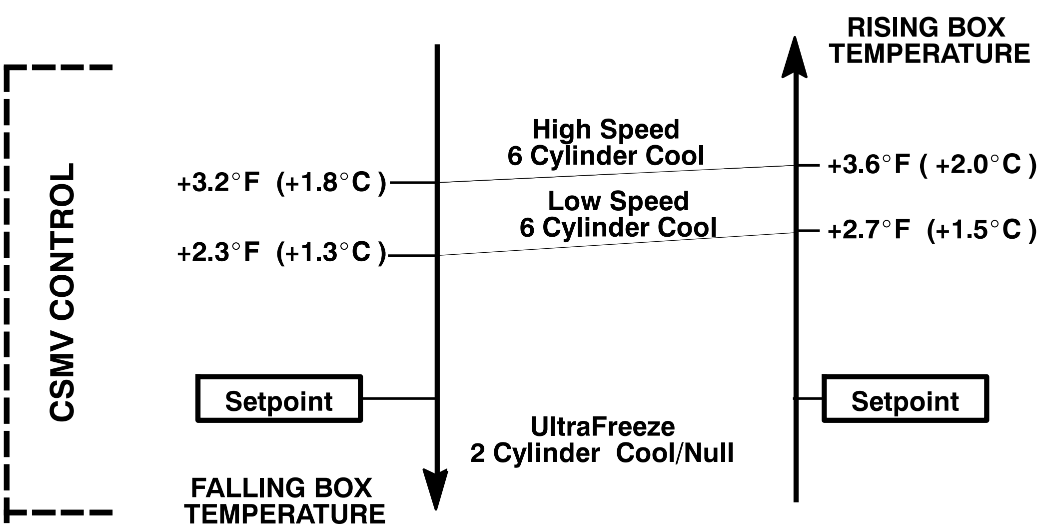
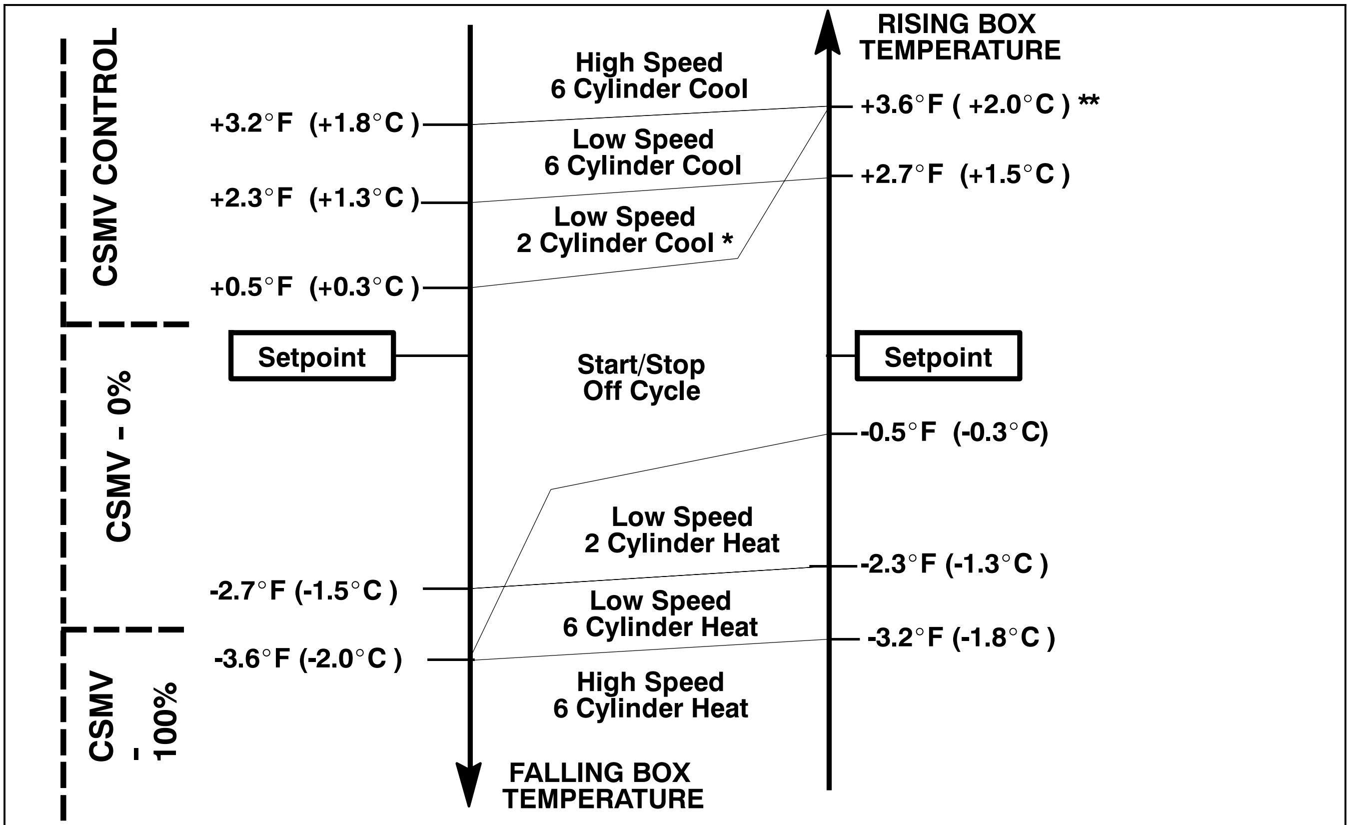


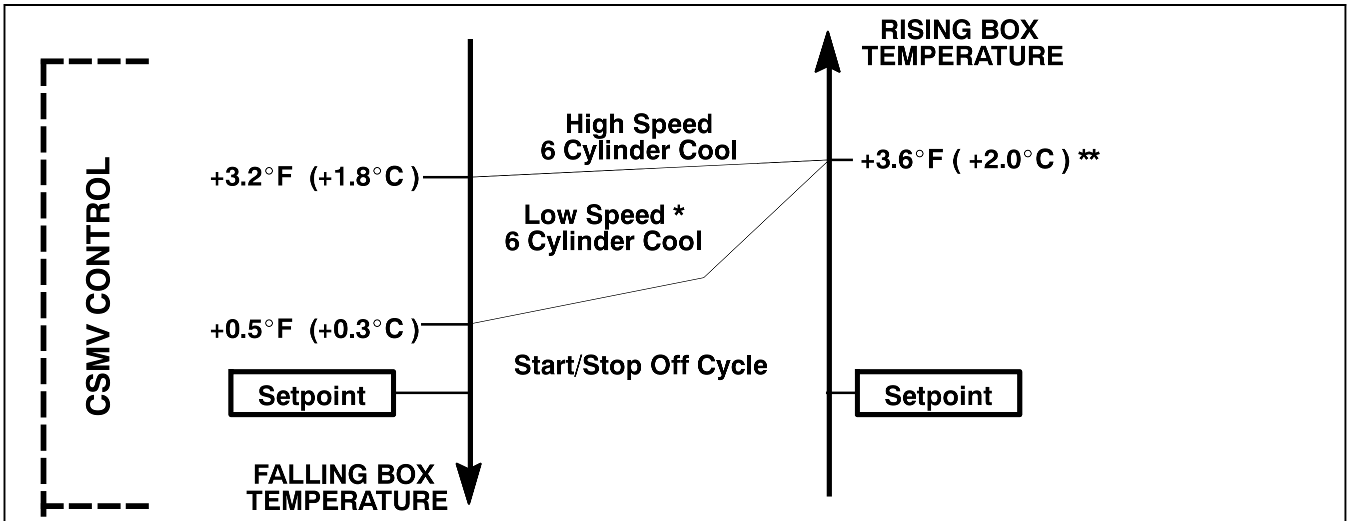
Figure 5-2. Continuous Run Temperature Control Operating Sequence - Frozen Range



*** Once the Minimum Run Time has expired, the compressor will operate in 6 cylinders, depending on suction pressure**
**** During the Minimum Off Time, the unit will restart at Override Temperature selected in the Functional Parameter List.**

Note: System can change from Low Speed 2 Cylinder Cool to Low Speed 6 Cylinder Cool when the box temperature rises. However, once the unit enters UltraFresh 3 Mode, it will remain in that mode until the box temperature rises to 3.6° F (2.0° C) above setpoint at which point it will go to High Speed 6 Cylinder Cool

Figure 5-3. Start-Stop - Temperature Control Operating Sequence - Perishable Range



*** Once the Minimum Run Time has expired, the compressor will operate in 6 cylinders, depending on suction pressure**

**** During the Minimum Off Time, the unit will restart at Override Temperature selected in the Functional Parameter List.**

Figure 5-4. Start-Stop - Temperature Control Operating Sequence - Frozen Range

5.10 ENGINE SPEED OPERATION

The engine will operate the compressor at two different speeds (low and high). Speed Control is based on the differences of Controlling Temperature and set point as follows:

Mode	HIGH SPEED	LOW SPEED
COOL	Control Temp is more than 3.6°F (2.0°C) above setpoint	Control Temp is less than 3°F (1.8°C) above setpoint
HEAT	Control Temp is more than 3.6°F (2.0°C) below setpoint	Control Temp is less than 3°F (1.8°C) below setpoint
NULL	No	Always

NOTE

For X2 units only - When the ambient air temperature reaches 120°F (48.9°C), the engine will go to low speed for a minimum of two minutes, and until the ambient air temperature drops below 110°F (43.3°C).

5.11 DEFROST

Defrost is an independent cycle overriding cooling and heating functions in order to de-ice the evaporator as required. When the unit is in Defrost, the DEFROST LED will be on, the MessageCenter will display DEFROST CYCLE STARTED for the first 5 seconds, then the default message will be displayed for the rest of the Defrost Cycle. The compartment temperature section of the Main Display will show "dF". The set point will continue to be displayed on the left side. Compartment temperature will not be displayed during Defrost. The CSMV will always be 100% open during Defrost Mode.

NOTE

The unit will operate in high speed in the defrost mode except during pump down in high ambient defrost.

5.11.1 Evaporator Temperature Criteria For Defrost

Before a defrost cycle can be initiated, DTT (Defrost Termination Temperature sensor) and SAT (Supply Air Temperature sensor) must be below 40°F (4.4°C) OR SAT must be below 45°F (7.2°C). If the DTT2and SAT alarms are active, then the RAT (Return Air Temperature sensor) must be below 45°F (7.2°C).

5.11.2 Defrost Initiation

When one of the applicable criteria is met, defrost may be initiated by any of four different methods:

a. Defrost Interval Timer: The microprocessor contains an internal Defrost Timer (adjustable in the Functional Parameter list) which can be set using the keyboard (Refer to Section 3.16 Functional Change) or the ReeferManage PC Program. The Defrost Timer may be set for 1.5, 3.0, 6.0, or 12.0 hour intervals. When the unit has run for the selected amount of time, a defrost cycle will be initiated if the evaporator temperature criteria as defined in Section 5.11.1 have been met. .The Defrost Timer is reset to zero whenever a defrost cycle ends(regardless of how it was initiated), and begins counting down until the next defrost cycle. The microprocessor holds in memory the last entered Defrost Timer interval.

The Defrost Timer only counts time when the engine and compressor are running and evaporator temperature criteria as defined in Section 5.11.1 have been met. When the START/RUN-OFF switch is placed in the OFF position, the defrost timer will be reset to zero. Units running in Start-Stop will not increment the timer during off cycles. For this reason, the defrost timer can not attempt to initiate a defrost cycle during an OFF cycle. However, it is possible that the unit will go into a defrost cycle very shortly after restarting from a Start-Stop OFF Cycle, if the timer expires at that point.

b. Defrost Air Switch: A Defrost Air Switch (DAS) measures the air restriction through the evaporator coil. As ice forms and builds up, the air flow is restricted. Once enough ice builds up, the switch contacts will close, and initiate a defrost cycle f the evaporator temperature criteria as defined in Section 5.11.1 have been met. The Defrost Air Switch requires periodic testing and calibration. (Refer to Section 9.25.2) In the case where the switch is out of adjustment, it will either not put the unit into defrost as soon as needed, or it will attempt to put the unit into defrost prematurely. In the first case, the defrost timer will help correct any icing problem.

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 grill can also cause the Defrost Air Switch contacts to close.

When looking at a unit for a Defrost Air Switch problem, be sure to also inspect the condition and cleanliness of the evaporator coil, and the return air area.

c. Manual Defrost : The Defrost cycle may be started at any time (providing that evaporator temperature criteria as defined in Section 5.11.1 have been met) by pushing the MANUAL DEFROST key (Refer to Section 3.10).

5.11.3 Normal Defrost Operation

SV1	SV2	SV4	SCS	Clutch Output	UL1	UL2	CSMV
CLOSE (energized)	Refer to SV2 Operation	OPEN (ener-gized)	HIGH	DISENGAGE (de-energized)	LOAD (de-en-ergized)	LOAD (de-en-ergized)	100% Open

When the ambient air temperature is greater than 35°F (1.7°C) the compressor discharge pressure will be monitored during the defrost cycle:

NOTE

If the Ambient Air temperature is below 80°F (26.7°C) the Normal Defrost Operation will be used. When the Ambient Air temperature is above 80°F (26.7°C), the High Ambient Defrost Operation will be used .

If the discharge pressure rises to 340 psig (23.1 Bar), UL1 will energize and unload for the remainder of the defrost cycle.

If the discharge pressure rises to 350 psig (23.8 Bar), the SV1 valve will de-energize (open) for 1 second to reduce the discharge pressure. If the discharge pressure remains at 350 psig (23.8 Bar), the SV1 valve may de-energize (open) again ad much as twice a minute.

5.11.4 Normal Defrost Termination

Defrost Termination: Defrost will be terminated once any of the following conditions are met:

a. When the defrost termination temperature (DTT) and Supply Air Temperature (SAT) **are both** above 55°F (12.8°C) and the sensors are working properly. If both DTT and SAT sensors are bad, then defrost will terminate in 10 minutes. A sensor alarm indicates that the sensor is bad.

b. A54 - DEFROST NOT COMPLETE ALARM. The microprocessor also has a Defrost Cycle Timer which monitors the total time of the Defrost cycle. This is the amount of time that the system is actually defrosting. This timer starts every time a Defrost Cycle is initiated and it keeps track of the time that the system is actually defrosting. If the Defrost cycle does not complete within 45 minutes, the following will occur:

- The Defrost cycle will be terminated.
- Defrost Override timer is activated which will initiate another defrost cycle in 1.5 hours regardless of the standard Defrost Timer setting.
- A54 DEFROST NOT COMPLETE Alarm will be activated

NOTE

If the Defrost Air Switch (DAS) contacts are still closed at defrost termination or if the DAS calls for a defrost cycle within eight minutes of the previous defrost cycle termination in two consecutive defrost cycles, the following will occur:

- The Defrost Air Switch (DAS) is ignored for defrost initiation until the unit has completed another defrost cycle in which the DAS contacts were open at termination. (The manual defrost switch can always start a new Defrost cycle.)
- A55 CHECK DEFROST AIR SWITCH Alarm is activated.
- A Defrost Override timer is activated which will initiate another defrost cycle in 1.5 hours regardless of the standard Defrost Timer setting.

5.11.5 Normal Defrost Termination Sequence

The following sequence will be used to perform a transition from defrost to normal temperature control:

a. The microprocessor will place the engine in Low Speed and Open (de-energize) SV1 and Open (energize) SV2 and SV4.

b. The microprocessor will return the CSMV to the same % it was prior to the initiation of defrost.

c.The SV4 will close (de-energize) .

d. After a few seconds the Clutch will be engaged (energized). There will be a short delay before the engine can return to High Speed.

e. At this point, the microprocessor will return to normal temperature control. (The data recorder will record a Defrost Termination Event)

5.11.6 High Ambient Defrost Operation

NOTE

If the Ambient Air temperature is below 80°F (26.7°C) then the Normal Defrost Operation will be used. When the Ambient Air temperature is above 80°F (26.7°C), the High Ambient Defrost Operation will be used.

If the discharge pressure rises to 340 psig (23.1 Bar), UL1 will energize and unload for the remainder of the defrost cycle.

If the discharge pressure rises to 350 psig, the SV1 valve will de-energize (open) for 1 second to reduce the discharge pressure. If the discharge pressure remains at 350 psig (23.8 Bar), the SV1 valve may de-energize (open) again ad much as twice a minute.

The High Ambient Defrost Cycle has three separate modes:

a. Pump Down Mode - The Pump Down Mode pumps the low side of the refrigeration system down to a lower suction pressure, and reduces the engine load normally seen at the beginning of a Defrost Cycle.

SV1	SV2	SV4	Engine Speed	Clutch Output	UL1	UL2	CSMV
OPEN (de-energized)	CLOSE (de-energize)	CLOSE (de-energize)	LOW (de-energize)	ENGAGE (energized)	UNLOAD (energized)	UNLOAD (energized)	100% Open

The unit will remain in the Pump Down Mode until the following conditions are met:

- A minimum of 30 seconds, and the suction pressure is less than 10 PSIG (0.68 Bar) or
  OR
- A maximum of 5 1/2 minutes, regardless of suction pressure.

b. High Ambient Defrost Mode - Following the Pump Down Mode, the Defrost Cycle will begin. The unit controls will be opened/closed as follows:

SV1	SV2	SV4	Engine Speed	Clutch Output	UL1	UL2	CSMV
CLOSE (energized)	Refer to SV2 Operation	OPEN (energized)	HIGH (de-energized)	DISENGAGE (de-energized)	UNLOAD (de-energized	LOAD (energized)	100% Open

c. High Ambient Defrost Termination - Once the Defrost Termination Temperature Sensor (DTT) and Supply Air Temperature (SAT) reach 55°F (12.8°C), the high ambient defrost cycle will terminate.

5.11.7 High Ambient Defrost Termination Sequence

The following sequence will be used for High Ambient Defrost Termination.

- The unit will remain in High Speed and will reset the CSMV position to the position it was in at the start of defrost.
- The microprocessor will open (de-energize) SV1 and open (energize) SV2 and unload (energize) UL1.
- When suction pressure has risen 10 PSIG (0.7 Bar) above start point or after 15 seconds, the microprocessor will place the unit in Low Speed, close (de-energize) SV4, and unload (energize) UL2.
- After 5 seconds, the clutch will be engaged.
- After an additional 5 seconds, the microprocessor will return to normal temperature control. (The data recorder will record a Defrost Termination Event)

NOTE

If the Ambient Air temperature is below 80°F (26.7°C) then the Normal Defrost Operation will be used. When the Ambient Air temperature is above 80°F (26.7°C), the High Ambient Defrost Operation will be used.

5.11.8 High Ambient Defrost Termination

Once the Defrost Termination Temperature Sensor (DTT) and Supply Air Temperature (SAT) reach 55°F (12.8°C), the defrost cycle will terminate.

5.11.9 High Ambient Defrost Termination Sequence

The following sequence will be used for High Ambient Defrost Termination.

a.The unit will remain in High Speed and will reset the CSMV position to the position it was in at the start of defrost.

b.The microprocessor will open (de-energize) SV1 and open (energize) SV2 and unload (energize) UL1.

c.When suction pressure has risen 10 PSIG (0.68 Bar) above start point or after 15 seconds, the microprocessor will place the unit in Low Speed, close (de-energize) SV4, and unload (energize) UL2.

d.After 5 seconds, the clutch will be engaged.

e.After an additional 5 seconds, the microprocessor will return to normal temperature control. (The data recorder will record a Defrost Termination Event)

NOTE

Refer to Section 2.15 for more on the defrost mode.

5.12 UNLOADER CONTROL OPERATION

To "LOAD," or de-energize, a compressor unloader increases the capacity of the system by increasing the number of cylinders pumping refrigerant in the compressor. To "UNLOAD," or energize, a compressor unloader decreases the capacity of the system by decreasing the number of cylinders pumping refrigerant. Refer to Section 2.3.4 for more information on compressor unloaders.

Unloaders will use the differences of Controlling Temperature and set point, as follows:

Mode	LOAD (de-energize) UL1 and UL2	UNLOAD (energize) UL1 and UL2
COOL (Perishable)	Control Temp is more than 3.6°F (2°C) above setpoint	Control Temp is less than 2.3°F (1.3°C) above setpoint
HEAT	Control Temp is more than 2.7°F (1.5°C) below setpoint	Control Temp is less than 2.3°F (1.3°C) below setpoint
COOL (Frozen)	Control Temp is more than 3.6°F (2°C) above setpoint	Control Temp is less than 1.4°F (0.8°C) above setpoint

When the compressor is fully loaded, it is operating on six cylinders. When the front unloader UL1 is Unloaded (energized), the unit operates on four cylinders. When UL1 and the rear unloader UL2 are both unloaded (energized), the unit operates on two cylinders. UL2 always unloads before UL1.

5.13SV1 OPERATION :

The SV1 valve will be open (de-energized) whenever the system is operating in the Cool Cycle's SV1 valve will be closed (energized) during Heat and Defrost Cycles. When the system is operating in the Defrost Cycle, and the Discharge Pressure reaches 350 PSIG (23.8 Bars) during Defrost, SV1 opens (de-energizes) for 1 second then closes (energizes) again to help control Discharge Pressure.

5.14 SV2 OPERATION :

The SV2 valve will be open (energized) whenever the system is operating in the Cool Cycle. The SV2 valve will open and close during the Heat and Defrost Cycles to control Discharge and Suction pressures.

The following SV2 control is used during the Heat and Defrost cycles:

1. If the Discharge Pressure is greater than the SV2 closed value shown in the table below, SV2 is de-energized (closed).

2. If the Discharge Pressure is less than the SV2 open value, SV2 is energized (open).

SV2 closed and open pressure settings are based on the model number as follows:

Model No.	SV2 OPEN	SV2 CLOSE
Ultima XTC and X2 2500	190 PSIG (12.9 Bars)	250 PSIG (17 Bars)
Ultra XTC and X2 2100	200 PSIG (13.6 Bars)	300 PSIG (20.4 Bars)

5.15 TEMPERATURE RANGE LOCK 1 & 2 (See Figure 5-5. and Figure 5-6.)

The unit can be locked into Start-Stop or Continuous Run operation for various set points. Two independent ranges are available for selection. Each range can be set to lock the unit into either Start-Stop or Continuous Run based on the current set point

Each Range has its own selectable minimum and maximum temperatures, which define the span of the range. If some set point temperatures are contained in both ranges due to range overlap, the unit operation specified for Range 1 will always have priority over the unit operation specified for Range 2.

Typically, both Range 1 and Range 2 are used to control different set point ranges when the unit is not equipped with the IntelliSet option. 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 Run Mode, and Range Lock 2 is left OFF.

For example, if Continuous Run operation is ALWAYS required whenever the set point is between +28°F and +55°F (-2.2°C and 12.8°C), Range 1 will be set for Continuous Run, with a Range 1 Minimum Temperature of +28°F (-2.2°C) and a Range 1 Maximum Temperature of +55°F (12.8°C). Should Continuous Run operation ALWAYS also be required with set points between -22°F (-30°C) and 0°F (-17.8°C), then Range 2 will be set for Continuous Run, with a Range 2 Minimum Temperature of -22°F (-30°C) and a Range 2 Maximum Temperature of 0°F (-17.8°C). Any set point outside of Range 1 or Range 2 will allow the user to change unit operation between Start-Stop and Continuous Run.

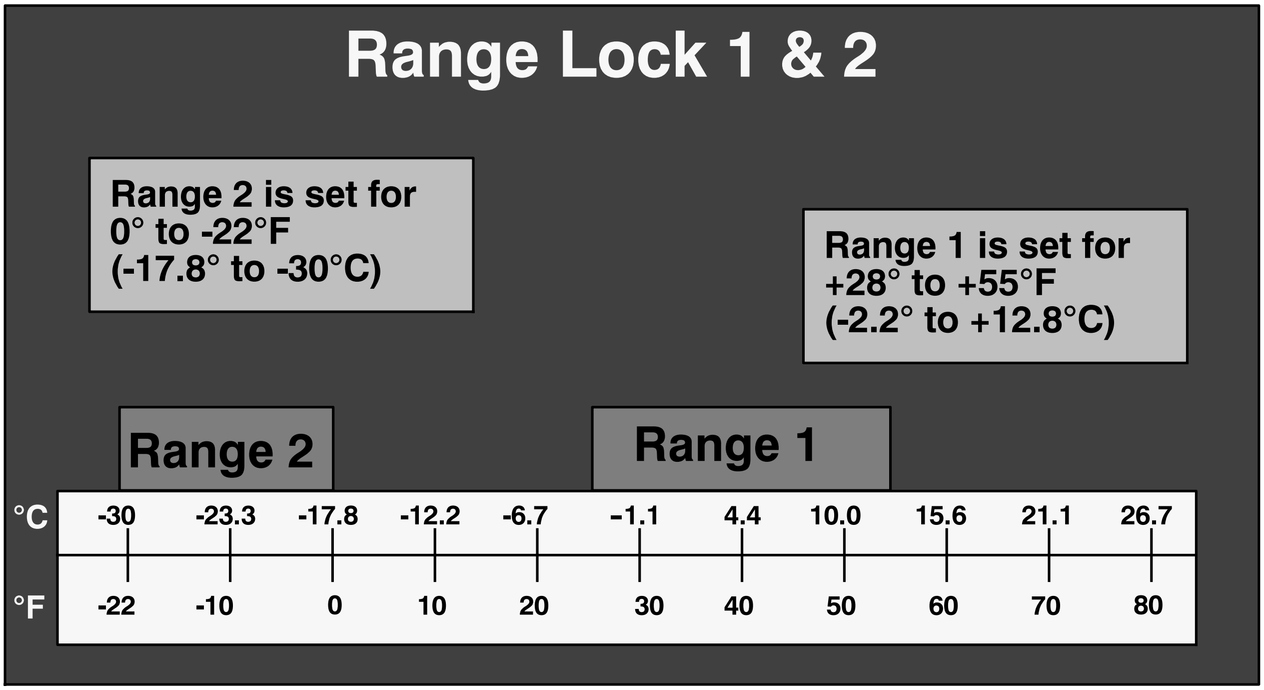


Figure 5-5. Range Lock 1

In the example shown in Figure 5-5. Range 1 or Range 2 can be changed to lock the unit operation into Start-Stop. It is primarily important to determine which range is to be Range 1 and which is to be Range 2 is when the ranges overlap.

In the example shown in Figure 5-6., the ranges will be set to lock all set points into Start-Stop, except for a small range between +32 and +42°F (0 and 5.6°C) during which the unit will always operate in Continuous Run. Range 1 Minimum Temperature will be set for +32°F (0°C), and Maximum Temperature of +42°F (5.6°C). Range 2 will be set for a Minimum Temperature of -22°F (-30°C) and a Maximum Temperature of +89.6°F (32°C).

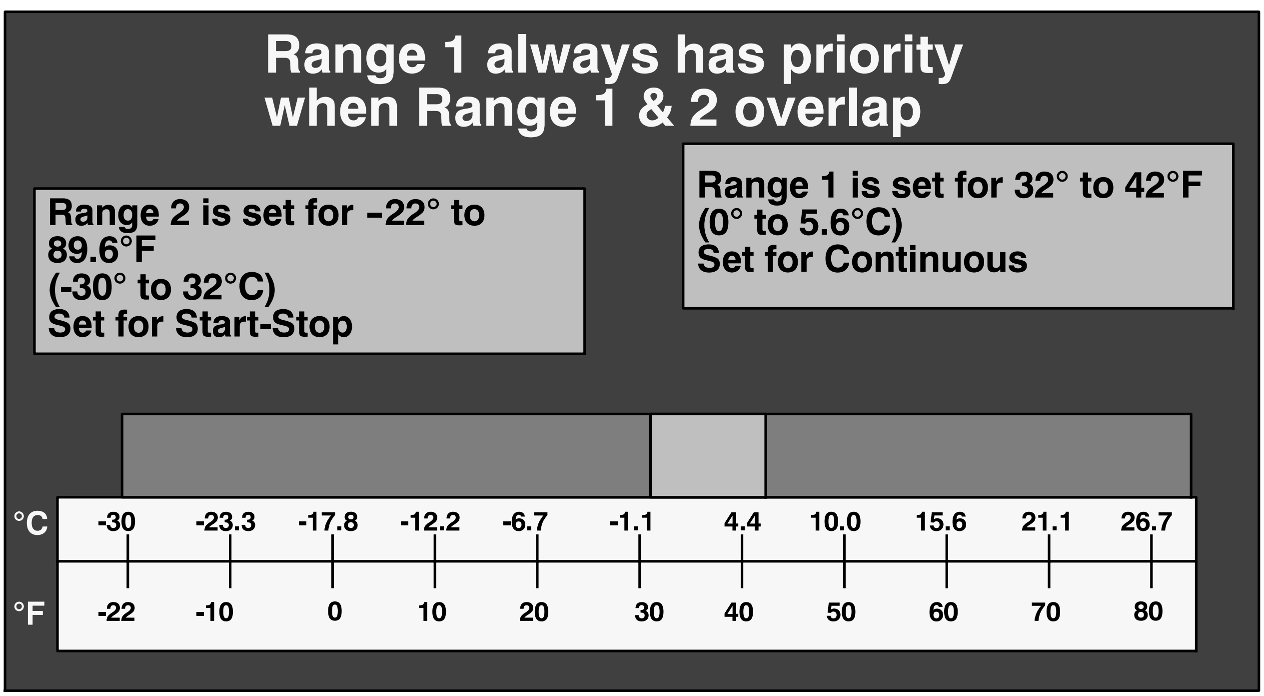


Figure 5-6. Range Lock 2

5.16 ProductShield™

NOTE

ProductShield does not operate within Sleep Mode.

ProductShield is a group of configuration settings within the microprocessor that are available in all Advance Microprocessors that have the IntelliSet option installed. The ProductShield Modes work together with the various IntelliSets to allow improved operating efficiency while providing customized product protection for up to 31 different commodities.

Each ProductShield setting allows the user to select an ambient temperature range in which to operate. The Minimum and Maximum range values can be set to OFF, or any value from -20 to +119°F (-28.9 to +48.4°C).

5.16.1 ProductShield Modes:

a. ProductShield: Econo Go To Start-Stop and Go To Continuous Run

ProductShield Econo allows the unit to automatically switch from Start-Stop operation to Continuous run or vice versa based on a change in the ambient air temperature. This allows for maximum product protection while providing for fuel savings - depending on ambient conditions.

1) When the unit is set for Continuous Run, ProductShield Econo allows the unit to cycle OFF in Start-Stop when:

- ProductShield Econo configuration is set to GO TO S/S (Refer to Section 6.2.1) **AND**
- The unit has run in Continuous Run for a minimum of either 15 minutes or the Minimum Run Time as selected in the Functional Parameter list (whichever time is longer) **AND**
- The ambient temperature falls **within** the pre-programmed temperature range **AND**
- The unit is not already running in ProductShield Winter mode which forces the unit to operate in Continuous Run only. (Refer to Section c. below) **AND**
- All the normal criteria for a Start-Stop Off Cycle (box temperature at set point, engine coolant temperature, battery volts and charging amps) are met.
- Optionally, if the Econo Delta-T configuration is set for a numerical value and not set to OFF, the operator can pre-program a maximum evaporator coil temperature differential (Delta-T) between the return air (1RAT) and supply air (1SAT) sensors as an additional criteria for switching to Start-Stop. In this case, the unit must bring the Delta-T below this pre-programmed setting before going to Start-Stop.

The product is probably cooled close to set point if the Delta-T is pre-programmed for a relatively low temperature [4 to 6°F (2.2 to 3.3°C)] and that setting has been reached. Reaching the low Delta-T setting is an indication that not much heat is being removed from the product in order to maintain the Return Air Temperature.

Setting the Delta-T for a higher value [8 to 27°F (4.4 to 15°C)]) or leaving the setting OFF enables the unit to cycle into an OFF cycle whether or not the unit is cooling at a higher capacity.

NOTE

In ProductShield Econo: Go to Start-Stop, the Delta-T must be <u>lower</u> than the value selected in order to enter Start-Stop.

NOTE

If the unit is set for Continuous Run and ProductShield Econo is configured for GO TO CONTINUOUS or OFF, the unit will remain in Continuous Run.

Once the microprocessor detects that the above criteria have been met, the unit will switch from Continuous Run to a Start-Stop Off Cycle and remain Off for the Minimum Off Time as set in the Functional Parameter list. A restart will be initiated when **one** of the following four conditions occurs:

a) Normal restart 1: The Refrigerated Compartment Temperature Has Exceeded Selectable Override Temperature

The microprocessor continually monitors the refrigerated compartment temperature during the Minimum Off Time. The unit will restart if the refrigerated compartment temperature goes beyond the Override Temperature (above or below set point in the perishable range or above set point in the frozen range). The Minimum Off Time and the Override Temperatures are selected in the microprocessor Functional Parameter List (Refer to Section 3.17). The default value is 20 minutes for the Minimum Off Time and 11.0°F (6°C) for the Override Temperature.

b) Normal restart 2: The Refrigerated Compartment Temperature Has Exceeded Standard Override Temperature

After the Minimum Off Time has expired, the microprocessor continually monitors the refrigerated compartment temperature. If the refrigerated compartment temperature goes more than +3.6°F(+2.0°C) away from set point (above or below set point in the perishable range or above set point in the frozen range), the unit will restart. The Minimum Off Time is selected in the microprocessor Functional Parameter List (Refer to Section 3.17). The default setting is 20 minutes.

c) Engine coolant temperature drops below 34°F (1°C).

If the Engine Coolant Temperature drops below 34°F (1°C), the unit will restart, and will run until all conditions for shutdown are met.

If Alarm 129 CHECK ENG COOLANT SENSOR is active, the unit will restart if the ambient air temperature drops to 32°F(0°C) after the unit has been in the OFF cycle for 60 minutes. If the unit restarts due to this condition, the Minimum Run Time will be at least 20 minutes, regardless of the setting in the Functional Parameter list.

d) Battery voltage falls below voltage selected in the configuration list. (See Section 6.2.1)

In some ambient conditions, there are times when the unit may be off for very long periods of time. To ensure that the load stays within safe temperature ranges, the Maximum Off Time may be used to force the unit to restart regardless of any change in refrigerated compartment temperature. Maximum Off Time is selected in the microprocessor Functional Parameter List. The default setting is OFF.

When the unit restarts, it will return to Continuous Run operation for a minimum of 15 minutes or the Minimum Run Time (as selected in the Functional Parameter list), whichever time is longer. The same ProductShield Econo: Go To Start-Stop activation conditions must again be met in order for the unit to cycle OFF again. While the unit is running and the set point is between 32 and 65.1°F (0 and 18.4°C), the FreshProtect settings (as selected in the Functional Parameter list) will be effective.

When ProductShield Econo Maximum Temperature is set for OFF, and ProductShield Econo Minimum Temperature is set for a temperature, the ambient air temperature will be considered to be “inside the range” whenever the ambient air temperature is higher than the Minimum Temperature setting, with no upper limit.

When ProductShield Econo Maximum Temperature is set for a temperature, and ProductShield Econo Minimum Temperature is set for OFF, the ambient air temperature will be considered to be “inside the range” whenever the ambient air temperature is lower than the Max Temp setting, with no lower limit.

When ProductShield Econo Maximum Temperature is set for OFF, and ProductShield Econo Minimum Temperature is set for OFF, the ambient air temperature will be considered to be “inside the range” at any ambient air temperature.

ProductShield ECONO: GO TO START/STOP EXAMPLES

The following examples apply in situations where all other Start-Stop conditions have been met. (Refer to Section 4.3.1..)

1. If the Econo Minimum Temperature is set to 30°F (-1.1°C) and the Econo Maximum Temperature is set to 40°F (4.4°C) and the *ambient air* temperature falls **between** these temperatures, the unit operation can change to Econo Start-Stop.

2. If the Econo Minimum Temperature is set to 30°F (-1.1°C) and the Econo Maximum Temperature is set to OFF and the *ambient air* temperature is anywhere **above** 30°F (-1.1°C), the unit operation can change to Econo Start-Stop.

3. If the Econo Minimum Temperature is set to OFF and the Econo Maximum Temperature is set to 40°F (4.4°C) and the *ambient air* temperature falls anywhere **below** 40°F (1.7°C), the unit operation can change to Econo Start-Stop.

4. If both the Econo Minimum and Econo Maximum Temperatures are set to OFF, unit operation can change to Econo Start-Stop at any ambient temperature.

2) When the unit is set for Start-Stop, ProductShield Econo allows the unit to run in Continuous Run when:

- ProductShield Econo configuration is set to GO TO CONTINUOUS (Refer to Section 6.2.1), **AND**
- The unit has run in Start-Stop for a minimum of 15 minutes OR the Minimum Run Time, whichever is longer as set in the Functional Parameter list. (See Table 3-3) **AND**
- The ambient temperature falls **outside** the pre-programmed temperature range.

NOTE

If unit is set for Start-Stop and ProductShield Econo is configured for GO TO START / STOP or OFF, the unit will remain in Start-Stop.

Once the microprocessor detects that the above criteria have been met, the unit will switch from Start-Stop to Continuous Run for a minimum of 30 minutes. After 30 minutes the unit will return to Start-Stop when the ambient temperature has fallen within the pre-programmed temperature range by ±3.6°F (±2°C).

NOTE

Delta-T logic is not used or available when unit is configured for GO TO CONTINUOUS.

ProductShield ECONO: GO TO CONTINUOUS EXAMPLES

1. If the Econo Minimum Temperature is set to 0°F (-17.8°C) and the Econo Maximum Temperature is set to 90°F (32.2°C) and the *ambient air* temperature falls **outside** these temperatures, the unit operation can change to Econo Continuous Run.

2. If the Econo Minimum Temperature is set to 0°F (-17.8°C) and the Econo Maximum Temperature is set to OFF and the *ambient air* temperature falls **below** 0°F (-17.8°C), the unit operation can change to Econo Continuous Run.

3. If the Econo Minimum Temperature is set to OFF and the Econo Maximum Temperature is set to 90°F (32.2°C) and the *ambient air* temperature rises **above** 90°F (32.2°C), the unit operation can change to Econo Continuous Run.

4. If both the Econo Minimum and Econo Maximum Temperatures are set to OFF, ProductShield Econo: Go To Continuous can not operate because no range has been defined and it is therefore impossible for the ambient temperature to be outside of range.

b. ProductShield: High Air

ProductShield High Air mode allows the unit to provide increased airflow by operating the engine in high speed. This generally results in a reduced Delta-T. This can maximize product protection under difficult conditions while allowing the unit to operate more efficiently during less demanding conditions.

When the Air Flow parameter (in the Functional Parameter list) is set for NORMAL, ProductShield High Air allows the unit to run as required - either High Speed or Low Speed depending on:

- How far the compartment temperature is away from set point AND
- Speed Override Conditions - Refer to Section 4.4

When the ambient temperature falls outside the pre-programmed temperature range, ProductShield High Air mode will be enabled, and the engine will go to high speed to provide high air flow within the refrigerated compartment.

The operator can also optionally pre-program a maximum evaporator coil temperature differential (Delta-T) between the return air (1RAT) and supply air (1SAT) sensors as an additional criteria for switching to ProductShield High Air. When the Delta-T setting is used, the unit must bring the Delta-T above this pre-programmed setting before going to High Air Mode. The Delta-T setting is used to prevent ProductShield High Air from operating when the heat load on the refrigeration unit is low.

NOTE

In ProductShield High Air, the Delta-T must be **higher** than the value selected in order to enter the mode.

ProductShield ECONO: HIGH AIR EXAMPLES

1. If the High Air Minimum Temperature is set to 0°F (-17.8°C) and the High Air Maximum Temperature is set to 90°F (32.2°C) and the *ambient air* temperature falls **outside** these temperatures, the unit operation can change to High Air.

2. If the High Air Minimum Temperature is set to 0°F (-17.8°C) and the High Air Maximum Temperature is set to OFF and the *ambient air* temperature falls **below** 0°F (-17.8°C), the unit operation can change to High Air.

3. If the High Air Minimum Temperature is set to OFF and the High Air Maximum Temperature is set to 90°F (32.2°C) and the *ambient air* temperature rises **above** 90°F (32.2°C), the unit operation can change to High Air.

4. If both the High Air Minimum and High Air Maximum Temperatures are set to OFF, ProductShield Econo: High air can not operate as no range is defined and it is impossible for the ambient temperature to be outside of range.

If the unit shuts down in Auto Start-Stop during High Air, it will not be in High Air when it restarts and will return to normal operation for a minimum of 15 minutes. The original activation conditions must then be met in order for the unit to return to High Air.

c. ProductShield: Winter

When the unit is set for Start-Stop operation, ProductShield Winter allows it to switch to continuous run when the ambient air temperature falls below a pre-programmed temperature falling between 32 to -20°F (0 to -29°C). This helps protect the unit from the possibility of fuel gelling and other cold weather issues.

NOTE

When the unit is operating in Continuous Run, the unit will not switch into ProductShield Winter.

When the unit is operating in Start-Stop and the microprocessor detects that the ambient temperature has dropped below the pre-programmed temperature, the unit will switch into ProductShield Winter mode which will force the unit to operate in Continuous Run. The unit will continue to operate in Continuous Run for a minimum of 30 minutes. After 30 minutes, the unit will return to auto Start-Stop if the ambient temperature has risen more than 3.6°F (2°C) above the pre-programmed ProductShield Winter temperature.

NOTE

All of the ProductShield settings may be viewed in the Data List (Refer to Section 3.14). For units with IntelliSets, the Data List will reflect the ProductShield settings for the IntelliSet that is currently active.

5.17 UNLOADER CONTROL OVERRIDES

The compressor unloaders will operate in either a de-energized (loaded) or energized (unloaded) position, depending on current operating conditions. The list below shows the conditions that will control the operation of the unloaders in addition to the unloader control used by the temperature control described in section 5.12.

There is a delay of 10 seconds between LOADING (de-energizing) compressor cylinders under all operating conditions except engine starting.

The overrides will be allowed in Cargo Protect Mode if the override does not use the return or supply temperature.

Unloader Overrides in priority order. If an override only applies or takes effect for one unloader, continue down the priority list for the other unloader:

a. High Ambient:

If the ambient temperature is above 120°F (48.9°C) when the engine starts UL1 and UL2 will both be unloaded for a minimum of 2 minutes and until the ambient air temperature drops below 110°F (43.3°C)

b. Mop Override, Maximum Operating Pressure Control:

UL1 and UL2 will be energized and de-energized based on Compressor Suction Pressure (CSP). Refer to MOP Override Section 5.19

If the unit is operating in Defrost or in HEAT, the MOP Override can only UNLOAD the UL1. The UL2 must remain LOADED.

c. Low Suction Pressure/High Discharge Pressure:

Unloading is used along with low speed to increase the suction pressure or decrease the discharge pressure. These steps in capacity reduction are taken in the following order: 6-cylinder high speed to 4-cylinder high speed to 4-cylinder low speed to 2-cylinder low speed. Unloading will take place if the following conditions occur: discharge pressure is greater than 435 PSIG (29.6 Bars) for 5 seconds or suction pressure is less than 0 PSIG (0Bar) for 30 seconds.

Therefore, if the engine is running at high speed 6 cylinder operation and one of the conditions listed above occurs, the compressor will be unloaded from 6 to 4 cylinders (UL1 will be energized) and the engine will remain in high speed. If the condition (discharge pressure greater than 435 PSIG or suction pressure less than 0 PSIG) does not change to at least a drop in discharge pressure to less than 410 PSIG or an increase in suction pressure to above 5 PSIG, the engine will shift to low speed and the compressor will remain running on 4 cylinders). If the condition still does not change, UL2 will energize and the compressor will operate on 2 cylinders, still in low speed operation. Once the engine shifts to low speed, or one or both of the unloaders energize due to these conditions the unit will remain in low speed, and the unloader(s) will remain energized for a minimum of 5 minutes.

d. Defrost: Refer to defrost control (Refer to Section 5.11).

In a Normal Defrost cycle, both unloaders will be loaded (de-energized).

In a High Ambient Defrost Cycle, both unloaders will be unloaded (energized) during the Stage 1 pumpdown mode. The remainder of the Defrost Cycle will have UL1 unloaded (energized) and UL2 loaded (de-energized).

e. Cargo Protect Mode:

If the setpoint is in the frozen range [below +10.4°F (-12°C)] and both RAT and SAT sensor alarms are active, the unit will run fully loaded (UL1 and UL2 de-energized).

f. Start/Stop Override:

If the system is running in Start/Stop-Run Mode, and the minimum run time has expired and the compartment temperature is not at setpoint, and the Return Air Temperature is less than 50°F (10°C), both unloaders will be LOADED (de-energized) to increase the unit capacity so that set point may be reached more quickly, and allow an Off Cycle.

g. Continuous Run Low Speed Null Mode: UL1 and UL2 will load and unload periodically as the control system makes adjustments in the system's capacity to maintain compartment temperature when it is close to setpoint.

5.18 MAXIMUM SUCTION OPERATING PRESSURE (COOL ONLY)

In Cool Mode, the CSMV is used to control Suction Pressure to these **MAXIMUM** operating limits determined by the compressor speed and number of loaded cylinders, as shown in the following table. Pressures may be lower depending on ambient and control temperatures, etc.

Table 4-3 Suction MOP

Model	Ambient Air Temperatures below 108.5°F (42.5°C)			Ambient Air Temperatures above 110.3°F (43.5°C)		
	6 Cylinders	4 Cylinders	2 Cylinders	6 Cylinders	4 Cylinders	2 Cylinders
Ultima XTC and X2 2500 High Speed	25 PSIG (1.7 Bars)	40 PSIG (2.7 Bars)	76 PSIG (5.2 Bars)	19 PSIG (1.3 Bars)	30 PSIG (2.0 Bars)	70 PSIG (4.8 Bars)
Ultima XTC and X2 2500 Low Speed	35 PSIG (2.4 Bars)	50 PSIG (1.5 Bars)	76 PSIG (5.2 Bars)	21 PSIG (1.4 Bars)	35 PSIG (2.4 Bars)	60 PSIG (4.1 Bars)
Ultra XTC and X2 2100 High Speed	31 PSIG (2.1 Bars)	50 PSIG (1.5 Bars)	76 PSIG (5.2 Bars)	20 PSIG (1.4 Bars)	40 PSIG (2.7 Bars)	70 PSIG (4.8 Bars))
Ultra XTC and X2 2100 Low Speed	35 PSIG (2.4 Bars)	50 PSIG (1.5 Bars)	76 PSIG (5.2 Bars)	20 PSIG (1.4 Bars)	30 PSIG (2.0 Bars))	60 PSIG (4.1 Bars)

5.19 MAXIMUM OPERATING PRESSURE (MOP) OVERRIDE (HEAT AND DEFROST ONLY)

The microprocessor monitors the suction pressure of the refrigeration system and controls the unloaders to maintain a Maximum Operating Pressure (MOP). The CSMV is always at 100% open in heat and defrost modes. A Compressor Suction Pressure (CSP) transducer is used to provide this information to the microprocessor. This MOP is calculated based on suction pressure, ambient air temperature, and mode of operation. From this the microprocessor will be able to determine the system load. The system load will correspond to a maximum horse power, discharge pressure and coolant temperature which the unit can operate within. By overriding temperature control and unloading cylinder banks on the compressor, these conditions can be maintained at the appropriate levels.

When the compressor is fully loaded it is operating on six cylinders. When the front unloader UL1 is UNLOADED (energized), the unit operates on four cylinders. When UL1 and the rear unloader UL2 are UNLOADED (energized), the unit operates on two cylinders. The front unloader, UL1, always unloads before the rear unloader, UL2.

5.20 SUCTION PRESSURE OPERATION

5.20.1 Directions For Reading the Chart Below

a. At ambient temperatures of 90°F (32.2°C) or below:

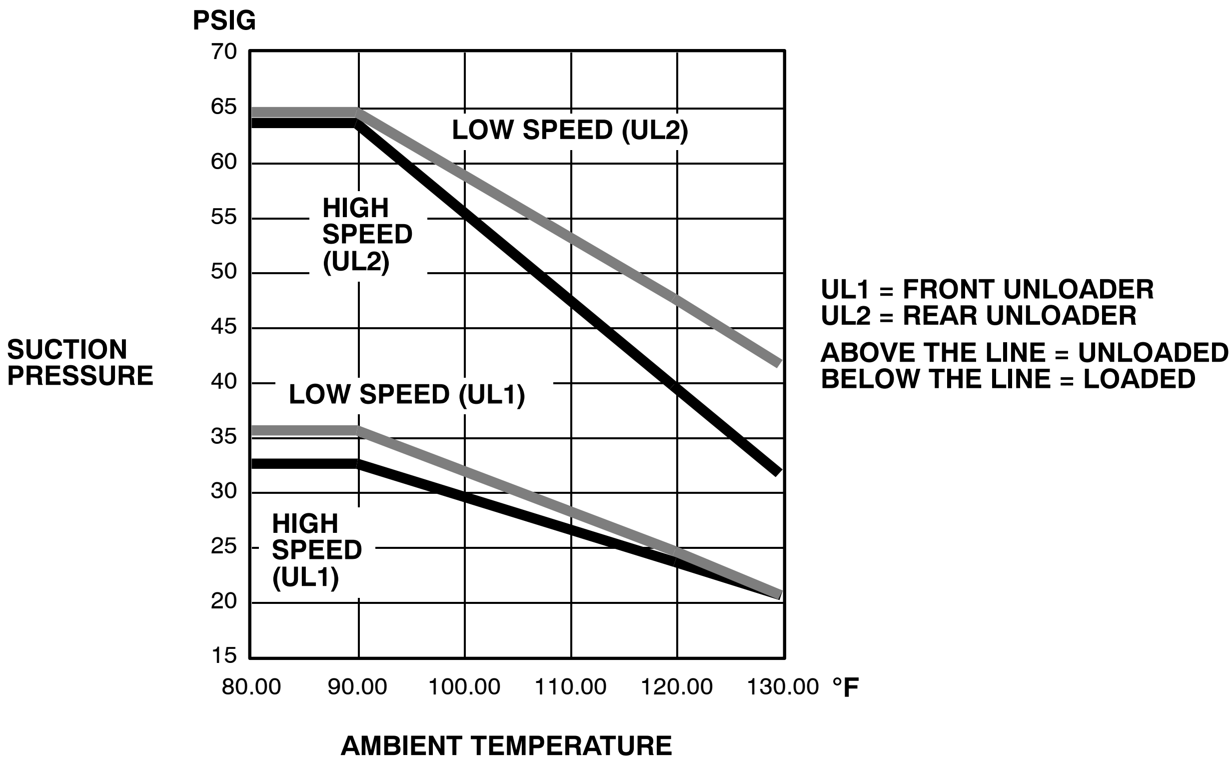
When the system is operating in *high speed* and the suction pressure is greater than 63 PSIG (4.3 Bars), both unloaders are unloaded. As the suction pressure drops below 63 PSIG (4.3 Bars), the UL2 unloader is loaded. If the suction pressure drops below 32 PSIG (2.2 Bars), the UL1 unloader is loaded.

When the system is operating in *low speed* and the suction pressure is greater than 65 PSIG (4.4 Bars), both unloaders are unloaded. As the suction pressure drops below 64 PSIG (4.4 Bars), the UL2 unloader is loaded. If the suction pressure drops below 35 PSIG (2.4 Bars), the UL1 unloader is loaded.

b. At ambient temperatures of 90°F (32.2°C) or higher:

At ambient temperatures of 90°F (32.2°C) or higher the unloading suction pressure settings relative to ambient temperatures follow a descending straight line. (Refer to following chart)

REFRIGERATION SYSTEM SUCTION PRESSURES FOR LOADING AND UNLOADING



SECTION 6

TECHNICIAN INTERFACE

SECTION 6

TECHNICIAN INTERFACE

6.1 PC MODE/DOWNLOAD PORT

PC mode allows the user to access and download data using a computer when the unit is not running and without starting the eight-hour DataRecorder timer. Connecting a download cable
(P/N 22-01737-00 (6' Long) or 22-01737-04 (20' Long) to the download port with the START/RUN-OFF switch in the OFF position allows the Advance Microprocessor to power up and communicate with the computer.

All functions available from the keypad may be viewed or changed using the ReeferManager and a personal computer (PC) connected to the download port. Using the PC will provide additional programming and configuring capabilities that will not be available through the keypad.

The DataRecorder may also be configured and downloaded through the download port using the ReeferManager program.

PC mode can be used for:

- Changing set point for the next load
- Changing any of the functional parameters for the next load
- Reading Engine hourmeters
- Reading Maintenance hourmeters
- Resetting Maintenance hourmeters
- Viewing the Active and Inactive alarm lists.
- Entering a Trip Start
- Keeping the microprocessor powered up after turning the START/RUN-OFF switch to the OFF position
- Demonstrating the operation of the microprocessor without the engine running
- Use any of the PC cards (Download, Program, Configuration or Option)

To better utilize PC mode, a PC Mode jumper (CTD P/N 22-50180-01) is available. This jumper looks similar to the Configuration jumper (refer to Section 6.2), but has a **GREEN WIRE** on it. With the unit off, locate the download port. Remove the protective plug to gain access to the wire terminals. Plug in jumper or connect an ***insulated jumper*** wire to terminals C and E.

If the START/RUN-OFF switch is placed in the START/RUN position, the microprocessor will go to normal operation. If the unit is shut down with the PC cable or jumper still in place, the engine will shut down and the microprocessor will remain powered up.

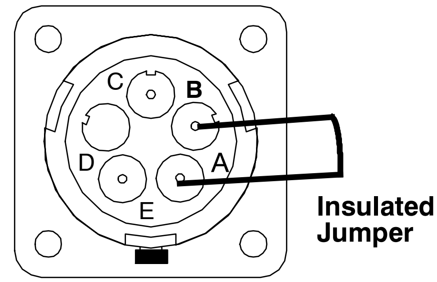
⚠ WARNING

Do not place the START/RUN-OFF Switch in the START/RUN position or the unit will start.

6.2 MICROPROCESSOR CONFIGURATION AND TECHNICIAN TEST MODES (REMOVE JUMPER MODE)

c. Place the START/RUN-OFF switch in the OFF position.

d. With the unit off, locate the download port. Remove the protective plug to gain access to the wire terminals. Plug in jumper P/N 22-50180-00 or connect an ***insulated jumper*** wire between plug terminals A and B.



Download Port

Jumper P/N 22-50180-00

WHITE WIRE

⚠ WARNING

Do Not Allow Jumper Wire To Touch Any Ground.

e. Place the START/RUN-OFF switch in the START/RUN position. The ALARM LED will come on and the set point will appear, but the refrigerated compartment temperature will not and "REMOVE JUMPER" will appear in the MessageCenter for 10 seconds. Remove the jumper at this time. ↑ ↓ TO SCROLL, THEN = TO SELECT will appear in the MessageCenter for 10 seconds or until either the UP or DOWN ARROW keys is pressed.

f. Press the UP ARROW key to scroll through the Main Menu beginning at the top.
Press the DOWN ARROW key to scroll through the Main Menu beginning at the bottom.

g. Select the mode you wish to access and press the = key. See the following pages for information on these test modes:

- Configuration Mode
- Component Test Mode
- Service Mode

6.2.1 Configuration Mode

NOTE

To enter Configuration mode, refer to Section 6.2.

a. ↑ ↓ TO SCROLL, THEN = TO SELECT will appear in the MessageCenter.

b. Press the UP ARROW key to scroll through the Configuration list beginning at the top.
Press the DOWN ARROW key to scroll through the Configuration list beginning at the bottom.

c. To read through the Configuration list, continue to press either the UP or DOWN ARROW keys. The list is circular, meaning that once the end is reached, it is repeated from the beginning.

d. To change one of the configurations, bring the Configuration to change into the MessageCenter and press =. ↑ ↓ TO SCROLL, THEN = TO SAVE will show in the MessageCenter for 10 seconds Then the selected Configuration will flash, showing the current value. Press the UP or DOWN ARROW key to scroll through the list of available selections for this Configuration.

e. Once a new value is showing in the MessageCenter, press the = key to save the selection. The MessageCenter will stop flashing. The new value is now in memory.

f. Press the UP ARROW key to continue to scroll through the Configuration list.

CONFIGURATION	SELECTIONS	DESCRIPTION
UNIT MODEL FAMILY	ULTRA / ULTIMA VECTOR	Units models are grouped into families. The correct family must be identified for the correct model number to be displayed in the next selection.
UNIT MODEL NUMBER* This list contains many selections. Only those covered by this manual are shown here. Pick one of these models from the X series model family.	NDL93N*ABO NDL93P*ABO NDL93R*ABO NDL93S*ABO NDL93S*ABA NDL93U*ABA NDL93V*ABO	The correct model number must be selected for proper operation and control. This is also part of the Unit Data where user can read the information. Configuration mode is the only way user can write information.
UNIT SERIAL NUMBER		The unit S/N may be entered. This may be up to 11 characters long. Numbers, letters, and a space are available by scrolling through the available list.
TRAILER ID #		The ID number may be entered. This may be up to 10 characters long. Numbers, letters, and a space are available by scrolling through the available list.
SET NEW HOURS		Hours from existing microprocessor can be installed into replacement micro. **NOTE:** Changes to these values may be made for up to 60 minutes based on the real time clock. This configuration only appears in the list until an hourmeter reaches 25 hours.
GLOW TIME	(LONG/**SHORT**)	LONG = Longer glow times may be used for units in colder ambient conditions.
		SHORT= Shorter glow times are used as the factory setting for all engines.
NOTE: Refer to Section 4.2.1 for glow time table.		

CONFIGURATION	SELECTIONS	DESCRIPTION
OUT OF RANGE SHUTDOWN:	YES/**NO**	YES = When the compartment temperature has been out-of-range for 30 minutes, the alarm light will come on, and the unit will shut down.
		NO = When the compartment temperature has been out-of-range for 15 minutes, the alarm light will come on and the unit will continue to run.
PARAMETERS LOCKOUT:	YES/**NO**	YES = All Functional Parameters in the function list are locked in place.
		NO = All Functional Parameters in the function list can be changed using the keypad, unless individually locked out by ReeferManager.
RPM ALARM SHUTDOWN:	YES/**NO**	YES = If Alarm 39 (Check Engine RPM) is active, turn the alarm light on and shut the engine off.
		NO = If Alarm 39 (Check Engine RPM) is active, turn the alarm light on and allow the unit to continue to run.
LOW PRESSURE SHUTDOWN:	**YES**/NO	YES = When low refrigerant pressure is sensed in the system (alarm 18 is active), turn the alarm light on and shut the unit down (after the time delay in the following selection).
		NO = When low refrigerant pressure is sensed in the system (Alarm 18 is active), turn the alarm light on and the unit will continue to run.
LP SHUTDOWN DELAY:	**120SECS** (0 - 255 seconds)	After the Low Pressure signal is received, how long shall the unit continue to run before it is shut down.
HIGH SUCT PRESS SHUTDOWN	**YES**/NO	YES = If the unit is running and the suction pressure rises to 98 psig (6.67 Bars) or higher for 10 minutes (Alarm 27 is active), the unit will shut down.
		NO = High suction pressure will not shut down the unit.
REFRIGERATION SYS SHUTDOWN	**YES**/NO	YES = Alarm 28 is Alarm and Shut Down.
		NO = Alarm 28 is Alarm only.
COMPRESSOR ALARM SHUTDOWN (Special activation required)	YES/**NO**	YES = The unit will shutdown and not restart when Alarms 13, 17, 18, 27, 28, 29 or 56 occur three times within two hours.
		NO = Normal shutdown rules for above alarms.
CURRENT FOR S/S SHUTOFF	**6.5A** 1A TO 10A (in .5A increments)	Charging amps must be lower than this for start-stop off cycle.
VOLTAGE FOR S/S RESTART	**12.2A** 12.0 TO 12.8 VDC (in .5A increments)	This value will be used during Start/Stop-Off cycles. If battery voltage falls below this value, the unit will restart.
ALTERNATOR CHECK SHUTDOWN:	YES/**NO**	YES = When the alternator is not charging (Alarm 51 is active), turn the alarm light on and shut the unit down.
		NO = When the alternator is not charging (Alarm 51 is active), turn the alarm light on and the unit will continue to run.
ENGINE OIL LEVEL SWITCH:	YES/**NO**	YES = This unit has a low engine oil level switch installed.
		NO = This unit does not have a low engine oil level switch installed.

CONFIGURATION	SELECTIONS	DESCRIPTION
ENGINE OIL LEVEL SHUTDOWN	YES / **NO**	YES = When the A2 – "LOW ENGINE OIL LEVEL" alarm is activated the alarm light will illuminate and the unit will shutdown. NO = When the A2 – "LOW ENGINE OIL LEVEL" alarm is activated the alarm light will illuminate and the unit will continue to run.
ENGINE OIL PRESS SHUTDOWN	YES / **NO**	YES = When the A11 – "LOW ENGINE OIL PRESSURE" alarm has been activated three times in the last two hours of engine operation the A21 – "TECHNICIAN RESET REQUIRED" alarm will be activated. NO = A21 will not be activated.
HIGH ENGINE TEMP SHUTDOWN	YES / **NO**	YES = When the A12 – "HIGH COOLANT TEMPERATURE" alarm has been activated three times in the last two hours of engine operation the A21 – TECHNICIAN RESET REQUIRED alarm will be activated. NO = A21 will not be activated.

<table>
<tr><th>CONFIGURATION</th><th>SELECTIONS</th><th>DESCRIPTION</th></tr>
<tr><td rowspan="2">LOW COOLANT LEVEL</td><td rowspan="2">YES/NO</td><td>YES = A Low Coolant Level sensor is installed in the coolant system.</td></tr>
<tr><td>NO = There is no Low Coolant Level sensor installed in the coolant system.</td></tr>
<tr><td rowspan="3">FUEL TANK</td><td>NO DEVICE</td><td>NO DEVICE = There is no Low Fuel Level sensor installed in the fuel tank.</td></tr>
<tr><td>SWITCH INSTALLED</td><td>SWITCH INSTALLED = A Low Fuel Level switch is installed in the fuel tank.</td></tr>
<tr><td>0 TO 100% SEN-SOR</td><td>0 to 100% SENSOR = A Low Fuel Level sensor is installed in the fuel tank. The fuel level may be read in the unit data list.</td></tr>
<tr><td>FUEL TANK SIZE</td><td>OFF
30 GALLONS
50 GALLONS
75 GALLONS
100 GALLONS
120 GALLONS</td><td>OFF = No Low Fuel Level <u>Switch</u> or <u>0 to 100% Sensor</u> is installed in the tank; OR

A Low Fuel Level <u>switch</u> or a <u>0 to 100% sensor</u> is installed in the tank, but the unit will not shutdown due to a Low Fuel Level alarm.

30 - 120 GALLONS = When a Low Fuel Level <u>switch</u> is installed and the LOW FUEL LEVEL WARNING (Alarm 1) is on, the unit will shutdown (Alarm 19) after a time delay (Refer to chart below)
30 gallon – 30 min
50 gallon – 60 min
75 gallon – 90 min
100 gallon – 120 min
120 gallon – 150 min
OR
If a <u>0 to 100% sensor</u> is installed, the low fuel level WARNING (Alarm 1) will come on when the level reaches 15% or less and the unit will shutdown (Alarm 19) when the level reaches 10%.</td></tr>
<tr><td rowspan="2">DISPLAY TOTAL ENGINE HR</td><td rowspan="2">NO/YES</td><td>YES = This hourmeter will be displayed during the startup messaging sequence and will be in hour-meter menu.</td></tr>
<tr><td>NO = This hourmeter will not be displayed during the startup messaging sequence and will be shown with the other meters and counters lists.</td></tr>
<tr><td rowspan="2">DISPLAY TOTAL SWITCH ON HR</td><td rowspan="2">NO/YES</td><td>YES = This hourmeter will be displayed during the startup messaging sequence and will be in hour-meter menu.</td></tr>
<tr><td>NO = This hourmeter will not be displayed during the startup messaging sequence and will be shown with the other meters and counters lists.</td></tr>
<tr><td rowspan="2">DIESEL RESET VALUE
(Refer to Section 2.7 for oil change intervals)</td><td rowspan="2">OFF
50 TO 30,000 HRS</td><td>OFF = The Engine Maintenance hourmeter is turned off.</td></tr>
<tr><td>50 – 30,000 hrs = The value selected here will be the number of hours between engine service inter-vals.</td></tr>
<tr><td rowspan="2">SWITCH ON RESET VALUE</td><td rowspan="2">OFF
50 TO 30,000 HRS</td><td>OFF = The Switch-On Maintenance hourmeter is turned off.</td></tr>
<tr><td>50 – 30,000 hrs = The value selected here will be the number of hours between Switch-On service intervals.</td></tr>
</table>

CONFIGURATION	SELECTIONS	DESCRIPTION
•PM (1-5)	**OFF**	OFF = The PM (1-5) Maintenance hourmeter(s) is turned off.
	ENGINE HOURS	ENGINE HOURS = PM meter will count engine hours until the next service interval.
	SWITCH ON HOURS	SWITCH ON HOURS = PM meter will count Switch On Hours until the next service interval.
	CLUTCH CYCLES	CLUTCH CYCLES = PM meter will count how many times the fan clutch cycled on/off until the next service interval.
	START CYCLES	START CYCLES = PM meter will count how many times the engine has started until the next service interval.
	HIGH SPEED HOURS	HIGH SPEED HOURS = PM meter will count how many hours the unit operated in high speed until the next service interval.
	MAINTENANCE DAYS	MAINTENANCE DAYS = PM meter will count how many days until the next service interval.
•PM (1-5) RESET INTERVAL (This is not displayed unless the PM meter is assigned to a counter in the previous configuration.)	**OFF**	OFF = The PM (1-5) Maintenance hourmeter(s) is turned off.
	ENGINE HOURS	ENGINE HOURS = PM Meter will count engine hours until the next service interval.
	SWITCH ON HOURS	SWITCH ON HOURS = PM Meter will count Switch On Hours until the next service interval.
	CLUTCH CYCLES 1,000 TO 90,000 CYCLES in 1,000 cycle increments	CLUTCH CYCLES = PM Meter is connected to the clutch cycle meter. This meter counts every time the fan clutch engages. The reset interval will be (1,000 to 90,000 cycles).
	START CYCLES 1,000 TO 90,000 CYCLES in 1,000 cycle increments	START CYCLES = PM Meter is connected to the clutch cycle meter. This meter counts every time the engine starter engages. The reset interval will be (1,000 to 90,000 cycles).
	HIGH SPEED HOURS 50 – 30000 HRS in 50 hr increments	HIGH SPEED HOURS = PM Meter is connected to the high engine speed hourmeter, which counts only high speed engine hours. The reset interval will be (50 – 30,000 hrs).
	MAINTENANCE DAYS 0 to 99,999 DAYS in 10 day increments	MAINTENANCE DAYS = PM (1-5) is connected to the real time clock, which counts only days. The reset interval will be (10 – 99,999 days).

CONFIGURATION	SELECTIONS	DESCRIPTION
PRODUCTSHIELD SETUP **NOTE:** ProductShield is only available when IntelliSet is installed. Refer to Section 5.16 for more information on the following settings.	YES	This message will only appear if ProductShield is installed. The information set in the following configurations can be read in the Unit Data list.
•PRODUCTSHIELD ECONO	**OFF**	OFF = ProductShield Econo is OFF
	GO TO START-STOP	GO TO START/STOP = Allows unit to be set for and operate in Continuous Run until ambient temperature falls **within** a user-defined range when unit will go to Start-Stop. This allows fuel savings while offering Continuous Run operation protection when ambient is outside range. Unit will return to Continuous Run when ambient goes beyond range.
	GO TO CONTINUOUS	GO TO CONTINUOUS = Allows unit to be set for and operate in Start-Stop until ambient temperature falls **outside** a user-defined range when unit will go to Continuous Run. This provides continuous air flow and good product protection for extreme ambient temperatures. Unit will return to Start-Stop when ambient comes back inside range. The minimum range allowed for this selection is 10°F (5.5°C).This means that the MIN temperature will never be closer to the MAX temperature than 10°
•PRODUCTSHIELD ECONO MIN TEMP	OFF	OFF = There is no lower limit for this parameter.
	-19°F to +119°F (-28.3°C to +48.3°C) in 0.5°F or °C increments Default: **119°F (48.3°C)**	Select the lower limit of the ambient range desired for this parameter. Refer to Section 5.16 for more information on Econo Min. Temp.
•PRODUCTSHIELD ECONO MAX TEMP	OFF	OFF = There is no upper limit for this parameter.
	-19°F to +119°F (-28.3°C to +48.3°C) in 0.5°F or °C increments Default: **119°F (48.3°C)**	Select the upper limit of the ambient range desired for this parameter. Refer to Section 5.16 for more information on Econo Max. Temp.
•PRODUCTSHIELD ECONO - DELTA-T	**OFF**	OFF = Delta-T is not used for determining the activation/de-activation of ProductShield Econo: Go To Start/Stop mode
	+3.6°F to +27°F (+2°C to 15°C) (in 0.5° increments	Select the desired Delta-T value for activation of ProductShield Econo: Go To Start/Stop mode.
•PRODUCTSHIELD HIGH AIR	**OFF**	OFF = The unit will operate normally in high and low speeds.
	ON	ON = The unit will operate in high speed when the ambient air temperature falls OUTSIDE the minimum / maximum temperature range (selected settings for HIGH AIR MIN TEMP, HIGH AIR MAX TEMP, AND HIGH AIR DELTA-T - see below)
•PRODUCTSHIELD HIGH AIR MIN. TEMP	OFF	OFF = There is no lower limit for this parameter.
	-19°F to +119°F (-28.3°C to +48.3°C) in 0.5°F or °C increments Default: **119°F (48.3°C)**	Select the lower limit of the ambient range desired for this parameter. Refer to Section 5.16 for more information on High Air Min. Temp.

CONFIGURATION	SELECTIONS	DESCRIPTION
•PRODUCTSHIELD HIGH AIR MAX. TEMP	OFF	OFF = There is no upper limit for this parameter.
	–19°F to +119°F (–28.3°C to +48.3°C) in 0.5°F or °C increments Default: **119°F (48.3°C)**	Select the upper limit of the ambient range desired for this parameter. Refer to Section 5.16 for more information on High Air Max. Temp.
•PRODUCTSHIELD HIGH AIR DELTA-T	**OFF**	OFF = Delta–T is not used for determining the activation/de–activation of High Air Delta–T
	+3.6° F to +27°F (+2°C to 15°C) (in 0.5° increments	Select the desired Delta-T value for activation of ProductShield High Air
•PRODUCTSHIELD WINTER - xx°	**OFF**	OFF = ProductShield Winter is disabled.
	-20°F to +32°F (-28.9°C to 0°C) (in 0.5° C or °F increments	Select the desired ambient temperature below which ProductShield Winter will operate (forced Continuous Run operation.)
RANGE (1-2) LOCK	**OFF**	OFF = If both Range 1 & Range 2 locks are off, Start-Stop or Continuous Run may be selected. If either Range 1 or Range 2 is not OFF, the unit will operate in the selected mode whenever the set point is within that range.
	START-STOP	START-STOP = The unit will always operate in Start-Stop whenever the set point is between the minimum & maximum temperatures for that range (see below).
	CONTINUOUS	CONTINUOUS = The unit will always operate in Continuous Run whenever the set point is between the minimum & maximum temperatures for that range (see below).
•RANGE (1-2) MINIMUM TEMP	-22°F TO +**89.6**°F (-30°C to +**32**°C) (in 0.1° increments)	Select the lowest temperature desired for either Range 1 and/or Range 2.
•RANGE (1-2) MAXIMUM TEMP	(-22°F TO +**89.6**°F (-30°C to +**32°C**) (in 0.1° increments)	Select the highest temperature desired for either Range 1 and/or Range 2.
MIN SETPOINT	**-22°F** TO +89.6°F (-30°C to +32°C) (in 0.1° increments)	Select the lowest temperature that will ever be used as set point. Set point can not be set lower than this value.
MAX SETPOINT	-22°F TO +**89.6**°F (-30°C to +**32°C**) (in 0.1° increments)	Select the highest temperature that will ever be used as set point. Set point can not be set higher than this value.
AUTO FRESH AIR EXCHANGE	**NOT INSTALLED**/STANDARD	Indicates if the Auto Fresh Air Exchange is installed. If AutoFresh Air hardware is not installed, this configuration needs to be set to NOT INSTALLED to prevent alarms from occurring.

