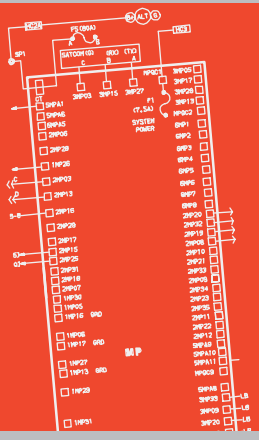
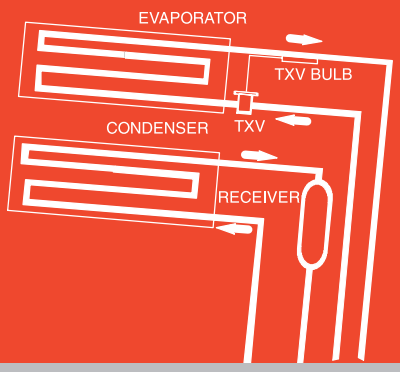
Carrier®

Trailer Refrigeration





OPERATION & SERVICE

for

ULTIMA 53, PHOENIX ULTRA AND EXTRA

with Advance™ Microprocessor

Prior to S/Ns Beginning with HAY

62-10285 Rev D

Carrier

TRANSICOLD

OPERATION AND SERVICE MANUAL

TRAILER REFRIGERATION UNIT

Ultima 53
NDX-93M

Phoenix Ultra
NDA-93A/94A

Phoenix Ultra XL
NDA-93M/94M

Extra
NDA-93E/94E
NDA-93N/94N

with Advance Microprocessor

Prior To S/Ns Beginning With HAY

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 – Operation This section shows you how to configure and operate the Carrier Advance Microprocessor controller.
Section 3 – System Description This section describes the components of the control system, special control features, and options.
Section 4 – Engine and Temperature Control This section describes the engine and temperature control.
Section 5 – Alarm Troubleshooting This section provides information on the probable causes of the alarm codes given by the microprocessor controller.
Section 6 – Message Center and Alarms This section describes all the messages and alarms which can be displayed on the Messages Center.
Section 7 – Unit Description This section describes the units listed in the Model Chart Table 7-1.
Section 8 – Service This section describes the service procedures for the unit .
Section 9 – Troubleshooting This section provides information on the probable causes for unit troubleshooting.
Section 10 – Electrical Schematic Wiring Diagrams This section contains Electrical Schematic Wiring Diagrams for the models covered in this book.

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 (1) 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, a buzzer will sound for 5 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 Start-Run / Off switch is in the OFF (0) 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.

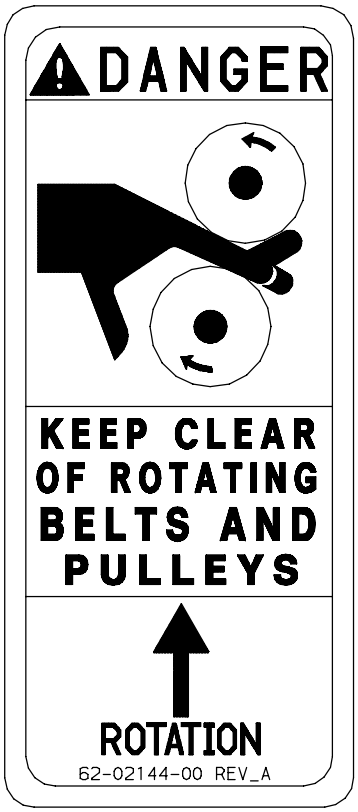
REFRIGERANTS

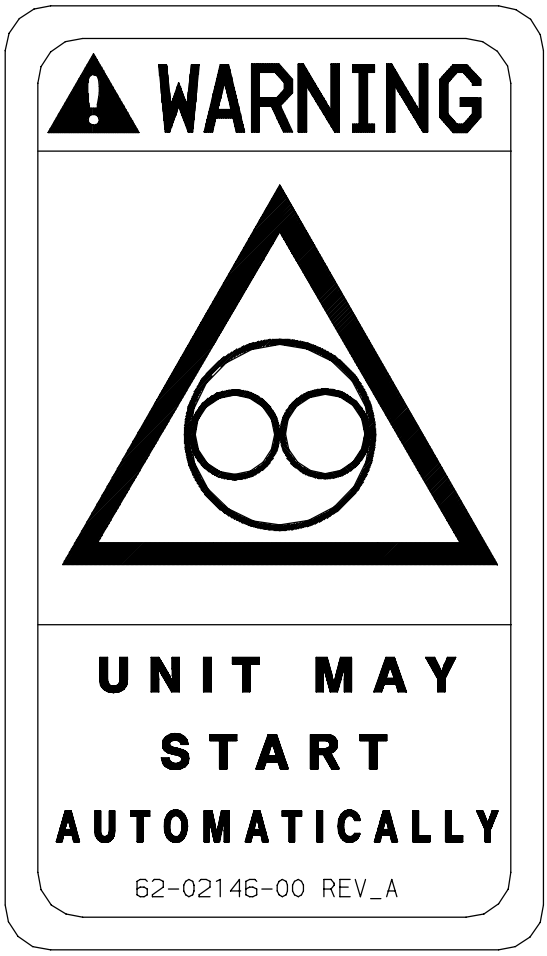
The refrigerant contained in the refrigeration system of your unit can cause frostbite, severe burns, or blindness when in direct contact with the skin or eyes. For this reason, and because of legislation regarding the handling of refrigerants during system service, we recommend that, whenever your unit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

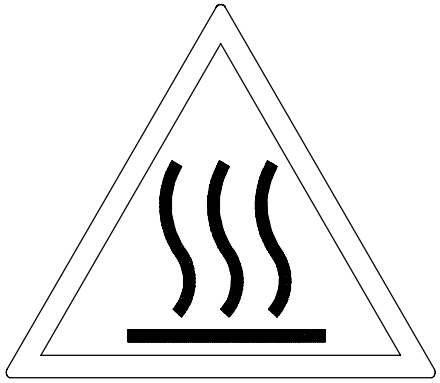
BATTERY

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.

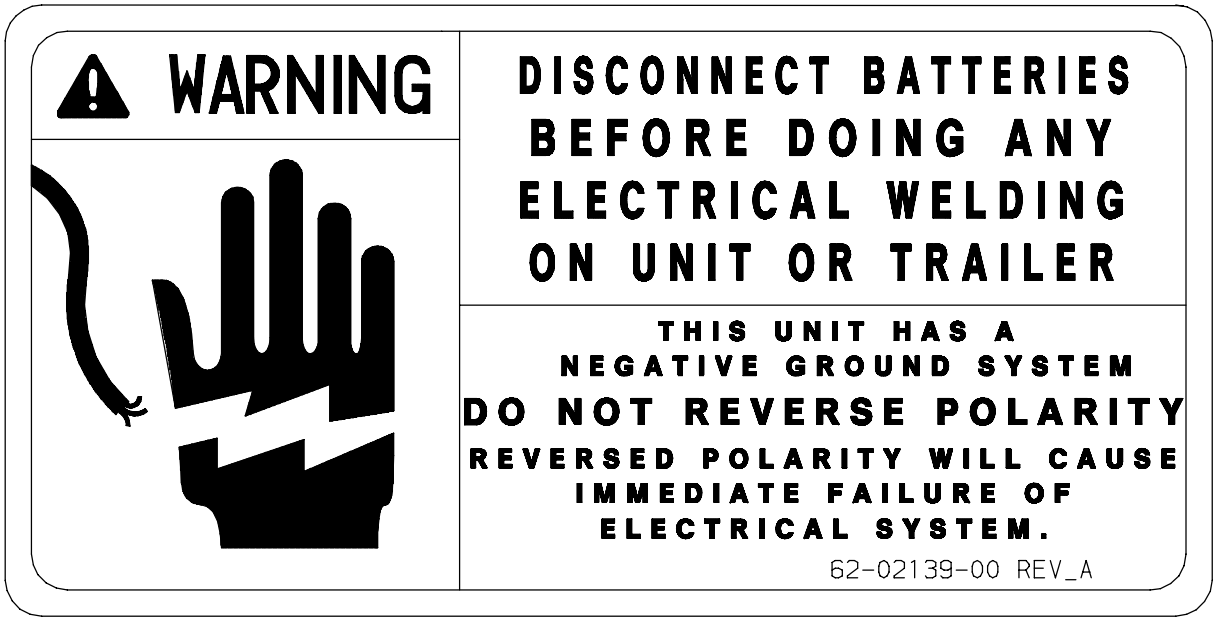
1.2 Safety Decals

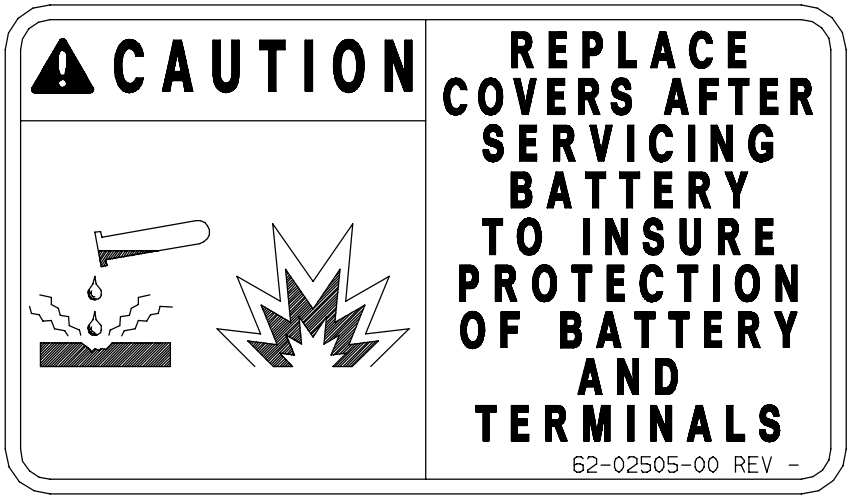


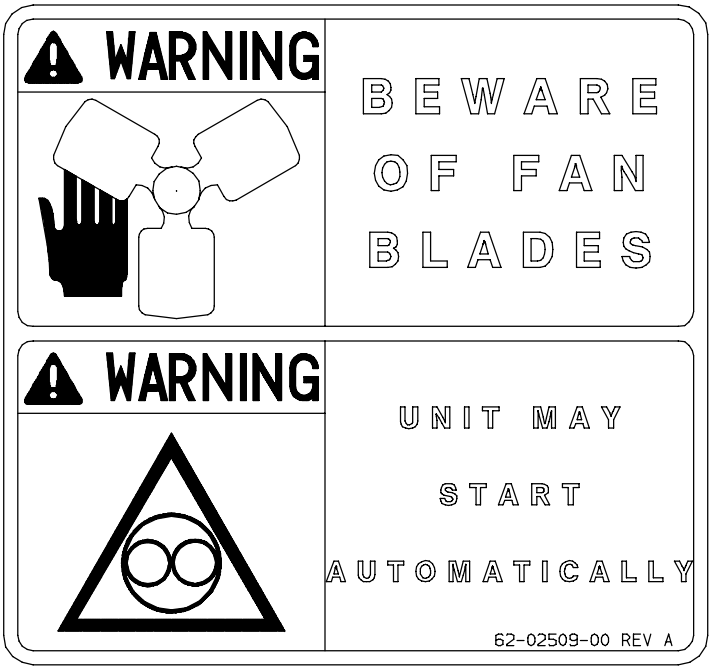


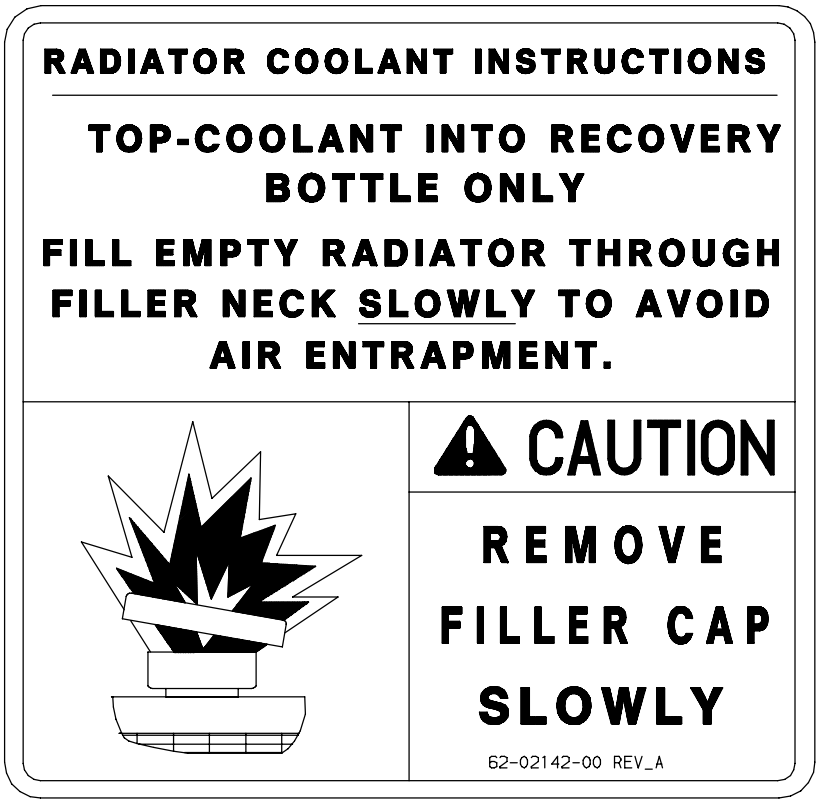


62-03958-00 Heat Warning


WARNING
DISCONNECT BATTERIES BEFORE DOING ANY ELECTRICAL WELDING ON UNIT OR TRAILER
THIS UNIT HAS A NEGATIVE GROUND SYSTEM
DO NOT REVERSE POLARITY
REVERSED POLARITY WILL CAUSE IMMEDIATE FAILURE OF ELECTRICAL SYSTEM.
62-02139-00 REV_A

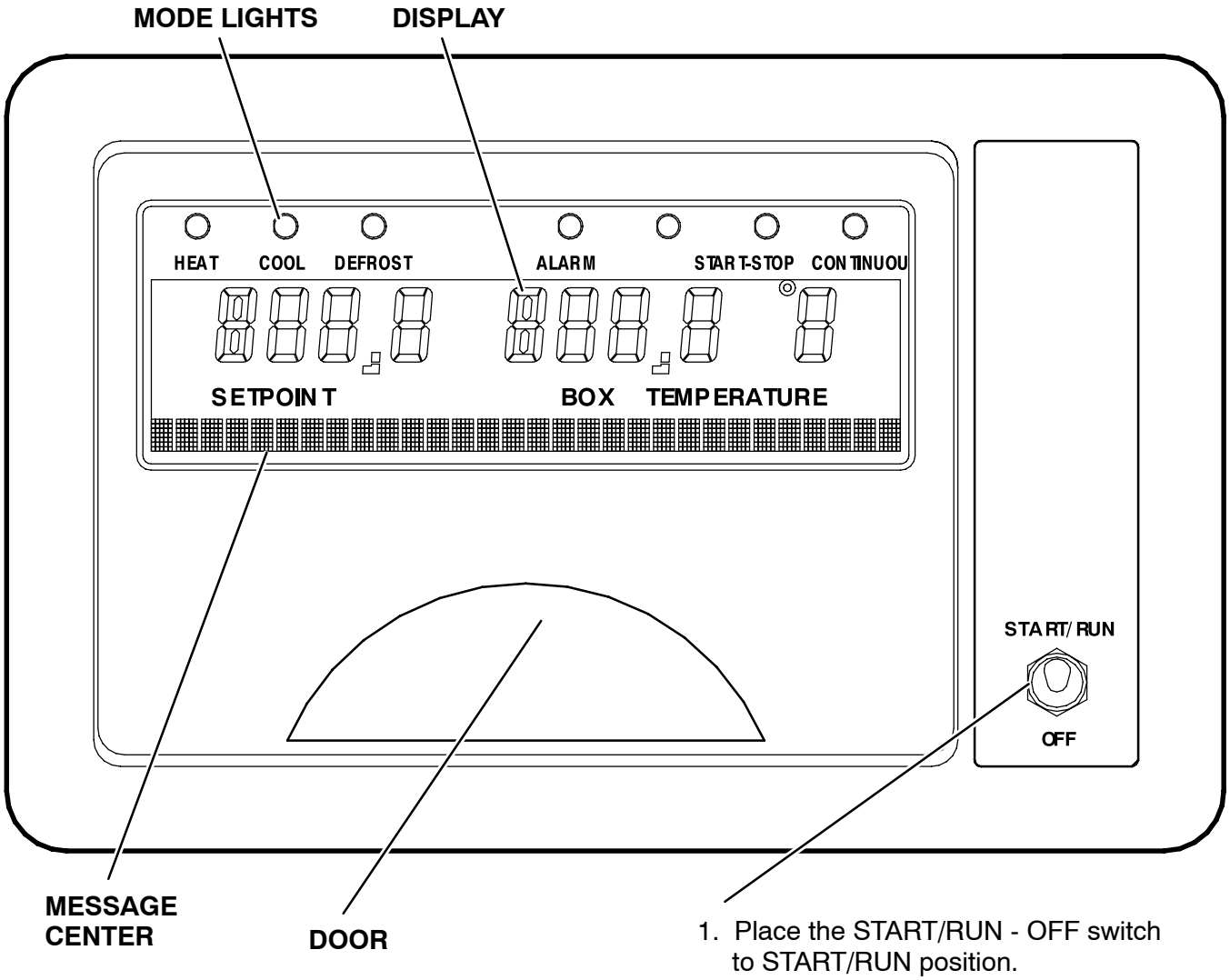

CAUTION
REPLACE COVERS AFTER SERVICING BATTERY TO INSURE PROTECTION OF BATTERY AND TERMINALS
62-02505-00 REV -


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


RADIATOR COOLANT INSTRUCTIONS
TOP-COOLANT INTO RECOVERY BOTTLE ONLY
FILL EMPTY RADIATOR THROUGH FILLER NECK SLOWLY TO AVOID AIR ENTRAPMENT.
CAUTION
REMOVE
FILLER CAP
SLOWLY
62-02142-00 REV_A

Section 2 - Operation

2.1 Starting Unit - Auto



The microprocessor controller will run a self test. All of the mode lights will light, all of the segments on the display will be turned on, all of the Liquid Crystal Display (LCDs) in the Message Center will be turned on, and all of the selectable option lights will light to verify their operation.

The display will then show the setpoint temperature in the left four characters and the box temperature of the trailer in the right four characters. The last character (after the degree symbol) shows the temperature units as "C" Celsius or "F" Fahrenheit.

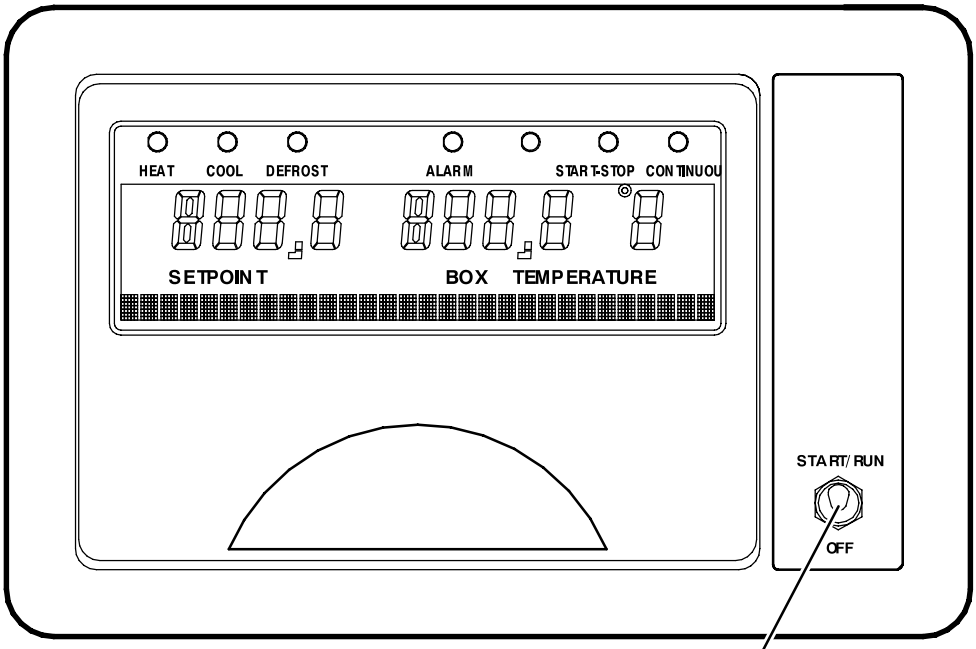
The Message Center will show "STATUS OK" unless there is an alarm(s) stored in the controller. If there is an alarm(s) stored in the controller, "INACTIVE ALARMS IN MEMORY" will be displayed on the Message Center and the Alarm LED will flash for 5 seconds, then turn off. "CHECK AT NEXT SERVICE INTERVAL" will then be displayed if there are any active non-shutdown alarms present.

WARNING

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

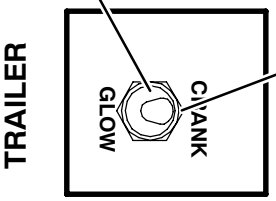
The glow plugs will energize (as required), the buzzer will sound, and the diesel engine will start.

2.2 Manual Start (Glow & Crank)



1. Hold GLOW/CRANK switch in the GLOW position (toggle towards trailer for Ultima / toggle down for Ultra, Ultra XL & Extra).

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



Back-side of Control Box

3. Continue to hold GLOW/CRANK switch in the GLOW position for up to 55 seconds, based on the Ambient Temperature table below.

4. Then crank the engine by holding the GLOW/CRANK switch in the CRANK position for up to 10 seconds to start the diesel engine.

WARNING

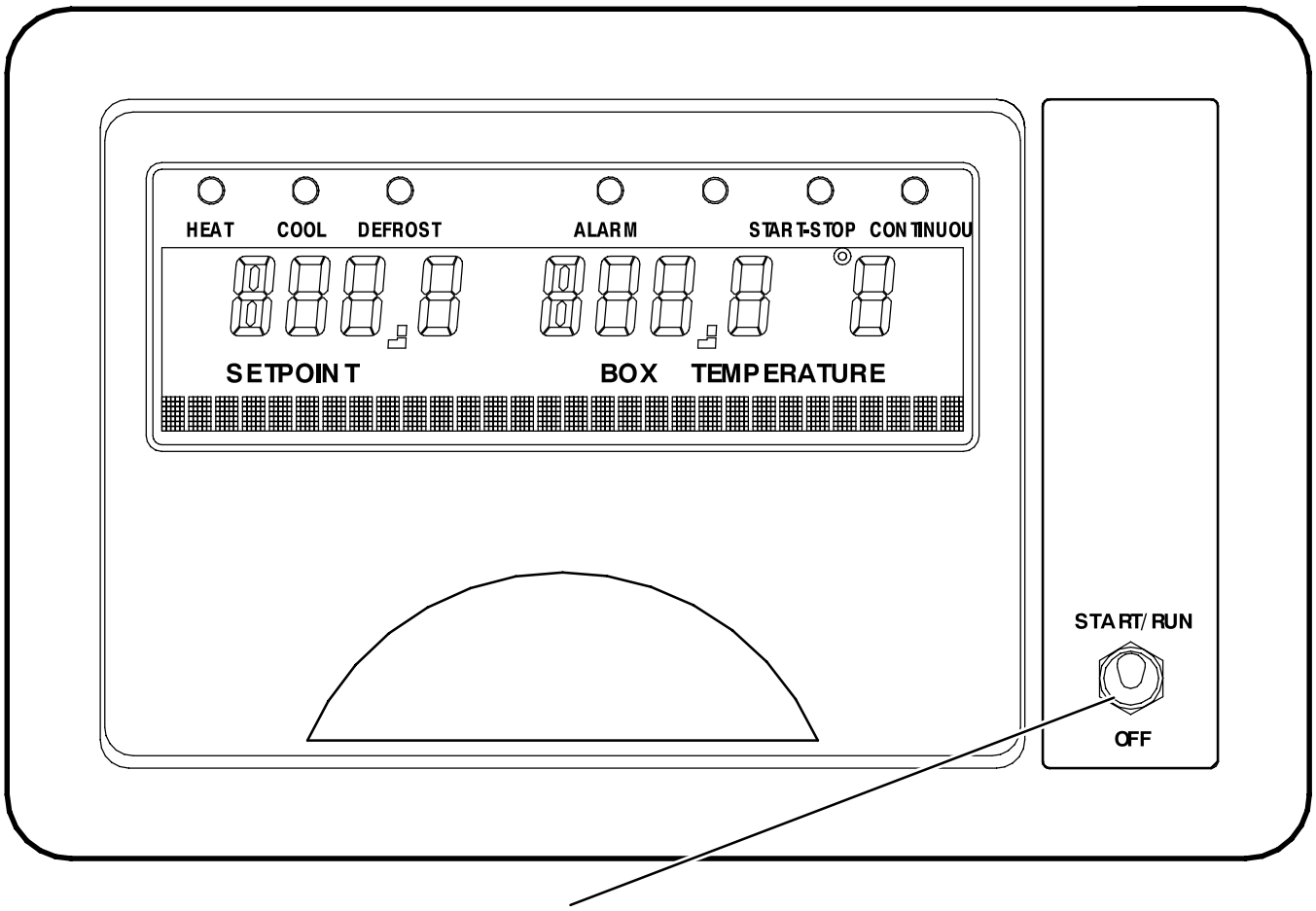
Under no circumstances should ether or any other starting aids be used to start engine.

The diesel engine may be manually started using the GLOW/CRANK switch and the START/RUN – OFF switch.
When the micro powers up, "MANUAL START MODE SELECTED" will appear in the Message Center and the Alarm LED will blink for 5 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 turned off them back to Start/Run.

Glow Time		
Ambient Temperature	**Glow Time in Seconds**	
	Short	**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

2.3 Stopping Unit

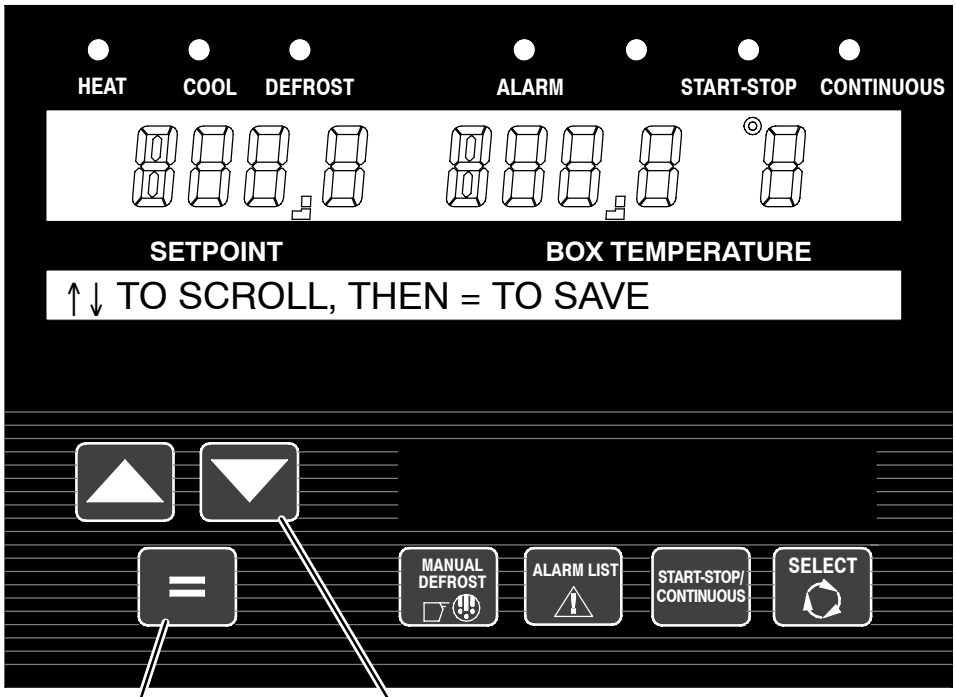


1. To stop the unit, place the START/RUN - OFF switch to OFF position.

The diesel engine will stop and the Microprocessor controller will turn off. The Microprocessor Main Display, Message Center, 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 RUN will result in a 10 to 15 second delay between the display going off and coming back on again.

2.4 Changing Setpoint



1. With the setpoint displayed, press the UP ARROW or DOWN ARROW key to change the setpoint to the desired value. The display will flash to indicate that the setpoint reading being displayed is a non-entered value. The Message Center will show ↑↓ TO SCROLL, THEN = TO SAVE. The setpoint display will flash for 5 seconds or until the = (ENTER) key is pressed.

2. Press the = key (ENTER) to save the new setpoint.

Setpoints of −22°F to +89.6°F (−30°C to +32°C) may be entered. The Microprocessor always retains the last entered setpoint in memory. The setpoint may be changed up or down one tenth of a degree in 0.1°F or 0,1°C increments, providing "Decimal Displayed" is configured in the configuration list See the configuration table Section 2.17.

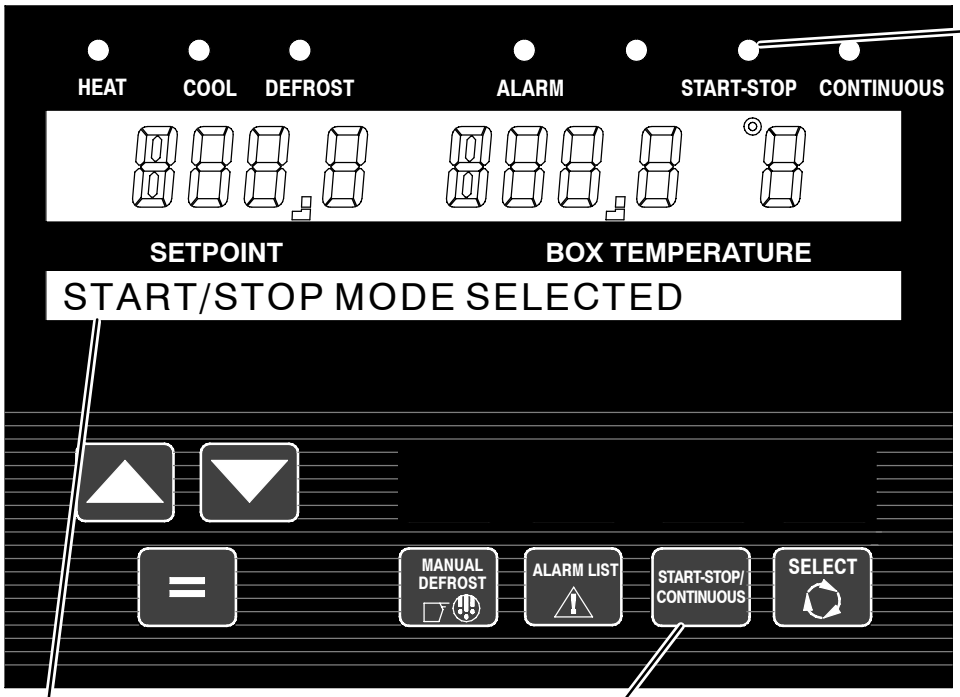
NOTE: The Microprocessor Configurations allow a Minimum and Maximum Setpoint to be entered, so that only Setpoints within that range may be selected.

You can not change the setpoint when viewing the Alarm List, Data List or Functional Parameters, or when unit is in Pretrip or is in Sleep Mode. Setpoint may be changed any other time the SROS is in the Run position, or with the unit in PC Mode.

Pressing the = key (ENTER) will cause the new displayed setpoint value to become active and "SET POINT CHANGED" is displayed. If the display is flashing and the new value is not entered, after 5 seconds of no keyboard activity, the entire display and Driver's Light Bar will flash for 15 seconds with "SET POINT NOT CHANGED" displayed and then revert back to the active setpoint. All other keys are active at this time and if pushed while the display is flashing, will stop the flashing, and perform the requested function.

TIP: You may press and hold the UP ARROW or DOWN ARROW key to quickly change the setpoint. The longer the key is held, the faster the setting will change.

2.5 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 Message Center and that the START-STOP light is illuminated. The unit is now in Start-Stop operation.

Automatic start/stop gives the Microprocessor automatic control of starting and stopping the diesel engine as required. The main function of automatic start-stop is to turn off the refrigeration system near the setpoint to provide a fuel efficient temperature control system and then restart the engine when needed. Start-Stop operation is normally used for frozen loads.

Start-Stop and Continuous operation may be tied to the setpoint ranges for frozen and perishable loads. The START-STOP/CONTINUOUS key is locked out if "START-STOP LOCKED" appears in the Message Center when the key is pressed and the unit is in Start–Stop Mode or "CONTINUOUS LOCKED" appears in the Message Center when the key is pressed and the unit is in Continuous Run Mode. See the configuration table Section 2.17.

The unit will remain in low speed for 10 minutes after engine start-up. 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.

The Microprocessor monitors box temperature, battery voltage, and engine coolant temperature during the off cycle. Once setpoint is reached, the controller will shut off the diesel engine to conserve fuel. The Microprocessor will not shut off the engine if the battery voltage is not sufficient to restart it, if the battery charge is greater than the amp setting selected in the Configuration List (Refer to Section 2.17), or if the engine coolant temperature is below 122°F (50°C). The controller will restart the engine if the box temperature has moved away from set point by 3.6°F to 18°F (2°C to 10°C) depending on the unit Functional Parameter settings, if the battery voltage drops below 11 Vdc, or if the engine coolant temperature drops below 34°F (1°C).

TIP: The status of the unit battery and engine coolant temperature can be readily checked by reading the Battery Voltage in the Data List. If "O.K." appears after the voltage reading, both battery volts and engine coolant temperature are sufficient to allow the unit to cycle off. If "O.K." does not appear, then one or both of these conditions have not been met, and the unit is not ready to cycle off.

Also, any time the ambient temperature is below 35°F (1.7°C) the unit will not operate in High Speed Cool. Low Speed Cool, High and Low Speed Heat cycles will operate at all ambient temperatures.

2.5.1 Charging Amps

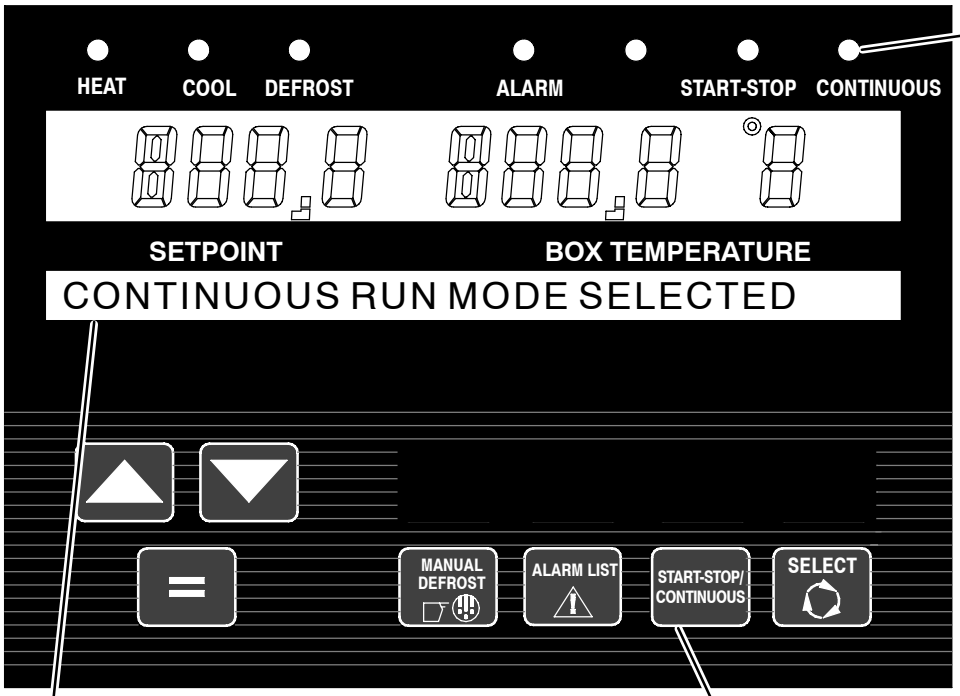
Beginning with software revision 01.06.00, a Configuration has been added that allows the Microprocessor to monitor battery charging amperage in addition to battery voltage. The battery charging rate (as seen in the Data List) must be below the selected amp setting to allow the unit to cycle off.