CONFIGURATION	SELECTIONS	DESCRIPTION
AUTO FRESH AIR DELAY	**SETPOINT**	SETPOINT – Once the compartment temperature has reached set point ±1.5°F (0.8°C), the Auto-Fresh Air Exchange system will start to operate based on the parameters selected in the Functional Parameter list.
	0-48 HOURS IN 1 HOUR INCREMENTS	0 to 48 Hours – After this length of time, AutoFresh Air Exchange will begin if the unit is no longer running in pull down mode (Refer to Section 5.3), even though the compartment temperature has never reached set point.
S/S PARAMETERS	**TOGETHER**	TOGETHER = When the Minimum Run Time, Minimum Off Time, Maximum Off Time, and Override Temperatures are set in the Functional Parameter List, the same values will be used for both Frozen and Perishable set points.
	SEPARATE	SEPARATE = When the Minimum Run Time, Minimum Off Time, Maximum Off Time, and Override Temperatures are set in the Functional Parameter List, different values may be entered for Perishable and Frozen set points.
REMOTE TEMP SENSOR (1-3) (Optional) **NOTE:** Sensor(s) on DataRecorder must also be set.	ON/**OFF**	ON=A remote sensor has been added to the unit and connected into the wire harness at Remote Temp Sensor (1-3) plug. This enables Remote Temp Sensor (1-3) to be read through the Data List.
		OFF=There is no Remote Sensor (1-3) in this unit.
DOOR SWITCH: (Optional) **NOTE:** Door Switch must be set to be recorded on DataRecorder.	**SWITCH NOT INSTALLED**	SWITCH NOT INSTALLED = There is no door switch in this compartment.
	OPEN SWITCH OPEN	DOOR OPEN SWITCH OPEN = A door switch has been installed on one of the refrigerated compartment doors. The switch contacts will be OPEN whenever the door is OPEN.
	OPEN SWITCH CLOSED	DOOR OPEN SWITCH CLOSED = A door switch has been installed on one of the refrigerated compartment doors. The switch contacts will be CLOSED whenever the door is OPEN.
DOOR SWITCH UNIT SHUTDOWN: (Optional)	**ALARM ONLY**	ALARM ONLY = When Door switch indicates that the door is open, a warning alarm will be displayed in the MessageCenter.
	UNIT SHUTDOWN	UNIT SHUTDOWN = When Door switch indicates that the door is open, a warning alarm will be displayed in the MessageCenter and the unit will shutdown.
	LOW ENGINE SPEED	LOW ENGINE SPEED = When Door switch indicates that the door is open, the engine will be forced to low speed.
	DATA RECORDER ONLY	

CONFIGURATION	SELECTIONS	DESCRIPTION
REMOTE SWITCH(1-2) (Optional) **NOTE:** Sensor(s) on DataRecorder must also be set.	**NOT INSTALLED**	NOT INSTALLED = This remote switch is not installed in this unit.
	DOOR OPEN SWITCH OPEN	DOOR OPEN SWITCH OPEN = The Remote switch will be used as a refrigerated compartment door switch. The switch contacts will be OPEN whenever the door is OPEN.
	DOOR OPEN SWITCH CLOSED	DOOR OPEN SWITCH CLOSED = The Remote switch will be used as a refrigerated compartment door switch. The switch contacts will be CLOSED whenever the door is OPEN.
	SWITCH ON CONTACTS OPEN	SWITCH ON CONTACTS OPEN = The Remote switch will be used as a remote control switch. The switch contacts will be OPEN whenever the switch is in the ON position.
	SWITCH ON CONTACTS CLOSE(D)	SWITCH ON CONTACTS CLOSE(D) = The Remote switch will be used as a remote control switch. The switch contacts will be CLOSED whenever the switch is in the ON position.
REMOTE SWITCH (1-2) (Optional)	**ALARM ONLY**	ALARM ONLY = When Door switch indicates that the door is open, a warning alarm will be displayed in the MessageCenter.
	UNIT SHUTDOWN	UNIT SHUTDOWN = When Door switch indicates that the door is open, a warning alarm will be displayed in the MessageCenter and the unit will shutdown.
	LOW ENGINE SPEED	LOW ENGINE SPEED = When Door switch indicates that the door is open, the engine will be forced to low speed.
	DATA RECORDER ONLY	DATA RECORDER ONLY = The data recorder will record every time the door is opened or closed. There will be no alarms or messages displayed in the MessageCenter.
SET TIME		The following will allow the Real Time Clock in the DataRecorder to be set. The time set here can be read in the unit data list.
• MONTH	1-12	Select the correct month of the year.
• DAY	1-31	Select the correct day of the month.
• YEAR	1998 - 2037	Select the correct year.
• HOURS	0-23	Select the correct hour (0-11 is AM/12-23 is PM)
• MINUTES	0-59	Select the correct minute.
LIGHT BAR	**8**/2	Indicates the type of light bar installed.
8 HR ADDITIONAL DATA:	**YES**/NO	YES = When the START/RUN-OFF switch is turned OFF, the data recorder will continue to record sensor data for an additional eight hours.
	YES/NO	YES = When the START/RUN-OFF switch is turned OFF, the data recorder will continue to record sensor data for an additional eight hours. NO = When the START/RUN-OFF switch is turned OFF, the data recorder will stop recording all data.
DECIMAL	**DISPLAYED**	DISPLAYED = Set point will be shown with a decimal and temperatures may be selected to a tenth of a degree.
	NOT DISPLAYED	NOT DISPLAYED = Set point will not be shown with a decimal. All other temperatures will still be displayed with a decimal.

CONFIGURATION	SELECTIONS	DESCRIPTION
HIGH SPEED DELAY	**1 MIN** 0 TO 10 MINUTES IN 0.5 MINUTE INCREMENTS	Select the length of time unit remains in low speed before transitioning to high speed.
SATELLITE COMM (Optional) (This configuration is only visible in the microprocessor configuration list when the DataTrak option is installed in the microprocessor. It is always visible in the configuration list in ReeferManager, although it is non-functional until the DataTrak option is installed.)	QUALCOMM	QUALCOMM = The microprocessor is set to send Qualcomm communication messages.
	OTHER	OTHER = The microprocessor is set to send communication messages to communication telematics companies other than Qualcomm.
UNIT OPERATION:* See Note on Following Page	**STANDARD** RAIL	STANDARD = The microprocessor is set to control over-the-road trailer refrigeration operation.
		RAIL = The microprocessor is set to control Rail refrigeration operation.
• VEHICLE ID: This is only available when Unit Operation: “Rail” is selected in above configuration.	ASSET **TRAILER** CAR	If Rail is selected for Unit Operation, this indicates type of vehicle in use. This selection will be used as the label text when displaying Trailer/Asset/Car ID for modification.
•RAIL SHUTDOWN OVERRIDE: This is only available when Unit Operation: “Rail” is selected in above configuration. See Note on Following Page	NO **YES**	NO = When Alarm 30 or Alarm 31 occur, the unit will not automatically restart until the Alarms are cleared.
		YES = When Alarm 30 or Alarm 31 occur, the unit will automatically restart after 4 hours.
•RAIL OVERRIDE RESTART: This is only available when Unit Operation: Rail is selected in above configuration.	1-20 **3**	If Rail is selected for Unit Operation and the Rail Shutdown Override is in effect this indicates the number of restarts allowed.
ENABLE INTELLISET AT = KEY	**NO** YES	NO = Pressing the SELECT key will allow the user to access the IntelliSet Menu.
		YES = Pressing the = key will allow the user to access the IntelliSet Menu.
CONFIGS COMPLETE = TO EXIT		Press = to return to the Configuration Main Menu

NOTE

The following changes occur in the unit’s performance when Rail Mode is selected:

- The “Trailer ID” can now be changed in order to more accurately define the vehicle carrying the unit. The choices ae: “ASSET”, “CAR”, or “TRAILER.”
- Rail Shutdown Override can be selected.

When the Rail Shutdown Override configuration is set to NO the unit will remain off until all alarm(s) are manually reset in cases where:

the unit has unsuccessfully attempted to start 3 times OR

the unit has shut down on an alarm 3 times.

When the Rail Shutdown Override configuration is set to YES, the unit will restart and attempt to continue to run when:

the unit has shut down 3 times OR the unit has failed to start after 3 start attempts AND

either Alarm 30 or Alarm 31 is active AND

the unit has been off for 4 hours

- Rail Override Restart is the number of times the unit can clear Alarms 30 or 31 after the unit has been off for the 4 hour off time. The factory setting is 3. Setting this number too high may result in a discharged or damaged battery if the unit never actually starts or fails to run long enough to charge the battery prior to shutting down again.

6.2.2 Component Test Mode

NOTE

To enter Component Test mode refer to Section 6.2.

Component Test Mode allows the Technician to energize individual circuits for five minutes at a time while the unit isn't running. The engine cannot start when the microprocessor is in Component Test Mode.

From the Main Menu, select Component Test Mode and press the =. key. Use the UP or Down arrow keys to scroll through the list when
↑ ↓ TO SCROLL, THEN = TO SELECT appears in the MessageCenter. Press the = key to select the component desired for testing. For example, if the Front Unloader (UL1) Light is selected, the UL1 coil will be energized, and the MessageCenter will display
"UL1 OFF IN 5 MINUTES". The minutes will count down to 0 at which time the UL1 circuit will be de-energized, and the MessageCenter will display the last component tested.

The test may be stopped at any time by placing the START/RUN-OFF switch in the OFF position or by pressing and holding the = key for 6 seconds. Should you need more than 5 minutes, the timer may be reset to 5 minutes anytime during the test by pressing the = key. The timer may only be reset once during each test. After the 5 minute timer expires, the MessageCenter will return to the Component Test Mode Menu and display the last component tested.

To retest the same component and circuit again, press the = key. To select another component to test, press the UP or DOWN Arrow key to view other components, and press the = key to select the desired component. To go to Service Mode or Configuration Mode, select the Main Menu and press the = key.

The only keys that operate during Component Test Mode are the ALARM and SELECT keys. The alarm list is available for viewing any active or inactive alarms. The SELECT key will only allow access to the Amp Current Draw for the item in the Data List.

When Component Test mode is selected, the Main Display will show OFF.

The following components may be tested during the Component Test mode:

Component/Menu List	MessageCenter	FET LED	Board LED
Cool Light *	COOL LIGHT OFF IN X MINS	17	
Heat Light *	HEAT LIGHT OFF IN X MINS	8	
Defrost Light *	DEFROST LIGHT OFF IN X MINS	16	
Auto Restart Light *	ARL LIGHT OFF IN X MINS	7	
Out Of Range Light *	ORL LIGHT OFF IN X MINS	15	
Fault Light *	FAULT LIGHT OFF IN X MINS.	14	
Unloader 1 (front)	UL1 OFF IN X MINS	23	
Unloader 2 (rear)	UL2 OFF IN X MINS	22	
SV1	SV1 OFF IN X MINS	10	
SV2	SV2 OFF IN X MINS	21	
SV4	SV4 OFF IN X MINS	9	
Clutch Relay	CLHR OFF IN X MINS		29
Speed Relay	SR OFF IN X MINS		27
Run Relay	RR OFF IN X MINS		28
Buzzer	BUZZER OFF IN X MINS	18	
Glow Plug Relay	GPR OFF IN X MINS		30
AutoFresh Air Exchange Relay	AFAR OFF IN X MINS	12	
Main Menu (To access Component Test mode or Configuration mode)			
* These are for the Light Bar only. The FET LED will illuminate, however the corresponding indicator LED on the Display will not illuminate.			

NOTE

Electronic speed control modules can not be tested through the microprocessor. Refer to Section 10.4.1 for Troubleshooting guide for units with Electronic Speed Control Engines.

6.2.3 Service Mode

CAUTION

Service Mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating.

NOTE

The START/RUN-OFF switch MUST be in the START/RUN position to keep the unit in Service Mode. If the switch is placed in the OFF position, the unit exits Service Mode and closes the CSMV to 0% open and de-energizes UL1.

a. Scroll through the Main Menu then press the = key when SERVICE MODE appears in the MessageCenter.

b. "ENTERING SERVICE MODE" will appear in the MessageCenter and OFF will be displayed in the main display. The CSMV will be set to 100% open and the Front Unloader (UL1) will be energized.

c. Once the CSMV is 100% open, "RECOVER/LEAK CHK/EVAC MODE" is displayed in the MessageCenter.

d. Refrigerant recovery, leak checking, or evacuation may be performed on the unit at this time. Refer to Service Procedures in Section NO TAG.

e. When the refrigeration system is evacuated the system pressure will go into a deep vacuum. While this is occurring, the MessageCenter will change to "EVAC/CHARGE MODE." The position of the CSMV and UL1 does not change in this mode.

f. To prevent refrigerant migration to the compressor during charging, if all pressure transducers (CSP and CDP) drop below-9.8 psig or –20 inHg (0.68 bar), and then 2 of the 3 pressure transducers rise above 5 psig (0.34 bar), the microprocessor will close the CSMV to 0% open and de-energize UL1. When the valves are closed, "CHARGE MODE – HOLD = TO EXIT" is displayed in the MessageCenter. The = key must be pressed and held for six seconds to exit Service mode or the START/RUN-OFF switch can be be placed in the OFF position and then back in the START/RUN position.

g. If the unit shifts to Charge Mode and "CHARGE MODE – HOLD = TO EXIT" is displayed in the MessageCenter while you are still recovering refrigerant, leak testing or evacuating the refrigeration system, DO NOT CONTINUE. Exit Service Mode and then re-enter, making sure that "RECOVER/LEAK CHK/EVAC MODE" is displayed in the MessageCenter before performing any of these services.

h. To exit Service Mode at any time, press and hold the = key for 5 seconds. "EXITING SERVICE MODE" will then appear in the MessageCenter. When exiting Service Mode the microprocessor closes the CSMV to 0% open and de-energizes UL1.

6.3 PC SUPPORT SOFTWARE

6.3.1 ReeferManager And Reports

a. ReeferManager enables the user to do the following:

- Monitor in real-time via the download port (an RS-232 connection) the current status of the microprocessor inputs, outputs, refrigeration, electrical, engine and temperature sensors and alarms
- Record sensor data to a file for diagnostic purposes
- Download microprocessor and DataRecorder data via serial port communications
- Display, edit and send unit model number, serial number and trailer ID to the microprocessor
- Display, edit and send functional parameters and configuration settings to the microprocessor and data recorder
- Transfer hour meter values to replacement microprocessors
- Initiate Pretrip and Defrost operations
- Support Download, Configuration and Program PC Card operations
- Provide a security log on system controlled by a System Administrator

b. The Reports Program enables the user to do the following:

- Read .DCX download files from the Advance microprocessor
- Create various customized reports that include set point, sensors, and events
- Create various customized graphical reports
- Print numerical, graphical, and event reports
- View and print refrigeration system historical settings and changes
- Filter download data by date range and desired sensors and events
- Search for a sensor or event of interest
- Synchronize multiple graphical and numerical windows to better understand historical operation
- PC Setup enables the user to select how to display various parameters for use in the graph and text window.
- Easily adjust x and y axis and color scheme to accommodate various data
- Export data to a spreadsheet friendly format such as MS Excel.

NOTE

The ReeferManager program does not support USB port serial connections. In the event that a notebook PC does not have a DB-9 serial port connector, an RS_232 serial port type II PCMCIA card adaptor may be used to adapt the notebook PC to the Carrier download cable. For desktop PCs, a PCI bus RS-232 serial card adaptor must be used to accomplish this task.

c. Uninstall earlier versions of ReeferManager And Reports as follows:

All previous version of both ReeferManager and Reports must be uninstalled prior to installing newer versions of these programs.

NOTE

These instructions are intended to be generic and not specific to any computer. Because ReeferManager can be installed on any computer with any operating system (excluding Vista) there will be some differences within those operating systems from one version to another. The wording may not be exactly the same; however, the procedure below will work for all operating systems mentioned.

- Click the Start button located at the lower left corner of your computer screen.
- Move the mouse pointer up to Settings. A secondary menu will slide out to the right. Move the mouse pointer over and click on Control Panel.
- With the pop-up box, there is an icon or line item named Add / Remove Programs. Double click it.
- In the next pop-up box, scroll down until you find ReeferManager and click it once to highlight it.
- Click on the Add / Remove button. A “Confirm File Deletion” or and InstallShield Wizard will appear. If you are certain you have selected the correct program, click Yes, Next or OK buttons and follow the on-screen instructions.
- When ReeferManager has been uninstalled you will receive a confirmation pop-up message. Clear it.

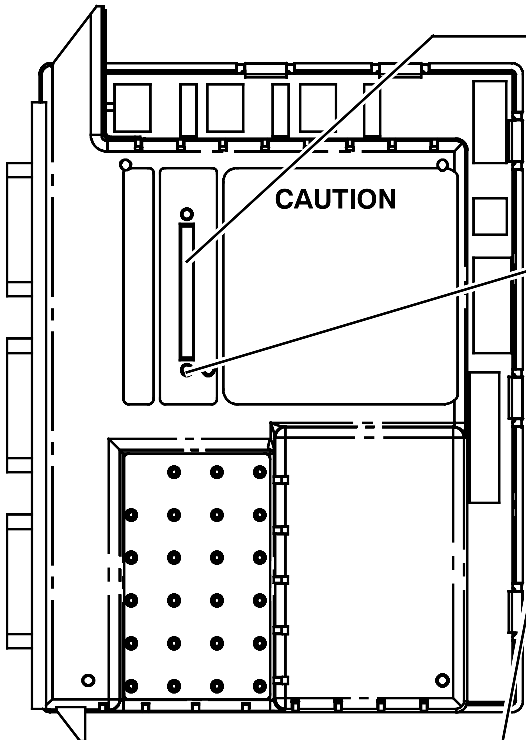
d. Auto Install ReeferManager

NOTE

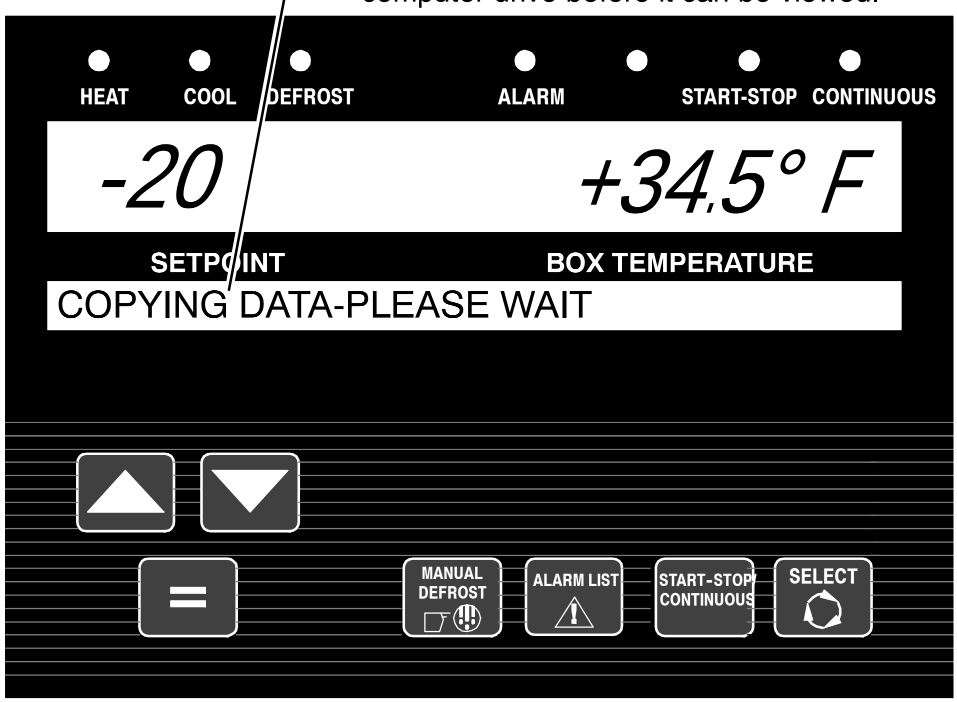
If this is the first time that ReeferManager has been installed onto a particular computer, Carrier Communications (CCN) must first be installed. If an earlier version of CCN has already been installed onto this computer AND the program communications between the computer and the Advance Microprocessor worked correctly, it is not necessary to uninstall and reinstall CCN. If the communications between the computer and the microprocessor did not work, uninstall and reinstall CCN.

- Close all programs and applications that are currently running.
- Insert the ReeferManager CD-ROM into the appropriate drive (usually D:\\)
- The CD-ROM will start running and automatically start the install program.
- Click the button to install ReeferManager. Follow the on-screen instructions, using the default settings.
- Click the Finish button to close the install program.
- Remove the CD from the drive and store for future use.
- Reboot the computer to enable the programs.

6.4 DOWNLOADING DATA WITH THE PC CARD



1. Place the microprocessor in PC Mode (Refer to Section 6.1), or place the START / RUN-OFF switch in the START / RUN Position.
2. Insert a Download Card into the PC card slot on the front of the microprocessor. Be certain that the instruction label is facing the “Caution” label. Do not force card into slot.
3. The MessageCenter will show “COPYING DATA-PLEASE WAIT”. While the data is being copied, the green PC CARD STATUS LED will flash.
4. When the copy is complete, “COPY COMPLETE, REMOVE CARD X” (“X” is the number of empty spaces remaining on the card) will show in the MessageCenter. The PC Card Status LED will be solid. You may then remove the PC card. ***Do not remove the card until prompted to do so.***
5. When the card is removed, the MessageCenter will return to the default message.
6. If any other messages appear, refer to Section 7.1 MessageCenter for an explanation of the error message. If there is an error, the PC CARD FAULT LED will be on until the card is removed.
7. Data must be copied from the Download Card onto a computer drive before it can be viewed.



6.5 INSTALLING NEW SOFTWARE

NOTE

All units should have the Controller software upgraded to 04.05.00 (04.07.00 for X2 units) or above. It is no longer possible to load any versions of 03 software into that microprocessor. Newer versions can be loaded as they are released.

6.5.1 Software Version Numbers

The first two digits of the software revision number (e.g. 04) indicate the major release. Major releases occur when significant changes are made to the software. Whenever a major change to software is made and that software is installed into a microprocessor, it is not possible to downgrade the software back to any lower major release version.

The second two digits (e.g. 05) indicate a minor release. Minor releases occur when new features, new models or other enhancements are added to the software. Software versions of newer or older minor versions can be installed into a microprocessor as needed.

The third set of digits (e.g. 00) is the actual release number. Production software is generally 00. Test and experimental versions will have a different number. The third digit does not affect the major or minor designation; therefore, the software can still be installed into a microprocessor as needed.

NOTE

Some test or experimental versions may be the ONLY current version that will operate correctly in a particular unit. Until a new production version is announced, changing the software may result in incorrect unit operation.

6.5.2 Using The Program PC Card

TIP

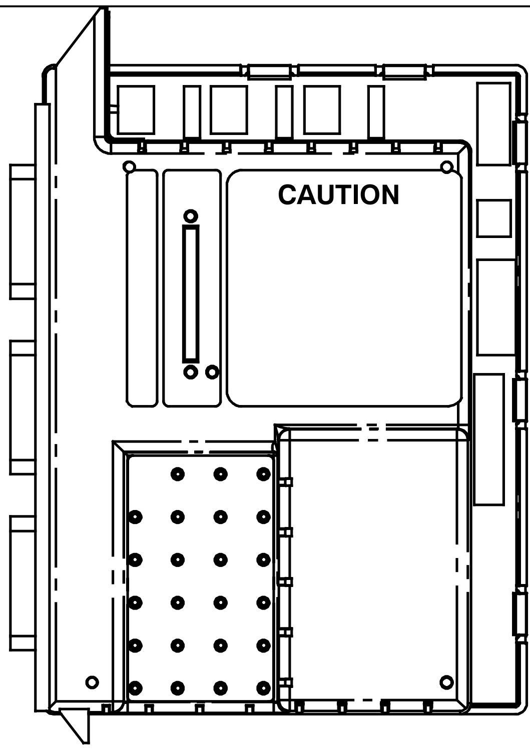
Whenever performing a major operation to a microprocessor, such as installing new operating software, it is always a good idea to start the unit and give it a quick check over *prior* to performing the operation.

NOTE

Once the unit shuts down to begin the software install process, the Compressor Suction Modulation Valve (CSMV) closing process begins. The software installation processes will not begin until the CSMV is completely closed, which will delay the actual process for about 45 seconds.

CAUTION

The display and MessageCenter may behave differently during the software loading process, depending on the version of software currently in the controller. DO NOT INTERRUPT THE SOFTWARE INSTALLATION PROCESS ONCE IT HAS STARTED.



1. Place the Microprocessor in PC mode (Refer to Section 6.1), or place the START/RUN-OFF switch in the START/RUN position.
2. Insert a Program PC card into the PC card slot on the front of the microprocessor. Be certain that the instruction label on Program PC card is facing the “Caution” label on the microprocessor. **Do not force card into slot. Hold the Program PC card at the end opposite the plug end. Do not squeeze the card in the middle while inserting. (See Section 2.5.4 for PC card care)**
3. The MessageCenter will show one of three different messages:
   Same SW: “= to Load, ↑ To Cancel”
   Old SW: “= to Load, ↑ To Cancel”
   New SW: “= to Load, ↑ To Cancel”
4. Verify by the message that you are upgrading/downgrading the software according to your intentions.
5. Press the = key to load the program. The MessageCenter will show “ENGINE AND MICRO WILL STOP NOW.” If the engine is running, it will shut down. After about 45 seconds the MessageCenter backlight will dim and the message “INSTALLING PROGRAM SOFTWARE” will be displayed. The Card Status LED adjacent to the PC card slot will blink together with the Micro Status LED at a rate of 1/2 second on then 1/2 second off during this installation process. Once the entire program has been loaded, the MessageCenter will show “INSTALL COMPLETE – REMOVE CARD. At the same time, the Card Status LED will stop blinking and be on solid, indicating that the software install is complete.
6. When the card is removed, the Microprocessor will power up as it was prior to inserting the card (PC mode or unit running). Allow the Micro to completely power up (Main Display and MessageCenter displaying appropriate messages) once after installing the new software before turning the power off, or removing the PC mode jumper. **DO NOT TURN THE START/RUN-OFF SWITCH OFF DURING THE INITIAL START FOLLOWING A SOFTWARE UPGRADE**.

6.5.3 Using ReeferManager to Install Software

⚠ CAUTION

It is important that communications between the Microprocessor and the computer not be disturbed during the software loading process. If using a laptop computer, turn all energy saving features off. Turn off any screen saver, or any hard drive time out settings.

NOTE

04.10 software and above can be installed using either the preferred previously described Program PC card method or by using a minimum of ReeferManager 03.07 and a computer. Existing Program PC cards may be upgraded to the latest software version by using the ReeferManager program.

The ReeferManager version 03.07 program is designed to be installed and operated on the following Windows operating systems: Windows 95, 98, ME, 2000, and XP. The programs will not operate on Windows Vista.

Prepare the PC that will be used with ReeferManager as follows:

- The screen saver must be turned off.
- The battery should be capable of running the PC for 30 minutes, or the PC should be plugged into an electrical outlet.
- All battery saver features (hard drive time out, monitor time out, etc.) should be set to more than 30 minutes.
- The download cable must be connected to a 9-pin COM port on the PC. USB to COM Port adaptors will not work.

Follow these steps to use ReeferManager:

a. Connect the computer to the microprocessor using a Download Cable. Once the cable is connected to the download port, the microprocessor will power up, and show “PC MODE”.

b. Start the program by double clicking on the MicroProgrammer icon on your computer desktop.

c. Click on the Load File button. The Open box will appear on the screen.

d. Using the mouse, select the file you want to load (this will be a .bex file) by clicking once on it to highlight it.

e. Click the OK button. Watch the lower left message area of the program. Once the file is validated, the Program Micro button will become active.

f. Place the START / RUN-OFF switch in the START/RUN position. Wait for the Main Display and MessageCenter to power up.

g. Click on the Program Micro button. The MessageCenter will go blank. If the engine was running, it will shut down. Nothing will happen for the first 5-10 seconds, then the software will begin to load. The Microprocessor Status LED will start blinking at the rate of 0.5 seconds on and 0.5 seconds off.

h. The % complete value on the computer screen will increment itself as the program is loaded. The % complete will stop several times during the loading process for up to 15 seconds. This is normal. DO NOT STOP THE PROCESS. The time to load the program is dependent upon the speed of the computer. This will generally take from 4 to 6 minutes.

i. It is important that the program is not interrupted from the time the “Program Micro” button is clicked until the program is completely loaded. Once the % complete reaches 100%, the shutdown box will appear. Click the OK button.

j. The microprocessor will power up, and the unit will start. Allow the engine to start completely the first time after loading software. **DO NOT PLACE THE START/RUN-OFF SWITCH IN THE OFF POSITION DURING THE INITIAL START FOLLOWING A SOFTWARE UPGRADE**.

6.5.4 Troubleshooting Software Loading Problems

If after loading the software program, the microprocessor does not power up, or the engine does not start, use the following to isolate the problem.

a. Did the unit perform properly prior to loading the software? If not, the problem most likely is not a result of the software loading process.

b. Check the Microprocessor Status LED near the PC Card slot on the microprocessor. It should be blinking continuously at the rate of 1 second on and 1 second off. This is the “normal” heartbeat rate of the microprocessor.

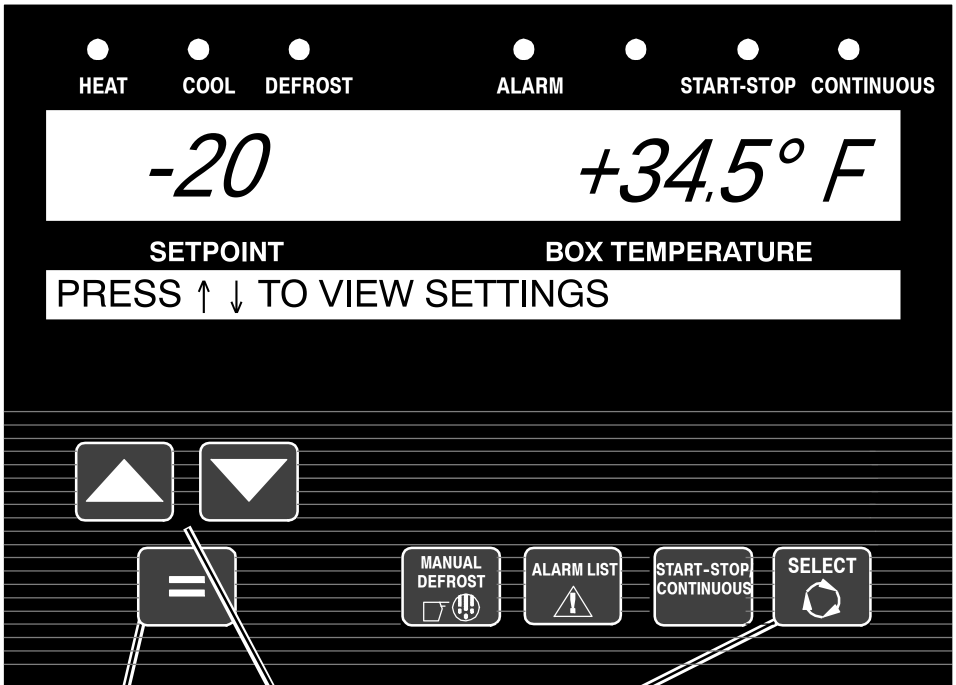
c. If the Microprocessor Status LED is blinking at the rate of .5 seconds on and .5 seconds off, the microprocessor is still in Program Mode, and the software is not fully loaded into memory. Load the software again, being careful to follow each step completely in sequence.

d. If the Microprocessor Status LED is not on at all, check voltage to QC1 & QC2. Also check for voltage from the START / RUN-OFF switch at 5MPA1. If voltage and grounds check OK, the microprocessor may be dead and require replacement.

6.6 RE-SETTING PM (PREVENTATIVE MAINTENANCE) HOURMETERS

TIP

PM hourmeters may be reset for the next maintenance interval from the Functional Parameter list using the keypad.



1. Press the SELECT key until PRESS ↑↓ TO VIEW SETTINGS. appears in the MessageCenter.
2. Press the UP ARROW key or the DOWN ARROW key until RESET PM HOURMETERS is displayed.
3. Press the = key. ↑ ↓ TO SCROLL, THEN = TO SELECT will be displayed in the MessageCenter.
4. If “NO HOURMETERS TO RESET“ appears there are none to reset.
5. Press the UP or DOWN ARROW key until the PM hourmeter you wish to reset is shown.
6. The MessageCenter will show the hourmeter name with the instructions “= TO RESET”, followed by the number of hours or cycles that will be used for the next service interval.
7. Press the = key to reset the hourmeter to the new value shown.
8. The name of the hourmeter and “RESET” will be displayed indicating that the reset was successful.
9. Repeat steps 5-7 to Reset additional PM hourmeters

SETTING PM (PREVENTATIVE MAINTENANCE) HOURMETERS (Continued)

NOTE

The hourmeters must first be configured "ON" (Refer to Section 6.2.1)

PM (Preventative Maintenance) hourmeters are provided to track unit operation and to notify the user when periodic preventative maintenance is due. Within the Advance Microprocessor, there are seven PM hourmeters available for use:

- Engine
- Switch On
- Five programmable hourmeters

The programmable PM hourmeters (PM1 – PM5) can be configured to count any of the following:

- Engine Hours
- Switch On Hours
- Clutch Cycles
- Start Cycles
- High Speed Hours

The PM hourmeters are activated and the reset interval is selected from the Configuration List. To turn on the Engine PM hourmeter, select the desired maintenance interval (in hours), and enter as the "DIESEL RESET VALUE" in the Configuration list. Selecting OFF will completely turn the Engine PM hourmeter off. The reset value selected here will be the value used when the PM hourmeter is reset from the Functional Parameter List.

To turn on the Switch On PM hourmeter, select the desired maintenance interval (in hours), and enter as the "SWITCH ON RESET VALUE" in the Configuration list. Selecting OFF will completely turn the switch on PM hourmeter off.

To turn on any of the Programmable PM hourmeters, they must first be programmed to count one of the available parameters from the list above. For example, PM 1 may be programmed to count Clutch Cycles. Selecting OFF will completely disable the PM hourmeter. Once a selection is made, then a reset interval may be selected. For hours, the PM hourmeter may be set in 50-hour increments anywhere from 50 to 30,000 hours. For cycles, the PM hourmeter may be set in 1,000 cycle increments anywhere from 1,000 to 90,000 cycles. Selecting OFF instead of an interval will also disable the PM hourmeter.

Maintenance Days are also available for customers who service their equipment by calendar days instead of operating hours or cycles.

Once the PM hourmeters are activated from the Configuration List, they can only be turned OFF or RESET for a new interval from the Functional Parameter List.

The PM Hourmeters may be reset using either a PC and the ReeferManager program or the keypad. RESET is only available when the accumulated hours are more than 95% of the reset value for that Hourmeter. (For example: the Engine PM Hourmeter Reset Interval is 1000 hrs. Reset will be allowed anytime after 950 hours have expired.)

TIP

Factory default is OFF for all PM hourmeters.

To reset a PM hourmeter that has not expired and is not found in the Functional Parameter list:

a. From the Configuration list, select the PM hourmeter.
b. Press the = key to change.
c. Select OFF for the interval.
d. Press the = key to enter.
e. Press the = key to change.
f. Select the correct interval.
g. Press the = key to enter.
h. Place the START/RUN-OFF switch in the OFF position then back to START/RUN. Check the Data list. The correct number of hours should be showing as "HOURS TO ENGINE MAINT".

6.7 ADVANCE MICROPROCESSOR REPLACEMENT & CONFIGURATION SETUP

⚠ CAUTION

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.

⚠ CAUTION

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 trailer microprocessor.

As mentioned above, some microprocessor inputs operate at voltage levels other than the conventional 12 VDC. Connection 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.

Table 6-1. Connection Point Voltage

Connection Point	Approximate Voltage
AAT, CDT, DTT, ENCT, RAT, SAT	2.5 VDC (Variable)

Although there is less danger of electrical static discharge (ESD) damage in the outdoor environment or in a repair shop – where the processor is likely to be handled – proper board handling techniques should always be stressed. Advance Microprocessors should always be handled by the plastic cover and not the exposed printed circuit board. This not only precludes the possibility of ESD damage, but also lowers the possibility of physical damage to the electronic components.

When field diagnosis of a Carrier Transicold Vector 6500 refrigeration unit determines that an Advance Microprocessor is not performing properly and must be replaced, the following steps MUST be taken to ensure correct operation of the unit following the repair.

Prior to beginning work on the unit, be certain that the current configuration file has been downloaded for the customer, from the Carrier Transicold Information Center, and written onto a Configuration PC Card, using the ReeferManager Program. If the original microprocessor was equipped with the IntelliSet option, this file will need to be on a Config Card in order to install the IntelliSet parameters into the replacement microprocessor. A computer is needed to enter the engine and switch on hours into the new microprocessor. All settings – including unit model number, Trailer ID, unit serial number, and operating hours and cycles – from the old microprocessor can be installed into the new microprocessor using either the keypad or a computer with the ReeferManager program.

NOTE

A single set of configurations, functional parameters and data recorder settings can be sent serially to the microprocessor using the ReeferManager program. Multiple sets of settings (IntelliSets) can only be sent to the microprocessor by using a Configuration PC card.

6.7.1 Microprocessor Replacement

a. If possible, power the microprocessor up, either using a PC mode jumper, or by placing the START/RUN-OFF switch in the START/RUN position. If the microprocessor will not power up, skip ahead to step d.

b. Insert a Download PC card into the PC card slot and download all data from the data recorder. If a Download PC card is not available, data may also be downloaded using a download cable and the ReeferManager PC Program.

c. Scroll through the DataList and make note of the following from the MessageCenter:
   - ID Number
   - Unit Serial Number
   - Unit Model Number
   - Engine Protect Hours
   - Switch On Protect Hours
   - Engine Sleep Hours
   - Switch On Sleep Hours
   - High Speed Hours
   - Clutch Hours
   - Start Cycles
   - Date And Time

d. Remove PC jumper or turn START/RUN-OFF switch to Off.

e. Remove negative battery cable from battery.

f. Remove Connectors 1MP, 2MP, & 3MP from the outside of the control box.

g. Open keypad door by removing the screws at the bottom. Open control box door and use the retaining rod to hold the door open.

h. Remove Connectors 5MP & 6MP inside the control box. Remove all wires from the Micro.

i. Locate wire to 80A fuse that runs through the Current Sensor. Note the orientation of the wire through the Current Sensor, to be certain that the wire is reinstalled through the new Current Sensor in the same direction. (Inserting the wire through the Current Sensor in the opposite direction will result in erroneous current readings.) Remove wire from fuse holder and gently pull through the Current Sensor.

j. Remove the screws holding the sides of the Micro into the control box. Remove the single screw holding the top of the Micro in place.

k. Pull the Micro back, and twist out of the control box.

l. Install the new Micro by reversing steps a. thru k.

6.7.2 Microprocessor Setup

NOTE

Before starting the unit, the microprocessor must be configured for the correct unit model family and model number. This can be done at the unit keypad, or by using the ReeferManager program. The steps below are used when setting the microprocessor up from the keypad.

Generally, the microprocessor can be setup using a Configuration PC card however certain parameters can not be set using a Configuration PC card. Those parameters can be entered using the keypad or the ReeferManager program. The steps below detail entering the data using the keypad.

a. Ensure that the new microprocessor is in place, all wires connected and the negative battery cable is reconnected.

b. Place the START/RUN-OFF switch in the START/RUN position. The microprocessor will immediately go into the Configuration List so that the correct model number can be selected. Using the UP or DOWN ARROW keys, scroll through the list until the correct Model Family appears, and press the = key. Use the Up or Down Arrow keys to scroll through the list of model numbers until the correct model number appears (verify the model/serial plate on the unit). Press the = key to enter the new model number.

c. Press the UP ARROW key again, and the unit serial number field will appear. Press the = key, then the UP ARROW key. You will see a blinking cursor in the field. Now, using the UP or DOWN ARROW key, scroll through the Number/Letter list, until the first letter of the serial number you recorded above appears. Press the = key to enter that letter and advance the cursor to the next place. Repeat this process until the entire unit serial number is entered
(i.e. LAD90887654).

d. Press the UP ARROW key again, and the ID field will appear. Press the = key, then the UP ARROW key. You will see a blinking cursor in the field. Using the UP or DOWN ARROW key, scroll through the Number/Letter list, until the first letter/number of the ID you recorded above appears. Press the = key to enter that number/letter, and advance the cursor to the next place. Repeat this process until the entire ID number is entered. If the cursor is still blinking in a blank space after you are finished, slowly (wait 2 to 3 seconds between presses) press the = key to leave blanks in the remaining spaces. When you reach the end, the message
↑↓ TO SCROLL, THEN = TO SELECT will appear (i.e. XYZ5678).

e. Now, press the DOWN ARROW key until "SET TIME" appears. Press the = key then the UP ARROW key to enter that menu.

⚠ CAUTION

Be certain that the clock you are using is accurate, and is showing the correct time. Also, some customers are located in different time zones from where the repair is being made. If you know what time zone they use, enter that time. If you don't, then enter the current time where you are located.

f. When MONTH appears, press the = key, then the UP ARROW key. The MessageCenter will begin to flash, indicating that it is ready to accept changes. Use the UP or DOWN ARROW key to scroll through the number list until the correct number of the current month appears. Press the = key to enter that number for the month.

g. Press the UP ARROW key to go to Day.

h. Using the same key presses as in f. and g. above, continue to enter the correct numerical value for the Day, Year, Hour and Minute. Hours are displayed and entered as a 24 hour clock. 0 to 12 is AM. 13 to 24 is PM.

i. When you are finished, the MessageCenter will diisplay "PRESS = TO SAVE TIME CHANGES".

NOTE

If you do not press the = key, none of the time changes you just made will be saved.

j. Press the UP ARROW key to go to
"SET NEW HOURS". Press the = key then the Up Arrow key to enter that menu.

k. The first hourmeter is Engine Protect Hours. Press the = key to select this meter. The cursor will be blinking on the ten-thousands place. Press the UP or DOWN ARROW key to select the correct value, then press the = key. If the correct number in any of the locations is 0 (zero), just press the = key to enter 0 as the value and move the cursor to the next place. For example, if you are entering 567 hours, you will press the = key twice to leave a 0 for the first two numbers, then use the UP and DOWN ARROW key to scroll through the numbers to enter the correct hours. When the correct hours for Engine Protect Hours has been entered, press the = key to advance to the next hourmeter. If an invalid number is entered, a warning message will flash in the MessageCenter. For example, you can not enter a higher number of hours for Engine Protect than the number of Switch On Hours.

NOTE

None of the "Total" hourmeters are listed. When the hours for all the hourmeters are entered, the microprocessor will add the correct hours together and calculate the Total Engine Hours, and Total Switch On Hours. When the end of the list is reached "PRESS = TO SAVE HOURS" will be displayed. Pressing the = key will save the hours, and return you to the configuration list.

If you do not press the = key, none of the time hours or cycles you just entered will be saved.

Hourmeters may be changed for 60 minutes following the initial hour entry. If an error has been made, be certain to correct it within the 60 minute time period. Following that time, the hourmeters will count the appropriate hours because the unit switch is on and the unit is operating, and no further manual changes will be allowed.

NOTE

After the configuration settings are complete use the UP or DOWN ARROW keys until "CONFIGS COMPLETE, = TO EXIT" is displayed in the MessageCenter. Press the = key to save.

NOTE

If a Configuration card will be used to configure the microprocessor, skip ahead to CONFIGURATION CARD, Section **6.7.7** If the Configurations and Functional Parameters will be set from the keypad, continue with following steps 6.7.3 and 6.7.4

6.7.3 Configurations Via Keypad

Refer to Section 6.2 for a list of available microprocessor configurations. Refer to Section 6.2.1 for instructions on how to access them.

NOTE

Units equipped with IntelliSet MUST have the settings installed using ReeferManager and a Configuration PC card.
IntelliSet settings CANNOT be installed by using either the keypad, or by using a laptop computer.

6.7.4 Functional Parameters via Keypad

a. Refer to Section 3.16 for the list of available Microprocessor Functional Parameters and for directions on how to access them.

b. Leave the microprocessor powered up as you continue with the next section.

6.7.5 DataRecorder Via ReeferManager PC Program

NOTE

If the factory settings are used, you can skip this section and proceed to hourmeter Setup.

a. Refer to Section 3.19 for list of DataRecorder Setups.

b. Power up the microprocessor. If it is not already powered up, refer to directions under Microprocessor Setup – Functional Parameters via keypad, Section 6.7.4 above.

c. Connect your computer to the download port of the unit (use cable 22-001737) and start the ReeferManager program. You will need ReeferManager version 03.07.00 or higher.

NOTE

ReeferManager 03.07.00 is **REQUIRED** in order to view, change and send new features to and from the microprocessor.

d. In ReeferManager, go to the Serial Operations Tab, and then click on DataRecorder/Microprocessor setup button.

e. Select the Sensors to be recorded and whether you wish averaged or snapshot recordings (averaged is recommended for all temperature sensors; snapshot is recommended for pressure, voltage, amperage, & RPM).

f. When the setup is correct, press the Send button to send the new settings to the microprocessor.

g. From the "Confirm Send Information" Pop Up, check the data you want to send and un-check the data you don't want to send. Click the OK button.

h. Verify that the settings were sent by waiting for the confirmation pop up message.

NOTE

If the DataRecorder date and time were not set earlier, they can be set from this screen by clicking on DataRecorder Tools>Set Date and Time.

i. Leave the microprocessor powered up as you continue with the next section.

6.7.6 Engine And Switch-on Hourmeters Via ReeferManager PC Program

a. Start the ReeferManager program. Go to the Serial Operations Tab.

b. Click on DataRecorder/Microprocessor Setup button.

c. In the upper left menu bar, click on MicroprocessorTools>Set New Micro Hours.

d. At this screen, enter the hours that were recorded in step b. of Section 6.7.1. Send the new readings to the microprocessor.

NOTE

Hours can only be entered into the microprocessor until either the Total Engine Hours or the Total Switch On Hours reach 25. However, in the case of incorrect hours being entered, changes can be made for 60 minutes after the initial change has been made - regardless of the number of hours entered. Once the 60 minutes has expired, and either of the total hourmeters reaches 25 hours, no further changes can be made.

The 60 minute grace period is based on the Real Time Clock in the DataRecorder. That is why it is important that the Real Time Clock is set to the correct time prior to setting the hour meters.

e. Your computer may now be disconnected and turned off or you can continue setting up the configurations.

6.7.7 Configuration/IntelliSet PC Card

a. Place the START/RUN-OFF switch in the OFF position to power down the microprocessor and to take it out of Configuration mode.

b. Power the microprocessor up by either placing the START/RUN-OFF switch in the START/RUN position (Manual Start Operation can be used if the unit is so equipped) or by inserting a PC mode jumper into the download port.

c. Insert the Configuration PC card into the PC card slot in the microprocessor and watch the MessageCenter. When the MessageCenter shows "CFG, = TO LOAD, ↑ TO CANCEL", press the = key. It will take 10 – 15 seconds to load the IntelliSets from the card. "LOADING INFO" will be displayed during this time. When finished, the MessageCenter will show "ALL INFO LOADED – REMOVE CARD". Remove the Configuration PC card.

d. The MessageCenter will show "MICRO WILL RESET AND RESTART NOW", the display will go blank, then come back on after a few seconds.

NOTE

When the microprocessor powers up the display will show "PRESS = TO VIEW INTELLISETS". The unit will not start until one of the new IntelliSets has been selected.

e. Press the UP or DOWN ARROW key to scroll through the list of IntelliSets. Pressing the UP ARROW key will bring the first IntelliSet name into the Message Center.

f. Move to the desired IntelliSet and press the = key. The desired IntelliSet will automatically become active and the unit will be able to be started.

6.7.8 Microprocessor Final Checkout

a. Start the unit and allow it to run for a few minutes.

b. While the unit is running, scroll through the Data List of the microprocessor. Verify that all the data that was recorded in Step b. of Section 6.7.1 is now accurately displayed in the Data List. Also verify that the correct date and time are being displayed.

c. Initiate a Pretrip test. Allow the unit to complete the Pretrip and check for any alarms. Make any necessary repairs before returning the unit into service.

6.7.9 Replacing Display Bezel Assembly

Display Bezel Assembly Removal

a. Place the START/RUN-OFF switch in the OFF position and disconnect the negative battery cable. Attach a grounded wrist strap (CTD P/N 07-00304-00) and ground it to a good unit frame ground.

b. Open the roadside side door containing the Keypad/Display Assembly. Unplug the display cable from the 10-pin harness.

c. Loosen and remove the (4) hex head 1/4-20 bolts holding the bezel bracket to the door and lay the bezel assembly on a clean work surface.

d. Loosen and remove the (4) 5mm x 20mm lg hex head bolts holding the bezel assembly to the bracket. Carefully separate the bezel assembly from the bracket. Disconnect the wiring harness from the display board and the START/RUN-OFF switch.

Display Bezel Assembly Installation (CTD P/N 91-00312-02SV)

CAUTION

Do not over-torque screws. Torque all screws to 11in-lbs (1.2 Nm).

NOTE

Eleven Phillips head screws are used to retain the keypad to the bezel: (8) 3/4" Lg. screws around the perimeter of the keypad and (3) 3/8" Lg. blunt tip screws in the center of the keypad. Four 3/8" Lg. Phillips head screws are used to retain the display board to the keypad.

a. Remove the old gasket from the door mounting bracket.

b. Ensure that the surface is completely free of any old gasket material and apply the new gasket (included in the kit) to the bracket.

c. Plug the wire harness into the new display board and reconnect the wires to the START/RUN-OFF switch.

d. Secure the bezel to the control door with the (4) 5mm X 20mm lg. hex head bolts. Torque bolts to 26 in. lbs. (2.9 Nm).

e. Fasten bezel and bracket assembly to unit side door using (4) hex head 1/4-20 bolts.

f. Reconnect wire harness (10-pin connector) from the microprocessor.

g. Reconnect negative battery cable and run Pretrip to check unit operation.

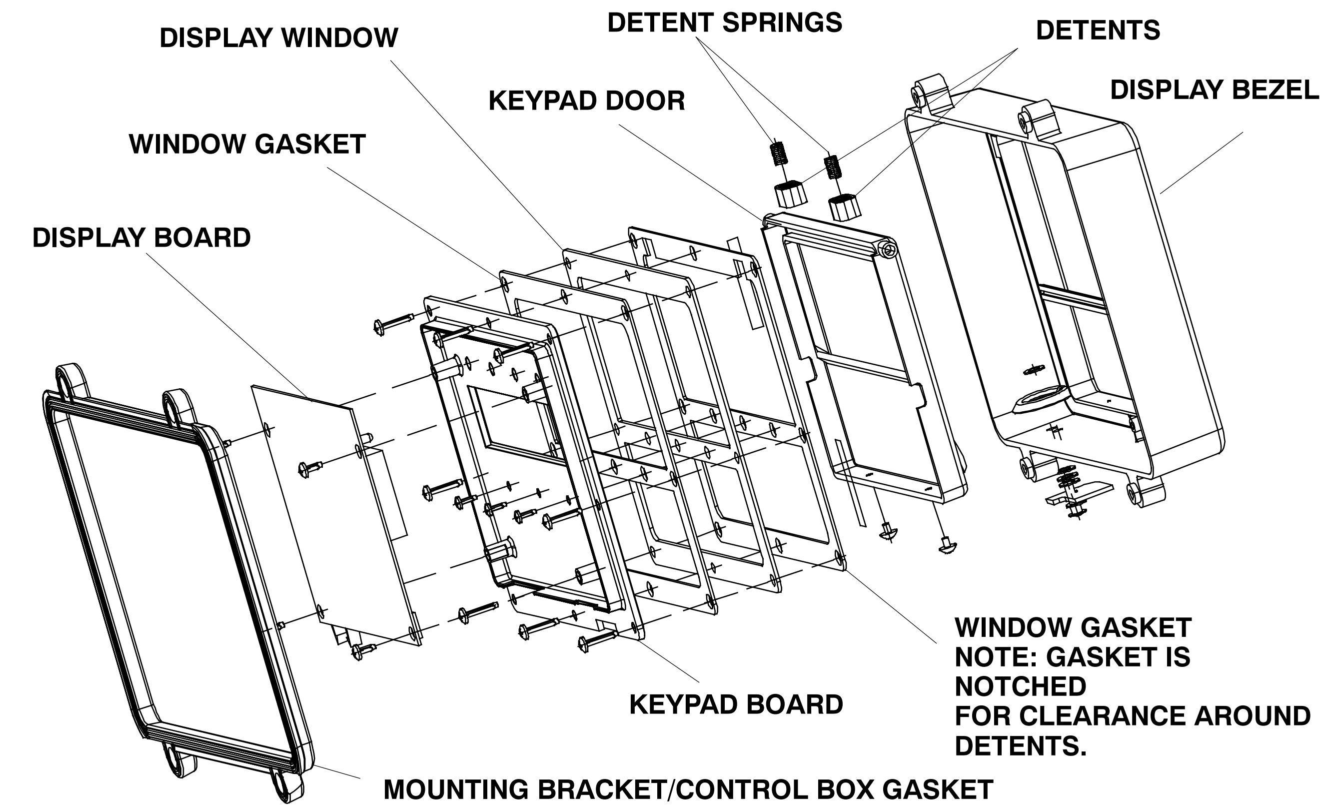


Figure 6 -1. Display Module Assembly

SECTION 7

MessageCenter

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SECTION 7

MessageCenter

7.1 MessageCenter MESSAGES

The following table lists all of the messages that do not appear in other lists in this manual and a description of their meaning. Refer to Section 8 for a list of alarm messages. Refer to Section 3.14 for a list of Unit Data messages. Refer to Section 3.16 for a list of Functional Parameter messages. Refer to Section 6.2.1 for a list of Configuration messages.

MessageCenter MESSAGES	
Message	Description
↑↓ TO SCROLL, THEN = TO LOCK	This message is used when viewing Unit Data. Use the UP and DOWN arrow keys to move through the data list. Press the = key to lock a data item in the MessageCenter
↑↓ TO SCROLL, THEN = TO SAVE	Press the UP or DOWN arrow key to scroll through menu selections available in this mode. When you reach the desired selection, press the = key to store new value in microprocessor's memory.
↑↓ TO SCROLL, THEN = TO SELECT	Press the UP or DOWN arrow key to scroll through menu selections available in this mode. When you reach the desired selection, press the = key to select it.
= TO INSTALL, INSTALLS LEFT XX	An Option PC card has been inserted into the PC card slot. Press the = key to install the option into the microprocessor. The number of installs remaining on the PC card will be shown.
ACTIVE	This message will appear in the MessageCenter along with the current IntelliSet indicating that the IntelliSet is active and none of its settings have been modified.
ACTIVE ALARM LIST CLEARED	The list of active alarms in the microprocessor alarm lists has been erased. (This does *not* remove alarms from the data recorder.)
ALL ALARMS CLEARED	The list of active and inactive alarms in the microprocessor alarm lists have been erased. (This does *not* remove alarms from the data recorder.)
ALL INFO LOADED – REMOVE CARD	All data has been loaded into the microprocessor from the PC card. The card may be safely removed from the microprocessor.
ARL LIGHT OFF IN X MINS	The Auto Restart Light circuit to the Operator's Light Bar has been energized in Component Test mode. The ARL circuit will continue to be energized for the number of minutes shown.
BACK TO CONFIGS	Pressing the = key with this message showing will return the user to the main microprocessor Configuration list.
BACK TO FUNC PARAMS	Pressing the = key with this message showing will return the user to the main Functional Parameter list.
BAD PC CARD OR CARD SLOT	The microprocessor has detected a problem with either the PC card or the PC card slot.
BUZZER OFF IN X MINS	The Buzzer circuit has been energized in Component Test mode. The Buzzer circuit will continue to be energized for the number of minutes shown.
CALIBRATION UNSUCCESSFUL	Attempt to calibrate discharge transducer failed.
CANNOT ENTER TRIP START	Cannot enter trip start. A problem has been detected within the DataRecorder.
CANNOT START DEFROST CYCLE	Cannot start defrost cycle. Refer to Defrost Sections 3.10, 5.11, 2.15 and 9.24.
CANNOT START PRETRIP	Cannot start pretrip. Refer to Pretrip Section 3.4.
CANNOT DOWNLOAD – BATTERY DEAD	Data cannot be downloaded and software upgrades are prohibited when battery voltage is below 7.0 volts. This message will be displayed until the serial cable is removed.
CARD FULL, REMOVE CARD	The PC Download card is full. There is no additional room to download information from the microprocessor. You may safely remove the PC card from the slot.

MessageCenter MESSAGES	
Message	Description
CARD LOCKED – REMOVE CARD	The lock switch on the PC card is in the “Locked” position. To use the PC card, move the switch to the “Unlocked” position.
CARD REMOVED, DATA NOT COPIED	The PC card was removed before all data was copied onto the card.
CARD REMOVED, REINSERT CARD	The PC card was removed from the card slot before the operation was completed. Reinsert the PC card into the card slot to perform the operation.
CFG: =TO LOAD,↑ TO CANCEL	A Configuration card has been inserted into the PC card slot. Press the = key to load configurations or IntelliSets into microprocessor.
CHANGE INTELLISET TO EXIT	The IntelliSleep Intelliset is active. Alternates with “INTELLI-SLEEP MODE” at 5 second interval whether unit is running or not.
CHARGE MODE – HOLD=TO EXIT	Service mode has the refrigeration system set so that it can be charged with refrigerant through the king valve. Press the = key to manually exit, or wait until the charging is complete.
CHECK AT NEXT SERVICE INTERVAL	The unit needs to be checked at next service interval. There is currently an active non-shutdown alarm in the Alarm list.
CHECK COOLANT LEVEL (Requires Optional Sensor)	The engine coolant level is not full.
CHECK DOOR	Door switch indicates that trailer or rail car compartment door is not closed.
CHECK ENGINE OIL LEVEL (Requires Optional Sensor)	The oil level in the diesel engine is low.
CHECK FUEL LEVEL (Requires Optional Sensor)	The level in the fuel tank is very close to empty.
CHECK MICROPROCESSOR **Earlier Units Only**	There is a communication signal lost between the keypad/display and the microprocessor. Check and test the wiring to the keypad/display
CHK WIRES FROM MICRO TO KEYPAD **Later Units**	There is a communication signal lost between the keypad/display and the microprocessor. Check and test the wiring to the keypad/display
CLHR OFF IN X MINS	The Clutch Relay circuit has been energized in Component Test mode. The Clutch Relay circuit will continue to be energized for the number of minutes shown.
COMPONENT TEST MODE	Pressing the = key while this message is being displayed will allow user access to Component Test mode.
COMPONENT TEST MODE MENU SELECTIONS	The selections following this message are the components available for energizing during Component Test mode.
CONFIG ERROR, REMOVE CARD	There was an error configuring the microprocessor with the Configuration PC card. Remove the PC card from the slot.
CONFIGS COMPLETE,= TO EXIT	The user has reached the end of the Configurations list. Pressing the UP or DOWN ARROW key will start list over. Press the = key to exit Configuration list.
CONFIGURATION MODE	Press the = key to enter Configuration mode.
CONFIGURATION NOT CHANGED	New configuration selection was not entered (saved).
CONTINUOUS LOCKED	The current set point is within a range that has been locked into the Continuous Run mode. Start-Stop can not be selected.
CONTINUOUS RUN MODE SELECTED	Continuous run mode is selected.
COPY COMPLETE, REMOVE CARD XX	A DownLoad PC card has been inserted into the PC card slot, and all data from the DataRecorder has been copied onto the PC card. You may safely remove PC card from the slot. XX indicates the number of empty download slots remaining on the card.

MessageCenter MESSAGES	
Message	Description
COPY ERROR, REMOVE CARD XX	A DownLoad PC card has been inserted into the PC card slot and an error occurred while the data was being copied onto the PC card. You may safely remove the PC card from the slot. XX indicates the number of empty download slots remaining on the card.
COPYING DATA – PLEASE WAIT	A DownLoad PC card has been inserted into the PC card slot and all data from the data recorder is being copied onto the PC card. DO NOT REMOVE THE CARD WHILE THIS MESSAGE IS BEING DISPLAYED.
DATA RECORDER FAILURE	The microprocessor has stopped recording unit data.
DEFROST CYCLE STARTED	The unit has gone into defrost.
DOOR OPEN	The trailer or rail compartment door is open.
DOOR OPEN – LOW SPEED	The trailer or rail compartment door is open forcing the unit to run in low speed.
ENTERING SERVICE MODE	The initial message for Service mode. See Section 6.2.3.
EVAC / CHARGE MODE	The unit is in Service Mode, and the refrigeration system is ready to be evacuated or changed with refrigerant. See Section 6.2.3.
EXITING PRETRIP MODE	Pretrip has been aborted either by user or by a pretrip alarm.
EXITING SERVICE MODE	Service mode has been turned off and unit is returning to normal operation.
FUNCTION NOT CHANGED	The = key was not pressed in the allotted amount of time to select the new Functional Parameter setting. The new setting was not stored and the old setting will be used.
HOUR METERS NOT CHANGED	Indicates that no changes have been made to the hourmeters in either the configuration or functional parameter lists.
INACTIVE ALARMS IN MEMORY	There are inactive alarms in the microprocessor alarm list which have not yet been cleared.
INSTALLED, REMOVE CARD XX	An Option PC card has been inserted into the PC card slot, and the option has been installed in the microprocessor. The PC card may safely be removed from the slot. XX indicates the number of option installations remaining on card.
INSTALLING OPTION, PLEASE WAIT	An Option PC card has been inserted into the PC card slot, and the option is being installed in the microprocessor. DO NOT REMOVE THE CARD WHILE THIS MESSAGE IS BEING DISPLAYED.
INSTALL STOPPED, REINSERT CARD	An Option PC card has been inserted into the PC card slot, and the install process has been stopped been stopped by the PC card not being fully inserted in the slot or by being removed. Remove and reinsert PC card to continue.
KEYPAD LOCKED – BATTERY TOO LOW	If any keys are pressed while “UNIT BATTERY–xx V” message is being displayed this message will be displayed as a warning that no changes can be made and information can not be viewed until the battery voltage is brought back up above 10 volts for more than 10 seconds.
LIST END, = TO CLEAR ALARMS	The end of the Alarm list has been reached. Pressing the = key will clear the Alarm list.
LOADING INFO	A Configuration PC card has been inserted into the PC card slot, and information from the Configuration card is being loaded into the microprocessor. DO NOT REMOVE THE CARD WHILE THIS MESSAGE IS BEING DISPLAYED.
MAIN MENU	Consists of Configuration mode, Component Test mode and Service modes.
MANUAL START MODE SELECTED	The user has selected manual start mode. The diesel engine must be started using the manual GLOW/CRANK switch. This is available only on units that have a Glow Crank Switch.
MAX SETPOINT HAS BEEN REACHED	Maximum set point allowed by configuration settings has been reached.

MessageCenter MESSAGES	
Message	Description
MIN SETPOINT HAS BEEN REACHED	Minimum set point allowed by configuration settings has been reached.
MODIFIED	This message will appear in the MessageCenter along with the current IntelliSet indicating that the IntelliSet is active and one or more of its settings have been modified.
NEW SW: = TO LOAD, TO ↑ CANCEL	A Program PC card has been inserted into the PC card slot, and the program on the PC card is a newer version than what is already loaded in the microprocessor. Press the = key to load the program.
NO ACTION TAKEN, REMOVE CARD	A Program PC card has been inserted into the PC card slot, and no key presses have been made to install the program into the microprocessor. The PC card may be safely removed from the slot.
NO ACTIVE ALARMS	There are no active alarms in the microprocessor alarm list.
NO DATA ON CARD, REMOVE CARD	A Program or Configuration PC card has been inserted into the PC card slot, and no valid data is present on the PC card. The PC card may safely be removed from the unit.
NO DATA TO COPY, REMOVE CARD	A Download PC card has been inserted into the PC card slot, and there is no valid data in the data recorder to copy onto the PC card. The PC card may safely be removed from the unit.
NO INACTIVE ALARMS	There are no inactive alarms in the Alarm list
NO INSTALLS LEFT, REMOVE CARD	An Option PC card has been inserted into the PC card slot and all install options have been used. The PC card may safely be removed from the unit.
OLD INTELLISETS - USE REEFERMAN	The IntelliSets that are on the Configuration PC Card were written with too old of a PC Program, like ServiceManager. The software in the microprocessor requires IntelliSets to be written to the Configuration PC Card using ReeferManager. Rewrite the information to the card using ReeferManager, then use it in the microprocessor again.
OLD SW, = CANNOT LOAD - REMOVE CARD	A Program PC Card has been inserted into the PC Card slot, and the major version of the program on the PC Card is an older version than what is already loaded in the microprocessor. Software with older major versions can not be loaded into the microprocessor. Remove the PC Card. (Refer to Section 6.5.1 for software version description.)
OLD SW, = TO LOAD, ↑ TO CANCEL	A Program PC Card has been inserted into the PC Card slot, and the minor version of the program on the PC Card is an older version than what is already loaded in the microprocessor. Press the = key to load the older program. (Refer to Section 6.5.1 for software version description.)
PC MODE	Indicates that the conditions for entering PC Mode are met: the START/RUN-OFF switch is OFF, the PC mode Jumper is connected and the engine is not running. PC Mode allows the user to access and download data using a computer when the unit is not running and without starting the 8 hour data recorder timer. Refer to Section 6.1.
PM DUE	Preventative Maintenance is now due on the unit.
PM HOUR METER NOT CHANGED	The last change for the PM hourmeter was not received by the microprocessor.
PRESS ↑↓ TO VIEW DATA	Press the UP or DOWN ARROW key to scroll through the Data list.
PRESS ↑↓ TO VIEW SETTINGS	Press the UP or DOWN ARROW key to scroll through Functional Parameter settings
PRESS ↑↓ TO VIEW PRINT MENU	Press the UP or DOWN ARROW key to view the strip print setup menu.
PRESS = TO MARK TRIP START	Press the = key to mark the start of the trip in the data recorder.
PRESS = TO START PRETRIP	Press the = key to begin pretrip tests.
PRESS ↑↓ TO VIEW INTELLISET	Press the UP or DOWN ARROW key to view IntelliSet list.
PRETRIP FAIL & COMPLETED	Some of the pretrip tests did not pass.

MessageCenter MESSAGES	
Message	Description
PRETRIP FAIL IN TEST XX	Some of the pretrip tests did not pass and the pretrip was not completed.
PRETRIP PASS	All of the pretrip tests were OK.
PRODUCT SHIELD: HIGH AIR ON	The unit is operating in ProductShield High Air which overrides normal unit operation. Refer to Section 5.16.1.b.
PRODUCT SHIELD: WINTER ON	The unit is operating in ProductShield Winter which overrides normal unit operation. Refer to Section 5.16.1.c.
PRODUCT SHIELD: ECONO ON	The unit is operating in ProductShield Econo which overrides normal unit operation. Refer to Section 5.16.1.a.
RECOVER / LEAK CHK / EVAC MODE	This message will be displayed when the unit is in Service Mode and the system is ready for recovery and leak testing.
REMOVE CARD – BATTERY TOO LOW	If a PC card is inserted when battery is below 7.0 volts this message will be displayed until card is removed.
REMOTE SWITCH 1 (2) OPEN	Remote switch is open. May be connected to a trailer or rail car compartment door or a remote control switch.
REMOTE SWITCH 1 (2) OPEN – LOW SPEED	Shows that the remote switch is open and that the unit is running in low speed. Switch may be connected to a trailer or rail car compartment door or a remote control switch.
REMOVE JUMPER	The Configuration/Technician Test mode has been entered. Remove the jumper wire before continuing.
SAME SW, = TO LOAD, ↑ TO CANCEL	A Program PC card has been inserted into the PC card slot, and the program on the PC card is the same as the program currently in the microprocessor. Press the = key to reload the same program or press the UP ARROW key to cancel and remove card.
SERVICE MODE	Indicates that this selection has been made in Configuration and Test Modes which allows servicing of the refrigeration system.
SETPOINT CHANGED	The new set point has been entered (saved into microprocessor memory). The new set point will be used.
SETPOINT NOT CHANGED	The new set point has NOT been entered (NOT saved into microprocessor memory). The old set point will be used.
SETTING SMV: XXX %	The START/RUN-OFF position has been placed in the START/RUN position and the CSMV is opening.
SLEEP MODE, OFF / ON TO WAKE	The unit is cycled off in Sleep Mode. Place the START/RUN–OFF switch in the OFF position, then back to the START/RUN position to wake the microprocessor up.
SLEEP WARNING: DOOR OPEN	The rail unit is in Sleep Mode and a rail car compartment door is open. The unit will start as needed for Sleep Mode.
SLEEP WARNING: NO TEMP CONTROL	The unit is running in Sleep mode.
SLEEP WARNING: REMS1(2) OPEN	The rail unit is in Sleep mode and a remote switch is open. Switch may be connected to a door or a remote control switch. The unit will start as needed for Sleep mode.
SMV CLOSING: WAIT xxx SECONDS	Microprocessor is powering up and CSMV is closing. XX indicates the number of seconds remaining until valve is fully closed.
START MODE: AUTO or MANUAL	Indicates whether the unit is in Auto Start or Manual Start mode
START-STOP LOCKED	The set point has been locked into the Start-Stop mode. Continuous Run can not be selected.
START-STOP MODE SELECTED	Start–Stop Mode has been selected.
STATUS OK	The unit is working correctly.
TECHNICIAN RESET REQUIRED (A21)	AL11 (Low Engine Oil Pressure) or AL12 (High Coolant Temperature) has been activated three times in the last two hours and the unit has been locked out. The unit must be brought to a Carrier Transicold Dealer for Service.
TEST #1 to #16	Pretrip is currently running this test and is x% complete
TIME SELECTION NOT CHANGED	A time change was started but not entered in Configuration list.

MessageCenter MESSAGES	
Message	Description
TRIP START ENTERED	The Trip Start marker has been placed in the DataRecorder.
UNIT BATTERY LOW	The unit battery has dropped below 7 volts for more than 10 seconds.
UNIT SHUTDOWN – DOOR OPEN	The unit has shut down because the trailer or rail compartment door is open.
UNIT SHUTDOWN – SEE ALARM LIST	An active shutdown alarm has shut the unit down
UNIT SHUTDOWN – RMS1(2)	The unit has shut down because switch is open. May be connected to a door or a remote control switch.
UNKNOWN CARD – REMOVE CARD	A defective or different type of PC Card has been inserted into the PC Card slot. The microprocessor can not recognize any data on the card. The card may be safely removed from the micropro-cessor.
WARNING: NO TEMP CONTROL	Both RAT and SAT alarms are on and unit is running with a set point in the frozen range in low speed six cylinder cool.
WRONG UNIT TYPE, REMOVE CARD	A Configuration PC Card has been inserted into the PC Card slot. The unit model type on the PC card is not in the same unit family type as the controller. The card may be safely removed from the microprocessor

SECTION 8

ALARM TROUBLESHOOTING

SECTION 8

ALARM TROUBLESHOOTING

8.1 INTRODUCTION TO ALARM TROUBLE-SHOOTING GUIDE

The Alarm Troubleshooting Guide should be used whenever an alarm occurs. Alarms will appear in the MessageCenter and will begin with the alarm number. Alarms are listed in the Troubleshooting Guide by alarm number.

When an alarm occurs, look through both Active and Inactive Alarm lists in the microprocessor **(See Note Note 1 Section 8.2)** and make note of all alarms.

Before beginning to actually troubleshoot a unit, 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.

Usually you should begin troubleshooting with the first alarm that appears in the active Alarm list. Other alarms in the list may have contributed to the occurrence of the first alarm. The first alarm that appears is the last alarm that was recorded.

The check items in the troubleshooting guide are listed in order of their likeliness of occurrence and ease of testing. We recommend that you follow the order in which they are presented; however, there may be times when situations or experience directs you to use a different order. For example, if the trailer or rail car is loaded, you may want to perform all the condensing unit checks first, even though some evaporator section checks may be listed before them.

As you go through the troubleshooting steps, you will find the cause of the problem. When you find and correct the problem, it is not necessary to continue through the remainder of the steps. Some active alarms will clear (inactivate) themselves automatically once the cause has been corrected. You then only need to go to the inactive list to clear all alarms before verifying the remainder of the unit operation. Alarms that do not inactivate themselves automatically must be cleared manually. **(See Note 1 Page 8.2)**

When you are finished making repairs, run the unit through a Pretrip cycle and verify that no further active alarms occur. Also, both Alarm lists should be cleared so that there are no 'old' alarms in memory when the unit leaves your repair facility.

If the message CHECK MICROPROCESSOR appears in the MessageCenter, there is a communication error between the keypad and the microprocessor. With no communication, there will not be an associated alarm. Should this occur, check the wire connections for the wiring that connects connector 6 on the microprocessor to the connector at the Keypad/Display assembly.

In later model units this message will read "CHK WIRES FROM MICRO TO KEYPAD."

When working on the refrigeration system, an accurately calibrated manifold test set should always be installed. It is also a good idea to connect an additional high pressure gauge to the king valve.

In high or low ambients, it may be necessary to cool or warm the box temperature before performing specific tests providing that the trailer or rail compartment is not loaded with perishable product.

WARNING

Beware of V-belts and belt driven components as the unit may start automatically. Before servicing unit, make sure the START/RUN-OFF switch is in the OFF position or the unit is in the Maintenance mode. Also disconnect the negative battery cable.