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 general 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 re-charging 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.)

2.6 Continuous Run Operation



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

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

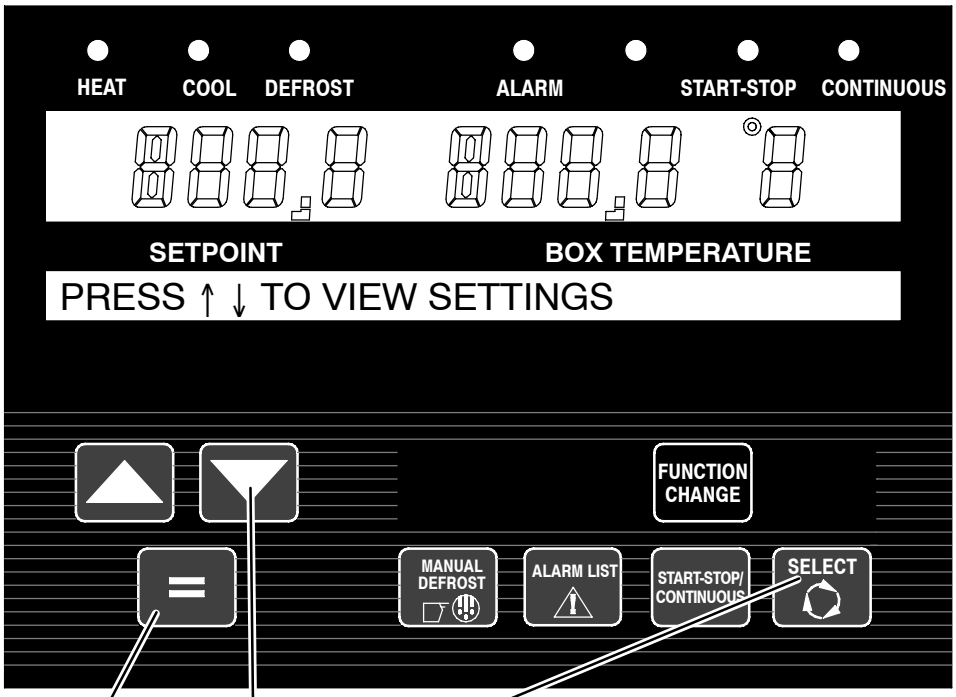
In the continuous run mode, the diesel engine will not shut down except for safeties or if the engine stalls. Continuous Run operation is normally used for perishable loads.

Start-Stop and Continuous operation may be tied to the setpoint ranges for frozen and perishable loads. The START-STOP/CONTINUOUS key is locked out if "START-STOP LOCKED" appears in the Message Center when the key is pressed and the unit is in Start-Stop Mode or "CONTINUOUS LOCKED" appears in the Message Center when the key is pressed and the unit is in Continuous Run Mode. See the configuration table Section 2.17.

The unit will remain in low speed for 10 minutes after engine start-up when the Continuous Run setpoint is below 10.4°F (–12°C). 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 device three consecutive times, without running a minimum of 15 minutes between shutdowns, the "FAILED TO RUN MINIMUM TIME" Alarm will be activated. The shutdown counter is cleared when the unit has run for 15 minutes.

Also, any time the ambient temperature is below 35°F (1.7°C) the unit will not operate in High Speed Cool. Low Speed Cool, High and Low Speed Heat cycles will operate at all ambient temperatures.

2.7 Sleep Mode ON



1. Press the SELECT key until FUNCTION CHANGE is lit. Message Center will show PRESS ↑↓ TO VIEW SETTINGS.
2. By pressing the ↓ DOWN ARROW key, you will move through the Function List to SLEEP MODE.
3. Press = (ENTER) key.
4. Continue pressing ↑ UP or ↓ DOWN ARROW key until YES is showing, then press the = (ENTER) key to select Sleep Mode.

Sleep Mode OFF

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

Sleep Mode is used generally in cold ambients when the trailer may be parked and the unit OFF for an extended period of time (1 day to several weeks) with no product in the trailer. Many times units are very difficult to start due to battery being discharged, engine oil being very thick, 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. There is **NO temperature control** in Sleep Mode and it should never be used for hauling perishable or frozen products.

While the unit is running in Sleep Mode, "WARNING: NO TEMP CONTROL" will be displayed in the Message Center. No setpoint or box temperature will be shown, as the unit is not running to control the box temperature. The unit will operate for a minimum run time of 4 minutes, and until the battery is fully charged, and the engine coolant temperature is 122°F (50°C), or above.

NOTE: In the event that the Engine Coolant Temperature sensor fails, Sleep Mode will operate:

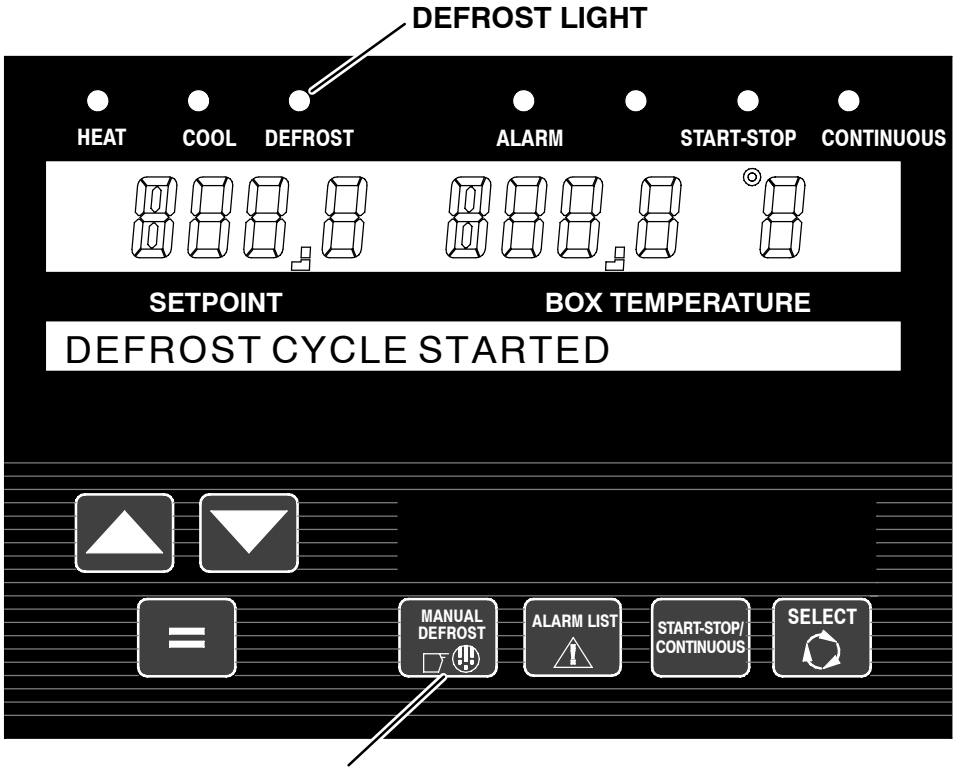
Ambients above +32°F (0°C) unit will run as above, monitor battery voltage and charging amps (according to the configuration setting) only.

Ambients below +32°F (0°C) 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.

While the unit is cycled off in Sleep Mode, "SLEEP MODE, OFF/ON TO WAKE" will be shown in the Message Center. To exit Sleep Mode, you can use the instructions for changing Functional Parameters as shown in section 2.15, and select Sleep Mode NO, or simply turn the Start/Run-Off switch to the Off position, then back to the Start/Run position.

2.8 DEFROST

2.8.1 Manual Defrost



1. Press the MANUAL DEFROST key. The DEFROST light will come on and the Message Center will display DEFROST CYCLE STARTED for 5 seconds, or flash CANNOT START DEFROST CYCLE for 5 seconds.

The defrost mode may be manually initiated.

If "CANNOT START DEFROST CYCLE" is displayed, the coil temperature is above 40°F (4.4°C), the unit is in a Start-Stop Off Cycle, or the engine has not run 15 seconds after starting. Run the unit to lower temperature below 40°F (4.4°C) and then restart defrost. Only one DTT needs to be below 40°F (4.4°C) to allow Defrost to start. Defrost can not be started with the unit in Sleep Mode or in PC Mode or if there is an active Shut–Down Alarm.

The defrost mode terminates when:
Both DTT1 & DTT2 are 55°F (12.8°C) or above (software versions prior to 01.06.00), or
DTT1 is above 45°F (7.2°C), and DTT2 is above 55°F (12.8°C) (software versions 01.06.00 and later).

Should the defrost cycle not complete within 45 minutes, the defrost cycle will be terminated after 45 minutes, and "DEFROST NOT COMPLETE" will be in the Message Center. The Microprocessor will initiate another Defrost Cycle in 1.5 hours. Pressing the manual defrost key will override this mode and start a defrost cycle.

If a shutdown alarm occurs, defrost will be terminated.

In the event that one of the DTT sensors fails, the unit will disregard that DTT sensor, and use only the remaining DTT sensor to determine the 40°F (4.4°C) requirement to begin a defrost cycle, and the 45°F (7.2°C) or 55°F (12.8°C) temperature at which the defrost cycle will terminate.

If both DTT sensors fail, the unit may be put into defrost at any temperature, and the defrost cycle will terminate at the end of 20 minutes.

2.8.2 Automatic Defrost

The defrost mode may be automatically initiated by either or two devices:

Defrost Timer

Defrost Air Differential Switch

a. Defrost Initiation Timer

The Defrost Timer is set in the Functional Parameter List. Refer to Section 2.15

The Defrost Timer may be set for 1.5, 3.0, 6.0, or 12.0 hour intervals. When the correct amount of time has elapsed, a defrost cycle will be initiated providing that at least one of the DTTs is at a temperature at or below 40°F (4.4°C). If the DTTs are both above this temperature, the unit will not go into a defrost cycle, the timer will reset to zero, and will begin counting toward the next interval.

The Defrost Timer increments (counts) time only when the engine is running. 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, if the timer expires then.

When a Defrost Cycle is initiated by the defrost timer, the timer is reset to zero, and will not begin counting until the defrost cycle has terminated.

When the SROS is turned off, the defrost timer will be reset to zero.

b. Defrost Maximum Time Timer

The Defrost Maximum Time Timer monitors the length of the defrost cycle. Once the unit has been in a defrost cycle for 45 minutes, this timer will terminate the defrost cycle, and allow the unit to heat or cool as needed to maintain temperature control.

When the Defrost Maximum Time Timer is used to terminate the defrost cycle, Alarm 54 "Defrost Not Complete" will be active, and the Defrost Initiation Timer will be temporarily reset to 1.5 hours. (This temporary setting will not be shown in the Functional Parameters list. Only the saved defrost interval will be displayed there.)

c. Defrost Air Differential Switch

The Defrost Air Differential Switch measures the difference in air pressure entering the evaporator against the pressure of the air leaving the evaporator. A build up of ice will cause the difference to increase. Once the pressure difference increases to the setting of the switch, the contacts will go closed, and initiate a defrost cycle, providing that at least one of the DTTs is reading a temperature at or below 40°F (4.4°C).

The Defrost Air Differential Switch requires periodic testing and calibration. (Refer to Section 8.27) 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.

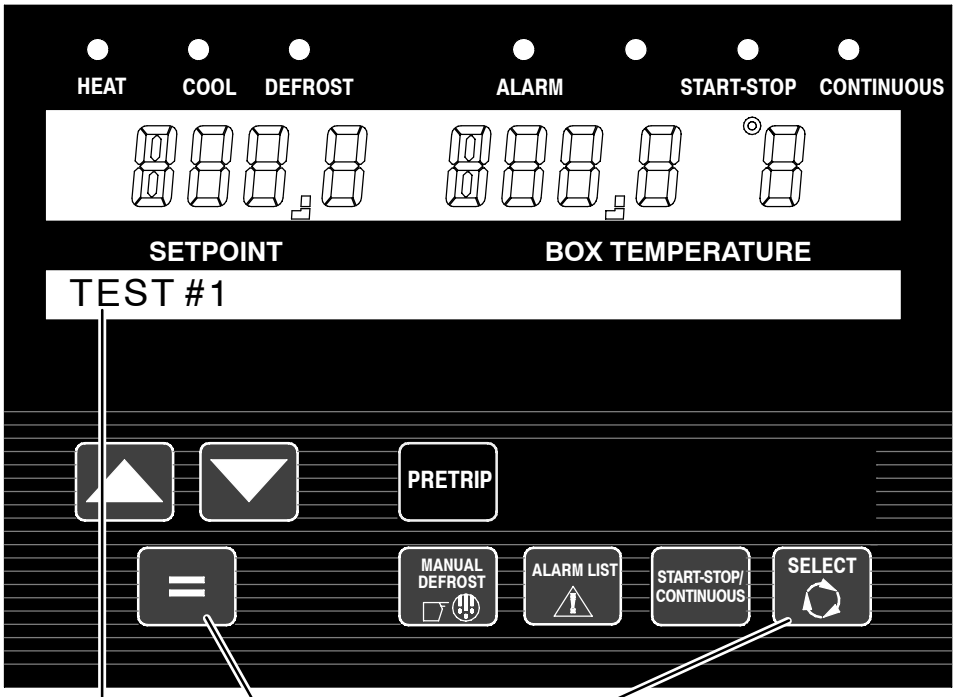
If the Defrost Air Switch calls for a defrost cycle within 8 minutes of the previous defrost cycle termination, in two consecutive defrost cycles, Alarm 55 "Check Defrost Air Switch" alarm will become active. In this case, the Defrost Initiation Timer will be set for 1.5 hours, and the Defrost Air Switch signal will not be used to start a defrost cycle during this time.

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

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.

2.9 Pretrip



1. Press the SELECT key until PRETRIP is illuminated.
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 Drivers' 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 and indicating a failure when detected.

TIP: A Pretrip can be started with any box temperature.

The Message Center displays the current test and the % complete of the test. When the Pretrip tests are complete the Message Center will display "PRETRIP PASS". If "PRETRIP FAIL IN TEST X or PRETRIP FAILED & COMPLETE" is displayed the ALARM light will flash. Press the ALARM LIST key to review the alarms set by the Pretrip tests.

TIP: "PRETRIP PASS" or "PRETRIP FAIL" will stay displayed until a key is pressed, or until the SROS switch is turned Off.

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

TIP: If "CAN NOT START PRETRIP" is displayed in the message center, check the alarm list for active shutdown alarms or if the unit is in Sleep Mode or PC Mode.

Pretrip

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 Run position. Pretrip will not start if there is an active shutdown alarm, or if the unit is in Sleep Mode or PC Mode.

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 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 5 seconds. **PRETRIP STOPPED BY USER** will appear in the Message Center.

If unit is running, the micro will shut it down by de-energizing the fuel solenoid.

Once the unit is not running, Pretrip will begin.

TIP: It is always a good idea to clear all alarms from both Alarm Lists before starting Pretrip. This practice allows the technician to know that any alarms present following Pretrip had to occur during Pretrip, and are not old alarms that had simply never been cleared out before.

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

Test 1 – Display Test

The Microprocessor activates the LCD / LED display. This test will last 5 seconds. All segments of the display, all LEDs on the Microprocessor will be on during this test. Any segments that are not visible, any LEDs that do not come on indicate a defective display test. During the next 5 seconds all the lights in the Driver's Light Bar will be turned on, and the buzzer will sound. Test 1 is the only portion of the Pretrip cycle that must be monitored by the technician or driver. Any lights that do not illuminate, or if the buzzer does not sound 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)
- Evaporator/Condenser Fan clutch
- UL1 Front Unloader
- UL2 Rear Unloader
- Speed Solenoid
- SV1
- SV2
- SV3
- SV4
- Glow Plugs
- Fuel Solenoid

Most components will be energized for 4 seconds at which time the amperage reading is taken. There is a 2 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 2 minutes. If a problem is detected with any of the listed components, the corresponding alarm will be displayed.

Test 3 – Temperature & 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 #1
- Defrost Termination Sensor #2
- Compressor Discharge Sensor

Test 3 will last approximately 5 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 Mode divides at this point as the engine and compressor are allowed to run and be warmed up. If the ambient temperature is above +32°F, the unit will operate in the "Cool Pretrip" Mode. If the ambient temperature is at or below +32°F, the unit will operate in the "Heat Pretrip" Mode.

In the *Cool Pretrip mode*, the unit will operate in 2 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 4 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, box temperature and unit condition. For very low box temperature, the unit may operate in 6 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 the rear Unloader is tested. If the Rear Unloader fails to load or unload, 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 the Front Unloader is tested. If the Unloader fails to load or unload, the CHECK UL1 alarm will be displayed. Test 6 will last about 20 seconds.

Test 7, 8, & 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 RPMs 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, & 9 will last about 30 seconds.

Test 10 – SV1 (Cool Pretrip Only)

With the unit running in 2 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 3 minutes.

Test 11 – Check SV4

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

With the unit running in 2 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 8 minutes. Also if the unit cannot pump down, the CANNOT PUMP DOWN alarm is displayed.

Test 12 – Check SV3

With the unit running in 2 cylinder Low Speed Heat, SV3 is tested for opening and closing. If the valve does not operate correctly, the CHECK SV3 VALVE alarm will be displayed. This test may last up to 8 minutes. Also if the unit cannot pump down, the CANNOT PUMP DOWN alarm is displayed.

Test 13 – Low Side Pump Down

With the unit running in 2 cylinder Low Speed, SV2, SV3, & 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 8 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 1 minute.

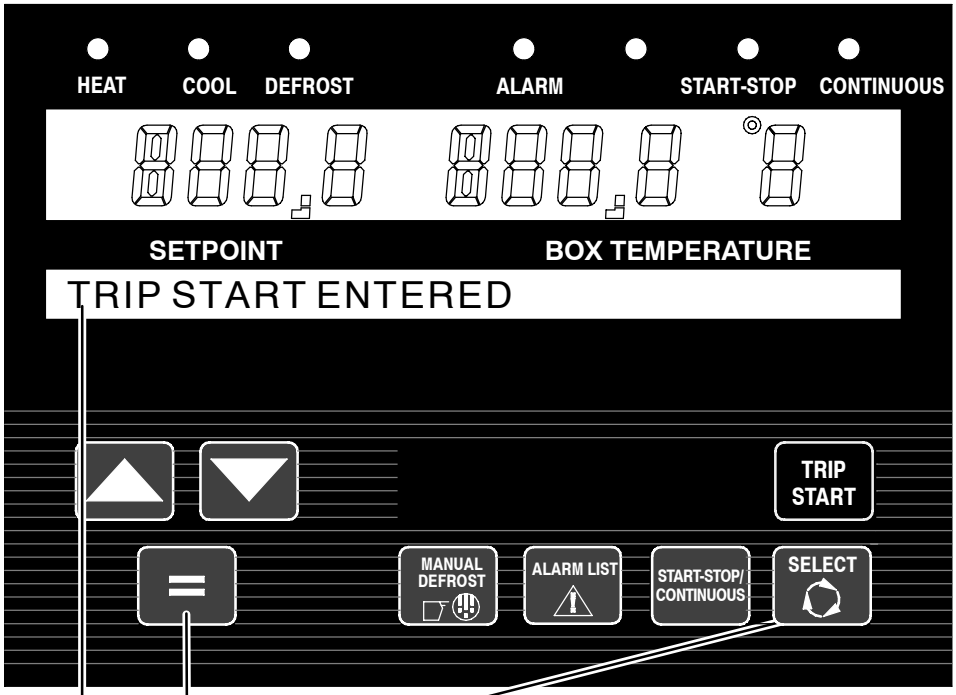
Test 15 – Check Discharge Check Valve

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.

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 & 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).

2.10 Trip Start

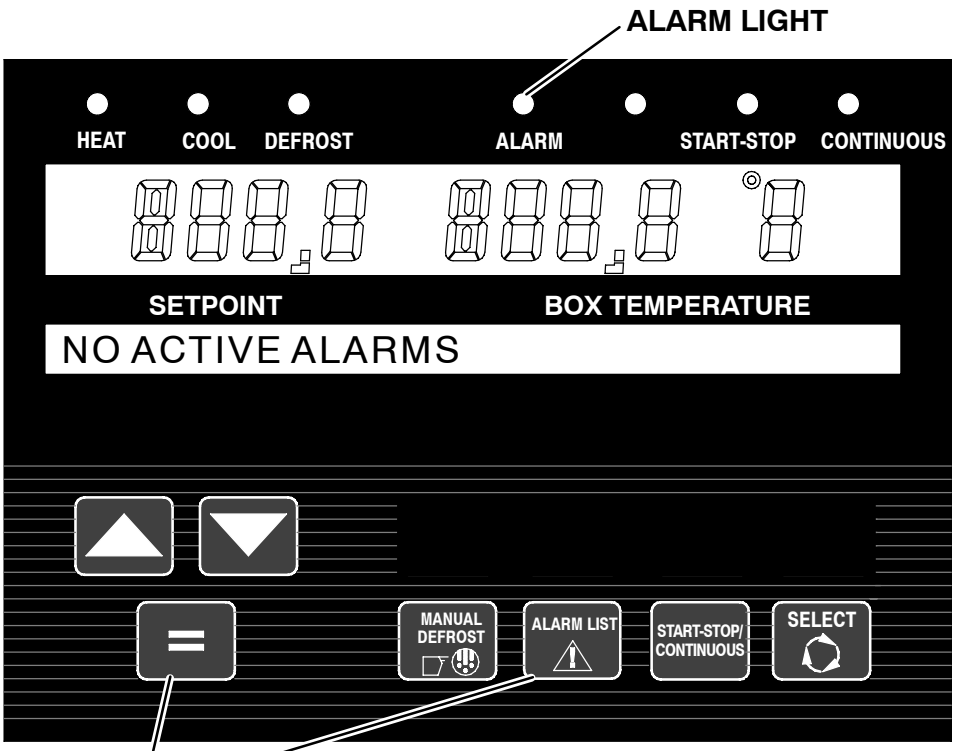


1. To mark the start of a trip in the data recorder, press the SELECT key until TRIP START is lit. PRESS = TO ENTER TRIP START will be displayed.
2. Press the = key.
3. If trip start is acknowledged by the data recorder, TRIP START ENTERED will be displayed for 5 seconds and then the display will revert 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 stamp 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.

2.11 View Active Alarms



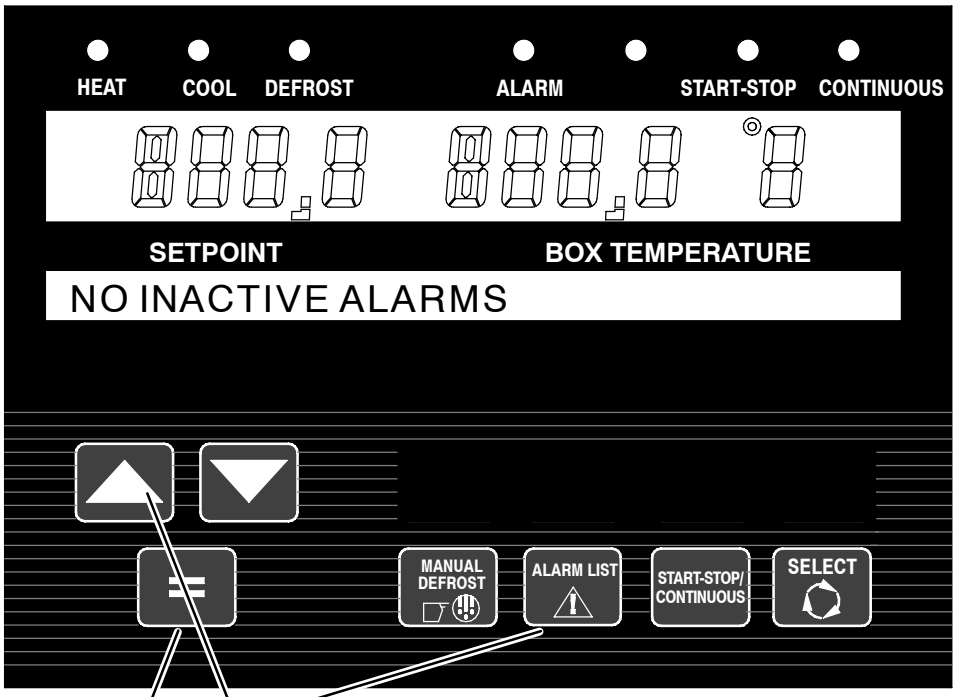
1. Press the ALARM LIST key. If there are no active alarms, the display will say NO ACTIVE ALARMS for 5 seconds.
2. If there are active alarms, the display will be 'A' (active) and the alarm number and message. The last Alarm that occurred will be the first Alarm displayed and so on.
3. Press the ALARM 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 5 seconds.
5. To deactivate 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.

Unit problems detected by the controller are stored in the Alarm List in the controller. Stored alarms may be viewed on the 30 character display.

For a complete list of Alarms and their meaning, refer to the Message Center display description in Section 6.1. Refer to Section 5.1 for troubleshooting information.

TIP: To deactivate active alarms, turn the controller OFF and then back ON using the START/RUN – OFF switch.

2.12 View Inactive Alarms



1. Press and hold both the ALARM LIST key and the UP ARROW key for 6 seconds. If there are no inactive alarms, the display will say NO INACTIVE ALARMS for 5 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 5 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 within the Active and Inactive Alarm Lists combined. The list can be read via the Message Center or using the PC Service Tool. There are 2 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 (section) to the Active Alarm List (section).

As additional alarms occur, they will be placed first in the Active Alarm List. An alarm can not be active and inactive at the same time. Each alarm can only be present in either the Active or Inactive Alarm List at any given time. As conditions changed, alarms may be moved from the Active Alarm List to the inactive alarm list and back.

Alarms are also recorded in the DataLink Data Recorder. They are recorded at the time they occur (become active), and the time they become inactive.

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

2.13 Alarms & Default Messages

Unit problems detected by the controller are stored in the Alarm List in the Microprocessor controller. Stored alarms may be viewed in the Message Center.

STATUS OK will be shown in the Message Center most of the time.

DATA RECORDER FAILURE will be shown if there is a problem with the DataLink data recorder, .

If a problem begins to develop one of the following messages may be shown:

LOW FUEL LEVEL WARNING means that the fuel level in the fuel tank needs to be checked and fuel added.

CHECK ENGINE OIL LEVEL means that the engine oil level needs to be checked and oil added.

LOW COOLANT LEVEL means that the engine coolant level needs to be checked and coolant (anti-freeze) added.

SLEEP MODE, OFF / ON TO WAKE will appear when the unit is in Sleep Mode, and the engine has cycled off. (See page 2-8 for more information on Sleep Mode.)

WARNING: NO TEMP CONTROL will be displayed when the unit is in Sleep Mode, and the unit has temporarily "woke up" and is running. (See page 2-8 for more information on Sleep Mode.) This will also be displayed when the unit is running in Default Mode. (See Section 4.5)

CHECK DOOR will be displayed if the trailer door is opened, and your trailer has an optional door switch to notify you when the door is opened or not closed tightly.

UNIT SHUTDOWN – DOOR OPEN will be displayed if the trailer door is opened, and your trailer has an optional door switch to shut the unit down when the door is opened, or not closed tightly.

CHECK REMOTE SWITCH 1 (2) will be displayed if an optional remote control switch is installed as a warning devise (for example – a second door switch, or remote toggle OFF/ON switch), and the switch is in the OFF position.

UNIT SHUTDOWN – REMOTE SWITCH 1 (2) will be displayed if an optional remote control switch is installed and configured to shut the unit down when it is turned OFF (for example – a second door switch, and the door is opened) whenever the door is opened or not tightly closed.

CHECK AT NEXT SERVICE INTERVAL is shown when there is an active non-shutdown alarm present (the alarm condition is present but is not serious enough to stop the unit). These alarms may be viewed by pressing the Alarm List Key. The message will clear itself when the condition is corrected.

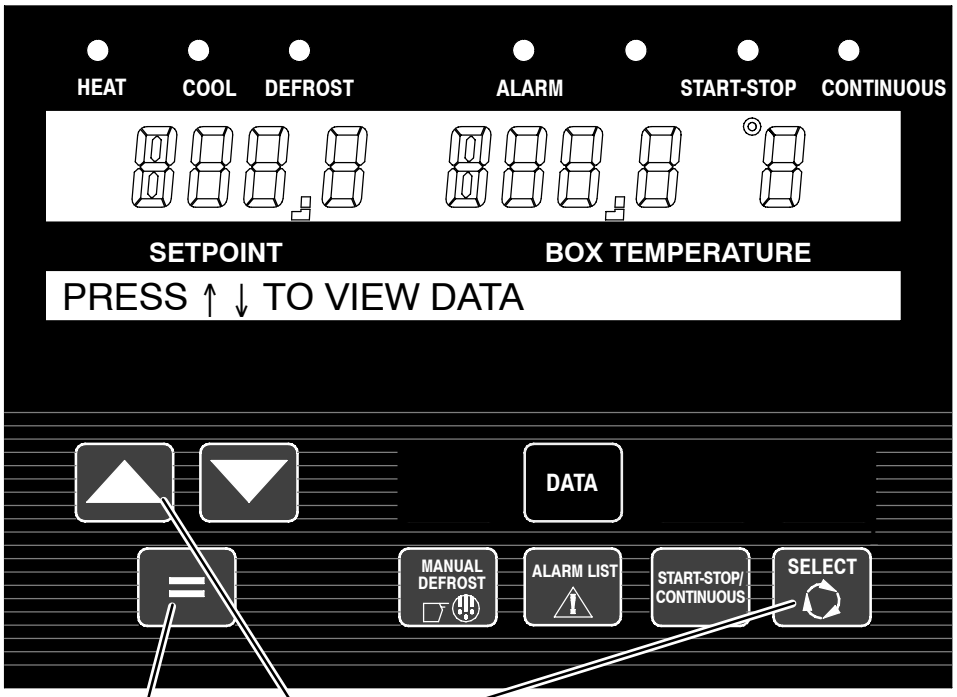
PM DUE is shown when any of the maintenance hour meters has expired, indicating that the unit should be brought into a shop for scheduled maintenance.

TIP: To deactivate active alarms, turn the microprocessor OFF and then back ON using the START/RUN-OFF switch.

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 Message Center. The following are the Shutdown Alarms that may appear:

SHUTDOWN ALARMS		
2	Low Engine Oil Level	Alarms may be cleared from the display by turning the Start/Run-Off switch off, waiting a few seconds, then turning it back on again, or by viewing all the alarms in the Active Alarm list. At the end of the list are the instructions LIST END, = TO CLEAR ALARMS. Pressing the = (enter) key while this message is in the Message Center will clear all active alarms. (In the event that the alarm re-occurs, it will reappear in the Message Center. The unit may need to go in for repairs if an alarm reappears multiple times.)
11	Low Engine Oil Pressure	
12	High Coolant Temperature	
13	High Discharge Pressure	
15	Battery Voltage too High	
16	Battery Voltage too Low	
17	High Comp Discharge Temp	
18	Low Refrigerant Pressure	
19	Low Fuel Shutdown	
27	High Suction Pressure	
28	Check Refrigeration System	
30	Failed to run Minimum Time	
31	Failed to Start - Auto Mode	
32	Failed to Start - Manual	
35	Check Starter Circuit	
39	Check Engine RPM	
41	Engine Stalled	
51	Alternator not Charging	
53	Box Temp Out-of-Range	
56	Check Evaporator Airflow	
57	Check Remote Switch 1	
58	Check Remote Switch 2	
61	Door Open	
71	Bad F2 or F3 Fuse	
72	Bad F4 or F6 Fuse	
122	Check Return Air Sensor	
123	Check Supply Air Sensor	
204	Low Suction Pressure	
232	Setpoint Error	
233	Model # Error	
234	Unit Serial # Error	
235	Control Serial # Error	
236	Trailer Id # Error	
237	Function Parameter Error	
238	Configurations 1 Error	
239	Configurations 2 Error	
240	Hour Meter Error	
241	Alarm Status Error	
242	DIS PRESS Calibrate Error	
243	SUCT/EVAP Calibrate Error	
245	MICRO SW REV Error	
246	EEPROM Write Failure	
247	Configurations 3 Error	
248	CONFIG MODE / HP2 Error	
249	Microprocessor Error	

2.14 Unit Data



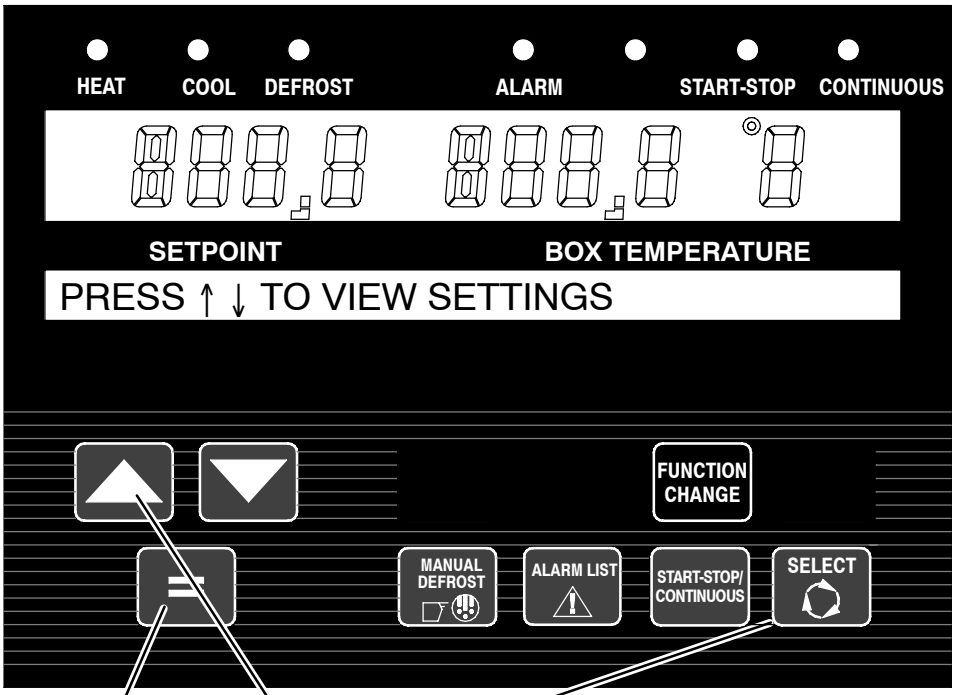
1. Press the SELECT key until DATA is lit. The Message Center will show PRESS ↑↓ TO VIEW DATA.
2. By pressing the ↑ UP ARROW key, you will move through the Data List beginning at the top and moving toward the bottom, or by pressing the ↓ DOWN ARROW key, you will move through the Data List beginning at the bottom, and moving toward the top.
3. To lock a Data List item in the Message Center, press the = (ENTER) key. The Data item will flash on and off to indicate it is locked.
4. Pressing ↑ UP or ↓ DOWN key will unlock that item and move to the next data item. Pressing the = (ENTER) key will unlock the item.

Unit Data

Press the SELECT Key until the Data light comes on, and "Press ↑ ↓ to View Data" appears in the Message Center. Pressing either ↑ ↓ UP or DOWN ARROW key will bring up the instructions "↑ ↓ to Scroll, Then = To Lock". 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. If no keys are pressed for 10 seconds, the Message Center will return to the default display, which is usually "**STATUS OK**". To lock a Data List item on the screen, press the = (ENTER) key. The Message Center will flash the Data List item that is being displayed, and will keep it visible until any key on the Keypad is pressed.

UNIT DATA	
DATA	**DEFINITION**
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
AMBIENT AIR TEMP	Ambient (air entering condenser) air temperature
DEFROST TERM TEMP 1	Defrost termination temperature #1 (Located in the blower housing - near SAT)
DEFROST TERM TEMP 2	Defrost termination temperature #2 (Located on the center evaporator tube sheet)
COMP DISCHARGE TEMP	Compressor discharge temperature
BATTERY	Battery voltage
CURRENT DRAW	Battery charging or discharging amps. (Is used in place of ammeter.)
ENGINE RPM	Engine revolutions per minute
FUEL LEVEL	% of fuel in tank. (This is only shown when 0% - 100% sensor is configured ON.)
START MODE	AUTO if the engine will start automatically MANUAL if the engine must be started manually
SOFTWARE REVISION	Revision of the software that is operating the Microprocessor
DISPLAY SOFTWARE REV	Revision of the software that is operating the Keypad
CONTROL SERIAL #	Serial Number of the Microprocessor
TRAILER ID #	Trailer ID (as entered by the user)
UNIT SERIAL #	Unit serial number
UNIT MODEL #	Unit model number (selected through configurations)
ENGINE HOURS	Total engine operating time
SWITCH ON HOURS	Total hours that the Start/Run-Off switch has been in the Start/Run position.
*HOURS TO ENGINE MAINT	Number of engine hours until the next programmed engine maintenance.
*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 PM maintenance.
*RANGE 1 LOCK	OFF - Temperature Range 1 Lock is turned off. CONTINUOUS - When the Set Point is set between Range 1 Minimum & Maximum Temperatures, the unit is set to operate only in Continuous Run. START/STOP - When the Set Point is set between Range 1 Minimum & Maximum Temperatures, the unit is set to operate only in Start/Stop.
*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 - When the Set Point is set between Range 2 Minimum & Maximum Temperatures, the unit is set to operate only in Continuous Run. START/STOP - When the Set Point is set between Range 2 Minimum & Maximum Temperatures, the unit is set to operate only in Start/Stop.
*RANGE 2 MINIMUM TEMP	This is the lower limit for Range 2.
*RANGE 2 MAXIMUM TEMP	This is the upper limit for Range 2.
*TEMPERATURE 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 3 remote sensors may be listed.)
DATALOGGER	This is the current Date and Time that the Data Recorder 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.
* These may or may not be displayed depending on the Functional Change (Parameters) settings.	

2.15 Functional Change (Parameters)



1. Press the SELECT key until FUNCTION CHANGE is lit. The Message Center will show 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 Message Center, and press = (ENTER) key. "↑ ↓ TO SCROLL, THEN = TO SAVE" will show in the Message Center. Pressing either ↑ UP or ↓ DOWN ARROW key will begin to change the Function setting. The Message Center will flash, indicating that a change has been made that has not been entered into memory.
4. Continue pressing ↑ UP or ↓ DOWN ARROW key until the desired value is showing, then press the = (ENTER) key. The Message Center will stop flashing. The new value is now in memory. If the = key is not pressed within 10 seconds, the Message Center will change to "FUNCTION NOT CHANGED". This will appear for 5 seconds, then return to the last Functional Parameter shown. If no further keys are pressed, the default display will return in another 10 seconds.

Functional Change (Parameters)

To view or change any of the Functional Parameters for the Microprocessor:

1. Press the SELECT Key until Function Change is highlighted.
   "↑ ↓ TO VIEW SETTINGS" will appear in the Message Center
2. Press the ↑ UP ARROW Key to scroll through the Function list beginning at the top.
   Press the ↓ DOWN ARROW Key to scroll through the Function list beginning at the bottom.
3. "↑ ↓ TO SCROLL THEN = TO SELECT" will appear in the Message Center.
4. To read through the Function list, continue to press either the ↑ or ↓ key. The Functional Parameters will appear in the Message Center in the order as shown below. The list is circular meaning that once the end is reached, it is repeated from the beginning. If no key presses are made for 10 seconds, the Message Center will return to the default message (Status OK, Check At Next Service Interval, etc.).

NOTE: Any Function that is shown with a lock symbol can not be changed from the keypad.

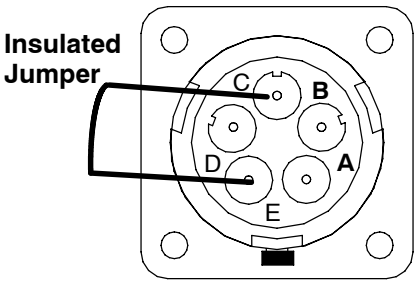
5. To change one of the Functions, bring the Function you wish to change into the Message Center, and press = key (ENTER). "↑ ↓ TO SCROLL, THEN = TO SAVE" will show in the Message Center. Pressing either ↑ or ↓ UP or DOWN ARROW key will begin to change the Function setting. The Message Center will flash, indicating that a change has been made that has not been entered into memory.
6. Continue pressing ↑ or ↓ UP or DOWN ARROW key until the desired value is showing, then press the = key (ENTER). The Message Center will stop flashing. The new value is now in memory. If the = key is not pressed within 10 seconds, the Message Center will change to "FUNCTION NOT CHANGED". This will appear for 5 seconds, then return to the last Functional Parameter shown. If no further keys are pressed, the default display will return in another 10 seconds.

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. 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.
• (PERISH / FROZEN) MIN RUN TIME:	**4MINS** TO 60MINS (in 1 minute increments)	This determines the minimum length of time the unit will run every time the unit starts in (Perishable or Frozen or both) Auto Start/Stop Modes.
• (PERISH / FROZEN) MIN OFF TIME:	10MINS TO 90MINS **20MINS** default (in 1 minute increments)	This determines the minimum length of time the unit will remain off whenever the unit cycles off in (Perishable or Frozen or both) Auto Start/Stop Modes.
• (PERISH / FROZEN) OVERRIDE TEMP:	3.5°F (2°C) TO 18°F (10°C) **11°F (6°C)** default (in 0.5 degree increments)	This selects the override temperature for the (Perishable or Frozen or both) Auto Start/Stop Off Cycle. During the Minimum Off Time, should the box temperature drift this far above or below setpoint in the Perishable Range, or above setpoint in the Frozen Range, the unit will override the Minimum Off Time, and restart.
• (PERISH / FROZEN) MAX OFF TIME:	**OFF** 10MINS TO 255MINS (in 1 minute increments)	OFF – There is no maximum off time. 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 box.
FROZEN SHUT-DOWN OFFSET	**0°F (0°C)** TO 3.5°F (2°C)	This only applies to Frozen Setpoints in Start–Stop operation. This offset is the number of degrees below setpoint that the unit will run before cycling off. This will allow for a lower average box 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 Set Point setting.
DISPLAY IN	**ENGLISH UNITS** METRIC UNITS	The display will show temperatures & pressures in either English (°F & psig) or Metric (°C & Bars)
* SET PM HOURMETERS		Maintenance Hour Meters that are enabled will appear in this list.
• ENGINE • SWITCH ON • PM 1 Thru 5	**ON** OFF RESUME RESET	When the Hour Meter has timed out, and preventative maintenance has been performed, selecting RESET and pressing = will de–activate the alarm, and reset the Hour Meter for the next service interval. When the Hour Meter is between intervals, OFF or RESUME will be the only selections. Pressing the = key while OFF is displayed will suspend operation of that Hour Meter, and prevent any maintenance alarms from showing. Hour Meters that have been turned off can be activated by selecting RESUME. Pressing = will resume the Hour Meter including all the hours that had been logged while it had been turned off.

FUNCTIONAL PARAMETER	SELECTIONS	DESCRIPTION
OUT OF RANGE ALARM:	English Metric OFF OFF 4°F 2°C 5.5°F 3°C **7°F 4°C**	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.
AIR FLOW	**NORMAL** HIGH	The Normal selection allows the unit to cycle from High Speed to Low Speed, depending on how close the box temperature is to Set Point. 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. NOTE: HIGH AIR FLOW does not work with setpoints below +10.4°F.
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	**NO** YES	NO - is the normal operating selection. 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.
* OVERRIDE DOOR SHUTDOWN	**NO** YES	NO - allows the door switch to shut the unit down whenever the trailer door is opened and the door switch is configured for shutdown. YES - allows you to over-ride the trailer door shutdown switch, and allow the unit to continue to run, even with the trailer door open.
* OVERRIDE REMS (1-2) SHUTDOWN	**NO** YES	NO - allows remote switch (1 and/or 2) to shut the unit down whenever door is open or the switch is turned OFF. YES - allows you to over-ride remote switch (1 and/or 2), and allow the unit to continue to run, even with the remote switch in the OFF position or the door is open.
LANGUAGE / IDIOMAS:	**ENGLISH** ESPANOL	**ENGLISH**- All information displayed in the Message Center will be shown in English. ESPANOL- All information displayed in the Message Center will be shown in Spanish.
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.		

2.16 PC Mode

PC Mode was created for the ability to download data using a computer, without having to have the unit run. Connecting a download cable to the download port, with the SROS in the OFF position, allows the Advance Microprocessor to power up, and communicate with the computer.



Serial / Downloader Port

To better utilize PC Mode, PC Mode Jumper 22−50180−01 is available. With the unit off, locate the serial / downloader port (Refer to Section 3.7). Remove the protective plug to gain access to the wire terminals. Plug in Serial Jumper P/N 22-50180-01 or connect an ***insulated jumper*** wire between plug terminals C and E.

Jumper P/N 22-50180-01

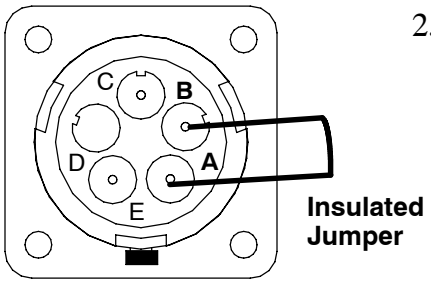
One big advantage of using PC Mode is that it allows the technician or service writer to read various data from the Microprocessor, without starting the 8 hour data recorder timer, and without having to start the units.

Some of the things that you may want to use PC Mode for are:

- Changing setpoint for the next load
- Changing any of the functional parameters for the next load
- Reading Engine hour meters
- Reading Maintenance hour meters
- Resetting Maintenance hour meters
- Viewing the Active and Inactive alarm lists.
- Entering a Trip Start
- Keeping the Microprocessor powered up after turning the SROS to the OFF position.
- Demonstrating the operation of the Microprocessor.

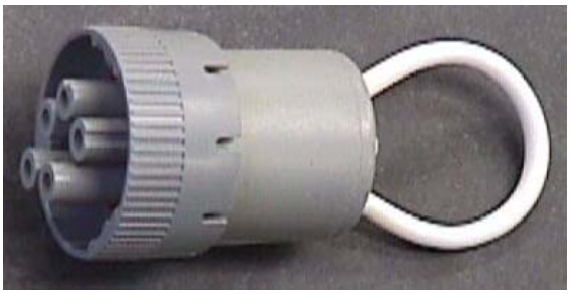
2.17 Microprocessor Configuration and Technician Test Modes (Remove Jumper Mode)

1. Turn the Start/Run-Off switch to the Stop position.



Serial / Downloader Port

2. With the unit off, locate the serial / downloader port (Refer to Section 3.7). Remove the protective plug to gain access to the wire terminals. Plug in Serial Jumper P/N 22-50180-00 or connect an ***insulated jumper*** wire between plug terminals A and B.



Jumper P/N 22-50180-00

Caution: Do Not Allow Jumper Wire To Touch Any Ground.

3. Turn the Start/Run-Off switch to the Run position. The ALARM LED will come on, the setpoint will appear, but the Box Temperature will not, and REMOVE JUMPER will appear in the Message Center for 10 seconds. Remove the jumper at this time. ↑ ↓ TO SCROLL, THEN = TO SELECT will appear in the Message Center for 10 seconds, or until either the ↑ ↓ keys are pressed.
4. The first selection is Configuration Mode, then Diagnostic Mode, and finally Component Test Mode.
5. Press the ↑ ARROW Key to scroll through the Main Menu beginning at the top.
   Press the ↓ ARROW Key to scroll through the Main Menu beginning at the bottom.
6. Select the Mode you wish to access, and press the = key.
7. For Configuration Mode (Refer to Section 2.17.1)
   For Diagnostic Mode (Refer to Section 2.17.2)
   For Component Test Mode (Refer to Section 2.17.3)

2.17.1 Configuration Mode

NOTE: To enter Configuration Mode Refer to Section 2.17.

1. ↑ ↓ TO SCROLL, THEN = TO SELECT will appear in the Message Center.
2. Press the ↑ ARROW Key to scroll through the Configuration list beginning at the top. Press the ↓ ARROW Key to scroll through the Configuration list beginning at the bottom.
3. To read through the Configuration list, continue to press either the ↑ or ↓. The list is circular meaning that once the end is reached, it is repeated from the beginning.
4. To change one of the Configurations, bring the Configuration to change into the Message Center, and press "=". ↑ ↓ TO SCROLL, THEN = TO SAVE will show in the Message Center for 10 seconds Then the selected Configuration will flash, showing the current value. Press the ↑ or ↓ ARROW Key to scroll through the list of available selections for this Configuration.
5. Once a new value is showing in the Message Center, press the = Key to save the selection. The Message Center will stop flashing. The new value is now in memory.
6. Press the ↑ ARROW Key to continue to scroll through the Configuration list.

CONFIGURATION DESCRIPTION	SELECTIONS	DESCRIPTION
UNIT MODEL NUMBER	NDX93MN0AA NDA93AN0AA NDA94AN0AA NDA93MN0AA NDA94MN0AA NDA93EN0CA NDA93NN0CA NDA94EN0CA NDA94NN0CA NDX93GN0DB NDP33LN6FBZ NDP33L0N6FB NDP33LN6FBR2 NDP33LN6FBR3	The correct model number must be selected for proper operation and control.
TRAILER ID #		The trailer ID # may be entered. This may be up to 10 characters long. Numbers, Letters, and a space are available by scrolling through the available list.
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: See Section 4.1 for glow time table.
OUT OF RANGE SHUTDOWN:	YES / **NO**	YES = When the box temperature has been out-of-range for 45 minutes, the alarm light will come on, and the unit will shut down. NO = When the box 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 Service Tool.

CONFIGURATION DESCRIPTION	SELECTIONS	DESCRIPTION
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 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 = When the unit is running, and the discharge pressure is not at least 5 psig higher than the suction pressure (alarm 28 is active), shut the unit down. NO = When the unit is running, do not shut the unit down if the above condition exists.
CURRENT FOR S/S SHUTOFF	**6.5A** 1A TO 10A (in .5A increments)	This is the maximum charging amps permitted for start–stop off cycle.
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.
ENGINE OIL LEVEL SHUTDOWN	YES / **NO**	YES = When a low engine oil level is sensed (alarm 2 is active), turn the alarm light on, and shut the unit down. NO = When a low engine oil level is sensed (alarm 2 is active), turn the alarm light on and the unit will continue to run.
LOW COOLANT LEVEL	**YES** / NO	YES = A Low Coolant Level Sensor is installed in the coolant system. NO = There is no Low Coolant Level Sensor installed in the coolant system.
FUEL TANK	**NO DEVICE** SWITCH INSTALLED 0 TO 100% SENSOR	NO DEVICE = There is no Low Fuel Level Sensor installed in the fuel tank. SWITCH INSTALLED = A Low Fuel Level Switch is installed in the fuel tank. 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.

CONFIGURATION DESCRIPTION	SELECTIONS	DESCRIPTION
FUEL TANK SIZE	**OFF** 30 GALLONS 50 GALLONS 75 GALLONS 100 GALLONS 120 GALLONS	OFF = No Low Fuel Level *Switch* or *0 to 100% Sensor* is installed in the tank; OR A Low Fuel Level *Switch* or a *0 to 100% Sensor* 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 *Switch* is installed, and the LOW FUEL LEVEL WARNING (alarm 1) is on, the unit will shutdown (alarm 19) after a time delay (see chart below) 30 gal 30 min 50 gal 60 min 75 gal 90 min 100 gal 120 min 120 gal 150 min OR If a *0 to 100% Sensor* 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%.
DIESEL RESET VALUE (Refer to Section 7.2 for oil change intervals)	OFF **1500** (Factory setting) 50 TO 30,000 HRS	OFF = The Engine Maintenance Hour Meter is turned off. 50 – 30,000 hrs = The value selected here will be the number of hours between engine service intervals.
SWITCH ON RESET VALUE	**OFF** 50 TO 30,000 HRS	OFF = The Switch-On Maintenance Hour Meter is turned off. 50 – 30,000 hrs = The value selected here will be the number of hours between Switch-On service intervals.
PM (1-5)	**OFF** ENGINE HOURS SWITCH ON HOURS CLUTCH CYCLES START CYCLES HIGH SPEED HOURS	OFF = The PM 1-5 Maintenance Hour Meter(s) is turned off. ENGINE HOURS = PM Meter will count engine hours until the next service interval. SWITCH ON HOURS = PM Meter will count Switch On Hours until the next service interval. CLUTCH CYCLES = PM Meter will count how many times the fan clutch cycled on / off until the next service interval. START CYCLES = PM Meter will count how many times the engine has started until the next service interval. HIGH SPEED HOURS = PM Meter will count how many hours the unit operated in high speed until the next service interval.

CONFIGURATION DESCRIPTION	SELECTIONS	DESCRIPTION
• PM (1-5) RESET INTERVAL	**OFF** ENGINE HOURS 50 TO 30,000 HRS in 50 hr increments SWITCH ON HOURS 50 TO 30,000 HRS in 50 hr increments CLUTCH CYCLES 1,000 TO 90,000 CYCLES in 1,000 cycle increments START CYCLES 1,000 TO 90,000 CYCLES in 1,000 cycle increments HIGH SPEED HOURS 50 – 30000 HRS in 50 hr increments	OFF = PM (1-5) is not being used. ENGINE HOURS = PM (1-5) is connected to the engine hour meter. The reset interval will be (50 – 30,000 hrs). SWITCH ON HOURS = PM (1-5) is connected to the switch on hour meter. The reset interval will be (50 – 30,000 hrs). CLUTCH CYCLES = PM (1-5) 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 = PM (1-5) 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 = PM (1-5) is connected to the high engine speed hour meter, which counts only high speed engine hours. The reset interval will be (50 – 30,000 hrs).
RANGE (1-2) LOCK	**OFF** START STOP CONTINUOUS	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 = The unit will always operate in Start/Stop whenever the set point is between the minimum & maximum temperatures for that range (see below). 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°F or °C 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°F or °C 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°F or C increments)	Select the lowest temperature that will ever be used as setpoint. Setpoint can not be set lower than this value.
MAX SETPOINT	-22°F TO +**89.6**°F (-30°C to +32°C) (in 0.1°F or °C increments)	Select the highest temperature that will ever be used as setpoint. Setpoint can not be set higher than this value.

CONFIGURATION DESCRIPTION	SELECTIONS	DESCRIPTION
S/S PARAMETERS	**TOGETHER** SEPARATE	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 setpoints. 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 setpoints.
REMOTE TEMP SENSOR (1–3) (Optional)	ON / **OFF**	ON=A remote sensor has been added to the unit, and connected into the hire 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: (Optional)	**SWITCH NOT INSTALLED** OPEN SWITCH OPEN OPEN SWITCH CLOSED	SWITCH NOT INSTALLED = There is no door switch in this trailer. DOOR OPEN SWITCH OPEN = A Door Switch has been installed on one of the trailer doors. The switch contacts will be OPEN whenever the door is OPEN. DOOR OPEN SWITCH CLOSED = A Door Switch has been installed on one of the trailer doors. The switch contacts will be CLOSED whenever the door is OPEN.
DOOR SWITCH: (Optional)	**ALARM ONLY** UNIT SHUTDOWN DATA RECORDER ONLY	ALARM ONLY = When Door Switch indicates that the door is open, a warning alarm will be displayed in the Message Center. UNIT SHUTDOWN = When Door Switch indicates that the door is open, a warning alarm will be displayed in the Message Center, and the unit will shutdown. 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 Message Center.
REMS(1–2) (Optional)	**NOT INSTALLED** DOOR OPEN SWITCH OPEN DOOR OPEN SWITCH CLOSED SWITCH ON CONTACTS OPEN SWITCH ON CONTACTS CLOSE(D)	NOT INSTALLED = This remote switch is not installed in this unit. DOOR OPEN SWITCH OPEN = The Remote Switch will be used as a trailer door switch. The switch contacts will be OPEN whenever the door is OPEN. DOOR OPEN SWITCH CLOSED = The Remote Switch will be used as a trailer door switch. The switch contacts will be CLOSED whenever the door is 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) = 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.
REMS(1–2) (Optional)	**ALARM ONLY** UNIT SHUTDOWN	ALARM ONLY = When Remote Switch (1–2) indicates DOOR OPEN or SWITCH ON, a warning alarm will be displayed in the Message Center. UNIT SHUTDOWN = When Remote Switch (1–2) indicates DOOR OPEN or SWITCH ON, a warning alarm will be displayed in the Message Center, and the unit will shutdown.

CONFIGURATION DESCRIPTION	SELECTIONS	DESCRIPTION
SET TIME		The following will allow the Real Time Clock in the Data Recorder 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.
• BACK TO CONFIGS		Press = to return to the Configuration Main Menu
8 HR ADDITIONAL DATA:	**YES** / NO	YES = When the SROS is turned OFF, the data recorder will continue to record data for an additional 8 hours. NO = When the SROS is turned OFF, the data recorder will stop recording data.
DECIMAL	**DISPLAYED** NOT DISPLAYED	DISPLAYED = Set point will be shown with a decimal and temperatures may be selected to a tenth of a degree. NOT DISPLAYED = Set point will not be shown with a decimal. All other temperatures will still be displayed with a decimal.
SATELLITE COMM (Optional) (This configuration is only visible when more than 1 type of satellite communication option is installed in the Microprocessor.)	QUALCOMM OTHER	QUALCOMM = The Microprocessor is set to send Qualcomm communication messages. OTHER = The Microprocessor is set to send communication messages other than Qualcomm.

2.17.2 Diagnostic Mode

NOTE: To enter Diagnostic Mode Refer to Section 2.17.

When Diagnostic Mode is selected, the Main Display will show OFF.

DIAGNOSTIC MODE, ↑ ↓ TO SCROLL is the default message. This will appear when you are within the Diagnostic Mode Menu and have not selected a Mode, and after a Mode has timed out by the timer.

Diagnostic Mode allows the Technician to place the unit into one of the primary refrigeration system operating modes, and "lock" that mode in for 15 minutes, with no regard to set point, or controlling box temperature. All unit safety circuits are operational during Diagnostic Mode, and will shut the unit down if a fault should occur.

Once a Mode is selected, UNIT STARTING will appear in the Message Center. This will remain in the Message Center until 15 seconds after the engine starts. Then the Diagnostic Mode and time remaining will be displayed (for example: COOL REMAINING: 15 MINS) Once the unit is running, the minute timer will decrement every minute until the time runs out. The timer may be reset to 15 minutes once during the test by pressing the = key once. During the final minute, the buzzer will be on to alert the Technician that the test is about to end. Once the test ends, the unit will shut off.

To stop the test, press and hold the = key for 6 seconds. The unit will go to low speed cool default mode. DIAGNOSTIC MODE, ↑ ↓ TO SCROLL will appear in the Message Center, and allow you to select another mode. When a test is aborted, the unit will continue to run and allow you to start another test.

The only keys that operate during Diagnostic Test Mode are the Alarm, Select, ↑ ↓ and = keys. The alarm list is available for you to look at any active or inactive alarms. The Select key will only allow access to the Data List. The ↑ ↓ and = keys will allow you to scroll through the Alarm and Data Lists.

The following cycles are available in Diagnostic Mode:

Diagnostic Mode / Menu	Message Center
COOL–HIGH SPEED UNLOADED	COOL REMAINING XX MINS
HEAT–HIGH SPEED UL1 UNLOADED	HEAT REMAINING XX MINS
DEFROST (See notes 2 & 3 below)	DEFROST CYCLE STARTED CANNOT START DEFROST CYCLE
PULSED COOL–LOW SPEED UNLOADED	NULL/COOL REMAINING XX MINS
PULSED HEAT–LOW SPEED UNLOADED	NULL/HEAT REMAINING XX MINS
MAIN MENU (To access Component Test Mode, or Configuration Mode)	

NOTES:

1. In each of the Pulsed Modes, each 10 second segment will consist of either cool or heat mode for 5 seconds, then null for 5 seconds.

2. The unit must be running before Defrost can be started. All other modes will start the unit automatically. To start Defrost, first select another Test Mode. After the unit has started, and UNIT STARTING has cleared from the Message Center, press = to abort (stop) the cycle. The unit will continue to run, and the Message Center will go to the Diagnostic Mode Main Menu. From the Main Menu, use the ↑ ↓ keys to select Defrost, then press = to start the Defrost cycle.

3. The Defrost Mode is controlled by the Defrost Termination Temperature Sensors (DTTs). If both of the DTTs are above +40°F (4.4°C) the unit will not start the Defrost Cycle. Only <u>one</u> of the DTTs must be below +40°F (4.4°C) to allow the Defrost Cycle to start. After the Defrost Cycle is started, it will terminate automatically when:
   B<u>oth</u> DTTs rise to +55°F (12.8°C) (software versions prior to 01.06.00), or
   DTT1 is above 45°F (7.2°C), and DTT2 is above 55°F (12.8°C) (software versions 01.06.00 and later).

2.17.3 Component Test Mode

NOTE: To enter Component Test Mode Refer to Section 2.17.

Component Test Mode allows the Technician to energize individual circuits for 5 minutes at a time. The engine is not allowed to start when the Micro is in Component Test Mode.

From the Main Menu, select Component Test Mode, and press =. ↑ ↓ TO SCROLL, THEN = TO SELECT are your instructions to use the up & down arrow keys to scroll through the list, select the component you wish to test, then press =. For example, if the Cool Light is selected, the Cool Light on the Driver's Light Bar will come on, and COOL LIGHT OFF IN 5 MINUTES will appear in the Message Center. The minutes will count down to 0 at which time the Cool Light circuit will be de-energized, and the Message Center will display the last component tested.

The test may be stopped at any time by turning the Start/Run–Off Switch (SROS) to 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 Message Center will return to the Component Test Mode Menu, and display the last component tested.

To retest the same component and circuit again, press =. To select another component to test, us the ↑ ↓ keys to select another component, and press =. To go to Diagnostic Mode or Configuration Mode, select Main Menu and press =.

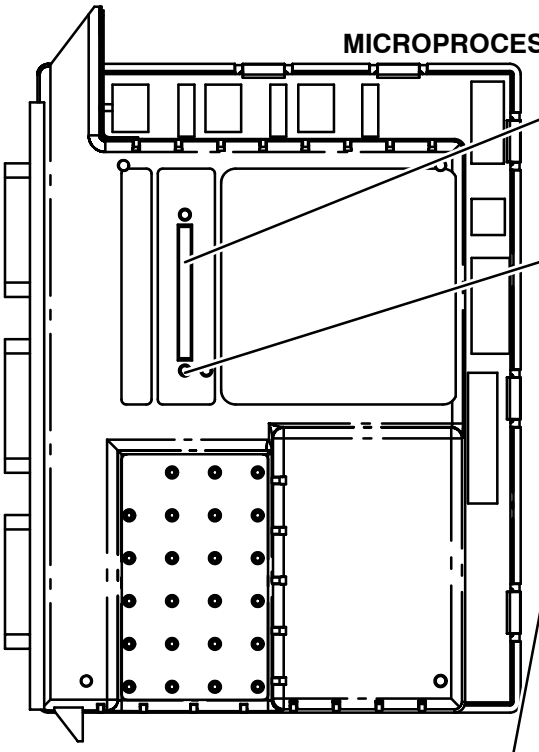
The only keys that operate during Diagnostic Test Mode are the Alarm and Select keys. The alarm list is available for you to look at any active or inactive alarms. The Select key will only allow access to the Current Draw item in the Data List.

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

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

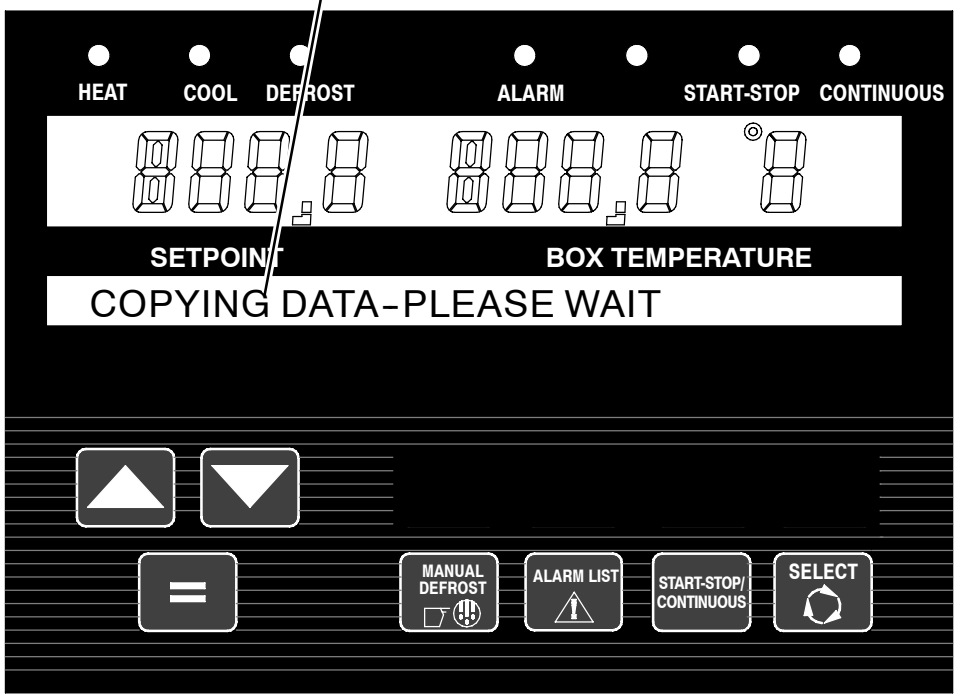
Component / Menu List	Message Center	FET LED	Board LED
Cool Light *	COOL LIGHT OFF IN X MINS	17	
Heat Light *	HEAT LIGHT OFF IN X MINS	8	
Defrost Light *	DEFROST LIGHT OFF IN X MINS	16	
Auto Restart Light *	ARL LIGHT OFF IN X MINS	7	
Out Of Range Light *	ORL LIGHT OFF IN X MINS	15	
Fault Light *	FAULT 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	
SV3	SV3 OFF IN X MINS	20	
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
Main Menu (To access Component Test Mode, or Configuration Mode)			
* These are for the Driver's Light Bar only. The FET LED will illuminate, however the corresponding indicator LED on the Display will not illuminate.			

2.18 Downloading Data with the PC Card



MICROPROCESSOR MUST BE POWERED-UP TO DOWNLOAD DATA

1. Insert a DataShare 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.
2. The Message Center will show 'COPYING DATA–PLEASE WAIT'. While the data is being copied, the green PC CARD STATUS LED will flash.
3. 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 Message Center. 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.***
4. When the card is removed, the Message Center will return to the default message.
5. If any other messages appear, refer to section 6.1 MESSAGE CENTER 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.

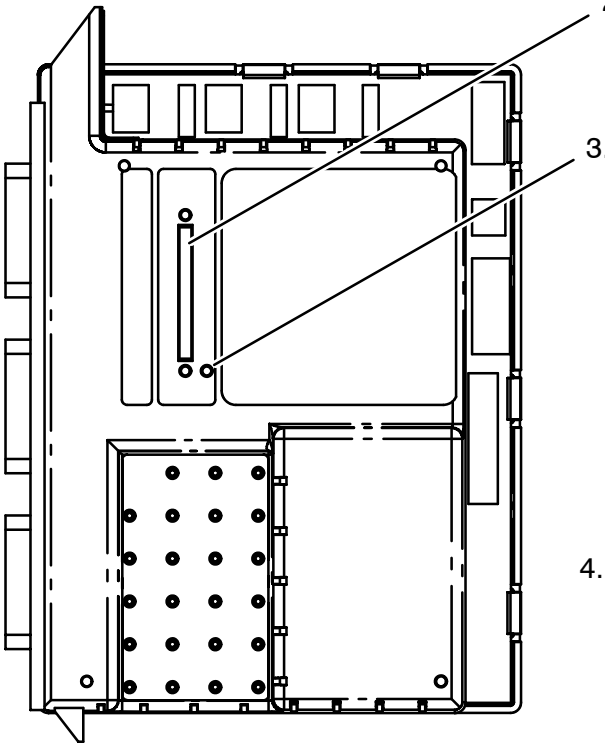


Recorded data can also be downloaded from the Microprocessor through the PC card slot. Data downloading is automatic unless there is an error. The Microprocessor will recognize that there is a DataShare Download PC Card present and automatically download (copy) *all* data from the Data Recorder to the PC Download Card. Data must then be downloaded off the PC Download Card onto a computer drive before it can be viewed.

2.19 Installing New Software

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.

2.19.1 Using the DataShare Program PC Card



1. Place the Micro in PC Mode (See Section 2.16), or turn the SROS switch to the Run Position.
2. Insert a DataShare Program 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. If the current software version is <u>prior</u> to 01.06.00, after a few seconds the Message Center will go blank. If the engine is running, it will shut down. Then the green PC CARD STATUS LED and MICRO STATUS LED will flash together at the rate of .5 seconds on / 5. seconds off. Both LEDs will blink 2-3 times then stop. Blinking will resume within 10 seconds. Both LEDs will continue to blink together while the program is being loaded (this will take about 90 seconds). The CARD STATUS LED will come on solid when the programming is complete. Remove card at this time.
4. If the current software version is 01.06.00 or <u>later</u>, the Message Center will show one of 3 different messages:
   Same SW: = to Load, ↑ To Cancel
   Old SW: = to Load, ↑ To Cancel
   New SW: = to Load, ↑ To Cancel
5. Press = to load the program. The Message Center will go blank. If the engine is running, it will shut down. Then the green PC CARD STATUS LED and MICRO STATUS LED will flash together at the rate of .5 seconds on / 5. seconds off. Both LEDs will blink 2-3 times then stop. Blinking will resume within 10 seconds. Both LEDs will continue to blink together while the program is being loaded (this will take about 90 seconds). The CARD STATUS LED will come on solid when the programming is complete. Remove card at this time.
6. When the card is removed, the Micro 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 Message Center displaying appropriate messages) once after installing the new software before turning the power off, or removing the PC Mode jumper.

2.19.2 Using Microprogrammer

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.

1. Connect the computer to the Microprocessor using a Carrier Transicold Downloader Cable. Once the cable is connected to the download port, the Microprocessor will power up, and show PC MODE.
2. Start the program by double clicking on the Microprogrammer icon on your computer desktop.
3. Click on the Load File button. The Open box will appear on the screen.
4. Using the mouse, select the file you want to load (this will be a .bex file) by clicking once on it to highlight it.
5. 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.
6. Turn the SROS switch to the Run position. Wait for the Main Display and Message Center to power up.
7. Click on the Program Micro button. The Message Center will go blank. If the engine was running, it will shut down. The Micro Status LED will start blinking at the rate of .5 seconds on / .5 seconds off.
8. The % complete value on the 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 NOTHING DURING THIS TIME BUT WAIT. The time to load the program is dependent upon the speed of the computer. This will generally take from 4 to 6 minutes.
9. Once the % complete reaches 100%, the shutdown box will appear. Click the OK button.
10. The Microprocessor will power up, and the unit will start. Allow the engine to start completely the first time after loading software. DO NOT TURN THE SROS SWITCH OFF DURING THE INITIAL START FOLLOWING A SOFTWARE UPGRADE.