WARNING

UNITS EQUIPPED WITH STAR-TRAK TWO WAY COMMUNICATION CAPABILITIES MAY HAVE THE ABILITY TO BE STARTED OR TURNED OFF REMOTELY REGARDLESS OF THE SETTING OF THE START/RUN-OFF SWITCH.

The unit is controlled locally and there can be no two-way communication when the Mode switch on the Remote Monitoring Control Box is in MAINTENANCE MODE. Therefore, when performing any work on the unit, place the Mode switch in MAINTENANCE MODE. After the unit is serviced, return the Mode switch to REMOTE ON. (Refer to Section 3.20.3 for more detailed information on two-way communication.)

8.2 NOTES

Note 1 Active alarms will always be in the Alarm list. They will have an "A" in front of the alarm number. Active alarms may be inactivated by going to the end of the Active Alarm list. "LIST END, = TO CLEAR ALARMS" will appear in the MessageCenter. Pressing the = key will clear or inactivate the alarms. This moves the alarm to the Inactive Alarm list, *if* the condition that caused the alarm has been corrected. When Shutdown Alarms are cleared, the unit will attempt to restart (if the micro is set for auto-start). When non-Shutdown Alarms are cleared, there will be no noticeable change in the unit's operation.

The Inactive Alarm list is reached by first pressing and holding the Alarm list key, then the UP Key, and holding both of them for six seconds. Alarms in this list will begin with "I" (Inactive) followed by the alarm number.

Clearing alarms from the Inactive Alarm list will also clear alarms from the Active Alarm list. Go to the end of the Inactive Alarm List. "LIST END, = TO CLEAR ALARMS" will show in the Message Center. Press = to clear all alarms from both lists.

Note 2 For units with a Glow/Crank switch, refer to Note 4, Note 5 and Note 9.

Note 3 To test electrical circuits when unit is without a glow crank switch, locate the 3 "extra" wires inside the control panel that were used to connect to the glow crank switch before April, 2007. Use either a jumper wire to energize the circuits, or connect a temporary GCS into the circuit to continue.

Note 4 To test electrical circuits when the unit is equipped with a glow crank switch, place the unit in Manual Start Operation.

To do this, first turn the unit off. Press and hold the Glow/Crank switch in the Glow position. Place the Start/Run-Off Switch in Start/Run position. Continue to hold the Glow/Crank switch until the setpoint and box temperature are shown in the display, then release it. The MessageCenter will show "Manual Start Mode Selected", and the Run Relay will be energized. See Unit non-running amps below for current draw in this state.

Note 5 Many checks will be made with the microprocessor powered up, but with no outputs to the unit components. The unit may be put into PC Mode to do this. For additional information see PC Mode - Section 6.1.

For units with a Glow/Crank switch, an alternative method to power up the microprocessor with no load, hold the Glow/Crank switch in the glow position, and place the START/RUN-OFF switch in START/RUN. Continue to hold the Glow/Crank switch for two seconds after the self test begins, then release. This is before the setpoint and box temp values are show. The Message Center will show "Manual Start Mode Selected," however no electrical circuits will be energized. Current draw in this state is 0 ± 0.5 Amps.

Note 6 Sensors and sensor circuits may be tested at the 1MP plug. Remove plug from microprocessor and using the 1MP Plug Map and an ohmmeter, test resistance of circuits. (See Section 9.28 for chart of resistances for different sensors.)

Note 7 When checking the Defrost Air switch, RPM Sensor (Standard Engine Only), Engine Oil Level switch, Door switch, or HPS, unplug 2MP at the microprocessor. Using the 2MP Plug Map and wiring diagram, check for voltage at the appropriate terminal.

Note 8 When checking the light bar, Solenoid Valves & Unloader circuits, unplug 3MP at the microprocessor. Using the 3MP Plug Map and wiring diagram, check for voltage at terminal of the circuit you are testing. Should be battery voltage.

Note 9 Some tests can only be conducted while the unit is operating. The unit may be started automatically by placing the START/RUN-OFF switch in the START/RUN position. Units with a Glow/Crank switch can be started manually by pressing and holding the Glow/Crank switch in the Glow position. Place the START/RUN-OFF switch in START/RUN. Continue to hold the Glow/Crank switch until the setpoint and box temperature are shown in the display, then release it after glowing the engine for the appropriate time required for the ambient temperature. The MessageCenter will show "Manual Start Mode Selected." Hold the Glow/Crank switch in the Crank position until the engine starts.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
8.3 DRIVER/OPERATOR ALARMS			
1 LOW FUEL LEVEL WARNING (for units with Low Fuel Level 0% to 100% Sensor / fuel level is displayed in Data list) **Note:** This is an optional alarm which will not occur unless a fuel level sensor is present and configured ON. • TRIGGER ON: Fuel level is 15% or less for more than 30 seconds. • UNIT CONTROL: Alarm only • RESET CONDITION:Auto reset when the fuel level is above 17% for more than 30 seconds, or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check For Low Fuel Level**	
		a. Check fuel level in the fuel tank	Add fuel as needed to the fuel tank.
	2	**Check Fuel Level Sensor**	
		a. Inspect fuel level sensor& connector pins & terminals	No physical damage to switch. No damaged or corroded pins in plug.
		b. Check fuel level sensor operation	Place START/RUN-OFF switch in START/RUN position.
		c. Check for voltage at the harness plug between pins for BLACK (SP24) negative and RED (SPK5) positive wires.	Voltage should be approximately12VDC.
		d. Check for voltage at harness plug between pins for BLACK (SP24) negative and WHITE (1MP26)	Voltage should be greater than 0 VDC and less than 5 VDC, unless the probe is completely dry.
		e. Check continuity of the wire from the harness plug, pin C to the microprocessor plug 1MP26	Place START/RUN-OFF Switch in OFF position prior to checking for continuity. Must be less than 10 ohms.
	3	**Check Circuits With Test (Substitute) Sensor**	
		a. Substitute known good sensor and clear alarm. Start unit and run for 30 seconds.	Alarm should not come on. (Install new sensor if necessary)
		b. Check to see if alarm re-occurs.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
1	**LOW FUEL LEVEL WARNING (for units with Low Fuel Level switch/no fuel level display in Data list**		
	• TRIGGER ON: Fuel level is less than 1/8 of a tank for more than 30 seconds. • UNIT CONTROL: Alarm only • RESET CONDITION: Auto reset when fuel level is above 1/4 tank for more than 30 seconds. Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check For Low Fuel Level**	
		a. . Check fuel level in the fuel tank	Add fuel as needed to the fuel tank.
	2	**Check Fuel Level Switch**	
		a. . Inspect fuel level switch & connector pins & terminals	No physical damage to switch. No damaged or corroded pins in plug.
		b. .Check fuel level switch operation	Place unit in Component Test Mode - Run Relay On, or in Manual Start Mode (see Note Note 4). DO NOT START UNIT.
		c. .Check for voltage at harness plug between pins A and B	Voltage should be approximately 12VDC at harness plug between pins A and B.
		d. .Check continuity of the wire from the harness plug, pin C to the microprocessor plug 2MP04	Place START/RUN-OFF switch in OFF position prior to checking for continuity. Must be less than 10 ohms.
	3	**Check Circuits With Test (Substitute) Switch**	
		a. Substitute known good sensor and clear alarm. Start unit and run for 30 seconds.	Alarm should not come on. (Install new switch if necessary)
		b. Check to see if alarm re-occurs.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
2	**LOW ENGINE OIL LEVEL**		
Note: This is an optional alarm which will not occur unless an oil level sensor is present and configured ON. • TRIGGER–ON: Engine oil level is sensed approx. 7 or more qts. (6.62 or more liters) low for longer than 30 seconds. • UNIT CONTROL: Alarm Only, or may be configured to shut unit down on some models. • RESET CONDITION: Auto reset if engine oil level is above 4 qt. (3.79 liters) low for more than 30 seconds or alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Engine Oil Level**	
		a. Check engine oil dipstick	Add engine oil as needed to fill.
	2	**Check Engine Oil Level Switch**	
		a. Inspect engine oil level switch & connector pins & terminals	No physical damage to switch. No damaged or corroded pins in plug.
		b. Check engine oil level switch operation	Contacts open when level is more than 7 qts low Contacts closed when level is less than 4 qts low
	3	**Check Engine Oil Level Switch Harness**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins
		b. Check for shorted circuit in harness, and continuity through the harness	Place unit in PC mode, or in Manual Start mode (see Note Note 4.) DO NOT START UNIT. Battery voltage reading (12-13 VDC) between wires in plug
	4	**Check Oil Level Switch**	
		a. Drain oil level to approximately 2.8 to 3-4 quarts (3.8 liters) low. Remove switch.	
		b. Visually and physically inspect upper and lower float stops.	Must be securely fastened to center rod.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
3	**LOW COOLANT LEVEL**		
	• TRIGGER ON: Engine coolant level is 1 or more quarts (.95 or more liters) low for more than 30 seconds. • UNIT CONTROL: Alarm only • RESET CONDITION: Auto reset if engine coolant level is at the full mark for more than 30 seconds. Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check For Low Coolant Level**	
		a. Check engine coolant level in the coolant bottle	Add coolant as needed to the coolant reservoir and to the fill tube on the radiator
		b. Check coolant hoses for leaks or breaks	Repair all leaks and breaks as necessary Add coolant as needed to the coolant reservoir and to the fill tube on the radiator
	2	**Check Engine Coolant Level Switch**	
		a. Inspect engine coolant level switch & connector pins & terminals	No physical damage to switch. No damaged or corroded pins in plug.
		b. Check harness wiring to plug.	Verify wires are in correct plug orifice.
		c. Check engine coolant level switch operation	Place unit in Component Test mode, Run Relay On or in Manual Start mode (see Note Note 4). DO NOT START UNIT.
		d. Check for voltage at harness plug between pins A and B	Voltage should be 12 volts at harness plug between pins A and B.
		e. Check continuity of the wire from the harness plug, pin C to the microprocessor plug 2MP15	Place START-RUN/OFF switch in OFF position prior to checking for continuity. Must be less than 10 ohms.
	3	**Check Circuits With Test (Substitute) Switch**	
		a. Substitute known good sensor and clear alarm. Start unit and run for 30 seconds.	
		b. Check to see if alarm re-occurs.	Alarm should not come on. (Install new sensor)

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
		8.4 SHUTDOWN ALARMS	
11	**LOW ENGINE OIL PRESSURE**		
	• TRIGGER–ON: Engine oil pressure is below 12 PSIG (0.82 Bar) for longer than five seconds while the engine is running. • UNIT CONTROL: Unit Shutdown & Alarm. • RESET CONDITION: Auto Reset after 15 minutes or, alarm may be manually reset via keypad 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 active alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active active alarm occurs. Continue with the steps below as necessary.			
	1	**Check For Low Engine Oil Level Alarm**	
		a. Check for alarm 2	Alarm conditions must be corrected and the alarm cleared to continue
	2	**Check Engine Oil Pressure Switch**	
		a. Inspect switch & connector pins & terminals	No physical damage to switch. No damaged or corroded pins in plug.
		b. Check engine oil switch operation.	Contacts closed when oil pressure is above 15 PSIG (1.02 Bars) Contacts open when oil pressure is below 12 PSIG (0.82 Bar)
	3	**Check Engine Oil Switch Harness**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins
		b. Check for shorted circuit in harness, and continuity through the harness	START/RUN-OFF switch in START/RUN position, Manual Start mode (See Note Note 4) or PC mode Battery voltage reading (12-13 VDC) between wires in plug
	4	**Check Engine Oil Pressure**	
		a. Connect mechanical oil gauge	Oil pressure must be greater than 15 PSIG (1.02 Bars)
		b. Check engine oil level	Oil must be in safe range on dipstick

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
12		**HIGH COOLANT TEMPERATURE** • TRIGGER–ON: For ambient temperatures below 120°F (48.9°C) Engine coolant temperature is above 230°F (110°C), or Ambient temperatures above 120°F (48.9°C), engine coolant temp is over 241°F (116°C), or Engine coolant temperature is between 230°F and 241°F (110°C and 116°C) for more than five minutes. • UNIT CONTROL: Unit Shutdown & Alarm. • RESET CONDITION: Auto Reset after 15 minutes if the engine coolant temp falls below 212°F (100°C), or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Coolant Level.**	
		a. Check coolant level in overflow bottle	Level must be in the Normal range.
		b. Check coolant level in radiator **Do not remove the cap from a hot radiator; if the cap must be removed, do so very slowly in order to release the pressure without spray.**	Level must be at the top of the radiator fill tube.
	2	**Check Freeze Point Of Coolant.**	
		a. Use Coolant tester to check concentration of anti-freeze mixture.	Must be between 40% to 60% Ethylene Glycol to water mixture.
	3	**Check Airflow Through Radiator/Condenser Coil**	
		a. Inspect condenser & radiator fins	Fins must be straight. 90% or more of the coil surface must be undamaged. No “dead” air spaces. Condenser / Radiator coil must be clean.
	4	**Check Condenser And Water Pump Belts**	
		a. Check upper fan belt tension & condition.	(Refer to Section 9.9 for belt tensions) No Glazing, no cracking, no slipping
		b. Check lower fan belt tension & condition.	
		c. Check radiator fan belt.	
		d. Check water pump belt tension & condition.	
	5	**Check engine cooling system.**	
		a. Compare actual engine temperature to the microprocessor reading	Temperature must be within ±20°F (±11.1°C).
		b. Test operation of engine coolant thermostat	(Refer to Section 2.7 for coolant thermostat specifications)
		c. Check water pump operation	Must not leak, impeller attached tightly to shaft
		d. Check water pump bypass hose to thermostat housing for internal blockage	Must be clear and open.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
13	**HIGH DISCHARGE PRESSURE** • TRIGGER–ON: Compressor discharge pressure is over 465 PSIG (31.6 Bars) • UNIT CONTROL: Immediate Unit Shutdown & Alarm • RESET CONDITION: Auto Reset after 15 minutes if the compressor discharge pressure falls below 350 PSIG (23.8 Bars), or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**If Alarm Occurs During Pretrip Test 11, 12 Or 13**	
		a. Check discharge snubber tee	Remove and inspect tee. If snubber restrictor is in place, remove it, reinstall tee, and re-test for alarm.
		b. Check SV1 for opening.	During pretrip tests 11, 12 and 13, SV1 may be energized for 1 second to reduce head pressure during tests. If SV1 fails to actually open during the 1 second that it is de-energized, this alarm may occur. Repair SV1 as needed.
	2	**Check Fan Belts**	
		a. Check upper fan belt tension & condition	(Refer to Section 9.9 for belt tensions) No Glazing, no cracking, no slipping
		b. Check lower fan belt tension & condition.	(Refer to Section 9.9 for belt tensions) No Glazing, no cracking, no slipping
	3	**Check Wiring**	
		a. Visually Inspect wiring to HPS, SV4, & both Compressor Unloaders	Wires must be connected properly & securely to each component
	4	**Check Airflow Through Condenser Coil**	
		a. Inspect condenser / radiator fins	Fins must be straight. 90% or more of the coil surface must be undamaged. No “dead” air spaces. Condenser / Radiator coil must be clean.
		b. Check airflow (with unit running).	Even airflow through the entire coil No “dead” spots
	5	**Check System Pressures**	
		a. Install Manifold Test Set and check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading on gauges & on micro display. Pressures must be in the normal range for ambient & box temperature conditions.
	6	**Check For Refrigerant Overcharge**	
		a. Check refrigerant level in the receiver tank.	Level must be between upper & lower sight glasses
	7	**Check HPS Switch**	
		a. Inspect switch & connector pins & terminals	No physical damage to switch. No damaged or corroded pins in plug.
		b. Check switch operation (Refer to Section 2.11 for pressure settings)	Contacts open when compressor discharge pressure is above cut-out point ± 10 PSIG (±0.68 Bar) Contacts closed when compressor discharge pressure is below cut-in point ± 10 PSIG (±0.68 Bar)
		Additional steps on the next page.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
13	**HIGH DISCHARGE PRESSURE (Continued)**		
	8	**Check HPS Switch Harness**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins
		b. Check for shorted circuit in harness, and continuity through the harness	START/RUN-OFF switch in START/RUN position, Manual Start mode (See Note Note 4) Battery voltage reading (12-13 VDC) between wires in plug
	9	**Perform Pretrip Check**	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.
	10	**See Refrigeration Trouble Shooting Section 10.3**	Discharge Pressure must be in normal range for the current ambient and box temperature conditions.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
15	**BATTERY VOLTAGE TOO HIGH** • TRIGGER–ON: Voltage at the microprocessor is greater than 17 VDC. • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset after 15 minutes when the voltage at the microprocessor is between 11 – 14 VDC, or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Battery Voltage**	
		a. Test voltage at battery with unit off.	Must be between12-16 VDC
		b. Test voltage at battery with unit running.	Must be between12-16 VDC
	2	**Check Alternator Voltage**	
		a. Test voltage at alternator output terminal with unit off	Must be between 12-16 VDC
		b. Test voltage at alternator output terminal with unit running.	Must be between 12-16 VDC
	3	**Check Voltage At Microprocessor**	
		a. Check voltage reading at microprocessor input (QC1+ to QC2-)	Must be between 12–16 VDC.
		b. Check voltage reading on microprocessor display	Must be within 0.5 VDC of reading obtained in 3 Amp (above)
16	**BATTERY VOLTAGE TOO LOW** • TRIGGER–ON: Voltage at the microprocessor is less than 10 VDC (except when the engine starter is engaged) • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset after 15 minutes when the voltage at the microprocessor is between 11 – 14 VDC, or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check For Alternator Not Charging Alarm**	
		a. Check for alarm 51	Alarm conditions must be corrected and the alarm cleared to continue
	2	**Check Battery Voltage**	
		a. Inspect battery cable ends and posts	Must be clean and tight
		b. Test voltage at battery with unit off.	Must be above 11 VDC
		c. Test voltage at battery with unit running.	Must be above 11 VDC
		d. Test specific gravity of battery	(Check for battery specifications)
		e. Perform load test on battery (Follow battery manufacturer's procedure)	(Check for battery specifications)
	3	**Check Voltage At Microprocessor**	
		a. Check voltage reading at microprocessor input (MPQC1+ to MPQC2-).	Must be above 11 VDC
		b. Check voltage reading on microprocessor display	Must be within 0.5 VDC of reading obtained in 3a (above)

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
17	**HIGH COMP DISCHARGE TEMP** • TRIGGER–ON: Ambient temp below 120°F (48.9°C) discharge temp was between 310°F – 349°F (154.4°C – 176.7°C) for three minutes, or Ambient temp above 120°F (48.9°C) Discharge temp was between 340°F – 349°F (171.1°C – 176.7°C) for three minutes, or Discharge temp ever reaches 350°F (176.7°C) • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset after 15 minutes with Ambient temp below 120°F (48.9°C) the discharge temp falls below 300°F (148.8°C), or Auto Reset after 15 minutes with Ambient temp above 120°F (48.9°C) the discharge temp falls below 330°F (65.4°C), or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**If Alarm Occurs During Pretrip**	
		a. Pump down low side of refrigeration system.	Verify that system will pump down to 0 PSIG and will hold without leak-back.
	2	**Check Refrigerant Charge**	
		a. Check for undercharged system	Level must be above lower sight glass
	3	**Check Airflow Through Condenser Coil**	
		a. Inspect condenser/radiator fins	Fins must be straight. 90% or more of the coil surface must be undamaged. No “dead” air spaces. Condenser/ Radiator coil must be clean.
		b. Check airflow (with unit running).	Even airflow through the entire coil No “dead” spots
	4	**Check system pressures**	
		a. Install Manifold Test Set and check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading on gauges & on micro display.
	5	**Check DTT2**	
		a. Visually inspect the mounting and orientation of DTT2	Must be mounted tightly to the evaporator section, with the long flat surface of DTT2 in contact with the metal surface.
		b. Verify the temperature of DTT2.	Use a test temperature reading device (infrared, independent thermometer, etc.) to verify that DTT2 temperature is the same as that being displayed in the Unit Data list. (Refer to Section 3.14.)
	6	**Perform Pretrip Check**	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.
	7	**Check compressor reed valves & gaskets**	
		a. Remove compressor heads & inspect condition of all reeds & gaskets	Must be in good condition.
		Additional steps on the next page.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
17	**HIGH COMP DISCHARGE TEMP (Continued)**		
	8	**Check Expansion Valve (TXV)**	
		a. Visually inspect valve	Bulb must be clamped tightly on the suction line and insulated. No physical damage to bulb, capillary tube of valve body.
		b. Check MOP of valve	Refer to Section 2.11
		c. Check superheat of valve	Refer to Section 2.11
	9	**Check system for non-condensables**	
		a. Check refrigeration system for non-condensable gas(es)	No non–condensable gas(es) may be present.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
18	**LOW REFRIGERANT PRESSURE**		
	• TRIGGER–ON: Suction Pressure is less than -6 inHg (-0.2 Bar) for more than 120* seconds, when the RAT is above -10°F (-23.3°C), or If the Suction Pressure is less than -16 inHg (-0.41 Bar) for more than 120*seconds at any RAT temperature, • UNIT CONTROL: Alarm Only or Unit Shutdown & Alarm (if configured) • RESET CONDITION: Auto Reset after 15 minutes if Suction Pressure is more than -4 inHg (-0.41 Bar), or if RAT falls below -10°F (-23.3°C), or Alarm may be manually reset via keypad or by turning the unit off, then back on again. * Time may be set from 0 – 255 seconds in the configuration list. Refer to section 6.2.1.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Fan Belts**	
		a. Check upper fan belt tension & condition	(Refer to Section 9.9 for belt tensions) No Glazing, no cracking, no slipping)
	2	**Check System Pressures**	
		a. Install Manifold Test Set and check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction pressure must be above 3 PSIG (0.2 Bar) Suction & Discharge Pressures must have the same reading on gauges & on micro display.
	3	**Check Refrigerant Charge**	
		a. Check for undercharged system	Level must be above lower sight glass
	4	**Manually Defrost Unit**	
		a. Defrost unit and terminate automatically.	Typical defrost cycle time is 5-20 minutes Suction pressure should rise gradually during cycle.
	5	**Check Evaporator Airflow**	
		a. Check evaporator fan clutch	Must be engaged
		b. Check evaporator section, blower wheel, return air bulkhead, air chute, and cleanliness of evaporator coil	Good Air Flow Return air not restricted Air chute in good condition No damage to blower wheel Evap. coil clean
	6	**Perform Pretrip Check**	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.
	7	**Check Expansion Valve (TXV)**	
		a. Visually inspect valve	Bulb must be clamped tightly on the suction line and insulated
		b. Check MOP of valve	Refer to Section 2.11
		c. Check superheat of valve	Refer to Section 2.11

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
19 LOW FUEL SHUTDOWN (for units with Low Fuel Level 0% to 100% Sensor / fuel level is displayed in Data list) • TRIGGER ON: Fuel level is 10% or less for more than 1 minute. • UNIT CONTROL: Unit shutdown and Alarm. • RESET CONDITION: Auto reset when fuel level is above 12% for more than 1 minute, or alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check For Low Fuel Level Warning Alarm**	
		a. Check for alarm 1	Must be cleared.
		b. Check fuel level intake	Must be above 1/4 tank. Fill as needed.
	2	**Check accuracy of sensor**	
		a. Verify sensor accuracy	See Section 9.8.2 for sensor testing.
		b. Check wiring to sensor	No physical damage to sensor. No damaged or corroded pins.
	3	**Check fuel level sensor harness**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
		b. Check for shorted circuit in harness, and continuity through the harness	START/RUN-OFF switch in START/RUN position. Battery voltage reading (12-13 VDC) between A and B wires in plug.
19 LOW FUEL SHUTDOWN (for units with Low Fuel Level Switch / no fuel level display in Data list) • TRIGGER ON: Alarm 1 (LOW FUEL LEVEL) has been on past the allowed run time (See chart below) • UNIT CONTROL: Unit shutdown and Alarm. • RESET CONDITION: Auto reset when fuel level is above 1/4 tank for more than 30 seconds or Alarm may be manually reset via keypad or by turning the unit off, then back on again. 30 gal. Fuel tank — 30 Minutes 50 gal. Fuel tank — 60 Minutes 75 gal. Fuel tank — 90 Minutes 100 gal. Fuel tank — 120 Minutes 120 gal. Fuel tank — 150 Minutes			
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check For Low Fuel Level Warning Alarm**	
		a. Check for alarm 1	Must be cleared.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
20	**MAXIMUM COMPRESSOR ALARMS** • TRIGGER ON: One of the following alarms: 13 – High Discharge Pressure 17 – High Compressor Discharge Temperature 18 – Low Refrigerant Pressure 27 – High Suction Pressure 28 – Check Refrigerant System 29 – Check Heat Cycle 56 – Check Evaporator Airflow has occurred three times during the last two hours of actual unit operation (off cycle time is not included), AND this alarm (Alarm 20) has been enabled in this microprocessor ("Test 6" or "Compressor Alarm Shutdown" appears in the Installed Options List in Unit Data), AND Compressor Alarm Shutdown in the configuration list has been set to YES. (Refer to Section 3.14. for information on Unit Data list) • UNIT CONTROL: Unit shutdown and Alarm. • RESET CONDITION: This alarm can only be cleared from the Inactive Alarm list. It can not be cleared from the Active Alarm list, and it will not clear when the START/RUN-Stop switch is turned Off then On again. This is so that drivers and other operators can not reset the alarm. The unit MUST be taken to a repair shop for inspection and repair.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for trigger on alarms**	
		a. Check the Active Alarm list to see which of the following alarms is also present: A13, A17, A18, A27, A28, A29, A56	See steps for the active alarm so that the alarm can be cleared. All Alarm(s) from the above list must be cleared to continue. Reset Alarm 20 from the Inactive Alarm list.
21	**TECHNICIAN RESET REQUIRED** • TRIGGER ON: The High Engine Temp Shutdown Configuration and/or Engine Oil Pressure Shutdown Configuration is/are set to YES, and either Alarm 11 – Low Engine Oil Pressure, **or** Alarm 12 – High Coolant Temperature has become active and shut the unit down three times within the past 2 hours • UNIT CONTROL: Unit shutdown and alarm • RESET CONDITION: Reset from inactive alarm list only. Can not be reset by turning switch OFF and then 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Determine Which Alarm Caused This Alarm To Be Active.**	
		a. Check active alarm list for Alarm #'s 11 or 12.	One or more of these alarms will be present.
		b. Follow the steps for the alarm(s) found above, and correct the alarm condition.	All alarms condition must be corrected.
	2	**Reset Alarm**	
		Reset all alarms from the inactive alarm list.	All alarms must be cleared to start unit.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
27	**HIGH SUCTION PRESSURE** • TRIGGER ON: Suction pressure has been greater than 98 PSIG (6.7 Bars) for more than 10 minutes • UNIT CONTROL: Alarm Only or Unit Shutdown & Alarm (if configured) • RESET CONDITION: Auto reset when suction pressure is less than 75 PSIG (5.1 Bars) for five minutes if configured for alarm only,or Auto Reset after 15 minutes if configured as a Shutdown Alarm or, Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check System Pressures**	
		a. Check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading ± 5 PSIG (±0.34 Bar) on gauges & on micro display.
	2	**Check Compressor Drive Coupling**	
		a. Verify that compressor coupling is intact, and that the compressor crankshaft is turning.	Compressor crankshaft must be turning.
	3	**Perform Pretrip Check**	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.
	4	**Check compressor reed valves & gaskets**	
		a. Remove compressor heads & inspect condition of all reeds & gaskets	Must be in good condition.
	5	**Check compressor pistons and connecting rods.**	
		a. Check compressor pistons and connecting rods.	Must be in good condition.
	6	**See Refrigeration Trouble Shooting Section 10.3**	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
28		**CHECK REFRIGERATION SYSTEM** • TRIGGER ON: Discharge pressure is not at least 5 PSIG (0.34 Bar) higher than Suction pressure for more than 10 minutes • UNIT CONTROL: Alarm Only or Unit Shutdown & Alarm (if configured) • RESET CONDITION: Auto reset when discharge pressure is more than 20 PSIG (1.36 Bars) above the suction pressure for five minutes, or alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check System Pressures**	
		a. Install Manifold Test Set and check and compare compressor discharge & suction pressures with those shown on the microprocessor display.	Suction & Discharge Pressures must have the same reading – ± 5 PSIG (±0.34 Bar) – on gauges & on micro display.
	2	**Check Compressor Drive Coupling**	
		a. Verify that compressor coupling is intact, and that the compressor crankshaft is turning.	Compressor crankshaft must be turning.
	3	**Perform Pretrip Check**	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.
	4	**Check compressor reed valves & gaskets**	
		a. Remove compressor heads & inspect condition of all reeds & gaskets	Must be in good condition.
	5	**Check compressor pistons and connecting rods.**	
		a. Check compressor pistons and connecting rods.	Must be in good condition.
	6	**See Refrigeration System Troubleshooting, Section 10.3.**	
29		**CHECK HEAT CYCLE** • TRIGGER ON: The unit has been operating in the heat cycle for more than 5 minutes, and the SAT is more than 5.5°F (3°C) colder than the RAT constantly for more than 60 seconds. (Unit is actually cooling the air going through the evaporator). • UNIT CONTROL: Unit shutdown and alarm. • RESET CONDITION: Auto reset after 15 minutes or alarm may be manually reset via keypad or by turning the START/RUN-OFF switch OFF and 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Perform Pretrip Check**	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.
	2	**See Troubleshooting, Section 10.3. – Refrigeration System Not Heating**	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
8.5 START UP ENGINE ALARMS			
30	**FAILED TO RUN MINIMUM TIME**		
	• TRIGGER–ON: Engine has shut down on an alarm 3 times without having run for at least 15 minutes between each shutdown (not including Door or Remote switch shut downs). • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Alarm may be manually reset via keypad or by turning the unit off, then back on again. If Unit Operation mode is set for Rail, this alarm will automatically reset after 4 hours.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check For Alarms**	
		a. Check for shut down alarms	Alarm conditions must be corrected and the alarm(s) cleared to continue.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
31	**FAILED TO START - AUTO MODE**		
	• TRIGGER–ON: Engine has tried to start three times unsuccessfully in the auto start mode. • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Alarm may be manually reset via keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check For Flash Code On Engine Speed Control Unit (ENSCU) (Applies to ESC engines only).**	
		a. Check for flash codes on the ENSCU.	Refer to Electronic Speed Control Diagnostic tables - Figure 10-1 thru Figure 10-4. There must be no LED flashing alarm codes occurring to continue.
	2	**Check Fuel Level In Tank.**	
		a. Check fuel gauge on tank.	Fill tank as needed.
	3	**Check For Alarms**	
		a. Check for the following alarms: 71 Check for Bad F2 or F3 Fuse alarm 40 Check Glow Plugs alarm 35 Check Starter Circuit alarm	Alarm conditions must be corrected and the alarm cleared to continue
	4	**Check Fuel Solenoid (Applies to non-ESC engines only)**	
		a. Check Run Relay LED	Must be ON.
		b. Check voltage to fuel solenoid	Energize Run Relay in Component Test Mode (Refer to section 6.2.2) to energize the fuel solenoid. Must have 12 VDC between FSC-C (ground) & FSH-A (hold) With Manual Crank Switch in crank position (for units with GCS only) 12 VDC between FSC-C (ground) & FSP-B (pick) For units without GCS, check FSC-B (pick) circuit between fuel solenoid and starter motor.
		c. Inspect solenoid & connector pins & terminals	No damage to solenoid No damaged or corroded pins
		d. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
		e. Check resistance of solenoid	Refer to Section 2.13
		f. Check operation of solenoid	Plunger must move in when energized
	5	**Check Fuel System**	
		a. Check fuel system prime	No air in fuel system
		b. Check fuel flow	Unrestricted fuel flow through system
		c. Check voltage to glow plugs	Glow Plug switch ON, Manual Start Mode (units with GCS only) Units without GCS, energize Glow Plug Relay in Component Test Mode (Refer to section 6.2.2) In both cases there must be more than 11 VDC
	6	**Check Engine Air–Intake System**	
		a. Check air filter indicator	Flag must not be visible.
		b. Inspect air intake system	Hoses & tubes in good condition. No kinks or restrictions
		Additional steps on the next page.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
31	**FAILED TO START - AUTO MODE (Continued)**		
	7	**Check For Correct Engine Oil**	
		a. Check for correct oil viscosity (weight) for conditions	Refer to Section 2.7 Must be correct for ambient conditions
	8	**Check Engine Exhaust System**	
		a. Inspect the exhaust system	Must be clear and unobstructed
	9	**Check Engine**	
		a. Check engine compression	Refer to Section 2.7
	10	**Check RPM Sensor**	
		a. Check sensor.	Refer to Section 9.8.3.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
32	**FAILED TO START – MANUAL**		
	• TRIGGER–ON: The unit was placed in Manual Start mode, and the engine was not manually started within five minutes. or, The user has tried to start the engine three times unsuccessfully in the Manual Start mode. • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Reset by changing to Auto Start mode, or Alarm may be manually reset via keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check If Unit Has A Glow/Crank Switch (GCS).**	
		a. Visually check to see if the unit has a GCS (Units built after April, 2007 do not have this switch). Refer to Section 3.2 for location of switch.	For units with a GCS, continue with Step 2 below. For units without a GCS, check the wiring that would connect to the switch if it were present for shorts. It is not possible to place the unit in Manual Start Mode without energizing this circuit.
	2	**Check For Flash Code On Engine Speed Control Unit (ENSCU) (Applies to ESC engines only).**	
		a. Check for flash codes on the ENSCU.	Refer to Electronic Speed Control Diagnostic tables – Figure 10–1 thru Figure 10–4. There must be no LED flashing alarm codes occurring to continue.
	3	**Operator Failed To Crank Engine**	
		a. Manually start unit.	Engine starts and runs
	4	**Check Fuel Level In Tank.**	
		a. Check fuel gauge on tank.	Fill tank as needed.
	5	**Check For Check Glow Plugs Alarm**	
		a. Check for alarm 40	Alarm conditions must be corrected and the alarm cleared to continue.
	6	**Check Manual Glow/Crank Switch (GCS) (Only for units with a GCS)**	
		a. Check the glow/crank switch	No damaged or corroded pins No physical damage
		b. Check voltage to glow/crank switch - Voltmeter lead on - Battery post + Voltmeter lead on switch terminals (With wires connected to switch)	START/RUN-OFF switch in START/RUN position, Manual Start mode (See Note Note 4) Position / Terminals / VDC Off: 1 — 11 V (min) 2 & 3 — 0 V (min) Glow 1 & 3 — 10 1/2 V (min) 2 — 0 V (min) Disconnect wire to Starter Solenoid before checking: Crank: 1 & 2 — 11 1/2V (min) 3 — 0 V (min)
		c. Check voltage to glow plugs	Glow Plug switch ON, Manual Start mode More than 11 VDC
		d. Check voltage to starter solenoid	Crank switch ON, Manual Start Mode More than 11 VDC
	7	**Check Glow/Crank Switch Harness – All Units**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
		Additional steps on the next page.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
32	**FAILED TO START - MANUAL (Continued)**		
	8	**Check Fuel Solenoid (Applies to non-ESC engines only)**	
		a. Check Run Relay LED	LED 28 must be ON.
		b. Check voltage to fuel solenoid	START/RUN-OFF switch in START/RUN position, Manual Start mode (See Note Note 4) More than 11 VDC positive and good ground
		c. Inspect solenoid & connector pins & terminals	No damage to solenoid or wires No damaged or corroded pins Wires plugged in
		d. Inspect harness & control box connector pins & terminals (See wiring schematic (See Wiring Schematic Section 11.)	No physical damage to harness. No damaged or corroded pins
		e. Check resistance of solenoid	Refer to Section 2.13
		f. Check operation of solenoid	Plunger must move in when energized
	9	**Check Fuel Solenoid Harness**	
		a. Inspect harness & control box connector pins & terminals (See Wiring Schematic Section 11.)	No physical damage to harness. No damaged or corroded pins
	10	**Check Fuel System**	
		a. Check fuel system prime	No air in fuel system
		b. Check fuel flow	Unrestricted fuel flow through system
		c. Check fuel system check valve from filter to injection pump.	Check valve must hold fuel and not leak back
	11	**Check Engine Air–Intake System**	
		a. Check air filter indicator	Flag must not be visible.
		b. Inspect air intake system	Hoses & tubes in good condition. No kinks or restrictions
	12	**Check For Correct Engine Oil**	
		a. Check for correct oil viscosity (weight) for conditions	Refer to Section 2.7 Must be correct for ambient conditions
	13	**Check Engine Exhaust System**	
		a. Inspect the exhaust system	Must be clear and unobstructed
	14	**Check Engine**	
		a. Check engine compression	Compression must be above 400 PSIG (27.22 Bar)

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
34	**ENGINE FAILED TO STOP**		
	• TRIGGER–ON: Engine is turning more than 500 RPM (or the micro input shows that the engine is turning more than 500 RPM) for 20 seconds after unit was turned off, shut down on an alarm or cycled off in a Start/Stop Off Cycle, or Oil Pressure Switch contacts are closed longer than 20 seconds after unit was turned off, shut down on an alarm, or cycled off in a Start/Stop Off Cycle. • UNIT CONTROL: Alarm Only • RESET CONDITION: Alarm may be manually reset via Keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check For Engine Running**	
		a. Verify that engine is still running.	Engine should not be running.
	2	**Check RPM Sensor**	
		a. Check actual engine RPM using hand held tachometer.	Adjust engine linkage setting as needed.
		b. Compare actual RPM with those shown on display.	Both readings within ± 50 RPM.
	3	**Check For Bad Engine RPM Sensor Alarm**	
		a. Check for Alarm 130	Alarm conditions must be corrected and the alarm cleared to continue
	4	**Check Engine Oil Pressure Switch**	
		a. Inspect switch & connector pins & terminals	No physical damage to switch. No damaged or corroded pins in plug.
		b. Check engine oil switch operation.	Contacts closed when oil pressure is above 15 PSIG (1.02 Bars) Contacts open when oil pressure is below 12 PSIG (0.82 Bar)
	5	**Check Engine Oil Switch Harness**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
		b. Check for shorted circuit in harness, and continuity through the harness	Start/Run-Off Switch in Start/Run position, Manual Start Mode (See Note Note 4) (for units with GCS only) For units without a GCS, use Component Test Mode to energize the Run Relay (Refer to Section 6.2.2) Battery voltage reading (12-13 VDC) between wires in plug to Oil Pressure Switch when disconnected from the switch.
	6A.	**Check Fuel And Speed Actuator (FSA) & Circuit (ESC Engines Only)**	
		a. Check Run Relay LED	LED 28 must be OFF.
		b. Check for 12 VDC on the Run Relay circuit	Must be 0 VDC
		c. Check SPK20 for voltage	Must be 0 VDC
		d. Check ENSCU terminals 13 & 15 for voltage	Must be 0 VDC
		e. Check FSA plunger	Must be free to move
	6B.	**Check Fuel Solenoid (non-Electronic Speed Controlled (ESC) engines) & Circuit**	
		a. Check Run Relay LED	LED 28 must be OFF.
		b. Check voltage at harness to fuel solenoid (non ESC engines)	Must be 0 VDC
		c. Check fuel solenoid plunger	Must be free to move

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
35	**CHECK STARTER CIRCUIT** • TRIGGER–ON: Engine speed failed to reach 50 RPM during 2 start attempts. • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Alarm may be manually reset via keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Engine Start-Up**	
		a. Does engine actually start, run for a few seconds then shut off?	If NO, continue with step 2 below. If YES, check wiring to RPM sensor for a broken wire.
	2	**Check If Unit Has Electronic Speed Control Flash Code (ESC Engines Only)**	
		a. Check for flash codes on the Engine Speed Control Unit (ENSCU).	Refer to Electronic Speed Control Diagnostic tables - Figure 10-1 thru Figure 10-4
		b. Check for voltage at ENSCU terminal 13	Must be above 11.5 VDC
		c. Check for ground at ENSCU terminal 19.	No damage or high resistance.
	3	**Check Starter Relay Circuit**	
		a. Check operation of starter solenoid relay	START/RUN-OFF switch in START/RUN position, Manual Start mode (See Note Note 4) Relay contacts closed when crank switch is ON
		b. Check relay socket & terminals	No signs of discoloration from overheating No corrosion
		c. Check voltage to Starter Solenoid Relay	Negative lead on 85, Positive lead on 86 = 12 VDC Negative lead on Gnd, Positive lead on 87 & 30 = 12 VDC
		d. Inspect wiring to starter solenoid & starter motor	No physical damage to wiring or battery cable end. No damaged or corroded terminals
		e. Check voltage to starter solenoid	Must be above 11.5 VDC
		f. Check voltage to starter motor	Must be above 10 VDC while cranking
	4	**Check Fuel and Speed Actuator (FSA) & circuit (ESC Engines Only)**	
		a. Check Run Relay LED	LED 28 must be ON.
		b. Check for 12 VDC on the Run Relay circuit	Must be 0 VDC
		c. Check SPK20 for voltage	Must be 12 VDC
		d. Check ENSCU terminals 13 & 15 for voltage	Must be 12 VDC
		e. Check FSA plunger	Must be free to move
	5	**Check Starter**	
		a. Inspect starter and wiring.	No damage or corrosion Wiring and battery cable must be clean and tight.
		b. Check resistance of solenoid	Refer to Section 2.13
		c. Check resistance of starter motor	Refer to Section 2.13
		d. Test amperage draw of starter.	Refer to Section 2.13
		Additional steps on the next page.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
35	**CHECK STARTER CIRCUIT (Continued)**		
	6	**Check Battery Voltage**	
		a. Inspect battery cable ends and posts	Must be clean and tight No corrosion
		b. Test voltage at battery with unit off.	Must be above 11 VDC
		c. Test specific gravity of battery	Check
		d. Perform load test on battery (Follow battery manufacturer's procedure)	Check
	7	**Check for correct engine oil**	
		a. Check for correct viscosity for conditions	Refer to Section 2.7 Must be correct for ambient conditions

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
36	**CHECK COOLANT TEMPERATURE** • TRIGGER–ON: Coolant temperature is below 32°F (0°C) after the engine has been running for five minutes. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when Coolant temp rises above 36°F (2.2°C), or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Coolant Temperature**	
		a. Check temperature of coolant or upper radiator hose	Must be above 32°F (0°C)
	2	**Check Engine Coolant Sensor**	
		a. Check resistance of Engine Coolant Sensor **(See Note 6)**	(Refer to Section 2.13 for complete resistance chart) 10k Ohms @ 77°F (25°C)
		b. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins

<table>
<tr><th>Alarm NO.</th><th>Steps</th><th>ALARM / CAUSE</th><th>CORRECTIVE ACTION</th></tr>
<tr><td colspan="4">37 CHECK LOW SPEED RPM
• TRIGGER–ON: Controller is set for low engine speed operation, and RPM being read by the microprocessor are not correct. The correct RPM for low speed are different for different models as shown below:
Less than 1325 or greater than 1625 for Ultima XTC and X2 2500A/R; or
Less than 1200 or greater than 1500 for Ultra XTC and X2 2100A/R
for more than 60 seconds (120 seconds when the microprocessor calls for a change from high speed to low speed, or when the unit first starts)
• UNIT CONTROL: Alarm Only
• RESET CONDITION: Auto Reset if controller is set for low engine speed operation and RPM are:
Between 1375 to 1575 for Ultima XTC and X2 2500A/R; or
Between 1250 to 1400 for Ultra XTC and X2 2100A/R for 60 seconds, or
Alarm may be manually reset via keypad or by turning the unit off, then back on again.</td></tr>
<tr><td colspan="4">NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.</td></tr>
<tr><td></td><td>1</td><td colspan="2">Check Model Number</td></tr>
<tr><td></td><td></td><td>a. Verify that the model number on the unit data label matches the model number shown in the micro unit data list.</td><td>Enter the correct number in the data list. (Refer to Section 3.14.)</td></tr>
<tr><td></td><td>2</td><td colspan="2">Check For Proper Voltage To The Engine Speed Control Unit (ENSCU) Pin 22 Based On The Model. Check For Proper Voltage With Unit Running. (ESC Engine only)</td></tr>
<tr><td></td><td></td><td>a. Ultima XTC and X2 2500A</td><td>Verify 0 VDC at terminal 16 of the ENSCU.
Verify 12 VDC at terminal 22 of the ENSCU.</td></tr>
<tr><td></td><td></td><td>b. Ultra XTC and X2 2100A</td><td>Verify 0 VDC at terminal 16 of the ENSCU.
Verify 0 VDC at terminal 22 of the ENSCU.</td></tr>
<tr><td></td><td>3</td><td colspan="2">Check Speed Solenoid & Linkage On Non-electronic Speed Controlled (ESC) Engines (Fuel and Speed Actuator on ESC engines)</td></tr>
<tr><td></td><td></td><td>a. Check speed solenoid on standard engines (Fuel and speed actuator on ESC plunger)</td><td>Must move in and out freely</td></tr>
<tr><td></td><td></td><td>b. Check engine speed arm and linkage</td><td>Must move freely</td></tr>
<tr><td></td><td>4</td><td colspan="2">Force Low Speed Operation (See Note 9)</td></tr>
<tr><td></td><td></td><td>a. Using Functional Parameters, set the Low Speed Start Up Delay to 10 minutes.</td><td>Unit will run in low speed. RPM must be within range shown above for each specific model. Adjust speed linkage as needed.</td></tr>
<tr><td></td><td></td><td>b. Check operation of Speed Relay LED</td><td>LED 27 must be OFF.</td></tr>
<tr><td></td><td></td><td>c.Check voltage at engine speed control unit (ENSCU) pin 16.</td><td>Must be 0 VDC</td></tr>
<tr><td></td><td>5</td><td colspan="2">Check Engine RPM</td></tr>
<tr><td></td><td></td><td>a. Check actual engine RPM using hand held tachometer</td><td>Refer to Section 2.7
Adjust engine linkage setting as needed.</td></tr>
<tr><td></td><td></td><td>b. Compare actual RPM with those shown on display.</td><td>Both readings within ± 50 RPM</td></tr>
<tr><td></td><td>6</td><td colspan="2">Check Engine Air–Intake System</td></tr>
<tr><td></td><td></td><td>a. Check air filter indicator</td><td>Flag must not be visible.</td></tr>
<tr><td></td><td></td><td>b. Inspect air intake system</td><td>Hoses & tubes in good condition.
No kinks or restrictions</td></tr>
<tr><td></td><td></td><td colspan="2">Additional steps on the next page.</td></tr>
</table>

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
37	**CHECK LOW SPEED RPM (Continued)**		
	7	**Check Engine Fuel System**	
		a. Check fuel tank level.	Must have enough fuel to run engine.
		b Check fuel lines.	Connections are tight and not leaking. No kinks or sharp bends in the lines.
		c Check fuel screen.	Fuel screen is located in the inlet fitting to the lift pump. Screen must be clean.
		d Check fuel filters.	Fuel filters must be clean and allow full flow of fuel through them.
	8	**Check Engine Exhaust System**	
		a. Inspect the exhaust system	Must be clear and unobstructed

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
38		**CHECK HIGH SPEED RPM**	
		• TRIGGER–ON: Controller is set for high engine speed operation, and RPM being read by the microprocessor are not correct. The correct RPM for low speed are different for different models as shown below: Less than 2000, or greater than 2400 for **Ultima XTC and X2 2500A/R**; or Less than 1500 or greater than 1900 for **Ultra XTC and X2 2100A/R** for more than 60 seconds (120 seconds when the microprocessor calls for a change from low speed to high speed) • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if controller is set for high engine speed operation and RPM are: Between 2050 to 2350 for **Ultima XTC/X2 2500A/R** or; Between 1550 to 1850 for **Ultra XTC/X2 2100A/R** for 60 seconds, or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.	
	1	**Check Model Number**	
		a. Verify that the model number on the unit data label matches the model number shown in the micro unit data list.	Enter the correct number in the data list. (Refer to Section 3.14.)
	2	**Check For Proper Voltage To The Engine Speed Control Unit (ENSCU) Pin 22 Based On The Model. Check For Proper Voltage With Unit Running. (ESC Engine Only)**	
		a. Ultima XTC and X2 2500A	Verify 12 VDC at terminal 16 of the ENSCU. Verify 12 VDC at terminal 22 of the ENSCU.
		b. Ultra XTC and X2 2100A	Verify 12 VDC at terminal 16 of the ENSCU. Verify 0 VDC at terminal 22 of the ENSCU.
		c. Check circuit from ENSCU terminal 16 to micro connection MPQC3.	Must be 12 VDC
	3	**Check Speed Solenoid & Linkage On Non-ESC Engines**	
		a. Check speed solenoid plunger on non ESC engines (Fuel and speed actuator on ESC engines)	Must move in and out freely
		b. Check engine speed arm & linkage (non-ESC engines)	Must move freely
	4	**Check Speed Solenoid Harness (FSA Harness on ESC Engines)**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins or terminals
		b. Check resistance of speed solenoid (FSA on ESC units)	Refer to Section 2.13. With the FSA disconnected, check the FSA coil resistance. Spec is 3-4 ohms +/- 10%.
		c. Check amp draw of speed solenoid	Refer to Section 2.13. Use Component Test Mode (Refer to Section 6.2.2) to test. Refer to Section 2.13 for amp values. View current draw in the Unit Data List. (Section 3.14)
		Additional steps on the next page.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
38	**CHECK HIGH SPEED RPM (Continued)**		
	5	**Force High Speed operation (See note Note 9)**	
		a. Place unit in continuous run and adjust set point to at least 15 degrees away from box temperature, and a temperature greater than 20°F (5.6°C). If the unit does not immediately go into High Speed, set the AIRFLOW Functional Parameter to HIGH.	Controller will call for High Speed operation.
		b. Check operation of Speed Relay LED	LED 27 must be ON. (If LED 27 is not on, the microprocessor is not calling for High Speed operation. Check Speed Overrides in Section 4.4 for more information.)
		c. Check voltage to speed solenoid (On ESC engines, check voltage on the engine speed control unit (ENSCU) pin 16)	Must be 12-14 VDC
	6	**Check Engine RPM**	
		a. Check actual engine RPM using hand held tachometer	Refer to Section 2.7 Adjust engine linkage setting as needed.
		b. Compare actual RPM with those shown on display	Both readings within ± 50 RPM
	7	**Check Engine Air–Intake System**	
		a. Check air filter indicator	Flag must not be visible.
		b. Inspect air intake system	Hoses & tubes in good condition. No kinks or restrictions
	8	**Check Engine Exhaust System**	
		a. Inspect the exhaust system	Must be clear and unobstructed

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
39	**CHECK ENGINE RPM**		
		• TRIGGER–ON: Engine RPM have been: Less than 1200 or greater than 2500 for **Ultima XTC and X2 2500A/R**; or Less than 1100 or greater than 2000 for **Ultra XTC and X2 2100A/R** for more than five minutes • UNIT CONTROL: Alarm Only or Unit Shutdown & Alarm (if configured) • RESET CONDITION: Auto Reset if unit is set for Alarm Only when engine RPM are: Between 1200 to 2500 for **Ultima XTC and X2 2500A/R** or: Between 1100 to 2000 for **Ultra XTC and X2 2100A/R** for more than five minutes, or After 15 minutes if the unit is set for RPM Shutdown or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Model Number**	
		a. Verify that the model number on the unit data label matches the model number shown in the micro unit data list.	Enter the correct number in the data list. (Refer to Section 3.14.)
	2	**Check For Flash Code On Engine Speed Control Unit (ENSCU) (Applies to ESC engines only).**	
		a. Check for flash codes on the ENSCU.	Refer to Electronic Speed Control Diagnostic tables – Figure 10–1 thru Figure 10–4
	3	**On All Units With ESC, Refer To Electronic Speed Control Diagnostic Tables**	
		a. Check speed solenoid plunger on non ESC engines (Fuel and speed actuator on ESC engines)	Must move in and out freely
		b. Check engine speed arm & linkage	Must move freely
	4	**Check Fuel System**	
		a. Check for Alarm 1	Fill tank as needed
		b. Check fuel flow	Unrestricted fuel flow through system Fuel not gelled
		c. Check fuel system prime	No air in fuel system
	5	**Check Engine Air–Intake System**	
		a. Check air filter indicator	Flag must not be visible.
		b. Inspect air intake system	Hoses & tubes in good condition. No kinks or restrictions
		c. Check voltage to speed solenoid	Must be 0 VDC
	6	**Force Low Speed Operation (See Note 9)**	
		a. Using Functional Parameters, set the High Speed Delay for at least 10 minutes so the unit starts in low speed.	Unit will run in low speed. RPM must be within range shown above for each specific model. Adjust speed linkage as needed.
		b. Check operation of Speed Relay LED	LED 27 must be OFF when the microprocessor is calling for Low Speed.
		c. Check voltage to speed solenoid (FSA voltage cannot be checked on ESC)	Must be 0 VDC
		Additional steps on the next page.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
39	**CHECK ENGINE RPM (Continued)**		
	7	**Check Low Speed Engine RPM**	
		a. Check actual engine RPM using hand held tachometer	Refer to Section 2.7 Adjust engine linkage setting as needed.
		b. Compare actual RPM with those shown on display	Both readings within ± 50 RPM
	8	**Force high speed operation (See Note 9)**	
		a. Place unit in continuous run and adjust set point to at least 15 degrees away from box temperature, and a temperature greater than 20° F (5.6°C) If the unit does not immediately go into High Speed, set the AIRFLOW Functional Parameter to HIGH.	Controller will call for High Speed operation.
		b. Check operation of Speed Relay LED	LED 27 must be ON. (If LED 27 is not on, the microprocessor is not calling for High Speed operation. Check Speed Overrides in section 4.4 for more information.)
		c. Check voltage to speed solenoid on standard engines. (FSA voltage cannot be checked on ESC engines.)	Must be 12-14 VDC
	9	**Check High Speed Engine RPM**	
		a. Check actual engine RPM using hand held tachometer	Refer to Section 2.7 Adjust engine linkage setting as needed.
		b. Compare actual RPM with those shown on display	Both readings within ± 50 RPM

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
40	**CHECK GLOW PLUGS**		
	• TRIGGER–ON: Glow Plug amperage is less than 30 Amps, or greater than 43 Amps after 14 seconds of glow time (NOTE: In auto start, this can only occur when the Engine Coolant Temperature is below 32°F (0°C) and the glow time is configured SHORT.) • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if glow plug amperage is between 30 to 43 amps for at least 14 seconds during the glow cycle, or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Glow Plug Circuit**	
		a. Inspect glow plug relay & socket	No signs of discoloration from overheating No corrosion
		b. Check operation of Glow Plug Relay	START/RUN-OFF switch in START/RUN position-Manual Start Operation. (See Note Note 4) Glow Crank switch in Glow position OR, use Component Test Mode to energize the Glow Plug Relay. (Refer to Section 6.2.2) LED 30 must be ON
		c. Check Non–Running Amps	View Current Draw in Data list Refer to Section 2.13
		d. Check Glow Plug circuit amperage	Current Draw = Non–Running Amps + Glow Plug Amps In Component Test Mode, only the Glow Plug Amps will be displayed.
		e. Check voltage to glow plugs	Must be 11 VDC or higher
	2	**Check Glow Plug Circuit Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
	3	**Check Glow Plugs**	
		a. Check amp draw of each glow plug	Refer to Section 2.13

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
41	**ENGINE STALLED**		
	• TRIGGER–ON: The engine is running, RPM sensor is good, and engine speed is less than 10 RPM; or The engine is running, RPM sensor alarm is ON, and the Oil Pressure switch contacts are open. • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Restart after 15 minutes, or Alarm may be manually reset via keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check For Alarm 130 - Check RPM Sensor**	
		a. Check for alarm 130	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 RPM 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 drawing air in.
	2	**Check For Flash Code On Engine Speed Control Unit (ENSCU) (Applies to ESC engines only).**	
		a. Check for flash codes on the ENSCU.	Refer to Electronic Speed Control Diagnostic tables - Figure 10-1 thru Figure 10-4 All flash codes must be cleared before continuing.
	3	**Was Engine Shut Off Manually?**	
		a. Check for external cause	Correct problem.
	4	**Check for Bad F2 or F3 Fuse Alarm**	
		a. Check for alarm 71	Alarm conditions must be corrected and the alarm cleared to continue.
	5	**Check Fuel System**	
		a. Check for Alarm 1	Fill tank as needed
		b.Check fuel flow	Unrestricted fuel flow through system Fuel not gelled
		c. Check fuel system prime	No air in fuel system
		d. Check fuel system check valve from filter to injection pump.	Check valve must hold fuel and not leak back
	6	**Check Fuel Solenoid (non-ESC engines) or Fuel Speed Actuator (ESC engines)**	
		a. Check Run Relay LED	LED 28 must be ON.
		b. Check voltage to fuel solenoid or ENSCU module.	START/RUN-OFF switch in START/RUN position, Manual Start mode (See Note Note 4) More than 11 VDC positive and good ground
		c. Inspect solenoid & connector pins & terminals for non-ESC engines __Inspect ENSCU module connector pins & terminals for ESC engines	No damage to solenoid, or wires No damaged or corroded pins Wires plugged in ENSCU module, or wires No damaged or corroded pins Wires plugged in
		d. Inspect harness & control box connector pins & terminals (See wiring schematic (See Wiring Schematic Section 11.)	No physical damage to harness. No damaged or corroded pins
		e. Check resistance of solenoid or FSA	Refer to Section 2.13
		f. Check operation of solenoid or FSA	Plunger must move in when energized
		Additional steps on the next page.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
41	**ENGINE STALLED (Continued)**		
	7	**Check RPM Sensor (Standard Engines Only)**	
		a. Check Engine RPM in Data list	Must be Steady Accurate Reading
		b. Check wiring from RPM Sensor to Control Box, Connectors and Pins (See Wiring Schematic)	No physical damage to harness No damaged or corroded pins Plug connection fits tightly
	8	**Check Engine Speed Sensor (ENSSN)** **(Units With Electronic Speed Control (ESC) engines Only)**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins
	9	**Check Engine Air–Intake System**	
		a. Check air filter indicator	Flag must not be visible.
		b. Inspect air intake system	Hoses & tubes in good condition. No kinks or restrictions
	10	**Check Engine Exhaust System**	
		a. Inspect the exhaust system	Must be clear and unobstructed
	11	**Check Engine**	
		a. Check Injection pump timing	Timing must be correct
		b. Check engine valve adjustment	Rocker arm clearance must be correct
		c. Check engine compression	Compression must be above 27.2 Bars (400 PSIG)
	12	**Check Refrigeration System**	
		a. Check discharge & suction pressures	Must be within normal operating range for conditions

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
		8.6 WARNING / STATUS ALARMS	
51	**ALTERNATOR NOT CHARGING**		
	• TRIGGER–ON: Unit is running (either engine or standby) and the current flow is more than -1.0 Amps (discharge) between the alternator to the battery for three continuous minutes. • UNIT CONTROL: Alarm Only or Unit Shutdown & Alarm (if configured) • RESET CONDITION: Auto Reset (if not shut down) when alternator is charging or alarm may be manually reset via keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Microprocessor Current Sensor**	
		a. Check micro Current Value	START/RUN-OFF switch in START/RUN position, Manual Start mode, all electrical circuits off. (See Note Note 5) Must be -2.0 to 1.5 Amps with no load
		b. Check direction of wire through current sensor.	Must be in correct direction (See arrow on current sensor.)
		c. Check amp current value with 0 amps going through the current sensor.	Disconnect and remove the wire going through the current sensor, then reconnect it to the fuse holder. Power up micro and check CURRENT DRAW in the Unit Data List. The value must be between –1.0 and 1.0 Amps. (Refer to Section 3.14.)
	2	**Check Alternator Belt**	
		a. Check alternator belt tension & condition	(Refer to Section 9.9 for belt tensions) No Glazing, no cracking, no slipping
	3	**Check Alternator Wiring**	
		a. Check output & ground wire (unit OFF)	Negative lead on Ground terminal Positive lead on Output terminal = same as battery voltage.
		b. Check exciter wire (if used)	START/RUN-OFF switch in START/RUN position, Manual Start mode (See Note Note 4) Must have 11 or more VDC with switch ON
	4	**Check Aux (D+) Terminal**	Must have less than 3 VDC with unit OFF
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
		b. Check output wire (unit running)	Must have 13 or more VDC (when tested against – battery post)
		c. Check ground wire (unit running)	Must have 13 or move VDC (when tested against + battery post)
	5	**Check For Add–On Equipment Drawing Too Much Current**	
		a. Check amperage of added–on components & accessories	All add–on components & accessories must draw less than 20 Amps
	6	**Perform Pretrip Check**	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.

<table>
<tr><th>Alarm NO.</th><th>Steps</th><th>ALARM / CAUSE</th><th>CORRECTIVE ACTION</th></tr>
<tr><td colspan="4">53 BOX TEMP OUT-OF-RANGE
• TRIGGER–ON: UNIT CONTROL:
<u>Alarm Only</u>: The box temperature has been in range - within ±2.7°F (±1.5°C) of setpoint for perishable and frozen - at least once since the unit was started (Sleep Model and Component Test Modes excluded), and is now further away from setpoint than the limit set in the functional parameters - 4°, 5.5°, or 7°F (2.°, 3°, or 4°C) for this unit, for more than 15 minutes, or for more than 30 minutes immediately following the end of a defrost cycle. OR
If a unit Shutdown alarm occurs and the box temperature is further away from setpoint than the limit set in the functional parameters - 4°, 5.5°, or 7°F (2°, 3° or 4°C) - for more than 30 minutes regardless if the box temperature has been in-range.
The box temperature has not been in range, and the unit is operating in Pulldown (Cool) and the DeltaT (SAT minus RAT) is less than 1°F (0.56°C) OR
The unit is operating in Pullup (Heat) and the SAT is the same temperature or colder than the RAT for more than 30 minutes. (Alarm 122 - CHECK RETURN AIR SENSOR and Alarm 123 CHECK SUPPLY AIR SENSOR must not be active).
<u>Shut Down & Alarm</u>:
The box temperature has been in range - within ±2.7°F (±1.5°C) - of setpoint for perishable and frozen at least once since the unit was started (Sleep mode, Diagnostic and Component Test modes excluded), and is now further away from setpoint than the limit set in the functional parameters for this unit, for more than 45 minutes
• UNIT CONTROL: Alarm Only or Unit Shutdown & Alarm (if configured)
• RESET CONDITION: Auto Reset or Alarm may be manually reset via keypad or by turning the unit off, then back on again.</td></tr>
<tr><td colspan="4">NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.</td></tr>
<tr><td colspan="4">NOTE: The temperature criteria for this alarm is reset, and the box temperature must again go In-Range before this alarm can be triggered if any of the following occur:
•Pretrip is started
•Setpoint is changed
•A door switch or remote switch is installed and configured as a door switch</td></tr>
<tr><td colspan="4">NOTE: The 15, 30, or 45 minute timer is reset and starts again whenever:
•The unit cycles off and restarts in Start-Stop
•The unit goes into and comes out of Defrost
NOTE: This alarm does not go into the Inactive Alarm list when it becomes inactive or is cleared.
NOTE: This alarm will not be used in Sleep mode</td></tr>
<tr><td></td><td>1</td><td colspan="2">Check Trailer Or Rail Compartment Doors</td></tr>
<tr><td></td><td></td><td>a. Inspect all trailer or rail compartment doors</td><td>Must be closed, no air leakage</td></tr>
<tr><td></td><td>2</td><td colspan="2">Check For Low Refrigerant Pressure Alarm</td></tr>
<tr><td></td><td></td><td>a. Check for alarm 18</td><td>Alarm conditions must be corrected and the alarm cleared to continue</td></tr>
<tr><td></td><td></td><td colspan="2">Additional steps on the next page.</td></tr>
</table>

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
53	**BOX TEMP OUT-OF-RANGE (Continued)**		
	3	**Check Refrigerant Level**	
		a. Visually check refrigerant level in receiver tank.	Must be at correct level.
	4	**Check system pressures**	
		a. Install Manifold Test Set and check system pressures.	Suction & Discharge Pressures must be in the normal range. Suction & Discharge Pressures must have the same reading on gauges & on micro display.
	5	**Perform Pretrip Check**	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.
	6	**Check Delta-T**	
		a. Calculate SAT minus RAT, or check Delta-T value in Data list.	In cool, SAT must be at least 1°F (0.6°C) than RAT. In heat, SAT must be at least the same temperature as RAT or warmer.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
54	**DEFROST NOT COMPLETE**		
	• TRIGGER–ON: Defrost cycle did not terminate automatically. [DTT2 and SAT did not reach termination temperature of 55°F (12.8°C) within 45 minutes]. • UNIT CONTROL: Alarm Only. While this alarm is active, the Defrost Timer will be temporarily set to initiate a defrost cycle 90 minutes (1.5 hours) of unit running time after the alarm comes on. • RESET CONDITION: Auto Reset when defrost cycle is started again, or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Perform Pretrip Check**	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.
	2	**Check For Defective Defrost Sensor Location/Correct Installation**	
		a. Has sensor fallen from location?	Must be corrected to continue.
	3	**Check Evaporator Fan Clutch**	
		a. Check Evap Fan Clutch operation in defrost	Must disengage fan.
	4	**Check Refrigerant Level**	
		a. Visually check refrigerant level in receiver tank.	Must be at correct level.
	5	**Check For Low Refrigerant Pressure Alarm**	
		a. Check for alarm 18	Alarm conditions must be corrected and the alarm cleared to continue
	6	**Verify Temperature Of DTT2**	
		a. Using a service (Test) thermometer check temperature of Evaporator tube sheet at DTT2 and compare with DTT2 temperature in Data list.	Must be within ±2°F (1°C)
		b. Check DTT2 and RAT wiring.	Verify that RAT temperature is being displayed as RAT in unit Data list and that DTT2 is being displayed as DTT2. Correct wiring if required. (Refer to Section 3.14.)
	7	**Check Accuracy Of DTT2 And SAT Temperature Readings**	
		a. Check DTT2 resistance, and. Check SAT resistance (See Note Note 6)	(Refer to Section 2.13 for complete resistance chart) 10K Ohms @ 77°F (25°C)
	8	**Check DTT2 For Proper Mounting**	
		a. Inspect DTT2	Should be screwed tightly in place. Flat area of DTT2 must be against metal surface.
	9	**See Troubleshooting, Section 10.3.6 – Refrigeration System Not Heating**	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
55	**CHECK DEFROST AIR SWITCH**		
	• TRIGGER–ON: The defrost air switch has called for a defrost cycle within eight minutes of a defrost termination for two consecutive defrost cycles. (The air switch contact must be closed continuously for 15 seconds before the defrost cycle is started.) • UNIT CONTROL: Alarm ON. While this alarm is active, the defrost air switch will NOT be used to initiate a defrost cycle; however the Defrost Timer will initiate a defrost cycle 90 minutes after the alarm comes on, and the manual defrost switch will remain operative. • RESET CONDITION: Auto Reset when defrost cycle terminates correctly, and the air switch does not call for a defrost cycle within the eight minutes following defrost termination, or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Defrost Air Switch**	
		a. Inspect switch & connector pins & terminals	No damaged or corroded pins
		b. Check defrost air switch setting with Magnehelic Gauge, and check the resistance of switch contacts	Refer to Section 2.11 Contacts closed with pressure applied to high side Contacts open with no pressure applied
	2	**Check Switch Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Note NO TAG No physical damage to harness. No damaged or corroded pins
	3	**Check Air Switch Hoses**	
		a. Inspect air hoses to switch	No kinks or other obstructions No holes Connected to correct nipple
	4	**Check Condition Of Evaporator**	
		a. Visually inspect evaporator following defrost.	Coil must be clean and cleared of ice or any other material.
	5	**Perform Pretrip**	
		a. Clear Active Alarm list, then run Pretrip & check for any new alarms.	Any active alarms must be corrected and cleared before proceeding.
	6	**Check Evaporator Pressure Drop**	
		a. Check pressure reading with Magnehelic Gauge	Refer to Section 2.11
	7	**Check Evaporator Fan Clutch**	
		a. Check Evap Fan Clutch operation in defrost	Must disengage fan.
	8	**Check Condition Of Refrigerated Compartment & Load**	
		a. Check condition of refrigerated compartment doors & seals	Doors must be closed, and door seals must seal and prevent outside air from leaking in.
		b. Check condition of product. If it is warm and moist, frequent defrost cycles can be expected.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
56	**CHECK EVAPORATOR AIRFLOW**		
	• TRIGGER–ON: In the Cool mode, the Supply Air temperature is 5°F (2.8°C) or more warmer than Return Air Temperature for five minutes; or In the Heat mode, the Suction pressure has been higher than 100 PSIG (6.8 Bars) for more than 60 seconds. **NOTE:** For this alarm the unit must be running. This alarm will not occur in either the Defrost or Pretrip cycles. • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset in 15 minutes IF Alarm 30 is not also active or, alarm may be manually reset via keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Fan Belts**	
		a. Check upper fan belt tension & condition.	(Refer to Section 9.9 for belt tensions) No Glazing, no cracking, no slipping
		b. Check lower fan belt tension & condition.	(Refer to Section 9.9 for belt tensions) No Glazing, no cracking, no slipping
	2	**Check Evaporator Air Flow**	
		a. Check evaporator fan clutch	Must be engaged
		b. Check evaporator section, condition of evaporator blower wheels, return air bulkhead, air chute, cleanliness of evap. coil	Good Air Flow Return air not restricted Air chute in good condition No damage to blower wheel Evap. coil clean
	3	**Check System Pressures**	
		a. Install Manifold Test Set and check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading on gauges & on micro display.
	4	**Check Refrigerant Charge**	
		a. Check for undercharged system	Level must be above lower sight glass
	5	**Perform Pretrip Check**	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.
	6	**Check SV4**	
		a. Check SV4 for leakage when closed	Must not leak

<table>
<tr><th>Alarm NO.</th><th>Steps</th><th>ALARM / CAUSE</th><th>CORRECTIVE ACTION</th></tr>
<tr><td>57</td><td colspan="3">CHECK REMOTE SWITCH 1
• TRIGGER–ON:Remote Switch 1 is set to trigger alarm (contacts open or contacts closed depending on set up in configuration list for Remote Switch 1) for more than five seconds.
NOTE: •This alarm is disabled for Shutdown when the ’Unit Operation’ configuration is set for Rail and the unit is operating in Sleep Mode
•Shut down may be overridden in the Functional Parameter list.
• UNIT CONTROL: Alarm Only, or may be configured to shut unit down.
• RESET CONDITION:
Alarm Only: Auto Reset after Remote Switch 1 has been set to allow unit to run for more than five seconds.
Unit Shutdown: Auto Reset after three minutes (minimum off time for Remote switch shutdown condition) and Remote Switch 1 has been set to allow unit to run for more than five seconds.</td></tr>
<tr><td colspan="4">NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.</td></tr>
<tr><td></td><td>1</td><td colspan="2">Determine What Remote Switch 1 Is Controlled By</td></tr>
<tr><td></td><td></td><td>a. Remote Switch 1 may be connected to a refrigerated compartment door, or some other device and used to remotely control the unit.</td><td>Find and locate Remote Switch 1</td></tr>
<tr><td></td><td>2</td><td colspan="2">Check To See If Refrigerated Compartment Side Or Rear Door Is Open, Or If The Device That Remote Switch 1 Is Connected To Is Set To Trigger The Alarm</td></tr>
<tr><td></td><td></td><td>a. Inspect refrigerated compartment doors</td><td>Refrigerated compartment door(s) must be closed</td></tr>
<tr><td></td><td></td><td>b. Check device at Remote Switch 1</td><td>Must have switch in position that allows unit to operate.</td></tr>
<tr><td></td><td>3</td><td colspan="2">Check Wiring</td></tr>
<tr><td></td><td></td><td>a. Visually inspect wiring to switch</td><td>Wiring must be connected</td></tr>
<tr><td></td><td></td><td>b. Visually inspect condition of switch</td><td>Must not be damaged</td></tr>
<tr><td></td><td>4</td><td colspan="2">Check Remote Switch 1</td></tr>
<tr><td></td><td></td><td>a. Check switch operation</td><td>Contacts must Open & Close as switch is opened and closed.</td></tr>
<tr><td></td><td>5</td><td colspan="2">Check Configurations</td></tr>
<tr><td></td><td></td><td>a. Verify that Configuration is set for the type of switch being used (i.e. when Door is open, switch contacts are closed; etc.)</td><td>Must be correct for type of Remote switch being used.</td></tr>
</table>

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
58	**CHECK REMOTE SWITCH 2**		
	• TRIGGER–ON: Remote Switch 2 is set to trigger alarm (contacts open or contacts closed depending on set up in configuration list for Remote Switch 2) for more than five seconds. **NOTE:** •This alarm is disabled for Shutdown when the 'Unit Operation' configuration is set for Rail and the unit is operating in Sleep Mode. •Shut down may be overridden in the Functional Parameter list. • UNIT CONTROL: Alarm Only, or may be configured to shut unit down. • RESET CONDITION: Alarm Only: Auto Reset after Remote Switch 2 has been set to allow unit to run for more than five seconds. Shutdown: Auto Reset after three minutes (minimum off time for Remote switch shutdown condition) and Remote Switch 2 has been set to allow unit to run for more than five seconds.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Determine What Remote Switch 2 Is Controlled By**	
		a. Remote Switch 2 may be connected to a refrigerated compartment door, or some other device and used to remotely control the unit.	Find and locate Remote Switch 2
	2	**Check To See If Refrigerated Compartment Side Or Rear Door Is Open, Or If The Device That Remote Switch 2 Is Connected To Is Set To Trigger The Alarm**	
		a. Inspect refrigerated compartment doors	Refrigerated compartment door(s) must be closed
		b. Check device at Remote Switch 2	Must have switch in position that allows unit to operate.
	3	**Check Wiring**	
		a. Visually inspect wiring to switch	Wiring must be connected
		b. Visually inspect condition of switch	Must not be damaged
	4	**Check Remote Switch 2**	
		a. Check switch operation	Contacts must Open & Close as switch is opened and closed.
	5	**Check Configurations**	
		a. Verify that Configuration is set for the type of switch being used (i.e. when Door is open, switch contacts are closed; etc.)	Must be correct for type of Remote switch being used.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
59	**DATALOGGER NOT RECORDING** • TRIGGER–ON: No data is being recorded by the data recorder. • UNIT CONTROL: Alarm Only • RESET CONDITION: Alarm may be manually reset via keypad.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Clear Alarm**	
		a. Clear Active Alarm(s)	Alarms Clear
		b. Check for Active Alarm reoccurrence	If Inactive, download all data & retain. If Active, go to next step
	2	**Microprocessor Defective**	
		a. Download previous data using Download PC Card, or ReeferManager Program.	Data retrieval OK
		b. Replace microprocessor & set Configurations, Functional Parameters, Enter hours from removed microprocessor, set Maintenance Hour Meters, and Data Recorder Setup.	New microprocessor in place
NOTE: Specific configurations or IntelliSet settings may be found on the TransCentral Website (Authorized Carrier Transicold Dealers only.)			