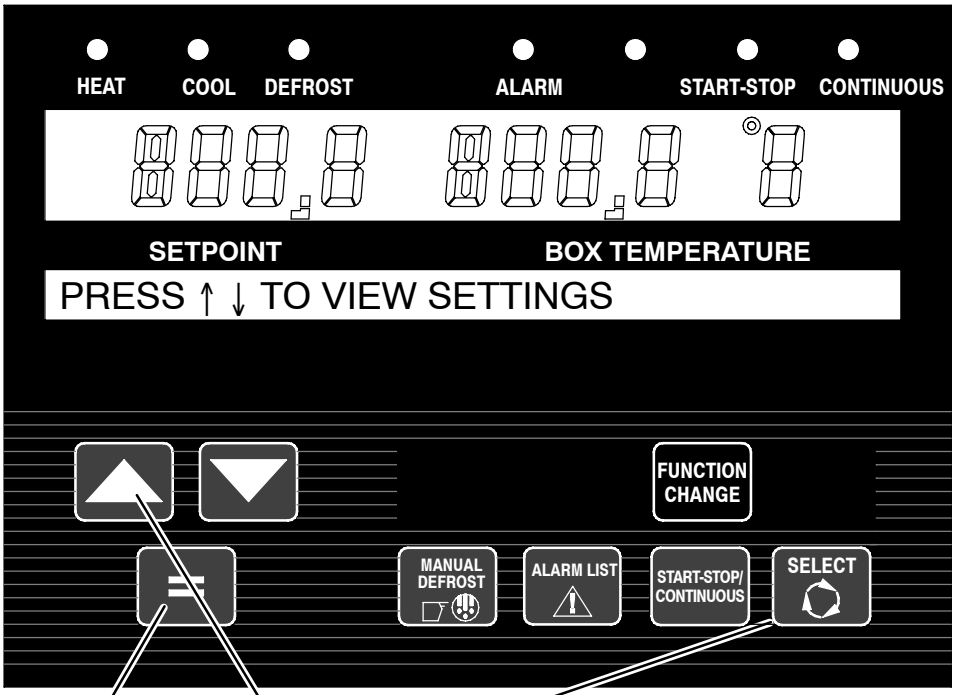
2.19.3 Troubleshooting Software Loading Problems

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.

1. 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.
2. Check the Micro 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.
3. If the Micro 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.
4. If the Micro Status LED is not on at all, check voltage to QC1 & QC2. Also check for voltage from the SROS at 5MPA1. If voltage and grounds check OK, the Microprocessor may be dead and require replacement.

2.20 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 FUNCTION CHANGE is lit. The Message Center will show PRESS ↑↓ TO VIEW SETTINGS.
2. Press the ↑ UP ARROW key or the ↓ DOWN ARROW key until SET PM HOURMETERS is displayed.
3. Press = (ENTER) key. "↑ ↓ TO SCROLL, THEN = TO SELECT" will show in the Message Center.
4. Press ↑ UP or ↓ DOWN ARROW key until the PM Hourmeter you wish to reset is shown.
5. Press = (ENTER) key to select.
6. Press ↑ UP or ↓ DOWN ARROW keys until RESET is shown.
7. Press = (ENTER) key to save.
8. Repeat steps 3–7 to Reset additional PM Hourmeters

NOTE: First the Hourmeters must be configured on (Refer to Section 2.17.1).

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 (7) PM Hourmeters available for use:

- Engine
- Switch On
- 5 programmable Hourmeters

The programmable PM Hourmeters (PM1 – PM5) which 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.

Once the PM Hourmeters are activated from the Configuration List, they can be turned OFF; once off the operation can be RESUMED; or it can be RESET for a new interval, all from the Functional Parameter List.

The PM Hourmeters may be set or reset using either a PC or the Keypad. Keypad access to the PM Hourmeters may be locked out using Service Tool. When Keypad access is locked out, a padlock symbol will appear in the Message Center. Available selections from the Functional Parameter List for the PM Hourmeters are:

OFF This selection will suspend the operation of the PM Hourmeter. The Hourmeter will continue to count hours, but the alarm will not be generated.

RESUME This selection will resume the operation of a PM Hourmeter that has been turned off. If the Hourmeter is currently running, then this selection will have no effect on the Hour Meter.

RESET This selection is only available when the accumulated hours are within 5% or more 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: Units originally came from the factory with the Engine PM Hourmeter on, and the reset value set for 400 Hrs. For these units, at the first PM, the reset value in the Configuration List should be changed to the recommended interval for each particular engine, or to the user's requirements. *Current units come with the Engine PM Hourmeter set for 1500 Hrs.*

In the event that the Engine PM Hourmeter is reset to 400 hours from the Functional Parameter List before the reset value in the Configuration List has been changed, the following procedure may be used:

1. From the Configuration List, select the PM Hourmeter, and change the reset interval to OFF.
2. Press = to enter.
3. Now select the desired new interval.
4. Press = to enter.
5. Turn the Start/Run Off switch off then back to Run. Check the Data List. The correct number of hours should be showing as "HOURS TO ENGINE MAINT".

2.21 Recommended Transport Temperatures

Below are some general recommendations on product transport temperatures and operating modes for the unit. These are included for reference only and should not be considered preemptive of the set point required by the shipper or receiver.

More detailed information can be obtained from your Carrier Transicold dealer.

Product	Set Point Range		Operating Mode[1]
	°F	°C	
Bananas	55 to 60	13 to 16	Continuous
Fresh fruits and vegetables	33 to 38	0 to 3	Continuous
Fresh meats and seafood	28 to 32	-2 to 0	Auto-Start/Stop or Continuous
Dairy Products	33 to 38	0 to 3	Auto-Start/Stop or Continuous
Ice	15 to 20	-10 to -7	Auto-Start/Stop[2]
Frozen fruits and vegetables	0	-18	Auto-Start/Stop[2]
Frozen meats and seafood	-10 to 0	-23 to 18	Auto-Start/Stop[2]
Ice Cream	-20	-29	Auto-Start/Stop[2]

[1] During delivery cycles that include frequent stops and door openings, it is recommended that the unit always be operated in the continuous run mode to help insure product quality. If it is possible, the unit should be turned off during the time the trailer doors are open to help conserve the product temperature.

[2] Variations may be necessary for very high or very low ambient temperatures.

Section 3 - System Description

3.1 Component Description and Location

The Advance Microprocessor controller consists of two modules, the Control Module and Display & Keypad Module. In Ultima units, the Control Module is housed in the control box on the lower roadside (right) corner of the unit, just inside the lower roadside door. In Ultra units, the Control Module is located in the control box below the radiator, inside the lower roadside door. The Control Module contains replaceable relays and fuses which are externally accessible. LEDs are located next to the 3 relays plugged into the control module to indicate relay operation. Additional LEDs indicate operation of the FETs (Field Effect Transistors). The Display & Keypad Module is located for driver access at the lower roadside corner of the unit.

The Control Module includes the logic board, program memory, FETs, PC Card slot, and necessary input/output circuitry to interface with the unit.

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

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.

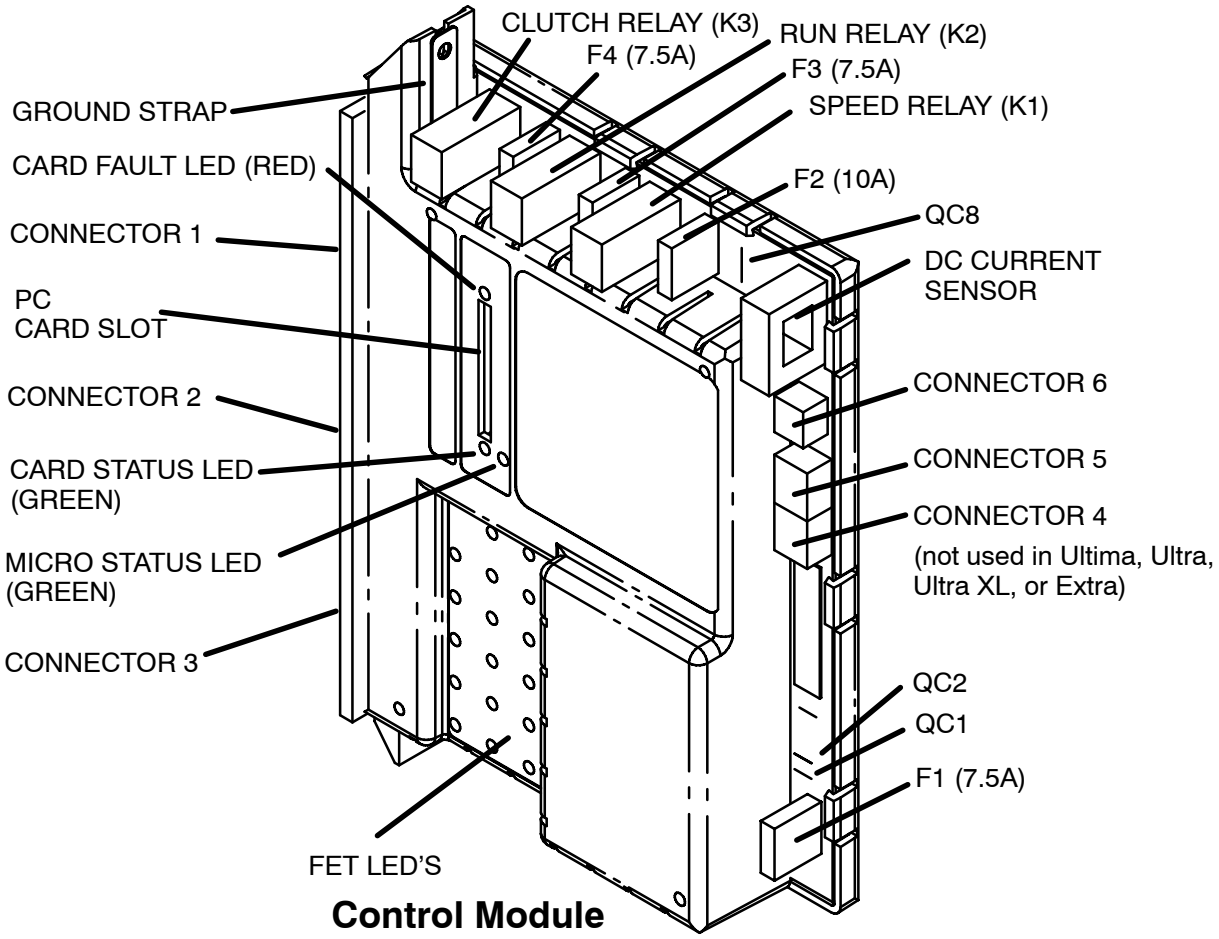
Display & Keypad Location

3.2 Special Features

The Carrier Transicold Advance Microprocessor controller incorporates the following features:

- Message Center
- Unit Operation & Alarms are displayed in English (not in codes)
- UltraFresh 2
- UltraFreeze
- Large LCD Display
- Unit Data and Functional Parameters
- Programmable Maintenance Hour Meters
- PM Hour Meters are resettable from the Keypad
- Bright LED Alarm Light
- Bright LED Mode Lights
- Fully Automated Pretrip
- Automated Micro Self–test
- DataLink Data Recorder
- DataLink Data Recorder date & time can be set from the Keypad
- Auto Start–Stop
- Trip Start to record date/time of trip in Data Recorder memory
- PC card functionality for Downloading data, upgrade programming, and Configuration set up
- FETs (Field Effect Transistors) for switching components on & off, and checking circuit current
- Automatic or Manual Engine Starting
- Functional Parameter locks
- Alarms are stored in Microprocessor memory for future reference
- New Menu system to simplify keyboard and enhance functionality

3.3 Control Module Description



Control Module

The figure above shows the Control Module. The Control Module has 3 relays and 4 fuses that are user accessible. There are three 7.5 amp. fuses and one 10 amp. fuse.

The PC card slot is also shown above. This card slot is used with all Carrier Transicold DataShare PC Cards. The controller automatically detects the presence and type of DataShare PC Card inserted and responds accordingly. The different types of DataShare PC Cards are:

- Download Card for downloading unit data,
- Options PC Card for installing optional software programs,
- Configuration PC Card for setting the Microprocessor Functions, Configurations, and Data Recorder configurations, and
- Program PC Card for upgrading the Microprocessor software.

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

- The green Micro Status LED which will blink steadily every 1 second indicating that the Microprocessor is operating.
- The green (PC) Card Status LED which comes on when there is a PC card inserted in the slot. This LED will blink 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.
- The red (PC) Card Fault LED comes on if there is a problem transferring data from the PC card that has been plugged into the PC card slot. The red LED will stay on until the PC card is removed.

3.4 DataLink Data Recording

The Advance Microprocessor contains a built–in DataLink Data Recorder with 512K of memory. The recorded data can be downloaded from the DataLink Data Recorder using either DataManager, a PC software program, or a DataShare PCMCIA (PC) card.

The Advance Data Recorder reads the same input information as the Microprocessor (Functional Parameter, Configurations, and Unit Data) at all times. The Data Recorder records events as they occur, such as Set Point changes and Defrost Initiation and Termination, and can record any or all temperature and pressure sensors in averaged or snapshot format. The details are provided below.

3.4.1 Microprocessor Information

The Microprocessor Information that is available within a downloaded data file is as follows:

- Recorder Configurations (Logging Interval, Event Logging, Sensor Logging)
- Real Time Clock Date / Time
- Compartment setpoints
- Truck / Trailer ID
- Unit Serial Number
- Unit Model Number
- Current System Mode
- Functional Parameters
- Controller Configurations

3.4.2 Data Recording

The DataLink Data Recorder data comes from four general categories of information:

1) Microprocessor Information as described in section 3.4.1

2) Sensor Data

- This information is recorded at pre–determined 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 interval, and whether snapshot or averaged readings are preferred. Snapshot readings of sensors are also taken at the time of a shutdown alarm.

3) Event Occurrences

- This information is any additional data that is recorded on a “when it occurs” basis. In general, 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.).

4) User Area Data

- The User or service technician is able to enter a Comment into the DataLink Data Recorder using the Data Manager Program.

3.4.3 Sensor & Event Data

Sensors

The following sensors may be recorded either with an averaged reading, or snapshot.

- Return Air Temperature
- Supply Air Temperature
- Ambient Air Temperature
- Defrost Termination Temperature #1
- Defrost Termination Temperature #2
- Compressor Discharge Temperature
- Engine Coolant Temperature
- Compressor Discharge Pressure
- Compressor Suction Pressure
- Battery Voltage
- Battery DC Current
- Engine RPMs

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

Events

The following Events *may* be recorded.

- Pretrip Start . . . . . Selectable
- Pretrip End . . . . . Selectable
- Trailer ID change . . . . . Selectable
- Unit Serial Number Changed . . . . . Selectable
- Unit Model Number Changed . . . . . Selectable
- Unit Mode (Start/Stop – Continuous Run) . . . . Selectable
- Control Mode (Heat / Cool / Defrost / etc) . . . . . Selectable
- Door Opened / Closed . . . . . Selectable
- Transducer Calibration . . . . . Selectable

The following Events *will* be recorded.

- Set Point Changed . . . . . Fixed
- Unit Alarm . . . . . Fixed
- Defrost Started . . . . . Fixed
  - By Keypad
  - By Air Switch
  - By Timer
- Functional Parameter Changes . . . . . Fixed
- Configuration Changes . . . . . Fixed
- Data Recorder Setup Changes . . . . . Fixed
- Start/Run Off Switch turned to Run . . . . . Fixed
- Start/Run Off Switch turned to Off . . . . . Fixed
- Data Download . . . . . Fixed
- Software Upgrade . . . . . Fixed
- Real Time Clock Changes . . . . . Fixed

3.4.4 Optional Sensors & Events

In addition to the above Sensors and Events, the Advance DataLink Data Recorder 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
- Fuel Tank % Level

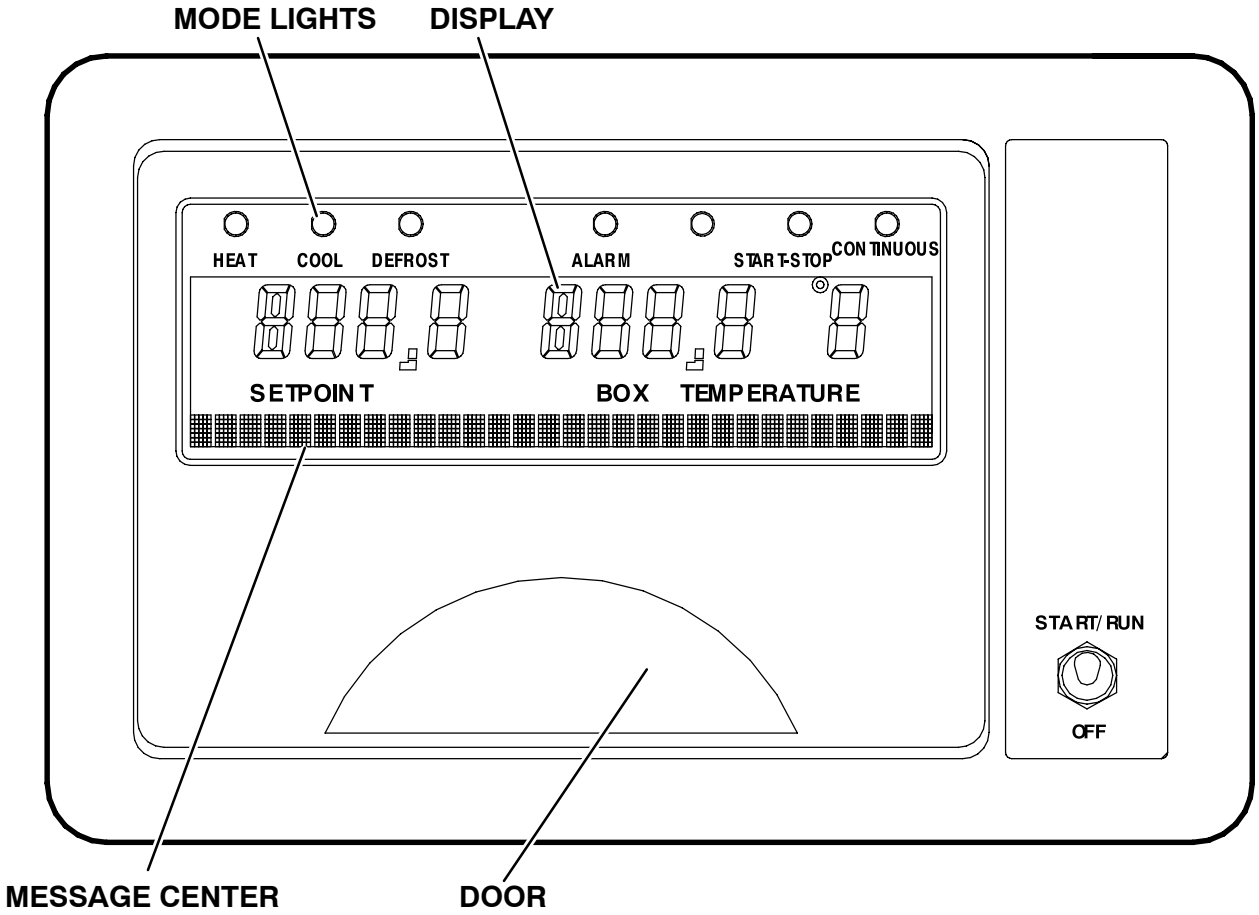
3.4.5 Data Downloading

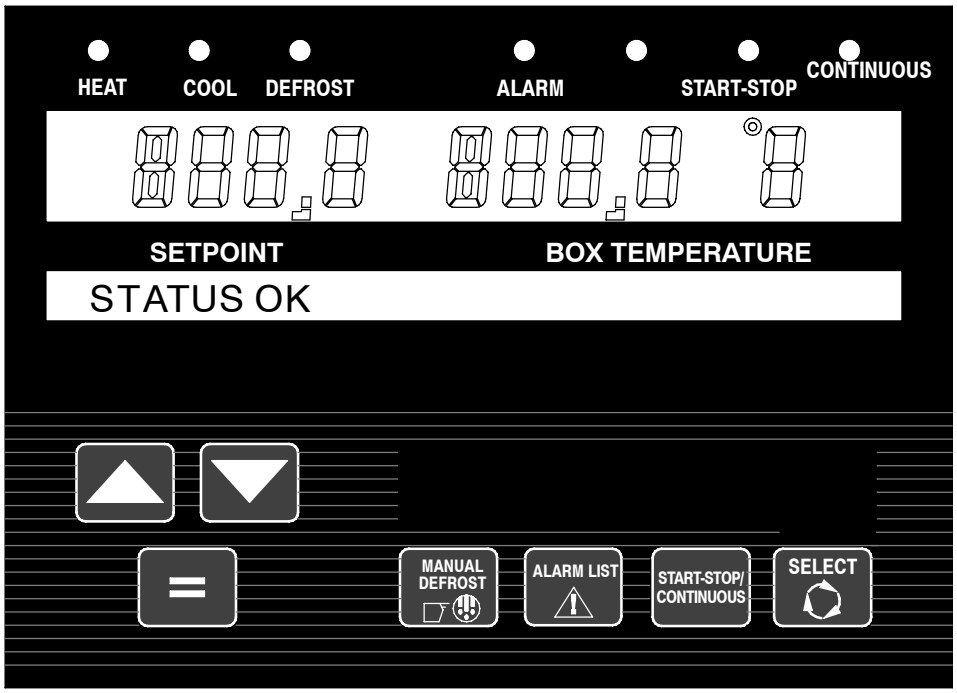
The data within the Data Recorder can be downloaded by either the Data Manager Program, using a PC and a Serial / Download Cable connected to the Download Port (Refer to Section 3.7) or with a DataShare PC Download Card (Refer to Section 2.18).

3.4.6 Data Recorder Power-Up

The Data Recorder records data the entire time the Start/Run Off switch is in the Run position. Software versions prior to 01.06.00 continue data recording for 8 hours after the Start/Run Off switch is turned to the Off position. Software versions starting with 01.06.00 have a configuration added to allow the user to select the additional 8 hours of data to be recorded, or to stop recording at the same time the Start/Run Off Switch (SROS) is turned to the Off position.

3.5 Display & KeyPad Description





Display & Keypad Module

The Keypad & Display Module provides the user with a panel to view and control the functions of the refrigeration unit. The module consists of a switch, keypad, Message Center, and Main Display. You select the set points and other system information using the keypad. The figure above shows the Display & Keypad Module.

Display

The Main Display has 9 characters (7 seven–segment characters and 2 nine–segment characters), 2 decimal points, 2 commas, and a degree symbol. The display is used to provide the user a setpoint and box temperature, either in degrees Celsius 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 to indicate decimal points. When English Units is selected in the Functional Parameters, the decimal points are used.

Temperature display is right justified, with unused digits blank. A negative sign will be displayed for all setpoint and box temperatures below Zero. A positive sign will be displayed for all setpoint and box temperatures above Zero, but less than 100 degrees. 0.0 degrees will not have a sign in front of it. The resolution for box temperature in both Celsius and Fahrenheit is one–tenth (0.1F or 0,1C) degrees.

Beginning with software version 01.06.00, the user has the option of whether to have the set point displayed with a decimal or comma. Only the setpoint is affected by this selection. All other temperatures and pressures will continue to be displayed with either a decimal or comma. See Configurations Section 2.17.1.

Indicator LEDs

The display has six LED's 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 Null mode, 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.

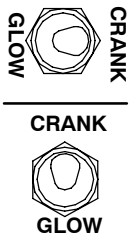
Message Center

The Message Center is used to show messages. Details of the messages are described in Section 6.1 MESSAGE CENTER.

Switch Descriptions

START/RUN - OFF Switch (SROS)

The Start/Run–Off switch is a 12VDC input to the Microprocessor. When placed in the RUN position, this switch activates the Control Module. To stop the unit, move the switch to the OFF position.



GLOW/CRANK Switch (GCS)

The GLOW/CRANK switch is located on the back–side of the control box near the bottom on Ultima units, and on the left side of the control box behind the front unit door on Ultra, Ultra XL, and Extra units. The Switch is mounted horizontal on Ultima's and vertical on all other models.

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.

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 1 second, for a maximum 10 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 turned on, 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.

Key Descriptions

UP ARROW and DOWN ARROW Keys

These keys allow you to change the set points or other displayed data of the system. Also allows 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, among other things.

MANUAL DEFROST Key

The MANUAL DEFROST key is used to initiate a defrost cycle, given that 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 Message Center. 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, see Section 2.

START-STOP/CONTINUOUS Key

This key allows you to change from Start–Stop operation to Continuous Run operation. In Start–Stop operation, when the controller is in Off–Cycle mode, the unit will not be running. During Off–Cycle mode, the Microprocessor monitors box 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. When the SELECT key is pressed, one of the four menu selections, PRETRIP, DATA, FUNCTION CHANGE, or TRIP START, will light. Repeated presses of the SELECT key will sequence the menu through the four selections. The menu will wrap around from TRIP START to PRETRIP. Press the SELECT key until the desired menu selection is lit.

Selected Menu Lights

Pressing the SELECT key allows you to select 1 of 4 different selections on the controller. The four menu selections are:

PRETRIP – Used to initiate a pretrip.

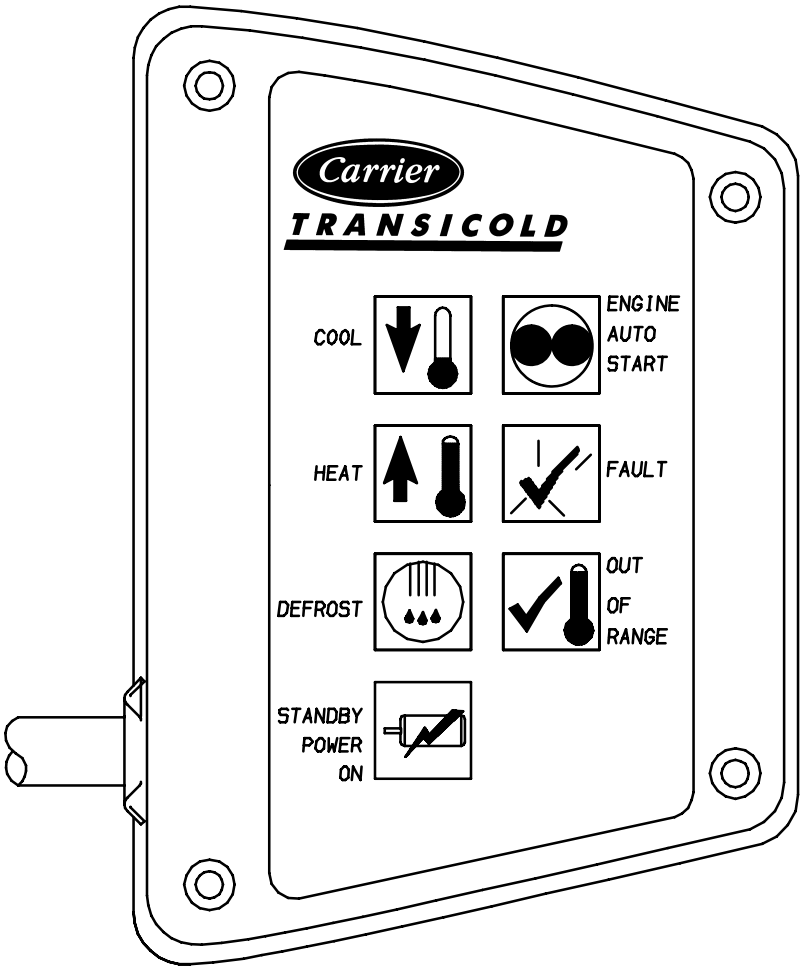
DATA – Displays Unit Data. See Section 2.14.

FUNCTION CHANGE – Displays unit Functional Parameter settings. See Functional Change (Parameters), Section 2.15.

TRIP START – This menu selection is only used with theData 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.

3.6 Driver's Light Bar

The Driver's Light Bar is an external set of indicator lights which can be seen in the mirror from the cab. They are controlled by the Microprocessor. 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.



3.7 Serial Port (SLP) / PC Communication Mode

PC Mode is entered into when a PC Cable (P/N 22-01737-00) or a PC Mode Jumper (P/N 22-50180-01) is connected to the Serial Port or the Serial Port terminals C & E is jumped (using an insulated jumper wire) and the Start/Run Off Switch (SROS) is in the OFF position. If the unit is started 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.

All functions available from the Keypad may be viewed or changed using the Advance Service Tool Program, and a Personal Computer (PC) connected to the Serial Port. Using the PC will provide additional programming and configuring capabilities that will not be available through the Keypad.

NOTE: The unit also has a 3–wire Packard Connector similar to the Serial Port used on other models. This connector is used with remote communication options, and DOES NOT allow PC access to the Microprocessor or DataLink Data Recorder.

The Data Recorder may also be configured and downloaded through the Serial Port using the Data Manager Program.

3.8 Door Switches & Remote Switches

The unit has provisions to install a Trailer Door Switch (DS), and up to 2 remote switches (REMS1&2), and connect them to the Microprocessor so that when the door is opened (or a remote switch is turned on/off), either an alarm is displayed, or the unit may be programmed to shut down. Either event may also be recorded by the DataLink Data Recorder.

Because different door switches are available, there are provisions within the Configuration List to configure the Microprocessor to correctly read the type of switch that is installed. 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, to enable the alarm and also shut the unit down, or to have no alarm, and only record door openings & closing in the data recorder.

If the Door Switch or Remote Switches are configured to shut the unit down, there is an Override Door Switch and Remote Switch Shutdown selection in the Functional Parameter List. When this is turned OFF, the Door Switch or Remote Switch Alarm(s) will come on as needed, however, the unit will not shut down.

3.9 Sleep Mode

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 4 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, WARNING: NO TEMP CONTROL will flash in the Message Center, and the Main Display (set point and box temperature) will be turned off. This is because box 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).

While the unit is cycled off in Sleep Mode, SLEEP MODE, OFF/ON TO WAKE will be displayed in the Message Center. Sleep Mode may be exited by either turning the Start / Run – Stop switch to the OFF position, then back to the ON position, or by accessing the Functional Parameter list, and selecting SLEEP MODE: OFF.

While in Sleep Mode, Unit Data and Alarm Lists may be viewed, and Functional Parameters may be viewed and changed as necessary. Data may be downloaded from the DataLink Data Recorder. However, Start/Stop–Continuous Run selections, and set point can not be changed, and Manual Defrost can not be initiated.

3.10 Out Of Range Alarm

The Out Of Range Alarm is intended to notify the driver when the box temperature is moving away from Set Point. The Out Of Range Alarm may be configured as an Alarm Only, or as an Alarm and Unit Shutdown. (Refer to Section 2.17.1 Configuration Mode)

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

If the unit shuts down due to a shutdown alarm, the Out Of Range Alarm will come on after the timer expires (15 or 45 minutes), and when the box temperature goes out of range, regardless if the box temperature was ever within setpoint range or not.

Out of Range is determined by the 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 setpoint the box temperature may move before turning on the Alarm. Once the box temperature has moved the away from set point by the selected amount, the Out of Range timer begins. If the alarm is configured for Alarm Only, after 15 minutes the alarm will be activated. If the alarm is configured for Alarm & Shutdown, after 45 minutes the alarm will be activated and the unit will shutdown.

In Sleep Mode, Pretrip, Diagnostic Test Mode, Component Test Mode, or if the unit has a Door Switch, and the door has been opened, the Out of Range Alarm is not in use. After exiting any of these modes, or closing the trailer door, the box temperature must again come In Range of the set point before the Out of Range Alarm can be activated.

In Defrost and in Start/Stop Off Cycle, the 15 or 45 minute timer does not count. Once the unit leaves these modes, and goes into a temperature control mode (heat, cool, or null), the timer will be reset for the full time, allowing the unit either 15 or 45 minutes to bring the box temperature into range before activating the Out of Range Alarm.

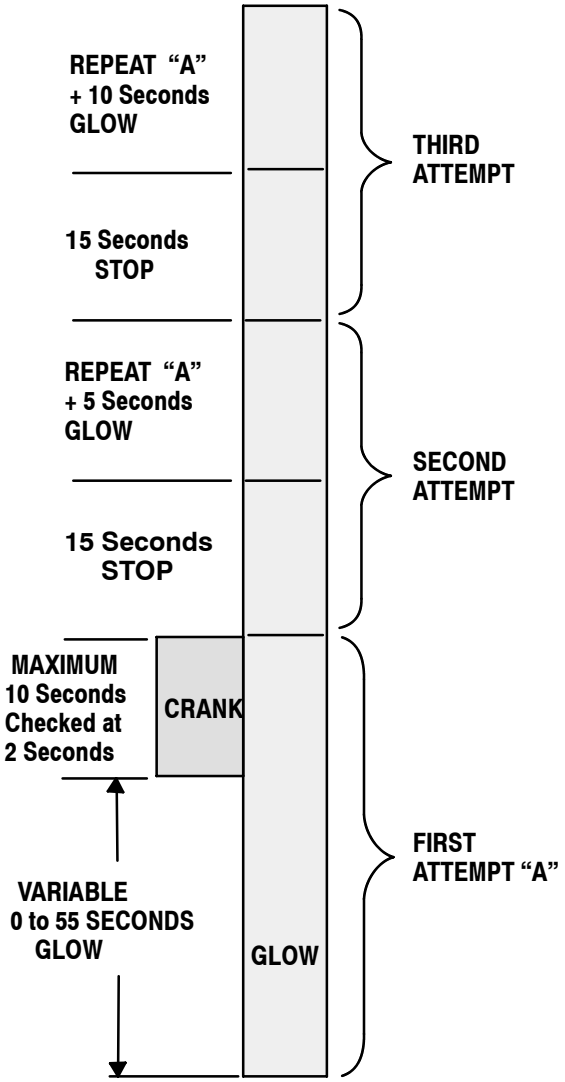
Section 4 - Engine and Temperature Control

4.1 Auto Start Sequence

When the starting conditions are met, the start sequence will begin by energizing the run and clutch relays, along with the SV–2 and both unloaders. 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 SV–2 will remain energized 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 before the starting is locked out and the Failed To Start – Auto Mode alarm is activated.

NOTE: If the Engine Coolant Sensor Alarm is Active, the glow time for temperatures less than 32°F will be used.



Auto Start Sequence

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:

Glow Time		
Engine Coolant Temperature	Glow Time in Seconds	
	Short	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 5 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.

Engine Running

The engine is considered to be running when:

1. Engine RPM's are greater than 1000, and
2. Oil pressure is ok

4.2 Start-Stop Operation

Start–Stop is provided to permit starting/stopping/restarting of the engine–driven compressor as required. This feature allows full automatic control of the engine starting and stopping. The main function of automatic engine cycling is to turn off the refrigeration system near setpoint to provide a fuel efficient temperature control system and to initiate a restart sequence after certain conditions are met. The Start–Stop / Continuous key is provided to select between Continuous Run and Start–Stop operating modes.

NOTE: The Microprocessor may be locked so that the unit will always operate in Start-Stop whenever the setpoint is within a specific range. Refer to Section 4.4 - Range Lock for additional information.

System shut-off is allowed only if the box temperature is within close range of setpoint, the battery condition signal is good, the battery charging amps are less than the setting selected in the Configuration List, the engine has run for the minimum run time, and engine coolant temperature is above 122°F (50°C). A restart will be initiated when one of the following conditions occurs:

- Engine coolant temperature drops below 34°F (1°C), or
- Battery voltage falls below 11.0 Vdc, or
- Box temperature is more than the selected Off Time Override Temperature (Functional Parameter) of 3.6°F to 18°F (2°C to 10°C) from set point (above setpoint in the frozen range), or
- After the Minimum Off Time expires and the box temperature is more than 3.6°F (2°C) from set point.
- After the Maximum Off Time expires.

NOTE: The unit will remain in low speed for 10 minutes after engine start-up when: In Start-Stop Mode at any setpoint or in Continuous Run Mode and setpoint is below 10.4°F (-12°C).

Start-Stop Indicator

The "Start–Stop" LED indicator is lit and Engine Auto Start light on the light bar will be ON to indicate the Start–Stop mode has been selected.

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 Message Center, and the Alarm LED on the Keypad and the Fault light on the light bar will flash on and off once a second.

Minimum RunTime

The Minimum Run Time is selected in the Microprocessor Functional Parameter List. The purpose of this is to force the unit to run long enough to completely circulate the air within the inside of the trailer, and to insure that the product temperature is at set point. This may be set for any value between 4 minutes and 60 minutes in 1 minute intervals. The engine must run for the Minimum Run Time before cycling off. The factory setting is 4 minutes.

Off Cycle Temperature

After the Minimum Run Time expires, the unit will shut down when the box temperature is within ±0.5°F (±0.3°C) of setpoint for setpoints in the Perishable range or is less than +0.5°F (+0.3°C) above setpoint for setpoints in the Frozen range.

Minimum Off-Time

The Minimum Off Time allows the unit to remain off for extended periods of time, maximizing fuel economy. The Minimum Off Time is selected in the Microprocessor Functional Parameter List. Settings may be for 10 minutes to 90 minutes in 1 minute intervals. The factory setting is 20 minutes.

Restart Temperature

After the Minimum Off Time, the unit will restart when the box temperature goes beyond ±3.6°F (±2.0°C) of setpoint for the Perishable range or above +3.6°F (+2.0°C) of setpoint for the Frozen range.

Off Time Override Temperature

During the Minimum Off Time, the Microprocessor continually monitors the Box Temperature. If the temperature should go beyond the Off Time Override Temperature, the unit will restart, regardless of how much Off Time remains. The Off Time Override Temperature is selected in the Microprocessor Functional Parameter List. This can be set for 3.5°F to 18°F (2°C to 10°C) in .5 increments.

Maximum Off-Time

In some ambient conditions, there are times when the unit may be off for very long periods of time. To insure that the product temperature is always protected, the Maximum Off Time may be used to force the unit to restart. Maximum Off Time is selected in the Microprocessor Functional Parameter List. This may be set for OFF, or 10 minutes to 255 minutes in 1 minute intervals. When the Maximum Off Time expires, the unit will restart, regardless of any change in box temperature.

Perishable & Frozen Selections

The Functional Parameter List has selections available to set different values for Perishable and Frozen setpoints in Start–Stop, or for the same values to be used for both. The Configuration List allows the user to select having these Start/Stop Parameters either TOGETHER or SEPARATE. The following may be set either for both Frozen and Perishable or separately for each, depending on how it is Configured:

PERISH MIN RUN TIME	FROZEN MIN RUN TIME
PERISH MIN OFF TIME	FROZEN MIN OFF TIME
PERISH OVERRIDE TEMP	FROZEN OVERRIDE TEMP
PERISH MAX OFF TIME	FROZEN MAX OFF TIME

FROZEN SHUTDOWN OFFSET only applies to Frozen Start/Stop operation. The available selections are 0°F to 3.6°F (0°C to 2°C). The factory setting is 0°F/C which effectively turns this feature off. This feature is first available with software version 01.07.00.

When different Perishable and Frozen values are entered through Functional Parameters, and then the Configuration is changed to TOGETHER, the values that had been entered for Perishable will be used.

Engine Coolant Temperature

The unit will not cycle off if the engine coolant temperature is less than 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).

Battery Voltage

Provisions are made to sense when the battery charge is good. A good battery is defined as having 13.4 Vdc at 75°F, and the charging rate is below that selected in the Configuration List. This condition is used to allow cycle off of the engine.

Battery Voltages	
Voltage Level	**Description**
10 Vdc or Less	Unit will shut down except during cranking.
11 to 13.4 Vdc	If the unit has cycled off in Start–Stop mode and battery voltage drops below 11.0 volts, the unit is automatically started to charge battery. Unit will operate until the battery voltage is high enough to allow unit to cycle off, provided that all other conditions required for an off cycle are met. When battery voltage is above minimum limits, "O.K." will appear in the Message Center right after the voltage in the Unit Data list.
17 Vdc or more	Unit will shut down.

4.3 Continuous Run Operation

In the Continuous Run mode, the engine will not shut down except for safeties or if the engine stalls. Continuous Run operation is normally used for fresh produce and other sensitive product loads. The Start-Stop/Continuous key is provided 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 setpoint is within a specific range.
Refer to Section 4.4 - Range Lock for additional information.

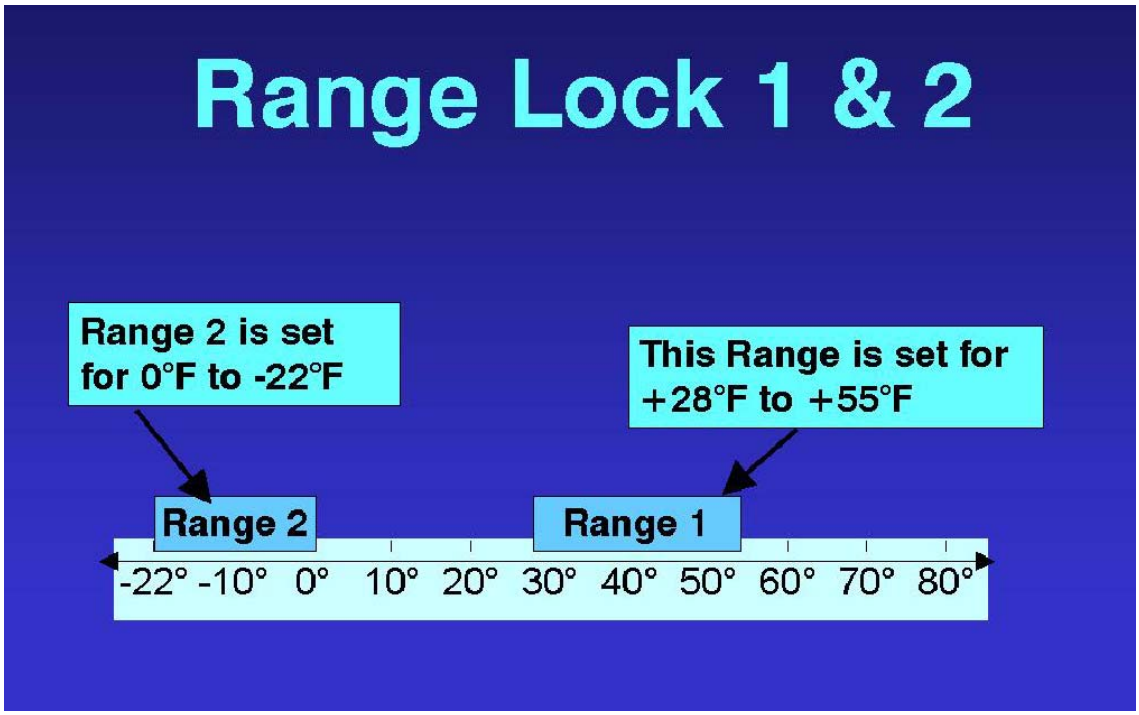
The unit will remain in low speed for 10 minutes after engine start-up when setpoint is below 10.4°F (–12°C).

4.4 Temperature Range Lock 1 & 2

The unit can be locked into Start–Stop or Continuous Run operation for various setpoints. Two ranges are available for setpoint range lock selection. Each Range can be independently set to lock it's setpoint temperatures into either Start–Stop or Continuous Run.

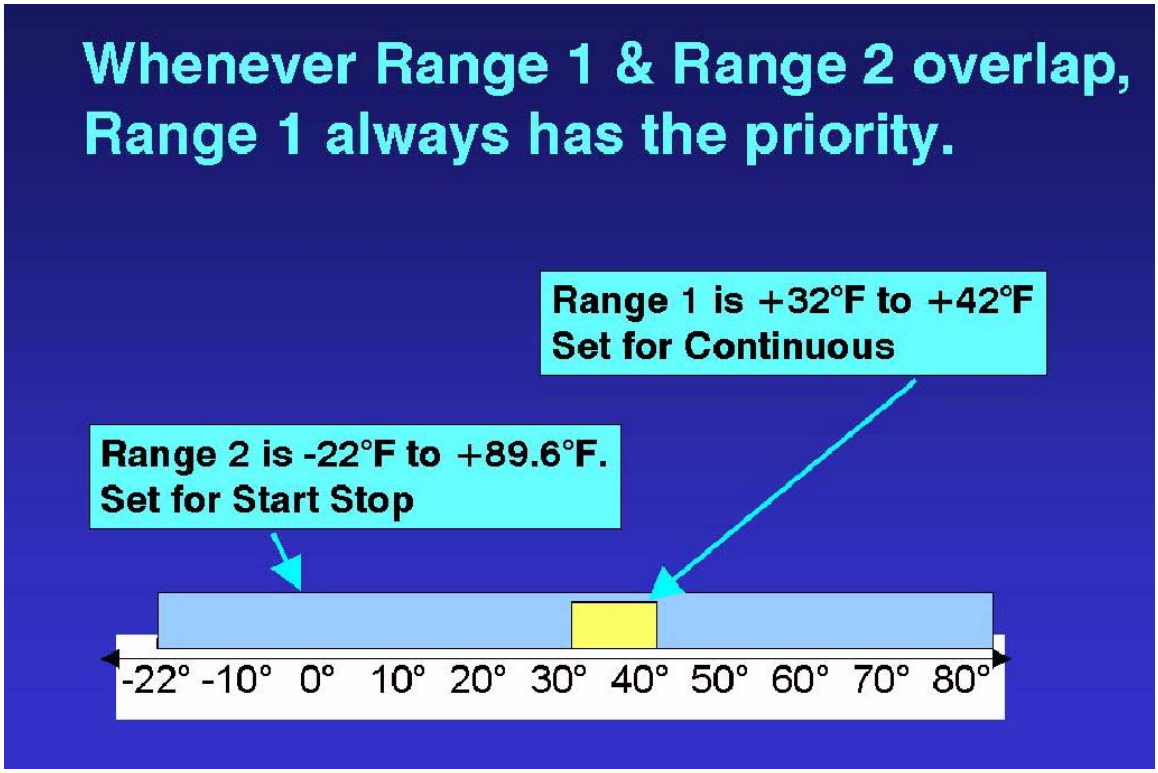
Each Range has it's own selectable minimum and maximum temperatures, which define the span of the range. If some setpoint temperatures are contained in both ranges due to range overlap, Range 1 will always have priority over Range 2.

For example (see following figure), if Continuous Run operation is ALWAYS required whenever the setpoint is between +28°F and +55°F, Range 1 will be set for Continuous Run, with a Minimum Temperature of +28°F and a Maximum Temperature of +55°F. Should Continuous Run operation ALWAYS also be required with setpoints between –22°F and 0°F, then Range 2 will be set for Continuous Run, with a Minimum Temperature of –22°F and a Maximum Temperature of 0°F. Any setpoint outside of Range 1 or 2 will allow changes between Start–Stop and Continuous Run.



In the same example as above, Range 1 or Range 2 can be changed to lock the unit operation into Start–Stop. The primary time that it is important to determine which range is to be Range 1 and which is to be Range 2 is when the ranges overlap each other.

In example 2 (see Figure below), the ranges will be set to lock all setpoints into Start–Stop, except for a small range between +32°F and +42°F where the unit will always operate in Continuous Run. Range 1 Minimum Temperature will be set for +32°F, and Maximum Temperature of +42°F. Range 2 will be set for a Minimum Temperature of –22°F and a Maximum Temperature of +89.6°F.



4.5 Temperature Control

Perishable or Frozen

There are two control ranges, Frozen and Perishable. The Frozen range is active with set points at or *below +10.4*°F *(−12°C)* and the Perishable range is active at set points *above +10.4*°F *(−12°C)*.

When in Frozen range, unit will default to low speed fully loaded if both the return and supply probes are bad. WARNING:NO TEMP CONTROL will be displayed.

When in Perishable range, the unit will shut down if both the return and supply probes are bad. UNIT SHUTDOWN − SEE ALARM LIST will be displayed.

Temperature control is achieved by controlling engine speed, compressor UL1 and UL2 unloaders, and solenoid valves (SV−1, SV−2, SV−3, SV−4).

UltraFresh 2 Temperature Control

UltraFresh 2 is an advanced method of temperature control for both Perishable or Frozen range. It can produce a reduced capacity state between the Heat and Cool Modes. This reduced capacity state is known as Pulsed−Null, which 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 Pulsed−Null temperature band (see the following charts), the unit will pulse between Cool and Null, or Heat and Null in 10 second increments. The capacity in the Pulsed−Null band is varied by adjusting the pulse rate.

UltraFresh 2 uses both the supply and return air sensors to control box temperature.

The sensor that is selected under the Functional Parameters for the temperature control is known as the “Selected Probe”. This is the probe that will be used to determine when the temperature is at set point.

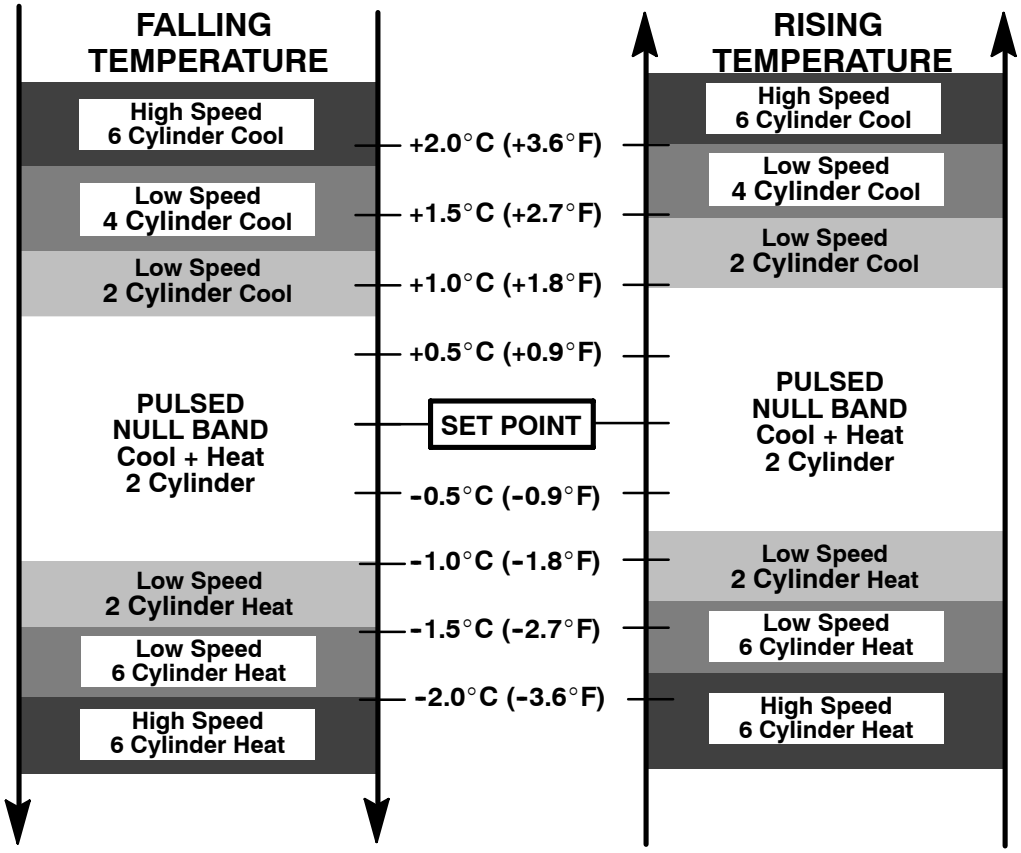
The “Active Probe” is the sensor actually used by the Microprocessor to perform the temperature control. It is the same as the “Selected Probe”, unless that sensor is not installed or is defective or if supply is the selected probe in Frozen Range.

SELECTED PROBE	ACTIVE PROBE
Return Air Sensor	Return Air Sensor (only)
Supply Air Sensor	Supply Air Sensor (Perishable Range) Return Air Sensor (Frozen Range)

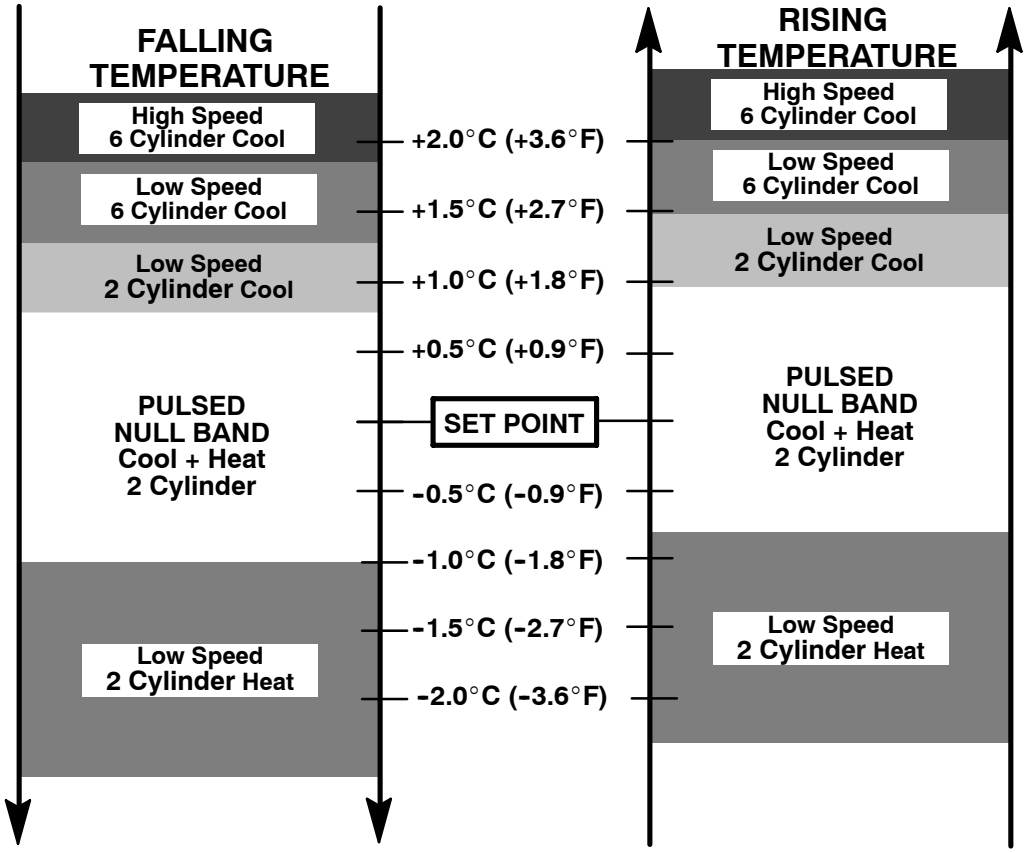
The “Controlling Temperature” is a calculated temperature value, based upon both the Supply and Return Air temperatures, and Set Point. Most of the time, the Controlling Temperature will be very close to or the same as the Active Probe temperature.

In the case of a bad probe, the remaining probe will be used for temperature control.

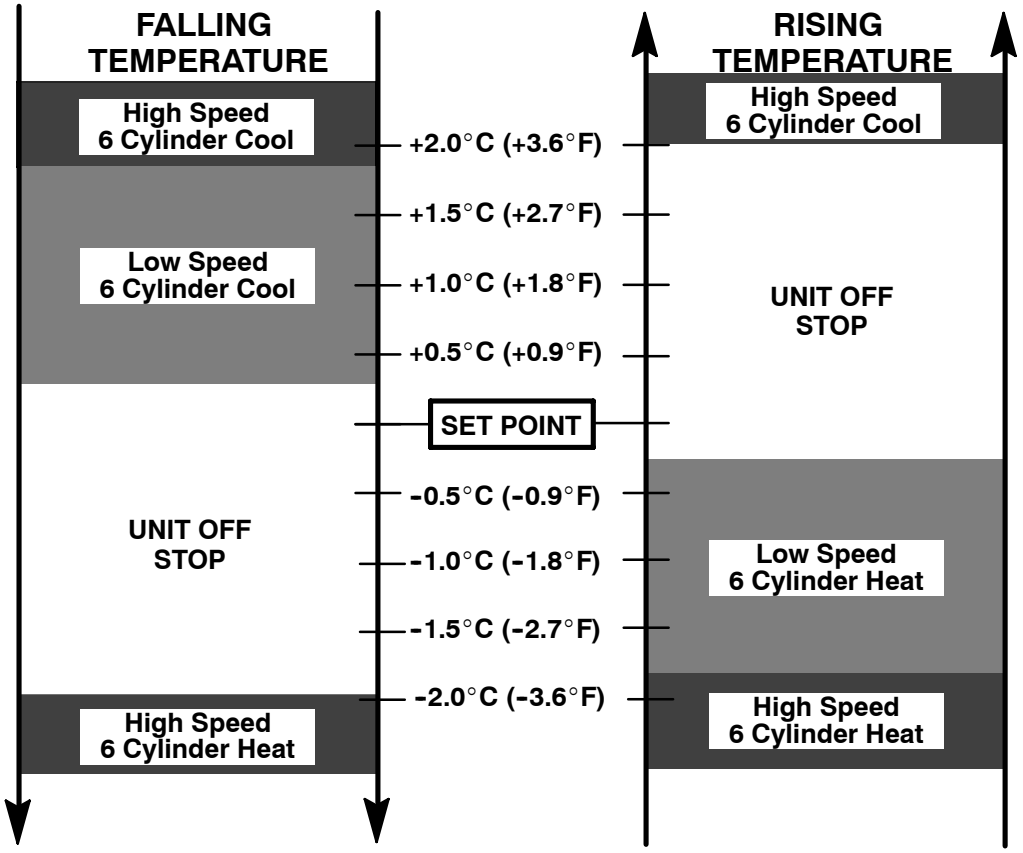
NOTE: The following temperature control operating sequence diagrams are after pulldown and do not show overrides.



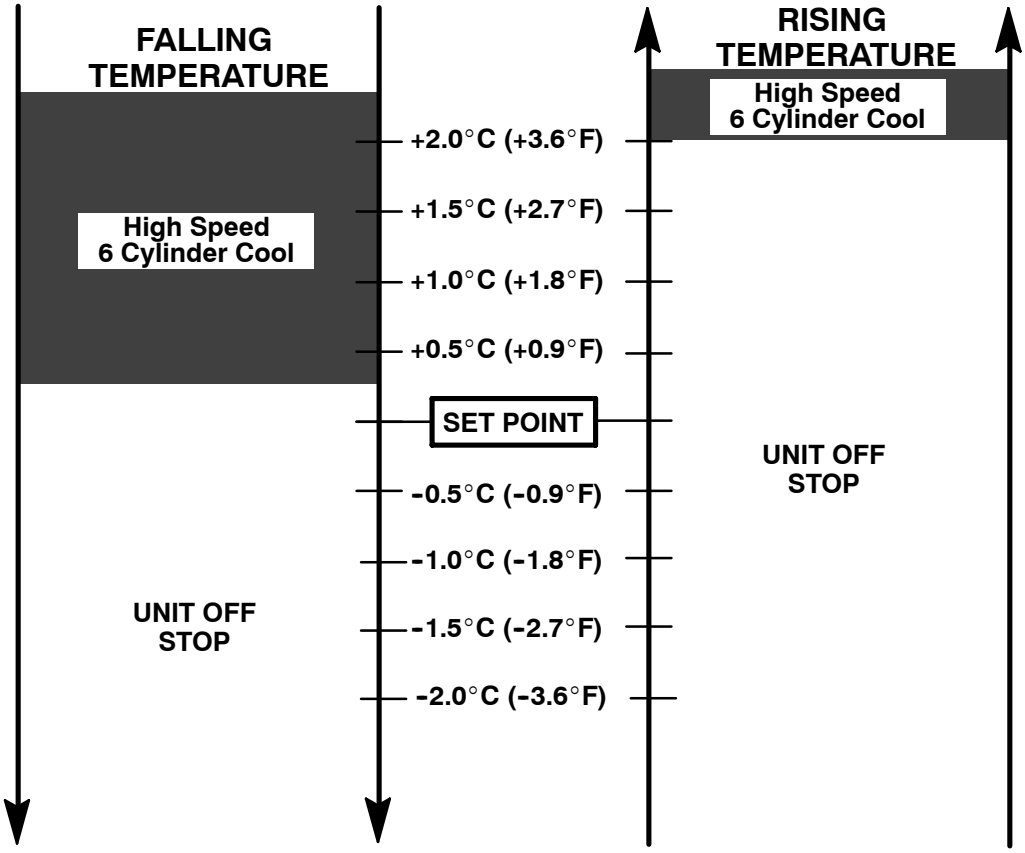
Continuous Run Temperature Control Operating Sequence - Perishable Range



Continuous Run Temperature Control Operating Sequence - Frozen Range



Start-Stop - Temperature Control Operating Sequence - Perishable Range



Start-Stop - Temperature Control Operating Sequence - Frozen Range

Pulldown / Pull-up Mode

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

- at engine start
- setpoint change
- operational mode change, ie, start/stop, continuous operation
- defrost termination
- 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 box temperature has not reached setpoint.
- pretrip termination

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

For CONTINUOUS RUN MODE:

- The Active Probe Temperature is within ± $\left(\frac{\text{RAT - SAT}}{2}\right)$ of setpoint when the setpoint is below 60°F (15.6°C), and both supply and return air sensors are good; OR
- The Active Probe Temperature is within the low speed operation range.

For START–STOP RUN MODE

- The Active Probe Temperature is within the set point range which allows the unit to shut off.

Heat/Cool/Null Switching Operation

When not in pulldown, UltraFresh 2 controls the unit based on the following switch points. (Note that the switch points are based upon the Controlling Temperature rather than the Active Probe.)

There are three possible modes for UltraFresh 2 control. These are heat, cool and null. To enter COOL the control temperature must be greater than or equal to 1.8°F (1°C) above setpoint. To exit cool and enter PULSED NULL the control temperature must be less than 1.5°F (0.8°C) above setpoint. To exit PULSED NULL and enter HEAT the control temperature must be more than or equal to 1.8°F (1°C) below setpoint and to exit heat and enter PULSED NULL the control temperature must be less than 1.5°F (0.8°C) below setpoint. (See the temperature control operating sequence diagrams).

Heat Mode Operation

In the Heat Mode, the Microprocessor will operate the unit controls as follows:

SV1	SV2	SV3	SV4	SCS	Clutch Output	UL1	UL2
CLOSE	Refer to SV2 Operation	Refer to SV3 Operation	OPEN	Refer to SCS Operation	ENGAGE	Refer to UL1 Operation	Refer to UL2 Operation

Cool Mode Operation

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

SV1	SV2	SV3	SV4	SCS	Clutch Output	UL1	UL2
OPEN	OPEN	CLOSE	CLOSE	Refer to SCS Operation	ENGAGE	Refer to UL1 Operation	Refer to UL2 Operation

Pulsed Null Mode Operation

Pulsed Null Mode will combine the Heat and Cool operation described above with the following Null Mode operation:

SV1	SV2	SV3	SV4	SCS	Clutch Output	UL1	UL2
OPEN	OPEN	CLOSE	OPEN	LOW	ENGAGE	UNLOAD	UNLOAD

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 9 seconds, then Null for 1 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 band.

Default Mode

When both the return air sensor alarm and the supply air sensor alarm are active, the unit will enter Default Mode for temperature control. In the frozen setpoint range, the unit will run low speed loaded cool. WARNING:NO TEMP CONTROL will be displayed. In the perishable setpoint range, the unit will shutdown.

Speed Control Solenoid (SCS) Operation

The engine will operate the compressor at two different speeds (low and high)

Speed Control will use the differences of Controlling Temperature and setpoint as follows:

Mode	HIGH SPEED	LOW SPEED
COOL	Control Temp is more than 3.5°F (2.0°C) above setpoint	Control Temp is less than 3°F (1.8°C) above set point
HEAT	Control Temp is more than 3.5°F (2.0°C) below setpoint	Control Temp is less than 3°F (1.8°C) below set point

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.

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

Mode	LOAD (de-energize) UL1 and UL2	UNLOAD (energize) UL1 and UL2
COOL	Control Temp is more than 2.7°F (1.5°C) above set point	Control Temp is less than 2.3°F (1.3°C) above set point
HEAT	Control Temp is more than 2.7°F (1.5°C) below set point	Control Temp is less than 2.3°F (1.3°C) below set point

SV2 Operation (Heating and Defrost)

The HP2 switch used in other models of Carrier Transicold trailer refrigeration systems is not used with the Advanced Microprocessor. In its place, there is a discharge pressure transducer which tells the Microprocessor exactly what the compressor discharge pressure is at all times.

Because the operation of the HP2 switch is very important to unit operation, we will continue to refer to the control of the SV2 valve in the Heat and Defrost cycles as by the HP2.

The following HP2 control is accessed during the Heat and Defrost cycles.
If the Discharge Pressure is greater than HP2 CUT OUT then SV2 is closed
If the Discharge Pressure is less than HP2 CUT IN then SV2 is open

HP2 Cut out and HP2 Cut in are based on the model number as follows (as other model units use the Advance Microprocessor, different values will be associated with the cut in and cut out of the HP2):

Model No.	HP2 CUT IN	HP2 CUT OUT
NDX93MN0AA Ultima (R404a)	190 psig	250 psig
All Other Models (R22 & 404a)	200 psig	300 psig

SV3 Operation (Heating and Defrost)

The SV3 valve will be opened during Heat or Defrost mode in the following circumstances.

- If SV4 has been open for at least 60 seconds AND
- The engine is operating in High Speed AND
- The Compressor Discharge Temperature Sensor Alarm is not active AND
- The Ambient Temperature Sensor Alarm is not active AND
- The (Compressor Discharge Temp – Ambient Temp) more than 100°F (55.5°C) AND
- The Ambient Air Temp less than 70°F (21.1°C)

The SV3 valve will be closed during Heat or Defrost in the following circumstances.

- If the Compressor Discharge Temperature Sensor Alarm is active OR
- The Ambient Temperature Sensor Alarm is active OR
- The (Compressor Discharge Temp – Ambient Temp) is less than 50°F (27.8°C) OR
- The Ambient Air Temp is more than 80°F (26.7°C)

NOTE: If the SV3 valve opens during the Heat or Defrost Cycle, then the Ambient Air Temperature rises above +80°F, the SV3 valve will be closed for the remainder of that cycle.

4.6 Output Overrides

4.6.1 Speed Control Solenoid (SCS) Overrides

Speed Control Solenoid Overrides in priority order:

1. **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).
2. **Defrost – see Defrost Control (Refer to Section 4.7)**
3. **10 Minute Startup low speed operation**
   - For the first 10 minutes of operation the unit will run in low speed except for perishable continuous run mode.
4. **High Air Flow**
   - For Perishable Set Points, 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.)
5. **Low Ambient Cool**
   - When the Ambient Temperature falls below 35°F (1.7°C) and the microprocessor calls for Cool, the engine will only operate in Low Speed. If the ambient Temperature rises above 40°F (4.4°C) High Speed will again be allowed for Cool Mode.
6. **Default Mode**
   - If the setpoint is in the frozen range (below +10.4°F) and both RAT and SAT sensor alarms are active, the unit will run in low speed cool.
7. **Start/Stop Frozen Range**
   - In Start–Stop Mode with the setpoint in the frozen range (below +10.4°F), minimum run time has expired, and the box temperature is not yet down to set point, the engine will be forced to high speed operation.
8. **Frozen Setpoint**
   - If the setpoint is in the frozen range (below +10.4°F) and the control temperature is below setpoint, the unit will run in low speed.
9. **High Speed Delay**

When operating in low speed, the Microprocessor switches between Heat Mode and Cool Mode there is a delay before the engine is switched into high speed. The specifics are detailed below.

- In Pulldown or pull-up, there are no delays.
- There is a 10 minute delay when switching from Low-Speed Cool to High-Speed Cool. The delay timer begins when the unit first goes into Low Speed Cool.
- There is a 1 minute delay when switching from Low-Speed Heat to High-Speed Heat. This timer begins when the unit first goes into Low Speed Heat.

4.6.2 Unloader Control Priority UL1 & UL2

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

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:

1. MOP Override – Maximum Operating Pressure Control – see section MOP Override
2. If the unit is operating in Defrost, or if the Temp Control calls for 6–cylinder HEAT, the MOP Override can only UNLOAD the UL1. The UL2 must remain LOADED.
3. Defrost – see defrost control (Refer to Section 4.7)
4. Frozen Setpoint
   - If the setpoint is in the frozen range (below +10.4°F) and the Control Temperature is below setpoint, unload both unloaders.
5. In the Cool Mode when the ambient temperature is below 35°F (1.7°C), UL 1 will be Unloaded.
6. If the setpoint is in the frozen range (below +10.4°F) and both RAT and SAT sensor alarms are active, the unit will run in low speed cool.
7. Auto Start Unloader Override Function
   - If the system is running in Start-Stop Run Mode, the minimum run time has expired, and the box temperature is not at set point, both unloaders will be LOADED (de-energized).
8. If the set point is in the perishable range, and the Control Temperature is within the low engine speed range, UNLOAD the UL1.
9. UltraFresh 2 Unloader Override Function – Perishable Setpoint

UNLOAD both UL1 and UL2 if the following conditions are satisfied:

- The system is in the Cool Mode AND
- The Supply Air Sensor is good AND
- The main compartment setpoint is in the perishable range (above +10°F) AND
- The Supply Air Temperature is less than 5.4°F (3°C) below setpoint
  OR
- The system is in Cool Mode AND
- The Supply Air Sensor is defective, but the Return Air Sensor is good AND
- The main compartment setpoint is in the perishable range (above +10.4°F) AND
- The Ambient Air Temperature is less than 90°F (32.2°C) AND
- The Return Air Temperature is less than 9°F (5°C) above the setpoint

If the Supply Air Sensor is good, then UNLOAD the UL1 and UL2 until the Supply Air Temperature is greater than the setpoint.
OR

If the Supply Air sensor is not good, UNLOAD both UL2 and UL1 until the Return Air Temperature is more than 14.4°F (8°C) above the setpoint, or the ambient exceeds 90°F (32.2°C).

Maximum Operating Pressure (MOP) Override

The Microprocessor monitors the suction pressure of the refrigeration system and controls the unloaders to maintain a Maximum Operating Pressure (MOP). A suction pressure transducer is used to provide this information to the Microprocessor. This pressure is calculated based on suction pressure and ambient air temperature. 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 with. 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 6 cylinders. When the front unloader UL1 is UNLOADED (energized), the unit operates on 4 cylinders. When UL1 and the rear unloader UL2 are UNLOADED (energized), the unit operates on 2 cylinders. The front unloader *UL1 always* UNLOADS before the rear unloader UL2 UNLOADS.