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
60	**DATALOGGER TIME WRONG**		
	• TRIGGER–ON: The real time clock in the Data Recorder does not contain a valid date. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when the Data Recorder Real Time Clock is reset, or Alarm may be manually reset 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Real Time Clock**	
		a. Check Real Time Clock in the Data list, or using ReeferManager.	Must show correct date and time. Change as needed (Configuration list).
	2	**Reset Microprocessor**	
		a. Turn main switch off for 30 seconds, then turn on.	Microprocessor powers up OK
		b. Check for valid Real Time Clock reading in Data list	Valid date and time in memory. Alarm is cleared automatically
		c. Real Time Clock can not be changed.	Replace microprocessor
	3	**Microprocessor Defective**	
		a. Download previous data using Download PC Card, or ReeferManager Program.	Data retrieval OK
		b. Replace microprocessor & set Configurations, Functional Parameters, Enter hours from removed microprocessor, set Maintenance Hour Meters, and Data Recorder Setup.	New microprocessor in place
NOTE: Specific configurations or IntelliSet settings may be found on the TransCentral Website (Authorized Carrier Transicold Dealers only.)			

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
61	**DOOR OPEN**		
	• TRIGGER–ON: Trailer or rail car compartment door has been open for more than five seconds. **NOTE:** •This alarm is disabled for Shutdown when the 'Unit Operation' configuration is set for Rail and the unit is operating in Sleep Mode. •Shut down may be overridden in the Functional Parameter list. • UNIT CONTROL: Alarm Only, or may be configured to shut unit down. • RESET CONDITION: Alarm Only: Auto Reset after the door has been closed for more than five seconds. Shutdown: Auto Reset after three minutes (minimum off time for door open condition) and the door has been closed for more than five seconds.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check To See If Refrigerated Compartment Side Or Rear Door Is Open**	
		a. Inspect refrigerated compartment doors	Refrigerated compartment door(s) must be closed
	2	**Check Wiring**	
		a. Visually inspect wiring to door switch	Wiring must be connected
		b. Visually inspect condition of switch	Must not be damaged
	3	**Check Door Switch**	
		a. Check switch operation	Contacts must Open & Close as door is opened and closed.
	4	**Check Configurations**	
		a. Verify that Configuration is set for the type of switch being used (i.e. when Door is open, switch contacts are closed; etc.)	Must be correct for type of door switch
	5	**Temporary Solution Tip**	
		a. In the event of a defective switch that can not be repaired or replaced, and the switch is forcing the unit into a Shutdown, this alarm may be temporarily overridden by setting the correct Functional Parameter.	In the Functional Parameter list set OVERRIDE DOOR SHUTDOWN to YES.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
8.7 ELECTRICAL ALARMS			
71	**BAD F2 OR F3 FUSE**		
• TRIGGER–ON: One or more of the following fuse circuits have been open for more than 2 seconds: F2 (Speed Relay output circuit), or F3 (Run relay output circuit) • UNIT CONTROL: Alarm Only • RESET CONDITION: Alarm may be manually reset via keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Unit Operation**	
		a. Did unit shut down?	Yes Check F3 No Check F2
	2	**Check Fuses**	
		a. Locate blown fuse(s)	Will have open circuit
		b. Verify fuse size	Refer to Section 2.12 Must be correct rating for circuit (see wiring diagram)
		c. Inspect fuse & fuse holder	Terminals tight; No signs of overheating, melting or discoloration
	3	**Check Circuit**	
		a. Check amperage draw on Speed Relay circuit	Refer to Section 2.13
		b. Check amperage draw on Run Relay circuit	Refer to Section 2.13
72	**BAD F4 OR F6 FUSE**		
• TRIGGER–ON: One or more of the following fuse circuits have been open for more than 2 seconds: F4 (Clutch Relay output circuit, or F6 (SV & UL valves, Buzzer, & Fuel Heater Relay coil circuit • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset when the fuse is replaced, and the unit is powered up, or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Fuse**	
		a. Locate blown fuse	Will have open circuit
		b. Verify fuse size	Refer to Section 2.12 Must be correct rating for circuit (see wiring diagram)
		c. Inspect fuse & fuse holder	Terminals tight; No signs of overheating, melting or discoloration
	2	**Check Circuit**	
		a. Check amperage draw on clutch circuit	Refer to Section 2.13
		b. Check amperage draw on F6 circuit (See wiring schematic)	Refer to Section 2.13

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
78	**CHECK SV1 CIRCUIT**		
	• TRIGGER–ON: In either the Heat, Null, or Defrost cycles, the SV1 coil circuit is shorted. (The SV1 output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the SV1 coil itself, or to a positive wire.) • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when unit calls for Heat or Defrost and the SV1 coil current (amp) draw is normal, or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check SV1 Coil**	
		a. Inspect SV1 coil & connector pins & terminals	No damage to coil No damaged or corroded pins
		b. Check resistance of coil	Refer to Section 2.13
		c. Check amp draw of coil.	Refer to Section 2.13. Use ammeter
	2	**Check SV1 Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes Note 3, Note 4 & Note 8 No physical damage to harness. No damaged or corroded pins
	3	**Check SV1 Current Draw**	
		a. Use Component Test mode (Refer to Section 6.2.2) to test actual current draw of the circuit.	Refer to Section 2.13 for normal current values. View current draw in Data list
79	**CHECK SV4 CIRCUIT**		
	• TRIGGER–ON: In either the Heat or Defrost cycles the SV4 coil circuit is shorted. (The SV4 output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the SV4 coil itself, or to a positive wire. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when unit calls for Heat or Defrost and the SV4 coil current (amp) draw is normal, or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check SV4 Coil**	
		a. Inspect SV4 coil & connector pins & terminals	No damage to coil No damaged or corroded pins
		b. Check resistance of coil	Refer to Section 2.13
		c. Check amp draw of coil.	Refer to Section 2.13. Use ammeter.
	2	**Check SV4 Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes Note 3, Note 4 & Note 8 No physical damage to harness. No damaged or corroded pins
	3	**Check SV4 Current Draw**	
		a. Use Component Test mode (Refer to Section 6.2.2) and Alarms 81 thru 90 and Alarms 93 and 97 to test actual current draw of the circuit.	Refer to Section 2.13 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.14)

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
81	**CHECK FHR CIRCUIT**		
	• TRIGGER–ON: Fuel Heater Relay circuit is shorted. (The Fuel Heater Relay output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the Fuel Heater Relay coil itself, or to a positive wire. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when Fuel Heater Relay current (amp) draw is normal, or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Fuel Heater Relay**	
		a. Inspect Fuel Heater Relay & socket	No damage to relay No damaged or corroded pins
		b.Check resistance of relay coil	Refer to Section 2.13.
	2	**Check Fuel Heater Relay Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes Note 3, Note 4 & Note 8 No physical damage to harness. No damaged or corroded pins
	3	**Check Fuel Heater Relay Current Draw**	
		a. Use Component Test mode (Refer to Section 6.2.2) to test actual current draw of the circuit.	Refer to Section 2.13 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.14).
82	**CHECK REMOTE OUT-RANGE LIGHT**		
	• TRIGGER–ON: The micro Light Bar configuration is set for an 8-LIGHT BAR, and the Out-of-Range light circuit (to the Light Bar) circuit is shorted. (The Out-Of-Range Light output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the Out-Of-Range Light itself, or to a positive wire. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when In–range light current (amp) draw is normal, or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Out-Of-Range Light**	
		a. Inspect Out-of-Range light & socket	No damage to bulb No damaged or corroded pins
		b. Check resistance of light bulb	Refer to Section 2.13
	2	**Check Out-Of-Range Light Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes Note 3, Note 4 & Note 8 No physical damage to harness. No damaged or corroded pins
	3	**Check Out-Of-Range Light Current Draw**	
		a. Use Component Test mode (See Section 6.2.6.2.2) to test actual current draw of the circuit.	Refer to Section 2.13 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.14)

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
83	**CHECK REMOTE DEFROST LIGHT**		
	• TRIGGER–ON: The micro Light Bar configuration is set for an 8-LIGHT BAR, and the Defrost light circuit (to the Light Bar) circuit is shorted. (The Defrost Light output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the Defrost Light itself, or to a positive wire. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when Defrost light current (amp) draw is normal, or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Defrost Light**	
		a. Inspect Defrost light & socket	No damage to bulb No damaged or corroded pins
		b. Check resistance of light bulb	Refer to Section 2.13
	2	**Check Defrost Light Wirin**g	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes Note 3, Note 4 & Note 8 No physical damage to harness. No damaged or corroded pins
	3	**Check Defrost Light Current Draw**	
		a. Use Component Test mode (Refer to Section 6.2.2) to test actual current draw of the circuit.	Refer to Section 2.13 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.14)
84	**CHECK REMOTE ALARM LIGHT**		
	• TRIGGER–ON: Remote Alarm light circuit (to the Light Bar) circuit is shorted. (The Alarm Light output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the Alarm Light itself, or to a positive wire. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when Alarm light current (amp) draw is normal, or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Alarm Light**	
		a. Inspect Remote Alarm light & socket	No damage to bulb No damaged or corroded pins
		b. Check resistance of light bulb	Refer to Section 2.13
	2	**Check Alarm Light Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes Note 3, Note 4 & Note 8 No physical damage to harness. No damaged or corroded pins
	3	**Check Alarm Light Current Draw**	
		a. Use Component Test mode (Refer to Section 6.2.2) to test actual current draw of the circuit.	Refer to Section 2.13 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.14)

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
85	**CHECK UL1 CIRCUIT** • TRIGGER–ON: UL1 (Front) Unloader Coil circuit is shorted. (The UL1 output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the UL1 itself, or to a positive wire. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when the UL1 Coil current (amp) draw is normal, or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Front Unloader (UL1) Coil**	
		a. Inspect Front Unloader (UL1) coil & terminals	No damage to coil No damaged or corroded pins
		b. Check resistance of coil	Refer to Section 2.13. Cannot be opened (infinite ohms), shorted (Zero Ohms) or shorted to ground.
		c. Check amp draw of coil.	Refer to Section 2.13. Use ammeter.
	2	**Check Front Unloader (UL1) Current Draw**	
		a. Use Component Test mode (Refer to Section 6.2.2) to test actual current draw of the circuit.	Refer to Section 2.13 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.14)
	3	**Check Front Unloader (UL1) Coil Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	See Notes Note 3, Note 4 & Note 8 No physical damage to harness. No damaged or corroded pins
86	**CHECK UL2 CIRCUIT** • TRIGGER–ON: UL2 (Rear) Unloader Coil circuit is shorted. (The UL2 output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the UL2 itself, or to a positive wire. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when the UL2 Coil current (amp) draw is normal, or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Rear Unloader (UL2) Coil**	
		a.Inspect Rear Unloader (UL2) coil & terminals.	No damage to coil No damaged or corroded pins
		b. Check resistance of coil	Refer to Section 2.13
		c. Check amp draw of coil.	Refer to Section 2.13. Use ammeter.
	2	**Check Rear Unloader (UL2) Current Draw**	
		a. Use Component Test mode (Refer to Section 6.2.2) to test actual current draw of the circuit.	Refer to Section 2.13 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.14)
	3	**Check Rear Unloader (UL2) Coil Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	See Notes Note 3, Note 4 & Note 8 No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
87	**CHECK REMOTE HEAT LIGHT**		
	• TRIGGER–ON: The micro Light Bar configuration is set for an 8-LIGHT BAR, and the Remote Heat light circuit (to the Light Bar) circuit is shorted. (The Heat Light output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the Heat Light itself, or to a positive wire. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when Heat light current (amp) draw is normal, or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Heat Light**	
		a. Inspect Heat light & socket	No damage to bulb No damaged or corroded pins
		b. Check resistance of light bulb	Refer to Section 2.13
	2	**Check Heat Light Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	See Notes Note 3, Note 4 & Note 8 No physical damage to harness. No damaged or corroded pins
	3	**Check Heat Light Current Draw**	
		a. Use Component Test mode (Refer to Section 6.2.2) to test actual current draw of the circuit.	Refer to Section 2.13 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.14)
88	**CHECK REMOTE COOL LIGHT**		
	• TRIGGER–ON: The micro Light Bar configuration is set for an 8-LIGHT BAR, and the Remote Cool light circuit (to the Light Bar) circuit is shorted. (The Cool Light output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the Cool Light itself, or to a positive wire. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when Cool light current (amp) draw is normal, or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Cool Light**	
		a. Inspect Cool light & socket	No damage to bulb No damaged or corroded pins
		b. Check resistance of light bulb	Refer to Section 2.13
	2	**Check Cool Light Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes Note 3, Note 4 & Note 8 No physical damage to harness. No damaged or corroded pins
	3	**Check Cool Light Current Draw**	
		a. Use Component Test mode (Refer to Section 6.2.2) to test actual current draw of the circuit.	Refer to Section 2.13 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.14)

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
89	**CHECK REMOTE AUTO LIGHT**		
	• TRIGGER–ON: Remote Auto light circuit (to the Light Bar) circuit is shorted. (The Auto Light output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the Auto Light itself, or to a positive wire. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when Auto light current (amp) draw is normal, or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Auto Light**	
		a. Inspect Auto light & socket	No damage to bulb No damaged or corroded pins
		b. Check resistance of light bulb	Refer to Section 2.13
	2	**Check Auto Light Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	See Notes Note 3, Note 4 & Note 8 No physical damage to harness. No damaged or corroded pins
	3	**Check Auto Light Current Draw**	
		a. Use Component Test mode (Refer to Section 6.2.2) to test actual current draw of the circuit.	Refer to Section 2.13 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.14)
90	**AUTOFRESH AIR EXCHANGE RELAY**		
	• TRIGGER–ON: AutoFresh Air Exchange circuit (to the relay coil) is shorted. (The AutoFresh Air Exchange Relay output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the relay itself, or to a positive wire.. Alarm may be manually reset via Keypad or by turning the unit off, then back on again. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when AFEX current (amp) draw is normal, or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Autofresh Air Exchange Relay (AFAR)**	
		a. Inspect AFAR & socket	No damage to relay No damage to socket
		b. Check resistance of relay coil	Refer to Section 2.13.
	2	**Check Afar Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	See Notes Note 3, Note 4 & Note 8 No physical damage to harness. No damaged or corroded pins
	3	**Check Afar Current Draw**	
		a. Use Component Test mode (Refer to Section 6.2.2) to test actual current draw of the circuit.	Refer to Section 2.13 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.14)

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
93	**CHECK START UP BUZZER**		
	• TRIGGER–ON: The Buzzer circuit is shorted. (The Buzzer output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the Buzzer itself, or to a positive wire.) • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when Buzzer amp draw is normal, or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Buzzer**	
		a. Inspect Buzzer & wire connections	No damage to buzzer No damaged or corroded pins
		b. Check resistance of buzzer	Refer to Section 2.13
	2	**Check Buzzer Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	See Notes Note 3, Note 4 & Note 8 No physical damage to harness. No damaged or corroded pins
	3	**Check Buzzer Current Draw**	
		a. Use Component Test mode (Refer to Section 6.2.2) to test actual current draw of the circuit.	Refer to Section 2.13 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.14)
97	**CHECK SV2 CIRCUIT**		
	• TRIGGER–ON: SV2 coil circuit is shorted. (The SV2 output from the Micro is negative, so the circuit will not be shorted to ground, but is shorted either within the SV2 coil itself, or to a positive wire. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when unit calls for Heat or Defrost and the SV2 coil current (amp) draw is normal, or Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check SV2 Coil**	
		a. Inspect SV2 coil & connector pins & terminals	No damage to coil No damaged or corroded pins
		b. Check resistance of SV2	Refer to Section 2.13
		c. Check amp draw of SV2.	Refer to Section 2.13. Use ammeter.
	2	**Check SV2 Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	See Notes Note 3, Note 4 & Note 8 No physical damage to harness. No damaged or corroded pins
	3	**Check SV2 Current Draw**	
		a. Use Component Test mode (Refer to Section 6.2.2) to test actual current draw of the circuit.	Refer to Section 2.13 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.14)

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
8.8 SENSOR ALARMS			
121	**CHECK AMBIENT AIR SENSOR**		
	• TRIGGER–ON: Ambient Air Sensor circuit has failed open or shorted. If shorted, the data list will display 158°F (70°C). If the circuit is open, the data list will show the temperature as -52.6°F (-47°C) • UNIT CONTROL: A default value of 122°F (50°C) will be used for any calculations. • RESET CONDITION: Auto Reset when Ambient Air Sensor is in range or, Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Ambient Air Temperature Sensor (AAT)**	
		a. Inspect Ambient Air Sensor & connector	No damage to sensor No damage, moisture, or corrosion in connector
		b. Check Ambient Air Sensor resistance (See Note Note 6)	(Refer to Section 9.28 for complete resistance chart) 10,000 Ohms @ 77°F (25°C)
	2	**Check Ambient Air Sensor Wiring**	
		a. Inspect harness & control box connector pins & terminals. (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins
		b. Power microprocessor up (**See Note 5 Page 8.2)**. Disconnect sensor from harness. Check for voltage at harness plug between pins. FROM VECTOR	Voltage should be 2.5 VDC volts at harness plug between pins.
	3	**Check Remote Sensor/Switch Connector**	
		a. Locate and inspect 10-way connector for optional sensors and switches.	Connector must have cap on, 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.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
122	**CHECK RETURN AIR SENSOR**		
	• TRIGGER–ON: Return Air Sensor circuit has failed open or shorted. If shorted, the data list will display 158°F (70°C). If the circuit is open, the data list will show the temperature as -52.6°F (-47°C) • UNIT CONTROL: Use Supply Air Sensor reading plus 3.6°F (2°C). If Supply Air Sensor Alarm is on, and setpoint is at or below +10.4°F (-12°C), unit will run in Low Speed Cool only. If setpoint is above +10.4°F (-12°C), unit will shut down. • RESET CONDITION: Auto Reset when Return Air Sensor is in range or, Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Return Air Temperature Sensor (RAT)**	
		a. Inspect Return Air Sensor & connector	No damage to sensor No damage, moisture, or corrosion in connector
		b. Check Return Air Sensor resistance (See Note Note 6)	(Refer to Section 9.28 for complete resistance chart) 10,000 Ohms @ 77°F (25°C)
	2	**Check Return Air Sensor Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins
		b. Power microprocessor up (**See Note 5 Page 8.2)**. Disconnect sensor from harness. Check for voltage at harness plug between pins.	Voltage should be 2.5 VDC volts at harness plug between pins.
	3	**Check Remote Sensor/Switch Connector**	
		a. Locate and inspect 10-way connector for optional sensors and switches.	Connector must have cap on, 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.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
123	**CHECK SUPPLY AIR SENSOR**		
	• TRIGGER–ON: Supply Air Sensor circuit has failed open or shorted. If shorted, the data list will display 158°F (70°C). If the circuit is open, the data list will show the temperature as -52.6°F (-47°C) • UNIT CONTROL: Use Return Air Sensor reading minus 3.6°F (2°C). If Return Air Sensor Alarm is on, and setpoint is at or below +10.4°F (-12°C) unit will run in Low Speed Cool only. If setpoint is above +10.4°F (-12°C), unit will shut down. If Alarm 132–CHECK DEFROST TERM 2 SENSOR is also active, Defrost termination will be as described in section 5.11. • RESET CONDITION: Auto Reset when Supply Air Sensor is in range or, Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Supply Air Temperature Sensor (SAT)**	
		a. Inspect Supply Air Sensor & connector	No damage to sensor No damage, moisture, or corrosion in connector
		b. Check Supply Air Sensor resistance (See Note Note 6)	(Refer to Section 9.28 for complete resistance chart) 10,000 Ohms @ 77°F (25°C)
	2	**Check Supply Air Sensor Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins
		b. Power microprocessor up (**See Note 5 Page 8.2)**. Disconnect sensor from harness. Check for voltage at harness plug between pins.	Voltage should be 2.5 VDC volts at harness plug between pins.
	3	**Check Remote Sensor/Switch Connector**	
		a. Locate and inspect 10-way connector for optional sensors and switches.	Connector must have cap on, 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.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
125		**CHECK COMP DISCH SENSOR** • TRIGGER–ON: Compressor Discharge Sensor circuit has failed open or shorted. If shorted, the data list will display 392°F (200°C). If the circuit is open, the data list will show the temperature as -40°F (-40°C) • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when Compressor Discharge Sensor is in range or, Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Compressor Discharge Temperature Sensor (CDT)**	
		a. Inspect Compressor Discharge Sensor & connector	No damage to sensor No damage, moisture, or corrosion in connector
		b. Check Compressor Discharge Sensor resistance (See Note Note 6)	(Refer to Section 9.28 for complete resistance chart) 100,000 Ohms @ 77°F (25°C)
	2	**Check Compressor Discharge Sensor Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins
		b. Power microprocessor up (**See Note 5 Page 8.2)**. Disconnect sensor from harness. Check for voltage at harness plug between pins.	Voltage should be 2.5 VDC volts at harness plug between pins.
	3	**Check Remote Sensor/Switch Connector**	
		a. Locate and inspect 10-way connector for optional sensors and switches.	Connector must have cap on, 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.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
126	**CHECK FUEL SENSOR CIRCUIT**		
	• TRIGGER–ON: The Low Fuel Shutdown is configured as a 0% to 100% sensor, and the fuel level reading (in the data list) is less than 2% for 30 seconds. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when fuel level is sensed above 4% for 30 seconds or, Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check For Low Fuel Level**	
		a. Check fuel level in the fuel tank	Add fuel as needed to the fuel tank.
	2	**Check Fuel Level Sensor**	
		a. Inspect fuel level sensor& connector pins & terminals	No physical damage to sensor. No damaged or corroded pins in plug.
		b. Check fuel level sensor operation	Place unit in Manual Start mode (see Note Note 4), OR Use Component Test Mode to energize the Run Relay. DO NOT START UNIT. (Refer to Section 6.2.2)
		c. Check for voltage at harness plug between pins for BLACK (SP24) and RED (SPK5) wires	Voltage should be 12 volts at harness plug between pins for BLACK (SP24) and RED (SPK5) wires
		d. Check continuity of the wire from the harness plug, pin C to the microprocessor plug 1MP26	START/RUN-OFF switch in OFF position prior to checking for continuity. Must be less than 10 ohms.
		e. With the Fuel Level Sensor reconnected, check the voltage at the microprocessor plug 1MP26	Voltage must be between 0.0 – 5.0 VDC.
	3	**Check Fuel Level Sensor Calibration**	
		a. Check fuel level sensor calibration	See Section 9.8.2
	4	**Check Circuits With Test (Substitute) Sensor**	
		a. Substitute known good sensor and clear alarm. Start unit and run for 30 seconds. b. Check to see if alarm re-occurs.	Alarm should not come on. (Install new sensor)

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
129	**CHECK ENG COOLANT SENSOR** • TRIGGER–ON: Engine Coolant Sensor circuit has failed open or shorted. If shorted, the data list will display 266°F (130°C). If the circuit is open, the data list will show the temperature as -58°F (-50°C) • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when Engine Coolant Sensor is in range or, Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Engine Coolant Temperature Sensor (ENCT)**	
		a. Inspect Engine Coolant Sensor & connector	No damage to sensor No damage, moisture, or corrosion in connector
		b. Check Engine Coolant Sensor resistance (See Note Note 6)	(Refer to Section 9.28 for complete resistance chart) 10,000 Ohms @ 77°F (25°C)
	2	**Check Engine Coolant Sensor Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins
	3	**Check Remote Sensor/Switch Connector**	
		a. Locate and inspect 10-way connector for optional sensors and switches.	Connector must have cap on, 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.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
130	**CHECK ENGINE RPM SENSOR** • TRIGGER–ON: With the unit in Auto Start: The ambient temperature is above 32°F (0°C), and this is the 2nd or 3rd start attempt, and the Engine Oil Pressure switch is closed (oil pressure good), and engine RPM are sensed at less than 1000 RPM; or The ambient is below 32°F (0°C) and the DC amp draw is more than 2 amps , and this is the 2nd or 3rd start attempt, and engine RPM are sensed at less than 1000 RPM; or With the unit in Manual Start: The ambient temperature is above 32°F (0°C), and this is the 2nd or 3rd start attempt, and the Engine Oil Pressure switch is closed (oil pressure good) engine RPM are sensed at less than 50 RPM; or The ambient is below 32°F (0°C) and the DC amp draw is more than 2 amps , and this is the 2nd or 3rd start attempt, and engine RPM are sensed at less than 50 RPM. **NOTE:** This alarm can only be triggered on during the engine starting sequence and the 20 seconds immediately following. • UNIT CONTROL: Alarm Only (Engine will be considered running) • RESET CONDITION: With the unit in Auto Start: Auto Reset in Auto Start when engine RPM are greater than 1,000 or, With the unit in Manual Start: Auto Reset in Auto Start when engine RPM are greater than 1,000 or, when Oil Pressure switch contacts OPEN or, Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Alarm List**	
		a.Check for A41	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. Check fuel tank and add fuel as necessary. Check fuel lines between the fuel tank and the fuel pump inlet for drawing air in.
	2	**Check Engine rpm Sensor (Non-ESC engines only)**	
		a. Inspect Engine RPM Sensor & connector	No damage to sensor. No damage, moisture, or corrosion in connector.
		b. Compare actual engine RPM with those shown on the display using hand held tachometer.	Must be ± 20 RPM Must be a steady reading.
	3	**Check Engine Speed Sensor (ENSSN) (ESC engines Only)**	
		a. Inspect circuit from ENSCU terminal 3 to micro connection 2MP18 & connector.	No damage to unit. No damage, moisture, or corrosion in connector.
		b. Compare actual engine RPM with those shown on the display using hand held tachometer.	Must be ± 20 RPM Must be a steady reading.
		c. Check for 12 VDC between ENSSN 12 V terminal & ENSSN ground.	Must be 12 VDC.
		d. Check for 12 VDC at ENSCU terminal 25 to ground	Must be 12 VDC.
		Additional steps on the next page.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
130	**CHECK ENGINE RPM SENSOR (Continued)**		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	4	**Check engine RPM sensor wiring (non-ESC engines only)**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	See Note NO TAG No physical damage to harness. No damaged or corroded pins
		b.Check RPM wiring	Place unit in Manual Start mode (see Note Note 4), OR Use Component Test Mode to energize the Run Relay. DO NOT START UNIT. (Refer to Section 6.2.2)
		c. Check voltage reading between plug terminals A & B.	With + lead on A and - lead on C reading should be 5 VDC ±.2 volts. If it is not, check for grounded positive circuit at CSP and CDP transducers.
	5	**Check circuits with test sensor**	
		a. Substitute known good sensor and check Unit Data List reading. (Refer to Section 3.14)	Must be within ± 20 RPM or reading on tachometer

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
132	**CHECK DEFROST TERM 2 SENSOR** • TRIGGER–ON: Defrost Termination Temperature Sensor 2 circuit has failed open or shorted. If shorted, the data list will display 158°F (70°C). If the circuit is open, the data list will show the temperature as -52.6°F (-47°C) • UNIT CONTROL: Use RAT or SAT for defrost initiation criteria. (See Defrost mode, Section 5.11) • RESET CONDITION: Auto Reset when Defrost Termination Temperature Sensor 2 is in range or, Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Defrost Termination Temperature Sensor 2 (DTT2)**	
		a. Inspect Defrost Termination Temperature Sensor 2 & connector	No damage to sensor No damage, moisture, or corrosion in connector
		b. Check Defrost Termination Temperature Sensor 2 resistance (See Note Note 6)	(Refer to Section 9.28 for complete resistance chart) 10,000 Ohms @ 77°F (25°C)
	2	**Check Defrost Termination Temperature Sensor 2 Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins
	3	**Check Remote Sensor/Switch Connector**	
		a. Locate and inspect 10-way connector for optional sensors and switches.	Connector must have cap on, 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.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
133	**CHECK REMOTE TEMP SENSOR 1**		
	• TRIGGER–ON: Remote Temperature Sensor 1 circuit is configured on, and has failed open or shorted. If shorted, the data list will display 158°F (70°C). If the circuit is open, the data list will show the temperature as -52.6°F (-47°C) • UNIT CONTROL: Alarm only. • RESET CONDITION: Auto Reset when Remote Temperature Sensor 1 is in range or, Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Remote Temperature Sensor 1 (REMSN1)**	
		a. Verify that Remote Temperature Sensor 1 has been installed and is correctly wired to the unit.	Remote Temperature Sensor 1 is installed. Wires are connected to 10-pin connector at cavities E & F. If sensor is not present change micro configuration to OFF.
	2	**Check Remote Temperature Sensor 1**	
		a. Inspect Remote Temperature Sensor 1 & connector	No damage to sensor No damage, moisture, or corrosion in connector
		b. Check Remote Temperature Sensor 1 resistance (See Note Note 6)	(Refer to Section 9.28 for complete resistance chart) 10,000 Ohms @ 77°F (25°C)
	3	**Check Remote Temperature Sensor 1 Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins
		b. Check 10-way connector for all remote sensors and switches.	No physical damage, moisture or corrosion to connector. Cavity plugs are in place for unused circuits.

<table>
<tr><th>Alarm NO.</th><th>Steps</th><th>ALARM / CAUSE</th><th>CORRECTIVE ACTION</th></tr>
<tr><td>134</td><td colspan="3">CHECK REMOTE TEMP SENSOR 2
• TRIGGER–ON: Remote Temperature Sensor 2 circuit is configured on, and has failed open or shorted. If shorted, the data list will display 158°F (70°C). If the circuit is open, the data list will show the temperature as -52.6°F (-47°C)
• UNIT CONTROL: Alarm only.
• RESET CONDITION: Auto Reset when Remote Temperature Sensor 2 is in range or, Alarm may be manually reset via keypad or by turning the unit off, then back on again.</td></tr>
<tr><td colspan="4">NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.</td></tr>
<tr><td></td><td>1</td><td colspan="2">Check Remote Temperature Sensor 2 (REMSN2)</td></tr>
<tr><td></td><td></td><td>a. Verify that Remote Temperature Sensor 2 has been installed and is correctly wired to the unit.</td><td>Remote Temperature Sensor 2 is installed.
Wires are connected to 10-pin connector at cavities G&H.
If sensor is not present change micro configuration to OFF.</td></tr>
<tr><td></td><td>2</td><td colspan="2">Check remote temperature sensor 2</td></tr>
<tr><td></td><td></td><td>a. Inspect Remote Temperature Sensor 2 & connector</td><td>No damage to sensor
No damage, moisture, or corrosion in connector</td></tr>
<tr><td></td><td></td><td>b. Check Remote Temperature Sensor 2 resistance (See Note Note 6)</td><td>(Refer to Section 9.28 for complete resistance chart)
10,000 Ohms @ 77°F (25°C)</td></tr>
<tr><td></td><td>3</td><td colspan="2">Check remote temperature sensor 2 wiring</td></tr>
<tr><td></td><td></td><td>a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)</td><td>No physical damage to harness.
No damaged or corroded pins</td></tr>
<tr><td></td><td></td><td>b. Check 10-way connector for all remote sensors and switches.</td><td>No physical damage, moisture or corrosion to connector.
Cavity plugs are in place for unused circuits.</td></tr>
</table>

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
135	**CHECK REMOTE TEMP SENSOR 3**		
	• TRIGGER–ON: Remote Temperature Sensor 3 circuit is configured on, and has failed open or shorted. If shorted, the data list will display 158°F (70°C). If the circuit is open, the data list will show the temperature as -52.6°F (-47°C) • UNIT CONTROL: Alarm only. • RESET CONDITION: Auto Reset when Remote Temperature Sensor 3 is in range or, Alarm may be manually reset via keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Remote Temperature Sensor 3 (REMSN3)**	
		a. Verify that Remote Temperature Sensor 3 has been installed and is correctly wired to the unit.	Remote Temperature Sensor 3 is installed. Wires are connected to 10-pin connector at cavities J & K. If sensor is not present change micro configuration to OFF.
	2	**Check remote temperature sensor 3**	
		a. Inspect Remote Temperature Sensor 3 & connector	No damage to sensor No damage, moisture, or corrosion in connector
		b. Check Remote Temperature Sensor 3 resistance (See Note Note 6)	(Refer to Section 9.28 for complete resistance chart) 10,000 Ohms @ 77°F (25°C)
	3	**Check remote temperature sensor 3 wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins
		b. Check 10-way connector for all remote sensors and switches.	No physical damage, moisture or corrosion to connector. Cavity plugs are in place for unused circuits.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
8.9 PRETRIP ALARMS			
P141 PRETRIP STOPPED BY USER • TRIGGER–ON: Pretrip cycle was stopped before the Pretrip cycle ended automatically • UNIT CONTROL: Alarm Only • RESET CONDITION: Alarm may be manually reset via keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check For Any Pretrip Alarms**	
		a. Scroll the Alarm list for any Active Pretrip alarms	Alarm conditions must be corrected and the alarm cleared to continue
	2	**Rerun Pretrip Check (If Desired)**	
		a. Clear Active Alarm List, then run Pretrip & check for any new alarms.	Unit running in Pretrip mode. Check for any new alarms.
		b. Allow to terminate automatically	Pretrip cycle operates normally.
P143 CHECK CLUTCH CIRCUIT • TRIGGER–ON: Normal Amps for the Clutch Circuit is 2.0 to 7 Amps. The circuit tests outside this range. • UNIT CONTROL: Pretrip will abort and “PRETRIP FAILED IN TEST 2” will be displayed in MessageCenter. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check For Bad F4 Or F6 Fuse Alarm**	
		a. Check for alarm 72	Alarm conditions must be corrected and the alarm cleared to continue.
	2	**Check Clutch**	
		a. Check resistance of clutch coil	Refer to Section 2.13
		b. Check amp draw of clutch coil.	Use Component Test mode (Section 6.2.2) to test. Refer to Section 2.13 for amp values. View current draw in the Unit Data list. (Refer to Section 3.14)
	3	**Check Clutch & Circuit**	
		a. Inspect clutch and wiring	No damage or corrosion Connector fits together tightly, no moisture inside
		b. Inspect clutch relay & socket	No signs of discoloration from overheating No corrosion
		c. Check operation of Clutch Relay	START/RUN-OFF switch in START/RUN-Manual Start Operation. (See Note Note 4) LED 29 must be ON
		d. Check voltage to clutch	Must be 11.5 VDC or higher
	4	**Check Clutch Circuit Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P144 CHECK UL1 CIRCUIT			
		• TRIGGER–ON: Normal Amps for the UL1 (Front) Unloader Circuit is 0.75 to 2.0 Amps. The circuit tests outside this range. • UNIT CONTROL: Pretrip will abort and "PRETRIP FAILED IN TEST 2" will be displayed in MessageCenter. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check For Bad F4 Or F6 Fuse Alarm**	
		a. Check for alarm 72	Alarm conditions must be corrected and the alarm cleared to continue.
	2	**Check Front Unloader (UL1)**	
		a. Check amp draw of coil.	Use Component Test mode (Section 6.2.2) to test. Refer to Section 2.13 for amp values. View current draw in the Unit Data list. (Refer to Section 3.14).
		b. Check resistance of Front Unloader (UL1) coil.	Refer to Section 2.13
	3	**Check Front Unloader (UL1) And Circuit**	
		a. Inspect Front Unloader (UL1) and wiring.	No damage or corrosion Connector fits together tightly, no moisture inside
		b. Check operation of UL1 FET (23)	START/RUN-OFF switch in Start/Run-Manual Start Operation. (See Note Note 4) LED must be ON
		c. Check voltage to Front Unloader (UL1).	Must be 11 VDC or higher across the 2 wires
	4	**Check Front Unloader (UL1) Circuit Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P145 CHECK SPEED SOL CIRCUIT • TRIGGER–ON: Normal Amps for the Speed Solenoid Circuit is 3.0 to 9.0 Amps for non-Electronic Speed Controlled (ESC) engines or 0 to 1.0 Amps for ESC engines. The circuit tests outsidethis range. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check For Bad F2 Or F3 Fuse Alarm**	
		a. Check for alarm 71	Alarm conditions must be corrected and the alarm cleared to continue.
	2A	**Check Speed Solenoid (Non-ESC engines)**	
		a. Check resistance of speed solenoid	Refer to Section 2.13
		b. Check amp draw of speed solenoid.	Use Component Test mode (Section 6.2.2) to test. Refer to Section 2.13 for amp values. View current draw in the Unit Data list. (Refer to Section 3.14).
	2B	**Check Circuit For High Resistance (ESC engines)**	
		a. Check amp draw of engine speed control circuit (ENSCU) pin 16 and MPQC3 on the micro.	Use Component Test mode (Section 6.2.2) to test. Refer to Section 2.13 for amp values. View current draw in the Unit Data list. (Refer to Section 3.14).
	3	**Check Speed Solenoid & Circuit**	
		a. Inspect speed solenoid and wiring	No physical damage to harness. No damaged or corroded pins No damage to solenoid
		b. Check operation of Speed Relay LED	LED 27must be ON
		c. Check voltage to speed solenoid	Must be 11 VDC or higher across the 2 wires
	4	**Check Speed Solenoid Circuit Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P148 CHECK SV1 CIRCUIT • TRIGGER–ON: Normal Amps for the SV1 Circuit is 0.75 to 2.5 Amps. The circuit tests outside this range. • UNIT CONTROL: Pretrip will abort and “PRETRIP FAILED IN TEST 2” will be displayed in MessageCenter. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check For Bad F4 Or F6 Fuse Alarm**	
		a. Check for alarm 72	Alarm conditions must be corrected and the alarm cleared to continue.
	2	**Check SV1**	
		a. Check resistance of SV1	Refer to Section 2.13
		b. Check amp draw of SV1.	Use Component Test mode (Section 6.2.2) to test. Refer to Section 2.13 for amp values. View current draw in the Unit Data list. (Refer to Section 3.14).
	3	**Check SV1 & Circuit**	
		a. Inspect SV1 and wiring	No physical damage to harness. No damaged or corroded pins
		b. Start unit, setpoint more than 10°F (5.5°C) above box temperature, and set above +11°F (-11.5°C). (See note Note 9)	Unit running in Heat Cycle
		c. Check operation of SV1 FET (10)	LED must be ON
		d. Check voltage to SV1	Must be 11 VDC or higher across the 2 wires
	4	**Check SV1 Circuit Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P150 CHECK SV4 CIRCUIT • TRIGGER–ON: Normal Amps for the SV4 Circuit is 0.75 to 2.0 Amps. The circuit tests outside this range. • UNIT CONTROL: Pretrip will abort and “PRETRIP FAILED IN TEST 2” will be displayed in MessageCenter. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check For Bad F4 Or F6 Fuse Alarm**	
		a. Check for alarm 72	Alarm conditions must be corrected and the alarm cleared to continue.
	2	**Check SV4**	
		a. Check resistance of SV4	Refer to Section 2.13
		b. Check amp draw of SV4.	Use Component Test mode (Section 6.2.2) to test. Refer to Section 2.13 for amp values. View current draw in the Unit Data list. (Refer to Section 3.14).
	3	**Check SV4 & Circuit**	
		a. Inspect SV4 and wiring	No physical damage to harness. No damaged or corroded pins
		b. Start unit with setpoint more than 10°F (5.5°C) above box temperature, and set above +11°F (-11.6°C). (See note Note 9)	Unit running in Heat Cycle
		c. Check operation of SV–4 FET (9)	LED must be ON
		d. Check voltage to SV–4	Must be 11 VDC or higher across the 2 wires
	4	**Check SV4 Circuit Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P151 CHECK GLOW PLUG CIRCUIT • TRIGGER–ON: Normal Amps for the Glow Plugs Circuit is 23 to 35 Amps after 15 seconds. The circuit tests outside this range. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Glow Plug Circuit**	
		a. Inspect glow plug relay & socket	No signs of discoloration from overheating No corrosion
		b. Check operation of Glow Plug Relay	START/RUN-OFF switch in START/RUN-Manual Start Operation. (See Note Note 4) Glow Crank switch in Glow position. LED 30 must be ON
		c. Check voltage to glow plugs	Must be 11 VDC or higher
		d. Check Glow Plug circuit Amps	Use Component Test mode (Section 6.2.2) to test. Refer to Section 2.13 for amp values. View current draw in the Unit Data list. (Refer to Section 3.14)
		e. Check amp draw of each glow plug.	Refer to Section 2.13 for amp values. Use ammeter.
	2	**Check Glow Plug Circuit Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P152 CHECK FUEL SOLENOID CIRC			
• TRIGGER–ON: Normal Amps for the Fuel Solenoid Hold Circuit is 0.42 to 3.5 Amps (0.2 to 4.5 Amps for ESC units)for non-Electronic Speed Controlled (ESC) engines, and 0.2 to 4.5 Amps for ESC engines (including possible electric fuel pump). The circuit tests outside this range. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check For Bad F2 Or F3 Fuse Alarm**	
		a. Check for alarm 71	Alarm conditions must be corrected and the alarm cleared to continue.
	2A	**Check Fuel Solenoid (Non-ESC engines only)**	
		a. Check resistance of fuel solenoid	Refer to Section 2.13
		b. Check amp draw of fuel solenoid.	Use Component Test Mode (Section 6.2.2) to test. Refer to Section 2.13 for amp values. View current draw in the Unit Data list. (Refer to Section 3.14)
	2B	**Check Fuel And Speed Actuator (FSA) (ESC engines only)**	
		a. Check resistance of FSA	Refer to Section 2.13. With FSA unplugged, ohm spec is 3-4 ohms, +/- 10%.
		b. Check amp draw between MPQC4 & terminal 13 and 15 of the ENSCU.	Use Component Test Mode (Section 6.2.2) to test. Refer to Section 2.13 for amp values.
	3A	**Check Fuel Solenoid & Circuit (Non-ESC engines only)**	
		a. Inspect fuel solenoid and wiring	No physical damage to harness. No damaged or corroded pins No damage to solenoid
		b. Check operation of Run Relay	Start/Run-Off switch in Start/Run-Manual Start Operation. (See Note 2) LED 28 must be ON
		c. Check voltage to fuel solenoid	Start/Run-Off switch in Start/Run, Manual Start Mode (See Note 2) 12 VDC between FSCC (ground) & FSHA (hold) With Manual Crank Switch in crank position 12 VDC between FSCC (ground) & FSPB (pick)
	3B	**Check FSA & Circuits (ESC only)**	
		a. Inspect FSA and wiring	No physical damage to harness. No damaged or corroded pins No damage to solenoid
		b. Check operation of Run Relay	Start/Run-Off switch in Start/Run-Manual Start Operation. (See Note 2) LED 28 must be ON
		c. Check voltage to FSA	Start/Run-Off switch in Start/Run, Manual Start Mode (See Note 2) OR component test mode, run relay.12 VDC between engine speed control unit (ENSCU) pins 13 and 19. 12 VDC between ENSCU pins 13 and 19 With Manual Crank Switch in crank position 12 VDC between ENSCU pins 15 and 19
	4	**Check Fuel Solenoid Circuit Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins
		b. Check operation of solenoid	Plunger must move in when energized

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P153 CHECK RETURN AIR SENSOR			
		• TRIGGER–ON: Return Air Sensor is not within the maximum range of -53°F to +158°F (-47°C to +70°C) • UNIT CONTROL: Pretrip will abort and “PRETRIP FAILED IN TEST 3” will be displayed in MessageCenter. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Return Air Temperature sensor (RAT)**	
		a. Inspect Return Air Sensor & connector	No physical damage to harness. No moisture, damaged or corroded pins 1MP Plug is connected tightly to microprocessor. No wires are pushed back through plug.
		b. Check Return Air Sensor resistance **(See Note 4 Page 8-2)**	10,000 Ohms @ 77°F (25°C) [See section 2.13 for complete table of temperatures and resistance values.]
	2	**Check Return Air Sensor Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins
	3	**Check Remote Sensor/Switch Connector**	
		a. Locate and inspect 10-way connector for optional sensors and switches.	Connector must have cap on, 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.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P154 CHECK SUPPLY AIR SENSOR			
• TRIGGER–ON: Supply Air Sensor is not within the maximum range of -53°F to +158°F (-47°C to +70°C) • UNIT CONTROL: Pretrip will abort and "PRETRIP FAILED IN TEST 3" will be displayed in MessageCenter. Defrost termination will be as described in Section 5.11 • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Supply Air Temperature Sensor (SAT)**	
		a. Inspect Supply Air Sensor & connector	No physical damage to harness. No moisture, damaged or corroded pins 1MP Plug is connected tightly to microprocessor. No wires are pushed back through plug.
		b. Check Supply Air Sensor resistance **(See Note 4 Page 8-2)**	10,000 Ohms @ 77°F (25°C) [See section 2.13 for complete table of temperatures and resistance values.]
	2	**Check Supply Air Sensor Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins
	3	**Check Remote Sensor/Switch Connector**	
		a. Locate and inspect 10-way connector for optional sensors and switches.	Connector must have cap on, 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.
	4	**Check Remote Sensor/Switch Connector**	
		a. Locate and inspect 10-way connector for optional sensors and switches.	Connector must have cap on, 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.

<table>
<tr><th>Alarm NO.</th><th>Steps</th><th>ALARM / CAUSE</th><th>CORRECTIVE ACTION</th></tr>
<tr><td colspan="4">P155 CHECK COOLANT TEMP SENSOR
• TRIGGER–ON: Engine Coolant Temp Sensor is not within the maximum range of -58°F to +266°F (-50°C to +130°C)
• UNIT CONTROL: Pretrip will abort and “PRETRIP FAILED IN TEST 3” will be displayed in MessageCenter.
• RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.</td></tr>
<tr><td colspan="4">NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.</td></tr>
<tr><td></td><td>1</td><td colspan="2">Check Engine Coolant Temperature Sensor (ENCT)</td></tr>
<tr><td></td><td></td><td>a. Inspect Engine Coolant Sensor & connector</td><td>No damage to sensor
No moisture, damage or corrosion in connector
1MP Plug is connected tightly to microprocessor. No wires are pushed back through plug.</td></tr>
<tr><td></td><td></td><td>b. Check Engine Coolant Sensor resistance (See Note 4 Page 8-2))</td><td>10,000 Ohms @ 77°F (25°C) [See section 2.13 for complete table of temperatures and resistance values.]</td></tr>
<tr><td></td><td>2</td><td colspan="2">Check Engine Coolant Sensor Wiring</td></tr>
<tr><td></td><td></td><td>a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)</td><td>No physical damage to harness.
No damaged or corroded pins</td></tr>
<tr><td></td><td>3</td><td colspan="2">Check Remote Sensor/Switch Connector</td></tr>
<tr><td></td><td></td><td>a. Locate and inspect 10-way connector for optional sensors and switches.</td><td>Connector must have cap on,
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.</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td colspan="4">P156 CHECK BATTERY VOLTS
• TRIGGER–ON: Battery voltage is less than 11 VDC or greater than 17 VDC
• UNIT CONTROL: Alarm Only
• RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.</td></tr>
<tr><td colspan="4">NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.</td></tr>
<tr><td></td><td>1</td><td colspan="2">Check For Battery Voltage Too High Alarm</td></tr>
<tr><td></td><td></td><td>a. Check for alarm 15</td><td>Alarm conditions must be corrected and the alarm cleared to continue.</td></tr>
<tr><td></td><td>2</td><td colspan="2">Check For Battery Voltage Too Low Alarm</td></tr>
<tr><td></td><td></td><td>a. Check for alarm A16</td><td>Alarm conditions must be corrected and the alarm cleared to continue.</td></tr>
</table>

<table>
<tr><th>Alarm NO.</th><th>Steps</th><th>ALARM / CAUSE</th><th>CORRECTIVE ACTION</th></tr>
<tr><td colspan="4">P157 CHECK BATTERY CURRENT
• TRIGGER–ON: With all circuits off, current flow of more than +1.5 or -2 Amps is detected in the electrical circuits.
NOTE: If this alarm occurs, Pretrip Test #2 will not be performed. You will need to run Pretrip again.
• UNIT CONTROL: Alarm Only
• RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.</td></tr>
<tr><td colspan="4">NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.</td></tr>
<tr><td rowspan="2"></td><td>1</td><td colspan="2">Check Battery Current Draw.</td></tr>
<tr><td></td><td>a. Note amp draw on display. (See Note 3)</td><td>Must show +1.5 to -2 Amps</td></tr>
<tr><td rowspan="2"></td><td>2</td><td colspan="2">Check Individual Circuits</td></tr>
<tr><td></td><td>a. Isolate individual circuits and test amp draw</td><td>Must be in range. (Refer to Section 2.13)</td></tr>
<tr><td rowspan="2"></td><td>3</td><td colspan="2">Check For Parasitic Loads (Electrical current being used by a non-refrigeration unit component)</td></tr>
<tr><td></td><td>a. Check for electrical loads that are drawing current with all circuits OFF.</td><td>Check for non-factory installed electrical devices such as lift gates, inside lights, satellite systems, etc). These must have zero amps during Pretrip.</td></tr>
</table>

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P158 CHECK AMBIENT AIR SENSOR • TRIGGER–ON: Ambient Air Sensor is not within the maximum range of -53°F to +158°F (-47°C to +70°C) • UNIT CONTROL: Pretrip will abort and "PRETRIP FAILED IN TEST 3" will be displayed in MessageCenter. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Ambient Air Temperature sensor (AAT)**	
		a. Inspect Ambient Air Sensor & connector	No damage to sensor No moisture, damage or corrosion in connector 1MP Plug is connected tightly to microprocessor. No wires are pushed back through plug.
		b. Check Ambient Air Sensor resistance **(See Note 4 Page 8-2)**	10,000 Ohms @ 77°F (25°C) [See section 2.13 for complete table of temperatures and resistance values.]
	2	**Check ambient air sensor wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins
	3	**Check remote sensor/switch connector**	
		a. Locate and inspect 10-way connector for optional sensors and switches.	Connector must have cap on, 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.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P160 CHECK DISCH TEMP SENSOR • TRIGGER–ON: Compressor Discharge Temp Sensor is not within the maximum range of -40°F to +392°F (-40°C to +200°C) • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Compressor Discharge Temperature Sensor (CDT)**	
		a. Inspect Compressor Discharge Temp Sensor & connector	No damage to sensor No damage or corrosion in connector 1MP Plug is connected tightly to microprocessor. No wires are pushed back through plug.
		b.Check Compressor Discharge Temp Sensor resistance **(See Note 4 Page 8-2)**	100,000 Ohms @ 77°F (25°C) [See section 2.13 for complete table of temperatures and resistance values.]
	2	**Check Compressor Discharge Temp Sensor Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins
	3	**Check Remote Sensor/Switch Connector**	
		a. Locate and inspect 10-way connector for optional sensors and switches.	Connector must have cap on, 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.

<table>
<tr><th>Alarm NO.</th><th>Steps</th><th>ALARM / CAUSE</th><th>CORRECTIVE ACTION</th></tr>
<tr><td colspan="4">P162 CHECK AUTO FRESH AIR EXCHANGE SOLENOID (AFAS) CIRCUIT
• TRIGGER–ON: Normal Amps for the AFAX Circuit is 0.4 to 2.5 Amps. The circuit tests outside this range.
• UNIT CONTROL: Alarm Only.
• RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again</td></tr>
<tr><td colspan="4">NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.</td></tr>
<tr><td rowspan="2"></td><td>1</td><td colspan="2">Check For Bad F10 Fuse</td></tr>
<tr><td></td><td>a. Check circuit current</td><td>All conditions must be corrected in circuit</td></tr>
<tr><td rowspan="2"></td><td>2</td><td colspan="2">Check Auto Fresh Air Exchange Solenoid (AFAS)</td></tr>
<tr><td></td><td>a. Check amp draw of AFAS</td><td>Use Component Test Mode (Section 6.2.2) to test.
Refer to Section 2.13 for amp values.
View current draw in the Unit Data List.</td></tr>
<tr><td rowspan="4"></td><td>3</td><td colspan="2">Check AFAS And Circuit</td></tr>
<tr><td rowspan="3"></td><td>a. Inspect AFAS and wiring</td><td>No physical damage to harness.
No damaged or corroded pins.
No damage to solenoid</td></tr>
<tr><td>b. Check operation of AutoFresh Air Exchange Relay (AFAR)</td><td>AFAS turned on and LED12 on.
AFAR energized.</td></tr>
<tr><td>c. Check voltage to AFAS</td><td>12VDC between AFAS B (ground) and AFAS A (+12VDC) when AFAR is energized.</td></tr>
</table>

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P164 CHECK UL2 CIRCUIT • TRIGGER–ON: Normal Amps for the UL2 (Rear) Unloader Circuit is 0.75 to 2.0 Amps. The circuit tests outside this range. • UNIT CONTROL: Pretrip will abort and "PRETRIP FAILED IN TEST 3" will be displayed in MessageCenter. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for bad F4 or F6 fuse alarm**	
		a. Check for alarm 72	Alarm conditions must be corrected and the alarm cleared to continue.
	2	**Check Rear Unloader (UL2)**	
		a. Check resistance of UL2	Refer to Section 2.13
		b. Check amp draw of UL2	Use Component Test mode (Section 6.2.2) to test. Refer to Section 2.13 for amp values. View current draw in the Unit Data list. (Refer to Section 3.14
	3	**Check Rear Unloader (UL2) And Circuit**	
		a. Inspect Rear Unloader (UL2) and wiring.	No damage or corrosion Connector fits together tightly, no moisture inside
		b. Check operation of Rear Unloader (UL2) FET (22).	START/RUN-OFF switch in START/RUN-Manual Start Operation. (See Note Note 4) LED must be ON
		c. Check voltage to UL2	Must be 11 VDC or higher across the 2 wires
	4	**Check Rear Unloader (UL2) Circuit Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P165 CANNOT PUMP DOWN			
		• TRIGGER–ON: With SV1, SV2, & SV4 in the closed position, the compressor is not able to pull the low side of the refrigerant system down to 10 PSIG (0.68 Bar). • UNIT CONTROL: Pretrip will abort and "PRETRIP FAILED IN TEST 11, 12 or 13" will be displayed in MessageCenter. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Visually Inspect Unit**	
		a. Is compressor turning with engine?	Compressor must turn with engine.
	2	**Check System Pressure**	
		a. Check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading ± 5 PSIG (±0.34 Bar) on gauges & on micro display.
	3	**Manually Test Refrigeration System (See Note 9 Page 8-2)**	
		a. See Refrigeration Troubleshooting, Section 10.3 - "System Will Not Pump Down"	Must pass all tests Correct any problems found before proceeding.
		b. Run Quick Check	Correct any problems found before proceeding.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P174 CHECK LOW SPEED RPM • TRIGGER–ON in Test #7: With Speed Relay turned off (speed solenoid de-energized), engine RPM are <u>NOT</u> Between 1375 and 1600 for **Ultima XTC and X2 2500A/R**; or Between 1275 and 1500 for **Ultra XTC and X2 2100A/R** • TRIGGER–ON in Test #9: 15 seconds after the High Speed Test, engine RPM have <u>NOT</u> dropped from the high speed RPM (in Test #8) by: Between 450 and 925 for **Ultima XTC and X2 2500A/R**; or Between 150 and 525 for **Ultra XTC and X2 2100A/R** • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Speed Solenoid& Linkage On Non-electronic Speed Controlled (ESC) Engines And The Fuel And Speed Actuator On ESC Engines**	
		a.Check speed solenoid (FSA on ESC) plunger	Must move in and out freely
		b. Check engine speed arm & linkage	Must move freely
	2	**Force Low Speed Operation (See Note 9 Page 8-2)**	
		a. Set Functional Parameter “LOW SPEED START” for a high number (30 to 90) then start the unit. **Set Functional Parameter back to original setting after completing repairs.**	LED 27 must be OFF
		b. Check operation of Speed Relay LED	LED 27 must be OFF
		c. Check voltage to speed solenoid (FSA on ESC)	Must be 0 VDC
		d. On X2 2500 units ONLY, check for voltage on engine speed control unit (ENSCU) pin 22.	Must be 12 VDC
	3	**Check For Proper Voltage To The Engine Speed Control Unit (ENSCU) Pin 16 Based On Requested Speed From The Microprocessor**	
		a. Check voltage at pin 16 with unit running.	Must be 0 VDC for all units
	4	**Check Engine RPM**	
		a. Check actual engine RPM using hand held tachometer	Refer to Section 2.7 Adjust engine linkage setting as needed.
		b. Compare actual RPM with those shown on display.	Both readings within ± 50 RPM
	5	**Check Engine Air-Intake System**	
		a. Check air filter indicator	Flag must not be visible.
		b. Inspect air intake system	Hoses & tubes in good condition. No kinks or restrictions
	6	**Check Engine Exhaust System**	
		a. Inspect the exhaust system	Must be clear and unobstructed

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P175 CHECK HIGH SPEED RPM			
		• TRIGGER–ON: With Speed Relay turned on (voltage at the speed solenoid / Engine Speed Control Unit for high speed operation (?)), engine RPM are NOT Between 2000 and 2300 for **Ultima XTC/X2 2500A/R**; or Between 1700 and 2000 for **Ultra XTC/X2 2100A/R** • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Speed Solenoid & Linkage On Non-Electronic Speed Controlled (ESC) Engines, Or The fuel And Speed Actuator On ESC Engines**	
		a. Check speed solenoid (FSA on ESC) plunger	Must move in and out freely
		b. Check engine speed arm & linkage	Must move freely
	2	**Force high speed operation (See Note 9 Page 8-2)**	
		a. Set Functional Parameter "LOW SPEED START" to zero and adjust setpoint at least 10°F (5.6°C) above or below box temperature then start the unit. **Set Functional Parameter back to original setting after completing repairs.**	LED 27 must be ON
		b. Check operation of Speed Relay	LED 27 must be ON
		c. Check voltage to speed solenoid (FSA on ESC)	Must be 12-14 VDC
		d. Check resistance of speed solenoid (FSA on ESC)	Refer to Section 2.13
		e. Check amp draw of speed solenoid (FSA on ESC)	Use Component Test Mode (Section 6.2.2) to test. Refer to Section 2.13 for amp values. View current draw in the Unit Data list. (Refer to Section 3.14
		f. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins or terminals
		g. On X2 2500 units ONLY, check for voltage on engine speed control unit (ENSCU) pin 22.	Must be 12 VDC
	3	**Check For Proper Voltage To The Engine Speed Control Unit (ENSCU) Pin 16 Based On Requested Speed From The Microprocessor**	
		a. Check voltage at pin 16 with unit running.	Must be 0 VDC for all units
	4	**Check Engine RPM**	
		a. Check actual engine RPM using hand held tachometer	Refer to Section 2.7 Adjust engine linkage setting as needed.
		b. Compare actual RPM with those shown on display	Both readings within ± 50 RPM
		Additional steps on the next page.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P175 CHECK HIGH SPEED RPM (Continued)			
	5	**Check engine air-intake system**	
		a. Check air filter indicator	Flag must not be visible.
		b. Inspect air intake system	Hoses & tubes in good condition. No kinks or restrictions
	6	**Check engine exhaust system**	
		a. Inspect the exhaust system	Must be clear and unobstructed

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P178 CHECK UL1			
		• TRIGGER–ON: The pressure differential between suction and discharge pressures did not change as expected when the UL1 (Front) Unloader was loaded (de-energized) or unloaded (energized) • UNIT CONTROL: If alarm A191 is already on, then Pretrip will be aborted & display will read "PRETRIP FAILED IN TEST 6". • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Wiring To DPT & SPT**	
		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.
	2	**Check for Check UL1 alarm**	
		a. Check for alarm 85 or P144	Alarm conditions must be corrected and the alarm cleared to continue
	3	**Check system pressures**	
		a. Check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading - ± 5 PSIG (±0.34 Bar) - on gauges & on micro display.
	4	**Check for Check SV2 Circuit Alarm**	
		a. Check for alarm 97 or P192	Alarm conditions must be corrected and the alarm cleared to continue
	5	**Check Front Unloader (UL1) Operation - Unit must be running (See Note 9 Page 8-2) (See Section 9.14 - Unloader Checkout Procedure)**	
		a. Energize UL1 coil	Pressures must change within 3-4 seconds of coil being energized or de-energized Suction pressure must raise slightly Discharge pressure must drop slightly
		b. De-energize UL1 coil	Suction pressure must drop slightly Discharge pressure must raise slightly
	6	**Check for Check UL2 Unloader alarm**	
		a. Check for alarm P191	Alarm conditions must be corrected and the alarm cleared to continue
	7	**Check SV1 for being closed.**	
		a. Check voltage to SV1 coil.	Must be 0 VDC
		b. Check pressure differential between compressor discharge port and receiver king valve.	Must be less than 25 PSIG (1.70 Bars).
	8	**Check the compressor center head snubber tee**	
		a. Check snubber (restrictor) inside the tee assembly for HPS and CDP sensors	Tee must be open and not blocked or overly restricted. If in doubt, remove the snubber restrictor with a hammer and small punch, then restart pretrip.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P180 CHECK SUCTION MOD VALVE • TRIGGER–ON: Suction pressure did not drop as expected during Test 10 in Pretrip, when the CSMV was changing position. • UNIT CONTROL: Alarm only. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Software Revision Level**	
		a. Upgrade software.	Revision level must be 04.06.00 or higher.
	2	**Check connector to the suction modulation valve**	
		a. Inspect CSMV and wiring.	No damage or corrosion. Connector fits together tightly. No moisture inside.
	3	**Check operation of suction modulation valve**	
		a. See CSMV troubleshooting, Section 9.22.2	Must pass all tests.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P181	**CHECK SV4 VALVE**		
		• TRIGGER–ON: Suction pressure did not rise within range & discharge pressure did not drop within range when SV4 was energized (opened) • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check For SV4 Alarm**	
		a. Check for alarms 79, P150	Alarm conditions must be corrected and the alarm cleared to continue
	2	**Check System Pressures**	
		a. Check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading – ± 5 PSIG (±0.34 Bar) – on gauges & on micro display.
	3	**Check SV4 Operation – Unit Must Be Running In Heat Cycle (See Note 9 Page 8–2) (See Section 9.21.1, Checking SV4)**	
		a. Set unit to run in high speed cool	After 60 seconds note suction and discharge pressures.
		b. Energize SV4 coil	Hot gas hissing sound will begin immediately. Suction pressure must rise slightly Discharge pressure must drop slightly
		c. De-energize SV4 coil	Hot gas hissing sound will stop immediately. Suction pressure must drop slightly Discharge pressure must rise slightly
	4	**Manually Test Refrigeration System**	
		a. Run Quick Check	Must pass all tests Correct any problems found before proceeding.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P182 CHECK SV1 VALVE • TRIGGER–ON: Discharge pressure did not decrease when SV1 was de-energized (opened) as expected in Heat Pretrip Mode, or discharge pressure did not increase as expected when SV1 was energized (closed) in Cool Pretrip Mode. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for SV1 Alarm**	
		a. Check for alarms 80, P148	Alarm conditions must be corrected and the alarm cleared to continue
	2	**Check System Pressures**	
		a. Check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading - ± 5 PSIG (±0.34 Bar) - on gauges & on micro display.
	3	**Check Sv1 Operation - Unit Must Be Running In Heat Cycle. (See Note 9 Page 8-2) (See Section 9.21.2 - Checking SV1)**	
		a. Set unit to operate in high speed heat	After 3 minutes note discharge and suction pressures
		b. De-energize SV1 coil	Compressor discharge pressure will drop Receiver tank pressure will raise slightly
	4	**Manually Test Refrigeration System**	
		a. Run Quick Check	Must pass all tests Correct any problems found before proceeding.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P191 CHECK UL2 • TRIGGER–ON: The pressure differential between discharge and suction pressures did not change as expected when the UL2 (Rear) Unloader was loaded (de-energized) or unloaded (energized) • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check For SV2 Circuit Alarm**	
		a. Check for alarm 97 or P192	Alarm conditions must be corrected and the alarm cleared to continue
	2	**Check For Check UL2 Unloader Alarm**	
		a. Check for alarm 85 or P144	Alarm conditions must be corrected and the alarm cleared to continue
	3	**Check System Pressures**	
		a. Check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading - ± 5 PSIG (±0.34 Bar) - on gauges & on micro display.
	4	**Check UL2 Operation - Unit Must Be Running (See Note 9 Page 8-2)** **(See Section 9.14 - Checking Unloaders)**	
		a. Energize UL2 coil	Pressures must change within 3-4 seconds of coil being energized or de-energized Suction pressure must raise slightly Discharge pressure must drop slightly Check snubber
		b. De-energize UL2 coil	Suction pressure must drop slightly Discharge pressure must raise slightly
	5	**Check The Compressor Center Head Snubber Tee**	
		a. Check snubber (restrictor) inside the tee assembly for HPS and CDP sensors	Tee must be open and not blocked or overly restricted. If in doubt, remove the snubber restrictor with a hammer and small punch, then restart pretrip.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P192 CHECK SV2 CIRCUIT			
		• TRIGGER–ON: Normal Amps for the SV2 Circuit is 0.75 to 2.0 Amps. The circuit tests outside this range. • UNIT CONTROL: Pretrip will abort and "PRETRIP FAILED IN TEST 2" will be displayed in MessageCenter. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check For Bad F4 Or F6 Fuse Alarm**	
		a. Check for alarm 72	Alarm conditions must be corrected and the alarm cleared to continue.
	2	**Check SV2**	
		a. Check resistance of SV2	Refer to Section 2.13
		b. Check amp draw of SV2.	Use Component Test mode (Section 6.2.2) to test. Refer to Section 2.13 for amp values. View current draw in the Unit Data list. (Refer to Section 3.14
	3	**Check SV2 & Circuit**	
		a. Inspect SV2 and wiring	No damage or corrosion Connector fits together tightly, no moisture inside
		b. Check operation of SV2 FET (21)	START/RUN-OFF switch in START/RUN-Manual Start Operation. (See Note Note 4) LED must be ON
		c. Check voltage to SV2	Must be 11 VDC or higher across the 2 wires
	4	**Check SV2 Circuit Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P194 HIGH SUCTION PRESSURE • TRIGGER–ON: This alarm is generated during Test 4 of Cool Pretrip. Suction pressure is higher than normal. (Maximum suction pressure should be approximate MOP of TXV or a little bit higher during this test. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for SV4 Alarm**	
		a. Check for alarm P181	Condition must be corrected and alarm cleared to proceed.
	2	**Check System Pressures**	
		a. Check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading - ± 5 PSIG (±0.34 Bar) - on gauges & on micro display.
	3	**Check MOP Of Expansion Valve**	
		a. Test MOP of Expansion valve.	Refer to Section 2.11
		b. Verify that correct TXV is in unit.	Must have correct valve.
	4	**Manually Test Refrigeration System (See Note 9 Page 8-2)**	
		a. Run Quick Check	Must pass all tests Correct any problems found before proceeding.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P195 LOW SUCTION PRESSURE			
		• TRIGGER–ON: This alarm is generated during Test 4 of Cool Pretrip. Suction pressure is lower than normal, using the lesser value of the two following calculations. Minimum suction pressure should be 15 PSIG (1Bar) less than TXV MOP (see section 2.11 for MOP values); OR RAT minus 40°F (22°C) (Calculate suction pressure using a Temperature–Pressure chart See Table 9-9). For example, if the RAT is +45°F, you would take 45°F minus 40°F which equals 5°F. Look up the saturated suction pressure for 5°F. See Table 9-9. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Wiring To DPT & SPT**	
		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.
	2	**Check Fan Belts**	
		a. Check upper fan belt tension & condition	(Refer to Section 9.9 for belt tensions) No Glazing, no cracking, no slipping
		b. Check lower fan belt tension & condition.	(Refer to Section 9.9 for belt tensions) No Glazing, no cracking, no slipping
	3	**Check Evaporator Air Flow (See Note 9 Page 8-2)**	
		a. Check evap fan clutch	Must be engaged
		b. Check evaporator section, return air bulkhead, air chute, cleanliness of evap. coil	Good Air Flow Return air not restricted Air chute in good condition No damage to blower wheel Evap. coil clean
	4	**Check For SV2 Circuit Alarm**	
		a. Check for alarm 97 or P192	Alarm conditions must be corrected and the alarm cleared to continue
	5	**Check System Pressures**	
		a. Check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading - ± 5 PSIG (±0.34 Bar) - on gauges & on micro display.
	6	**Check Refrigerant Charge**	
		a. Check for undercharged system. (See Section 9.11.4 - Checking Refrigerant Charge)	Level must be above lower sight glass
	7	**Manually Defrost Unit**	
		a. Defrost unit and terminate automatically.	Typical defrost cycle time is 5-20 minutes Suction pressure should rise gradually during cycle.
	8	**Check system pressures**	
		a. Check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading - ± 5 PSIG (±0.34 Bar) - on gauges & on micro display.
		Additional steps on the next page.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P195 LOW SUCTION PRESSURE (Continued)			
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	9	**Manually Test Refrigeration System (See Note 9 Page 8-2)**	
		a. Run Quick Check	Must pass all tests. Correct any problems found before proceeding
		b. See Refrigeration Troubleshooting, Section 10.3.9- “Low Suction Pressure.”	
	10	**Check Expansion Valve (TXV)**	
		a. Visually inspect valve	Bulb must be clamped tightly on the suction line and insulated
		b. Check MOP of valve	Refer to Section 2.11
		c. Verify that correct TXV is in unit.	Must have correct valve.
		d. Check superheat of valve	Refer to Section 2.11
	11	**Check For Damage To The Suction Line**	
		a. Visually inspect suction line for any kinks, restrictions, or other damage.	No damage to line
	12	**Check For Restricted Compressor Suction Screen**	
		a. Visually inspect compressor suction inlet screen for material.	Must be clean and unobstructed.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P196 HIGH DISCHARGE PRESSURE • TRIGGER–ON: This alarm is generated during Test 4 of Cool Pretrip. Discharge pressure is higher than normal. *('Normal" discharge pressure for systems operating in the Cool Mode can be estimated by taking the temperature of the air entering the condenser coil (Ambient Air Temperature AAT) and adding 30°F (16.6° C) to it, then looking at a pressure temperature chart-see Table 9-9- for the corresponding pressure.)* • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Fan Belts**	
		a. Check upper fan belt tension & condition	(Refer to Section 9.9 for belt tensions) No Glazing, no cracking, no slipping
		b. Check lower fan belt tension & condition.	(Refer to Section 9.9 for belt tensions) No Glazing, no cracking, no slipping
	2	**Check Wiring**	
		a. Visually Inspect wiring to SV4 & both Compressor Unloaders	Wires must be connected properly & securely to each component
	3	**Check Airflow Through Condenser Coil (See Note 9 Page 8-2)**	
		a. Inspect condenser / radiator fins	Fins must be straight. 90% or more of the coil surface must be undamaged. No "dead" air spaces. Condenser / Radiator coil must be clean.
		b. Check airflow (with unit running).	Even airflow through the entire coil No "dead" spots
	4	**Check System Pressures**	
		a. Install Manifold Test Set and check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading on gauges & on micro display. Pressures must be in the normal range for ambient & box temperature conditions.
	5	**Check For Refrigerant Overcharge**	
		a. Check refrigerant level in the receiver tank.	Level must be between upper & lower sight glasses
	6	**Check Discharge Check Valve**	
		a. Check that discharge check valve opens fully	Must open fully with unit running
		b. Check discharge check valve screen	Must be clean of any debris
	7	**Manually Test Refrigeration System (See Note 9 Page 8-2)**	
		a. Run Quick Check	Must pass all tests Correct any problems found before proceeding.
	8	**Check System For Non–Condensables**	
		a. Check refrigeration system for non–condensable gas(es)	No non–condensable gas(es) may be present.
		b. See Refrigeration Troubleshooting, Section 10.3.9 - "High Discharge Pressure."	
	9	**Check Compressor**	
		a. Remove all Compressor heads and inspect valve plates, unloaders, reed valves, & gaskets	Must be in good condition. No broken or missing parts.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P198 LOW DISCHARGE PRESSURE • TRIGGER–ON: In the Heat Pretrip mode, the Compressor Discharge Pressure did not rise to normal. *(The minimum 'Normal" discharge pressure for systems operating in the Heat Pretrip Mode can be estimated by taking the temperature of the air entering the condenser coil (Ambient Air Temperature AAT) and looking at a pressure temperature chart-see table Table 9-9-for the corresponding pressure, then adding 80 psig (5.5bars) to it.)* • UNIT CONTROL: Pretrip will abort and "PRETRIP FAILED IN TEST 4" will be displayed in MessageCenter. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check For Ambient Sensor Alarm**	
		a. Check for alarm(s) 121 and P158	Alarm conditions must be corrected and the alarm cleared to continue.
		b. Check Ambient Sensor calibration	Must be within ±10°F (±5.5°C) of actual temperature
	2	**Check System Pressures**	
		a. Install Manifold Test Set and check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction pressure must be above 3 PSIG (0.2 Bar) Suction & Discharge Pressures must have the same reading on gauges & on micro display.
	3	**Check Refrigerant Charge**	
		a. Check for undercharged system	Level must be above lower sight glass
	4	**Check SV1 Operation. (See Section 9.21.2 - Checking SV1)**	
		a. Check the operation of the SV1 valve per test procedure	Must perform correctly Correct any problems found before proceeding
	5	**Check Compressor For Ability To Pump Up Pressure**	
		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 & inspect condition of all reeds & gaskets	Must be in good condition.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P200 CHECK UL1 CYLINDERS • TRIGGER–ON: A problem has been detected inside the front cylinder head of the compressor with a suction reed, discharge reed, head gasket or valve plate gasket. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Refrigerant Charge**	
		a. Check for undercharged system	Level must be above lower sight glass
	2	**Manually Test Refrigeration System (See Note 9 Page 8-2)**	
		a. Run Quick Check	Must pass all tests Correct any problems found before proceeding.
		b. Check and compare compressor suction pressure with pressure shown on the microprocessor controller.	Suction Pressure must have the same reading on gauge & on micro display.
	3	**Check Compressor Front Head Reed Valves & Gaskets**	
		a. Remove compressor front head & inspect condition of all reeds & gaskets	Must be in good condition.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P201 CHECK UL2 CYLINDERS • TRIGGER–ON: A problem has been detected inside the rear cylinder head of the compressor with a suction reed, discharge reed, head gasket or valve plate gasket. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Manually Test Refrigeration System (See Note 9 Page 8-2)**	
		a. Run Quick Check	Must pass all tests Correct any problems found before proceeding.
		b. Check and compare compressor suction pressure with pressure shown on the microprocessor controller.	Suction Pressure must have the same reading on gauge & on micro display.
	2	**Check Compressor Rear Head Reed Valves & Gaskets**	
		a. Remove compressor rear head & inspect condition of all reeds & gaskets	Must be in good condition.
P202 HIGH SIDE LEAK • TRIGGER–ON: With the Low Pressure Side of the refrigeration system forced to low pressure, refrigerant pressure is leaking past one of the components in the High Pressure Side of the refrigeration system into the Low Pressure Side.. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Manually Test Refrigeration System (See Note 9 Page 8-2)**	
		a. Run Quick Check	Must pass all tests Correct any problems found before proceeding.
		b. Check and compare compressor suction pressure with pressure shown on the microprocessor controller.	Suction Pressure must have the same reading on gauge & on micro display.
		c. With manifold gauges connected to the compressor discharge and suction valves, and the unit running in Cool, slowly front seat the King Valve until the suction pressure reaches 5 psig (3 bar), then shut the engine off.	Monitor manifold gauges with the unit off. The suction and discharge pressures should not equalize for several minutes. Correct any problems before proceeding.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P203 CHK DISCHARGE CHECK VALVE • TRIGGER–ON: Refrigerant is leaking backwards through the Discharge Check Valve • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Discharge Check Valve**	
		a. Test Discharge Check Valve for leakage	Must not leak.
	2	**Manually Test Refrigeration System (See Note 9 Page 8-2)**	
		a. Run Quick Check	Must pass all tests Correct any problems found before proceeding.
		b. Check and compare compressor suction pressure with pressure shown on the microprocessor controller.	Suction Pressure must have the same reading on gauge & on micro display.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P204 LOW SUCTION PRESSURE			
		• TRIGGER–ON: Suction Pressure is less than -10inHg (-0.34 Bar) for more than 30 continuous seconds, or less than 16inHg (-0.54 Bar) for more than 5 seconds at any time during Pretrip. • UNIT CONTROL: Pretrip will abort and “PRETRIP FAILED IN TEST X” will be displayed in MessageCenter indicating in which test the suction pressure was too low. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Fan Belts**	
		a. Check upper fan belt tension & condition	(Refer to Section 9.9 for belt tensions) No Glazing, no cracking, no slipping
		b. Check lower fan belt tension & condition.	(Refer to Section 9.9 for belt tensions) No Glazing, no cracking, no slipping
	2	**Check System Pressures**	
		a. Install Manifold Test Set and check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction pressure must be above 3 PSIG (0.2 Bar) Suction & Discharge Pressures must have the same reading on gauges & on micro display.
	3	**Manually Defrost Unit**	
		a. Defrost unit and terminate automatically.	Typical defrost cycle time is 5-20 minutes Suction pressure should rise gradually during cycle.
	4	**Check Evaporator Air Flow**	
		a. Check evap fan clutch	Must be engaged
		b. Check evaporator section, return air bulkhead, air chute, cleanliness of evap. coil	Good Air Flow Return air not restricted Air chute in good condition No damage to blower wheel Evap. coil clean
	5	**Check Refrigerant Charge - See Section 9.11.4 - Checking Refrigerant Charge)**	
		a. Check for undercharged system	Level must be above lower sight glass
	6	**Check Expansion Valve (TXV)**	
		a. Visually inspect valve	Bulb must be clamped tightly on the suction line and insulated
		b. Check MOP of valve	Refer to Section 2.11
		c. Check superheat of valve	Refer to Section 2.11