Suction Pressure Operation

d. R-404A Refrigeration System

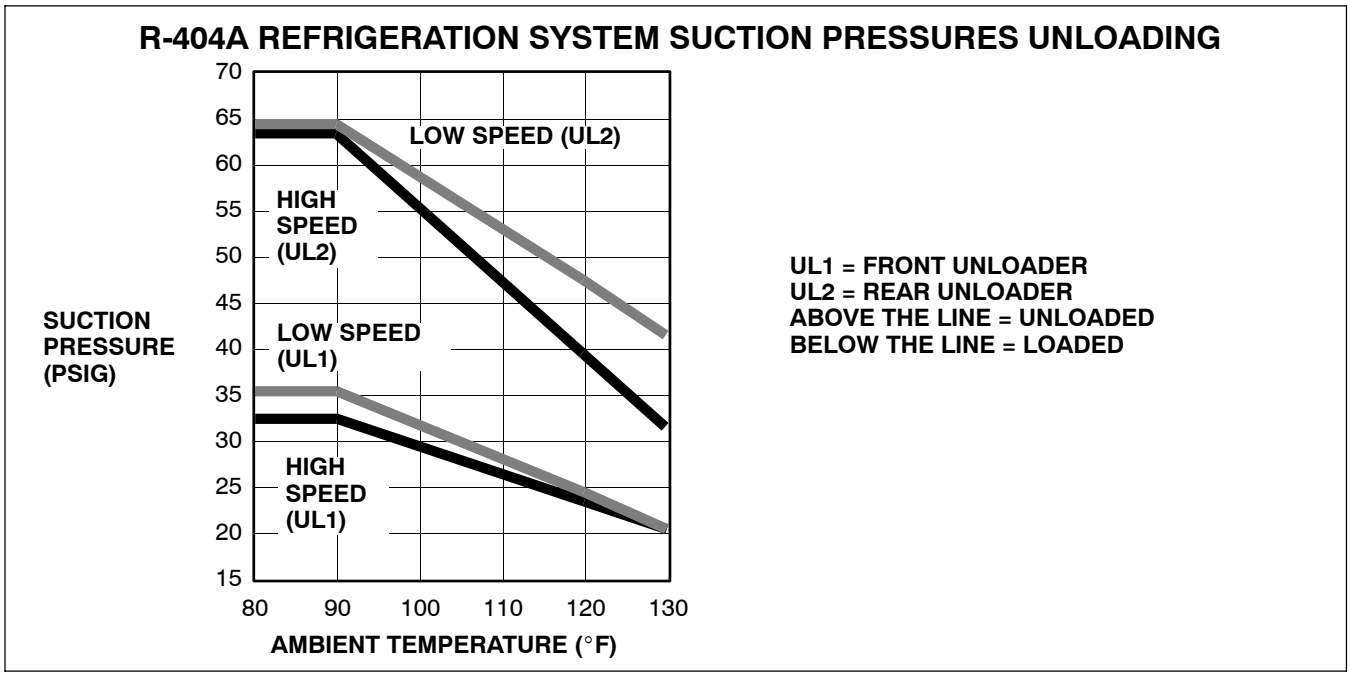
At ambient temperatures of 90°F (32.2°C) or below

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

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

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

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



e. R-22 Refrigeration System

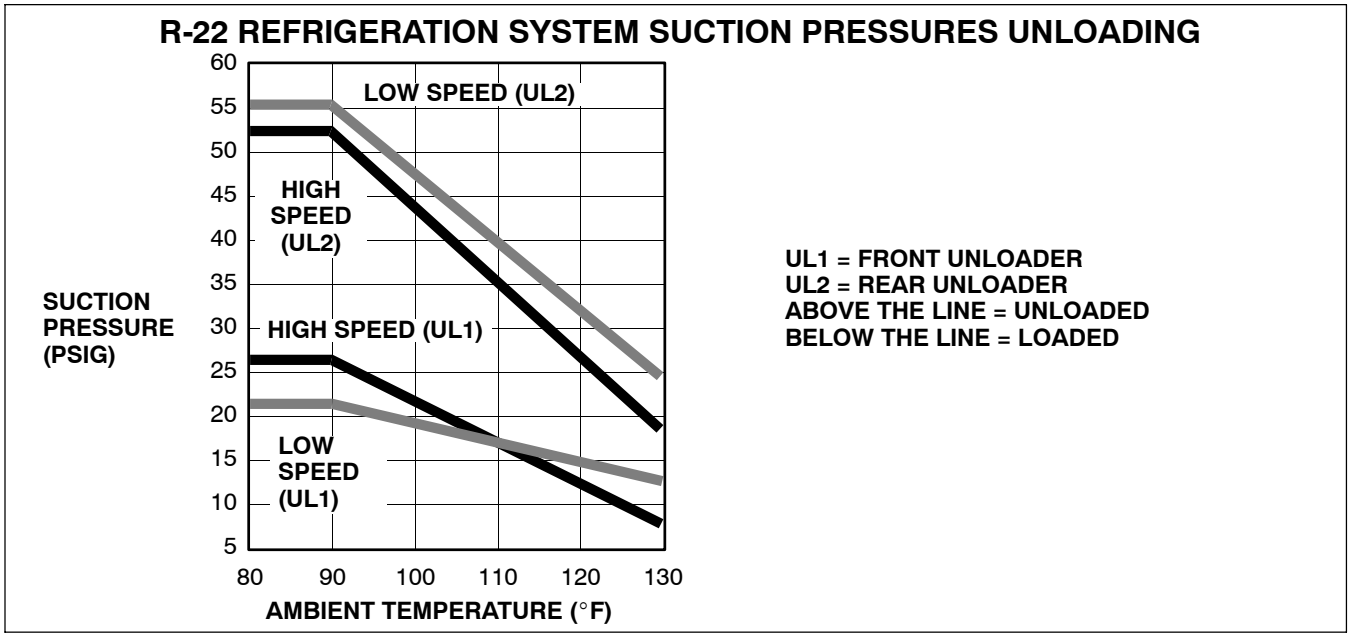
At ambient temperatures of 90°F (32.2°C) or below

When the system is operating in *high speed* and the suction pressure is greater than 53 psig, both unloader banks are unloaded. As the suction pressure drops below 52 psig, the UL2 unloader is loaded. If the suction pressure drops below 26 psig, the UL1 unloader is loaded.

When the system is operating in *low speed* and the suction pressure is greater than 56 psig, both unloader banks are unloaded. As the suction pressure drops below 55 psig, the UL2 unloader is loaded. If the suction pressure drops below 21 psig, the UL1 unloader is loaded.

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

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



4.7 Defrost

Defrost is an independent cycle overriding cooling and heating functions to de-ice the evaporator as required. When the unit is in Defrost, the DEFROST LED will be on, the Message Center will display DEFROST CYCLE STARTED for 5 seconds. The center of the Main Display will show "dF". The set point will continue to be displayed on the left side. Box Temperature will not be displayed during Defrost.

NOTE: The unit will operate in high speed in the defrost mode.

When Defrost is Initiated

The Defrost Mode may be initiated in three different ways once either DTT1 or DTT2 is below 40°F (4.4°C):

1. Defrost Timer

The Microprocessor contains an internal Defrost Timer (Functional Parameter) which can be set using the keyboard (Refer to Section 2.15 Functional Change) The Defrost Timer is restarted whenever a defrost cycle begins. The Microprocessor holds in memory the last entered Defrost Timer interval.

2. 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.

3. Manual Defrost

The Defrost cycle may be started at any time by pushing the MANUAL DEFROST key (Refer to Section 2.8).

TIP: Refer to Section 7.13 for more on the defrost mode.

When Defrost is Terminated

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

- When the defrost termination temperatures DTT1 is above 45°F (7.2°C) and DTT2 is above 55°F (12.8°C) and both sensors are working properly. If a sensor is bad, then it is ignored. If both sensors are bad then defrost will terminate in 20 minutes. A sensor is bad when its alarm is active.
- Defrost Terminated By Time Alarm
- The unit is allowed to stay in defrost for maximum time of 45 minutes.

NOTE: If the Defrost Air Switch (DAS) contacts are still closed at defrost termination 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.

Defrost Timer Operation

There are two timers which the Main Compartment Defrost Controller must maintain as described below:

1) Defrost Cycle Timer: This is the amount of time that the system is actually defrosting. This timer starts when a Defrost Cycle is initiated. It is used to terminate Defrost after a maximum time of 45 minutes.

a) The purpose for maintaining a Defrost Cycle Timer is to monitor the total time of the Defrost cycle. If the Defrost cycle does not complete within 45 minutes, the following will occur:
   - The Defrost cycle will be terminated.
   - A 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 is activated

2) Defrost Interval Timer: This is the amount of time between defrost cycles. However, this timer does not accumulate time during the following periods:

- When the unit is running in the Defrost Cycle
- During engine Off cycles or compressor Off cycles

Defrost Control Operation

The Defrost Control will control the following:

- Solenoid valves (SV1– SV4)
- Speed Control Solenoid (SCS)
- Front and Rear Unloaders (UL1 and UL2)
- Clutch

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, the High Ambient Defrost Operation will be used.

Normal Defrost Operation

SV1	SV2	SV3	SV4	SCS	Clutch Output	UL1	UL2
CLOSE	See SV2 Operation	See SV3 Operation	OPEN	HIGH	DISENGAGE	LOAD	LOAD

Normal Defrost Termination

Once DTT1 is above 45°F (7.2°C) and DTT2 is above 55°F (12.8°C), the defrost cycle will terminate. The following sequence will be used to perform a Normal Defrost Termination.

- Place the engine in Low Speed. Open (de-energize) SV1 and Open (energize) SV2. The unit will remain in this mode for two seconds.
- Then close (de-energize) SV3 and SV4. The unit will remain in this mode for three seconds.
- Then the Clutch will be engaged (energized). There will be a minimum of 2 seconds before the engine can return to High Speed.
- At this point, the Microprocessor will return to normal temperature control. (The data recorder will record a Defrost Termination Event)

High Ambient Defrost Operation

The High Ambient Defrost Cycle has 3 separate modes within it. The first is the Pump Down Mode, followed by the Defrost Mode, then the Defrost Termination Mode. Each of these is described below:

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	SV3	SV4	SCS	Clutch Output	UL1	UL2
OPEN	CLOSE	CLOSE	CLOSE	LOW	ENGAGE	UNLOAD	UNLOAD

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 for R404A units or 5 psig for R22 units.
  OR
- A maximum of 5 ½ minutes, regardless of suction pressure.

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	SV3	SV4	SCS	Clutch Output	UL1	UL2
CLOSE	See SV2 Operation	CLOSE	OPEN	HIGH	DISENGAGE	UNLOAD	LOAD

High Ambient Defrost Termination

Once both of the Defrost Termination Temperature Sensors reach 55°F, the defrost cycle will terminate. The following sequence will be used to complete a High Ambient Defrost Termination.

- Place the engine in Low Speed. Open (de-energize) SV1 and Open (energize) SV2. Unload (energize) both UL1 and UL2. The unit will remain in this mode for five seconds.
- Then engage (energize) the Clutch. The unit will remain in this mode for 10 seconds.
- Then close (de-energize) SV4. The unit will remain in this mode for 5 seconds.
- At this point, the Microprocessor will return to normal temperature control. (The data recorder will record a Defrost Termination Event)

Section 5 – Troubleshooting

Section 5 - Alarm Troubleshooting

5.1 Introduction To Alarm Troubleshooting Guide

The Alarm Troubleshooting Guide should be used whenever an alarm occurs. Alarms will appear in the Message Center and will begin with the alarm number. Alarms are listed in the Troubleshooting Guide by alarm number.

When an alarm occurs, look through both alarm lists (see Note 1), and make note of all alarms.

Before beginning to actually troubleshoot a unit, visually inspect the unit, and 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 so 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 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)

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 Message Center, 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 behind the Keypad Assembly, at the Keypad itself (remove the rear cover from it to check), and at connector 6 on the Microprocessor.

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 is not loaded with perishable product.

WARNING: Whenever working around the engine drive train, belts, pulleys or fans, always remove either a battery cable from the battery, or the starter solenoid wire.

Section 5 - Alarm Troubleshooting

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 Message Center. Pressing "=" 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.

Active alarms that have been cleared (inactivated) are moved to the Inactive Alarm List. This list is reached by first pressing and holding the Alarm List key, then the ↑ Key, and holding both of them for 4 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 To test electrical circuits, 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. Turn the Start/Run-Off Switch to Run. Continue to hold the Glow/Crank switch until the setpoint and box temperature are shown in the display, then release it. The Message Center 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 3 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 3.7.

An alternative method to power up the microprocessor with no load, hold the Glow/Crank switch in the glow position, and move the Start/Run-Off switch to Run. Continue to hold the Glow/Crank switch for 2 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 4 Sensors and sensor circuits may be tested at the 1MP plug. Remove plug from Microprocessor and using the MP1 Plug Map and an ohmmeter, test resistance of circuits. (See chart of resistances for different sensors.)

Note 5 When checking the Defrost Air Switch, RPM Sensor, Engine Oil Level Switch, Fuel Level Sensor, Door Switch, or HP1, unplug 2MP at the Microprocessor. Using the MP2 Plug Map and wiring diagram, check for voltage at the appropriate terminal.

Note 6 When checking the light bar, SV & Unloader circuits, unplug 3MP at the microprocessor. Using the MP3 Plug Map and wiring diagram, check for voltage at terminal of the circuit you are testing. Should be battery voltage.

Note 7 Some tests can only be conducted with the unit operating. The unit may be started automatically by placing the Start/Run-Off switch in the Start/Run position. To start the unit manually, press and hold the Glow/Crank switch in the Glow position. Turn the Start/Run-Off Switch to 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 Message Center will show "Manual Start Mode Selected". Hold the Glow/Crank switch in the Crank position until the engine starts.

Section 5 – Alarm Troubleshooting

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
5.2 DRIVER ALARMS			
1	**LOW FUEL LEVEL (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 ¼ 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 PC Mode, or in Manual Start Mode (see Note 2). DO NOT START UNIT.
		c. Check for voltage at harness plug between pins A and B	Voltage should be 12 volts 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	Start–Run/Off Switch OFF 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 switch)5

Section 5 – Alarm Troubleshooting

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
1	**LOW FUEL LEVEL (for units with Low Fuel Level 0% to 100% Sensor / fuel level is displayed in Data List)** • 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 unit in PC Mode, or in Manual Start Mode (see Note 2). DO NOT START UNIT.
		c. Check for voltage at harness plug between pins for BLACK (SP24) negative and RED (SPK5) positive wires	Voltage should be 12 volts.
		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	Start–Run/Off Switch OFF prior to checking for continuity, Must be less than 10 ohms.
	3	Check fuel level sensor calibration	
		a. Check fuel level sensor calibration	See Section (8.4.1) for sensor calibration procedure.
	4	Check circuits with test (substitute) sensor	
		c. Substitute known good sensor and clear alarm. Start unit and run for 30 seconds.	
		d. Check to see if alarm re-occurs.	Alarm should not come on. (Install new sensor)

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
2	**LOW ENGINE OIL LEVEL** • TRIGGER–ON: Engine oil level is sensed approx. 7 or more qts. low for longer than 10 seconds. • UNIT CONTROL: Alarm Only, or may be configured to shut unit down. • RESET CONDITION: Auto reset if engine oil level is above 4 qt. Low for more than 10 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)	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 2). DO NOT START UNIT. Battery voltage reading (12–13 VDC) between wires in plug

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
3	**LOW COOLANT LEVEL** • TRIGGER ON: Engine coolant level is 1 or more quarts 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 PC Mode, or in Manual Start Mode (see Note 2). 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	Start–Run/Off Switch OFF 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
5.3 SHUTDOWN ALARMS			
11	**LOW ENGINE OIL PRESSURE** • TRIGGER–ON: Engine oil pressure is below 12 psig while the engine is running. • 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 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 Contacts open when oil pressure is below 12 psig
	3	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	Run / Stop switch ON, Manual Start Mode (See Note 2) 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.

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 5 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	Level must be at the top of the radiator fill tube.
	2	Check for Bad Eng Coolant Sensor alarm	
		a. Check for alarm 129	Alarm conditions must be corrected and the alarm cleared to continue
	3	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.
	4	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.
	5	Check condenser & water pump belts	
		a. Check upper fan belt tension & condition.	(Refer to Section 8.6 for belt tensions) No Glazing, no cracking, no slipping
		b. Check lower fan belt tension & condition.	(Refer to Section 8.6 for belt tensions) No Glazing, no cracking, no slipping
		c. Check water pump belt tension & condition.	(Refer to Section 8.6 for belt tensions) No Glazing, no cracking, no slipping
	6	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 7.2 for coolant thermostat specifications)
		c. Check water pump operation	Must not leak, impeller attached tightly to shaft

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
13	**HIGH DISCHARGE PRESSURE** • TRIGGER–ON: Compressor discharge pressure is over 465 PSIG. • UNIT CONTROL: Immediate Unit Shutdown & Alarm • RESET CONDITION: Auto Reset after 15 minutes if the compressor discharge pressure falls below 350 PSIG, 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 fan belts	
		a. Check upper fan belt tension & condition	(Refer to Section 8.6 for belt tensions) No Glazing, no cracking, no slipping
		b. Check lower fan belt tension & condition.	(Refer to Section 8.6 for belt tensions) No Glazing, no cracking, no slipping
	2	Check Wiring	
		a. Visually Inspect wiring to HPS, SV3, SV4, & both Compressor Unloaders	Wires must be connected properly & securely to each component
	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. Pressures must be in the normal range for ambient & box temperature conditions.
	5	Perform Pretrip Check	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.
	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 7.6 for pressure settings)	Contacts open when compressor discharge pressure is above cut-out point ± 10 psig Contacts closed when compressor discharge pressure is below cut-in point ± 10 psig
	8	Check HPS 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	Run / Stop switch ON, Manual Start Mode (See Note 2) Battery voltage reading (12–13 VDC) between wires in plug

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
	9	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
	10	Check system for non–condensable	
		a. Check refrigeration system for non-condensable gas(es)	No non-condensable gas(es) may be present.
	11	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.
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 below 17 VDC
		b. Test voltage at battery with unit running.	Must be below 17 VDC
	2	Check alternator voltage	
		a. Test voltage at alternator output terminal with unit off	Must be below 17 VDC
		b. Test voltage at alternator output terminal with unit running.	Must be below 17 VDC
	3	Check voltage at microprocessor	
		a. Check voltage reading at microprocessor input (QC1+ to QC2–)	Run / Stop switch ON, Manual Start Mode (See Note 2) Must be below 17 VDC
		b. Check voltage reading on microprocessor display	Must be within .5 VDC of reading obtained in 3a (above)

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
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–).	Run / Stop switch ON, Manual Start Mode (See Note 2) Must be above 11 VDC
		b. Check voltage reading on microprocessor display	Must be within .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 3 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 3 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 (165.4°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	Check for Bad Compressor Discharge Temperature Sensor	
		a. Check for alarm 125	Alarm conditions must be corrected and the alarm cleared to continue
	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 mounting of DTTs	
		a. Visually inspect the mounting and orientation of DTT1 and DTT2	Must be mounted tightly to the evap section, with the long flat surface of the DTT in contact with the metal surface.
	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.
	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 7.6
		c. Check superheat of valve	Refer to Section 7.6
	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 (A): Suction Pressure is less than –3.0 psig (6 inches vacuum) for more than 120* seconds, when the RAT is above –10°F (–23.3°C), or If the Suction Pressure is less than –8.0 psig (16 inches vacuum) 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 –2.0 psig (4 inches vacuum), 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 configured from 0 – 255 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 fan belts	
		a. Check upper fan belt tension & condition	(Refer to Section 8.6 for belt tensions) No Glazing, no cracking, no slipping)
		b. Check lower fan belt tension & condition.	(Refer to Section 8.6 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 Suction & Discharge Pressures must have the same reading on gauges & on micro display.
	3	Perform Pretrip Check	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.
	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 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
	6	Check refrigerant charge	
		a. Check for undercharged system	Level must be above lower sight glass
	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 7.6
		c. Check superheat of valve	Refer to Section 7.6

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
19	**LOW FUEL LEVEL (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 ¼ 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	Add fuel as needed to the fuel tank.
19	**LOW FUEL LEVEL (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	Add fuel as needed to the fuel tank.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
27	**HIGH SUCTION PRESSURE** • TRIGGER ON: Suction pressure has been greater than 98 psig 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 for 5 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. Check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading (± 5 psig) 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.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
28	**CHECK REFRIGERATION SYSTEM** • TRIGGER ON: Discharge pressure is not at least 5 psig 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 above the suction pressure for 5 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. Check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading (± 5 psig) 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.
5.4 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.		
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 3 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 fuel level in tank.	
		a. Check fuel gauge on tank.	Fill tank as needed.
	2	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
	3	Check Fuel Solenoid	
		a. Check Run Relay LED	Must be ON.
		b. Check voltage to fuel solenoid	Run / Stop switch ON, Manual Start Mode (See Note 2) 12 VDC between FSC–C (ground) & FSH–A (hold) With Manual Crank Switch in crank position 12 VDC between FSC–C (ground) & FSP–B (pick)
		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 7.8
		f. Check operation of solenoid	Plunger must move in when energized
	4	Check fuel system	
		a. Check fuel system prime	No air in fuel system
		b. Check fuel flow	Unrestricted fuel flow through 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
	6	Check for correct engine oil	
		a. Check for correct oil viscosity (weight) for conditions	Refer to Section 7.2 Must be correct for ambient conditions
	7	Check engine exhaust system	
		a. Inspect the exhaust system	Must be clear and unobstructed
	8	Check engine	
		a. Check engine compression	Refer to Section 7.2

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 5 minutes. or, The user has tried to start the engine 3 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	Operator failed to crank engine	
		a. Manually start unit.	Engine starts and runs
	2	Check fuel level in tank.	
		a. Check fuel gauge on tank.	Fill tank as needed.
	3	Check for Check Glow Plugs alarm	
		a. Check for alarm 40	Alarm conditions must be corrected and the alarm cleared to continue.
	4	Check glow / crank switch	
		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)	Run / Stop switch ON, Manual Start Mode (See Note 2) 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 More than 11 VDC
	5	Check glow/crank switch harness	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
	6	Check Fuel Solenoid	
		a. Check Run Relay LED	LED 28 must be ON.
		b. Check voltage to fuel solenoid	Run / Stop switch ON, Manual Start Mode (See Note 2) 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. Check resistance of solenoid	Refer to Section 7.8
		e. Check operation of solenoid	Plunger must move in when energized
	7	Check fuel solenoid harness	
		a. Inspect harness & control box connector pins & terminals (See Wiring Schematic)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
	8	Check fuel system	
		a. Check fuel system prime	No air in fuel system
		b. Check fuel flow	Unrestricted fuel flow through system
	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 for correct engine oil	
		a. Check for correct oil viscosity (weight) for conditions	Refer to Section 7.2 Must be correct for ambient conditions
	11	Check engine exhaust system	
		a. Inspect the exhaust system	Must be clear and unobstructed
	12	Check engine	
		a. Check engine compression	Compression must be above 400 psig
34	**ENGINE FAILED TO STOP** • TRIGGER–ON: Engine is turning more than 500 RPM for 20 seconds after unit shut down or cycled off, or Oil Pressure Switch is closed longer than 20 seconds after unit shut down or cycle off. • 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 for Bad Engine RPM Sensor alarm	
		a. Check for alarm 130	Alarm conditions must be corrected and the alarm cleared to continue
	3	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 Contacts open when oil pressure is below 12 psig
	4	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	Run / Stop switch ON, Manual Start Mode (See Note 2) Battery voltage reading (12–13 VDC) between wires in plug
	5	Check fuel solenoid & circuit	
		a. Check Run Relay LED	LED 28 must be OFF.
		b. Check voltage at harness to fuel solenoid	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 RPMs 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 starter relay circuit	
		a. Check operation of starter solenoid relay	Run/Stop switch ON, Manual Start Mode (See Note 2) 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
	2	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 7.8
		c. Check resistance of starter motor	Refer to Section 7.8
		d. Test amperage draw of starter.	Refer to Section 7.8
	3	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
	4	Check for correct engine oil	
		a. Check for correct viscosity for conditions	Refer to Section 7.2 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 5 minutes. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when Coolant temp raises 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 4)	(Refer to Section 7.8 for complete resistance chart) 10k Ohms @ 77°F (25°C)
		b. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
37	**CHECK LOW SPEED RPMs** • TRIGGER–ON: Controller is set for low engine speed operation, and RPMs are Less than 1325 or greater than 1625 for Ultima; or Less than 1200 or greater than 1500 for Ultra, Ultra X/L, and Extra 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 RPMs come Between 1375 to 1575 for Ultima; or Between 1250 to 1400 for Ultra, Ultra X/L, and Extra 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 speed solenoid & linkage	
		a. Check speed solenoid plunger	Must move in and out freely
		b. Check engine speed arm & linkage	Must move freely
	2	Force Low Speed operation (See note 7)	
		a. Turn unit OFF, wait 10 seconds, then turn ON Set for Start Stop operation	Controller will call for Low Speed operation for the next 10 minutes.
		b. Check operation of Speed Relay LED	LED 27 must be OFF
		c. Check voltage to speed solenoid	Must be 0 VDC
	3	Check engine RPMs	
		a. Check actual engine RPM using hand held tachometer	Refer to Section 7.2 Adjust engine linkage setting as needed.
		b. Compare actual RPMs with those shown on display.	Both readings within ± 50 RPM
	4	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
	5	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 RPMs** • TRIGGER–ON: Controller is set for high engine speed operation, and RPMs are Less than 2000, or greater than 2400 for Ultima; or Less than 1700 or greater than 2100 for Ultra or Ultra X/L; or Less than 1500 or greater than 1900 for Extra 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 RPMs come Between 2050 to 2350 for Ultima; or Between 1750 to 2050 for Ultra or Ultra X/L; or Between 1550 to 1850 for Extra 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 speed solenoid linkage	
		a. Check speed solenoid plunger	Must move in and out freely
		b. Check engine speed arm & linkage	Must move freely
	2	Check speed circuit	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins or terminals
		b. Check resistance of speed solenoid	Refer to Section 7.8
		c. Check amp draw of speed solenoid	Refer to Section 7.8
	3	Force High Speed operation (See note 7)	
		a. Start unit, setpoint more than 10°F away from setpoint, and set for Continuous Run with Setpoint above +11°F.	Controller will call for High Speed operation.
		b. Check operation of Speed Relay	LED 27 must be ON
		c. Check voltage to speed solenoid	Must be 12–14 VDC
	4	Check engine RPMs	
		a. Check actual engine RPM using hand held tachometer	Refer to Section 7.2 Adjust engine linkage setting as needed.
		b. Compare actual RPMs 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
39	**CHECK ENGINE RPM** • TRIGGER–ON: Engine RPMs have been: Less than 1200 or greater than 2500 for Ultima; or Less than 1100 or greater than 2200 for Ultra or Ultra X/L; or Less than 1100 or greater than 2000 for Extra for more than 5 minutes • UNIT CONTROL: Alarm Only or Unit Shutdown & Alarm (if configured) • RESET CONDITION: Auto Reset if unit is set for Alarm Only when engine RPMs are between 1200 to 2500 for more than 5 minutes, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again. • RESET CONDITION: Auto Reset if unit is set for Alarm Only when engine RPMs are: Between 1200 to 2500 for Ultima; or Between 1100 to 2200 for Ultra or Ultra X/L; or Between 1100 to 2000 for Extra for more than 5 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 for engine stalled alarm	
		a. Check for alarm 41	When both alarms are present, unit may have been run out of fuel.
	2	Check speed solenoid & linkage	
		a. Check speed solenoid plunger	Must move in and out freely
		b. Check engine speed arm & linkage	Must move freely
	3	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
	4	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
	5	Force Low Speed operation (See note 7)	
		a. Turn unit OFF, wait 10 seconds, then turn ON Set for Start Stop operation	Controller will call for Low Speed operation for the next 10 minutes.
		b. Check operation of Speed Relay LED	LED 27 must be OFF
		c. Check voltage to speed solenoid	Must be 0 VDC
	6	Check low speed engine RPMs	
		a. Check actual engine RPM using hand held tachometer	Refer to Section 7.2 Adjust engine linkage setting as needed.
		b. Compare actual RPMs with those shown on display	Both readings within ± 50 RPM

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
	7	Force High Speed operation (See note 7)	
		a. Start unit, setpoint more than 10° away from setpoint, and set for Continuous Run operation	Controller will call for High Speed operation.
		b. Check operation of Speed Relay	LED 27 must be ON
		c. Check voltage to speed solenoid	Must be 12–14 VDC
	8	Check high speed engine RPMs	
		a. Check actual engine RPM using hand held tachometer	Refer to Section 7.2 Adjust engine linkage setting as needed.
		b. Compare actual RPMs with those shown on display	Both readings within ± 50 RPM
40	**CHECK GLOW PLUGS** • TRIGGER–ON: Glow Plug amperage is less than 30 Amps, or greater than 43 Amps after 13 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 13 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	Run/Stop switch in Run–Manual Start Operation. (See Note 2) Glow Crank switch in Glow position. LED 30 must be ON
		c. Check Non–Running Amps	View Current Draw in Data List Refer to Section 7.8
		d. Check Glow Plug circuit amperage	Current Draw = Non–Running Amps + Glow Plug Amps
		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 7.8

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	Was engine shut off manually?	
		a. Check for external cause	Correct problem.
	2	Check for Bad F2 or F3 Fuse Alarm	
		a. Check for alarm 71	Alarm conditions must be corrected and the alarm cleared to continue.
	3	Check fuel system	
		a. Check for Alarm 1 b. Check fuel flow c. Check fuel system prime	Fill tank as needed Unrestricted fuel flow through system Fuel not gelled No air in fuel system
	4	Check engine air–intake system	
		a. Check air filter indicator b. Inspect air intake system	Flag must not be visible. Hoses & tubes in good condition. No kinks or restrictions
	5	Check engine exhaust system	
		a. Inspect the exhaust system	Must be clear and unobstructed
	6	Check engine	
		a. Check Injection pump timing b. Check engine valve adjustment c. Check engine compression	Timing must be correct Rocker arm clearance must be correct Compression must be above 400 psig
	7	Check refrigeration system	
		a. Check discharge & suction pressures	Must be within normal operating range for conditions

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
5.5 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 3 continuous minutes. • UNIT CONTROL: Alarm Only or Unit Shutdown & Alarm (if configured) • 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 Current Sensor	
		a. Check Micro Current Value	Run/Stop switch ON, Manual Start Mode, all electrical circuits off. (See Note 3) Must be 0 ± 0.5 Amps with no load
	2	Check alternator belt	
		a. Check alternator belt tension & condition	(Refer to Section 8.6 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)	Run/Stop switch ON, Manual Start Mode (See Note 2) Must have 11 or more VDC with switch ON
		c. Check AUX (D+) terminal	Must have less than 3 VDC with unit OFF
		d. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
		e. Check output wire (unit running)	Must have 13 or more VDC (when tested against – battery post)
		f. Check ground wire (unit running)	Must have 13 or move VDC (when tested against + battery post)
	4	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
	5	Perform Pretrip Check	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
53	**BOX TEMP OUT–OF–RANGE** • TRIGGER–ON: UNIT CONTROL: **Alarm Only:** The box temperature has been in range (within ±2.7°F of setpoint for perishable and within +2.7°F for 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 (4°, 5°, OR 7°F) for this unit, for more than 15 minutes. **Shut Down & Alarm:** The box temperature has been in range (within ±2.7°F of setpoint for perishable and within +2.7°F for 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.		
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 trailer doors	
		a. Inspect all trailer doors	Must be closed, no air leakage
	2	Check for Low Refrigerant Pressure alarm	
		a. Check for alarm 18	Alarm conditions must be corrected and the alarm cleared to continue
	3	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.
	4	Check for Check Evaporator Airflow Alarm	
		a. Check for alarm 56	Must be corrected and cleared to continue
	5	Perform Pretrip Check	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.
	6	Defrost Evaporator	
		a. Initiate Manual Defrost Cycle	Must terminate automatically.
	7	Check refrigerant level	
		a. Visually check refrigerant level in receiver tank.	Must be at correct level.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
54	**DEFROST NOT COMPLETE** • TRIGGER–ON: Defrost cycle did not terminate automatically (Defrost Termination Temperature #1 or #2 did not reach termination temperatures) within 45 minutes • UNIT CONTROL: Alarm Only. While this alarm is active, the Defrost Timer will be set to initiate a defrost cycle 90 minutes (1.5 hours) 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	Check Evap Fan Clutch	
		a. Check Evap Fan Clutch operation in defrost	Must disengage fan.
	2	Check refrigerant level	
		a. Visually check refrigerant level in receiver tank.	Must be at correct level.
	3	Check for Low Refrigerant Pressure alarm	
		a. Check for alarm 18	Alarm conditions must be corrected and the alarm cleared to continue
	4	Check for Chk Defrost Term 1 or 2 Sensor Alarm	
		a. Check for Alarm(s) 124 and/or 132	Alarm conditions must be corrected and the alarm cleared to continue.
	5	Check accuracy of DTT1 & DTT2 temperature readings	
		a. Check Defrost Termination Temperature Sensor 1 & 2 resistance. (See Note 4)	(Refer to Section 7.8 for complete resistance chart) 10K Ohms @ 77°F (25°C)
	6	Check DTT1 & DTT2 for proper mounting	
		a. Inspect DTT1 & DTT2	Should be screwed tightly in place. Flat area of DTT should be against metal surface.
	7	Perform Pretrip Check	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.