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P205 CHK DEFROST TERM 2 SENSOR • TRIGGER–ON: Defrost Termination Temperature Sensor 2 is not within the maximum range of −53°F to +158°F (−47°C to +70°C) • UNIT CONTROL: Alarm and defrost cycle will terminate as described in section 5.11. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Defrost Termination Temperature Sensor 2 (DTT2)**	
		a. Inspect Defrost Termination Temperature Sensor 2 & connector	No damage to sensor No damage or corrosion in connector 1MP plug is connected tightly to microprocessor. No wires are pushed back through plug.
		b. Check Defrost Termination Temperature Sensor 2 resistance **(See Note 4 Page 8−2)**	10,000 Ohms @ 77°F (25°C) [See section 2.13 for complete table of temperatures and resistance values.]
	2	**Check Defrost Termination Temperature Sensor 2 Wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic Section 11.)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
		8.10 MAINTENANCE ALARMS	
223	**ENGINE MAINTENANCE DUE** • TRIGGER–ON: The Engine Maintenance Hour Meter time has expired. • UNIT CONTROL: Alarm Only. Alarm Light will NOT be turned on. • RESET CONDITION: Alarm may be manually reset via keypad.		
	1	**Check Unit Maintenance Records**	
		a. Schedule unit into service facility for maintenance	Must be done soon!
	2	**Perform Maintenance**	
		a. Perform appropriate engine & 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 Interval in Configuration list as required.
		b. Reset Engine Maintenance Hour Meter for the next service interval	Hour Meter is reset in the Functional Parameter list. Follow maintenance interval recommendations in Section 9.1.
	4	**See Note 1 Page 8-2**	
		a. Clear the inactive alarms.	All alarms cleared.
225	**GENERAL MAINTENANCE DUE** • TRIGGER–ON: The General Maintenance Hour Meter time has expired. • UNIT CONTROL: Alarm Only. Alarm Light will NOT be turned on. • RESET CONDITION: Alarm may be manually reset via keypad.		
	1	**Check Unit Maintenance Records**	
		a. Schedule unit into service facility for maintenance	Must be done soon!
	2	**Perform Maintenance**	
		a. Perform appropriate engine & unit maintenance	Follow instructions on proper maintenance form
	3	**Reset General Maintenance Hour Meter**	
		a. Check that the General Maintenance Hour Meter interval is set for your requirements.	Reset Interval in Configuration list as required.
		b. Reset General Maintenance Hour Meter for the next service interval	Hour Meter is reset in the Functional Parameter list. Follow maintenance interval recommendations in Section 9.1.
	4	**See Note 1 Page 8-2**	
		a. Clear the inactive alarms.	All alarms cleared.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
226	**SERVICE SOON – PM #1 DUE**		
	• TRIGGER–ON: The Maintenance Hour Meter #1 time has expired. • UNIT CONTROL: Alarm Only. Alarm Light will NOT be turned on. • RESET CONDITION: Alarm may be manually reset via keypad.		
	1	**Check Unit Maintenance Records**	
		a. Schedule unit into service facility for maintenance	Must be done soon!
	2	**Perform Maintenance**	
		a. Perform appropriate engine & unit maintenance	Follow instructions on proper maintenance form
	3	**Reset Maintenance Hour Meter #1**	
		a. Check that Maintenance Hour Meter #1 interval is set for your requirements.	Reset Interval in Configuration list as required.
		b. Reset Maintenance Hour Meter #1 for the next service interval	Hour Meter is reset in the Functional Parameter list. Follow maintenance interval recommendations in Section 9.1.
	4	**See Note 1 Page 8-2**	
		a. Clear the inactive alarms.	All alarms cleared
227	**SERVICE SOON – PM #2 DUE**		
	• TRIGGER–ON: The Maintenance Hour Meter #2 time has expired. • UNIT CONTROL: Alarm Only. Alarm Light will NOT be turned on. • RESET CONDITION: Alarm may be manually reset via keypad.		
	1	**Check Unit Maintenance Records**	
		a. Schedule unit into service facility for maintenance	Must be done soon!
	2	**Perform Maintenance**	
		a. Perform appropriate engine & unit maintenance	Follow instructions on proper maintenance form
	3	**Reset Maintenance Hour Meter #2**	
		a. Check that Maintenance Hour Meter #2 interval is set for your requirements.	Reset Interval in Configuration list as required.
		b. Reset Maintenance Hour Meter #2 for the next service interval	Hour Meter is reset in the Functional Parameter list. Follow maintenance interval recommendations in Section 9.1.
	4	**See Note 1 Page 8-2**	
		a. Clear the inactive alarms.	All alarms cleared.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
228	**SERVICE SOON – PM #3 DUE**		
	• TRIGGER–ON: The Maintenance Hour Meter #3 time has expired. • UNIT CONTROL: Alarm Only. Alarm Light will NOT be turned on. • RESET CONDITION: Alarm may be manually reset via keypad.		
	1	**Check Unit Maintenance Records**	
		a. Schedule unit into service facility for maintenance	Must be done soon!
	2	**Perform Maintenance**	
		a. Perform appropriate engine & unit maintenance	Follow instructions on proper maintenance form
	3	**Reset Maintenance Hour Meter #3**	
		a. Check that Maintenance Hour Meter #3 interval is set for your requirements.	Reset Interval in Configuration list as required.
		b. Reset Maintenance Hour Meter #3 for the next service interval	Hour Meter is reset in the Functional Parameter list. Follow maintenance interval recommendations in Section 9.1.
	4	**See Note 1 Page 8-2**	
		a. Clear the inactive alarms.	All alarms cleared
229	**SERVICE SOON – PM #4 DUE**		
	• TRIGGER–ON: The Maintenance Hour Meter #4 time has expired. • UNIT CONTROL: Alarm Only. Alarm Light will NOT be turned on. • RESET CONDITION: Alarm may be manually reset via keypad.		
	1	**Check Unit Maintenance Records**	
		a. Schedule unit into service facility for maintenance	Must be done soon!
	2	**Perform Maintenance**	
		a. Perform appropriate engine & unit maintenance	Follow instructions on proper maintenance form
	3	**Reset Maintenance Hour Meter #4**	
		a. Check that Maintenance Hour Meter #4 interval is set for your requirements.	Reset Interval in Configuration list as required.
		b. Reset Maintenance Hour Meter #4 for the next service interval	Hour Meter is reset in the Functional Parameter list. Follow maintenance interval recommendations in Section 9.1.
	4	**See Note 1 Page 8-2**	
		a. Clear the inactive alarms.	All alarms cleared.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
230	**SERVICE SOON – PM #5 DUE**		
	• TRIGGER–ON: The Maintenance Hour Meter #5 time has expired. • UNIT CONTROL: Alarm Only. Alarm Light will NOT be turned on. • RESET CONDITION: Alarm may be manually reset via keypad.		
	1	**Check Unit Maintenance Records**	
		a. Schedule unit into service facility for maintenance	Must be done soon!
	2	**Perform Maintenance**	
		a. Perform appropriate engine & unit maintenance	Follow instructions on proper maintenance form
	3	**Reset Maintenance Hour Meter #5**	
		a. Check that Maintenance Hour Meter #5 interval is set for your requirements.	Reset Interval in Configuration list as required.
		b. Reset Maintenance Hour Meter #5 for the next service interval	Hour Meter is reset in the Functional Parameter list. Follow maintenance interval recommendations in Section 9.1.
	4	**See Note 1 Page 8-2**	
		a. Clear the inactive alarms.	All alarms cleared.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
8.11 MICROPROCESSOR ALARMS			
232	**SETPOINT ERROR** • TRIGGER–ON: There is an error in the Setpoint that is stored in the microprocessor memory, or in the memory sector of the microprocessor that the Setpoint is stored in. • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset when a valid Setpoint is entered, or Alarm may be manually reset 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Set Point**	
		a. Check set point setting	Must be between -22 and +89.6° F (-30°C and +32°C)
		b. Enter new set point	
	2	**Reset Microprocessor**	
		a. Turn the Start/Run-Off switch off for 30 seconds and then turn back on.	The microprocessor powers up OK and the latest setpoint appears in the display.
		b. Valid set point can not be entered.	Replace microprocessor
	3	**See Note 1 Page 8-2**	
		a. Clear the inactive alarms.	All alarms cleared
233	**MODEL # ERROR** • TRIGGER–ON: There is an error in the Model Number that is stored in the microprocessor memory, or in the memory sector of the microprocessor that the Model Number is stored in. • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset only when a valid Model number is entered.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Model Number**	
		a. Check Model Number in microprocessor	Must be a valid Model Number from Configuration List.
		b. Enter correct Model Number	From Configuration List, select correct Model Number.
	2	**Reset Microprocessor**	
		a. Turn Start/Run-Off switch off for 30 seconds, then turn back on.	Microprocessor powers up OK
		b. Check for valid Model number in Data List.	Valid number is present. Alarm is cleared
		c. Valid model number can not be entered.	Replace microprocessor
	3	**See Note 1 Page 8-2**	
		a. Clear the inactive alarms.	All alarms cleared

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
237	**FUNCTIONAL PARAMETERS ERROR** • TRIGGER–ON: There is an error in one or more of the Functional Parameters that are stored in the microprocessor memory, , or in the memory sector of the microprocessor that the Functional Parameters are stored in. • UNIT CONTROL: Unit Shutdown & Alarm. • RESET CONDITION: Auto Reset when valid Functional Parameters are entered, or Alarm may be manually reset 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Functional Parameters**	
		a. Check Functional Parameters	All must be set for selectable values
	2	**Reset Microprocessor**	
		a. Turn Start/Run-Off switch off for 30 seconds, then turn back on.	Microprocessor powers up OK
		b. Check for valid Functional Parameters in Functional Parameters List.	Valid number is set for all parameters. Alarm is cleared
		c. Valid Functional Parameter(s) can not be entered.	Replace microprocessor
	3	**See Note 1 Page 8-2**	
		a. Clear the inactive alarms.	All alarms cleared.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
238	**CONFIGURATIONS 1 ERROR**		
	• TRIGGER–ON: There is an error in Configuration Group 1 that is stored in the microprocessor memory, or in the memory sector of the microprocessor that the Configurations are stored in. • UNIT CONTROL: Unit Shutdown & Alarm. • RESET CONDITION: Auto Reset when valid Configuration(s) are entered, or Alarm may be manually reset 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Configurations**	
		a. Check Configurations	All must be set for selectable values
	2	**Check Software Version**	
		a. Check Microprocessor Software version.	Upgrade to the latest version of software. Newer versions of ReeferManager may contain configurations that were not present in older versions of Microprocessor software.
	3	**Reconfigure Microprocessor**	
		a. Send settings to Microprocessor.	Using ReeferManager and a Configuration PC Card, write the desired configuration file to the PC Card, then load the file into the Microprocessor. Allow the Microprocessor to reboot itself.
	4	**Reset microprocessor**	
		a. Turn Start/Run-Off switch off for 30 seconds, then turn back on.	Microprocessor powers up OK
		b. Check for valid Configurations in Data List.	Valid number is present. Alarm is cleared
		c. Valid Configurations can not be entered.	Replace microprocessor
	5	**See Note 1 Page 8-2**	
		a. Clear the inactive alarm.	All alarms cleared.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
242	**DIS PRESS CALIBRATE ERROR**		
	• TRIGGER–ON: There is an error in the Discharge Pressure Sensor Calibration value stored inthe microprocessor memory or in the memory sector of the microprocessor that the calibration value is stored in. • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset when the Discharge Pressure Sensor is calibrated successfully, or Alarm may be manually reset via Keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Discharge Pressure Reading**	
		a. Check Discharge Pressure Reading	Must read valid data.
	2	**Calibrate Discharge Pressure Sensor**	
		a. Calibrate Discharge Pressure Sensor.	Calibration successful.
		b. Discharge Pressure Sensor can not be successfully calibrated.	Replace microprocessor
	3	**See Note 1 Page 8-2**	
		a. Clear the inactive alarms.	All alarms cleared.
243	**SUCT/EVAP CALIBRATE ERROR**		
	• TRIGGER–ON: There is an error in the Suction / Evaporator Pressure Sensor Calibration value stored in the microprocessor memory or in the memory sector of the microprocessor that the calibration value is stored in. • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset when the Suction / Evaporator Pressure Sensor is calibrated successfully, or Alarm may be manually reset via Keypad 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 (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Suction / Evaporator Pressure Reading**	
		a. Check Suction / Evaporator Pressure Reading	Must read valid data.
	2	**Calibrate Suction / Evaporator Pressure Sensor**	
		a. Calibrate Suction/Evaporator Pressure Sensor.	Calibration successful.
		b. Suction/Evaporator Pressure Sensor can not be successfully calibrated.	Replace microprocessor
	3	**See Note 1 Page 8-2**	
		a. Clear the inactive alarms.	All alarms cleared.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
246	**EEPROM WRITE FAILURE**		
	• TRIGGER-ON: There is an error in the ability to write information to be stored in the memory • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Alarm may be manually reset via keypad 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). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Microprocessor**	
		a. Check set point setting	Must be between -22°F to +89.6°F (-30°C to +32°C)
		b. Enter new set point	
	2	**Reset Microprocessor**	
		a. Turn START/RUN-OFF switch off for 30 seconds, then turn back on.	Microprocessor powers up OK
		b. Alarm 246 remains active.	Replace microprocessor.
	3	**See Note 1 Page 8-2**	
		a. Clear the inactive alarms.	All alarms cleared.
248	**CONF MODE / HP2 ERROR**		
	• TRIGGER–ON: Microprocessor internal operational program error. • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset only when valid info is available for the microprocessor are entered.		
Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Microprocessor**	
		a. Check set point setting	Must be between -22°F to +89.6°F (-30°C to +32°C)
		b. Enter new set point	
	2	**Reset Microprocessor**	
		a. Turn START/RUN-OFF switch off for 30 seconds, then turn back on.	Microprocessor powers up OK
		b. Alarm 248 remains active.	Replace microprocessor.
	3	**See Note 1 Page 8-2**	
		a. Clear the inactive alarms.	All alarms cleared.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
249	**MICROPROCESSOR ERROR** • TRIGGER–ON: Microprocessor Input Conversion Error • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset when input conversions are valid, or Alarm may be manually reset by turning the unit off, then back on again.		
Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Microprocessor**	
		a. Check Temperature Sensor Data	Must be valid reading for RAT, SAT, AAT, etc.
		b. Check for any Active Sensor Alarms	Must all be cleared.
	2	**Check Microprocessor & Unit Wiring**	
		a. Check Wiring to Micro and at input devices to the micro.	Must not be miss wired to allow 12 VDC on any of the sensor input circuits.
	3	**Reset Microprocesso**r	
		a. Turn START/RUN-OFF switch off for 30 seconds, then turn back on.	Microprocessor powers up OK
		b. Alarm 249 remains active.	Replace microprocessor.
	4	**See Note 1 Page 8-2**	
		a. Clear the inactive alarms.	All alarms cleared

SECTION 9

SERVICE

PARAGRAPH NUMBER — Page

SECTION 9

SERVICE

WARNING

Beware of V-belts and belt driven components as the unit may start automatically. Before servicing unit, make sure the START/RUN-OFF switch is in the OFF position or the unit is in Maintenance mode. Also disconnect the negative battery cable.

CAUTION

Use only Carrier Transicold approved Polyol Ester Oil (POE). Buy quantities of one quart or less. When using this hygroscopic oil, immediately reseal. Do not leave container of oil open or contamination will occur.

CAUTION

Unit uses R404A 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

CAUTION

When changing oil filters, the new filters should be primed (partially filled) with clean oil if possible. If the filters are not primed, the engine may operate for a period with no oil supplied to the bearings.

WARNING

UNITS EQUIPPED WITH STAR-TRAK TWO WAY COMMUNICATION CAPABILITIES MAY HAVE THE ABILITY TO BE STARTED OR TURNED OFF REMOTELY REGARDLESS OF THE SETTING OF THE START/RUN-OFF SWITCH.

The unit is controlled locally and there can be no two-way communication when the mode switch on the Remote Monitoring control box is in MAINTENANCE MODE. Therefore, when performing any work on the unit, place the mode switch in MAINTENANCE MODE. After the unit is serviced, return the mode switch to REMOTE ON. (Refer to Section 3.20.3 for more information on two-way communication.)

NOTE

To avoid damage to the earth's ozone layer, use a refrigerant recovery system whenever removing refrigerant. When working with refrigerants you must comply with all local government environmental laws, U.S.A. EPA section 608.

9.1 MAINTENANCE SCHEDULE

For the most reliable operation and for maximum life, your unit requires regular maintenance. This includes oil and filter changes, fuel and air filter replacement, coolant replacement, and pretrip inspections. Maintenance should be performed according to the schedule on the following page.

Table 9-1. Maintenance Schedule

SYSTEM	OPERATION	ACTION/ REFERENCE SECTION
a. Daily Maintenance		
	Pre-Trip Inspection - before starting Check Engine Hours Check Engine Oil Level	3.4 Check Check
b. Every Service Interval[1] or Annually		
Unit	1. Check unit mounting bolts 2. Check engine and compressor mount bolts 3. Check door latches & hinges 4. Check gauges, switches and electrical connections 5. Check all belt tensions[1] 6. Check control box 7. Check gearbox and fan shaft for oil leaks 8. Check fan shaft, idler and gearbox bearings 9. Check clutch air gap and adjust as required	Check Check Check Check 9.9 Check Check Check Check
Engine	1. Check oil/filter change interval[1] (refer to section **f.** of this table) 2. Check for oil leaks 3. Check low oil pressure safety 4. Clean crankcase breather 5. Check engine speeds for units without electronic speed control	9.8.5 Check 2.12 9.8.9 Table 2-1
Fuel System	1. Clean fuel pump strainer 2. Change fuel filter(s)[1] (refer to section **f.** of this table) 3. Check fuel heater (optional)	9.7 9.7 ---
Cooling System	1. Clean radiator/condenser fin surface 2. Check antifreeze concentration[1] 3. Check water pump 4. Check water temperature sensor functions	9.8.1 and 9.27 9.8.1 Check 2.7
Exhaust System	1. Check mounting hardware 2. Check muffler and exhaust pipes	Check Check
Air Intake System	1. Change air cleaner element[1] 2. Check and replace air filter indicator if needed	Check 9.8.8
Starting System	1. Check battery condition 2. Clean battery connections and cable ends 3. Check battery hold down clamps 4. Check starter operation	Check/Replace Check/Replace Check Check
Charging System	1. Check alternator brushes and replace if necessary 2. Check alternator output	Check 2.13

SYSTEM	OPERATION	ACTION/ REFERENCE SECTION
b. Every Service Interval[1] or Annually (Continued)		
Refrigeration System	1. Check air switch & calibrate 2. Check & clean evaporator coil and defrost drain hoses 3. Check operating refrigerant pressure 4. Check all sensor calibrations 5. Check manual defrost operation 6. Check Compressor drive coupling 7. Perform Pre-Trip inspection	4.15 9.26 Check Check Check Check 9.2
c. Every 6000 Hour Maintenance (Normal Operating Conditions) with conventional coolant		
Cooling System	1. Drain and flush cooling system **(12,000 hours with Extended Life Coolant)**	Section 9.8.1
d. Every 10,000 Hour Maintenance		
Perform complete 2000 and 3000 hour Preventive Maintenance and the following:		
Fuel System	1. Clean and adjust injector nozzles.	Engine Service Guide
e. Every 12,000 Hour Maintenance with extended life coolant		
Cooling System	1. Drain and flush cooling system **(6,000 hours with Conventional Coolant)**	Section 9.8.1

f. Oil And Filter Change Intervals		
	Oil & Filter Change Interval using API Class CG engine oil	**Oil & Filter Change Interval using Mobil Delvac 1 engine oil***
Standard Oil Filter	2000 hrs/1yr	4000 hrs/2 yrs**
ESI Oil Filter	3000 hrs/2 yrs	

* Mobil Delvac1 is the only approved synthetic oil. Maximum oil drain interval is two (2) years.
** New oil filter required at 1 yr interval

These maintenance schedules are based on the use of approved oils and regular pretrip inspections of the unit. Failure to follow the recommended maintenance schedule may affect the life and reliability of the refrigeration unit.

9.2 PRETRIP INSPECTION

⚠ WARNING

Inspect battery cables for signs of wear, abrasion or damage at every Pre-Trip inspection and replace if necessary. Also check battery cable routing to ensure that clamps are secure and that cables are not pinched or chafing against any components.

The following pretrip inspection should be performed before every trip and at regular maintenance intervals.

BEFORE STARTING ENGINE	OK	ADJUST/ REPLACE
Drain water from bottom of fuel tank	☐	☐
Drain water from water separator on fuel filter (if applicable)	☐	☐
Check radiator coolant level	☐	☐
Condenser Coil Cleanliness: Check the coil for cleanliness, straighten fins if necessary	☐	☐
Radiator Coil Cleanliness: Check the coil for cleanliness, straighten fins if necessary	☐	☐
Air Cleaner Hoses: insure they're secure with no leaks	☐	☐
Air Cleaner Indicator: check operation (if applicable)	☐	☐
Engine Oil Level: check and add if necessary	☐	☐
Check condition and tension of belts	☐	☐
Check all fan and idler bearings	☐	☐
Door Latches/Hinges: Check for proper operation	☐	☐
Condenser Fan Blades: Check condition	☐	☐
Check battery fluid level (if applicable)	☐	☐
Battery cables and terminals, are secured and clean	☐	☐
Evaporator Section: check coil(s) for cleanliness and clear of debris	☐	☐
Check air chute (if applicable)	☐	☐
Check bulkhead and return air screen	☐	☐
Defrost Water Drains: No debris & drain properly	☐	☐
Place in Continuous Run, and start unit.	☐	☐

IMMEDIATELY AFTER STARTING ENGINE	OK	ADJUST
Fuel Leaks: Check fuel lines/filters for leaks	☐	☐
Oil Leaks: Check oil lines/filters for leaks	☐	☐
Coolant System: Check for leaks	☐	☐
Exhaust System: Check for leaks	☐	☐
Condenser Fan: Check for proper airflow.	☐	☐
Evaporator Fan: Check for proper airflow.	☐	☐
Ensure clutch engages properly – no slip or unusual noises	☐	☐
Check for unusual noises – alternator, fan shaft, water pump, idler and gearbox bearings	☐	☐
PRETRIP	**OK**	**ADJUST**
Initiate Pretrip	☐	☐
List any Pretrip alarms	☐	☐
List Alarms occurring during Pretrip		

AFTER OPERATING UNIT FOR 15 MINUTES OR MORE	OK	ADJUST
Check refrigerant level	☐	☐
Check compressor oil level	☐	☐
Check for proper temperature control	☐	☐
Check engine speeds	☐	☐
Check auto start-stop operation	☐	☐
Initiate defrost and allow to terminate automatically	☐	☐
Allow Defrost to terminate automatically, ending the Pretrip.	☐	☐

OPERATE IN HIGH SPEED COOL AND RECORD (from Microprocessor Unit Data List)
SUCTION PRESSURE
DISCHARGE PRESSURE
ENGINE COOLANT TEMP
RETURN AIR TEMP
SUPPLY AIR TEMP
AMBIENT AIR TEMP
DEFROST TERM TEMP #2
COMP DISCH TEMP
CSMV%
BATTERY VOLTAGE
DC CURRENT DRAW
ENGINE RPM
SOFTWARE REVISION
CONTROL SERIAL #
UNIT MODEL #
HOURS TO ENGINE MAINTENANCE
HOURS TO UNIT MAINTENANCE
TIME LEFT TO PM1
TIME LEFT TO PM2
TIME LEFT TO PM3
TIME LEFT TO PM4
TIME LEFT TO PM5
DATALOGGER TIME AND DATE

FINAL	OK	ADJ
Review Functional Parameters and fill in Table 9-2	☐	
Download recorder data (if required)	☐	
Enter Trip Start in microprocessor	☐	

Table 9-2 CHECK AND RECORD THE FOLLOWING	
Function	**Setting**
Defrost Timer Set For:	
Set S/S Parameters:	
PERISHABLE	
Min. Run Time	
Min. Off Time	
Override Temp	
Max. Off Time	
FROZEN	
Min. Run Time	
Min. Off Time	
Override Temp	
Max. Off Time	
Frozen Shutdown Offset	
Temp. Control	
Display In:	
Set PM Hourmeters	
Engine	
Switch On	
PM 1	
PM 2	
PM 3	
PM 4	
PM 5	
Out of Range Alarm	
Air Flow	
Unloader Pressure Control	

9.3 GRILLE INSERT REMOVAL (See Figure 9-1)

Removal of insert will ease in condenser coil cleaning. (Refer to Section 9.27).

a. Remove the 3 bolts on each side of the grille insert.

b. Remove the 2 bolts on top of the grille insert.

c. Swing insert down and lift out of locating holes.

d. Reverse above steps to install new grille insert.

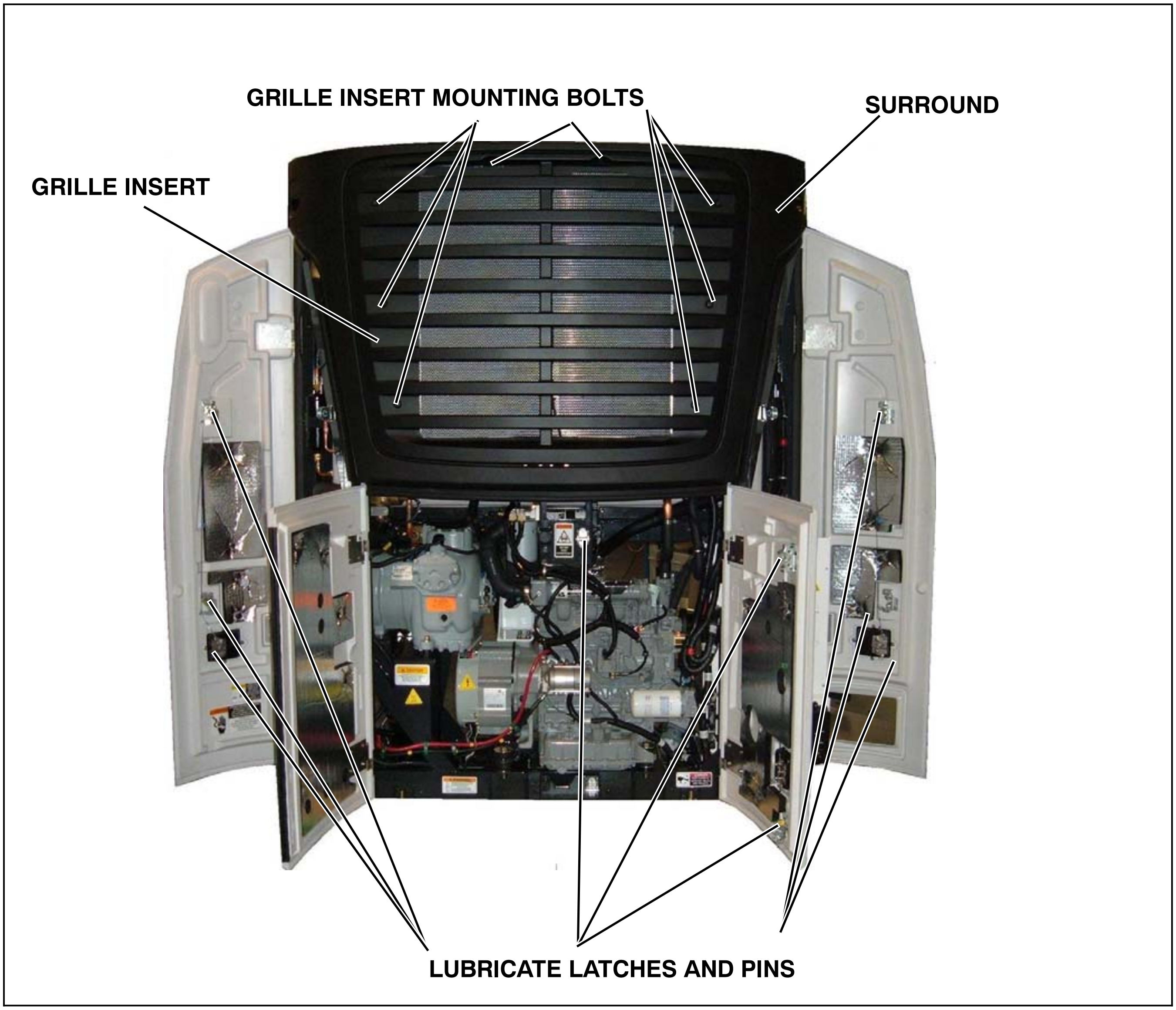


Figure 9-1 Grille Insert Removal And Door Latch Maintenance

9.4 SURROUND REMOVAL

a. Place the Start/Run-Off switch in the OFF position and disconnect the starter.

b. Open both side and front doors.

c. Remove the bolts that secure the surround to the unit.

d. Reverse above steps to install new surround.

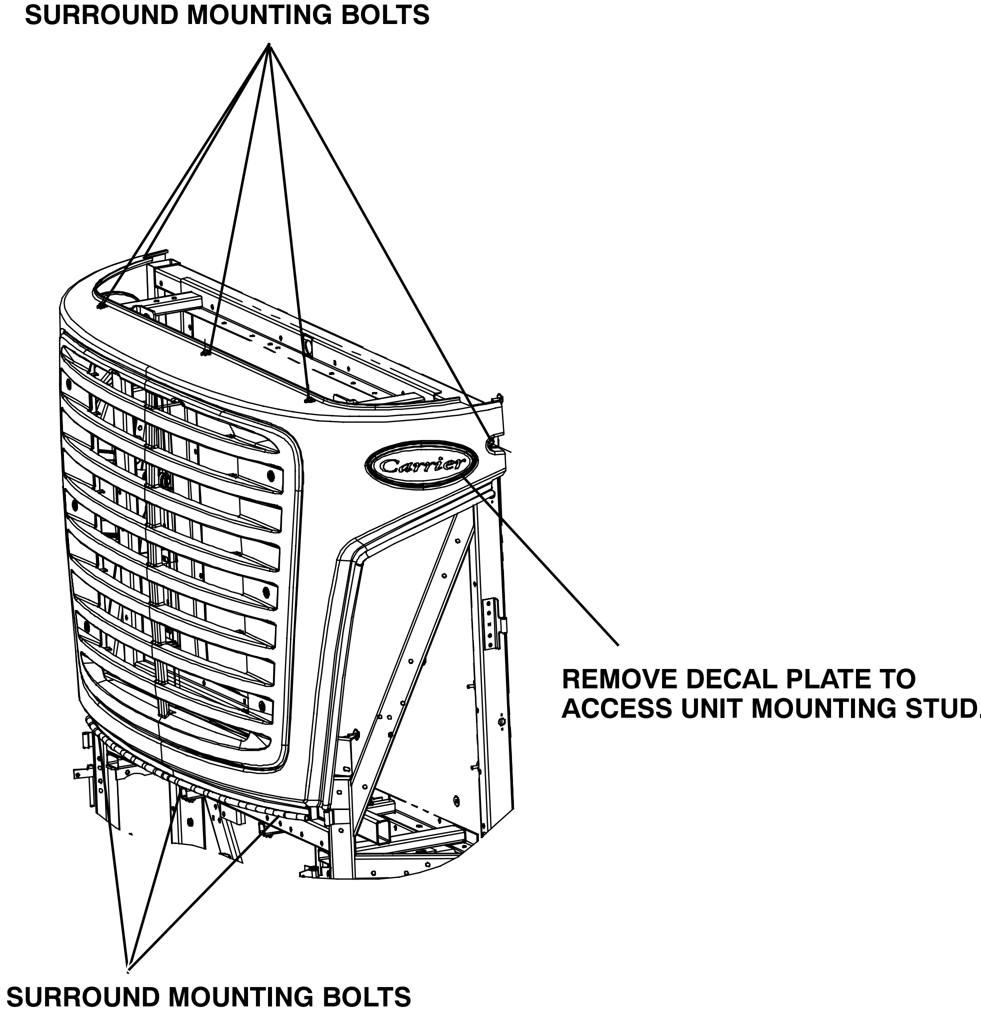


Figure 9-2 Surround Removal

9.5 DOOR LATCH MAINTENANCE AND REPLACEMENT

Proper maintenance is important for smooth operation of the latch assembly and the latch pins that are mounted on the unit's frame (See Figure 9-1). In order to keep the movable parts clean and lubricated, CTD recommends the use of a de-greasing cleaner and LPS 2 lubricant. This lubricant should be available at any local automobile and truck parts suppliers.

9.5.1 Front Door Latch Cable Replacement

a. Remove circular clip that secures the cable to the paddle assembly.

b. Slide cable from paddle and rotate other end out of latch assembly.

c. Reverse above steps to install new cable.

9.5.2 Side Door Latch Cable Replacement

a. Remove circular clip that secures the cable to the paddle assembly.

b. Remove the lower cable from the paddle assembly and the lower latch.

NOTE

The lower cable is threaded through the upper cable eyelet and the lower latch assembly. (See Figure 9-3)

c. Remove the upper cable from the upper latch.

d. Reverse above steps to install new cable.

Figure 9-3 Side Door Latch Lower Cable Removal

9.6 PRIMING FUEL SYSTEM

9.6.1 Mechanical Fuel Pump

The mechanical fuel lift pump is mounted on the engine next to the injection pump. This pump has a manual plunger for priming the fuel system when the fuel tank has been run dry. (See Figure 9-1).

To prime the fuel system, use the following steps:

a. Turn the bleed valve (red) counter-clockwise until fully opened.

b. Turn the top of the manual fuel pump plunger counter-clockwise to unlock it. **S-L-O-W-L-Y** (up/down once per second) pump the manual plunger until positive pressure (resistance) is felt. This may take up to 200 strokes. This will indicate fuel flow.

c. Continue to pump **S-L-O-W-L-Y** (up/down once per second) approximately 100 more strokes to fill the filter and bleed the air out of the lines.

d. Start engine. It may be necessary to continue to pump until the engine starts.

e. Depress and turn the top of the manual plunger clockwise to **lock in place.**

f. When engine is running smoothly, turn bleed valve clockwise until fully closed.

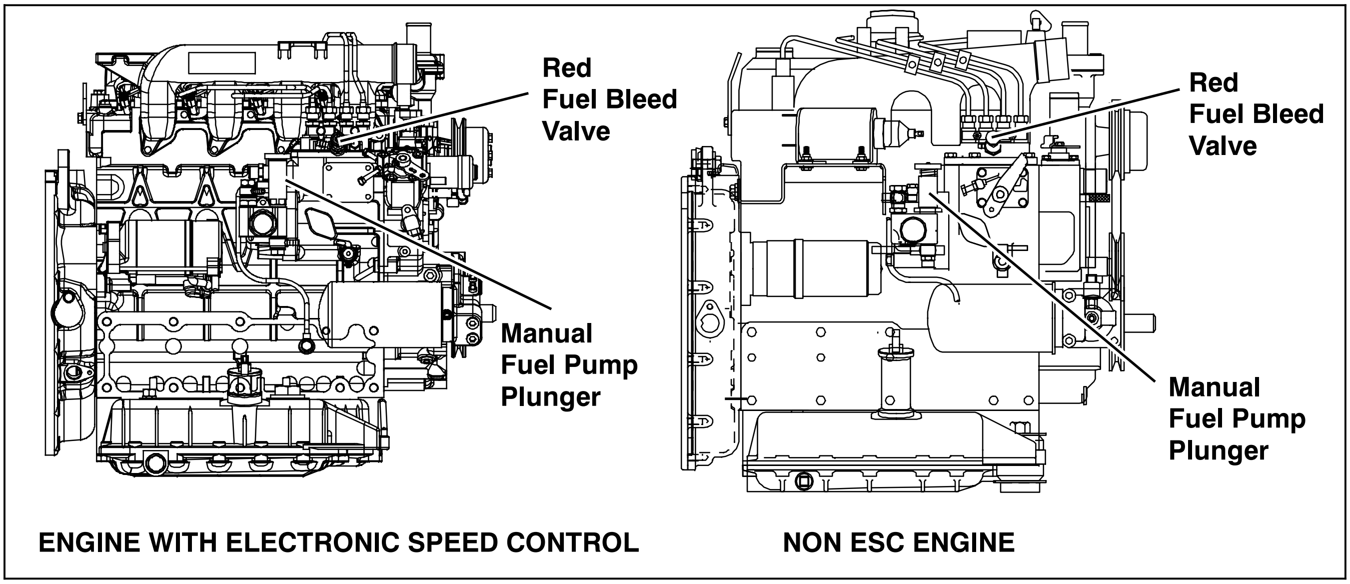
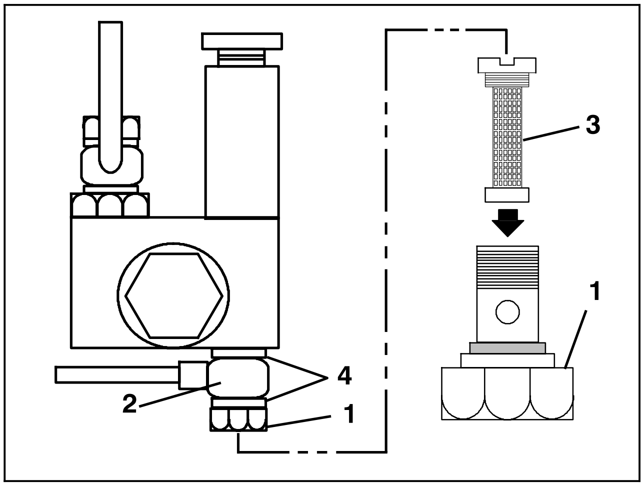


Figure 9-1. Priming Fuel Pump

9.7 SERVICING FUEL PUMP

9.7.1 Mechanical Pump (See Figure 9-2)

The fuel filter may become plugged or restricted with foreign particles or wax as a result of using the wrong grade of fuel or untreated fuel in cold weather. This will cause the engine to lose capacity. The filter must be cleaned on a regular schedule such as unit pre-trip or when the oil and fuel filters are changed. (Refer to Section 9.1).



1. Nut
2. Banjo
3. Filter
4. Copper Rings

Figure 9-2. Mechanical Fuel Pump

a. Turn nut counter-clockwise to loosen and remove nut (Item 1, Figure 9-2). Use container to catch draining fuel.

b. Remove banjo fitting (Item 2) and let it hang loose.

c. Turn filter (Item 3) counter-clockwise and remove. Check and clean.

d. Replace copper rings (Item 4).

e. To install reverse above steps.

9.8 ENGINE SERVICE AND COMPONENTS

9.8.1 Cooling System

Air flows through the condenser/radiator. The condenser/radiator must be internally and externally clean for adequate cooling. The water pump V-belt must be adjusted periodically to provide maximum air flow. (Refer to Section 9.9.2)

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 60% concentration of anti-freeze. Use a low silicate anti-freeze meeting GM specifications GM 6038M for standard life coolant or use an extended life coolant , which is Dexcool approved and has 5/150 (5 years/150,000 miles) on the label.

a. Servicing the Cooling System:

1) Remove all foreign material from the condenser/radiator coil. Compressed air or water may be used as a cleaning agent. It may be necessary to use warm water mixed with any good commercial dishwasher detergent. Rinse coil with fresh water if a detergent is used.

NOTE

Draining the coolant from the engine petcock will leave approximately 1 quart (.9 liters) of coolant in the block.

2) Drain coolant completely by removing lower radiator hose and radiator cap.
3) Install hose and fill system with clean, untreated water to which 3 - 5% of an alkaline based radiator cleaner is added - 6 oz (151 grams) to 1 gallon (3.78 liters) of water.
4) Run engine and drain while warm. Rinse system three times after it has cooled down. Refill system with water.
5) Run engine to operating temperature. Drain system again and fill with 50/50 water/anti-freeze mixture. Unit coolant capacity is 1.67 U.S. gallons. (see Caution Note and Refer to Section 2.7) NEVER POUR COLD WATER INTO A HOT ENGINE, however hot water can always be added to a cold engine.

9.8.2 Fuel Level Sensor

An optional fuel level sensor supplies an input signal to the microprocessor as to the % of fuel remaining in the fuel tank. The microprocessor then turns on the Check Fuel Level alarm when the level reaches 15%, and (if configured to do so) turns the engine off when the level reaches 10%.

The sensor has the capability of sending from 0% to 100% of the fuel level to the microprocessor. The fuel tank level will be displayed in the Unit Data list. Some units may have sensors that may be calibrated if necessary.

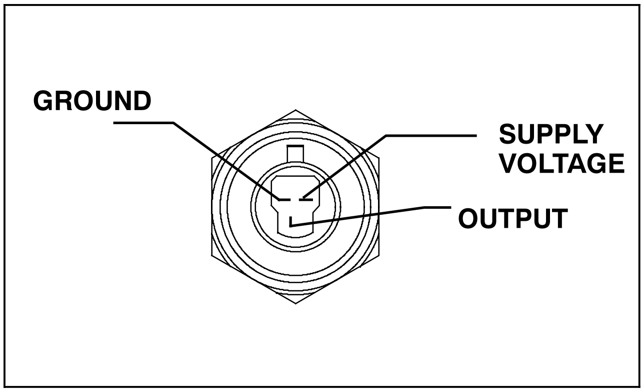


Figure 9-3. Fuel Level Sensor Wiring

a. Verify that the wiring to sensor is correct and connected properly.

b. Check voltage at the Fuel Level Sensor with the START/RUN-OFF switch in the START/RUN position. (Unit running, or Unit off and Manual Start mode selected.)

c. Voltage between red wire (positive) and black wire (negative) should be 12.5 to 13.5 VDC. Do not disconnect the red or black wires from the switch.

d. Disconnect the white wire (output) from the sensor. Voltage between black wire (negative) and white wire (output) should be 0 VDC when the switch is dry and out of the fuel.

e. When the switch is immersed into fuel, the voltage reading between black wire (negative) and white wire (output) increase up to 5 VDC when fuel has reached the full mark.

9.8.3 The RPM Sensor (Units beginning with below serial numbers and ALL X2 units. Refer to Section 9.8.7 for information on units with Electronic Speed Control).

a. Serial Number Cut-Offs

- Ultra XTC - KAV90910396
- Ultima XTC - KAV90910334

b. Testing

a. Verify that the wiring to sensor is correct. See wiring schematic in Section 11.

b. Check voltage at the RPM Sensor connector with the Run Relay energized (Unit running, Unit off, Manual Start mode selected, and test must be completed within five minutes - before the Failed To Start Manual mode occurs, or Component Test mode will energize the Run Relay for five minutes without starting the unit.)

c. Voltage between ENRPMA-2MP31 and ENRPMC-2MP7 should be 5.0 VDC.

d. Check continuity between ENRPMB and 2MP18.

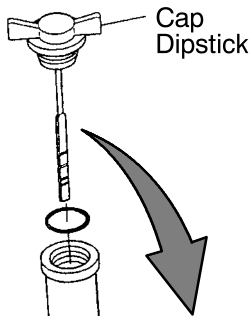
e. If the above tests check OK, read warning below. If the RPM display is still not correct, replace the RPM sensor.

⚠ WARNING

The +5.0 VDC (terminal B) is common between the compressor discharge pressure transducer, the compressor suction pressure transducer, and the RPM sensor. If this circuit is shorted to ground (due to one of the mentioned components being defective, or a frayed wire) the MessageCenter will show:

•Suction Pressure: -14.7 PSIG/Bar
•Discharge Pressure: 0 PSIG/Bar
•Engine RPM: 0

9.8.4 Engine Oil And Oil Filter



To check the engine oil level: Run the unit to bring the engine up to operating temperature, shut the unit off, and unscrew the cap/dipstick. Wipe the dipstick clean and insert the cap into the oil fill tube <u>without</u> threading it into the oil fill tube. Remove the dipstick again and check oil level. DO NOT add oil if the level is in the "safe" range. If needed, add oil as indicated by markings on dipstick until level is in the "safe" range.

QTS	2	1	SAFE	

a. To Change Engine Oil and Filter:

1) Warm up the engine and then stop it by placing the Start/Run-Off switch in the OFF position.

2) Remove drain plug from oil pan and drain engine oil using Oil Drain Tool (CTD P/N 68-15763-00).

3) Lightly oil gasket on new filter before installing. Tighten 3/4 to 1 of a turn after the seal makes contact.

⚠ CAUTION

When changing oil filters, the new filters should be primed (partially filled) with clean oil if possible. If the filters are not primed, the engine may operate for a period with no oil supplied to the bearings.

4) Replace filter and add lube oil. (Refer to Section 2.7.) Warm up engine and check for leaks.

b. Replace filter and add lube oil. (Refer to Section 2.7.) Warm up engine and check for leaks.

9.8.5 Lube Oil Filters

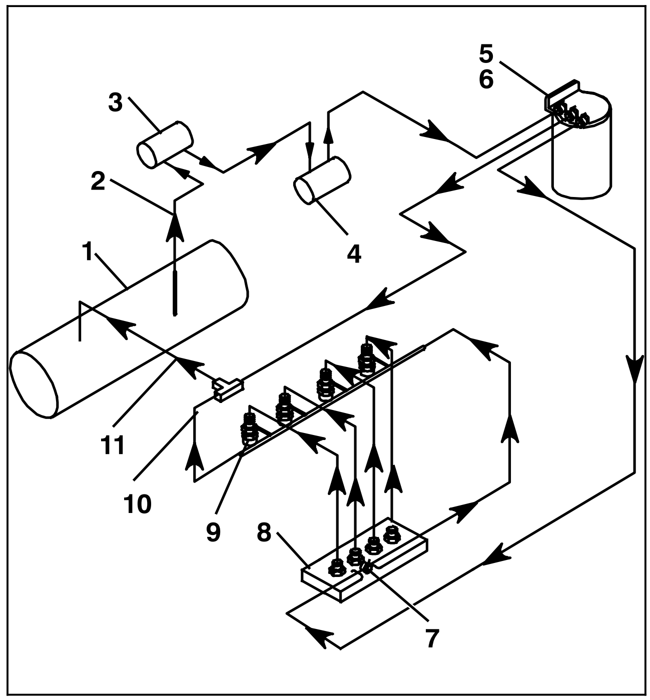
After warming up the engine, stop engine, place shallow drain pan under filter and remove filter. Lightly oil gasket on new filter before installing. Tighten per the filter manufacturer's directions.

⚠ CAUTION

When changing oil filters, the new filters should be primed (partially filled) with clean oil if possible. If the filters are not primed, the engine may operate for a period with no oil supplied to the bearings.

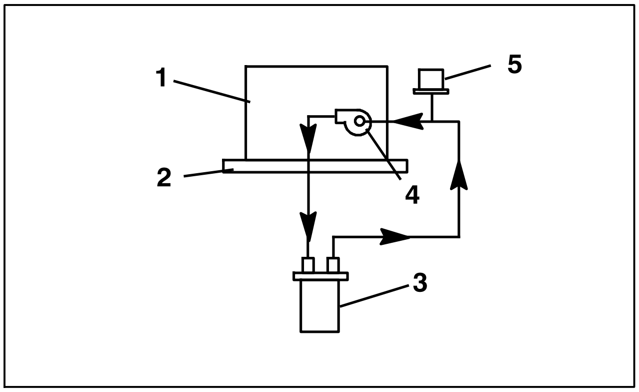
Replace filter(s) and add lube oil. (Refer to Section 2.7) Warm up engine and check for leaks.

a. Lube Oil And Fuel Flow Diagrams



1. Fuel Tank
2. Fuel Supply Line
3. Fuel Pump (Optional)
4. Mechanical Lift Pump
5. Fuel Filter
6. Fuel Warmer (Optional)
7. Fuel Bleed Valve
8. Injection Pump
9. Injector Nozzles
10. Fuel Leak-off Line
11. Fuel Return Line

Figure 9-4. Fuel System Diagram



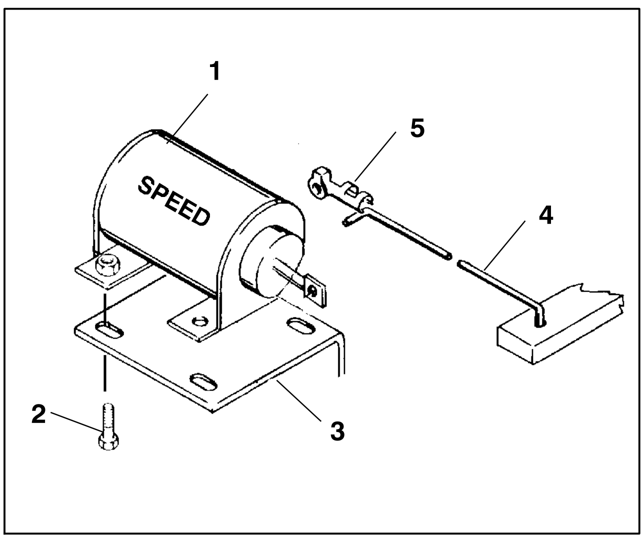
1. Engine Block
2. Oil Pan
3. Full Flow Oil Filter
4. Engine Oil Connection
5. Oil Pressure Switch

Figure 9-5. Lube Oil Flow Diagram

9.8.6 Speed Control Solenoid And Linkage - Non ESC engines only (Units beginning with below serial numbers and ALL X2 units Refer to Section 9.8.7 for information on units with Electronic Speed Control).

a. Serial Number Cut-Offs

- Ultra XTC - KAV90910396
- Ultima XTC - KAV90910334



1. Solenoid
2. Bolt
3. Solenoid Bracket
4. Linkage (Speed)
5. Clip

Figure 9-6. Speed Control Solenoid

b. Servicing the Speed Control Solenoid and Linkage

NOTE

Check operation of speed solenoid before replacement. If solenoid is sticking, clean and lubricate the solenoid in accordance with Technical Instruction 98-50234.

1) Solenoid Removal/Replacement

a) Disconnect wiring to solenoid. Disconnect linkage arm (Item 4, Figure 9-6) from solenoid. Remove mounting hardware from solenoid and then remove solenoid.

b) Install replacement solenoid and mounting hardware. Do not tighten at this time.

c) Attach linkage to solenoid and install the clip to the linkage rod.

2) Low Speed Adjustment

a) Hold the speed lever against the low speed stop and check the RPM. Adjust the low speed stop screw if necessary.

b) Check engine speed using microprocessor data list.

c) Check for proper operation by running Pretrip (Refer to Section 3.4).

3) High Speed Adjustment

a) Loosen but do not remove the 4-speed solenoid mounting nuts.

b) Turn the jacking nut, allowing the solenoid to move along the slots until the desired high speed is reached. Tighten the solenoid mounting bolts and verify correct high and low speed RPM.

4) Check for proper unit operation by running Pretrip (Refer to Section 3.4).

NOTE

LE (Low Emission) DI engines are delivered with a tamper resistant high-speed adjustment screw on the engine. High-speed adjustments are made using the slotted holes in the solenoid mounting bracket and the speed solenoid adjusting bracket with solenoid adjusting bolt and lockout (on the bracket).

9.8.7 Electronic Speed Control (ESC) (Units beginning with below serial numbers and ALL X2 units)

a. Serial Number Cut-Offs

- Ultra XTC - KAV90910396
- Ultima XTC - KAV90910334

Refer to Section 11 for schematic wiring diagram. Refer to Section 10 for ESC diagnostic alarms and diagnostic trees.

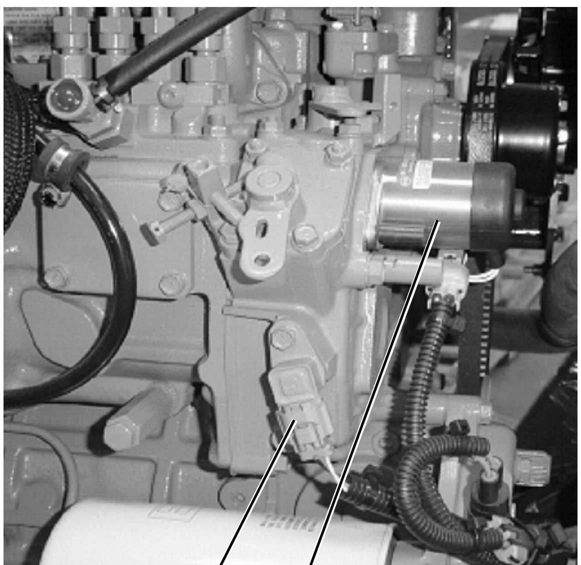


Figure 9-7. Electronic Speed Control Components

b. Description

Engines with electronic speed control have no RPM sensor, speed or fuel solenoids. Engine speed is controlled by three components: the engine speed control unit (ENSCU), the fuel and speed actuator (FSA) and the engine speed sensor (ENSSN).

The ENSCU is mounted on the roadside frame behind the upper door. It provides the RPM signal to the microprocessor. The unit has an alarm LED incorporated within it, which is used to diagnose failures within the ESC system.

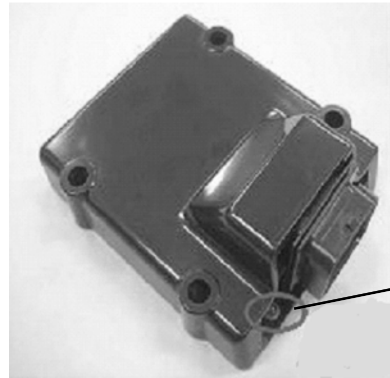


Figure 9-8. Frame Mounted Engine Speed Control Unit (ENSCU)

The FSA combines the fuel shutoff solenoid and speed control solenoid into one component. Engine speed is controlled by varying rod position.

The ENSSN provides the RPM signal to the ENSCU for speed control. It is located on the front of the engine in the gear case cover.

9.8.8 Engine Air Filter

a. Engine Air Filter Inspection

The dry type air filter should be inspected regularly for leaks. A damaged air filter or hose can seriously affect the performance and life of the engine. The air filter is designed to effectively remove contaminants from the air stream entering the engine. An excessive accumulation of these contaminants in the air filter will impair its operation; therefore, a service schedule should be set up and followed. The air cleaner filter element requires replacement when dirty.

1) Check all connections for mechanical tightness. Be sure filter outlet pipe is not fractured.
2) In case of leakage and if adjustment does not correct the trouble, replace necessary parts or gaskets. *Swelled or distorted gaskets must always be replaced.*
3) Air Filter Service Indicator

The air filter indicator is connected to the engine air intake manifold and its function is to indicate when the air filter requires replacement. During operation: when a plugged air cleaner causes the intake manifold pressure to drop to 20” (500 mm) WG, the indicator will move to the red line. The air cleaner should then be replaced and the indicator reset by pressing the reset button.

b. Air Filter Service Procedure

1) Release 2 clips on air cleaner housing and remove bottom cover.

2) Remove filter element, wipe inside of air cleaner housing clean and install new filter element.

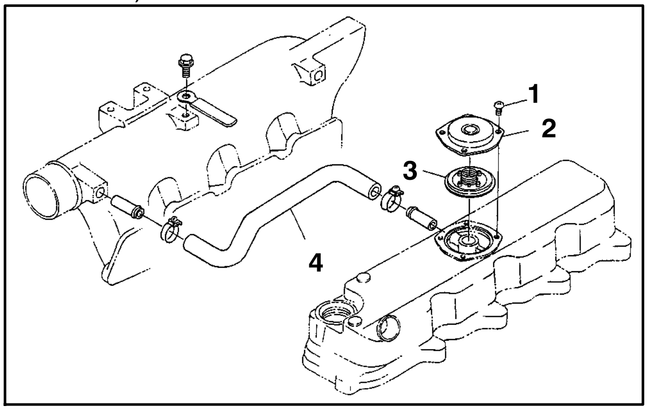
3) Wipe inside of bottom cover clean and re-install.

4) Re-secure 2 clips on air cleaner housing and close roadside door.

9.8.9 Engine Crankcase Breather

The engine uses a closed type breather with the breather line attached to the cylinder head cover. (See Figure 9-9)

The breather assembly should be cleaned once a year or at every 2000 hours maintenance interval (whichever comes first). See Table 9-1



1. Screw
2. Breather Cover
3. Breather Valve
4. Breather Tube

Figure 9-9. DI - Engine Crankcase Breather

9.8.10 Glow Plugs

a. Servicing Glow Plugs

The total circuit amp draw for the glow plug circuit is checked during a Pretrip cycle. The glow plugs, when energized, draw a nominal 6 to 9 amps each at 10.5 vdc. When servicing, the glow plug is to be fitted carefully into the cylinder head to prevent damage to glow plug. Torque value for the glow plug is 14 to 18 ft-lb (1.9 to 2.5 Mkg).

b. Checking for a Defective Glow Plug

1) The entire circuit may be tested using Component Test mode. (Refer to Section 6.2.2.)
2) To test individual glow plugs, disconnect all glow plugs from each other, and place an ammeter (or clip-on ammeter) in series with each glow plug and energize the plugs. Each plug (if good) should show 6 to 9 amps draw (at 12 VDC).
3) A second method is to disconnect the wire connection to the plug and test the resistance from the plug to a ground on the engine block. The reading should be 0.7 to 1.2 ohms if the plug is good.

9.9 SERVICING AND ADJUSTING V-BELTS

WARNING

Beware of V-belts and belt driven components as the unit may start automatically. Before servicing unit, make sure the START/RUN-OFF switch is in the OFF position or the unit is in Maintenance mode. Also disconnect the negative battery cable.

9.9.1 Belt Tension Gauge

Use a belt tension gauge (tester) P/N 07-00253, shown in Figure 9-10 whenever V-belts are adjusted or replaced.

A belt tension gauge 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 tension gauge can be used to adjust all belts. 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 this gauge, it should be placed as close as possible to the midpoint between two sheaves. (See Figure 9-11)

The V-belts must be kept in good condition with the proper tension to provide adequate air movement across the coils.

Table 9-3. Belt Tension (See Figure 9-11)		
BELTS	Tension	
	Lbs	Mkg
Water Pump/Alternator/Crankshaft	45 to 55	6.2 to 7.6
Gearbox to Fan shaft	70 to 80	9.7 to 11.1
Engine to Gearbox	70 to 80	9.7 to 11.1

Figure 9-10 Belt Tension Gauge (Part No. 07-00253)

9.9.2 Water Pump/Alternator/Crankshaft V-Belt

The water pump/alternator/crankshaft V-belt is driven by a sheave on the engine crankshaft. Frayed, cracked or worn belts must be replaced. Adjustment is achieved by altering the position of the front side idler/alternator.

When replacing a V-belt, avoid excessive force when applying tension to the V-belt to prevent damage to the water pump bearings. (Refer to Table 9-3)

a. Make sure negative battery terminal is disconnected and remove old belt.

b. Place V-belt on alternator sheave and then install alternator with two bolts loosely in position.

c. Check the center alignment of the engine drive, alternator and water pump sheaves to ensure proper alignment. Pulley misalignment will create excess belt wear and shorten alternator bearing life. The center line of all three sheaves must be in line.

d. Pivot alternator to place tension on belt using hand force only. *Do not use pry bar or excessive force as it may cause bearing failure.* For correct belt tension see Table 9-3. Tighten pivot and adjustment bolts.

e. Reinstall negative battery cable.

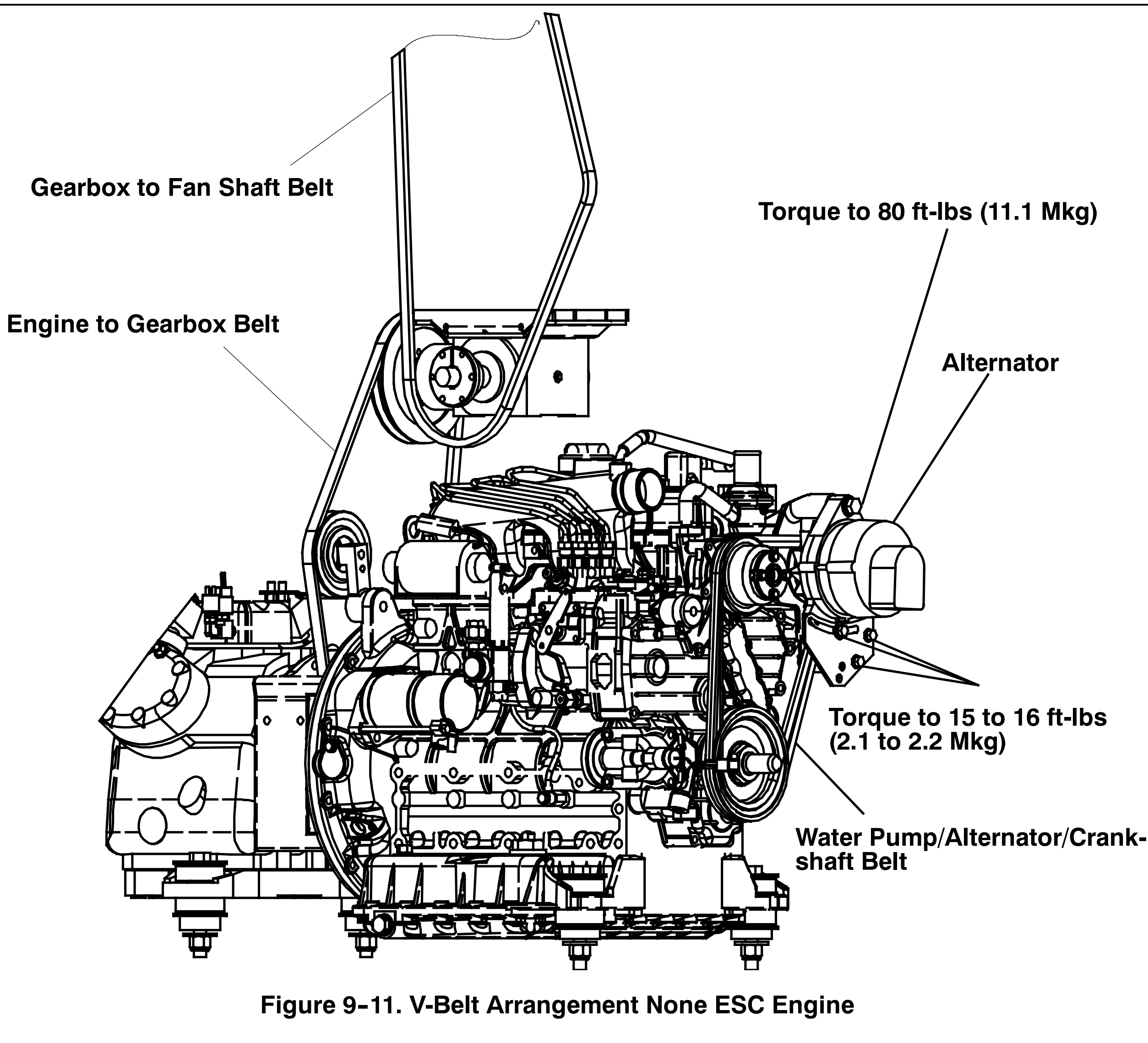


Figure 9-11. V-Belt Arrangement None ESC Engine

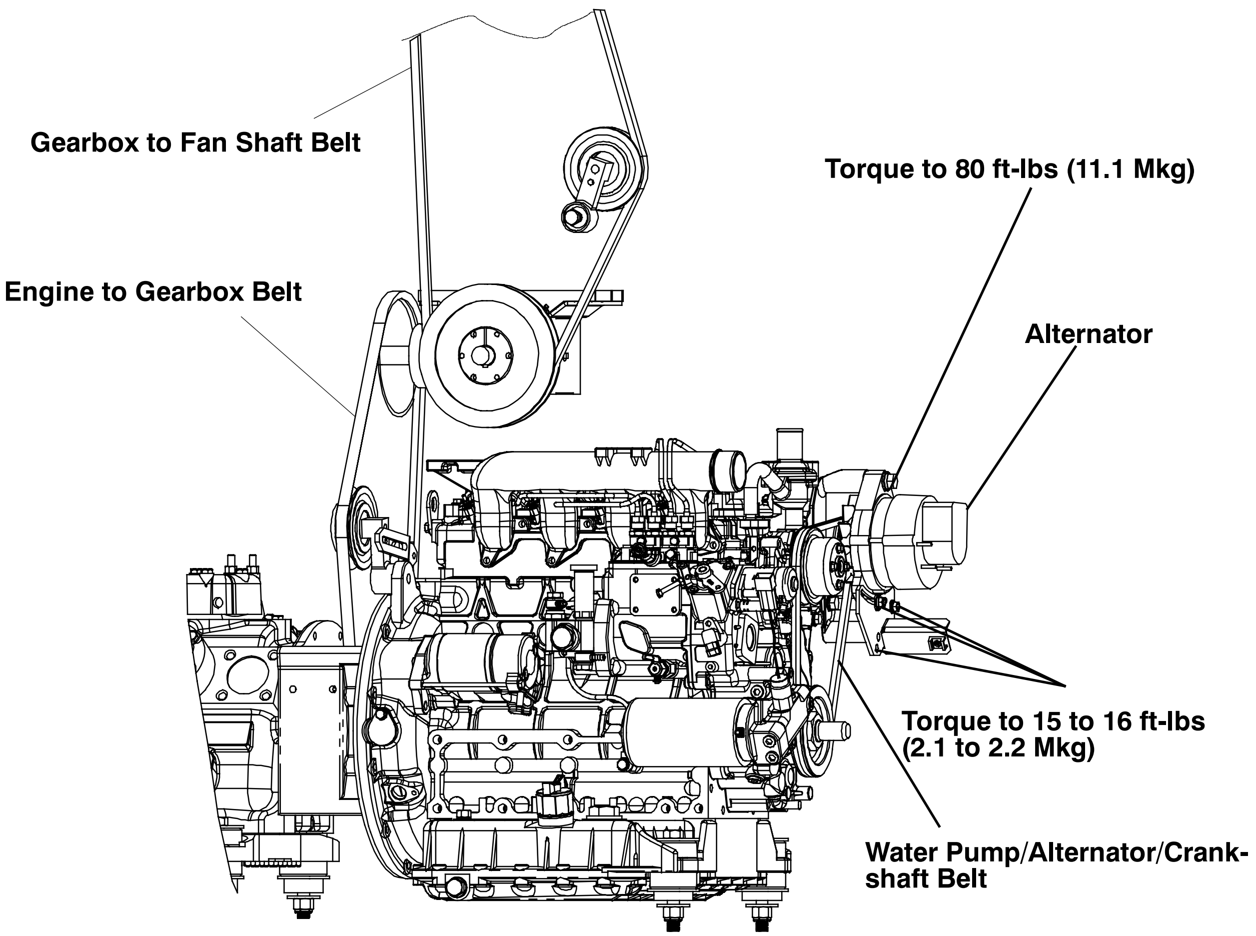


Figure 9-12. V-Belt Arrangement
Electronic Speed Control Engine

9.9.3 Gearbox To Fan Shaft V-Belt

⚠ WARNING

Keep hands and arms away from unit when operating without belt guard in place. Never release a unit for service without the belt guard securely tightened in place

a. To Replace V-belt:

1) Disconnect negative battery cable and remove V-belt guard.
2) DO NOT START UNIT UNTIL V-BELT GUARD IS INSTALLED.
3) Loosen idler pulley.
4) Remove old belt and replace with new belt. (See Figure 9-11)
5) Using a belt tension gauge (Figure 9-10) on the belt, rotate idler pulley so that the gauge reads the correct tension (Refer to Table 9-3).
6) Tighten idler, carriage bolt, and bolts.