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 8 minutes of a defrost termination for 2 consecutive defrost cycles. • 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 8 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 switch setting and resistance of switch contacts	Refer to Section 7.6 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 5 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 evaporator pressure drop	
		a. Check pressure reading with Magnehelic Gauge	Refer to Section 7.6
	5	Check Evap Fan Clutch	
		a. Check Evap Fan Clutch operation in defrost	Must disengage fan.
	6	Check Condition of Trailer & Load	
		a. Check condition of trailer 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 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 5 minutes; or In the Heat mode, the Suction pressure has been higher than: 100 psig for R404a; or 80 psig for R22 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: 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 8.6 for belt tensions) No Glazing, no cracking, no slipping
		b. Check lower fan belt tension & condition.	(Refer to Section 8.6 for belt tensions) No Glazing, no cracking, no slipping
	2	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
	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	Perform Pretrip Check	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
57	**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 5 seconds. • 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 5 seconds. Shutdown: Auto Reset after 3 minutes (minimum off time for Remote Switch shutdown condition) and Remote Switch 1 has been set to allow unit to run for more than 5 seconds. Shut down may be disarmed in the Functional Parameter List.		
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 1 is controlled by.	
		a. Remote Switch 1 may be connected to a Trailer Door, or some other devise and used to remotely control the unit.	Find and locate Remote Switch 1
	2	Check to see if trailer side or rear door is open, or if the device that Remote Switch 1 is connected to is set to trigger the alarm.	
		a. Inspect trailer doors b. Check devise at Remote Switch 1	Trailer door(s) must be closed Must have switch in position that allows unit to operate.
	3	Check Wiring	
		a. Visually inspect wiring to switch b. Visually inspect condition of switch	Wiring must be connected Must not be damaged
	4	Check Remote Switch 1	
		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 (ie. 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
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 5 seconds. • 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 5 seconds. Shutdown: Auto Reset after 3 minutes (minimum off time for Remote Switch shutdown condition) and Remote Switch 2 has been set to allow unit to run for more than 5 seconds. Shut down may be disarmed in the Functional Parameter List.		
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 Trailer Door, or some other devise and used to remotely control the unit.	Find and locate Remote Switch 2
	2	Check to see if trailer 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 trailer doors	Trailer door(s) must be closed
		b. Check devise 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 (ie. when Door is open, switch contacts are closed; etc)	Must be correct for type of Remote Switch being used.
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 DataShare Download PC Card, or DataManager Program.	Data retrieval OK
		b. Replace Microprocessor & set Configurations, Functional Parameters, Maintenance Hour Meters, and Data Recorder Setup.	New Microprocessor in place

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 DataManager.	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
61	**DOOR OPEN** • TRIGGER–ON: Trailer Door has been open for more than 5 seconds. • 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 5 seconds. Shutdown: Auto Reset after 3 minutes (minimum off time for door open condition) and the door has been closed for more than 5 seconds. Shut down may be disarmed in the Functional Parameter List.		
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 trailer side or rear door is open.	
		a. Inspect trailer doors	Trailer 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 (ie. when Door is open, switch contacts are closed; etc)	Must be correct for type of door switch

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
5.6 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, F3 • 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) b. Verify fuse size c. Inspect fuse & fuse holder	Will have open circuit Refer to Section 7.7 Must be correct rating for circuit (see wiring diagram) Terminals tight; No signs of overheating, melting or discoloration
	3	Check circuit	
		a. Check amperage draw on Speed Relay circuit b. Check amperage draw on Run Relay circuit	Refer to Section 7.8 Refer to Section 7.8
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, F6 • 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 b. Verify fuse size c. Inspect fuse & fuse holder	Will have open circuit Refer to Section 7.7 Must be correct rating for circuit (see wiring diagram) Terminals tight; No signs of overheating, melting or discoloration
	2	Check circuit	
		a. Check amperage draw on clutch circuit b. Check amperage draw on F6 circuit (See wiring schematic)	Refer to Section 7.8 Refer to Section 7.8

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
78	**CHECK SVI CIRCUIT** • TRIGGER–ON: In either the Heat 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 solenoid No damaged or corroded pins
		b. Check resistance of solenoid	Refer to Section 7.8
		c. Check amp draw of coil.	Refer to Section 7.8
	2	Check SV1 wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 2 & 6 No physical damage to harness. No damaged or corroded pins
	3	Check SV1 current draw	
		a. Use Component Test Mode (Refer to Section 2.17.3) to test actual current draw of the circuit.	Refer to Section 7.8 for normal current values.
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 solenoid No damaged or corroded pins
		b. Check resistance of solenoid	Refer to Section 7.8
		c. Check amp draw of coil.	Refer to Section 7.8
	2	Check SV4 wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 2 & 6 No physical damage to harness. No damaged or corroded pins
	3	Check SV4 current draw	
		a. Use Component Test Mode (Refer to Section 2.17.3) to test actual current draw of the circuit.	Refer to Section 7.8 for normal current values.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
80	**CHECK SV3 CIRCUIT** • TRIGGER–ON: In either the Heat or Defrost cycles the SV3 coil circuit is shorted. (The SV3 output from the Micro is negative, so the circuit will not be shorted to ground, but is shorted either within the SV3 coil itself, or to a positive wire. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when unit calls for Heat or Defrost and the SV3 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, 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 SV3 coil	
		a. Inspect SV3 coil & connector pins & terminals	No damage to solenoid No damaged or corroded pins
		b. Check resistance of solenoid	Refer to Section 7.8
		c. Check amp draw of coil.	Refer to Section 7.8
	2	Check SV3 wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 2 & 6 No physical damage to harness. No damaged or corroded pins
	3	Check SV3 current draw	
		a. Use Component Test Mode (Refer to Section 2.17.3) to test actual current draw of the circuit.	Refer to Section 7.8 for normal current values.
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 solenoid No damaged or corroded pins
		b. Check resistance of relay coil	Refer to Section 7.8
	2	Check Fuel Heater Relay wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 2 & 6 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 2.17.3) to test actual current draw of the circuit.	Refer to Section 7.8 for normal current values.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
82	**CHK REMOTE OUT-RANGE LIGHT** • TRIGGER–ON: Out–of–Range light (Driver's 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 solenoid No damaged or corroded pins
		b. Check resistance of light bulb	Refer to Section 7.8
	2	Check Out–of–Range light wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 2 & 6 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 2.16.3) to test actual current draw of the circuit.	Refer to Section 7.8 for normal current values.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
83	**CHECK REMOTE DEFROST LIGHT** • TRIGGER–ON: Defrost light (Driver's 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 solenoid No damaged or corroded pins
		b. Check resistance of light bulb	Refer to Section 7.8
	2	Check Defrost light wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 2 & 6 No physical damage to harness. No damaged or corroded pins
	3	Check Defrost light current draw	
		a. Use Component Test Mode (Refer to Section 2.17.3) to test actual current draw of the circuit.	Refer to Section 7.8 for normal current values.
84	**CHECK REMOTE ALARM LIGHT** • TRIGGER–ON: Remote Alarm light (Driver's 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 solenoid No damaged or corroded pins
		b. Check resistance of light bulb	Refer to Section 7.8
	2	Check Alarm light wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 2 & 6 No physical damage to harness. No damaged or corroded pins
	3	Check Alarm light current draw	
		a. Use Component Test Mode (Refer to Section 2.17.3) to test actual current draw of the circuit.	Refer to Section 7.8 for normal current values.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
85	**CHECK UL1 UNLOADER** • 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 UL1 (Front) Unloader Coil	
		a. Inspect UL1 Unloader coil & terminals	No damage to solenoid No damaged or corroded pins
		b. Check resistance of coil	Refer to Section 7.8
		c. Check amp draw of coil.	Refer to Section 7.8
	2	Check UL1 Unloader coil wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 2 & 6 No physical damage to harness. No damaged or corroded pins
	3	Check UL1 current draw	
		a. Use Component Test Mode (Refer to Section 2.17.3) to test actual current draw of the circuit.	Refer to Section 7.8 for normal current values.
86	**CHECK UL2 UNLOADER** • 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 UL2 (Rear) Unloader Coil	
		a. Inspect UL2 Unloader coil & terminals	No damage to solenoid No damaged or corroded pins
		b. Check resistance of coil	Refer to Section 7.8
		c. Check amp draw of coil.	Refer to Section 7.8
	2	Check UL2 coil wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 2 & 6 No physical damage to harness. No damaged or corroded pins
	3	Check UL2 current draw	
		a. Use Component Test Mode (Refer to Section 2.17.3) to test actual current draw of the circuit.	Refer to Section 7.8 for normal current values.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
87	**CHECK REMOTE HEAT LIGHT** • TRIGGER–ON: Remote Heat light (Driver's 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 solenoid No damaged or corroded pins
		b. Check resistance of light bulb	Refer to Section 7.8
	2	Check Heat light wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 2 & 6 No physical damage to harness. No damaged or corroded pins
	3	Check Heat light current draw	
		a. Use Component Test Mode (Refer to Section 2.17.3) to test actual current draw of the circuit.	Refer to Section 7.8 for normal current values.
88	**CHECK REMOTE COOL LIGHT** • TRIGGER–ON: Remote Cool light (Driver's 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 solenoid No damaged or corroded pins
		b. Check resistance of light bulb	Refer to Section 7.8
	2	Check Cool light wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 2 & 6 No physical damage to harness. No damaged or corroded pins
	3	Check Cool light current draw	
		a. Use Component Test Mode (Refer to Section 2.17.3) to test actual current draw of the circuit.	Refer to Section 7.8 for normal current values.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
89	**CHECK REMOTE AUTO LIGHT** • TRIGGER–ON: Remote Auto light (Driver's 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 solenoid No damaged or corroded pins
		b. Check resistance of light bulb	Refer to Section 7.8
	2	Check Auto light wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 2 & 6 No physical damage to harness. No damaged or corroded pins
	3	Check Auto light current draw	
		a. Use Component Test Mode (Refer to Section 2.17.3) to test actual current draw of the circuit.	Refer to Section 7.8 for normal current values.
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 solenoid No damaged or corroded pins
		b. Check resistance of buzzer	Refer to Section 7.8
	2	Check buzzer wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 2 & 6 No physical damage to harness. No damaged or corroded pins
	3	Check Buzzer current draw	
		a. Use Component Test Mode (Refer to Section 2.17.3) to test actual current draw of the circuit.	Refer to Section 7.8 for normal current values.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
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 solenoid No damaged or corroded pins
		b. Check resistance of SV2	Refer to Section 7.8
		c. Check amp draw of SV2.	Refer to Section 7.8
	2	Check SV2 wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 2 & 6 No physical damage to harness. No damaged or corroded pins
	3	Check SV2 current draw	
		a. Use Component Test Mode (Refer to Section 2.17.3) to test actual current draw of the circuit.	Refer to Section 7.8 for normal current values.
5.7 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 Sensor	
		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 4)	(Refer to Section 8.30 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)	No physical damage to harness. No damaged or corroded pins

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 +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 Sensor	
		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 4)	(Refer to Section 8.30 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)	No physical damage to harness. No damaged or corroded pins
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 –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. • 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 Sensor	
		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 4)	(Refer to Section 8.30 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)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
124	**CHK DEFROST TERM 1 SENSOR** • TRIGGER–ON: Defrost Termination Temperature 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: Alarm Only UNLESS: Check Defrost Termination Sensor 2 alarm is also active. Then defrost cycle time will be 20 minutes • RESET CONDITION: Auto Reset when Defrost Termination Temperature Sensor is in range or, Alarm maybe 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 1	
		a. Inspect Defrost Termination Temperature Sensor 1 & connector b. Check Defrost Termination Temperature Sensor 1 resistance (See Note 4)	No damage to sensor No damage, moisture, or corrosion in connector (Refer to Section 8.30 for complete resistance chart) 10,000 Ohms @ 77°F (25°C)
	2	Check Defrost Termination Temperature Sensor 1 wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
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 Sensor	
		a. Inspect Compressor Discharge Sensor & connector b. Check Compressor Discharge Sensor resistance (See Note 4)	No damage to sensor No damage, moisture, or corrosion in connector (Refer to Section 8.30 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)	No physical damage to harness. No damaged or corroded pins

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 switch. No damaged or corroded pins in plug.
		b. Check fuel level sensor operation	Place unit in Manual Start Mode (see Note 2), DO NOT START UNIT.
		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 OFF prior to checking for continuity, Must be less than 10 ohms.
	3	Check fuel level sensor calibration	
		a. Check fuel level sensor calibration	See section (8.4.1) for sensor calibration procedure.
	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)
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 Sensor	
		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 4)	(Refer to Section 8.30 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)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
130	**CHECK ENGINE RPM SENSOR** • TRIGGER–ON: <u>With the unit in Auto Start:</u> 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 RPMs 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 RPMs are sensed at less than 1000 RPM; or <u>With the unit in Manual Start:</u> 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 RPMs 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 RPMs are sensed at less than 50 RPM. • UNIT CONTROL: Alarm Only (Engine will be considered running) • RESET CONDITION: <u>With the unit in Auto Start:</u> Auto Reset in Auto Start when engine RPMs are greater than 1,000 or, <u>With the unit in Manual Start:</u> Auto Reset in Auto Start when engine RPMs 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 Engine RPM Sensor	
		a. Inspect Engine RPM Sensor & connector b. Compare actual engine RPMs with those shown on the display using hand held tachometer.	No damage to sensor No damage, moisture, or corrosion in connector Must be ± 20 RPMs
	2	Check Engine RPM Sensor wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic) b. Check RPM wiring C. Check voltage reading between plug terminals A & B.	See Note 5 No physical damage to harness. No damaged or corroded pins Place unit in PC Mode, or in Manual Start Mode (see Note 2). DO NOT START UNIT. With + lead on A and – lead on C reading should be 5 VDC ±.2 volts
	3	Check circuits with test sensor	
		a. Substitute known good sensor and check Data reading.	Must be within ± 20 RPMs or reading on tachometer

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
132	**CHK 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: Alarm Only UNLESS: Check Defrost Termination Sensor 1 alarm is also active. Then defrost cycle time will be 20 minutes • 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	
		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 4)	(Refer to Section 8.30 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)	No physical damage to harness. No damaged or corroded pins
133	**CHK 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	
		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 4)	(Refer to Section 8.30 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)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
134	**CHK 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.		
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 2	
		a. Verify that Remote Temperature Sensor 2 has been installed and is correctly wired to the unit.	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.
	2	Check Remote Temperature Sensor 2	
		a. Inspect Remote Temperature Sensor 2 & connector	No damage to sensor No damage, moisture, or corrosion in connector
		b. Check Remote Temperature Sensor 2 resistance (See Note 4)	(Refer to Section 8.30 for complete resistance chart) 10,000 Ohms @ 77°F (25°C)
	3	Check Remote Temperature Sensor 2 wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
135	**CHK 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	
		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 4)	(Refer to Section 8.30 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)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
5.8 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. Place into Pretrip mode	Unit running in Pretrip mode
		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 5.5 Amps. The circuit tests outside this range. • UNIT CONTROL: Abort PreTrip & display PRETRIP FAILED IN TEST 2 Alarm. • RESET CONDITION: Auto Reset if Pre Trip 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 & 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	Run/Stop switch in Run–Manual Start Operation. (See Note 2) LED 29 must be ON
		d. Check voltage to clutch	Must be 11.5 VDC or higher
	3	Check clutch circuit wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
	4	Check clutch	
		a. Check resistance of clutch coil	Refer to Section 7.8
		b. Check amp draw of clutch coil.	Use Component Test Mode (Section 2.17.3 to test. Refer to Section 7.8 for amp values.

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: Abort PreTrip & display PRETRIP FAILED IN TEST 2 Alarm. • RESET CONDITION: Auto Reset if Pre Trip 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 UL1 & circuit	
		a. Inspect UL1 and wiring	No damage or corrosion Connector fits together tightly, no moisture inside
		b. Check operation of UL1 FET (23)	Run/Stop switch in Run–Manual Start Operation. (See Note 2) LED must be ON
		c. Check voltage to front unloader	Must be 11 VDC or higher across the 2 wires
	3	Check UL1 circuit wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
	4	Check UL1	
		a. Check resistance of UL1 coil	Refer to Section 7.8
		b. Check amp draw of coil.	Use Component Test Mode (Section 2.17.3) to test. Refer to Section 7.8 for amp values.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P145	**CHECK SPEED SOLENOID CIRC** • TRIGGER–ON: Normal Amps for the Speed Solenoid Circuit is 3.0 to 9.0 Amps. The circuit tests outside this range. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pre Trip 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.
	2	Check speed solenoid & circuit	
		a. Inspect speed solenoid and wiring	No physical damage to harness. No damaged or corroded pins
		b. Start unit, setpoint more than 10° away from setpoint, and set for Continuous Run with Setpoint above +11°F. (See note 7)	Controller will call for High Speed operation.
		c. Check operation of Speed Relay LED	LED 27must be ON
		d. Check voltage to speed solenoid	Must be 11 VDC or higher across the 2 wires
	3	Check speed solenoid circuit wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
	4	Check speed solenoid	
		a. Check resistance of speed solenoid	Refer to Section 7.8
		b. Check amp draw of speed solenoid.	Use Component Test Mode (Section 2.17.3) to test. Refer to Section 7.8 for amp values.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P148	**CHECK SV1 CIRCUIT** • TRIGGER–ON: Normal Amps for the SV–1 Circuit is 0.75 to 2.5 Amps. The circuit tests outside this range. • UNIT CONTROL: Abort PreTrip & display PRETRIP FAILED IN TEST 2 Alarm. • RESET CONDITION: Auto Reset if Pre Trip 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 SV–1 & circuit	
		a. Inspect SV–1 and wiring	No physical damage to harness. No damaged or corroded pins
		b. Start unit, setpoint more than 10° above box temperature, and set above +11°F. (See note 7)	Unit running in Heat Cycle
		c. Check operation of SV–1 FET (10)	LED must be ON
		d. Check voltage to SV–1	Must be 11 VDC or higher across the 2 wires
	3	Check SV–1 circuit wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
	4	Check SV–1	
		a. Check resistance of SV–1	Refer to Section 7.8
		b. Check amp draw of SV–1.	Use Component Test Mode (Section 2.17.3) to test. Refer to Section 7.8 for amp values.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P149	**CHECK SV3 CIRCUIT** • TRIGGER–ON: Normal Amps for the SV–3 Circuit is 0.75 to .27 Amps. The circuit tests outside this range. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pre Trip 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 SV–3 & circuit	
		a. Inspect SV–3 and wiring	No physical damage to harness. No damaged or corroded pins
		b. Start unit, setpoint more than 10° above box temperature, and set above +11°F. (See note 7)	Unit running in Heat Cycle
		c. Check operation of SV–3 FET (20)	LED must be ON
		d. Check voltage to SV–3	Must be 11 VDC or higher across the 2 wires
	3	Check SV–3 circuit wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
	4	Check SV–3	
		a. Check resistance of SV–3	Refer to Section 7.8
		b. Check amp draw of SV–3.	Use Component Test Mode (Section 2.17.3) to test. Refer to Section 7.8 for amp values.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P150	**CHECK SV4 CIRCUIT** • TRIGGER–ON: Normal Amps for the SV–4 Circuit is 0.75 to 2.0 Amps. The circuit tests outside this range. • UNIT CONTROL: Abort PreTrip & display PRETRIP FAILED IN TEST 2 Alarm. • RESET CONDITION: Auto Reset if Pre Trip 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 SV–4 & circuit	
		a. Inspect SV–4 and wiring	No physical damage to harness. No damaged or corroded pins
		b. Start unit, setpoint more than 10°F above box temperature, and set above +11°F. (See note 7)	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
	3	Check SV–4 circuit wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
	4	Check SV–4	
		a. Check resistance of SV–4	Refer to Section 7.8
		b. Check amp draw of SV–4.	Use Component Test Mode (Section 2.17.3) to test. Refer to Section 7.8 for amp values.

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 Pre Trip 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	Run/Stop switch in Run–Manual Start Operation. (See Note 2) 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 2.17.3) to test. Refer to Section 7.8 for amp values.
		e. Check amp draw of each glow plug.	Refer to Section 7.8 for amp values.
	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

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P152	**CHECK FUEL SOLENOID CIRC** • TRIGGER–ON: Normal Amps for the Fuel Solenoid Hold Circuit is 0.4 to 3.5 Amps (including possible electric fuel pump). The circuit tests outside this range. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pre Trip 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.
	2	Check fuel solenoid & circuit	
		a. Inspect fuel solenoid and wiring	No physical damage to harness. No damaged or corroded pins
		b. Check operation of Run Relay	Run/Stop switch in Run–Manual Start Operation. (See Note 2) LED 28 must be ON
		c. Check voltage to fuel solenoid	Run / Stop switch ON, 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)
	3	Check fuel solenoid circuit wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
	4	Check fuel solenoid	
		a. Check resistance of fuel solenoid	Refer to Section 7.8
		b. Check amp draw of fuel solenoid.	Use Component Test Mode (Section 2.17.3) to test. Refer to Section 7.8 for amp values.
		c. Check operation of solenoid	Plunger must move in when energized
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: Abort PreTrip & display PRETRIP FAILED IN TEST 3 Alarm. • RESET CONDITION: Auto Reset if Pre Trip 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 Sensor	
		a. Inspect Return Air Sensor & connector	No physical damage to harness. No moisture, damaged or corroded pins
		b. Check Return Air Sensor resistance (See Note 4)	10,000 Ohms @ 77°F (25°C) [See manual 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)	No physical damage to harness. No damaged or corroded pins

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: Abort PreTrip & display PRETRIP FAILED IN TEST 3 Alarm. • RESET CONDITION: Auto Reset if Pre Trip 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 Sensor	
		a. Inspect Supply Air Sensor & connector	No physical damage to harness. No moisture, damaged or corroded pins
		b. Check Supply Air Sensor resistance (See Note 4)	10,000 Ohms @ 77°F (25°C) [See manual 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)	No physical damage to harness. No damaged or corroded pins
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: Abort PreTrip & display PRETRIP FAILED IN TEST 3 Alarm. • RESET CONDITION: Auto Reset if Pre Trip 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 Engine Coolant Sensor	
		a. Inspect Engine Coolant Sensor & connector	No damage to sensor No moisture, damage or corrosion in connector
		b. Check Engine Coolant Sensor resistance (See Note 4)	10,000 Ohms @ 77°F (25°C) [See manual for complete table of temperatures and resistance values.]
	2	Check Engine Coolant Sensor wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
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 Pre Trip 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 Battery Voltage Too High alarm	
		a. Check for alarm 15	Alarm conditions must be corrected and the alarm cleared to continue.
	2	Check for Battery Voltage Too Low alarm	
		a. Check for alarm A16	Alarm conditions must be corrected and the alarm cleared to continue.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P157	**CHECK BATTERY CURRENT** • TRIGGER–ON: With all circuits off current flow of more than ±1 amp 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 Pre Trip 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 battery current draw.	
		a. Note amp draw on display. (See Note 3)	Must show 0 ±.2 amps
	2	Check individual circuits	
		a. Isolate individual circuits and test amp draw	Must be in range. (Refer to Section 7.8)
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: Abort PreTrip & display PRETRIP FAILED IN TEST 3 Alarm. • RESET CONDITION: Auto Reset if Pre Trip 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 Sensor	
		a. Inspect Ambient Air Sensor & connector	No damage to sensor No moisture, damage or corrosion in connector
		b. Check Ambient Air Sensor resistance (See Note 4)	10,000 Ohms @ 77°F (25°C) [See manual 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)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P159	**CHK DEFROST TERM 1 SENSOR** • TRIGGER–ON: Defrost Termination Temperature Sensor 1 is not within the maximum range of −53°F to +158°F (−47°C to +70°C) • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pre Trip 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 1	
		a. Inspect Defrost Termination Temperature Sensor 1 & connector	No damage to sensor No moisture, damage or corrosion in connector
		b. Check Defrost Termination Temperature Sensor 1 resistance (See Note 4)	10,000 Ohms @ 77°F (25°C) [See manual for complete table of temperatures and resistance values.]
	2	Check Defrost Termination Temperature Sensor 1 wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
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 Pre Trip 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 Temp Sensor	
		a. Inspect Compressor Discharge Temp Sensor & connector	No damage to sensor No damage or corrosion in connector
		b. Check Compressor Discharge Temp Sensor resistance (See Note 4)	100,000 Ohms @ 77°F (25°C) [See manual 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)	No physical damage to harness. No damaged or corroded pins

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: Abort PreTrip & display PRETRIP FAILED IN TEST 3 Alarm. • RESET CONDITION: Auto Reset if Pre Trip 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 Bad F4 or F6 Fuse alarm	
		a. Check for alarm 72	Alarm conditions must be corrected and the alarm cleared to continue.
	3	Check UL2 & circuit	
		a. Inspect UL2 and wiring	No damage or corrosion Connector fits together tightly, no moisture inside
		b. Check operation of UL2 FET (22)	Run/Stop switch in Run–Manual Start Operation. (See Note 2) LED must be ON
		c. Check voltage to UL2	Must be 11 VDC or higher across the 2 wires
	4	Check UL2 circuit wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
	5	Check UL2	
		a. Check resistance of UL2	Refer to Section 7.8
		b. Check amp draw of UL2	Use Component Test Mode (Section 2.17.3) to test. Refer to Section 7.8 for amp values.
P165	**CANNOT PUMP DOWN** • TRIGGER–ON: With SV1, SV2, SV3, & SV4 in the closed position, the compressor is not able to pull the low side of the refrigerant system down to 5psig. • UNIT CONTROL: Abort PreTrip & display PRETRIP FAILED IN TEST 11, 12, or 13 Alarm. • RESET CONDITION: Auto Reset if Pre Trip 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 for Check SV3 alarm	
		a. Check for alarm P183	Condition must be corrected and alarm cleared to proceed.
	3	Check for Check SV4 alarm	
		a. Check for alarm P181	Condition must be corrected and alarm cleared to proceed.
	4	Manually test refrigeration system (See note 7)	
		a. Run Quick Check	Must pass all tests 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 RPMs are NOT Between 1375 and 1600 for Ultima; or Between 1275 and 1500 for Ultra or or Ultra X/L, or Extra • TRIGGER–ON in Test #9: 15 seconds after the High Speed Test, engine RPMs have NOT dropped from the high speed RPMs (in Test #8) by Between 450 and 925 for Ultima; or Between 350 and 725 for Ultra or Ultra X/L; or Between 150 and 525 for Extra • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pre Trip 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	
		a. Check speed solenoid plunger	Must move in and out freely
		b. Check engine speed arm & linkage	Must move freely
	2	Force Low Speed operation (See note 7)	
		a. Turn unit OFF, wait 10 seconds, then turn ON Set for Start Stop operation	Controller will call for Low Speed operation for the next 10 minutes.
		b. Check operation of Speed Relay LED	LED 27 must be OFF
		c. Check voltage to speed solenoid	Must be 0 VDC
	3	Check engine RPMs	
		a. Check actual engine RPM using hand held tachometer	Refer to Section 7.2 Adjust engine linkage setting as needed.
		b. Compare actual RPMs with those shown on display.	Both readings within ± 50 RPM
	4	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
	5	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 RPMs** • TRIGGER–ON: With Speed Relay turned on (speed solenoid energized), engine RPMs are NOT Between 2000 and 2300 for Ultima; or Between 1700 and 2000 for Ultra or Ultra X/L; or Between 1500 and 1800 for Extra. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pre Trip 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	
		a. Check speed solenoid plunger	Must move in and out freely
		b. Check engine speed arm & linkage	Must move freely
	2	Force High Speed operation (See note 7)	
		a. Start unit, setpoint more than 10° away from setpoint, and set for Continuous Run with Setpoint above +11°F.	Controller will call for High Speed operation.
		b. Check operation of Speed Relay	LED 27 must be ON
		c. Check voltage to speed solenoid	Must be 12–14 VDC
		d. Check resistance of speed solenoid	Refer to Section 7.8
		e. Check amp draw of speed solenoid	Refer to Section 7.8
		f. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins or terminals
	3	Check engine RPMs	
		a. Check actual engine RPM using hand held tachometer	Refer to Section 7.2 Adjust engine linkage setting as needed.
		b. Compare actual RPMs with those shown on display	Both readings within ± 50 RPM
	4	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
	5	Check engine exhaust system	
		a. Inspect the exhaust system	Must be clear and unobstructed

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P178	**CHECK UL1 UNLOADER** • 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 Abort PreTrip & display PRETRIP FAILED IN TEST 6 Alarm. • RESET CONDITION: Auto Reset if Pre Trip 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 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) on gauges & on micro display.
	3	Check for Check SV2 Circuit Alarm	
		a. Check for alarm 97 or P192	Alarm conditions must be corrected and the alarm cleared to continue
	4	Check for Check UL1 alarm	
		a. Check for alarm 85 or P144	Alarm conditions must be corrected and the alarm cleared to continue
	5	Check UL1 operation Unit must be running. (See Note 7)	
		a. Energize UL1 coil b. De-energize UL1 coil	Suction pressure must raise slightly Discharge pressure must drop slightly 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. b. Check pressure differential between compressor discharge port and receiver king valve.	Must be 0 VDC Must be less than 25 psig.

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 Pre Trip 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) on gauges & on micro display.
	3	Check SV4 operation Unit must be running in Heat Cycle. (See Note 7)	
		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 increase as expected with SV1 energized (closed) • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pre Trip 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) on gauges & on micro display.
	3	Check SV1 operation Unit must be running in Heat Cycle. (See Note 7)	
		a. Set unit to operate in high speed heat b. De-energize SV1 coil	After 3 minutes note discharge and suction pressures 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
P183	**CHECK SV3 VALVE** • TRIGGER–ON: Suction pressure did not rise within range & discharge pressure did not drop within range when SV3 was energized (opened) • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pre Trip 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 SV3 Alarm	
		a. Check for alarms 80, P149	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) on gauges & on micro display.
	3	Check SV3 operation Unit must be running in Heat Cycle. (See Note 7)	
		a. De-energize SV3 coil b. Energize SV3 coil	After 60 seconds note discharge and suction pressures Hot gas hissing sound will begin immediately. Suction pressure must raise slightly Discharge pressure must drop slightly
	4	Manually test refrigeration system	
		a. Run Quick Check	Must pass all tests Correct any problems found before proceeding.
P191	**CHECK UL2 UNLOADER** • 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 Pre Trip 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 Check 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) on gauges & on micro display.
	4	Check UL2 operation Unit must be running. (See Note 7)	
		a. Energize UL2 coil b. De-energize UL2 coil	Suction pressure must raise slightly Discharge pressure must drop slightly Suction pressure must drop slightly Discharge pressure must raise slightly

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P192	**CHECK SV2 CIRCUIT** • TRIGGER–ON: Normal Amps for the SV-2 Circuit is 0.75 to 2.0 Amps. The circuit tests outside this range. • UNIT CONTROL: Abort PreTrip & display PRETRIP FAILED IN TEST 2 Alarm. • RESET CONDITION: Auto Reset if Pre Trip 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 SV–2 & circuit	
		a. Inspect SV–2 and wiring	No damage or corrosion Connector fits together tightly, no moisture inside
		b. Check operation of SV–2 FET (21)	Run/Stop switch in Run–Manual Start Operation. (See Note 2) LED must be ON
		c. Check voltage to SV–2	Must be 11 VDC or higher across the 2 wires
	3	Check SV–2 circuit wiring	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
	4	Check SV–2	
		a. Check resistance of SV–2	Refer to Section 7.8
		b. Check amp draw of SV2.	Use Component Test Mode (Section 2.17.3) to test. Refer to Section 7.8 for amp values.
P194	**HIGH SUCTION PRESSURE** • TRIGGER–ON: This alarm is generated during Test 4 of Cool PreTrip. Suction pressure is higher than normal. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pre Trip 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 Check SV3 alarm	
		a. Check for alarm P183	Alarm conditions must be corrected and the alarm cleared to continue.
	2	Check for Check SV4 alarm	
		a. Check for alarm P181	Condition must be corrected and alarm cleared to proceed.
	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) on gauges & on micro display.
	4	Check MOP of expansion valve.	
		a. Test MOP of Expansion valve.	Refer to Section 7.6
	5	Manually test refrigeration system (See note 7)	
		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. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pre Trip 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 8.6 for belt tensions) No Glazing, no cracking, no slipping
		b. Check lower fan belt tension & condition.	(Refer to Section 8.6 for belt tensions) No Glazing, no cracking, no slipping
	2	Check evaporator air flow (See note 7)	
		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
	3	Check for Check SV2 Circuit Alarm	
		a. Check for alarm 97 or P192	Alarm conditions must be corrected and the alarm cleared to continue
	4	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) on gauges & on micro display.
	5	Check refrigerant charge	
		a. Check for undercharged system	Level must be above lower sight glass
	6	Manually defrost unit	
		a. Defrost unit and terminate automatically.	Typical defrost cycle time is 5–20 minutes Suction pressure should rise gradually during cycle.
	7	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) on gauges & on micro display.
	8	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 7.6
		c. Check superheat of valve	Refer to Section 7.6
	9	Check for damage to the suction line.	
		a. Visually inspect suction line for any kinks, restrictions, or other damage.	No damage to line
	10	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. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pre Trip 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 8.6 for belt tensions) No Glazing, no cracking, no slipping
		b. Check lower fan belt tension & condition.	(Refer to Section 8.6 for belt tensions) No Glazing, no cracking, no slipping
	2	Check Wiring	
		a. Visually Inspect wiring to SV3, SV4, & both Compressor Unloaders	Wires must be connected properly & securely to each component
	3	Check airflow through condenser coil (See note 7)	
		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 7)	
		a. Run Quick Check	Must pass all tests Correct any problems found before proceeding.
	8	Check system for non–condensable	
		a. Check refrigeration system for non–condensable gas(es)	No non–condensable gas(es) may be present.
	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. • UNIT CONTROL: Abort PreTrip & display PRETRIP FAILED IN TEST 4 Alarm. • RESET CONDITION: Auto Reset if Pre Trip 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 of actual temperature
	2	Manually test refrigeration system (See note 7)	
		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.
P200	**CHECK FRONT CYLINDERS** • TRIGGER–ON: A problem has been detected inside the front cylinder head of the compressor. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pre Trip 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 7)	
		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 REAR CYLINDERS** • TRIGGER–ON: A problem has been detected inside the rear cylinder head of the compressor. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pre Trip 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 7)	
		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: Refrigerant is leaking past one of the components in the High Pressure Side of the refrigeration system. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pre Trip 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 7)	
		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.
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 Pre Trip 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 7)	
		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 –5.0 psig (10 inches vacuum) for more than 30 seconds, or less than –8 psig (16 inches vacuum) for more than 5 seconds at any time during PreTrip. • UNIT CONTROL: Abort PreTrip & display PRETRIP FAILED IN TEST ___ Alarm. • RESET CONDITION: Auto Reset if Pre Trip 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 8.6 for belt tensions) No Glazing, no cracking, no slipping
		b. Check lower fan belt tension & condition.	(Refer to Section 8.6 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 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	
		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 7.6
		c. Check superheat of valve	Refer to Section 7.6

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 Only • RESET CONDITION: Auto Reset if Pre Trip 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	
		a. Inspect Defrost Termination Temperature Sensor 2 & connector	No damage to sensor No damage or corrosion in connector
		b. Check Defrost Termination Temperature Sensor 2 resistance (See Note 4)	10,000 Ohms @ 77°F (25°C) [See manual 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)	No physical damage to harness. No damaged or corroded pins
5.9 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 8.1.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
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. b. Reset General Maintenance Hour Meter for the next service interval	Reset Interval in Configuration List as required. Hour Meter is reset in the Functional Parameter list. Follow maintenance interval recommendations in Section 8.1.
	4	See Note 1	
		b. Clear the inactive fault code	All faults cleared.
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. b. Reset Maintenance Hour Meter #1 for the next service interval	Reset Interval in Configuration List as required. Hour Meter is reset in the Functional Parameter list. Follow maintenance interval recommendations in Section 8.1.
	4	See Note 1	
		a. Clear the inactive fault code	Alarm 226 is cleared

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
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. b. Reset Maintenance Hour Meter #2 for the next service interval	Reset Interval in Configuration List as required. Hour Meter is reset in the Functional Parameter list. Follow maintenance interval recommendations in Section 8.1.
	4	See Note 1	
		a. Clear the inactive fault code	Alarm 227 is cleared
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. b. Reset Maintenance Hour Meter #3 for the next service interval	Reset Interval in Configuration List as required. Hour Meter is reset in the Functional Parameter list. Follow maintenance interval recommendations in Section 8.1.
	4	See Note 1	
		a. Clear the inactive fault code	Alarm 228 is cleared

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
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. b. Reset Maintenance Hour Meter #4 for the next service interval	Reset Interval in Configuration List as required. Hour Meter is reset in the Functional Parameter list. Follow maintenance interval recommendations in Section 8.1.
	4	See Note 1	
		a. Clear the inactive fault code	Alarm 229 is cleared
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. b. Reset Maintenance Hour Meter #5 for the next service interval	Reset Interval in Configuration List as required. Hour Meter is reset in the Functional Parameter list. Follow maintenance interval recommendations in Section 8.1.
	4	See Note 1	
		a. Clear the inactive fault code	Alarm 230 is cleared

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
5.10 MICROPROCESSOR ALARMS			
232	**SETPOINT ERROR** • TRIGGER–ON: There is an error in the Setpoint that is stored in the Microprocessor memory • 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 Setpoint	
		a. Check Setpoint setting	Must be between –22°F to +89.6°F (–30°C to +32°C)
		b. Enter new Setpoint	Must be between –22°F to +89.6°F (–30°C to +32°C)
	2	Reset Microprocessor	
		a. Turn the Start/Run–Off switch off for 30 seconds, then turn back on.	The microprocessor powers up OK and the latest setpoint appears in the display.
		b. Valid Setpoint can not be entered.	Replace Microprocessor
	3	See Note 1	
		a. Clear the inactive fault code	Alarm 232 is cleared
233	**MODEL # ERROR** • TRIGGER–ON: There is an error in the Model Number that is stored in the Microprocessor memory • 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	Clear the fault code	
		a. See Note 1	Alarm 233 is cleared
		b. Clear the inactive fault code	All faults cleared.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
234	**UNIT SERIAL # ERROR** • TRIGGER–ON: There is an error in the Unit Serial Number that is stored in the Microprocessor memory • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset only when a valid Unit Serial 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 Unit Serial Number	
		a. Check Unit Serial Number	May be up to 11 characters long (no spaces or punctuation marks)
		b. Enter correct Serial Number	Serial Number may be entered using either DataManager or Service Tool computer program.
	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 Unit Serial Number can not be entered.	Replace Microprocessor
	3	See Note 1	
		a. Clear the inactive fault code	Alarm 234 is cleared
235	**CONTROL SERIAL # ERROR** • TRIGGER–ON: There is an error in the Microprocessor Serial Number that is stored in the Microprocessor • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset only when valid Microprocessor Serial Number is read.		
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 Microprocessor Serial Number	
		a. Check Microprocessor Serial Number	Will be a 10 character number (this can not be entered or changed)
	2	Reset Microprocessor	
		a. Turn Start/Run–Off switch off for 30 seconds, then turn back on.	Microprocessor powers up OK Alarm is reset
		b. Alarm 235 remains active.	Replace microprocessor.
	3	See Note 1	
		a. Clear the inactive fault code	Alarm 235 is cleared

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
236	**TRAILER ID # ERROR** • TRIGGER–ON: There is an error in the Trailer ID Number that is stored in the Microprocessor memory • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset only when a valid Trailer ID 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 Trailer ID Number	
		a. Check Trailer ID Number	Must be between 0 to 10 digits
	2	Reset Microprocessor	
		a. Turn Start/Run–Off switch off for 30 seconds, then turn back on. b. Check for valid Trailer ID Number in Data List. c. Valid Trailer ID Number can not be entered.	Microprocessor powers up OK Valid number is present. Alarm is cleared Replace Microprocessor
	3	See Note 1	
		a. Clear the inactive fault code	Alarm 236 is cleared
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 • 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. b. Check for valid Functional Parameters in Functional Parameters List. c. Valid Functional Parameter(s) can not be entered.	Microprocessor powers up OK Valid number is present. Alarm is cleared Replace Microprocessor
	3	See Note 1	
		a. Clear the inactive fault code	Alarm 237 is 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 • 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	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
	3	See Note 1	
		a. Clear the inactive fault code	Alarm 238 is cleared
239	**CONFIGURATIONS 2 ERROR** • TRIGGER–ON: There is an error in Configuration Group 2 that is stored in the Microprocessor memory • 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	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
	3	See Note 1	
		a. Clear the inactive fault code	Alarm 239 is cleared

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
240	**HOUR METER ERROR** • TRIGGER–ON: There is an error in the number of hours in memory for one or more of the system Hour Meters • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset when valid hours are read for all Hour Meters, 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 Hour Meters	
		a. Check Hour Meters	All must read valid 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 Hour Meter readings in Data List.	All hour meters show valid numbers. Alarm is cleared
		c. Valid Hour Meter readings can not be entered.	Replace Microprocessor
	3	See Note 1	
		a. Clear the inactive fault code	Alarm 240 is cleared
241	**ALARM STATUS ERROR** • TRIGGER–ON: There is an error in an Alarm that is stored in the Microprocessor 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 Alarms	
		a. Check Alarms	All must read valid 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 Alarms in Alarms List.	All Alarms show valid data. Alarm is cleared
		c. Alarms can not be cleared.	Replace Microprocessor
	3	See Note 1	
		a. Clear the inactive fault code	Alarm 241 is 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 in memory • 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. b. Discharge Pressure Sensor can not be successfully calibrated.	Calibration successful. Replace Microprocessor
	3	See Note 1	
		a. Clear the inactive fault code	Alarm 242 is 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 • 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. b. Suction / Evaporator Pressure Sensor can not be successfully calibrated.	Calibration successful. Replace Microprocessor
	3	See Note 1	
		a. Clear the inactive fault code	Alarm 243 is cleared

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
245	**MICRO SW REV ERROR** • TRIGGER–ON: There is an error in the Microprocessor Revision Number that is stored in the Microprocessor memory NOTE: This alarm may be present after new software is programmed into the controller. • 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 Microprocessor Software Revision	
		a. Check Microprocessor Software Revision	Must be a valid number
	2	Reset Microprocessor	
		a. Turn Start/Run–Off switch off for 30 seconds, then turn back on.	Microprocessor powers up OK
	3	See Note 1	
		a. Clear the inactive fault code	Alarm 245 is cleared
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 Setpoint setting	Must be between –22°F to +89.6°F (–30°C to +32°C)
		b. Enter new Setpoint	Must be between –22°F to +89.6°F (–30°C to +32°C)
	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	
		a. Clear the inactive fault code	Alarm 246 is cleared

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
247	**CONFIGURATIONS 3 ERROR** • TRIGGER–ON: There is an error in Configuration Group 3 that is stored in the Microprocessor memory • 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	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
		d. Alarm 247 remains active.	Replace Microprocessor.
248	**CONFIG 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 Setpoint setting	Must be between –22°F to +89.6°F (–30°C to +32°C)
		b. Enter new Setpoint	Must be between –22°F to +89.6°F (–30°C to +32°C)
		c. Check Functional Parameters	All settings must be valid.
	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.