NOTE

The tension of both belts must be checked and adjusted, if necessary, after a brief break-in period. (See step 6)

7) Reconnect negative battery cable, and install belt guard and operate unit in high speed for 5-10 minutes. Remove guard and disconnect battery. Repeat steps 4 and 5.

9.9.4 Engine To Gearbox V-Belt

a. To Replace V-belt:

1) Disconnect negative battery cable and remove V-belt guard, and then loosen idler bolt.
2) Match mark adapter to engine flywheel (See Figure 9-13A) for ease of assembly.
3) Remove six bolts (5/16-18 x 1 lg), securing adapter drive sheave to engine flywheel, Figure 9-13A.
4) Insert two of the six bolts (5/16-18 x 1 lg) into the threaded holes (jacking holes) provided on engine adapter. Jack adapter from engine flywheel. Remove the two screws from adapter. Insert a pry bar between engine flywheel and adapter, Figure 9-13A and slide the adapter-sheave toward the compressor enough to change the V-belt as shown in Figure 9-13B. Replace V-belt.
5) Pry the adapter back toward the engine flywheel or use 5/16-18 x 2-1/2 lg bolts (3) in every other hole of adapter and take up evenly on the bolts until the 5/16-18 x 1 lg bolts engage engine flywheel. Apply thread sealer (Loctite #262) to the bolts used to secure adapter to flywheel. Take up on all bolts evenly and then torque to a value of 28 ft-lb (3.87 Mkg).
6) Place V-belt on the gearbox sheave and adjust belt tension as indicated in Table 9-3. Install V-belt guard. DO NOT START UNIT UNTIL V-BELT GUARD IS INSTALLED.
7) Reconnect negative battery cable. Start unit and run for 10 minutes to allow for belt stretch.
8) Disconnect battery. Turn unit off, remove belt and re-check belt tension. Install belt guard.

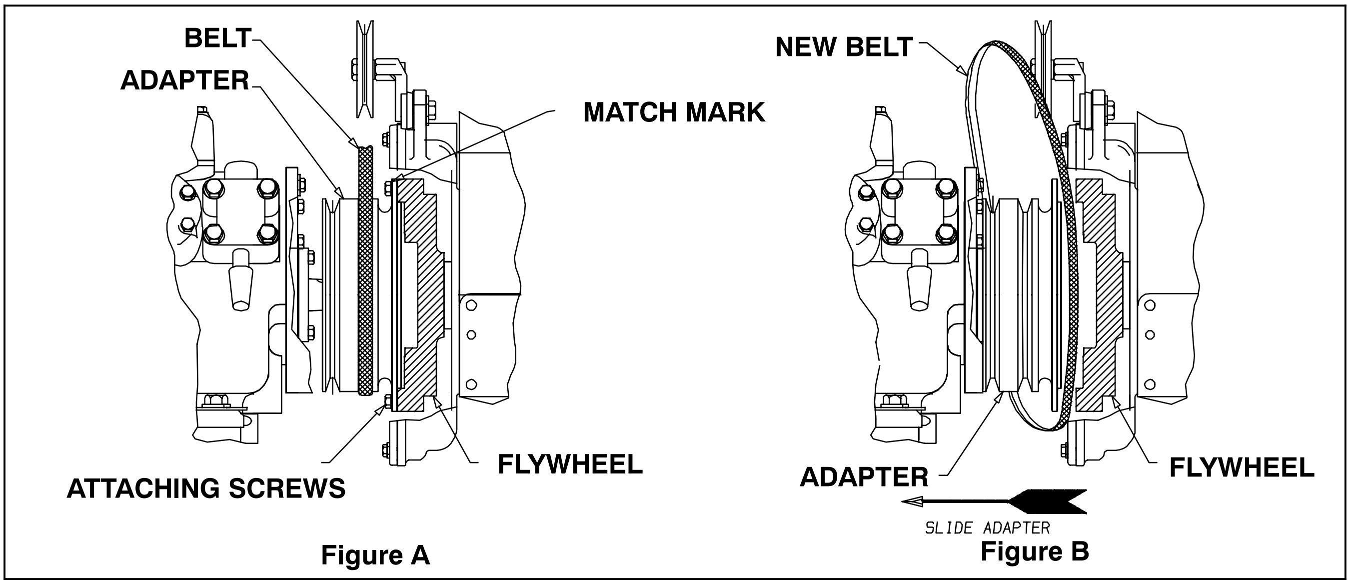


Figure 9-13. Removing V-Belt from Engine Adapter Drive Sheave

9.10 FANSHAFT ASSEMBLY – SEE FIGURE 9-14

WARNING

Beware of V-belts and belt driven components as the unit may start automatically. Before servicing unit, make sure the START/RUN-OFF switch is in the OFF position or the unit is in Maintenance mode. Also disconnect the negative battery cable.

9.10.1 Clutch Removal

CAUTION

Do not get anti-seize oil/compound onto clutch contact surfaces. Thoroughly clean off oil/compound with contact or brake cleaner if this occurs.

a. Turn the START/RUN-OFF switch to OFF and disconnect the negative battery cable.

b. Loosen the fan belt idler and remove upper drive belt.

c. Remove the top eight bolts (four along top edge and two down each side) that hold fan shroud to condenser frame.

d. Remove the three bolts that thread through the back of the clutch rotor/pulley forward into the condenser fan hub. Carefully remove the condenser fan and hub assembly from unit.

e. Place the three pins of the spanner wrench (CTD P/N 07-00396-01) into the holes on the face of the clutch armature. Place the tool handle between the fan shaft frame support and pod (10 o'clock position) to provide hands free anti-rotation. Loosen and remove the armature retaining bolt and washer.

NOTE

The armature-retaining bolt is a **LEFT HAND THREAD BOLT.**

f. Remove the clutch armature. A standard 5/8"-11 X 1" right hand thread bolt can be threaded through the center to jack the armature off the shaft, if needed.

g. Use spanner socket (CTD P/N 07-00303-02) to remove the spanner nut that secures the clutch rotor.

NOTE

The armature-retaining bolt is a **LEFT HAND NYLOCK THREAD BOLT.**

h. Slide the clutch rotor/pulley off and remove. If the rotor will not slide off easily, remove the condenser fan hub adapter from the fan. Place the adapter backwards against the fan shaft hub, and thread three 5/16-18 X 2 3/4" long bolts from the back of the rotor forward into the hub adapter. Tighten the bolts evenly to pull the rotor off the fan shaft hub.

i. Unplug the clutch coil connector from the wiring harness, then remove the clutch coil. **Be sure to retain all shims on fan shaft hub, correctly positioned on Fanshaft pin..**

j. Remove the vent hose and 1/8" barb fitting from fan shaft hub. Install a plug to prevent oil from spilling out vent hole while removing fan shaft.

9.10.2 Blower Wheel And Fanshaft Removal

a. Remove bulkhead and air chute (if so equipped). Remove evaporator back panel.

b. Remove the bolts that secure DTT and SAT to the nozzle cover. Care should be taken to prevent cutting wires on evaporator coil.

c. Remove the remaining bolts in the nozzle cover and carefully remove it from the pod.

NOTE

The nozzle cover (CTD P/N 58-04469-00) is sealed with a gasket (CTD P/N 42-00506-00). If the gasket is damaged during removal, it **MUST** be replaced.

d. Remove the two 1/4"-20 X 1" long bolts from the blower wheel split taper bushing. Insert them into the threaded holes. Tighten bolts evenly to push the blower wheel away from the bushing.

e. Remove the fan shaft seal ring clamp and carefully peel seal from pod (use a putty knife if needed).

NOTE

The fan shaft seal (CTD P/N 42-00372-00) is caulked to the pod. If seal is damaged during removal, it **MUST** be replaced.

f. Remove the four 3/8" bolts from the fan shaft.

g. Remove fan shaft from unit.

9.10.3 Fanshaft Installation

a. Install two keys into the shaft keyways.

NOTE

If it is necessary to drive the keys into place, be sure to support the shaft while tapping the keys.

b. Position the fan shaft so that the housing is in the normal mounting position, with the shaft horizontal and the vent hole facing directly up. Remove both pipe plugs (1/8" NPT) from fan shaft.

c. Ensure oil in fan shaft is at proper level. If not, fill the fan shaft with oil (07-00373-00) until oil is at the bottom of the level hole (approximately 3 oz/89 ml). Apply pipe thread sealant to the pipe plug on the side of fan shaft housing and tighten. Reinstall pipe plug on hub to prevent oil spillage.

d. Install the fan shaft into the unit with the four fan shaft mounting bolts and torque bolts to 28 to 30 ft-lb (3.9 to 4.1 Mkg), making sure the plug for the vent is pointing up.

NOTE

To aid in fan shaft alignment, install two 3/8"-16 x 1 1/2" studs (bolts with heads cut off) into the fan shaft mounting hub. Once the first two fan shaft mounting bolts are loosely installed, remove the studs and install bolts.

e. Apply pipe thread sealant to barb fitting and install into vent hole. Slide hose vent onto barb fitting.

f. Apply caulk to the fan shaft seal and place on the fan shaft. Place fan shaft seal ring clamp on seal and tighten.

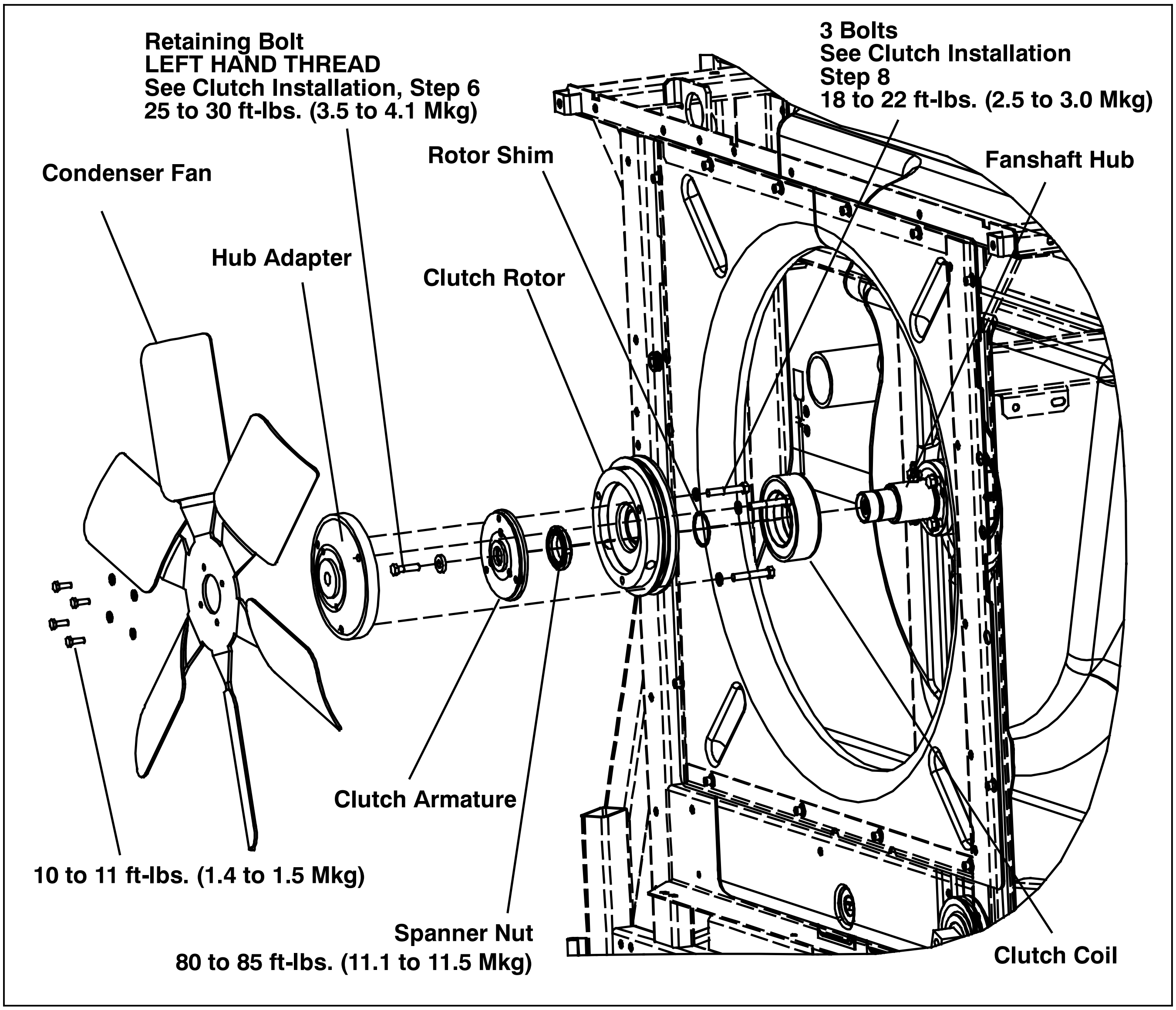


Figure 9-14. Fanshaft Assembly

9.10.4 Blower Wheel Installation

a. Make sure key is properly placed in keyway. Slide blower wheel and bushing onto shaft.

b. Loosely attach blower wheel to bushing and slide assembly forward until blower wheel touches pod. (This will set approximate clearance between blower wheel and pod.)

c. Loosely attach the nozzle cover to pod with retaining bolts. Install SAT with at least 1/2" of sensor in the nozzle. Reattach DTT.

d. Slowly and evenly torque blower wheel bushing bolts to 10 to 11 ft-lbs (1.4 to 1.5 Mkg)

e. Position nozzle cover so that blower wheel is centered in cover opening. Torque nozzle cover bolts to 20 in-lbs (0.23 Mkg).

f. Rotate blower wheel and check that clearance is approximately 1/4." Adjust nozzle cover and/or blower wheel if necessary.

g. Reinstall evaporator panel, reattach air chute and bulkhead (if so equipped).

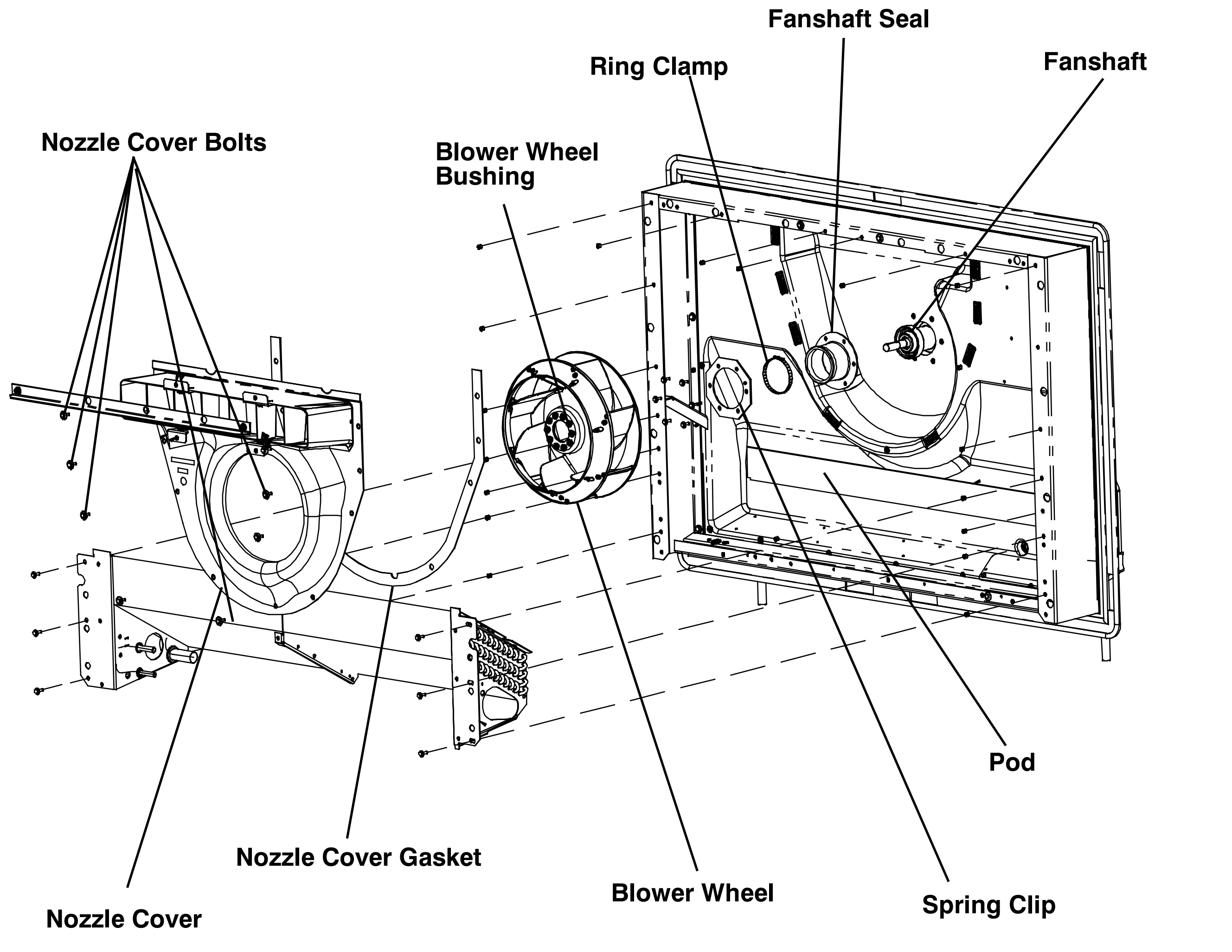


Figure 9-15. Blower Wheel And Nozzle Cover Assembly

9.10.5 Clutch Installation

NOTE

The orientation of the clutch coil **MUST** be on the bottom. Secure the harness to the lower right fan shaft mounting bolt using the cushion clamp provided.

a. Place clutch coil onto fan shaft hub, with coil harness on top. **Make sure all original shims are correctly positioned on fan shaft pin** and then slide coil onto hub so fan shaft pin fits into notch in coil.

NOTE

The fan shaft pin is used to position the coil to properly secure the wire harness to the frame.

b. Install rotor spacer and rotor onto the fan shaft.

c. Install the new spanner nut (included in mounting accessory kit (CTD P/N 50-00236-21.) Use CTD spanner socket 07-00303-02 and torque to 80-85 ft-lbs (11.1 to 11.5 Mkg.)

NOTE

The spanner nut is a **LEFT HAND NYLOCK-THREAD NUT.**

d. Slide the armature into place on the fan shaft, making sure the key is in place and the keyway lines up correctly with the shaft key.

e. Install the new armature retaining bolt and washer. Use spanner wrench (CTD P/N 07-00396-01) at the 2 o'clock position to hold the armature, then torque the retaining bolt to 25-30 ft-lb. (3.5 to 4.1 Mkg)

NOTE

The armature retaining bolt is a **LEFT HAND THREAD BOLT.**

f. Measure the clutch air gap with the air gap tool (CTD P/N 07-00432-00). The gap should be between 0.015 and 0.090 inches (0.38 and 2.3 mm). If it is not, remove entire clutch. If gap is less than 0.015" (0.38 mm), remove enough of the fan shaft hub shims to increase the gap to approximately 0.020" (0.51mm). Shims (CTD P/N 50-00232-30 are 0.010" (0.25mm) each. If the gap is more than 0.090" (2.3 mm), add enough shims to reduce gap to approximately 0.020" (0.51mm). Reinstall clutch assembly and re-measure to verify air gap.

g. Install cushion clamp on coil harness approximately 3" from coil to prevent harness from rubbing on rotor.

h. Reattach the condenser fan and hub assembly to the clutch rotor. Thread the three bolts from behind the clutch rotor into the condenser fan hub, and torque the bolts to 18-22 ft-lb. (2.5 to 3.0 Mkg).

i. Reinstall the upper drive belt and adjust idler to attain a belt tension of 70-80 ft-lb. (9.7 to 11.1 Mkg)

j. Remove condenser fan shroud spacer/supports that may have been inserted. Reinstall upper eight bolts that hold shroud to condenser frame.

k. Plug the clutch coil connector back into the wiring harness. Tie-wrap harness as needed to secure.

l. Re-connect negative battery cable.

m. Check unit for proper clutch operation.

⚠ WARNING

Do not start unit without installing the evaporator panels as unit damage or body harm may result.

n. Check for proper unit operation by running Pretrip (Refer to Section 3.4).

9.11 THERMOSTATIC EXPANSION VALVE

⚠ CAUTION

Service mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating. Refer to Section 6.2.3.

The thermostatic expansion valve (TXV) is an automatic device, which maintains constant superheat of the refrigerant gas leaving the evaporator regardless of suction pressure. The valve functions are: (a) automatic response of refrigerant flow to match the evaporator load and (b) prevention of liquid refrigerant entering the compressor. Unless the valve is defective, it seldom requires any maintenance.

9.11.1 Replacing Expansion Valve & Screen

a. Pump down the unit by closing the king valve. (Refer to Section NO TAG.)

b. Remove insulation (Presstite) from expansion valve bulb and then remove bulb from suction line.

c. Remove Presstite from the expansion valve power head. Unscrew power head only if the element is being changed and replace by reversing steps a. through c.

d. Use a wet rag to keep TXV cool whenever brazing. Heat inlet, outlet and equalizer connections to valve body and remove valve. Clean all tube stubs so new valve fits on easily.

e. Reverse steps a. through d. to install new valve and screen, with cone of screen pointing into liquid line at inlet to the valve.

f. The thermal bulb is located below the center of the suction line (See Figure 9-16). This area must be clean to ensure positive bulb contact. Firmly tighten the straps around the thermal bulb and suction line and insulate both with Presstite.

g. Evacuate by placing vacuum pump on suction service valve. Draw down to 500 microns.

h. Open king valve and then check refrigerant level. See Section 9.11.4.

i. Check unit operation by running Pretrip (Refer to Section 3.4).

9.11.2 Checking Superheat

NOTE

Do not adjust expansion valve unless absolutely necessary.

Due to the time involved in adjusting the superheat, replace the valve rather than adjusting it.

9.11.3 Measuring Superheat

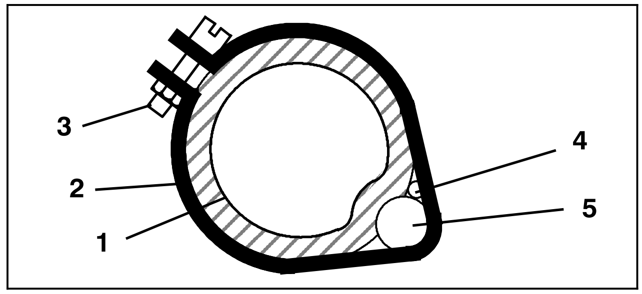
NOTE

The expansion valve and bulb location are shown in Figure 2-7.

a. Remove evaporator panel from rear of unit and then pull loose the Presstite insulation from one end of the expansion valve bulb.

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

c. Place thermocouple above (parallel with) TXV bulb and then secure loosened clamp making sure both bulbs are firmly secured to suction line as shown in Figure 9-16. Use Presstite insulation to completely cover both bulbs.



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

Figure 9-16. Thermostatic Expansion Valve Bulb and Thermocouple

NOTE

When conducting this test the suction pressure must be at least 6 PSIG (0.41 Bar) below expansion valve maximum operating pressure (MOP). For MOP Refer to Section 2.11.

d. Connect an accurate gauge to the 1/4" (0.01mm) port on the suction service valve.

e. Run unit until stabilized. Set controller 10°F (5.5°C) below refrigerated compartment temperature.

f. From the temperature/pressure chart (Refer to Table 9-9), determine the saturation temperature corresponding to the evaporator outlet pressure.

g. Note the temperature of the suction gas at the expansion valve bulb.

h. Subtract the saturation temperature determined in Step f. from the average temperature measured in Step g. The difference is the superheat of the suction gas.

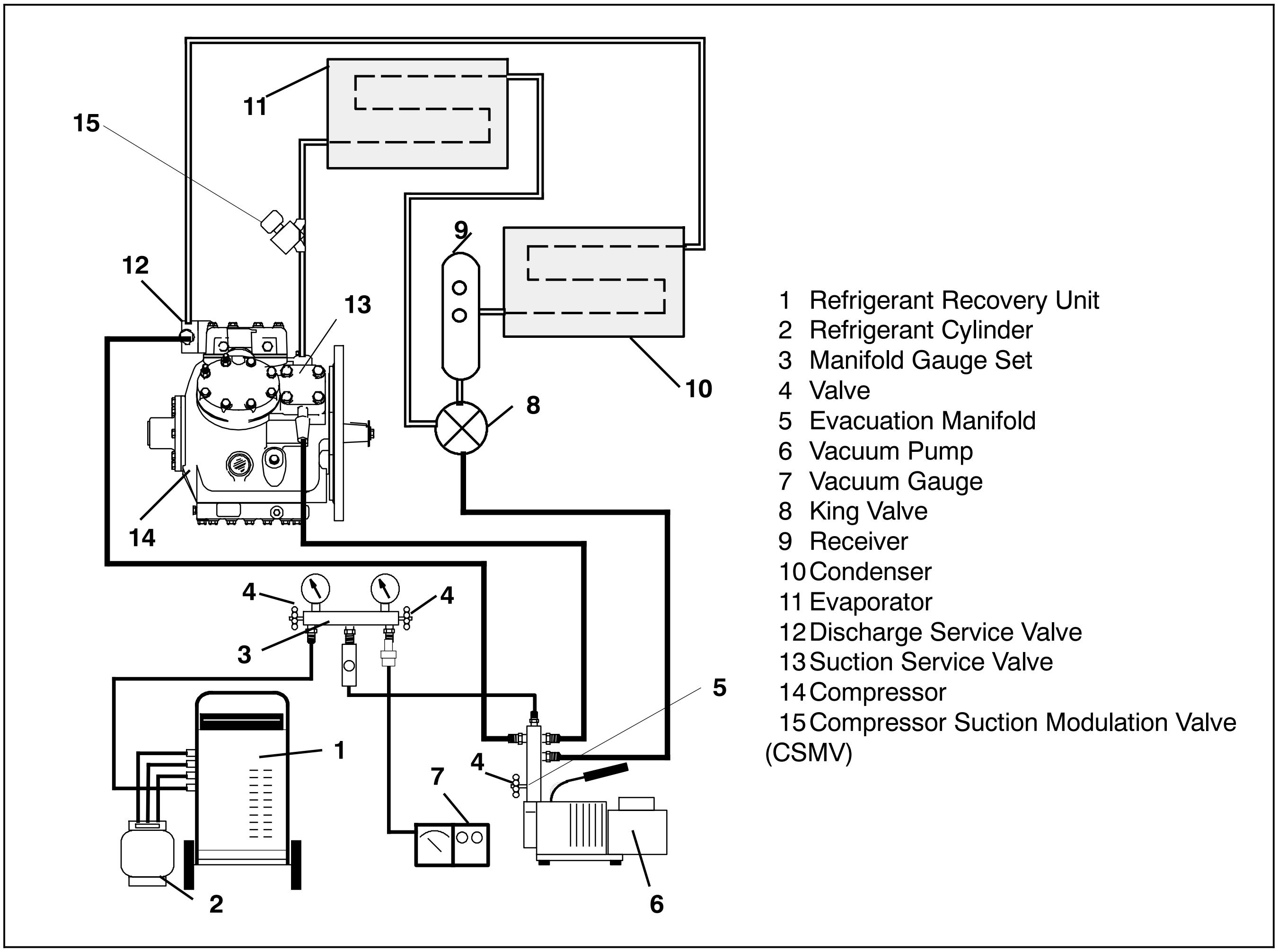


Figure 9-17. Vacuum Pump Connection

CAUTION

Service mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating. Refer to Section 6.2.3.

CAUTION

Do not vapor charge R404A. Only liquid charging through the receiver outlet (king) valve is acceptable.

9.11.4 Checking The Refrigerant Charge

NOTE

High speed operation at some conditions may create high turbulence inside the receiver. If it is difficult to see the refrigerant settling properly in the receiver sight glass, unplug the speed solenoid, forcing low speed operation. There should be less turbulence in the receiver and the liquid refrigerant should settle properly.

Checking Refrigerant Level on Units With S/N Prior to JAR90710713

NOTE

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

a. Start unit in cooling mode. Run approximately ten minutes - until the refrigeration system is warmed up and the refrigerated compartment temperature is less than 45°F (7.2C).

b. Check the lower sight glass on the receiver to determine charge. The system is correctly charged when refrigerant level is at centerline of sight glass, then weigh in another 3 lbs. (1.4 kg) of refrigerant.

Checking Refrigerant Level on Units With S/N Beginning With JAR90710713

NOTE

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

a. Start unit in cooling mode. Run approximately ten minutes – until the refrigeration system is warmed up and the refrigerated compartment temperature is less than 45°F (7.2C).

b. Check the lower sight glass to determine charge. The system is correctly charged when **the lower sight glass is not empty and the upper sight glass is not full**.

c. If the system appears to be overcharged: Remove refrigerant through the king valve to correct refrigerant level.

d. If the refrigerant system appears to be undercharged: Add refrigerant through the king valve.

9.11.5 Partial Charge

CAUTION

Do not vapor charge R404A. Only liquid charging through the receiver outlet (king) valve is acceptable.

NOTE

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

a. Place drum of refrigerant on scale and note weight. Backseat discharge and suction service valves and install a manifold gauge set. Purge lines. Connect a second manifold test set discharge gauge to the king valve. Connect the suction pressure hose to manifold dead head port. Connect a charging line between the center tap of the second gauge set and refrigerant drum. Open the LIQUID valve on drum and purge all hoses.

b. Start the unit. Adjust the setpoint so that the unit will run in high speed cool mode.

c. Run the unit for approximately ten minutes – until the refrigeration system is warmed up and the refrigerated compartment temperature is less than 45°F (7.2C).

d. Check the appropriate sight glass to determine charge. (See Step g. for determination of charge.) If undercharged proceed with step e.

e. Frontseat the king valve, and monitor the second set of manifold gauges. When the king valve pressure drops below the pressure in the refrigerant drum, open the manifold gauge set discharge valve and allow liquid refrigerant to flow into the system.

f. While monitoring the appropriate sight glass, carefully weigh the refrigerant into the system. Because the unit is in this charging state, it is not possible to accurately determine when the system is full. Therefore, never allow more than 3 lbs. (1.4 kg) of refrigerant into the system at a time.

g. After metering 3 lbs (1.4 kg) of refrigerant into the system, close the valve of the manifold gauge set connected to the king valve. Open the king valve and allow the system to balance out (approximately 4-5 minutes and the refrigerated compartment temperature is less than 45°F (7.2C). Check sight glass(es) to determine charge:

   Units With S/N Prior to JAR90710713 – Once the refrigerant level is at centerline of the lower sight glass, weigh in another 3 lbs. (1.4 kg) of refrigerant.

   Units With S/N Beginning With JAR90710713 – Charge the system until the refrigerant level is at centerline of the lower sight glass. THE LOWER SIGHT GLASS SHOULD NOT BE EMPTY AND THE UPPER SIGHT GLASS SHOULD NOT BE FULL.

h. Start unit and check for noncondensibles and run a unit Pretrip. (Refer to Section 3.4).

9.11.6 Adding Full Charge

⚠ CAUTION

Do not vapor charge R404A. Only liquid charging through the receiver outlet (king) valve is acceptable.

a. Dehydrate unit to 500 microns and leave in deep vacuum. (Refer to Section Table 9-9)

b. Place drum of refrigerant on scale and connect charging line from drum to king valve. Purge charging line at king valve.

c. Note weight of drum and refrigerant.

d. Open liquid valve on drum. Midseat king valve 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 Table 2-1.

NOTE

It is possible that all liquid may not be pulled into the receiver, as outlined in step d. In this case, frontseat the receiver outlet valve (king valve) and run the unit in cooling until the correct amount of refrigerant is added.

e. When scale indicates that the correct charge has been added, close liquid line valve on drum and backseat the king valve. Remove charging hose.

f. Start unit and check for noncondensibles and run a unit Pretrip. (Refer to Section 3.4).

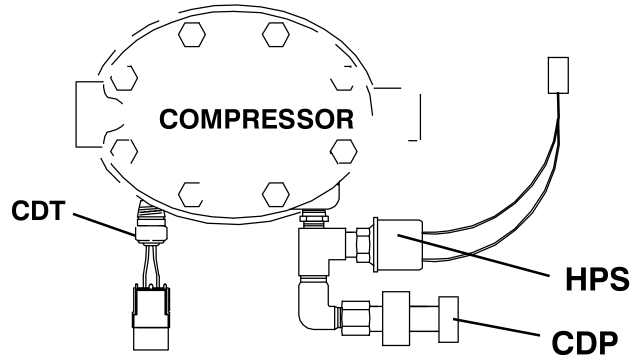


Figure 9-18. Pressure Switch and Sensor

9.12 REPLACING THE COMPRESSOR

⚠ CAUTION

Service mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating. Refer to Section 6.2.3.

NOTE

Service replacement compressors are shipped without oil.

9.12.1 Removal and Replacement of Compressor

NOTE

The service replacement compressor is sold without shutoff valves (but with valve pads). The valve pads should be installed on the removed compressor prior to return shipping. Customer should retain the original capacity unloader valves for use on replacement compressor. Check oil level in service replacement compressor. (Refer to Section 9.13)

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

If compressor runs, pump down the unit. (Refer to Section NO TAG.)

If compressor does not operate, frontseat both suction and discharge service valves, and remove refrigerant charge from compressor (Refer to Section NO TAG.)

a. Disconnect negative battery cable.

b. Remove the two rear compressor bracket mounting bolts (compressor shockmount end).

c. Block up engine.

d. Back out suction and discharge service bolt valve flange by two complete revolutions and leave threads engaged.

e. Break seal between service valves and compressor and remove bolts from valve flanges.

f. Remove fuel filter bracket (if necessary) from the compressor bell housing.

g. Disconnect wiring to unloader valve assemblies, Compressor Discharge Temperature Sensor (CDT), Compressor Discharge Pressure Transducer (CDP), Compressor Suction Pressure Transducer (CSP) and the wiring to the high pressure cutout switch (HPS). Identify wiring and switches if necessary. (See Figure 9-18)

h. Remove 10 bolts from the engine-compressor bell housing.

i. Disconnect ground strap from frame.

j. Remove Suction Pressure Transducer from suction line.

k. Attach sling or other device to the compressor.

l. Slide compressor enough to clear nylon drive gear (as shown in Figure 9-19), and remove compressor from unit.

m. Drain oil from defective compressor before shipping.

n. The original unloader valves must be transferred to the replacement compressor. The plug arrangement removed from the replacement is installed in the original compressor as a seal. If piston is stuck, it may be extracted by threading socket head cap screw into top of piston. A small Teflon seat ring at bottom of piston must be removed.

o. Remove the complete High Pressure switch assembly (HPS) (See Figure 9-18) and install on new compressor after checking switch settings. Remove Compressor Discharge Temperature sensor (CDT), Compressor Discharge Pressure transducer (CDP), and Compressor Suction Pressure transducer (CSP) and install on new compressor. Install compressor frame to new compressor (if removed with defective compressor).

p. Install compressor in unit by reversing step 4.12.b. through n. The use of new locknuts is recommended when replacing compressor. Torque bolts to a value of 46 ft/lb (6.4 Mkg). Install new gaskets on service valves and tighten bolts uniformly. Refer to Section 9.29.1 - drive gear installation.

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

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

s. Remove vacuum pump lines and install manifold gauges.

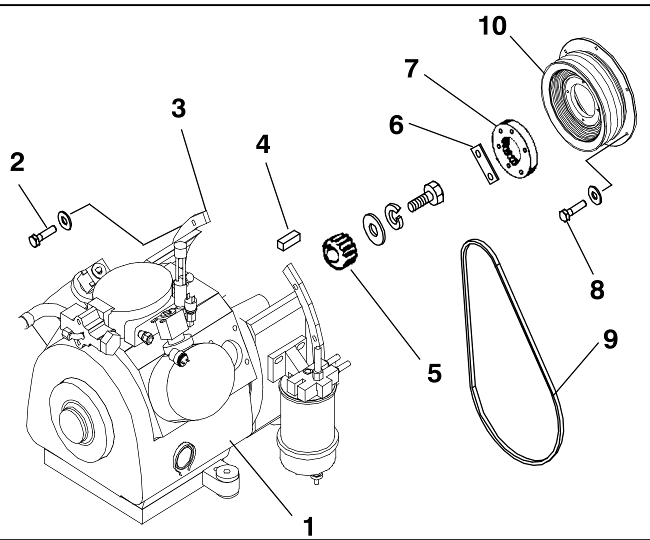
t. Check refrigerant level.

u. Start unit and check for noncondensibles.

v. Check compressor oil level. (Refer to Section 9.13) Add oil if necessary.

w. Check compressor unloader operation. (Refer to Section 9.14)

x. Check refrigerant cycles by running a unit Pretrip. (Refer to Section 3.4)



1) Compressor
2) Bolts
3) Compressor Bell Housing
4) Key
5) Compressor Drive Gear
6) Locking Tab
7) Nylon Drive Gear
8) Drive Sheave Bolts
9) V-Belt
10) Engine Adapter Drive Sheave

Figure 9-19. Compressor Drive Assembly

9.13 CHECKING COMPRESSOR OIL LEVEL

CAUTION

Service mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating. Refer to Section 6.2.3.

9.13.1 To Check The Oil Level In The Compressor:

a. Operate the unit in high speed, fully loaded cool for at least 15 minutes. Unplug wires to the unloaders if necessary to ensure six cylinder operation.

NOTE

Check the oil sight glass on the compressor to ensure that no foaming of the oil is present after 15 minutes of operation. If the oil is foaming check the refrigerant system for flood-back of liquid refrigerant. Correct this situation before performing step 2.

b. After 15 minutes, initiate a defrost cycle. This will allow any residual oil to be returned to the compressor.

NOTE

Operate the unit in defrost for 3-5 minutes only. **Do not allow the unit to terminate defrost automatically.** The sudden reduction of crankcase pressure at defrost termination could cause a temporary increase in oil circulation and gave a false oil level reading.

c. After 3-5 minutes of defrost operation, turn the unit off and wait 5-15 seconds. Observe the compressor oil level in the sight glass. (See Figure 9-20). Oil level should be between the Minimum and Maximum marks.

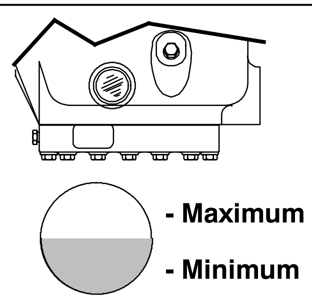


Figure 9-20. Oil Level in Sight Glass

9.13.2 Adding Oil With Compressor In System

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

a. Oil Pump Method

One compressor oil pump that may be purchased is a Robinair, part no. 14388. This oil pump adapts to a one U.S. gallon (3.785 liters) metal refrigeration oil container and pumps 2-1/2 ounces (0.0725 liters) per stroke when connected to the oil fill (item 3, Figure 9-21). 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 the technician 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 oil fill (Item 3, Figure 9-21). Purge the oil hose at oil pump. Add oil as necessary (Refer to Section 2.10).

b. Closed System Method

CAUTION

Extreme care must be taken to ensure the hose is immersed in the oil at all times. Otherwise air and moisture will be drawn into the compressor.

When an oil pump is not available, oil may be drawn into the compressor through the oil fill port or through the suction service valve.

1) Connect the suction connection of the gauge manifold to the compressor suction service valve port, and the common connection of the gauge manifold to a vacuum pump. Remove the discharge hose from the gauge manifold; connect one end to the compressor oil fill port, and immerse the other end in an open container of refrigeration oil. Start the vacuum pump, and pull the compressor into a 10”-15” vacuum. Stop the pump. Watch the oil level in the sight glass. As it reaches the minimum mark, stop the flow of oil from the container. (Refer to Section 2.10).

2) Break any remaining vacuum (raise to 0 Bar/PSIG) with refrigerant remaining in the system (crack open the suction service valve), or from a fresh drum of refrigerant. Replace the oil port plug, and evacuate the compressor crankcase. Open both service valves before starting the unit.

9.13.3 Adding Oil To Service Replacement Compressor

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

If compressor is without oil:

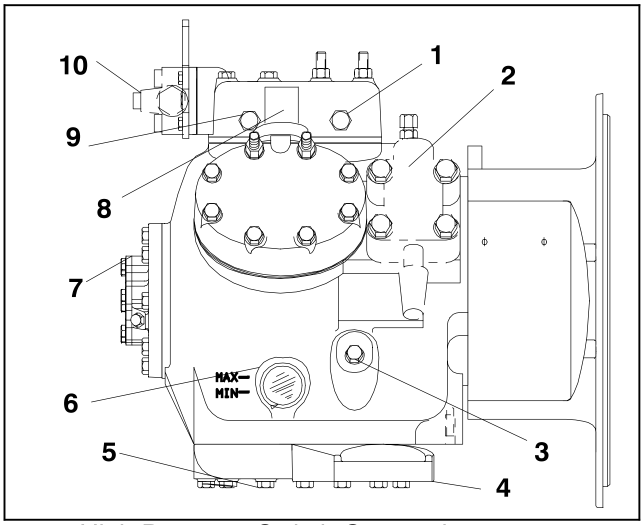
Add correct oil charge (Refer to Section 2.10) through the suction service valve flange cavity or by removing the oil fill plug (See Figure 9-21)

9.13.4 To Remove Oil From The Compressor:

a. Close suction service valve (frontseat) and pump unit down to 0.07 to 1 to 2 PSIG (0.1 Bar). Frontseat discharge service valve and slowly bleed remaining refrigerant.

b. Slowly remove the oil drain plug from the compressor and drain the proper amount of oil. Replace the plug securely back into the compressor.

c. Open service valves and run unit to check oil level, repeat as required to ensure proper oil level.



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

Figure 9-21. Compressor

9.14 COMPRESSOR UNLOADER VALVE (See Figure 9-22)

The compressor unloaders (located on the compressor cylinder heads) are controlled by the Advance Microprocessor. (Refer to Section 2.3.5)

9.14.1 Unloader Checkout Procedure

a. Connect manifold gauges to the compressor suction and discharge service valves and start unit in cooling with the refrigerated compartment temperature at least 5°F (2.8°C) above set point and the compressor will be fully loaded (both unloader coils are de-energized). Note suction pressure.

b. Unplug both unloader coils.

c. Using cable included in the test kit (CTD P/N 07-50006-00), energize front unloader. Note discharge and suction pressures. A rise of approximately 3 psig (0.2 bar) will be noted on the suction pressure gauge. Discharge pressure should drop approximately 5 to 15 psig (0.4 to 1.0 bar).

d. Disconnect UL1 and note pressures. Suction pressure should drop and discharge pressure should rise by same amount as in step c. above.

e. Repeat steps c. & d. for UL2 (rear unloader). At the end of the test, plug both unloaders back in.

NOTE

If either unloader coil energizes and the suction and discharge pressures do not change, the unloader assembly must be checked.

9.14.2 Replacing Unloader Valve Internal Parts (See Figure 9-22)

a. Pump down the unit. (Refer to Section NO TAG) Frontseat both service valves to isolate the compressor.

b. Remove coil retaining cap (if equipped), and coil.

c. Remove enclosing tube collar (item 2, Figure 9-22) using installation/removal tool supplied with repair kit (item 3).

d. Check plunger for restriction due to: (a) Corroded or worn parts; (b) Foreign material lodged in valve; (c) Bent or dented enclosing tube.

e. Install new parts. Do not over tighten enclosing tube assembly. Torque to a value of 8 ft pounds (1.1 Mkg).

f. Remove supplied installation/removal tool. Install coil, and voltage plate.

g. Evacuate and dehydrate the compressor. (Refer to Section NO TAG.)

h. Start unit and check unloader operation (Refer to Section 9.14.1.).

i. Check unit operation by running Pretrip (Refer to Section 3.4).

9.14.3 Unloader Coil Replacement

NOTE

The coil may be removed without pumping the unit down.

a. Disconnect leads. Remove retainer, if equipped. Lift off coil. (See Figure 9-22)

b. Check unloader coil resistance with an ohm meter. Correct resistance should be between 7.5 and 10.5 ohms.

c. Verify coil type, voltage and frequency of old and new coil. This information appears on the coil housing.

d. Place new coil over enclosing tube and retainer and connect wiring.

e. Check unit operation by running Pretrip (Refer to Section 3.4).

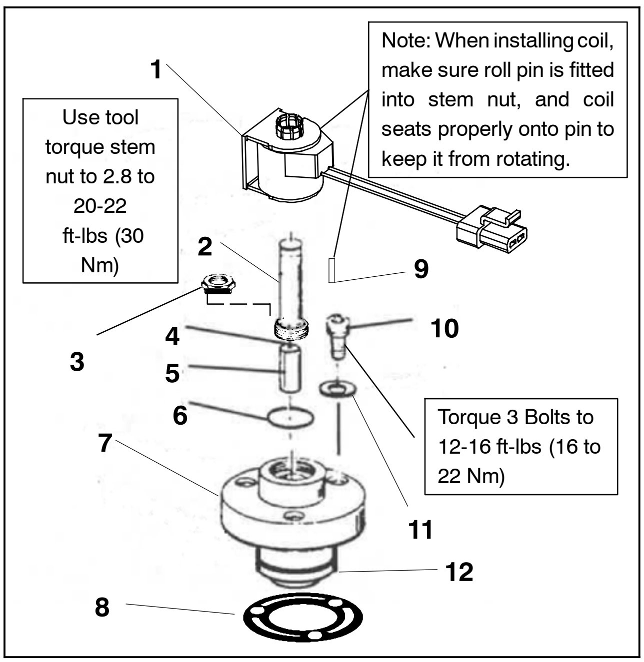


Figure 9-22. Unloader Valve

1. Coil Assembly
2. Stem/Enclosing Tube Assy
3. Installation/Removal Tool
4. Spring, Plunger
5. Plunger Assembly
6. "O" Ring
7. Valve Body
8. Gasket, Valve Body
9. Pin, Anti-Rotation (fits into top of stem nut)
10. Bolts, Valve Body (3)
11. Washers (3)
12. Piston (use only with hot gas bypass unloaders)

CAUTION

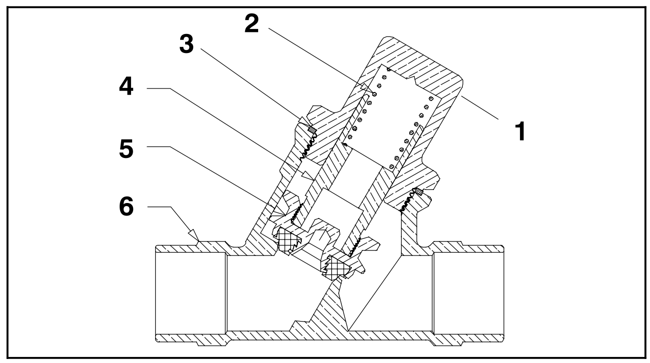
Service mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating. Refer to Section 6.2.3.

9.15 REPLACING OR SERVICING CHECK VALVE

A check valve allows the hot gas to travel in one direction only.

The function of the Hot Gas Bypass check valve is to raise the receiver pressure when the ambient temperature is low so that refrigerant can flow from the receiver to the evaporator when the unit is in heating or defrost.

The function of the Discharge Line check valve is to prevent any liquid refrigerant from migrating into the compressor during the unit off cycle.



1. Cap
2. Spring
3. Gasket
4. Stem
5. Seat
6. Body

Figure 9-23. Discharge Check Valve (Serviceable) Prior to S/N JAW90756460

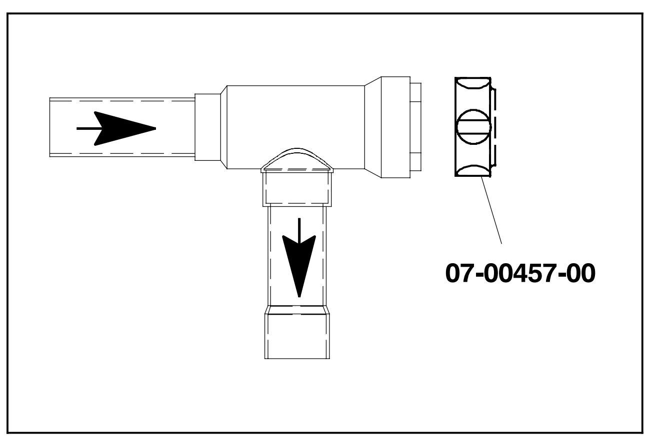


Figure 9-24. Discharge Check Valve (Non-Serviceable) Beginning With S/N JAW90756460

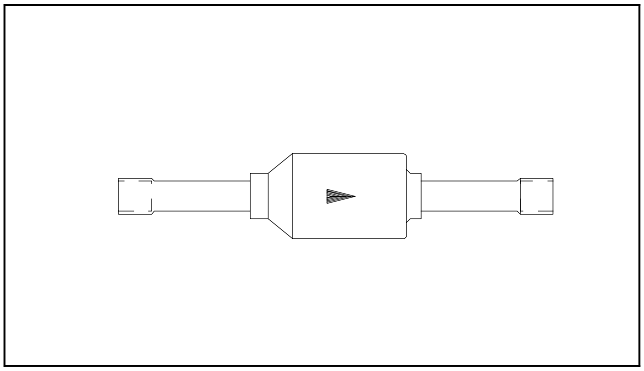


Figure 9-25. Hot Gas Check Valve (Non-Serviceable)

9.15.1 To Service Check Valve (See Figure 9-23)

a. Store the refrigerant in an evacuated container. (Refer to Section NO TAG.a)

b. Replace necessary parts.

c. Evacuate and dehydrate unit. (Refer to Section NO TAG)

d. Add refrigerant charge. (Refer to Section NO TAG)

9.15.2 To Replace Check Valve (See Figure 9-24 and Figure 9-25)

a. Store the refrigerant in an evacuated container. (Refer to Section NO TAG)

b. Using a pipe cutter, cut the valve stub-outs and unsweat the remaining stub-out from the connecting copper.

NOTE

Inert brazing techniques MUST be followed during replacement of valves.

NOTE

Place magnetic discharge check valve tool (Carrier Transicold P/N 07-00457-00) on top of discharge check valve (Figure 9-24) to pull the plunger from the body seat.

c. Replace valve.

d. Evacuate and dehydrate unit. (Refer to Section NO TAG)

e. Add refrigerant charge. (Refer to Section NO TAG)

f. Check unit operation by running Pretrip (Refer to Section 3.4.

9.16 CHECKING AND REPLACING FILTER-DRIER

9.16.1 To Check Filter-Drier

The unit must be running in Cool for this test. 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.

9.16.2 To Replace Filter-Drier

a. Pump down the unit per section NO TAG. Remove bracket, then replace drier. Tighten inlet side fitting.

b. Slowly open king valve and purge air through the drier. Tighten drier outlet side fitting.

c. Close the king valve.

d. Leak test drier connections.

e. Remove the refrigerant pressure from the low side of the system according to Step NO TAG of Section NO TAG.

f. Evacuate the low side of the system according to Section NO TAG.

g. Check refrigerant level.

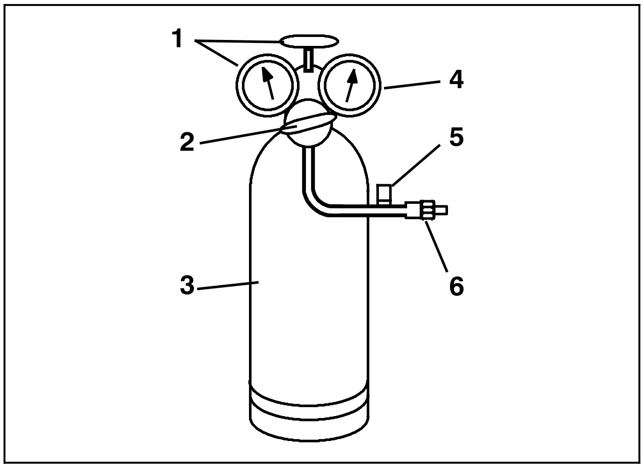
h. Check unit operation by running Pretrip (Refer to Section 3.4).

9.17 CHECKING AND REPLACING HIGH PRESSURE CUTOUT SWITCH (HPS)

9.17.1 Checking High Pressure Switch

⚠ WARNING

Do not use a nitrogen cylinder without a pressure regulator. Cylinder pressure is approximately 2350 PSIG (159.9 Bars). Do not use oxygen in or near a refrigerant system as an explosion may occur. (See Figure 9-26)



1. Cylinder Valve and Gauge
2. Pressure Regulator
3. Nitrogen Cylinder
4. Pressure Gauge [0 to 400 PSIG (0 to 27.2 Bars)]
5. Bleed-Off Valve
6. 1/4 inch Connection

Figure 9-26. Typical Setup for Testing High Pressure Switch

a. Remove switch as outlined in Section 9.17.2.

b. Connect ohmmeter or continuity light across switch terminals. Ohmmeter will indicate resistance and continuity light will be lit if switch closes after relieving pressure.

c. Connect switch to a cylinder of dry nitrogen. (See Figure 9-26)

d. Set nitrogen pressure regulator higher than cutout point on switch being tested. Pressure switch open and close points are shown in Section 2.11.

e. Close valve on cylinder and open bleed-off valve.

f. Open cylinder valve. Slowly close bleed-off valve and increase pressure until the switch opens. If a continuity light is used, it will go out. If an ohmmeter is used, the meter will indicate open. Open pressure on gauge. Slowly open bleed-off valve (to decrease pressure) until switch closes. (The light will light or the ohmmeter indicator will move.)

9.17.2 Replacing High Pressure Switch

a. Pump down compressor per Section NO TAG. Frontseat both suction and discharge service valves to isolate compressor.

b. *Slowly* equalize compressor pressure through the service valve gauge ports.

c. Recover refrigerant remaining in compressor to 0 psig/bar.

d. Disconnect wiring from defective switch, and remove old switch. The HPS is located on the top cylinder head (See Figure 9-21).

e. Install new HPS after verifying switch settings and reconnect wiring. (Refer to Section 9.17.1)

f. Evacuate and dehydrate the compressor. (Refer to Section NO TAG**)**

NOTE

Evacuation and dehydration is necessary only in the event that the compressor has reached atmospheric pressure during this procedure.

g. Check unit operation by running Pretrip (Refer to Section 3.4).

9.18 COMPRESSOR DISCHARGE PRESSURE TRANSDUCER (CDP)

(CTD P/N 12-00352-04 - RED)

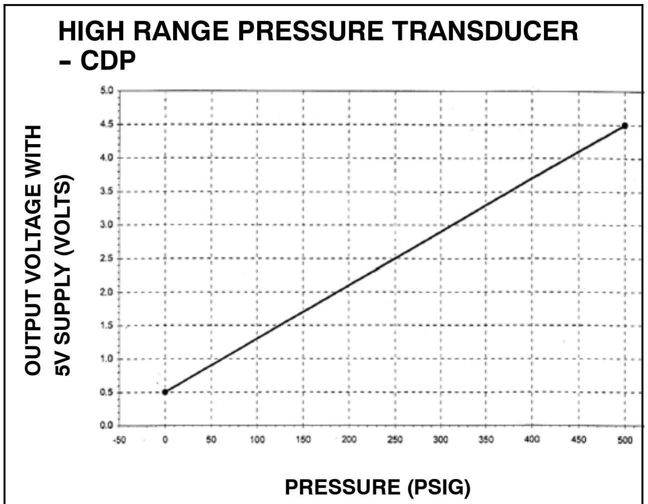


Figure 9-27 Discharge Pressure Transducer Values

9.18.1 Testing Compressor Discharge Pressure Transducer

a. Verify that the wiring to the transducer is correct. (See wiring diagram, Section 11.)

b. Power up the transducer circuit. Place unit into PC Mode (Refer to Section 6.1).

c. Check Voltage to transducer connector. Voltage reading between A (negative) and B (positive) should be 5.0 VDC.

d. Check wire resistance between C (output to microprocessor) and 1MP05.

e. Place +5.0 VDC on transducer terminal B and -5.0 VDC on transducer terminal A. Disconnect C from the microprocessor. Test voltage between B and C. The reading should be as shown in table below.

9.18.2 Calibrating Compressor Discharge Pressure Transducer

The compressor discharge pressure transducer (CDP) has a range of 0 to 500 PSIG (0 to 34.02 Bars). With this large of a pressure range, some transducers will not read exactly the same as the next. To allow for variations in transducers, and still display an accurate pressure reading in the Data list, a calibration feature for the CDP built into the microprocessor.

To calibrate the CDP, it *must* be removed from the compressor and exposed to atmosphere. During the calibration process, the microprocessor measures the difference between what the transducer is sending and what the microprocessor was expecting for a zero reading. The difference between these two is called an offset. This offset is then stored in the microprocessor's memory, and is used in all future calculations for displaying compressor discharge pressure.

NOTE

The Compressor Discharge Pressure on the microprocessor Data list will never read less than 0 Bar/PSIG, even if it is exposed to a vacuum (such as when evacuating the system.) Consequently, a transducer reading of 0 does not indicate accurate calibration. Every discharge transducer *must* be calibrated before being installed into a compressor.

a. Power up the transducer circuit. Place unit into PC mode (Refer to Section 6.1), or place unit in Manual Start mode.

b. Press the Select key until "Press ↑ ↓ to View Data" appears in the MessageCenter.

c. Press the Up Arrow until "Discharge Pressure" is displayed in the MessageCenter.

d. Press and hold the Equal key for six seconds. The MessageCenter will blink 5 times. When it stops blinking, the display will either show "DISCHARGE PRESSURE: 0.0 BAR/PSIG," or the message "CALIBRATION UNSUCCESSFUL."

e. When "DISCHARGE PRESSURE: 0.0 BAR/PSIG" appears, the offset has been saved into the microprocessor memory, and the calibration is complete.

f. If the calibration was unsuccessful, either there is more than 0 Bar/PSIG on the transducer, or the transducer is further away from 0 than an offset will allow. The transducer must be replaced.

Table 9-4. Compressor Discharge Pressure Transducer					
Bars/PSIG	**Voltage**	**Bars/PSIG**	**Voltage**	**Bars/PSIG**	**Voltage**
0/0	0.5	5.44/80	1.1	17.0/250	2.5
0.68/10	0.6	6.12/90	1.2	18.7/275	2.7
1.36/20	0.7	6.8/100	1.3	20.41/300	2.9
2.04/30	0.7	8.51/125	1.5	22.11/325	3.1
2.72/40	0.8	10.21/150	1.7	23.81/350	3.3
3.4/50	0.9	11.91/175	1.9	25.52/375	3.5
4.08/60	1.0	13.61/200	2.1	27.22/400	3.7
4.76/70	1.1	15.31/225	2.3	30.62/450	4.1

NOTE

The +5.0 VDC (terminal B) is common between the Compressor Discharge Pressure Transducer, the Compressor Suction Pressure Transducer, and the RPM sensor for non ESC engines or ENSSN for engines with electronic speed control. If this circuit is shorted to ground (due to one of the mentioned components being defective, or a worn wire) the MessageCenter will show:

•Suction Pressure: -14.7 PSIG (-1.0 Bar)
•Discharge Pressure: 0 PSIG/Bar
•Engine RPM: 0.

9.18.3 Replacing Compressor Discharge Pressure Transducer

⚠ WARNING

The Compressor Discharge Pressure Transducer does not have a Schrader valve in the connecting fitting. Any discharge pressure remaining in the compressor will be released when removing the CDP.

a. Pump down compressor per Section NO TAG. Frontseat both suction and discharge service valves to isolate compressor.

b. *Slowly* equalize compressor pressure through the service valve gauge ports.

c. Recover refrigerant remaining in compressor to 0 psig/bar.

d. Disconnect wiring from defective transducer, and remove the transducer. The CDP is located on the top cylinder head.

e. Connect wiring and calibrate the transducer per Section 9.18.2.

f. Install new CDP and reconnect wiring.

g. Evacuate and dehydrate the compressor. (Refer to Section NO TAG)

NOTE

Evacuation and dehydration is necessary only in the event that the compressor has reached atmospheric pressure during this procedure.

h. Check unit operation by running Pretrip (Refer to Section 3.4).

Table 9-5. Compressor Suction Pressure Transducer					
PSIG/Bars	**Voltage**	**PSIG/Bars**	**Voltage**	**PSIG/Bars**	**Voltage**
-10/-0.68	0.7	30/2.04	2.1	70/4.76	3.5
-5/-0.34	0.8	35/2.38	2.2	75/5.1	3.6
0/0	1.0	40/2.72	2.4	80/5.44	3.8
5/0.34	1.2	45/3.06	2.6	85/5.78	4.0
10/0.68	1.4	50/3.4	2.8	90/6.12	4.1
15/1.02	1.5	55/3.74	2.9	95/6.46	4.3
20/1.36	1.7	60/4.08	3.1	100/6.8	4.5
25/1.7	1.9	65/4.42	3.3		

9.19 COMPRESSOR SUCTION PRESSURE TRANSDUCER (CSP)

(CTD P/N 12-00352-03 - BLUE)

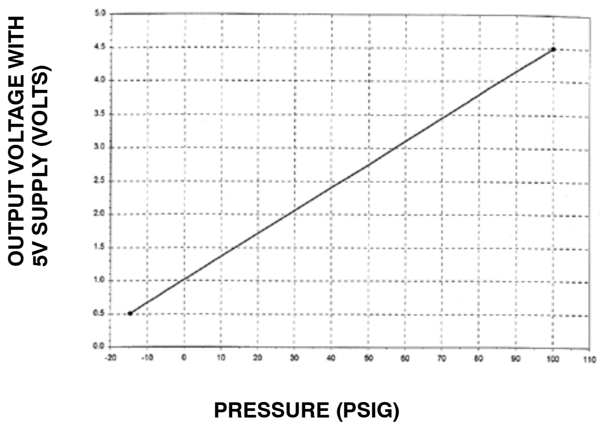


Figure 9-28 Suction Pressure Transducer Values

9.19.1 Testing Compressor Suction Pressure Transducer

a. Verify that the wiring to the transducer is correct. (See wiring diagram, Section 11).

b. Power up the transducer circuit. Place unit into PC mode (Refer to Section 6.1), or place unit in Manual Start mode.

c. Check Voltage to transducer. Voltage reading between A (negative) and B (positive) should be 5.0 VDC.

d. Check wire continuity C (output to microprocessor) and 1MP6.

e. Place +5.0 VDC on transducer terminal B and -5.0 VDC on transducer terminal A. Test voltage between B and C. The reading should be as shown in table below.

9.19.2 Calibrating Compressor Suction Pressure Transducer

The Compressor Suction Pressure Transducer (CSP) has a range of -14.7 to100 psig (-1 to 6.8 bar). Calibration is not required because the range is so small.

NOTE

The +5.0 VDC (terminal B) is common between the Compressor Discharge Pressure Transducer, the Compressor Suction Pressure Transducer, and the RPM sensor for non ESC engines or ENSSN for engines with electronic speed control. If this circuit is shorted to ground (due to one of the mentioned components being defective, or a worn wire) the MessageCenter will show:

•Suction Pressure: -14.7 PSIG/Bar
•Discharge Pressure: 0 PSIG/Bar
•Engine RPM: 0

9.19.3 Replacing Compressor Suction Pressure Transducer

a. Pump down compressor per Section NO TAG. Frontseat both suction and discharge service valves to isolate compressor.

b. *Slowly* equalize compressor pressure through the service valve gauge ports.

c. Recover refrigerant remaining in compressor to 0 psig/bar.

d. Disconnect wiring from defective transducer, and remove old transducer. The CSP is located on the fitting on the crankcase of the compressor.

e. Install new CSP and reconnect wiring.

f. Evacuate and dehydrate the compressor. (Refer to Section NO TAG**)**

NOTE

Evacuation and dehydration is necessary only in the event that the compressor has reached atmospheric pressure during this procedure.

g. Check unit operation by running Pretrip (Refer to Section 3.4).

9.20 REPLACING RECEIVER SIGHT GLASS ASSEMBLY OR FUSIBLE PLUG

CAUTION

Service mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating. Refer to Section 6.2.3.

a. Remove the refrigerant from the complete system. (Refer to Section NO TAG.)

b. Unscrew the sight glass assembly or fusible plug and discard.

c. Wrap threads of new sight glass or plug with Teflon tape or spread some sealing compound on pipe threads of new sight glass assembly or plug and install. Torque the sight glass to 15 to 25 ft lbs (20 to 34 Nm). Torque the fuse plug to 4 to 8 ft lbs (5 to 11 Nm).

d. Using a trace amount of refrigerant removed from the system in Step a. bring the pressure of the system up to about 10 psig (xxx). Add dry nitrogen to increase the pressure to 100 psig (6.9 bar). Leak check receiver sight glass or fusible plug. (Section NO TAG.)

e. After leak checking unit, release the refrigerant/nitrogen to atmosphere and evacuate and dehydrate as outlined in Section NO TAG.

f. Add refrigerant charge. (Refer to Section NO TAG)

g. Check unit operation by running Pretrip. (Refer to Section 3.4).

9.21 SERVICING SOLENOID VALVES

9.21.1 Solenoid Valve - SV2/SV4

CAUTION

Do not over tighten or damage the enclosing tube assembly. Torque to 17-ft pounds (2.4 Mkg). Also make sure all parts are placed on the enclosing tube in proper sequence to avoid premature coil burnout.

a. Replacing the SV2/SV4 Coil

NOTE

The coil may be replaced without removing the refrigerant or pumping the unit down.

1) Unplug from wiring harness, remove coil retainer and coil assembly.

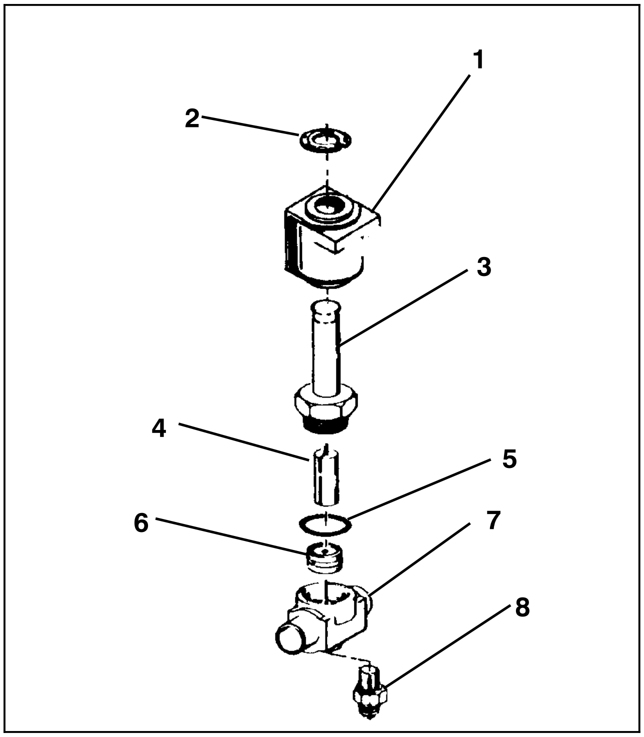
2) Verify coil type, voltage and frequency. This information appears on the coil housing.

3) Place new coil over enclosing tube, retainer and connect wiring.

b. Replacing SV2/SV4 internal parts

CAUTION

Service mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating. Refer to Section 6.2.3.



1) Coil Assembly	5) Seal
2) Retainer	6) Piston Assy
3) Enclosing Tube Assy	7. Body
4) Plunger Assy	8. Bracket Adapter

Figure 9-29. SV2/SV4 Solenoid Valves

To service the liquid line solenoid valve (SV2) or the hot gas solenoid valve (SV4) first pump the unit down. (Refer to Section NO TAG.)

Remove and store the refrigerant charge in an evacuated container. (Refer to Section NO TAG.)

1) Remove coil retainer and coil assembly from valve. Remove enclosing tube assembly and related items.

2) Check for foreign material in valve body.

3) Install new parts.

NOTE

Rebuild kit (P/N 14-00150-51) contains both a black neoprene seal and a white Teflon seal. Use the one that matches seal in existing valve. The valve with the Teflon seal can be identified by two dimples in the housing. (See Figure 9-30)

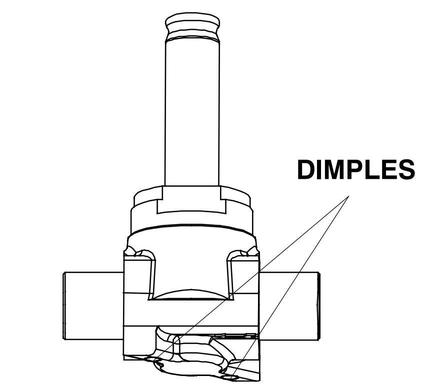


Figure 9-30. SV-2/SV-4 MARKING

4) Tighten enclosing tube assembly to a torque value of 17 ft pounds (2.4 Mkg) and leak check the valve. (Refer to Section NO TAG)
5) Install coil assembly and retainer.
6) Start unit and check refrigerant charge (Refer to Section NO TAG.)
7) Check refrigeration cycles.
8) Run Pretrip. (Refer to Section 3.4)

9.21.2 Solenoid Valve - SV1

a. Solenoid Valve SV1 Checkout Procedure

To obtain proper heating and defrost, the normally open (N.O.) SV1 solenoid valve must energize and close tightly during the heat and defrost cycles. If the valve does not close tightly due to physical damage, foreign material or wear, refrigerant leakage through the valve can reduce heating capacity.

During normal heat or defrost cycles the following conditions will be observed when the valve is operating properly:

1) Receiver refrigerant level will drop quickly at the initiation of heating or defrost mode.
2) Suction pressure will rise slowly to 90-100 PSIG (6.12 to 6.80 Bar).
3) Discharge pressure will drop quickly, but will begin to rise to a minimum of 250 PSIG (17.0 Bars) within 15 to 20 minutes.

If suction and discharge pressures remain low and the receiver level does not drop, the valve may be inoperative and can be checked by the following method.

1) Verify the solenoid coil has proper voltage and is energized in heating and defrosting.
2) Connect a discharge pressure gauge to the compressor discharge service valve and connect a gauge to the manual shut-off valve (king valve) leaving the receiver tank.
3) With the refrigerated compartment temperature at 35°F (1.7°C) or lower, operate the unit in high speed cool and remove or disconnect the “GND” wire leading to the SV1 coil.
4) With a separate 12 VDC negative ground wire, energize SV1 with the unit in high speed cooling and observe the discharge and receiver pressures. If the valve is closing properly, compressor discharge pressure will begin to rise and the receiver pressure will remain the same or begin to drop slowly. If the valve is not seating properly, both discharge and receiver pressure will rise slowly or remain the same.
5) Operate the unit until discharge pressure reaches 200 PSIG (13.61 Bars) and disconnect jumper wire to SV1 valve. Discharge and receiver pressure should be within 5 to 15PSIG (0.34 to 1.02 Bars) of each other.

b. Replacing the SV1 Coil

NOTE

The coil may be replaced without removing the refrigerant or pumping the unit down.

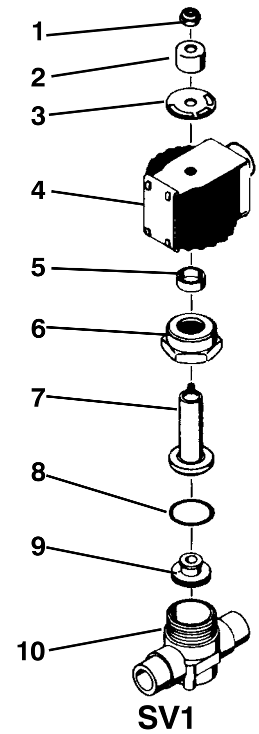
1) Remove top locknut, spacer cup and nameplate.
2) Disconnect wiring and remove coil.
3) Replace coil by reversing steps 1 and 2.

c. Replacing SV1 Internal Components (See Figure 9-31)

CAUTION

Service mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating. Refer to Section 6.2.3.

1) Remove and store the refrigerant charge in an evacuated container. (Refer to Section NO TAG.)
2) Remove the top locknut, spacer cup, nameplate, coil assembly and spacer.
3) Using a 12 point, 1-3/8 inch box wrench, loosen the enclosing tube locknut and bleed off remaining refrigerant.
4) Remove enclosing tube and locknut assembly. The gasket is inside the enclosing tube.
5) Remove seat disc from inside of body and check for obstructions and foreign material.
6) Place the seat disc into the valve body with the smaller diameter end facing up.
7) Place the enclosing tube locknut over the enclosing tube. Install spacer over enclosing tube making sure it is seated properly in the enclosing tube locknut. Tighten enclosing tube locknut to a torque value of 20 ft-lb (2.78 Mkg). Do not over tighten.
8) Install coil assembly, nameplate and top locknut or screw.
9) Dehydrate and evacuate the system. (Refer to section NO TAG) Charge unit with refrigerant per sections NO TAG.
10) Start unit and check operation.
11) Run Pretrip. (Refer to Section 3.4)



1) Locknut/Screw
2) Spacer Cup
3) Nameplate
4) Coil
5) Spacer
6) Enclosing Tube Lock nut
7. Enclosing Tube
8. Seal
9. Seat Disc
10. Body

Figure 9-31. SV1 Solenoid Valve

9.22 COMPRESSOR SUCTION MODULATION VALVE (CSMV)

The purpose of the CSMV is to control suction pressure, maintain the compressor within normal operating range and maximize unit capacity and fuel economy.

At initial startup, the microprocessor will go through a self test. When the test is complete, the MessageCenter will display “SMV CLOSING”. When closing is complete, the MessageCenter will display “SETTING SMV XXX%”. The XX% will count up to a predetermined percentage depending on ambient temperature and compartment temperature. The unit will then go through its normal start procedure.

Figure 9-32 Suction modulation valve (CSMV)

9.22.1 Function

The CSMV coil consists of two windings labeled 1 and 2. Each winding has two poles, labeled A and B.

Both poles of both windings have a wire connected back to the microprocessor.

Looking at the 4-pin connector on the CSMV coil, the wiring is as follow :

Table 9-6 CSMV Connections

Connector Pin	Wire Color	Winding/Pole
A	BLACK	1A
B	WHITE	1B
C	RED	2B
D	GREEN	2A

Refer to Section 2.13 for resistance value.

There is no common connection point between the two windings.

The microprocessor opens and closes the CSMV by sending a series of electrical pulses to the coil.

CAUTION

Do not connect 12 VDC to the CSMV windings in an attempt to rotate the valve or irreparable damage will occur.

9.22.2 CSMV Diagnostics

If the CSMV is suspected to be faulty, the first thing the operator should do is perform a Pretrip test (Refer to Section 3.4). Some symptoms that could indicate a faulty CSMV are:

- Unusually high suction pressure in COOL mode.

  A27 - “HIGH SUCTION PRESSURE ALARM” may be generated.

- Unusually low suction pressure

  A18 - “LOW REFRIGERANT ALARM” may be generated

- Poor temperature control

  Compartment temperature deviates from set point.

If the unit fails Test 10 during pretrip
(P180 “CHECK SUCTION MOD VALVE”) the CSMV could be faulty. The CSMV could have become mechanically jammed, or it could have failed electrically in the power head, or it may not be receiving the proper signal from the microprocessor. There are several steps the operator should make in addition to the unit Pretrip to further diagnose the valve.

a. The CSMV may be stuck in some position other than completely closed and the stepper motor cannot move the piston. To check if the valve is stuck, first start the unit and run in cool mode with manifold gauges attached to the compressor

b. Allow the suction pressure to pull down to 0 psig/bar.

WARNING

Carrier Transicold does not recommend allowing the compressor to pull less than 0 psig/bar at any time.

c. Once the unit has reached suction pressure of 0 psig/bar place the Start/Run-Off switch in the the OFF position. After the engine shuts down, the microprocessor will fully close the CSMV.

NOTE

Carefully listen to the valve. When the unit is off and the valve is closing, the valve will make a ratcheting noise that may be heard or felt as it is closing. If this can be heard or felt, it indicates that the microprocessor is **attempting** to close the valve, and may serve as a quick indication that the drive module is in working order. It is not, however, an indication that the valve piston is actually working.

d. Wait about 2 minutes after the engine stops to ensure the valve is fully shut.

e. If the CSMV is fully shut, the suction pressure should still read 0 psig/bar. If the valve is stuck at some position other than fully closed, or it cannot fully close for any reason, the suction pressure during this test will rise.

1) If the suction pressure holds at 0, go to Step f.

2) If the suction pressure rises, go to Step NO TAG

f. Use the Stepper Motor Tester (CTD special tool P/N 07-00375-00) to manually open the valve. The suction pressure on the manifold gauge should go up. If the suction pressure does not go up, the CSMV is stuck closed (go to Step NO TAG) or there is something obstructing the refrigerant.

NOTE

Opening the valve can also be accomplished by using the microprocessor. Place the Start/Run-Off switch in the START/RUN position. The microprocessor will go through its self test and the display will show
"SMV CLOSING: WAIT XXX SECONDS". *The valve is obviously closed at this point, but the microprocessor is programmed to always close the CSMV every time the microprocessor is powered up.* The display will then show "SETTING SMV XXX%" . Refer to 9.22 above. If the suction pressure does not go up, the CSMV is stuck closed (go to Step NO TAG) or there is something obstructing the refrigerant.

NOTE

If the valve passes steps a. through f., the valve is operating properly.

g. If the suction pressure rises during Step e., or if the valve is determined to be stuck closed in Step f., turn the unit Off by placing the Start/Run-Off switch in the OFF position and unplug the 4 pin connector to the CSMV. With a reliable digital ohmmeter, check the winding resistance between 1A (Black) wire and the 1B (White) wire AND between the 2A (Green) wire and the 2B (Red) wire. Refer to Section 2.13 for standard resistance in normal ambient temperatures. If this resistance is confirmed, proceed to Step 8. If an infinite or zero ohm reading occurs, first check the wires at the connector for good contact. If the connector is in good condition and the resistance is still bad, one (or both) of the coils could be faulty. Replace the CSMV power head assembly P/N 14-00263-20. Refer to Section 9.22.3.

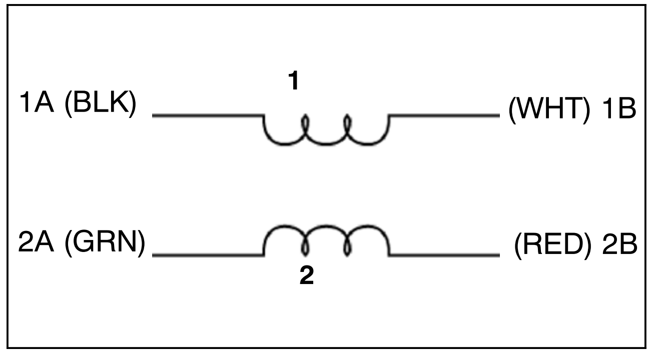


Figure 9-33 CSMV Coil

h. Locate the wires on the engine harness side of the CSMV connector. Locate the wires labeled CSMVA, CSMVB, CSMVC and CSMVD. These will correlate to the connector pins labeled A, B, C and D. See Figure 9-33.

i. Place the Start/Run-Off switch in the START/RUN position. DO NOT ALLOW THE UNIT TO START. When the MessageCenter displays "SMV CLOSING: WAIT XXX SECONDS", measure the AC voltage between pins A and B and then between C and D using a voltmeter that is set to read AC volts. The digital voltmeter should read from 10 to 16 VAC for each pair of wires. If this test passes, there is a good signal coming from the microprocessor.

j. If a reading of 10 to 16 VAC is not present on one or both of the wire pairs, check the wiring between the microprocessor and the CSMV connector, or check the microprocessor for proper model number configuration.

k. If all the above tests pass, the CSMV is operating properly and the abnormal unit operation can be contributed to something other than the CSMV.

9.22.3 Replacing The CSMV Power Head (14-00263-20)

a. Pump the unit down at the king valve (Refer to Section NO TAG).

⚠ CAUTION

Service mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating. Refer to Section 6.2.3.

b. Unplug the CSMV connector from the engine harness.

c. Loosen the 2 1/8" nut on the CSMV and remove the power head assembly. (See NO TAG).

d. Install the new CSMV power head.

e. The power head 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 Stepper Motor Tester (CTD special tool P/N 07-00375-00) to manually open the valve to 100% before it is installed.

f. Torque the 2 1/8” nut to 35 to 40 ft-lbs (47.4 to 54.2 Nm)

g. Reconnect the CSMV connector to the engine harness.

h. Evacuate the low side of the refrigeration system. (Refer to Section NO TAG)

i. Open the liquid line service valve, run the unit for approximately 10 minutes and initiate a pretrip.

Emergency CSMV Repair Procedures:

In the event that the CSMV system has a failure, and replacement components are not readily available in an emergency. A **LIMP-HOME** procedure can be done as follows :

a. Attach a manifold gauge set.

b. Perform a low side pump down per Section NO TAG. When the unit has reached 0 to 5 psig (0 to 0.34 bar) close the suction service valve and turn the unit OFF.

c. Remove CSMV power head by loosening the 2-1/8 inch diameter nut (see NO TAG), and sliding the power head out.

d. Remove the piston by loosening the Allen screw and removing the piston and screw.

e. Install the power head assembly (without the piston), torque to 35 to 40 foot-lbs (47.4 to 54.2 Nm).

f. Open all valves.

g. Start the unit.

h. Adjust the suction service valve so that the approximate temperature OR current limit is maintained. For perishable loads, it is recommended that the adjustment be made so that the available capacity is slightly larger than the load, the unit will cycle OFF and ON.

i. Once repair parts become available, repair as required.

9.23 LIGHT BAR

9.23.1 Light Bar Operation and Test

a. The green LEDs illuminate when +12 volts is applied to Pin G and ground is applied to Pin B.

b. The amber LEDs will illuminate when +12 volts is applied to Pin G and ground is applied to Pin B and Pin H.

c. Use an Ohmmeter to test light bar operation. PIN B should be open to other terminals, and PIN G should have 325 to 550 ohms to PIN H.

9.24 CHECKING DEFROST OR HEATING CYCLE

NOTE

DTT must be 40°F (4.4°C) or lower, before any checks can be made.

9.24.1 Hot Gas Solenoid Valve (SV1 & SV4) Heating and Defrosting

a. Connect a discharge pressure gauge to the manual shut-off valve (king valve) and another gauge to the compressor discharge service valve. Connect a gauge to the compressor suction service valve.

b. Start unit with controller set at least 10°F (5.5°C) below indicated refrigerated compartment temperature to obtain high speed cooling. Press the MANUAL DEFROST key to initiate defrost. (DTT must be at or below 40°F (4.4°C). The hot gas solenoid valve (SV4) will energize and the hot gas line will be hot to touch on both sides of the valve. The condenser pressure control solenoid (SV1) closes and suction pressure will rise approximately 10 to 15 PSIG (0.68 to1.02 Bars) after five minutes on unit operation. Refer to Section 9.21.2 if unit does not heat properly.

c. Unit should remain in defrost until DTT (located on the center tube sheet below the evaporator) reaches 55°F (12.8°C). At this point the defrost cycle will terminate and the unit will resume automatic operation.

9.25 DEFROST AIR SWITCH (DAS)

9.25.1 Testing The Defrost Air Switch And Circuit

a. To check the Defrost Air switch, run unit in high speed cooling and place a jumper across the air switch terminals. This will start the defrost cycle as it simulates the action of the defrost air switch. Bypassing the switch in this manner operates all components involved in defrost.

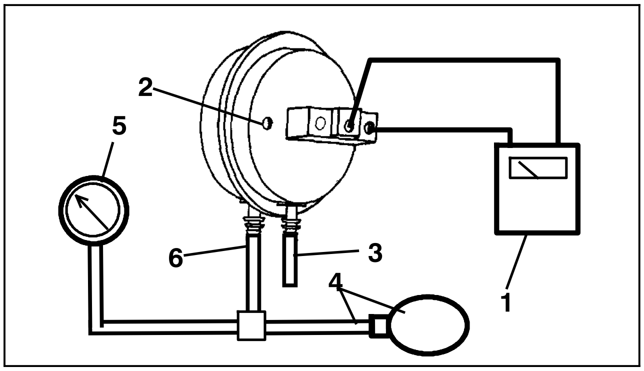
NOTE

If DTT is above 40°F (4.4°C), the MessageCenter will show “CANNOT START DEFROST CYCLE.”

b. Unit should remain in defrost until DTT reaches 55°F (12.8°C). At this point the defrost cycle will terminate, and the unit will resume automatic operation.

c. If the above test indicates satisfactory operation, test Defrost Air switch (DAS) settings using a magnehelic gauge. (Refer to Section 9.25.2)

9.25.2 Checking Calibration Of Defrost Air Switch



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 07-00177-00)
6. High Side Connection

Figure 9-34. Defrost Air Switch Test Setup

a. Make sure 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 ZEROED. The Defrost Air switch MUST be in the same orientation as it will be in when installed in the unit.

b. With air switch in vertical position, connect high pressure side of magnehelic gauge to high side connection of air switch. (See Figure 9-34)

c. 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.

d. Attach an ohmmeter to the air switch electrical contacts 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.

e. With the gauge reading at zero, apply air pressure very slowly to the air switch. An ohmmeter will indicate continuity when switch actuates. The switch contacts should close and the ohmmeter needle move rapidly to 0. Any hesitation in the ohmmeter indicates a possible problem with the switch, and it should be replaced.

f. Refer to Section 2.11 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.

g. Repeat checkout procedure until switch actuates at correct gauge reading.

h. After switch is adjusted, place a small amount of paint or fingernail polish on the adjusting screw so that vibration will not change switch setting.

9.26 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.

Clean the evaporator coil on a regular basis, not only to remove cardboard dust, but also 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.

a. Remove rubber check valves (Kazoo) from drain lines (front of refrigerated compartment).

b. Remove evaporator bulkhead and back panel, then 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 reverse flush (opposite normal air flow) with clean water at mild pressure. A garden hose with spray nozzle is usually sufficient. Make sure drain lines are clean.

c. Replace evaporator back panel and run unit until defrost mode can be initiated to check for proper draining from drain pan.

9.27 CONDENSER COIL CLEANING

Remove all foreign material from the condenser coil by reversing the normal air flow. (Air is pulled in through the front and discharges over the engine.) Use an FDA approved cleaning agent whenever possible. However, compressed air or water may be used as a cleaning agent. It may be necessary to use warm water mixed with any good commercial dishwasher detergent. Rinse coil with fresh water if a detergent is used.

9.28 MICROPROCESSOR SENSOR CHECKOUT

An accurate ohmmeter must be used to check resistance values shown in Table 9-7.

Due to variations and inaccuracies in ohmmeters, thermometers or other test equipment, a reading within 2% of the chart value would indicate a good sensor. If a sensor is bad, the resistance reading will usually be much higher or lower than the resistance values given in Table 9-7.

At least one lead from the sensor must be disconnected from the unit electrical system before any reading is taken. Not doing so will result in a false reading. Two preferred methods of determining the actual test temperature at the sensor, is an ice bath at 32°F (0°C) or a calibrated temperature tester.

Table 9-7. Sensor Resistance (ENCT, RAT, SAT, ATT, DTT)

°F	°C	Ohms	°F	°C	Ohms	°F	°C	Ohms	°F	°C	Ohms
-40	-40	336,500	18	-7.8	49,060	76	24.4	10,250	134	56.7	2,809
-38	-38.9	312,600	20	-6.7	46,230	78	25.6	9,760	136	57.8	2,697
-36	-37.8	290,600	22	-5.6	43,580	80	26.7	9,299	138	58.9	2,590
-34	-36.7	270,300	24	-4.4	41,100	82	27.8	8,862	140	60.0	2,488
-32	-35.6	251,500	26	-3.3	38,780	84	28.9	8,449	142	61.1	2,390
-30	-34.4	234,200	28	-2.2	36,600	86	30.0	8,057	144	62.2	2,297
-28	-33.3	218,200	30	-1.1	34,560	88	31.1	7,686	146	63.3	2,208
-26	-32.2	203,400	32	0	32,650	90	32.2	7,334	148	64.4	2,124
-24	-31.1	189,700	34	1.1	30,850	92	33.3	7,000	150	65.6	2,042
-22	-30	177,000	36	2.2	29,170	94	34.4	6,684	155	68.3	1,855
-20	-28.9	165,200	38	3.3	27,590	96	35.6	6,384	160	71.1	1,687
-18	-27.8	154,300	40	4.4	26,100	98	36.7	6,099	165	73.9	1,537
-16	-26.7	144,200	42	5.5	24,700	100	37.8	5,828	170	76.7	1,402
-14	-25.6	134,800	44	6.6	23,390	102	38.9	5,571	175	79.4	1,281
-12	-24.4	126,100	46	7.7	22,160	104	40.0	5,327	180	82.2	1,171
-10	-23.3	118,100	48	8.9	20,990	106	41.1	5,095	185	85.0	1,072
-8	-22.2	110,500	50	10	19,900	108	42.2	4,874	190	87.8	983
-6	-21.1	103,600	52	11.1	18,870	110	43.3	4,665	195	90.6	902
-4	-20	97,070	54	12.2	17,900	112	44.4	4,465	200	93.3	829
-2	-18.9	91,030	56	13.3	16,980	114	45.5	4,275	205	96.1	762
0	-17.8	85,400	58	14.4	16,120	116	46.7	4,095	210	98.9	702
2	-16.7	80,160	60	15.5	15,310	118	47.8	3,923	215	101.7	647
4	-15.6	75,270	62	16.6	14,540	120	48.9	3,759	220	104.4	598
6	-14.4	70,720	64	17.7	13,820	122	50.0	3,603	225	107.2	553
8	-13.3	66,460	66	18.9	13,130	124	51.1	3,454	230	110.0	511
10	-12.2	62,500	68	20.0	12,490	126	52.2	3,313	235	112.8	473
12	-11.1	58,790	70	21.1	11,880	128	53.3	3,177	240	115.6	438
14	-10.0	55,330	72	22.2	11,310	130	54.4	3,049	245	118.3	406
16	-8.9	52,090	74	23.3	10,760	132	55.6	2,926	250	121.1	378

Table 9-8. Sensor Resistance (CDT)														
°F	°C	Ohms	°F	°C	Ohms	°F	°C	Ohms	°F	°C	Ohms	°F	°C	Ohms
-40	-40	3,360,000	18	-7.8	189,690	76	24.4	102,460	134	56.7	28,160	260	126.7	3,290
-38	-38.9	3,121,020	20	-6.7	461,170	78	25.6	97,600	136	57.8	27,040	270	132.2	2,850
-36	-37.8	2,900,710	22	-5.6	434,790	80	26.7	92,990	138	58.9	25,970	280	137.8	2,490
-34	-36.7	2,697,500	24	-4.4	410,080	82	27.8	88,630	140	60.0	24,960	290	143.3	2,170
-32	-35.6	2,509,940	26	-3.3	386,940	84	28.9	84,510	142	61.1	23,980	300	148.9	1,910
-30	-34.4	2,336,720	28	-2.2	365,260	86	30.0	80,600	144	62.2	23,050	310	154.4	1,680
-28	-33.3	2,186,670	3	-1.1	344,930	88	31.1	76,890	146	63.3	22,160	320	160.0	1,480
-26	-32.2	2,028,680	32	0	325,860	90	32.2	73,380	148	64.4	21,310	330	165.5	1,310
-24	-31.1	1,891,780	34	1.1	307,970	92	33.3	70,040	150	65.6	20,500	340	171.1	1,160
-22	-30	1,765,060	36	2.2	291,180	94	34.4	66,880	155	68.3	18,980	350	176.7	1,040
-20	-28.9	1,647,700	38	3.3	275,410	96	35.6	63,880	160	71.1	16,940	360	182.2	920
-18	-27.8	1,538,950	40	4.4	260,590	98	36.7	61,040	165	73.9	15,450	370	187.8	830
-16	-26.7	1,438,120	42	5.5	246,670	100	37.8	58,330	170	76.7	14,070	380	193.3	740
-14	-25.6	1,344,580	44	6.6	233,570	102	38.9	55,770	175	79.4	12,870	390	198.9	670
-12	-24.4	1,257,770	46	7.7	221,260	104	40.0	53,330	180	82.2	11,750	400	204.4	600
-10	-23.3	1,177,150	48	8.9	209,670	106	41.1	51,010	185	85.0	10,750	410	210.0	540
-8	-22.2	1,102,240	50	10	198,760	108	42.2	48,800	190	87.8	9,870	420	215.6	490
-6	-21.1	1,032,600	52	11.1	188,490	110	43.3	46,710	195	90.6	9,050	430	221.1	450
-4	-20	967,830	54	12.2	178,820	112	44.4	44,710	200	93.3	8,320	440	226.7	410
-2	-18.9	907,560	56	13.3	169,700	114	45.5	42,820	205	96.1	7,650	450	232.2	370
0	-17.8	851,450	58	14.4	161,100	116	46.7	41,010	210	98.9	7,050	460	237.8	340
2	-16.7	799,180	60	15.5	152,990	118	47.8	39,290	215	101.7	6,510	470	243.3	310
4	-15.6	750,470	62	16.6	145,340	120	48.9	37,660	220	104.4	6,000	480	248.9	280
6	-14.4	705,060	64	17.7	138,120	122	50.0	36,100	225	107.2	5,540	490	254.4	260
8	-13.3	662,690	66	18.9	131,310	124	51.1	34,610	230	110.0	5,130	500	260.0	240
10	-12.2	623,150	68	20.0	124,870	126	52.2	33,200	235	112.8	4,760			
12	-11.1	586,230	70	21.1	118,790	128	53.3	31,850	240	115.6	4,410			
14	-10.0	551,740	72	22.2	113,040	130	54.4	30,560	245	118.3	4,090			
16	-8.9	519,500	74	23.3	107,600	132	55.6	29,330	250	121.1	3,800			

9.29 UNIDRIVE TORQUE REQUIREMENTS (FIGURE 9-35)

Extensive damage may occur if the proper hardware and procedures are not followed. Periodic inspection of hardware and bolt torque is recommended to insure the integrity of the unidrive.

NOTE

Thread locking sealant, 5/16 flat washer and 5/16 lock washer *must* be used on bolts between the compressor mounting flange and the engine bell housing. The recommended sealant is Loctite Threadlocker 262.

The following figures show the torque value, size and grade of the hardware to be used when reassembling the unidrive assembly.

9.29.1 Drive Gear

When installing a nylon drive gear always:

a. Install with black dot facing steel gear.

b. Use new bolts and locking tabs included in drive gear kit.

c. Use Loctite or a similar thread locking compound on threads of drive gear bolts.

d. DO NOT use Never-Seez or any other lubricating compound on the nylon drive gear or compressor steel gear. The gear must be assembled dry.

e. Torque the (6 bolt) nylon drive gear bolts to 30 ft-lbs.

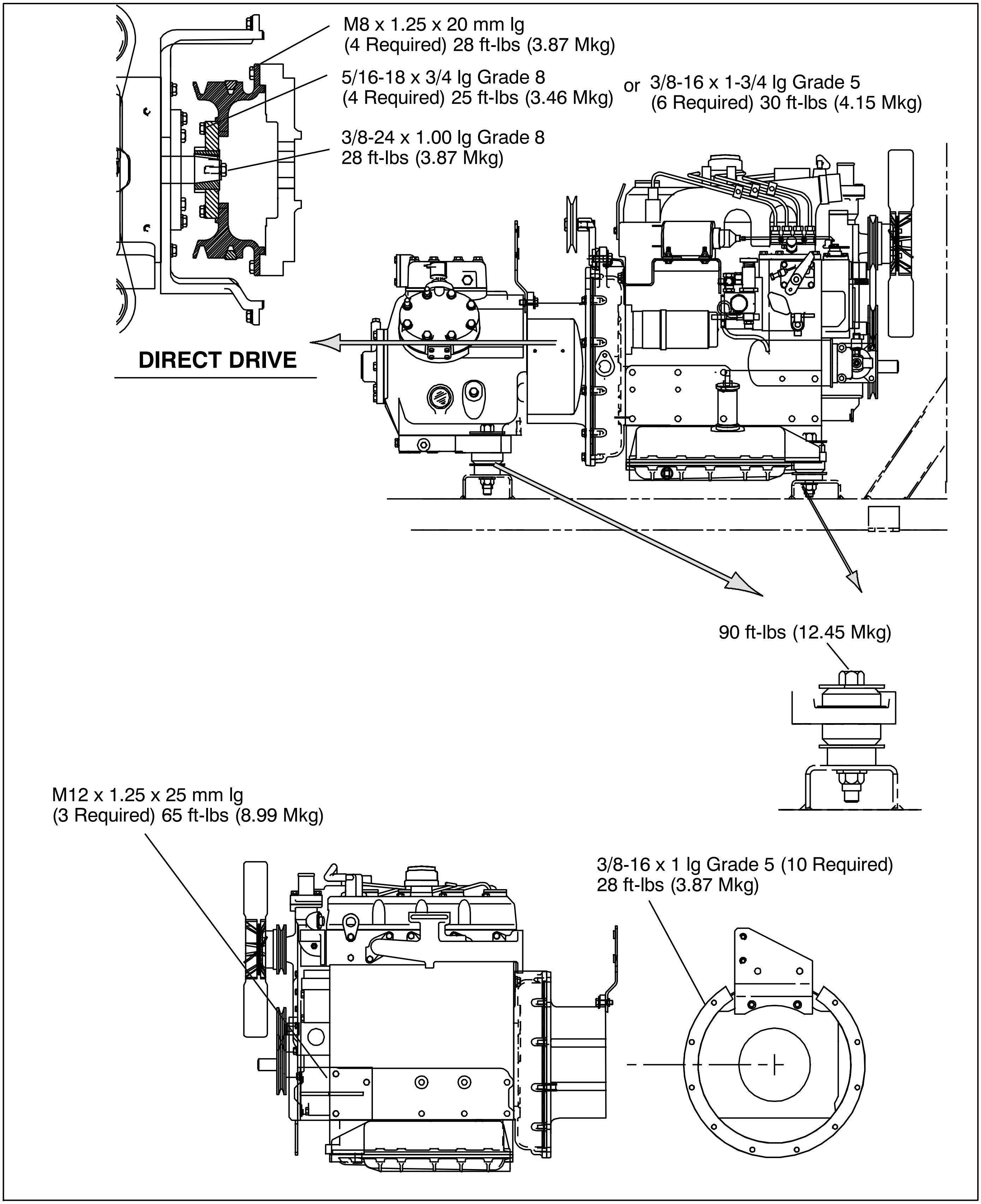


Figure 9-35. Unidrive Torque Requirements - Non ESC Engine

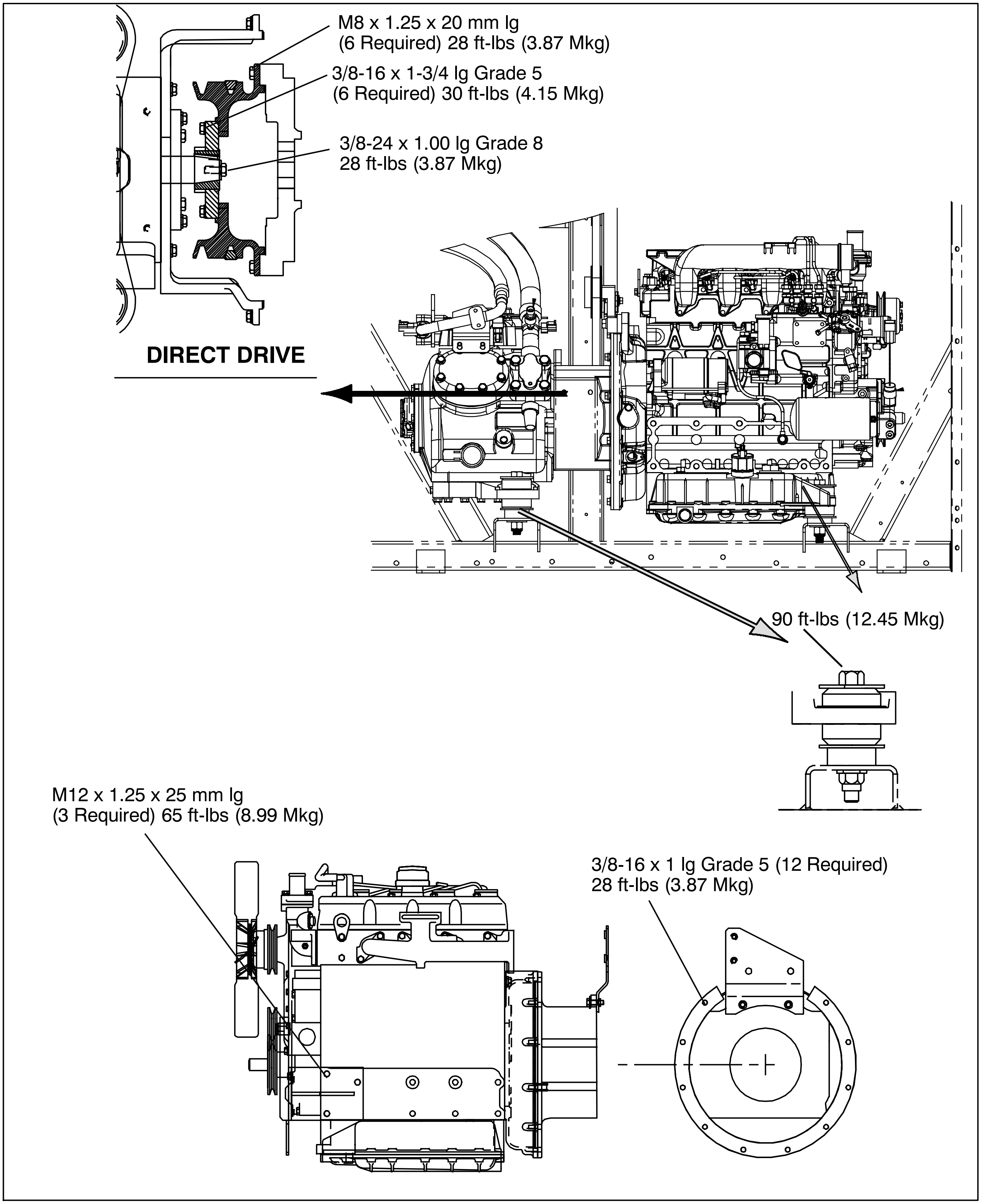


Figure 9-36. Unidrive Torque Requirements - Electronic Speed Control Engine

Table 9-9. R404A Temperature-Pressure Chart

Temperature		Pressure		Temperature		Pressure	
°C	°F	Bars	PSIG	°C	°F	Bars	PSIG
-40	-40	0.31	4.5	0	32	5.00	72.5
-37	-35	0.49	7.1	1	34	5.21	75.6
-34	-30	0.68	9.9	2	36	5.43	78.8
-32	-25	0.89	12.9	3	38	5.66	82.1
-29	-20	1.12	16.3	4	40	5.90	85.5
-28	-18	1.22	17.7	6	42	6.14	89.0
-27	-16	1.32	19.2	7	44	6.38	92.5
-26	-14	1.43	20.7	8	46	6.63	96.2
-24	-12	1.54	22.3	9	48	6.89	99.9
-23	-10	1.65	23.9	10	50	7.15	103.7
-22	-8	1.77	25.6	13	55	7.96	115.4
-21	-6	1.88	27.3	16	60	8.69	126.1
-20	-4	2.01	29.1	18	65	9.47	137.4
-19	-2	2.13	30.9	21	70	10.30	149.4
-18	0	2.26	32.8	24	75	11.18	162.1
-17	2	2.40	34.8	27	80	12.10	175.5
-16	4	2.54	36.8	29	85	13.07	189.6
-14	6	2.68	38.9	32	90	14.10	204.5
-13	8	2.83	41.1	35	95	15.18	220.2
-12	10	2.99	43.3	38	100	16.33	236.8
-11	12	3.14	45.6	41	105	17.53	254.2
-10	14	3.31	48.0	43	110	18.78	272.4
-9	16	3.47	50.4	46	115	20.11	291.6
-8	18	3.65	52.9	49	120	21.50	311.8
-7	20	3.83	55.5	52	125	22.95	332.9
-6	22	4.01	58.1	54	130	24.48	355.0
-4	24	4.20	60.9	57	135	26.07	378.1
-3	26	4.39	63.7	60	140	27.74	402.3
-2	28	4.59	66.5	63	145	29.48	427.6
-1	30	4.79	69.5	66	150	31.30	454.0

SECTION 10

UNIT TROUBLESHOOTING

SECTION 10

UNIT TROUBLESHOOTING

CAUTION

Under no circumstances should anyone attempt to service the Advance Microprocessor. See Section 10.4.1 for microprocessor troubleshooting. Should a problem develop with the Advance Microprocessor, contact your nearest Carrier Transicold dealer for replacement.

NOTE

Run a Pretrip and Check all active alarms before continuing with troubleshooting.

INDICATION / TROUBLE	POSSIBLE CAUSES	ACTION / REFERENCE SECTION
10.1 DIESEL ENGINE – See Table 10-1 and Figure 10–1 thru Figure 10–4 for ESC troubleshooting		
10.1.1 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	10.1.3
	Starter motor solenoid defective	Engine Manual
	Open starting circuit	10.1.4
	Incorrect grade of lubricating oil	2.7
	Unloaders not unloaded	9.14
	High refrigeration suction pressure	9.22
Starter motor cranks but engine fails to start	No fuel in tank	Check
	Air in fuel system	9.6
	Water in fuel system	Drain Sump
	Plugged fuel filter(s)	Replace
	Plugged fuel lines to injector(s)	Check
	ESC defective	10.4
Starter cranks, engages, but dies after a few seconds	Voltage drop in battery cable(s)	Check
	Engine lube oil too heavy	2.7.1
10.1.2 Engine Starts Then Stops		
Engine stops after several rotations	Fuel supply restricted	Check
	No fuel in tank	Check
	Leak in fuel system	Check
	Faulty fuel control operation	Engine
	Fuel filter restricted	Replace
	Injector nozzle(s) defective	Engine Manual
	Injection pump defective	Engine Manual
	Air cleaner or hose restricted	9.8.8
	Safety device open	2.12
	Fuel solenoid defective	Engine Manual
	Fuel pump (FP) malfunction	9.6

INDICATION / TROUBLE	POSSIBLE CAUSES	ACTION / REFERENCE SECTION
10.1.3Starter Motor Malfunction		
Starter motor will not crank or turns slowly	Battery insufficiently charged	Check
	Battery cable connections loose or oxidized	Check
	Battery cables defective	Replace
	Starter brushes shorted out	Engine Manual
	Starter brushes hang up or have no contact	Engine Manual
	Starter solenoid damaged	Engine Manual
	Glow/Crank switch defective	Replace
	Engine lube oil too heavy	2.7
Starter motor turns but pinion does not engage	Pinion or ring gear obstructed or worn	Clean both, remove burrs, or replace
Starter motor does not disengage after switch was depressed	Glow/Crank switch defective	Replace
	Starter motor solenoid defective	Engine Manual
	Engine is already running	Check
Starter motor does not disengage after engine is starts	Defective starter	Engine Manual
10.1.4Malfunction In The Engine Starting Circuit		
No power to starter motor solenoid (SS)	Battery defective	Check
	Loose electrical connections	Tighten
	ESC defective	10.4
	No power to Starter Solenoid connector	10.4
Fuel solenoid does not energize or does not remain energized	Battery defective	Check
	Loose electrical connections	Tighten
	Oil pressure safety switch (ENOPS) defective	Replace
	Run relay (RR) defective	Replace
	Engine coolant temp. (ENCT) defective	Replace
	Fuel solenoid defective	Engine Manual
	Start/Run-Off switch defective	Replace

INDICATION/ TROUBLE	POSSIBLE CAUSES	ACTION/ REFERENCE SECTION
10.1.5 Miscellaneous Engine Troubleshooting		
Loss of power	Restriction in air cleaner	9.8.8
	Air in fuel system	9.6
	Air vent restricted in fuel tank cap	Clean
	Restricted fuel lines	Engine Manual
	Defective fuel injection pump	Engine Manuall
	Defective injector(s) or incorrect type	Engine Manual
	Incorrect fuel injection pump timing	Engine Manuall
	Incorrect valve timing	Engine Manual
	Poor compression	Engine Manual
Vibration	Engine shockmounts defective	Replace
	Poor compression	Engine Manual
Overheating	Restriction in air cleaner	9.8.8
	Exhaust pipe restriction	Removel
	Restriction in water jacket	Engine Manual
	Restriction in radiator	9.8.1
	Coolant level too low	8.5.1
	Loose water pump	replace
	Defective thermostat	Engine Manual
	Defective water pump/belt	Engine Manual
Excessive crankcase pressure	Plugged crankcase breather line	9.8.9
10.2 ALTERNATOR (12 Volt DC)		
Alternator fails to charge	Limited charging system operating time	Check
	Battery condition	Check
	Alternator belt loose/broken	9.9
	Loose, dirty, corroded terminals, or broken leads	Check/Repair
	Excessively worn, open or defective brushes	Check
	Open blocking diode	Check
	Regulator faulty	Check
	Open isolation diode	Check
	Open rotor (field coil)	Replace
Low or unsteady charging rate	Alternator belt loose	9.9
	Loose, dirty, corroded terminals, or broken leads	Check/Repair
	Excessively worn, sticky or intermittent brushes	Check
	Faulty regulator	Check
	Grounded or shorted turns in rotor	Check
	Open, grounded or shorted turns in stator	Replace
Excessive charging rate (as evidenced by battery requiring too frequent refilling) or amp reading shows constant high amp charge.	Regulator leads loose, dirty, corroded terminals, or wires broken	Clean/Repair
	Defective regulator	Check

INDICATION/ TROUBLE	POSSIBLE CAUSES	ACTION/ REFERENCE SECTION
10.2 ALTERNATOR (12 Volt DC) - cont.		
Noisy alternator	Defective or badly worn V-belt	9.9
	Worn bearing(s)	Replace
	Misaligned belt or pulley	9.9
	Loose pulley	Tighten
10.3 REFRIGERATION / TEMPERATURE CONTROL		
10.3.1Unit Will Not Cool		
Diesel engine	Malfunction(s)	10.1
Compressor malfunction	Compressor drive defective	9.12
	Compressor defective	9.12
Refrigeration system	Defrost cycle did not terminate	10.3.8
	Abnormal pressure	10.3.9
	Solenoid valve malfunction	10.3.15
	Clutch Failure	9.10.5
	Check system for non-condensables	NO TAG
10.3.2Unit Runs But Has Insufficient Cooling		
Compressor	Compressor valves defective	9.12
	Unloader malfunction	9.14
Refrigeration system	Abnormal pressure	10.3.9
	Unloader malfunction	9.14
	Expansion valve malfunction	10.3.13
	No or restricted evaporator airflow	10.3.12
	Clutch Failure	9.10.5
Engine does not develop full rpm	Speed control linkage	9.8.6
	Engine malfunction	10.1
10.3.3System Will Not Pump Down		
	Check SV4	9.21.1
	Check by-pass check valve	9.15
	Check SV2	9.21.1
	Check king valve	
	Check compressor	
10.3.4Unit Operates Long Or Continuously In Cooling		
Refrigerated Compartment	Hot Load	Pre-cool product
	Defective box insulation or air leak	Correct
Refrigeration system	Abnormal pressure	10.3.9
	Temperature sensor malfunction	Check
	Check system for non-condensables	NO TAG
Compressor	Defective	9.12

INDICATION/ TROUBLE	POSSIBLE CAUSES	ACTION/ REFERENCE SECTION
10.3.5 Unit Will Not Terminate Cooling		
Unit fails to stop cooling	Temperature sensor malfunction	Check
	Microprocessor improperly set	Check set point Check whether microprocessor is set at °C or °F
10.3.6Unit Will Not Heat Or Has Insufficient Heating		
Refrigeration	Abnormal pressure	10.3.9
	Temperature sensor malfunction	10.3.11
	Solenoid valve malfunction	10.3.15
	1/4" check valve (bypass) defective	9.15
	Clutch Failure	9.10.5
Compressor	Compressor drive defective	9.12
	Compressor defective	9.12
Engine does not develop full rpm	Engine malfunction	10.1
	FSA malfunction	10.4
	Diagnostic code on ENSCU	10.4
10.3.7 Unit Will Not Terminate Heating		
Unit fails to stop heating	Microprocessor temperature improperly set	Reset
	Microprocessor malfunction	10.4.1
	Temperature sensor malfunction	Check
10.3.8Defrost Cycle Malfunction		
Will not initiate defrost automatically	Defrost air switch (DAS) out of calibration	9.25.2
	DTT2 is above 40°F (4.4°C)	Cool Box Down
	Defrost air switch (DAS) defective	9.24 & 9.25.2
	Loose terminal connections	Tighten
	Air sensing tubes defective or disconnected	Check
Will not initiate defrost manually	Keypad defective	Replace
	Loose terminal connections	Tighten
	DTT2 is above 40°F (4.4°C)	Cool Box Down
	Unit has been running less than 15 seconds	Try again
Initiates but does not defrost	Low refrigerant charge	NO TAG
	Solenoid valve malfunction	10.3.15
	Clutch/Gearbox defective	Replace
Frequent defrost	Defrost air switch (DAS) out of adjustment	9.24 & 9.25.2
	Wet load	Normal
Does not terminate or cycles on defrost	Low refrigerant charge Defrost air switch (DAS) out of adjustment	NO TAG 9.24 & 9.25.2
Refrigerated Compartment	Hot Load	Allow time to pull down
	Defective or insufficient refrigerated compartment insulation or air leak	Correct

INDICATION/ TROUBLE	POSSIBLE CAUSES	ACTION/ REFERENCE SECTION
10.3.9Abnormal Pressure a. Cooling		
High discharge pressure	Condenser coil dirty	9.27
	Condenser fan defective	9.10
	V-belt broken or loose	9.9
	Discharge check valve restricted	9.15
	Non−condensables or refrigerant overcharge	NO TAG and Table 2-1
	Solenoid valve (SV1) malfunction	9.21.2
Low discharge pressure	SV4 leaking	9.21
	Compressor valves(s) worn or broken	9.12
High suction pressure	SV4 leaking	9.21
	Compressor valves(s) worn or broken	9.12
	Compressor gasket(s) defective	9.12
Low suction pressure	Suction service valve partially closed	Open
	King valve partially closed	Open
	Filter-drier partially plugged	9.16
	Low refrigerant charge	NO TAG
	Expansion valve malfunction	10.3.13
	No evaporator air flow or restricted air flow	10.3.12
	Excessive frost on coil	9.24
	Solenoid valve (SV2) defective	9.21
	Clutch Failure	9.10.5
	Suction modulation valve malfunction	9.22
Suction and discharge pressures tend to equalize when unit is operating	Compressor valves defective	9.12
	Compressor gasket(s) defective	9.12
b. Heating		
High discharge pressure	Solenoid valves (SV1 and SV4) malfunction	10.3.15
	Condenser fan defective	9.10
	V-belts broken or loose	9.9
	Non-condensables in system	NO TAG
Low discharge pressure	Compressor valve(s) worn or broken	9.12
	Solenoid valve (SV1) malfunction	10.3.15
	Low refrigerant charge	NO TAG
Low suction pressure	Refrigerant shortage	NO TAG
	Solenoid (SV1) open	10.3.15

INDICATION/ TROUBLE	POSSIBLE CAUSES	ACTION/ REFERENCE SECTION
10.3.10 Abnormal Noise		
Compressor	Loose mounting bolts	Tighten
	Worn bearings	9.12
	Worn or broken valves	9.12
	Liquid slugging	10.3.13
	Insufficient oil	9.13
Condenser or evaporator fan	Loose or striking shroud	Check
	Bearings defective	9.10
	Bent shaft	9.10
Clutch/Gearbox	Defective	Replace
V-belts	Cracked or worn	9.9
10.3.11 Control System Malfunction		
Will not control	Sensor defective	9.28
	Relay(s) defective	Check
	Microprocessor malfunction	Check
10.3.12No Evaporator Air Flow Or Restricted Air Flow		
Evaporator coil blocked	Frost on coil	9.24
	Dirty coil	9.26
No or partial evaporator air flow	V-belt broken or loose	9.9
	Clutch/Gearbox defective	Replace
	Evaporator fan loose or defective	9.10
	Evaporator fan rotating backwards	9.9
	Evaporator air flow blocked in refrigerated compartment	Check
10.3.13 Expansion Valve Malfunction		
Low suction pressure with high superheat	Low refrigerant charge	NO TAG/ NO TAG
	External equalizer line plugged	Clean
	Ice formation at valve seat	NO TAG
	Wax, oil or dirt plugging valve or orifice	Clean
	Broken capillary	9.11
	Power assembly failure or partial loss of element/bulb charge	Replace
	Superheat setting too high	9.11.2
Low superheat and liquid slugging in compressor	Superheat setting too low	9.11.2
	External equalizer line plugged	Clean
	Ice holding valve open	NO TAG
	Foreign material in valve	Clean
	Pin and seat of expansion valve eroded or held open by foreign material	Clean
Fluctuating suction pressure	Improper bulb location or installation	Figure 9-16
	Low superheat setting	9.11.2
High superheat	Broken capillary	Replace

INDICATION/ TROUBLE	POSSIBLE CAUSES	ACTION/ REFERENCE SECTION
10.3.14 Compressor Suction Modulation Valve (CSMV) Malfunction		
CSMV not controlling correctly	Coil not seated properly	Check
	Coil defective	Check and Re-place
	Loose connector	Check and Tighten
	CSP defective	Check and Re-place
	CDT defective	Check and Re-place
	CDP defective	Check and Re-place
10.3.15 Solenoid Valve Malfunction (SV1, 2 OR 4)		
Solenoid valve does not function properly	No power to valve	Check
	Improper wiring or loose connections	Check
	Coil defective	9.21
	Valve improperly assembled	9.21
	Coil or coil sleeve improperly assembled	9.21
	Movement of plunger restricted due to: a. Corroded or worn parts b. Foreign material lodged in valve c. Bent or dented enclosing tub	 9.21 9.21 9.21
Solenoid valve closes but refrigerant continues to flow	Foreign material lodged under seat	Clean
	Defective seat	Replace

10.4 ELECTRONIC SPEED CONTROL TROUBLESHOOTING

Table 10-1. ENSCU LED Fault Chart (See following pages for troubleshooting trees)

	Fault	LED display pattern	Failed component
1	Engine Over Speed: more than 2,530 RPM	One Long–One Short	ENSSN or mechanical engine problem
2	No signal from ENSSN for 2 seconds after RPM is greater than 1,000 RPM for 10 seconds, **OR** for 5 seconds while engine cranking (no voltage at pin 18 of ENSCU).	Two Long–One Short	ENSSN or wiring problem
3	Actuator (FSA) wiring disconnected or open circuit. Coil Resistance Spec: 2.8 ohm +/- 10%.	Two Long–Three Short	FSA or wiring problem
4	ENSCU supply voltage is greater than 26V.	Two Long–Seven Short	ENSCU or alternator problem

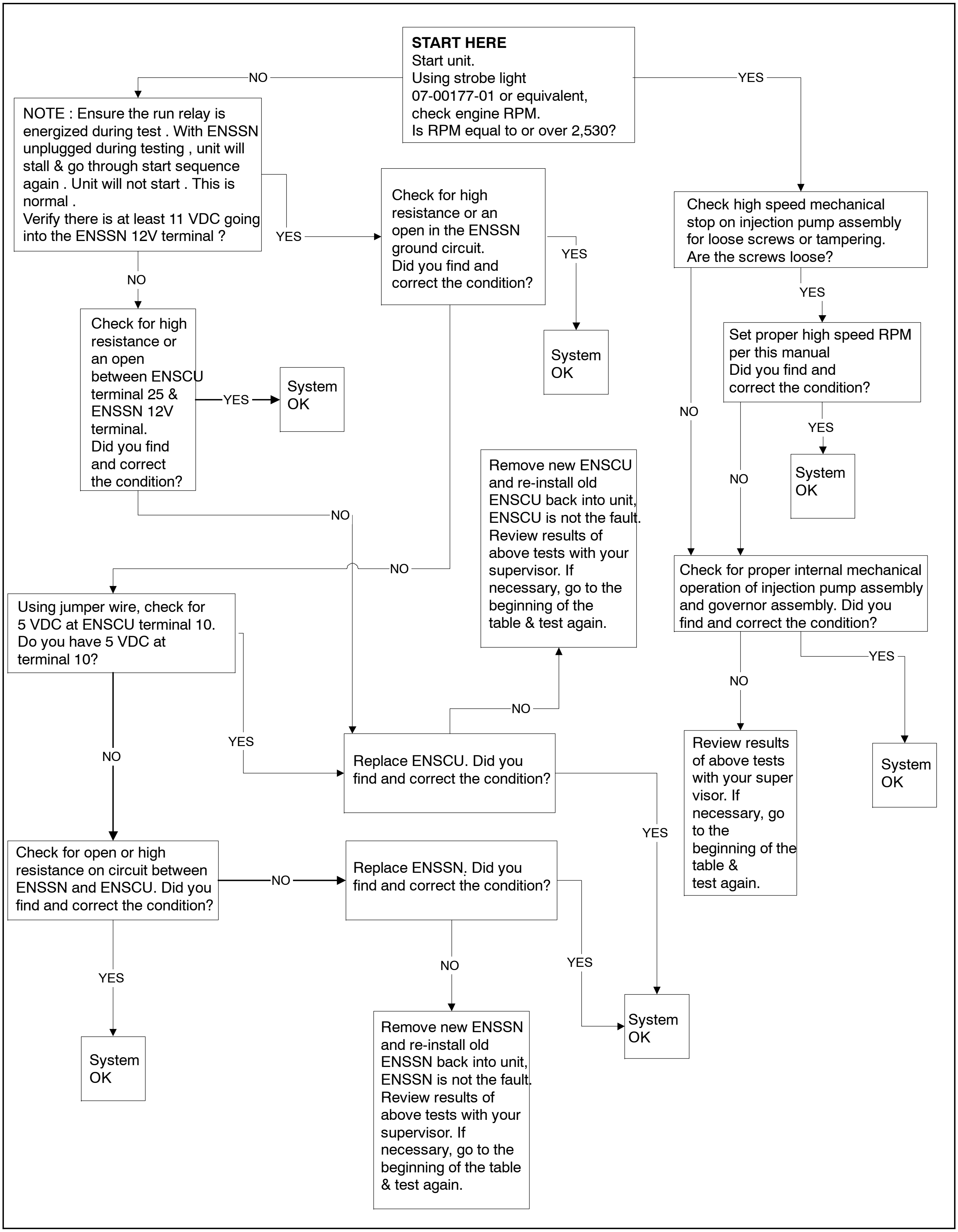


Figure 10-1. ESC Diagnostic Tree – 1 Long, 1 Short LED Code

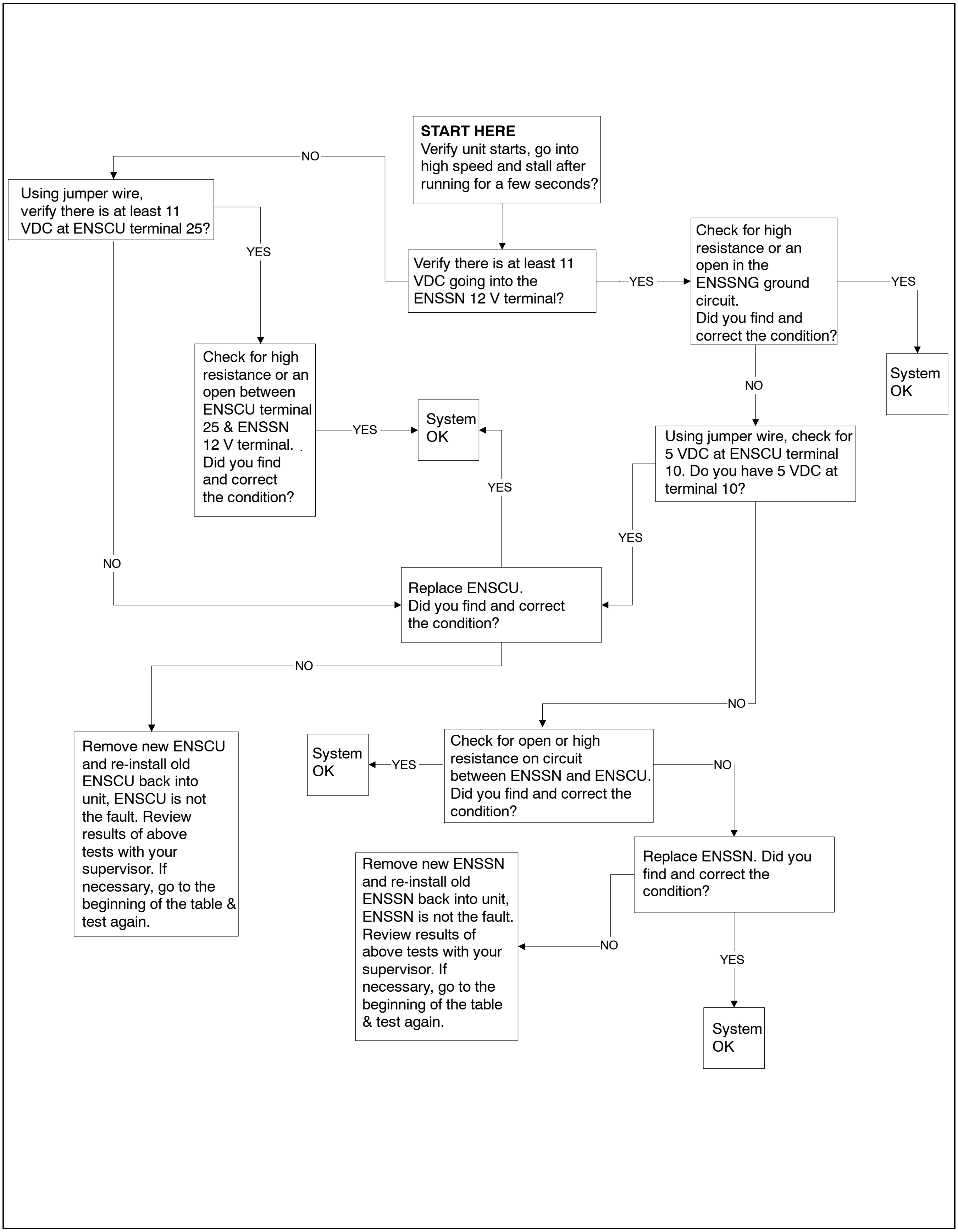


Figure 10-2. ESC Diagnostic Tree – 2 Long, 1 Short LED Code

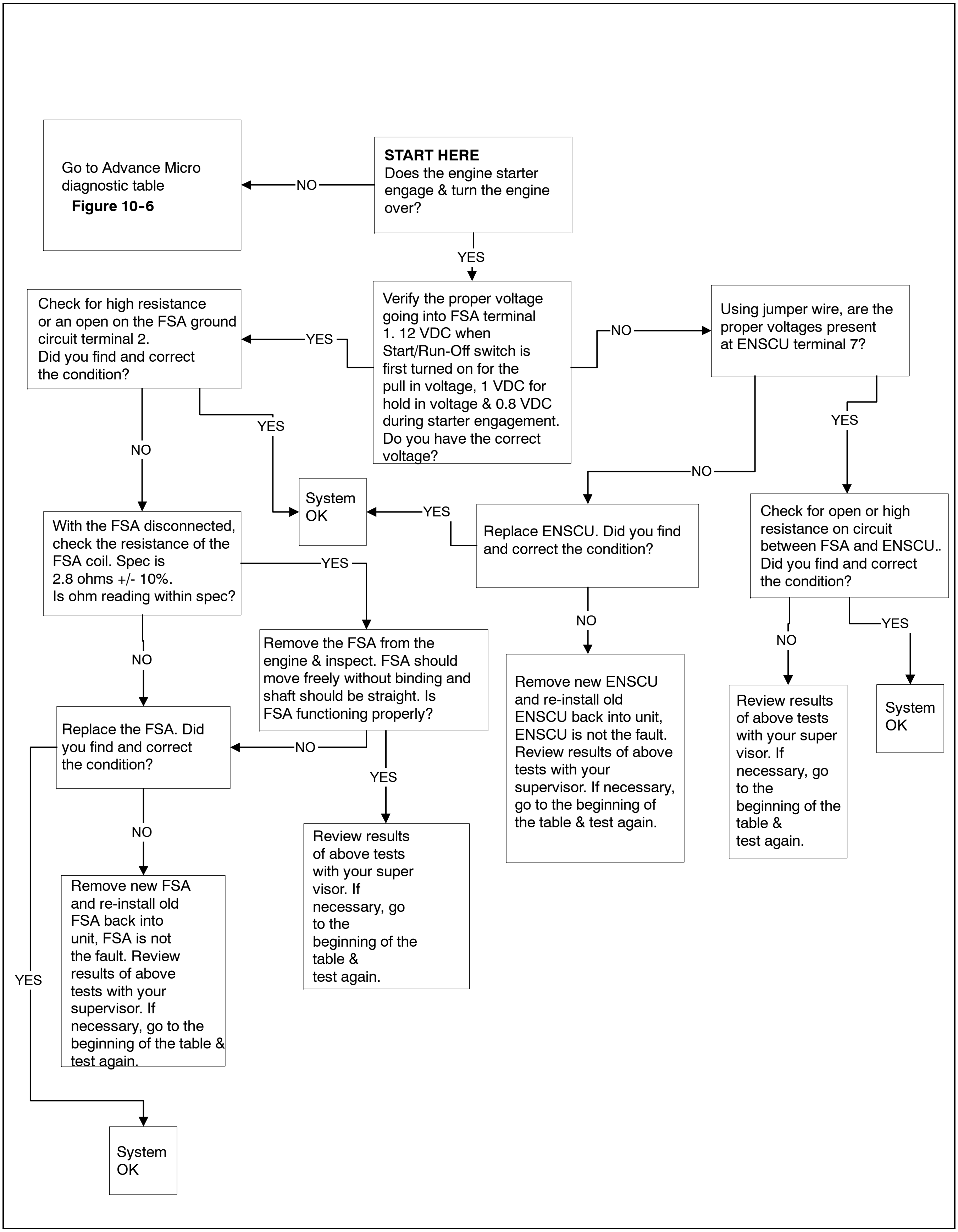


Figure 10-3. ESC Diagnostic Tree – 2 Long, 3 Short LED Code

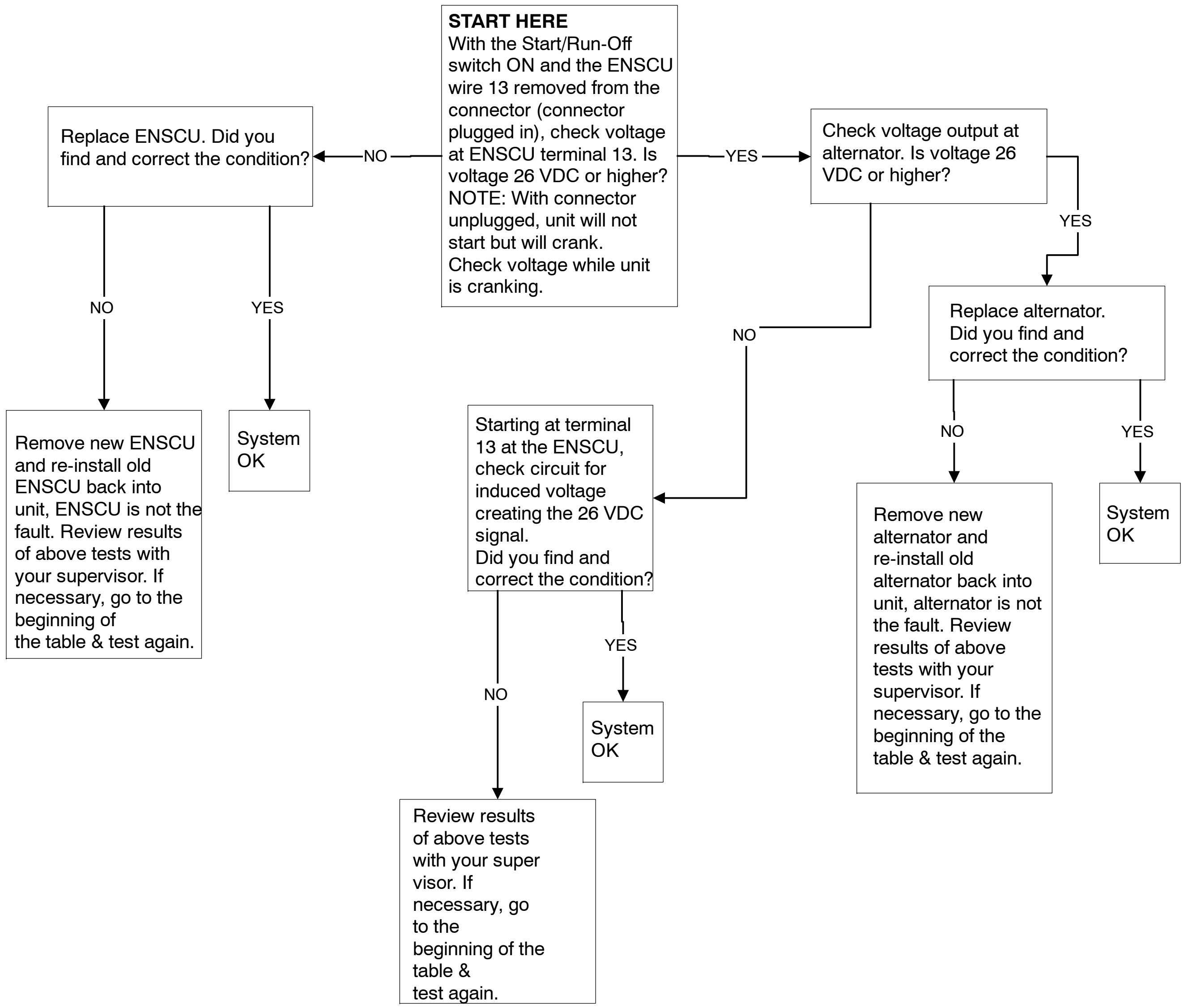


Figure 10-4. ESC Diagnostic Tree - 2 Long, 7 Short LED Code

10.4.1 Advance Microprocessor Troubleshooting Guide

The purpose of the following procedure is to provide a logical and straightforward guide to be used when troubleshooting operational or other problems occurring with the microprocessor. Often users and technicians have mistakenly worked to correct a problem that has ended up being normal operation. The microprocessor has several different conditions contributing to operating parameters. These conditions are called out in the various diagnostic charts to aid the technician in pinpointing the problem, or in realizing that the unit is performing normally.

When using these tables, it is important to verify the reported symptom or problem and then correctly identify the appropriate table for that particular condition. Using the incorrect table will lead to an incorrect diagnosis. A table of contents is included to easily identify the correct table to use.

When using these Diagnostic Tables, it is very important not to skip any steps. Follow the flow of the tables in the order that they are laid out. These tables are formatted into a logical troubleshooting sequence. Skipping around the tables will most likely lead to errors in diagnosis.

Throughout the tables, the steps will point the technician to areas to look at or check for a problem. Most of the steps will lead the technician to a circuit or other area of the unit to check, test, and possibly repair other than the microprocessor. Some steps will point to a possible problem with the microprocessor. Whenever reaching one of these steps, it is a very good practice to install the new microprocessor, then verify unit operation PRIOR TO writing hours, Trailer ID, Unit Serial Number, etc., into the new microprocessor. Once the technician is satisfied that a new microprocessor is required, the hours, trailer ID, unit serial number, customer configurations, or IntelliSets, etc., should be entered. Should the problem remain even with the new microprocessor in place, once all repairs are made, the original microprocessor is to be reinstalled into the unit, to avoid unnecessary costs to the customer or having the Warranty Request rejected if there is no problem found with the returned microprocessor.

All steps leading to replacement of the microprocessor have a number associated with them. When filling out the MPR tag that will be attached to the returned part, write the step number on the upper half of the tag in the Failure Description Field. Include the same information in the Failure Description Field when entering the warranty claim information on line. This will show which diagnostic table was used and the path that was followed to determine the micro was at fault.

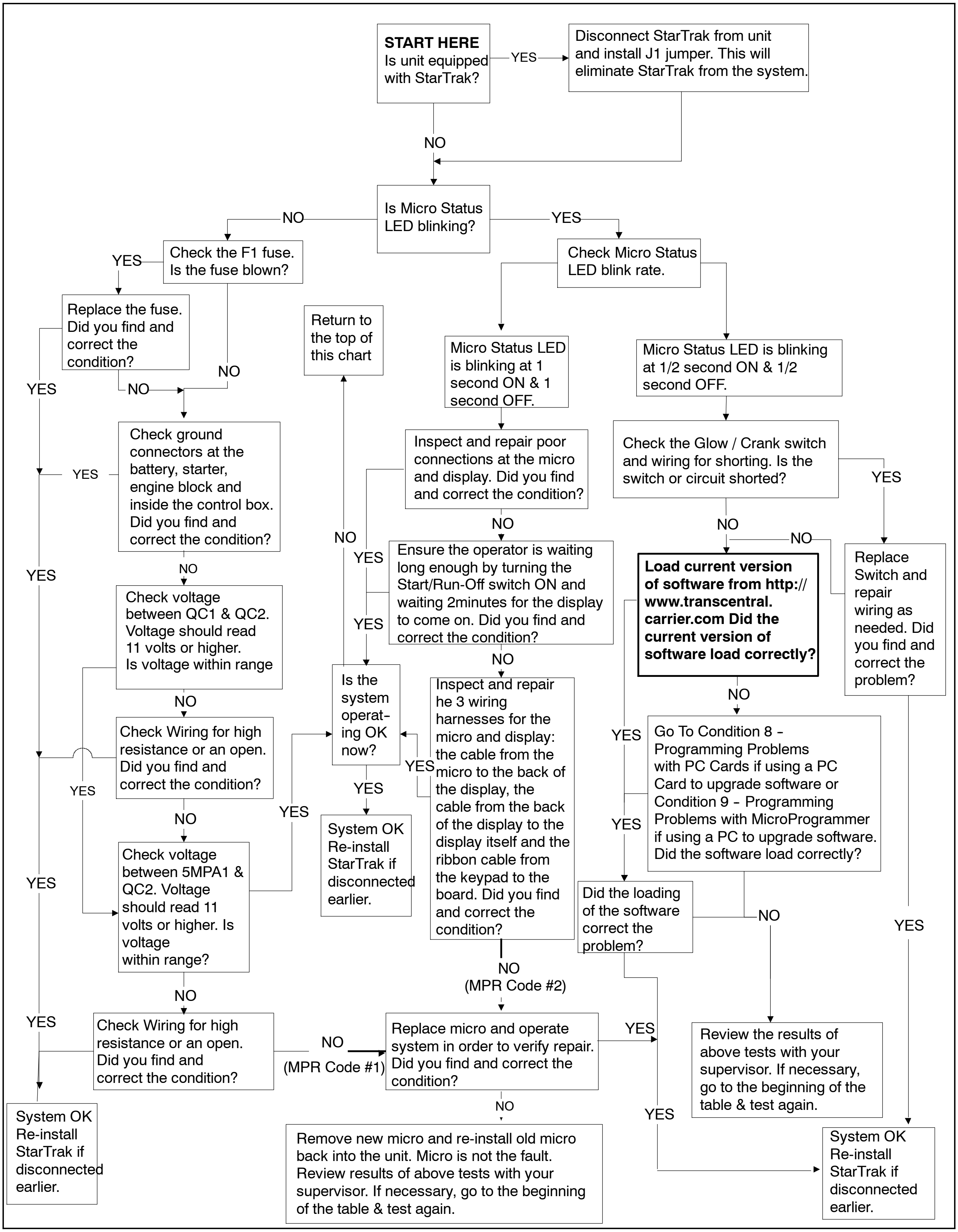


Figure 10-5. Micro Diagnostic Tree - Cond. 1 - Start/Run-Off Switch On - Unit Does Not Operate

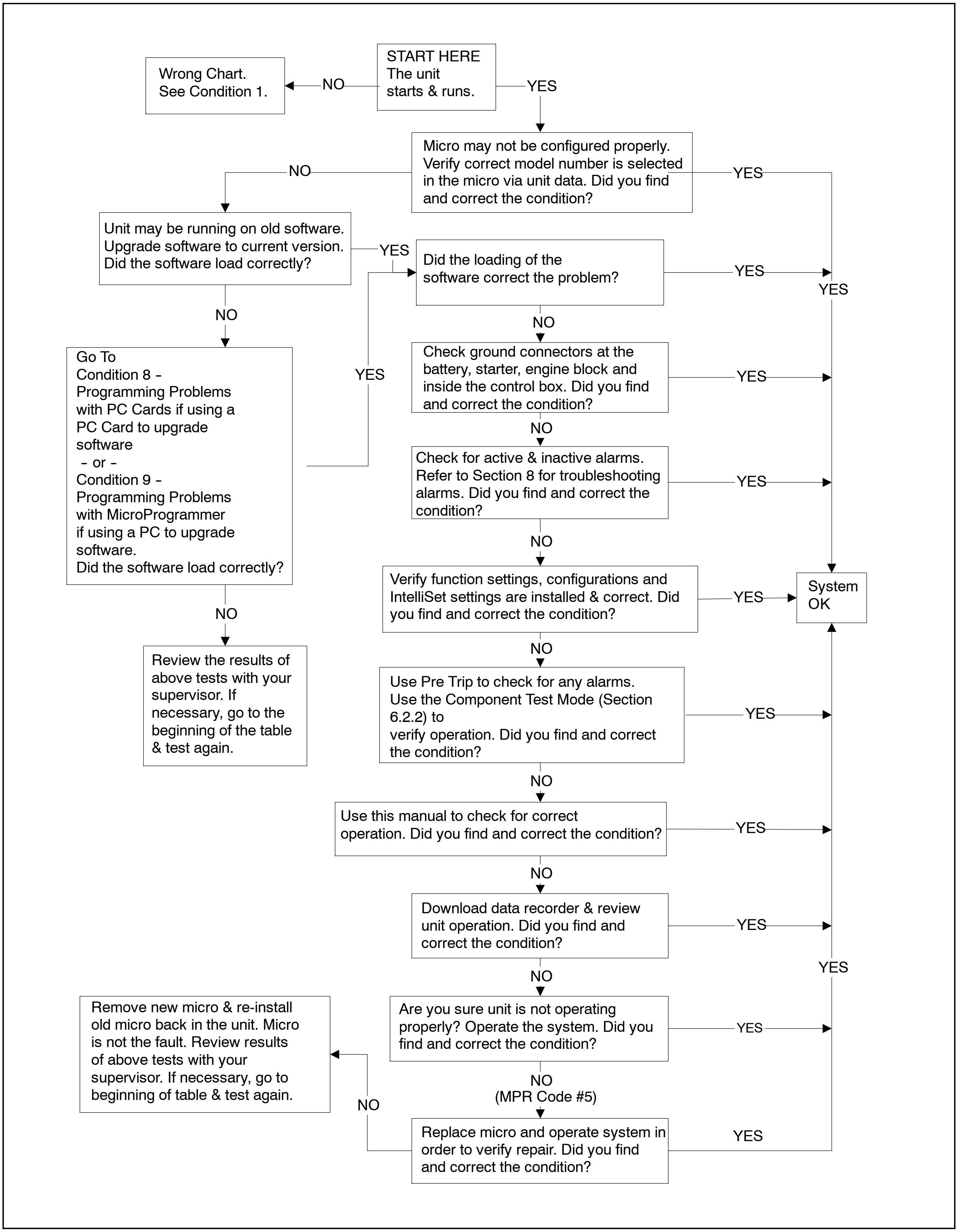


Figure 10-6. Micro Diagnostic Tree – Cond. 2 – Start/Run-Off Switch On – Unit Operates But Not Properly

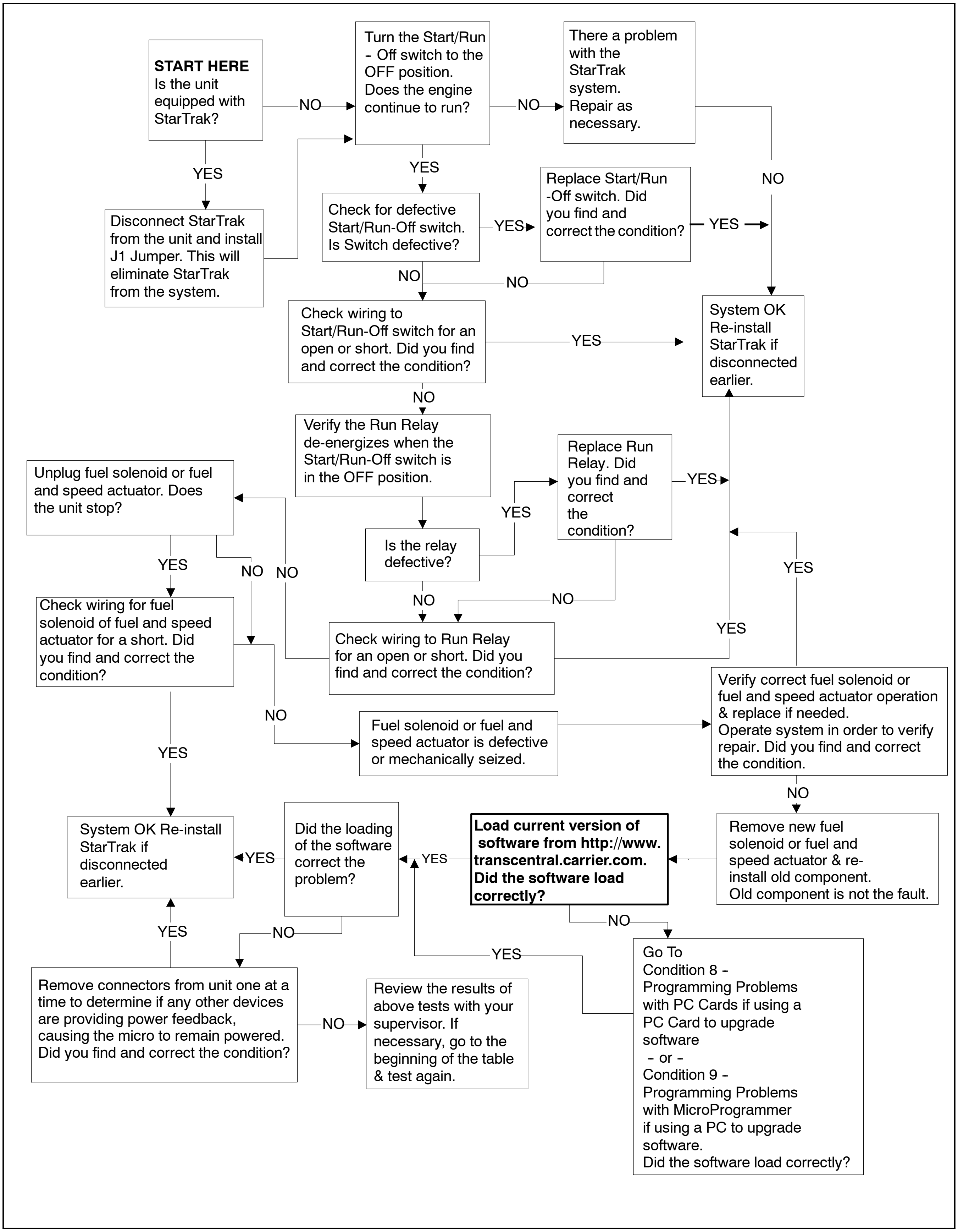


Figure 10-7. Micro Diagnostic Tree – Cond. 3 – Start/Run-Off Switch Off – Unit Fails To Stop

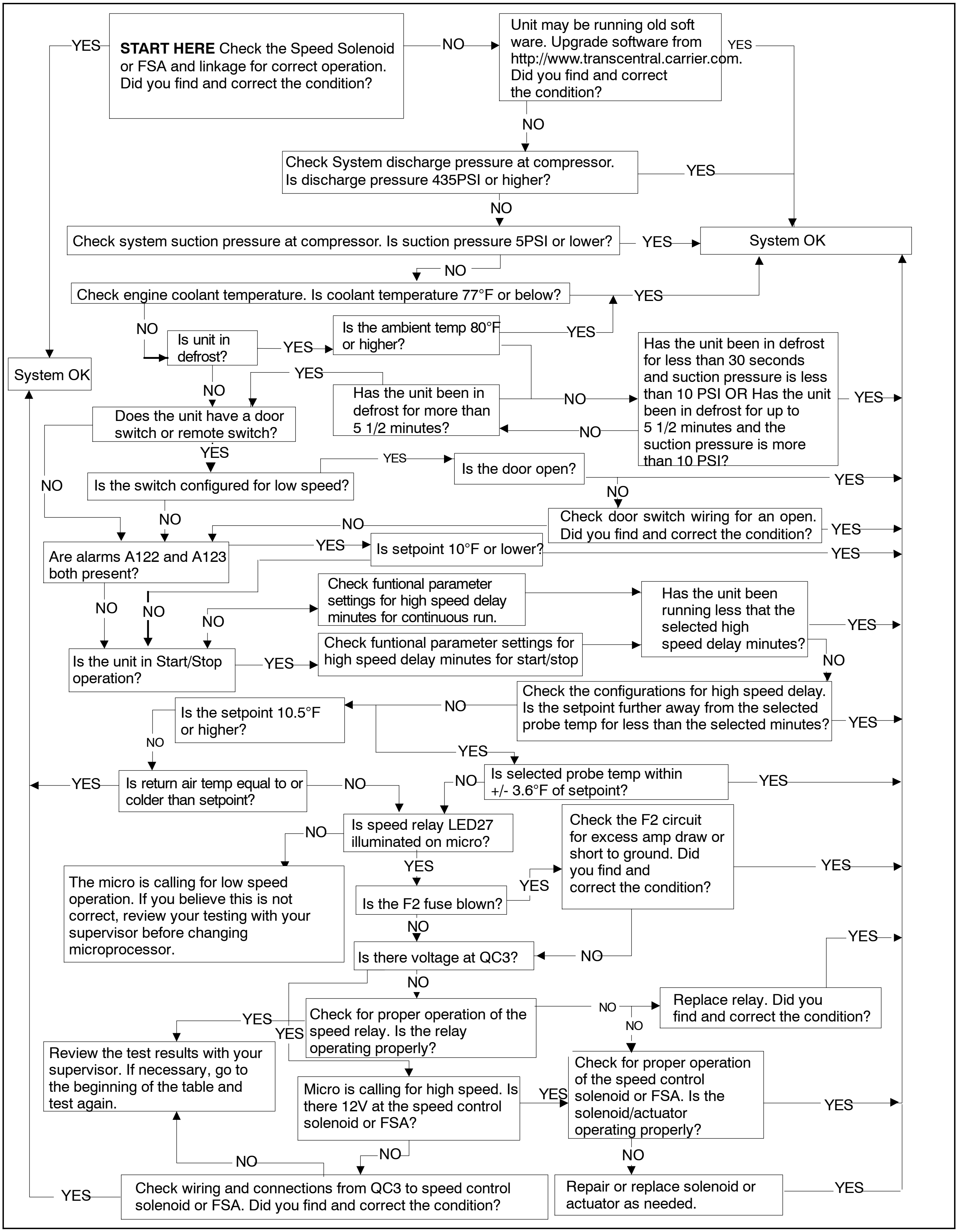


Figure 10-8. Micro Diagnostic Tree - Cond. 4 - Unit Will Not Run In High Speed

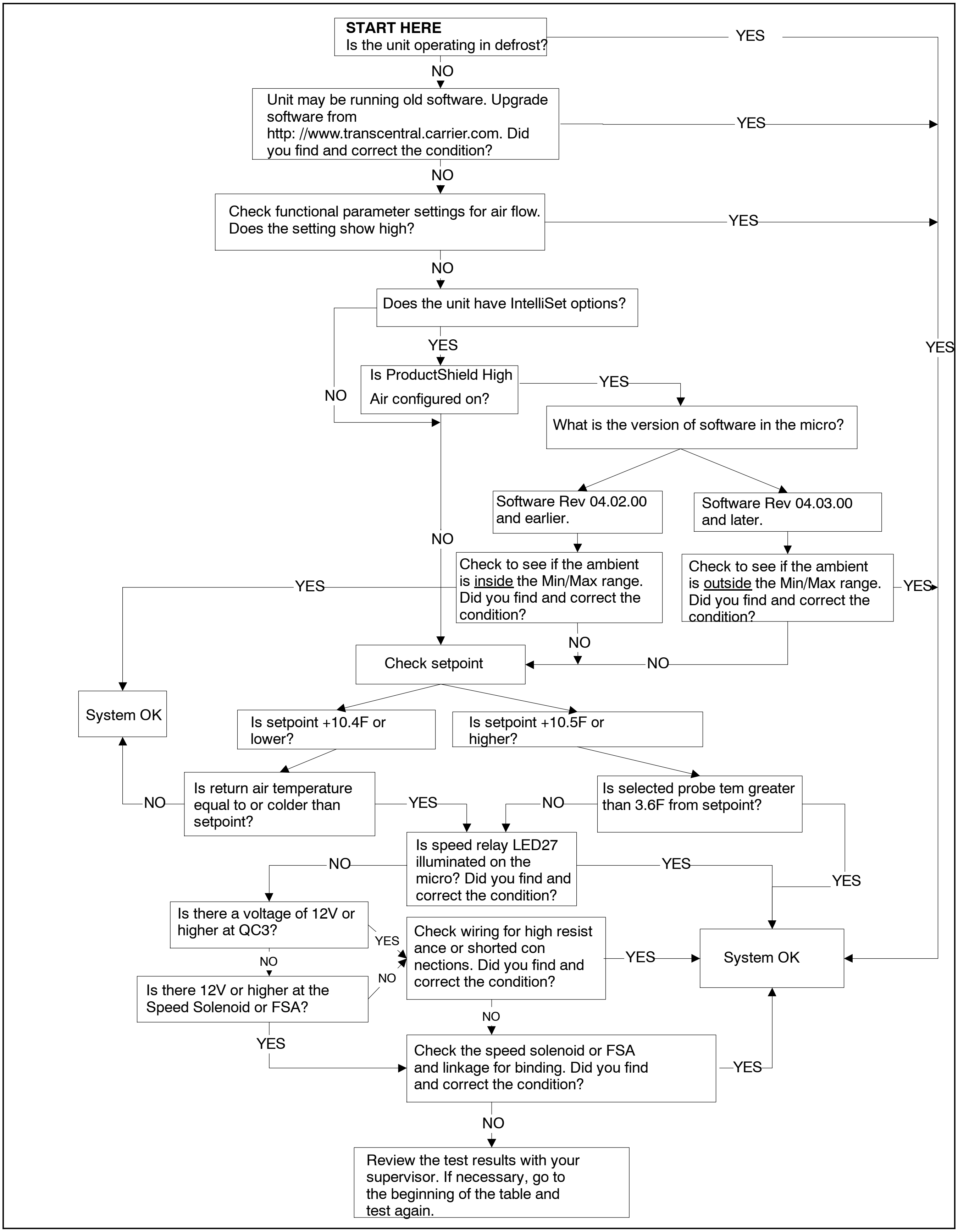


Figure 10-9. Micro Diagnostic Tree – Cond. 5 – Unit Will Not Run In Low Speed

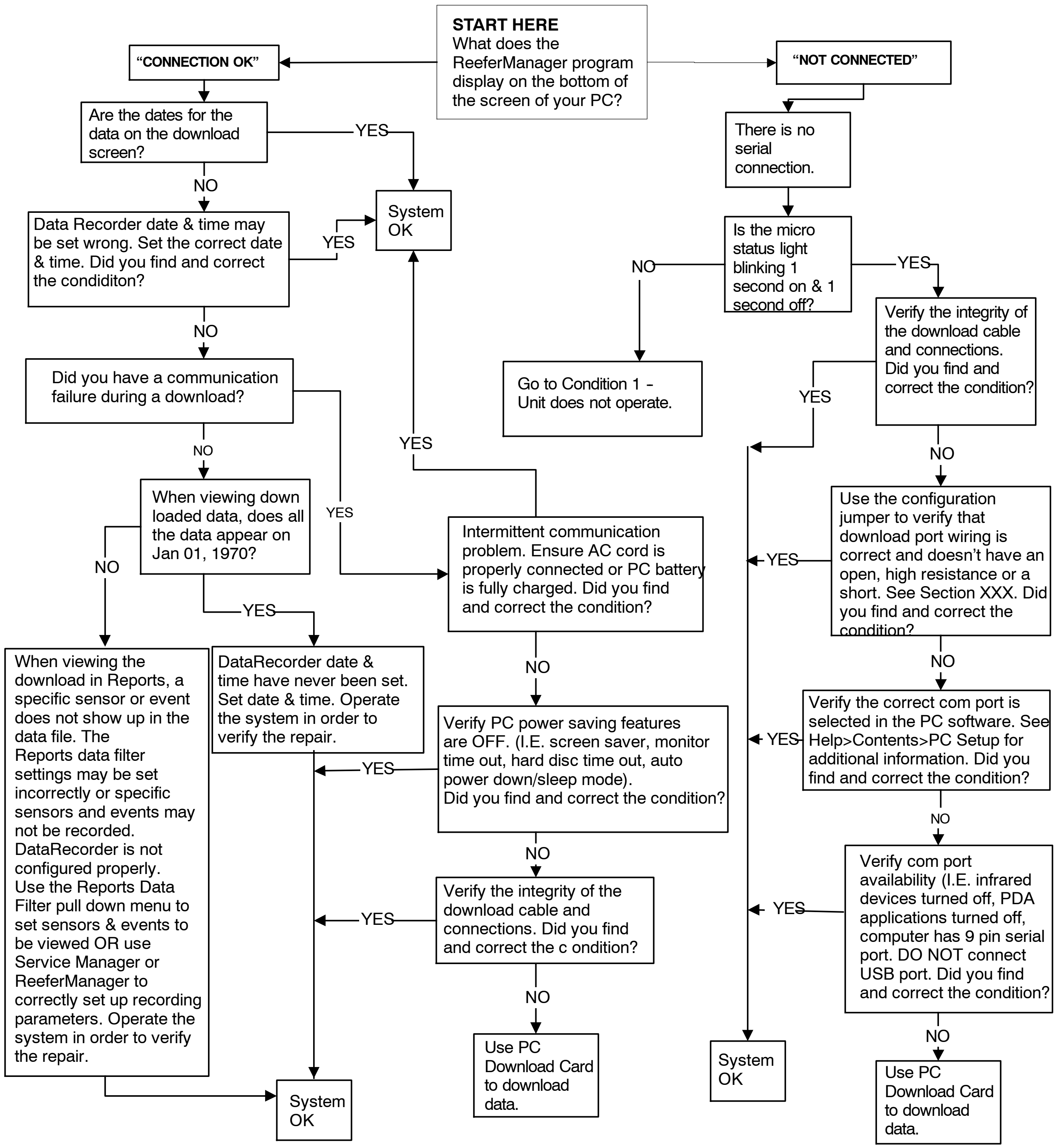


Figure 10-10. Micro Diagnostic Tree - Cond. 6 - Data Recorder Data Download Problems When Using ReeferManager and a Download Cable. Data File Analysis Problems Using Reports

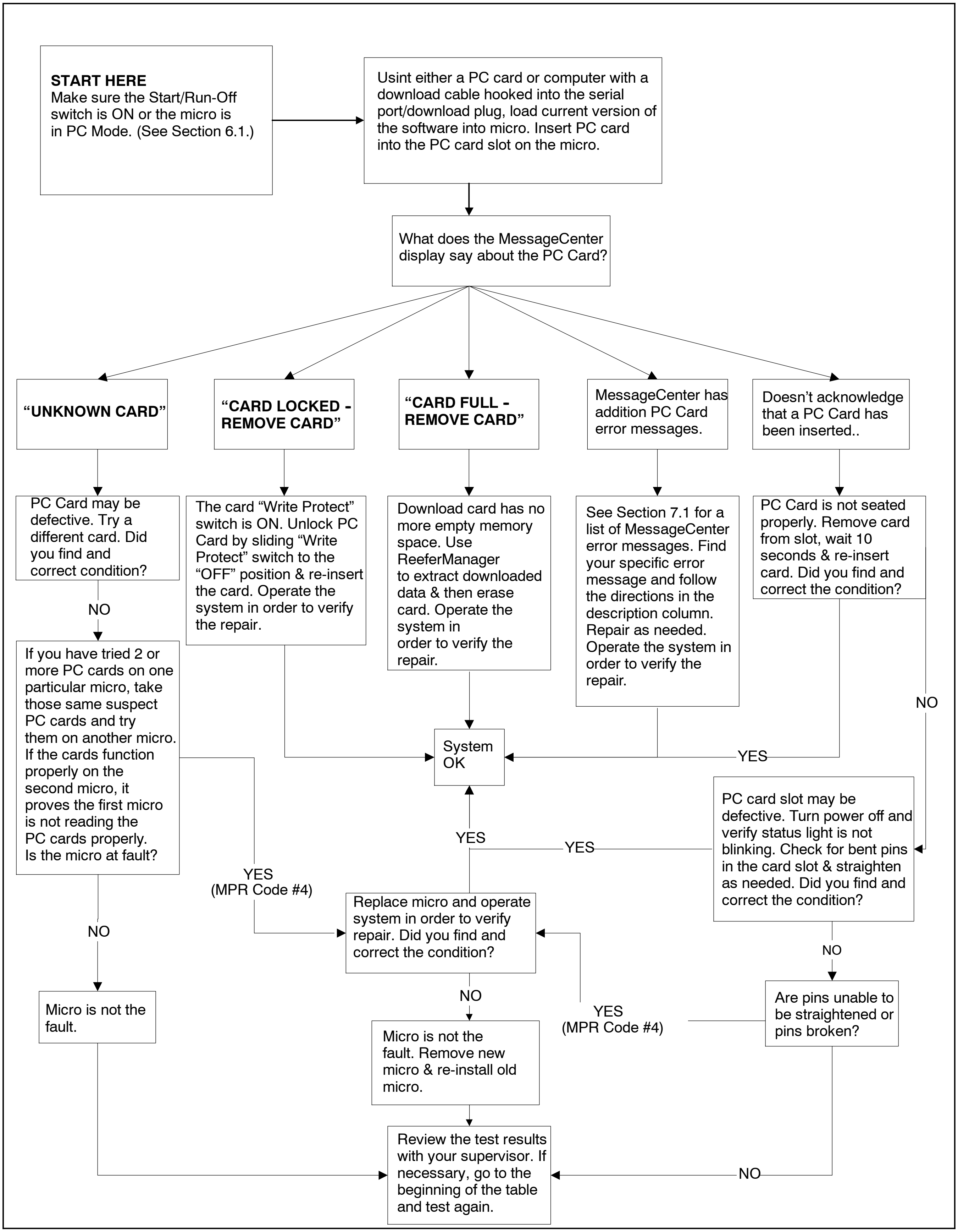


Figure 10-11. Microprocessor Diagnostic Tree - PC Card Problems

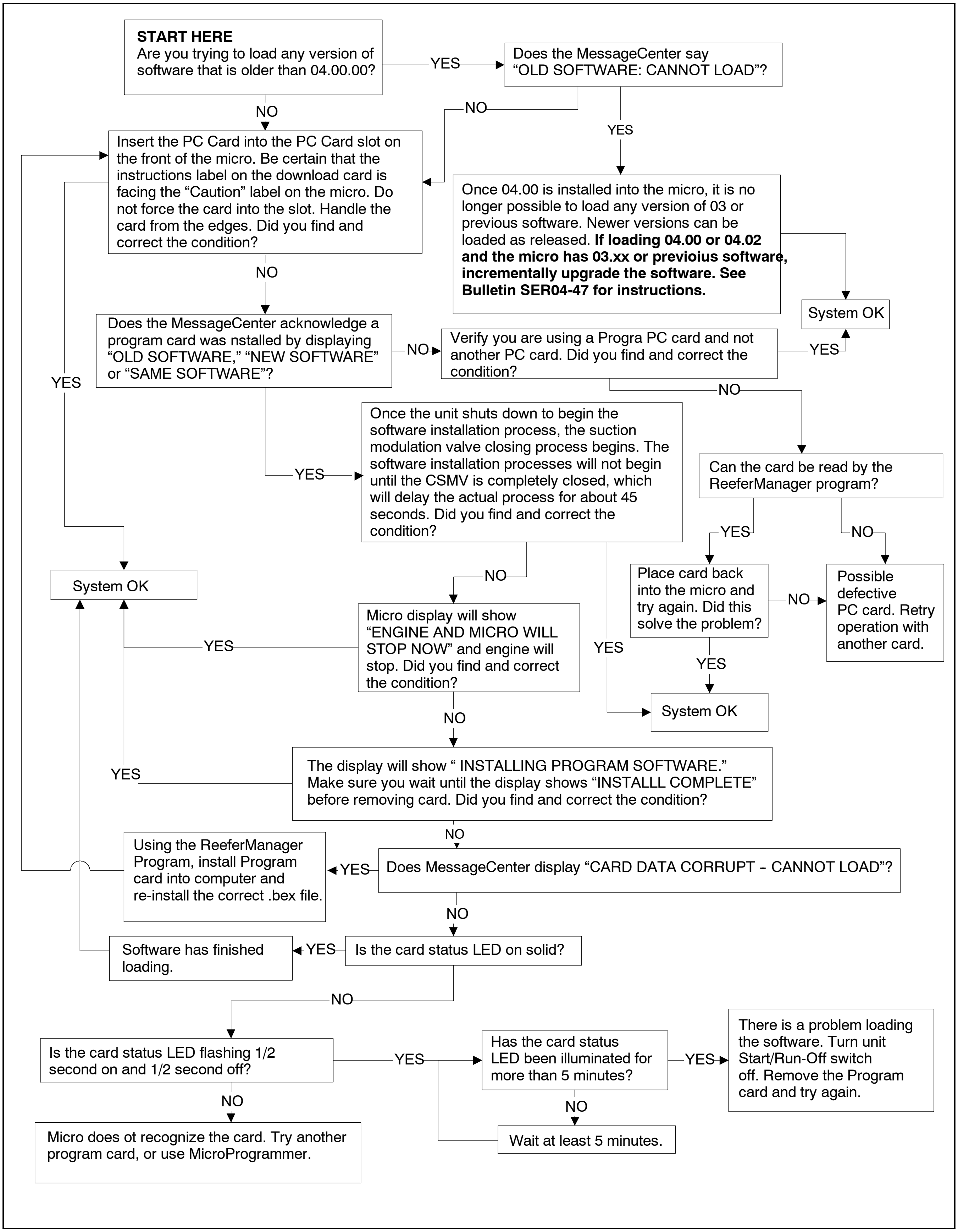


Figure 10-12. Micro Diagnostic Tree – Cond. 8 – Programming Problems With PC Cards

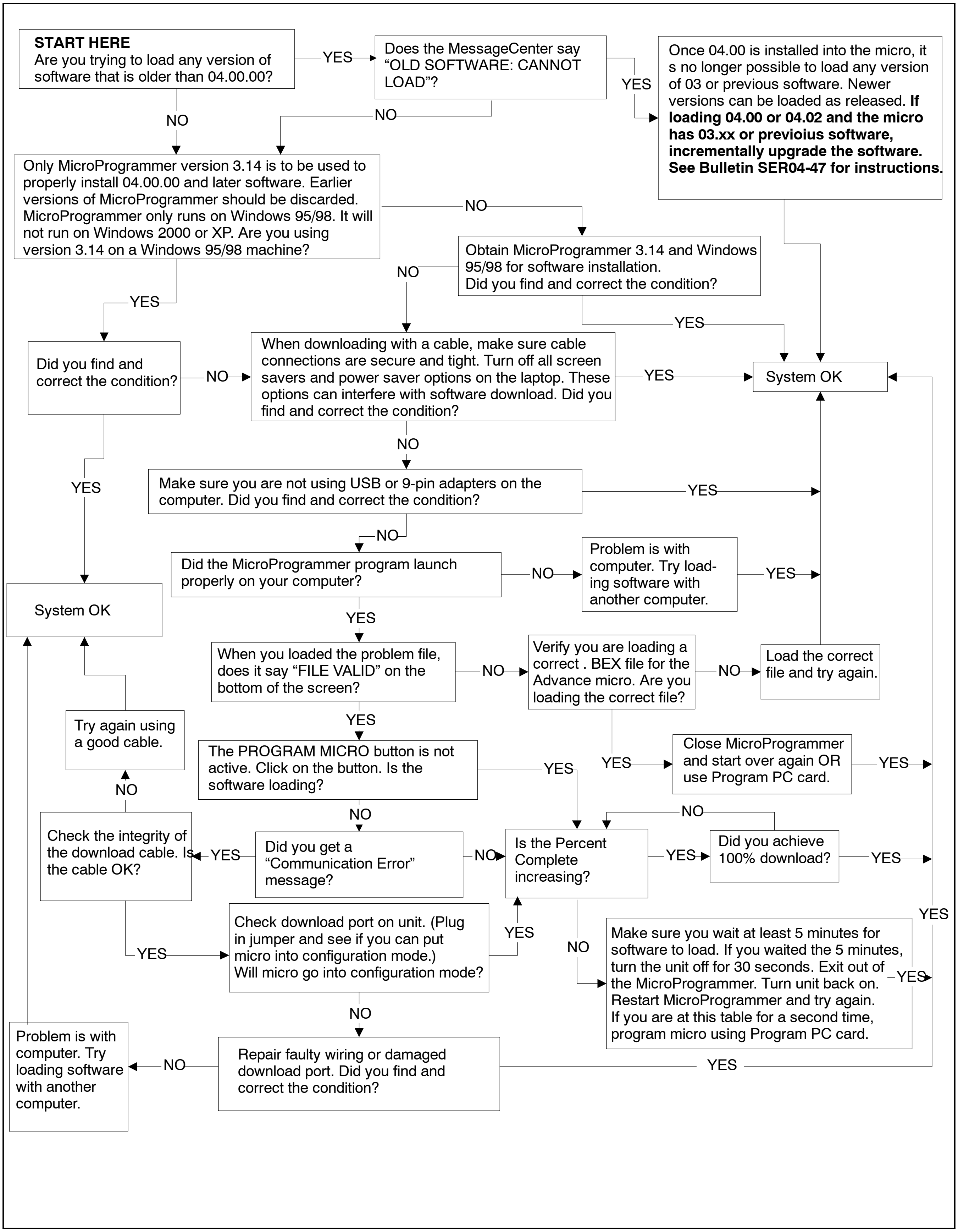


Figure 10-13. Micro Diagnostic Tree - Cond. 9 - Programming Problems With MicroProgrammer

10.5 Compressor Troubleshooting Guide

The purpose of the following procedure is to provide a logical and systematic method of determining whether 06D compressor repair or replacement is required.

A. Checkout Procedure For Determining If Compressor Repair Or Replacement Is Required

Certain operating conditions or refrigeration system components may be misdiagnosed and subsequently lead to the determination that the compressor is bad. These conditions or components ***must*** be checked ***prior*** to replacing a compressor and ***must*** be checked after a replacement compressor is installed to prevent replacement compressor damage.

1. Check refrigerant level per Section 9.11.4.
2. Ensure that the compressor crankshaft is turning and that the compressor drive gears are in good condition.
3. Install gauges on the suction and discharge service valves. A separate gauge should be connected to the unit liquid line king valve in order to determine pressures in other steps.
4. Check unloaders as follows:

   a. With the unit operating in high speed cool, check the status of the front and rear cylinder unloaders. The microprocessor energizes the unloaders independently, based on suction pressure. If one or both unloaders are energized, unplug or disconnect the power source separately for the front and rear unloaders.

   b. Using a separate 12V power source energize and de-energize each unloader separately. Note the suction pressure change as each unloader is energized or de-energized. Both unloaders should show a rise in suction pressure rise of 3 to 6 PSIG (0.2 to 0.4 bar) when energized and a drop of 3 to 6 PSIG when de-energized. If little or no change is noticed for either unloader, the cylinder head(s) must be removed for further inspection. See Section B. for inspection procedure.
5. Perform unit pumpdown per Section NO TAG:

   a. Shut the unit off and observe the suction, discharge, and receiver pressure. Receiver pressure should drop very slowly, and suction and discharge pressure will slowly equalize to within a nominal saturated pressure range. Refer to the refrigerant pressure temperature chart in Table 9-9 for pressures corresponding to approximate ambient temperatures. Remember, the engine compartment temperatures are generally higher than actual ambient air temperatures. A fast reading digital thermometer such as 07-00269 is helpful in determining ambient temperatures.

   NOTE

   The amount of time required to pump the unit down to 0 PSIG is **not** by itself an indicator that the compressor is bad. A longer than normal pumpdown time necessitates additional checks to determine the cause.

   b. If the suction, discharge, and receiver pressures do not rapidly equalize SV4, discharge and bypass check valves are in good condition. Further compressor evaluation can only be done by following the compressor inspection procedure (Section B.)

   c. If the suction, discharge, and receiver pressures equalize above saturated pressure, SV4, discharge and bypass check valves ***must*** be checked before determining whether further compressor inspection is required
6. To determine the cause of suction, discharge, and receiver pressure equalization, start the unit with the king valve closed and **slowly** close the suction service valve until suction pressure reaches 0 psig/bar. Turn the unit off and open the hand valves between the suction and discharge gauges.

   a. If the pressures equalize to above saturated pressure, the discharge check valve is not holding and must be repaired. Once the discharge check valve is repaired the compressor must be inspected further. (Section B.)

   a. If the pressures do not equalize, the SV4 or bypass check valve must be repaired. Any repair of these valves also requires further inspection of the compressor. (Section B.)
7. if all refrigeration system components check out, it will be necessary to follow the compressor inspection procedure. (Section B.)

B. Compressor Inspection Procedure

NOTE

Only conduct this procedure after running Pretrip.

The system must be OFF during the following procedure.

1. Refrigerant Recovery

a. Close (frontseat) the suction and discharge service valves.

b. Reclaim the refrigerant by using an approved refrigerant recovery machine, and reduce the compressor pressure to 0 PSIG. (Refer to Section NO TAG.)

NOTE

To avoid damage to the earth's ozone layer, use a refrigerant recovery system whenever removing refrigerant. When working with refrigerants you must comply with all local government environmental laws, U.S.A. EPA section 608.

CAUTION

Service mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating. Refer to Section 6.2.3.

When compressor disassembly is required for compressor inspection, disconnect electrical wires in order to isolate power from compressor.

2. Compressor Inspection

a. Start with the front cylinder head of the compressor.

b. Remove the cylinder head of the compressor and observe the following cautions.

CAUTION

Leave two cylinder head bolts loose with threads engaged in the crankcase until cylinder head is completely loosened to prevent any residual crankcase pressure.

c. Remove the valve plate.

NOTE

Do not pry the valve plate in order to remove it from the crankcase. If necessary, remove 2 bolts from the discharge valve stop. Remove the valve stop. Using one of the discharge valve stop bolts as a jacking screw, lift the valve plate from the dowel pins, pushing the head off the crankcase.

d. Inspect the parts of the cylinder head and/or the valve plate.

1) Inspect cylinder head gaskets for proper alignment and center web blow-out.

2) Inspect the discharge valves for loose or damaged valve stops, or any debris that may affect the proper operation of the valves.

3) Inspect for broken, cracked, or chipped discharge reeds.

4) If applicable, inspect the discharge check valve to ensure the piston moves and contacts the plate.

5) Inspect for broken, cracked, or chipped suction valves.

6) Inspect the valve plate and the cylinder head for cracks.

7) Inspect valve plate gaskets for damage and wear.

e. Remove oil in the cylinders on top of the pistons to avoid unnecessary clean up. Inspect the top of the piston for damage. Check for debris, burned and carbonized oil sludge, or mechanical failure.

f. Inspect cylinder bores for excessive wear. Excessive wear for cylinder bores is defined as heavy and uneven scratches, gouges, or chipping of the internal wall of the cylinder, with a depth greater than 0.025 inch, which are caused by foreign objects, other than a normal reciprocating movement of the pistons and piston rings.

g. Check compressor rotation.

1) ***Unplug the fuel solenoid.***

2) Rotate the compressor by hand if possible or by using the engine starter to “bump” the compressor.

NOTE

Bumping the compressor means to momentarily energize the starter motor without ignition of the engine.

3) All pistons should move freely and smoothly up and down without any inconsistent resistance or seizure.

h. Repeat Steps 2.b. thru 2.g. for the center head and the rear head.

3. Decision to repair or replace

a. The compressor should be REPAIRED if no defects are found, or if the only defects found are in Steps 2.d.1), 4), 5) or 6).

b. The compressor should be REPLACED if it failed the examination of 2.f., 2.g., 2. h., or has broken discharge valves.

4. Replacement of the compressor.

a. Refer to Section 9.12 for compressor replacement procedures.

b. Drain and measure the compressor oil, and put it in a plastic bottle. Follow Carrier Transicold instructions for returning the oil with the compressor.

5. Repair of the compressor.

a. Replace gaskets in addition to all replacement parts.

b. The torque required to reassemble the screws of the valve stop on the valve plate is 12 ft lbs (16. 3 Nm)

c. Replace a new valve plate or a cylinder head only when it is defective. The torque required for the bolts of the cylinder head is 35 to 55 ft lbs (40 to 48 Nm)

d.The failed compressor may have pumped oil into the system. Do not charge more oil until you install the new compressor and run the unit to determine if oil level is correct.

6. A reminder when shipping for warranty credit

a.When shipping the failed compressor for warranty credit, include the completed field failure diagnostic report and the bottled oil sample for the purpose of further analysis.

7. Electrical testing of the compressor.

a.Check current draw of the motor winding with a current meter while the motor is running. Each of the 3 legs should draw an equal amount of current within 10%. The rated load current at 460VAC is 17.5 amps for a high efficiency 41CFM compressor.

b.Check the resistance of each winding while compressor is off and power is isolated and disconnected from any source. The resistance will be approximately 1ohm and should be equal across all legs.

c.Check the resistance to ground from each leg while compressor power is isolated and disconnected from any source. There should be low resistance to ground, open with standard ohmmeter. Because oil and refrigerant fluids are conductors, the use of a megohmeter may show variations in resistance to ground through the case of the compressor using higher test voltages.

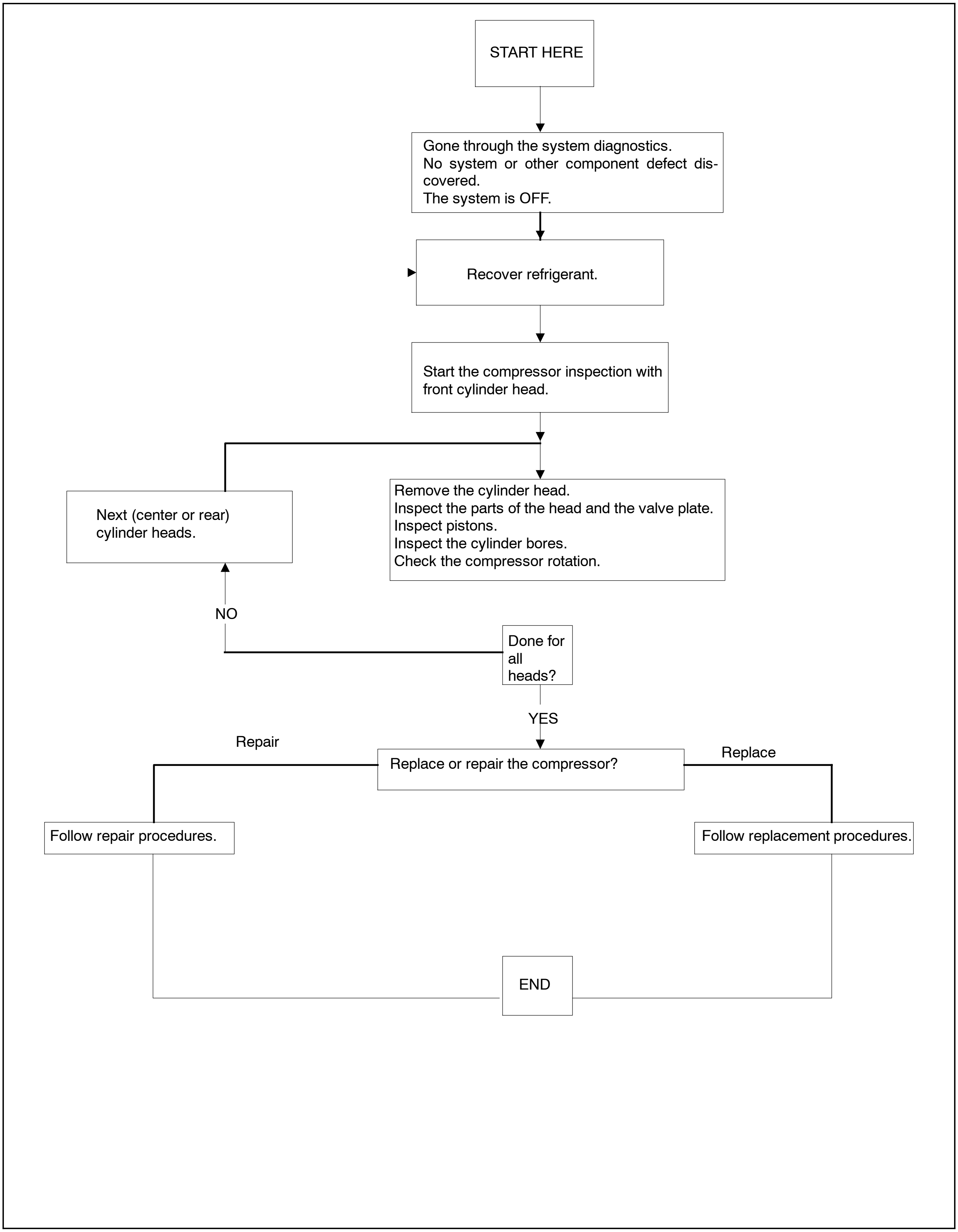


Figure 10-14 Compressor Diagnostics

C. Procedure After Compressor Repair Or Replacement

1. Run Pretrip to ensure all refrigeration components function properly.
2. In addition, to ensure the repair of the original compressor or the reliability of the replacement compressor, check the following:
   a. Verify proper air switch setting using 07-00177 magnehelic gauge or equal.
   b. Verify that air switch will initiate defrost by momentarily jumping the air switch contacts.
   c. Check all switches and sensors for proper operation.
3. See Section 9.13 for compressor oil level check procedure
4. Perform refrigerant and compressor oil moisture/acid tests per instructions with test kits; change oil or reclaim refrigerant as required. Refer to 98-50037 for system cleanup procedures.
5. If a compressor failure, such as broken valves, had the possibility of releasing large particles into the system, the discharge strainer located in the inlet of the discharge check valve should also be removed and inspected.

SECTION 11

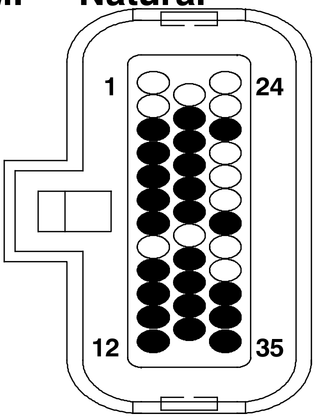
WIRING

PARAGRAPH NUMBER **Page**

SECTION 11
WIRING

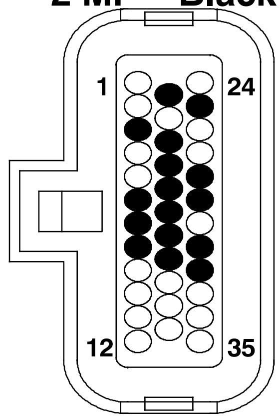
Plugs used with Schematic 62-10499 Rev V (Standard Engine)

1 MP – Natural



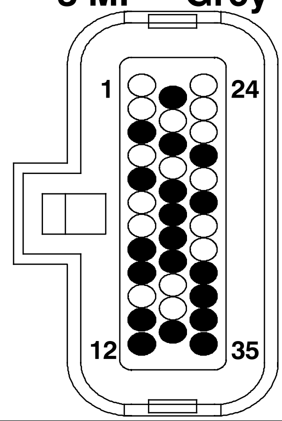
Component	Terminal
REMSN1	3 (14)
REMSN2	4 (14)
CDP	5 (16) (30)
CSP	6 (17) (30)
ENCT	7 (18)
CDT	9 (20)
DTT2	10 (21)
AAT	11 (22)
RAT	12 (23)
REMSN1 (SP23)	14 (3)
REMSN2 (SP23)	14 (4)
REMSN3	15 (33)
CDP	16 (5) (30)
CSP	17 (6) (30)
ENCT	18 (7)
CDT	20 (9)
DTT2 (SP11)	21 (10)
AAT	22 (11)
SAT (SP12)	23 (35)
RAT (SP12)	23 (12)
FLS	26
CDP (SPK4)	30 (5) (16)
CSP (SPK4)	30 (6) (17)

2 MP – Black



Component	Terminal
REMS1	3
DAS	6
ENRPM	7 (18) (31)
CSMV-D	8 (19) (20) (32)
REMS2	13
ENCLS	15
DS	16
ENOPS	17
ENRPM	18 (7) (31)
CSMV-C	19 (8) (20) (32)
CSMV -A	20 (8) (19) (32)
HC9	25
ENOLS	28
HPS	29
ENRPM	31 (7) (18)
CSMV-B	32 (8) (19) (20)

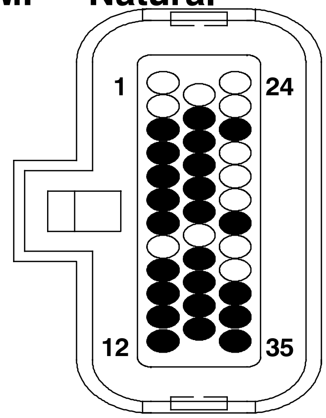
3 MP – Grey



Component	Terminal
SATCOM (C)	3
SLP (C)	5
ORL	8
CL	9
SV2	11
UL1 (Front)	12
SLP (E)	13
SATCOM (B)	15
SLP (A)	17
FHR (HC-17)	18
FL	19
DL	20
UL2 (Rear)	23
SATCOM (A)	27
SLP (B)	29
HL	33
SV4	34
SV1	35

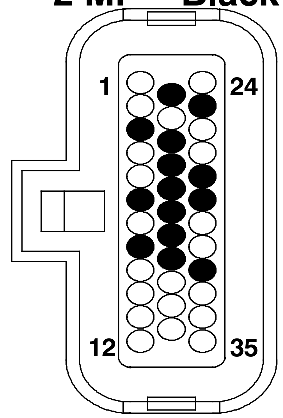
Plugs used with Schematic 62-04102 Rev - and 62-10300 Rev A (ESC Engine)

1 MP - Natural



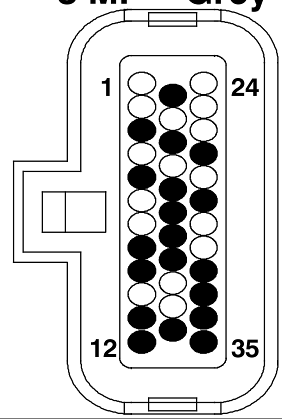
Component	Terminal
REMSN1	3 (14)
REMSN2	4 (14)
CDP	5 (16) (30)
CSP	6 (17) (30)
ENCT	7 (18)
CDT	9 (20)
DTT2	10 (21)
AAT	11 (22)
RAT	12 (23)
REMSN1 (SP23)	14 (3)
REMSN2 (SP23)	14 (4)
REMSN3	15 (33)
CDP	16 (5) (30)
CSP	17 (6) (30)
ENCT	18 (7)
CDT	20 (9)
DTT2 (SP11)	21 (10)
AAT	22 (11)
SAT (SP12)	23 (35)
RAT (SP12)	23 (12)
FLS	26
CDP (SPK4)	30 (5) (16)
CSP (SPK4)	30 (6) (17)
REMSN3	33 (15)
EV1	34
SAT	35 (23)

2 MP - Black



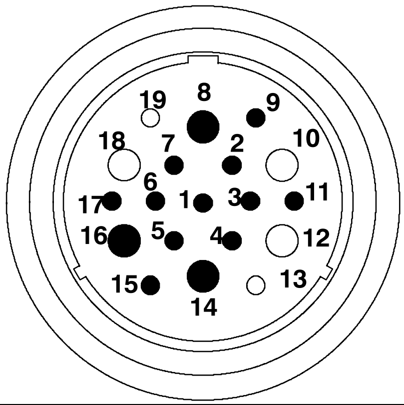
Component	Terminal
REMS1	3
DAS	6
CSMV-D	8 (19) (20) (32)
REMS2	13
ENCLS	15
DS	16
ENOPS	17
ENSCU	18
CSMV-C	19 (8) (20) (32)
CSMV -A	20 (8) (19) (32)
HC9	25
ENOLS	28
HPS	29
CSMV-B	32 (8) (19) (20)

3 MP - Grey



Component	Terminal
SATCOM (C)	3
SLP (C)	5
ORL	8
CL	9
SV2	11
UL1 (Front)	12
SLP (E)	13
SATCOM (B)	15
SLP (A)	17
FHR (HC-17)	18
FL	19
DL	20
UL2 (Rear)	23
SATCOM (A)	27
SLP (B)	29
HL	33
SV4	34
SV1	35

HC Plug For All Units



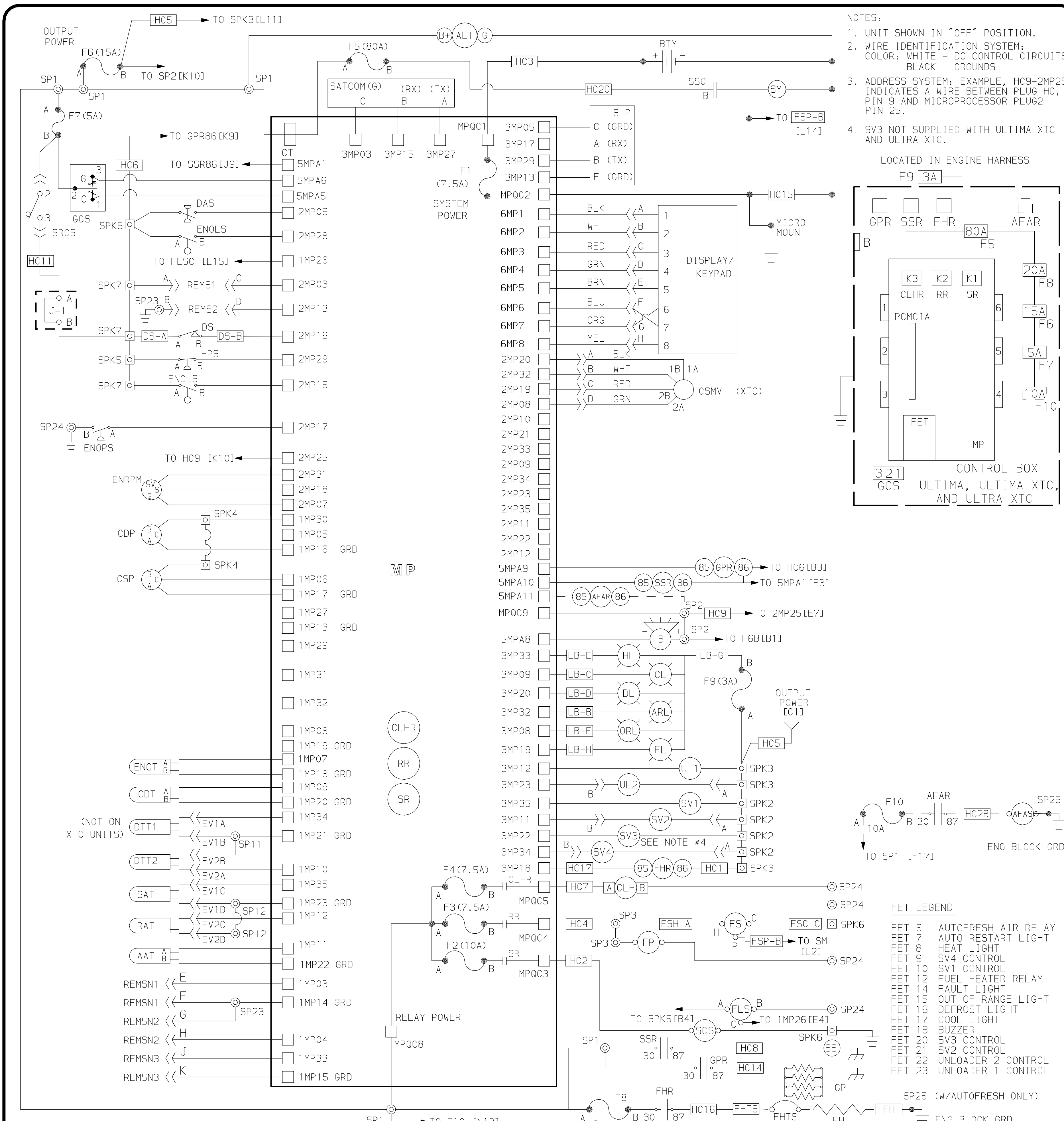
Component	Terminal
+12vdc Input from SPK3 to Fuel Heater Relay Coil	1
+12vdc Output from (MPQC3) to ENSCU-16	2
+12vdc Output from transformer to starter motor (SM)	2C
+12vdc Input unswitched Power from Battery (BTY+) To Main Power In (MPQCI)	3
+12vdc Output from (MPQC4) to SPK20	4
+12vdc Output unswitched to – SPK2 SPK3	5
+12vdc Output from J1 jumper to – SPK5 SPK7	6
+12vdc Output from Clutch Relay to Clutch (CLH)	7
+12vdc Output to Starter Solenoid (SS)	8
+12vcd Output to 2MP25	9
+12vdc from SROS to J1 jumper *	11*
+12vdc Output to Glow Plugs (GP)	14
-12vdc Input Ground from Battery (GRD)	15
+12vdc Output to Fuel Heater Circuit (FHTS)	16
-12vdc Output to Fuel Heater Relay Coil (FHR)	17
Unused Teminals: 10, 12, 13, 18 & 19	
NOTE: Terminal 11 used only with units with J-1 Jumper	

ADVANCE MICRO DISPLAY HARNESS CONNECTIONS

Test Point	Pin	Color	Description
TP14	Pin 1	Black	+12 Vdc for Display backlighting and indicator LED's
TP13	Pin 2	White	Ground for Backlighting and indicator LEDs
TP13	Pin 3	Red	Ground for Backlighting and indicator LEDs
TP12	Pin 4	Green	+5 Vdc for Display processor and LCD
TP11	Pin 5	Brown	Display ground
TP10	Pin 6	Orange	TX the serial communications from the control to the display
TP9	Pin 7	Blue	RX the serial communications from the display to the control
TP8	Pin 8	Yellow	Display ground

VOLTAGE TESTS:

Negative Test Lead	Positive Test Lead	Voltage Reading
TP13	TP14	12
TP13	TP12	5
TP13	TP11	0
TP13	TP8	0
TP11	TP14	12
TP11	TP8	0
TP8	TP14	12



[##] ZONE
SPLICE PACK
INDICATES A SOLDERED SPLICE POINT.
T1 PIN CONNECTION
1 COMPONENT CONNECTION NUMBER OR LETTER

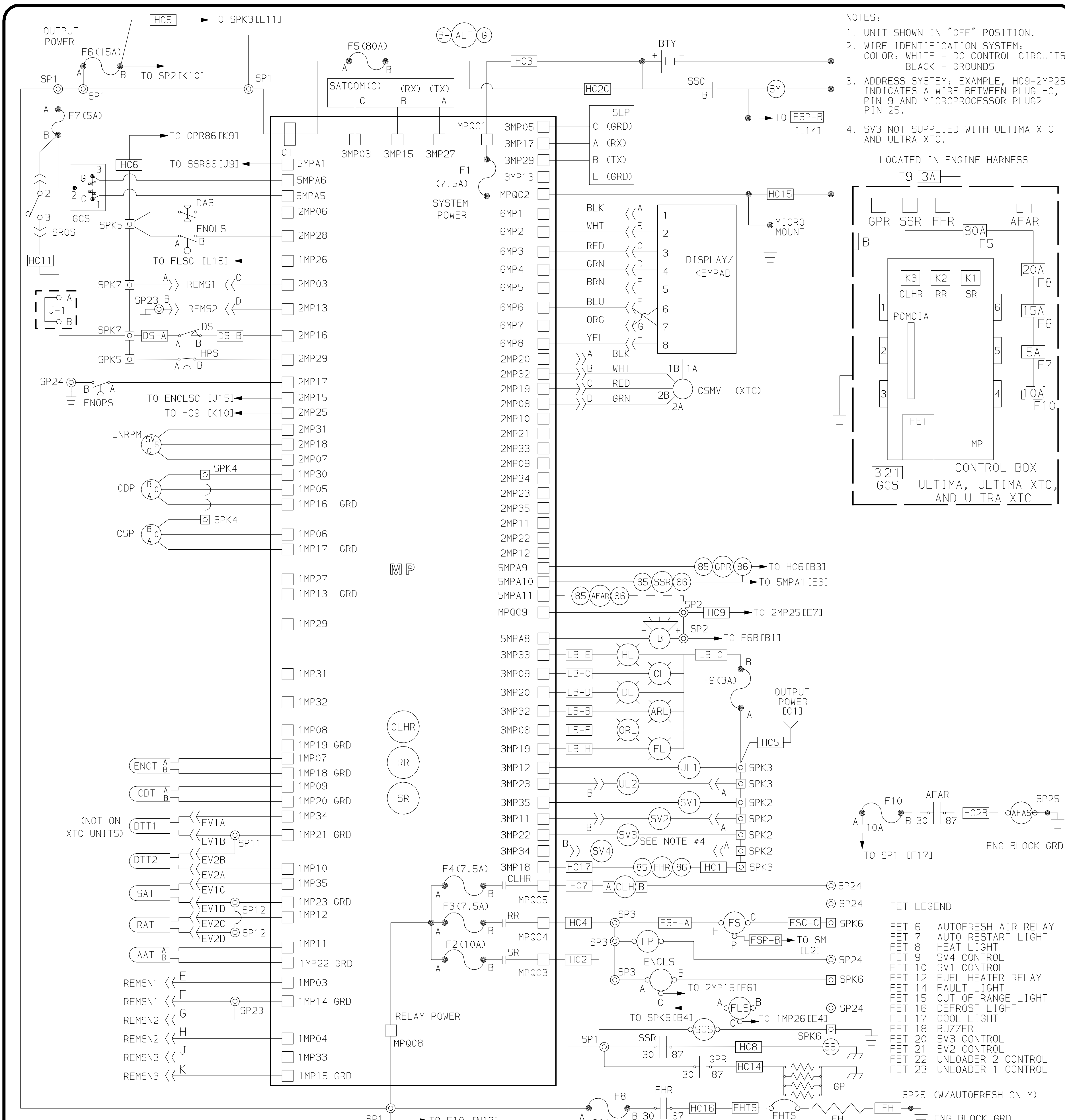
NORMALLY CLOSED CONTACTS.
NORMALLY OPEN CONTACTS.
X1 INDICATES CONNECTION
HC1 OR MULTIPLE PLUG CONNECTION NUMBER

SWITCH SYMBOL INDICATES MOMENTARY CONTACTS.
INDICATES A WIRE GROUND.
INDICATES A CHASSIS GROUND (NO WIRE).
INDICATES A CONNECTION, WIRE, LUG, ETC.

ZONE	SYMBOL	DESCRIPTION
C15	AAT	AMBIENT AIR TEMPERATURE
I9,O13	AFAR	AUTOFRESH AIR EXCHANGER RELAY (OPTION ON XTC)
O13	AFAS	AUTOFRESH AIR EXCHANGER SOLENOID (OPTION ON XTC)
G1	ALT	ALTERNATOR
J12	ARL	AUTO RESTART LIGHT (LIGHT BAR)
J10	B	BUZZER
K1	BTY	BATTERY
C8	CDP	COMPRESSOR DISCHARGE PRESSURE
C12	CDT	COMPRESSOR DISCHARGE TEMPERATURE
J11	CL	COOL LIGHT (LIGHT BAR)
J14	CLH	CLUTCH
H14	CLHR	CLUTCH RELAY
C8	CSP	COMPRESSOR SUCTION PRESSURE
J6	CSMV	COMPRESSOR SUCTION MODULATION VALVE (XTC)
C4	CT	CURRENT TRANSFORMER
C4	DAS	DEFROST AIR SWITCH
J11	DL	DEFROST LIGHT (LIGHT BAR)
C6	DS	DOOR SWITCH
C13	DTT	DEFROST TERMINATION TEMPERATURE
C6	ENCLS	ENGINE COOLANT LEVEL SWITCH
C12	ENCT	ENGINE COOLANT TEMPERATURE
C4	ENOLS	ENGINE OIL LEVEL SWITCH
B6	ENOPS	ENGINE OIL PRESSURE SWITCH (N.O.)
C7	ENRPM	ENGINE RPM
C13,C14	EV	EVAPORATOR PLUG
H3	F1	FUSE MP (7.5 AMPERE)
G15	F2	FUSE SR (10 AMPERE)
G14	F3	FUSE RR (7.5 AMPERE)
G14	F4	FUSE CLHR (7.5 AMPERE)
F1	F5	FUSE MAXI-FUSE (80 AMPERE)
B1	F6	FUSE SV & UL (15 AMPERE)
A2	F7	FUSE SROS (5 AMPERE)
H17	F8	FUSE FHR (20 AMPERE)(OPTIONAL)
L14	F9	FUSE LB (3 AMPERE)
N13	F10	FUSE AFAR (40 AMPERE, DUAL ELEMENT, SLOW BLOW) (OPTION ON XTC)

ZONE	SYMBOL	DESCRIPTION
L17,M17	FH	FUEL HEATER (OPTIONAL)
J17,K14	FHR	FUEL HEATER RELAY (OPTIONAL)
K17	FHTS	FUEL HEATER TEMP. SWITCH (OPTIONAL)
J12	FL	FAULT LIGHT (LIGHT BAR)
L15	FLS	FUEL LEVEL SWITCH
J14	FP	FUEL PUMP
L14,K14	FS	FUEL SOLENOID
B3	GCS	MANUAL GLOW/CRANK SWITCH
M17	GP	GLOW PLUG
K9,K16	GPR	GLOW PLUG RELAY
C1,E1,H1,J2,B3,L3 K10,L11,L14,J14,I14 I15,L16,J17	HC	HIGH CURRENT PLUG
J11	HL	HEAT LIGHT (LIGHT BAR)
C6	HPS	HIGH PRESSURE CUT-OUT-SWITCH (N.C.)
A5	J-1	J-1 JUMPER
I11,I12,K11	LB	LIGHT BAR
F9	MP	MICROPROCESSOR BOARD
F16,I14,H3,H2	MPQC	MICROPROCESSOR QUICKCONNECT
J12	ORL	OUT OF RANGE LIGHT (LIGHT BAR)
C14	RAT	RETURN AIR TEMPERATURE
C5,C6	REMS	REMOTE SWITCH
C15,C16	REMSN	REMOTE SENSOR
H14	RR	RUN RELAY
C14	SAT	SUPPLY AIR TEMPERATURE
F2,G2	SATCOM	SATELLITE COMMUNICATION
K16	SCS	SPEED CONTROL SOLENOID
J2	SLP	SERIAL PORT
L2	SM	STARTER MOTOR
A2,D2,B6,D9,D10 D11/D15,M14,J11/J16 K10,M15,F17 B3/B6,D8/D10	SP	SPLICE POINT
L11/L13,M14/M16	SPK	SPLICE PACK
H15	SR	SPEED RELAY
B3	SROS	START/RUN/OFF/SWITCH
M16	SS	STARTER SOLENOID
K2	SSC	STARTER SOLENOID CONTACTOR
J10,K16	SSR	STARTER SOLENOID RELAY
J13	SV	SOLENOID VALVE
J12	UL	UNLOADER

BASED ON DWG 62-10499 REV V

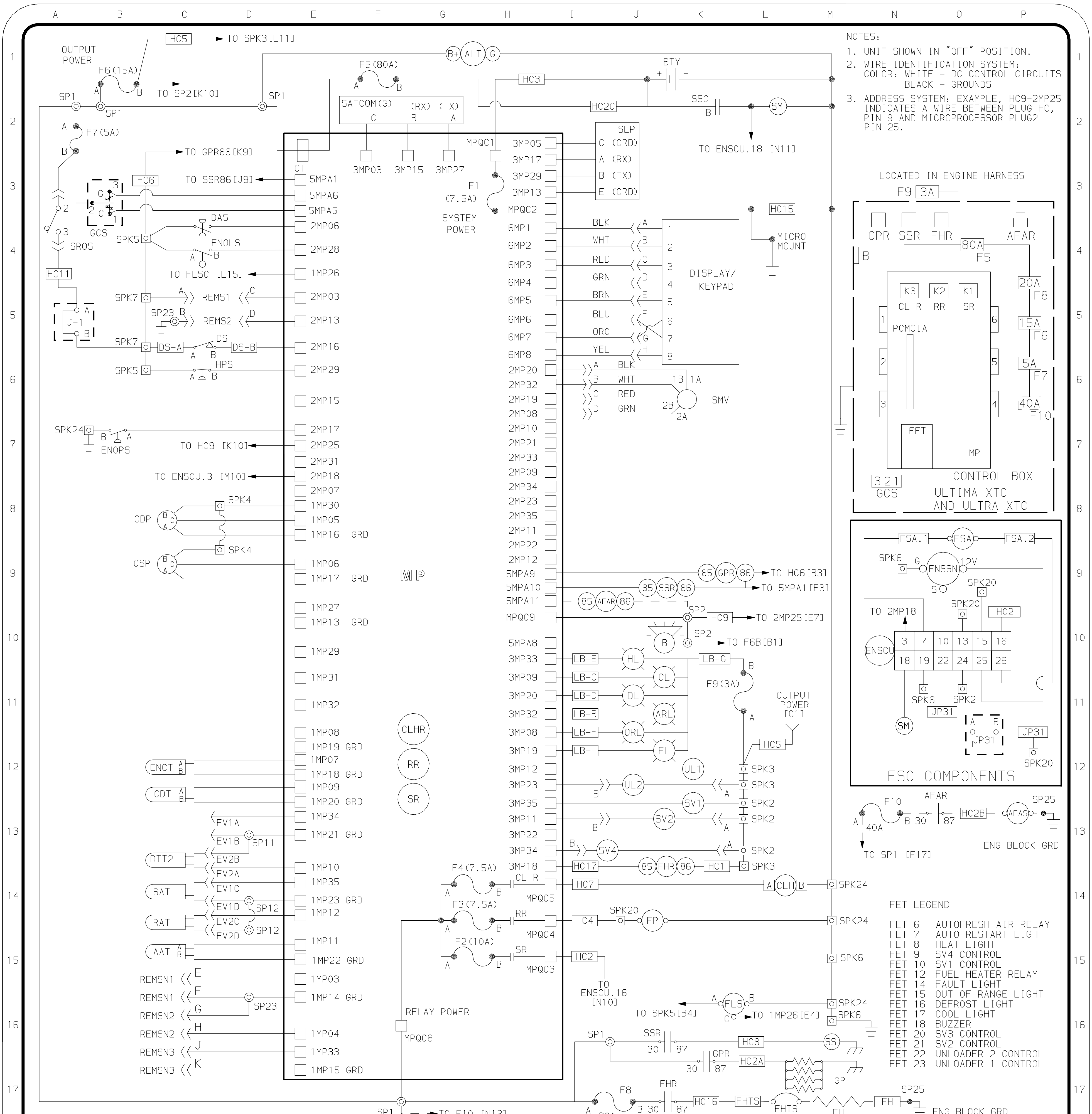


[##] ZONE
SPLICE PACK
INDICATES A SOLDERED SPLICE POINT.
T1 PIN CONNECTION
1 COMPONENT CONNECTION NUMBER OR LETTER
NORMALLY CLOSED CONTACTS.
NORMALLY OPEN CONTACTS.
X1 INDICATES CONNECTION
HC1 OR MULTIPLE PLUG CONNECTION NUMBER
SWITCH SYMBOL INDICATES MOMENTARY CONTACTS.
INDICATES A WIRE GROUND.
INDICATES A CHASSIS GROUND (NO WIRE).
INDICATES A CONNECTION,WIRE,LUG,ETC.

ZONE	SYMBOL	DESCRIPTION
C15	AAT	AMBIENT AIR TEMPERATURE
I9,013	AFAR	AUTOFRESH AIR EXCHANGER RELAY (OPTION ON XTC)
	AFAS	AUTOFRESH AIR EXCHANGER SOLENOID (OPTION ON XTC)
G1	ALT	ALTERNATOR
J12	ARL	AUTO RESTART LIGHT (LIGHT BAR)
J10	B	BUZZER
K1	BTY	BATTERY
C8	CDP	COMPRESSOR DISCHARGE PRESSURE
C12	CDT	COMPRESSOR DISCHARGE TEMPERATURE
J11	CL	COOL LIGHT (LIGHT BAR)
J14	CLH	CLUTCH
H14	CLHR	CLUTCH RELAY
C8	CSP	COMPRESSOR SUCTION PRESSURE
J6	CSMV	COMPRESSOR SUCTION MODULATION VALVE (XTC)
E2	CT	CURRENT TRANSFORMER
C4	DAS	DEFROST AIR SWITCH
J11	DL	DEFROST LIGHT (LIGHT BAR)
C6	DS	DOOR SWITCH
C13	DTT	DEFROST TERMINATION TEMPERATURE
J15	ENCLS	ENGINE COOLANT LEVEL SWITCH
C12	ENCT	ENGINE COOLANT TEMPERATURE
C4	ENOLS	ENGINE OIL LEVEL SWITCH
B6	ENOPS	ENGINE OIL PRESSURE SWITCH (N.O.)
C7	ENRPM	ENGINE RPM
C13,C14	EV	EVAPORATOR PLUG
H3	F1	FUSE MP (7.5 AMPERE)
G15	F2	FUSE SR (10 AMPERE)
G14	F3	FUSE RR (7.5 AMPERE)
G14	F4	FUSE CLHR (7.5 AMPERE)
F1	F5	FUSE MAXI-FUSE (80 AMPERE)
B1	F6	FUSE SV & UL (15 AMPERE)
A2	F7	FUSE SR05 (5 AMPERE)
H17	F8	FUSE FHR (20 AMPERE) (OPTIONAL)
L14	F9	FUSE LB (3 AMPERE)
N13	F10	FUSE AFAR (10 AMPERE, DUAL ELEMENT, SLOW BLOW) (OPTION ON XTC)

ZONE	SYMBOL	DESCRIPTION
L17,M17	FH	FUEL HEATER (OPTIONAL)
J17,K14	FHR	FUEL HEATER RELAY (OPTIONAL)
K17	FHTS	FUEL HEATER TEMP. SWITCH (OPTIONAL)
J12	FL	FAULT LIGHT (LIGHT BAR)
L15	FLS	FUEL LEVEL SWITCH
J14	FP	FUEL PUMP
L14,K14	FS	FUEL SOLENOID
B3	GCS	MANUAL GLOW/CRANK SWITCH
M17	GP	GLOW PLUG
K9,K16	GPR	GLOW PLUG RELAY
C1,E1,H1,J2,B3,L3 K10,L11,L14,J14,I14 I15,L16,J17	HC	HIGH CURRENT PLUG
J11	HL	HEAT LIGHT (LIGHT BAR)
C6	HPS	HIGH PRESSURE CUT-OUT-SWITCH (N.C.)
A5	J-1	J-1 JUMPER
I11,I12,K11	LB	LIGHT BAR
F9	MP	MICROPROCESSOR BOARD
F16,I14,H3,H2	MPQC	MICROPROCESSOR QUICKCONNECT
J12	ORL	OUT OF RANGE LIGHT (LIGHT BAR)
C14	RAT	RETURN AIR TEMPERATURE
C5,C6	REMS	REMOTE SWITCH
C15,C16	REMSN	REMOTE SENSOR
H14	RR	RUN RELAY
C14	SAT	SUPPLY AIR TEMPERATURE
F2,G2	SATCOM	SATELLITE COMMUNICATION
K16	SCS	SPEED CONTROL SOLENOID
J2	SLP	SERIAL PORT
L2	SM	STARTER MOTOR
A2,D2,B6,D9,D10 D11/D15,M14,J11/J16 K10,M15,F17 B3/B6,D8/D10	SP	SPLICE POINT
L11/L13,M14/M16	SPK	SPLICE PACK
H15	SR	SPEED RELAY
B3	SR05	START/RUN/OFF/SWITCH
M16	SS	STARTER SOLENOID
K2	SSC	STARTER SOLENOID CONTACTOR
J10,K16	SSR	STARTER SOLENOID RELAY
J13	SV	SOLENOID VALVE
J12	UL	UNLOADER

BASED ON DWG 62-10499 REV W



[##]	ZONE	NORMALLY CLOSED CONTACTS.	SWITCH SYMBOL INDICATES MOMENTARY CONTACTS.
▢	SPLICE PACK	NORMALLY OPEN CONTACTS.	INDICATES A WIRE GROUND.
◎	INDICATES A SOLDERED SPLICE POINT.	(X1) INDICATES CONNECTION	INDICATES A CHASSIS GROUND (NO WIRE).
T1	PIN CONNECTION	HC1 OR -<<- MULTIPLE PLUG CONNECTION NUMBER	● INDICATES A CONNECTION, WIRE, LUG, ETC.
(1)	COMPONENT CONNECTION NUMBER OR LETTER		

ZONE	SYMBOL	DESCRIPTION
C15	AAT	AMBIENT AIR TEMPERATURE
I9,O13	AFAR	AUTOFRESH AIR EXCHANGER RELAY (OPTION ON XTC)
O13	AFAS	AUTOFRESH AIR EXCHANGER SOLENOID (OPTION ON XTC)
G1	ALT	ALTERNATOR
J12	ARL	AUTO RESTART LIGHT (LIGHT BAR)
J10	B	BUZZER
K1	BTY	BATTERY
C8	CDP	COMPRESSOR DISCHARGE PRESSURE
C12	CDT	COMPRESSOR DISCHARGE TEMPERATURE
J11	CL	COOL LIGHT (LIGHT BAR)
J14	CLH	CLUTCH
H14	CLHR	CLUTCH RELAY
C8	CSP	COMPRESSOR SUCTION PRESSURE
J6	CSMV	COMPRESSOR SUCTION MODULATION VALVE (XTC)
E2	CT	CURRENT TRANSFORMER
C4	DAS	DEFROST AIR SWITCH
J11	DL	DEFROST LIGHT (LIGHT BAR)
C6	DS	DOOR SWITCH
C13	DTT	DEFROST TERMINATION TEMPERATURE
C12	ENCT	ENGINE COOLANT TEMPERATURE
C4	ENOLS	ENGINE OIL LEVEL SWITCH
B6	ENOPS	ENGINE OIL PRESSURE SWITCH (N.O.)
N10	ENSCU	ENGINE SPEED CONTROL UNIT
N9	ENSSN	ENGINE SPEED SENSOR
C13,C14	EV	EVAPORATOR PLUG
H3	F1	FUSE MP (7.5 AMPERE)
G15	F2	FUSE SR (10 AMPERE)
G14	F3	FUSE RR (7.5 AMPERE)
G14	F4	FUSE CLHR (7.5 AMPERE)
F1	F5	FUSE MAXI-FUSE (80 AMPERE)
B1	F6	FUSE SV & UL (15 AMPERE)
A2	F7	FUSE SROS (5 AMPERE)
H17	F8	FUSE FHR (20 AMPERE)(OPTIONAL)
L14	F9	FUSE LB (3 AMPERE)
N13	F10	FUSE AFAR (40 AMPERE)(OPTION ON XTC)
L17,M17	FH	FUEL HEATER (OPTIONAL)
J17,K14	FHR	FUEL HEATER RELAY (OPTIONAL)
K17	FHTS	FUEL HEATER TEMP. SWITCH (OPTIONAL)

ZONE	SYMBOL	DESCRIPTION
J12	FL	FAULT LIGHT (LIGHT BAR)
L15	FLS	FUEL LEVEL SWITCH
J14	FP	FUEL PUMP
N8	FSA	FUEL AND SPEED ACTUATOR
B3	GCS	MANUAL GLOW/CRANK SWITCH (OPTION)
M17	GP	GLOW PLUG
K9,K16	GPR	GLOW PLUG RELAY
C1,E1,H1,J2,B3,L3 K10,L11,L14,J14,I14 I15,L16,J17	HC	HIGH CURRENT PLUG
J11	HL	HEAT LIGHT (LIGHT BAR)
C6	HPS	HIGH PRESSURE CUT-OUT-SWITCH (N.C.)
A5	J-1	J-1 JUMPER
N11	JP31	JP31 JUMPER
I11,I12,K11	LB	LIGHT BAR
F9	MP	MICROPROCESSOR BOARD
F16,I14,H3,H2	MPQC	MICROPROCESSOR QUICKCONNECT
J12	ORL	OUT OF RANGE LIGHT (LIGHT BAR)
C14	RAT	RETURN AIR TEMPERATURE
C5,C6	REMS	REMOTE SWITCH
C15,C16	REMSN	REMOTE SENSOR
H14	RR	RUN RELAY
C14	SAT	SUPPLY AIR TEMPERATURE
F2,G2	SATCOM	SATELLITE COMMUNICATION
J2	SLP	SERIAL PORT
L2	SM	STARTER MOTOR
A2,D2,B6,D9,D10 D11/D15,M14,J11/J16 K10,M15,F17 B3/B6,D8/D10	SP	SPLICE POINT
L11/L13,M14/M16	SPK	SPLICE PACK
H15	SR	SPEED RELAY
B3	SROS	START/RUN/OFF/SWITCH
M16	SS	STARTER SOLENOID
K2	SSC	STARTER SOLENOID CONTACTOR
J10,K16	SSR	STARTER SOLENOID RELAY
J13	SV	SOLENOID VALVE
J12	UL	UNLOADER

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