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 b. Check for any Active Sensor Alarms	Must be valid reading for RAT, SAT, AAT, etc. 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 Microprocessor	
		a. Turn Start/Run–Off switch off for 30 seconds, then turn back on. b. Alarm 249 remains active.	Microprocessor powers up OK Replace microprocessor.

Section 6 – Message Center and Alarms

6.1 Message Center - What each Display Message Means

The following table lists all of the messages which are not Alarms that can be displayed in the Message Center Display and a description of their use. Refer to the Alarm list (Page 6-7) for Alarm messages.

MESSAGE CENTER MESSAGES	
Message	**Description**
↑↓ TO SCROLL, THEN = TO LOCK	This message is used when viewing Unit Data. Use the ↑ & ↓ arrow keys to move through the Data list. Press the = key to lock a Data item in the Message Center
↑↓ TO SCROLL, THEN = TO SAVE	Press the up or down arrow keys 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 keys 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 Options DataShare PC Card has been inserted into the PC Card slot. Press = to install the option into the Micro. The number of installs remaining on the PC Card will be shown.
ACTIVE ALARM LIST CLEARED	The list of active alarms in the Micro alarm has been erased. (This does *not* remove alarms from the data recorder.)
AIR FLOW: NORMAL or HIGH	This selectable Functional Parameter allows the user to determine whether the unit will operate with normal high and low engine speeds, or if the engine will continuously operate in High Speed and provide high air flow to the refrigerated product.
ALL ALARMS CLEARED	The list of active and inactive alarms in the Micro 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 Micro from the PC Card. The card may be safely removed from the Micro.
ALTERNATOR CHECK SHUTDOWN: YES or NO	This Micro configuration allows the user to determine whether the unit will continue to operate or shut down when an alternator problem is detected. (See Configuration List for recommended settings for your model.)
AMBIENT AIR TEMP: -52.6°F to 158.0°F (-47.0°C to 70.0°C)	Ambient (air entering condenser) temperature
ARL LIGHT OFF IN XMINS	The Auto Restart Light circuit to the Driver'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 Micro 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 Micro has detected a problem with either the PC Card, or the PC Card slot.
BATTERY: 0.0V to 28.0V	Unit battery voltage
BUZZER OFF IN XMINS	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	Transducer calibration was unsuccessful.
CANNOT ENTER TRIP START	Cannot enter trip start. A problem has been detected within the Data Recorder.
CANNOT START DEFROST CYCLE	Cannot start defrost cycle. Refer to Defrost Sections 2.8, 4.7, 7.13 and 8.26.
CANNOT START PRETRIP	Cannot start pretrip. Refer to Pre Trip Section 2.9.

MESSAGE CENTER MESSAGES	
Message	**Description**
CARD FULL, REMOVE CARD	The PC Downloader Card is full of downloaded files. There is no additional room to download the Micro. You may safely remove the PC Card from the slot.
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.
CHECK AT NEXT SERVICE INTERVAL	The unit needs to be checked at next service interval. One or more of the following have occurred: Preventative maintenance is due; or There is currently an active non-shutdown alarm in the alarm list.
CHECK COOLANT LEVEL	The engine coolant level is not full.
CHECK DOOR	Door switch indicates that trailer door is not closed.
CHECK DEFROST AIR SWITCH	Check defrost air switch (Refer to Sections 4.7 and 8.26).
CHECK ENGINE OIL LEVEL	The oil level in the diesel engine is low.
CHECK FUEL LEVEL	The level in the fuel tank is very close to empty.
CLHR OFF IN XMINS	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 = while this message is being displayed will allow user access to Component Test Mode.
COMPONENT TEST MODE MENU SELECTIONS	The selections following this message will be the components available for energizing during Component Test Mode.
COMP DISCHARGE TEMP: -40.0°F to 392.0°F (-40.0°C to 200.0°C)	Compressor discharge temperature
CONFIG ERROR, REMOVE CARD	There was an error configuring the Micro with the DataShare Configuration PC Card. Remove the PC Card from the slot.
CONFIGURATION MODE	Press = 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.
CONTROL SERIAL #: XXXXXXXXXX	Microprocessor serial #
COPY COMPLETE, REMOVE CARD XX	A DataShare DownLoad PC Card has been inserted into the PC Card slot, and all data from the Data Recorder has been copied onto the PC Card. You may safely remove PC Card from the slot. XX=number of empty download slots remaining on the card.
COPY ERROR, REMOVE CARD XX	A DataShare 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=number of empty download slots remaining on the card.
COPYING DATA-PLEASE WAIT	A DataShare 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.
CURRENT DRAW: -80.0A to +80.0A	Unit current (amp) draw
DATA RECORDER FAILURE	The controller has stopped recording unit data.
DEFROST CYCLE STARTED	The unit has gone into defrost.

MESSAGE CENTER MESSAGES	
Message	**Description**
DEFROST TIMER SET FOR 1.5 HRS or 3HRS or 6 HRS or 12 HRS	This Functional Parameter allows the user to select the correct time interval between defrost cycles.
DIAGNOSTIC MODE	Pressing = while this message is being displayed allows the user to enter the Diagnostic Mode.
DISCHARGE PRESSURE: 50.0PSIG to 500.0PSIG	Compressor discharge pressure
DISPLAY IN ENGLISH UNITS or METRIC UNITS	Allows the user to display temperatures in either °F or °C, and pressures in either psig or bars.
DISPLAY SOFTWARE REV: XXXXXX	Keypad / Display board software revision number
DOOR OPEN	The trailer door is open
DOOR SWITCH UNIT SHUTDOWN or DOOR SWITCH ALARM ONLY	This Configuration allows the user to determine whether the door switch will display an alarm only when the trailer door is opened, or display *and* alarm and shut the unit down.
DOOR SWITCH: YES or NO	This configuration allows the user to program the Microprocessor that a door switch has been installed.
ENGINE COOLANT TEMP: -58.0°F to 266.0°F (-50.0°C to 130.0°C)	Engine coolant temperature
ENGINE HOURS: 0HR to 99999HR	Total number of hours that the engine has run.
ENGINE OIL LEVEL SHUTDOWN: YES or NO	This Configuration allows the user to determine whether the engine oil level switch will turn on an alarm only, or if it will shut the engine down when the engine oil level is approx. 7 quarts low.
ENGINE OIL LEVEL SWITCH: YES or NO	This allows the user to configure the Micro whether an engine oil level switch is being used in this particular unit or not.
ENGINE RPM: 0 to 3000	Engine RPM (speed)
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.
GLOW TIME: SHORT or LONG	This configuration allows the user to determine how long the glow plugs will stay on in automatic mode.
INACTIVE ALARMS IN MEMORY	There are inactive alarms in the Micro alarm list which have not yet been cleared out.
INSTALLED, REMOVE CARD XX	A DataShare Option PC Card has been inserted into the PC Card slot, and the option has been installed in the Micro. The PC Card may safely be removed from the slot. XX indicates number of option installations remaining on card.
INSTALLING OPTION, PLEASE WAIT	A DataShare Option PC Card has been inserted into the PC Card slot, and the option is being installed in the Micro. DO NOT REMOVE THE CARD WHILE THIS MESSAGE IS BEING DISPLAYED.
INSTALL STOPPED, REINSERT CARD	A DataShare 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.
LIST END, = TO CLEAR ALARMS	You have reached the end of the alarm list. Pressing the = key will clear the alarm list.
LOADING INFO	A DataShare Configuration PC Card has been inserted into the PC Card slot, and information from the Config card is being loaded into the Micro. DO NOT REMOVE THE CARD WHILE THIS MESSAGE IS BEING DISPLAYED.
MANUAL START MODE SELECTED	The user has selected manual start mode. The Diesel engine must be started using the manual GLOW / CRANK switch.

MESSAGE CENTER MESSAGES	
Message	**Description**
NEW PROGRAM: = TO LOAD, TO ↑ CANCEL	A DataShare 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 Micro. Press = to load the program.
NEXT ENGINE MAINT: 0HR to 99999HR	Next engine maintenance is due in xxxx hours.
NO ACTION TAKEN, REMOVE CARD	A DataShare Program PC Card has been inserted into the PC Card slot, and no key presses have been made to install the program into the Micro. The PC Card may be safely removed from the slot.
NO ACTIVE ALARMS	There are no active alarms in the Micro Alarm List.
NO DATA ON CARD, REMOVE CARD	A DataShare Program 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 DataShare 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	A DataShare 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.
OLDER PROGRAM, = TO LOAD, ↑ TO CANCEL	A DataShare Program PC Card has been inserted into the PC Card slot, and the program on the PC Card is an older version than what is already loaded in the Micro. Press = to load the older program.
OUT OF RANGE ALARM: 4°F or 5.5°F or 7°F or **OFF** (if ENGLISH UNITS selected) or 2°C or 3°C or 4°C or OFF (if METRIC UNITS selected) 4°F or 5.5°F or 7°F	Tells the user how far the temperature must move away from setpoint before an out of range alarm is generated.
PM DUE	Preventative Maintenance is now due on the unit.
PM HOUR METER NOT CHANGED	The last change for the PM hour meter was not received by the micro.
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 the Functional Parameters settings.
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.
PRETRIP FAIL	Some of the pretrip tests did not pass.
PRETRIP FAIL & NOT COMPLETED	Some of the pretrip tests did not pass and the pretrip was not completed.
PRETRIP PASS	All of the pretrip tests were ok.
PRETRIP STOPPED BY USER	Pretrip testing was stopped by the operator.
PRETRIP TEST # 1-15	Each test number and a description of the test will be displayed as it is being performed during a Pretrip Test.
PROGRAM COMPLETED	A DataShare Program PC Card has been inserted into the PC Card slot, and the entire program has been loaded into the Micro. The PC Card may safely be removed from the slot.
PROGRAM NOT LOADED-REMOVE CARD	A DataShare Program PC Card has been inserted into the PC Card slot, and there was an error installing the program. The PC Card may safely be removed from the slot. (Reinsert the PC Card for another attempt.)
REMOVE JUMPER	The Configuration / Technician Test Mode has been entered. Remove the jumper wire before continuing.
RETURN AIR TEMP: -52.6°F to 158.0°F (-47.0°C to 70.0°C)	Return air temperature

MESSAGE CENTER MESSAGES	
Message	**Description**
SAME PROGRAM, = TO LOAD, ↑ TO CANCEL	A DataShare 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 Micro. Press = to reload the same program.
S/S MINIMUM OFF TIME: 10MINS or 20MINS or 30MINS or 45MINS or 90MINS	This Functional Parameter allows the user to determine what the minimum off time between start/stop run cycles will be.
S/S PARAMETERS - SEPARATE S/S PARAMETERS - TOGETHER	This Configuration allows the user to determine whether the same Start/Stop parameters will be used for setpoints in both the Perishable Range and the Frozen Range, or if each range will be handled separately.
SET PM HOUR METERS	Pressing = when this Functional Parameter message is shown, allows the user access to the PM hour meter settings.
SET S/S PARAMETERS	Pressing = when this Functional Parameter message is shown, allows the user access to the Start/Stop Minimum Run and Off times, and the restart override temperatures.
SETPOINT CHANGED	The new setpoint has been entered (saved into Micro memory), the new setpoint will be used.
SETPOINT NOT CHANGED	The new setpoint has NOT been entered (NOT saved into Micro memory), the old setpoint will be used.
SLEEP MODE, OFF / ON TO WAKE	The unit has been placed in Sleep Mode. Turn the Start/Run-Off Switch OFF, then back ON to wake the Micro up.
SLEEP MODE: YES or NO	This Functional Parameter allows the user to place the unit in the Sleep Mode.
SOFTWARE REVISION: XXXXXX	Micro operating program software revision number
STANDBY HOURS: 0HR to 99999HR	The number of hours the Standby Motor has actually operated.
START MODE: AUTO or MANUAL	This Data Message tells the user if the unit is in Auto Start or Manual Start Mode
START STOP LOCKED	This Set Point has been locked into the Start/Stop mode. Continuous Run can not be selected.
START/STOP MODE SELECTED	The current Set Point is within a range that has been locked into the Start/Stop Mode. Continuous Run can not be selected.
STATUS OK	The unit is working just great.
SUCTION PRESSURE: -10.0 PSIG to 100.0 PSIG	Compressor suction pressure
SUPPLY AIR TEMP: -52.6°F to 158.0°F (-47.0°C to 70.0°C)	Supply air temperature
SWITCH ON HOURS: 0HR to 99999HR	Hours the unit Start-Run/Off switch has been in the ON position.
TEMP CONTROL: RETURN AIR or SUPPLY AIR	This Functional Parameter allows the user to select which air sensor is used for the control temperature input.
TEST #1 to #15	Pretrip is currently running this test and is x% complete
TRAILER ID #: XXXXXXXXXX	Trailer identification #
TRIP START ENTERED	The Trip start marker has been placed in the Data Recorder.
UNIT MODEL #: XXXXXXXXXX	Unit model #
UNIT SERIAL #: XXXXXXXXXX	Unit serial #
UNIT SHUTDOWN - DOOR OPEN	The unit has shut down because the trailer door is open
UNIT SHUTDOWN - SEE ALARM LIST	The controller has detected a condition which caused it to shut down the unit. Refer to message type SHUTDOWN ALARM in this table.
UNIT STARTING	When Diagnostic Mode has been selected, this message will appear just prior to the unit starting.

MESSAGE CENTER MESSAGES	
Message	**Description**
UNKNOWN CARD – REMOVE CARD	A non–DataShare PC Card has been inserted into the PC Card slot. The Micro can not recognize any data on the card. The card may be safely removed from the Micro.
WARNING: NO TEMP CONTROL	When the unit is running in Sleep Mode, it is doing so only to warm the engine up and charge the unit battery. There is no temperature control, and the unit may shut off before setpoint is reached.

Alarms List		
ALARM		**CAUSES**
DRIVER ALARMS		
1	Low Fuel Level	Less than 1/8 or 15% of fuel remaining in fuel tank.
2	Low Engine Oil Level	Engine oil level is sensed approx. 7 qts. low for more than 10 seconds.
3	Low Coolant Level	Radiator is less than 2/3 full of coolant.
SHUTDOWN ALARMS		
11	Low Engine Oil Pressure	Engine oil pressure is less than 12 psig when engine is running.
12	High Coolant Temperature	Coolant temperature is greater than 116°C when the ambient temperature exceeds 48.9°C, greater than 110°C when the ambient temperature is less than 48.9°C or between 116°C and 110°C for 5 minutes.
13	High Discharge Pressure	Compressor discharge pressure is greater than 465 psig.
14	Not Used	
15	Battery Voltage Too High	Battery voltage is greater than 17 VDC.
16	Battery Voltage Too Low	Battery voltage is less than 10 VDC when not cranking the engine.
17	High Comp Discharge Temp	Compressor discharge temperature is greater than 171.1°C when the ambient temperature exceeds 48.9°C, greater than 154.4°C for 3 minutes when the ambient temperature is less than 48.9°C or ever greater than 176.7°C.
18	Low Refrigerant Pressure	Compressor suction pressure is less than -3.0 psig for more than * seconds when RAT is above -10°F. Compressor suction pressure is less than -8.0 psig for more than * seconds. *Time may be configured from 0 to 255 seconds.
19	Low Fuel Level Shutdown	Low Fuel Level warning alarm active for amount of time based on tank size from configuration parameter.
20 to 26	Not Used	
27	High Suction Pressure	Compressor suction pressure has been greater than 98 psig for longer than 10 minutes.
28	Check Refrigeration System	Compressor discharge pressure is not at least 5 psig higher than the suction pressure for 10 minutes.
START UP ENGINE ALARMS		
30	Failed to Run Minimum Time	Engine failed to run for at least 15 minutes following a shutdown alarm, 3 consecutive times.
31	Failed to Start - Auto	Engine fails to start on 3 consecutive attempts in automatic start mode.
32	Failed to Start - Manual	Engine fails to start on 3 consecutive attempts in manual start mode.
33	Not Used	
34	Engine Failed To Stop	Engine RPM is greater than 500 RPMs or engine oil pressure switch is closed longer than 5 seconds after attempting to stop engine.
35	Check Starter Circuit	Engine failed to reach 50 RPM on 2 consecutive attempts.
36	Check Coolant Temperature	Coolant temperature is less than 32°F (0°C) after engine has been running for 5 minutes.
37	Check Low Speed RPM	Engine RPM is outside limits when engine is running in low speed mode. See Alarm Troubleshooting Section for RPM values for each model.
38	Check High Speed RPM	Engine RPM is outside limits when engine is running in high speed mode. See Alarm Troubleshooting Section for RPM values for each model.
39	Check Engine RPM	Engine RPM is completely outside limits for 5 minutes. See Alarm Troubleshooting Section for RPM values for each model.
40	Check Glow Plug	When glow plugs are energized, glow plug current is <30 Amps or >43 Amps after being energized for 13 seconds.

Alarms List		
ALARM		**CAUSES**
41	Engine Stalled	Engine RPM <10 or engine oil pressure is less than 8 psig when engine RPM sensor is not operating.
WARNING / STATUS ALARMS		
51	Alternator Not Charging	Battery is not charging after engine is running for 15 seconds.
52	Not Used	
53	Box Temp Out Of Range	If not configured for shutdown, control probe (defined by user as either return or supply air temperature) goes out of tolerance band (configured by user) for 15 minutes If configured for shutdown, control probe must be out of range for 45 minutes.
54	Defrost Not Complete	Either defrost termination temperature sensor is less than 55°F after 45 minutes.
55	Check Defrost Air Switch	Air switch did not open when unit exits defrost mode, or air switch is calling for another defrost cycle 2 consecutive times in less than 8 minutes following the previous defrost cycle.
56	Check Evaporator Airflow	In the Cool mode, the Supply Air temperature is 5°F warmer than Return Air Temperature for 5 minutes. In the Heat mode, the Suction pressure has been higher than or = to 100 psig for more than 60 seconds for R404A (80 psig for R22).
57	Check Remote Switch 1	Remote Switch may be connected to a trailer door or some other devise, Check.
58	Check Remote Switch 2	Remote Switch may be connected to a trailer door or some other devise, Check.
59	Datalogger Not Recording	No data is being recorded by the Data recorder.
60	Datalogger Time Wrong	The internal clock is not operating correctly.
61	Door Open	Check to see if trailer door is open.
ELECTRICAL ALARMS		
71	Bad F2 or F3 Fuse	F2 or F3 fuse is open for 2 seconds when engine is not cranking.
72	Bad F4 or F6 Fuse	F4 or F6 fuse is open for 2 seconds when engine is not cranking.
73 to 77	Not Used	
78	Check SV1 Circuit	The SV1 FET senses a short in the circuit to the SV1 valve in the heat cycle.
79	Check SV4 Circuit	The SV4 FET senses a short in the circuit to the SV4 valve in the heat cycle.
80	Check SV3 Circuit	The SV3 FET senses a short in the circuit to the SV3 valve in the heat cycle.
81	Not Used	
82	Chk Remote Out-Range Light	The Out of Range FET senses a shorted circuit.
83	Check Remote Defrost Light	The Defrost FET senses a shorted circuit.
84	Check Remote Alarm Light	The Fault output FET senses a shorted circuit.
85	Check UL1 Unloader	The Front Unloader FET senses a shorted circuit.
86	Check UL2 Unloader	The Rear Unloader FET senses a shorted circuit.
87	Check Remote Heat Light	The Remote Heat Light FET senses a shorted circuit.
88	Check Remote Cool Light	The Remote Cool Light FET senses a shorted circuit.
89	Check Remote Auto Light	The Remote Autostart Light FET senses a shorted circuit.
90	Not Used	
91	Not Used	
92	Not Used	
93	Check Start-up Buzzer	Buzzer output is active and the Buzzer FETsenses a shorted circuit.

Alarms List		
ALARM		**CAUSES**
94	Not Used	
95	Not Used	
96	Not Used	
97	Check SV2 Circuit	The SV2 Output FET senses a short in the circuit to the SV2 valve when the SV2 circuit is active.
SENSOR ALARMS		
121	Check Ambient Air Sensor	Ambient air sensor is reading <-47°C or >70°C.
122	Check Return Air Sensor	Return air sensor is reading <-47°C or >70°C.
123	Check Supply Air Sensor	Supply air sensor is reading <-47°C or >70°C.
124	CHK Defrost Term 1 Sensor	Defrost termination temperature sensor is reading <-47°C or >70°C.
125	Check Disch Temp Sensor	Compressor discharge temperature sensor is reading <-40°C or >200°C.
126	Not Used	
127	Not Used	
128	Not Used	
129	Check Eng Coolant Sensor	Coolant Temperature sensor is reading <-50°C or >130°C.
130	Check Engine RPM Sensor	In automatic start mode, diesel engine rpm is above 100 RPMs and in manual start mode, diesel engine RPMs are above 50 RPMs.
131	Not Used	
132	CHK Defrost Term Sensor #2	Defrost termination temperature sensor is reading <-47°C or >70°C.
PRETRIP ALARMS		
141	Pretrip Stopped By User	Pretrip cycle was stopped by user.
142	Not Used	
143	Check Clutch Circuit	Clutch circuit is reading <2.0 Amps or >5.0 Amps.
144	Check UL1 Circuit	Front Unloader circuit is reading <0.75 Amps or >2.0 Amps.
145	Check Speed Sol Circ	Speed Solenoid circuit is reading <3.0 Amps or >9.0 Amps.
146	Not Used	
147	Not Used	
148	Check SV1 Circuit	SV1 circuit is reading <0.75 Amps or >2.5 Amps.
149	Check SV3 Circuit	SV3 circuit is reading <0.75 Amps or >2.5 Amps.
150	Check SV4 Circuit	SV4 circuit is reading <0.75 Amps or >2.0 Amps.
151	Check Glow Plug Circuit	Glow plug circuit is reading<23 Amps or >35 Amps after 13 seconds.
152	Check Fuel Solenoid Circ	Fuel Solenoid circuit is reading <0.4 Amps or >3.5 Amps.
153	Check Return Air Sensor	Return air temperature sensor is reading <-53°F or >158°.
154	Check Supply Air Sensor	Supply air temperature sensor is reading <-53°F or >158°F.
155	Chk Coolant Temp Sensor	Coolant temperature sensor is reading <-58°F or >266°F.
156	Check Battery Volts	Battery voltage is reading <11 VDC or >17VDC.
157	Check Battery Current	Battery current is reading <-1 Amp or >1 Amp when all circuits are off.

Alarms List		
ALARM		**CAUSES**
158	Check Ambient Air Sensor	Ambient air temperature sensor is reading <-53°F or >158°F.
159	Check Defrost Term 1 Sensor	Defrost termination temperature sensor is reading <-53°F or >158°F.
160	Check Disch Temp Sensor	Discharge temperature sensor is reading <-40°F or >392°F.
161	Not Used	
162	Not Used	
163	Not Used	
164	Check UL2 Circuit	Rear unloader circuit is reading <0.75 Amp or >2 Amps.
165	Can Not Pump Down	With SV1, SV2, SV3 and SV4 closed, the compressor, compressor suction pressure is >5 psig.
166 to 173	Not Used	
174	Check Low Speed RPM	Engine RPM is outside limits when engine is running in low speed mode. See Alarm Troubleshooting Section for RPM values for each model.
175	Check High Speed RPM	Engine RPM is outside limits when engine is running in high speed mode. See Alarm Troubleshooting Section for RPM values for each model.
176	Not Used	
177	Not Used	
178	Check UL1	The difference between the compressor suction and discharge pressure did not change as expected when the front unloader was loaded or unloaded.
179	Not Used	
180	Not Used	
181	Check SV4 Valve	The compressor suction pressure did not increase enough when SV4 was opened during pretrip.
182	Check SV1 Valve	The compressor discharge pressure pressure did not increase enough when SV1 was closed during pretrip.
183	Check SV3 Valve	The suction pressure did not increase enough when SV3 was opened during pretrip.
184 to 190	Not Used	
191	Check UL2	The difference between the compressor suction and discharge pressure did not change as expected when the rear unloader was loaded or unloaded during pretrip.
192	Check SV2 Circuit	The SV2 circuit is reading <0.75 Amps or >2.0 Amps.
193	Not Used	
194	High Suction Pressure	Compressor suction pressure is too high during test 4 of pretrip.
195	Low Suction Pressure	Compressor suction pressure is too low during test 4 of pretrip.
196	High Discharge Pressure	Compressor discharge pressure is too high during test 4 of pretrip.
197	Not Used	
198	Low Discharge Pressure	Compressor discharge pressure is too low during test 4 of pretrip.
199	Not Used	
200	Check UL1 Cylinders	Value out of range in pretrip test.
201	Check UL2 Cylinders	Value out of range in pretrip test.
202	High Side Leak	Value out of range in pretrip test.
203	Chk Discharge Check Valve	Value out of range in pretrip test.
204	Low Suction Pressure	Compressor suction pressure is less than 3.0 psig for more than 60 seconds.

Alarms List		
ALARM		**CAUSES**
205	Chk Defrost Term 2 Sensor	Defrost Termination Sensor 2 is reading <-53°F or >158°F.
MAINTENANCE ALARMS		
223	Engine Maintenance Due	The engine maintenance hour meter has expired.
224	Not Used	
225	General Maintenance Due	The general maintenance hour meter has expired.
226 -	Service Soon- PM#1(thru 5) Due	The programmable preventative maintenance.
230	Maintenance Hour Meter	Hour meter is greater than user programmed.
MICROPROCESSOR ALARMS		
231	Not Used	
232	Setpoint Error	There is an error in the setpoint stored in the microprocessor memory.
233	Model # Error	There is an error in the model number stored in the microprocessor memory.
234	Unit Serial # Error	There is an error in the serial number stored in the microprocessor memory.
235	Control Serial # Error	There is an error in the microprocessor controller serial number stored in the microprocessor memory.
236	Trailer ID # Error	There is an error in the trailer identification number stored in the microprocessor memory.
237	Function Parameter Error	There is an error in a functional parameter setting stored in the microprocessor memory.
238	Configurations 1 Error	There is an error in a configurations 1 stored in the microprocessor memory.
239	Configurations 2 Error	There is an error in a configurations 2 stored in the microprocessor memory.
240	Hour Meter Error	There is an error in the number of hours in microprocessor memory.
241	Alarm Status Error	There is an error in an Alarm that is stored in microprocessor memory.
242	DIS Press Calibrate Error	There is an error in the discharge pressure sensor calibration that is stored in memory.
243	Suct/Evap Calibrate Error	There is an error in the suction/evaporator pressure sensor calibration that is stored in memory.
244	Not Used	
245	Micro SW Rev Error	There is an error in the microprocessor revision number that is stored in memory.
246	EEPROM Write Failure	There is an error in the ability to write information to be stored in memory.
247	Configurations 3 Error	There is an error in a configurations 3 stored in the microprocessor memory.
248	Config mode/HP2 Error	There is an error in a configurations HP2 stored in the microprocessor memory.
249	Microprocessor Error	Microprocessor input conversion error.

Section 7 - Unit Description

7.1 Introduction

Table 7-1. Model Chart

Models	Refrigerant				Compressor	Engine	Engine Speed	
	R-22		R-404A				High	Low
	LB	KG	LB	KG				
ULTIMA 53 with Advance Microprocessor								
NDX-93M	–	–	26	11.8	05G 41 cfm	CT4-134-DI	2200	1475
PHOENIX ULTRA with Advance Microprocessor								
NDA-93A	–	–	26	11.8	05G 41 cfm	CT4-134-TV	1900	1350
NDA-94A	26	11.8	–	–				
PHOENIX ULTRA XL with Advance Microprocessor								
NDA-93M	–	–	26	11.8	05G 41 cfm	CT4-134-DI	1900	1350
NDA-94M	26	11.8	–	–				
EXTRA with Advance Microprocessor								
NDA-93E	–	–	26	11.8	05G 37 cfm	CT4-114-TV	1700	1350
NDA-94E	26	11.8	–	–				
NDA-93N	–	–	26	11.8	05G 37 cfm	CT4-134-DI	1700	1350
NDA-94N	26	11.8	–	–				

WARNING: Beware of V-belts and belt driven components as the unit may start automatically. Before servicing unit, make sure the Start/Run - Stop switch is in the STOP position. Also disconnect the negative battery cable.

The unit is a one piece, self-contained, fully charged, pre-wired, refrigeration/heating “nosemount” diesel powered unit for use on insulated trailers to maintain cargo temperatures within very close limits. The model/serial number plate is located inside of the unit on the rear frame as shown in Figure 7-2.

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

The condensing unit consists of an engine—compressor drive package, condenser fan, condenser/radiator coil (Ultima) or condenser coil, radiator (Ultra, Ultra XL, & Extra), control panel, refrigerant controls, piping, wiring, defrost air switch, and associated components.

The evaporator assembly consists of an evaporator coil, evaporator blower wheel, expansion valve, Return Air Temperature sensor (RAT), Supply Air Temperature sensor (SAT), and two Defrost Termination Temperature sensors (DTT1 & DTT2). The location of the RAT, SAT, and both DTT’s are shown in Figure 7-5.

Heating is accomplished by circulating hot gas directly from the compressor to the evaporator coil. Four electric 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 Advance Microprocessor.

The control door include manual switches, keypad, and associated wiring. Also available is an optional Driver’s Light Bar. It is generally mounted separately on the front roadside corner of the trailer.

The temperature controller is the Advance Microprocessor solid state controller. Once the Advance 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 trailer.

The refrigeration compressor used (Refer to Table 7-1) is equipped with Varipowr as standard equipment. Varipowr is used as a compressor capacity control to unload the compressor during periods of reduced loads. This provides closer temperature control, reduces potential for top freezing and reduces power required to operate the compressor; thus reducing fuel consumption.

The engine (Refer to Table 7-1) gives excellent fuel economy and has easy starting characteristics. The engine is equipped with spin-on lube oil and fuel oil filters for easier filter changes.

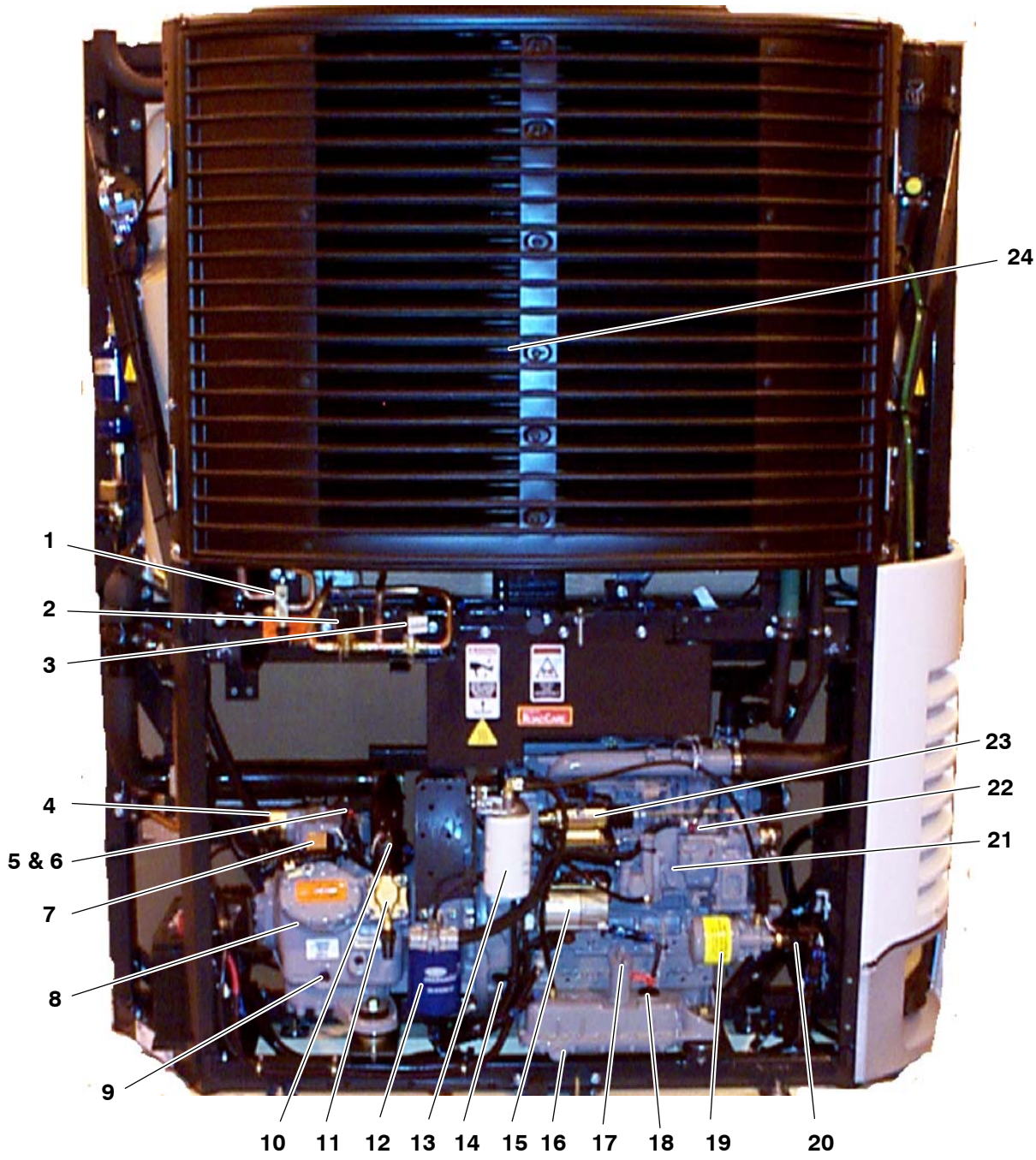
NOTE: Throughout this manual, whenever the “left” or “right” hand side of the engine is referred to, it is the side as viewed from the flywheel end of the engine.

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 clutch/gearbox. The condenser/evaporator fan shaft is driven with a V-belt from the clutch/gearbox. A separate V-belt from the clutch/gearbox drives the alternator.

Electrical power for the control system and for charging the batteries is provided by the 12 vdc alternator.

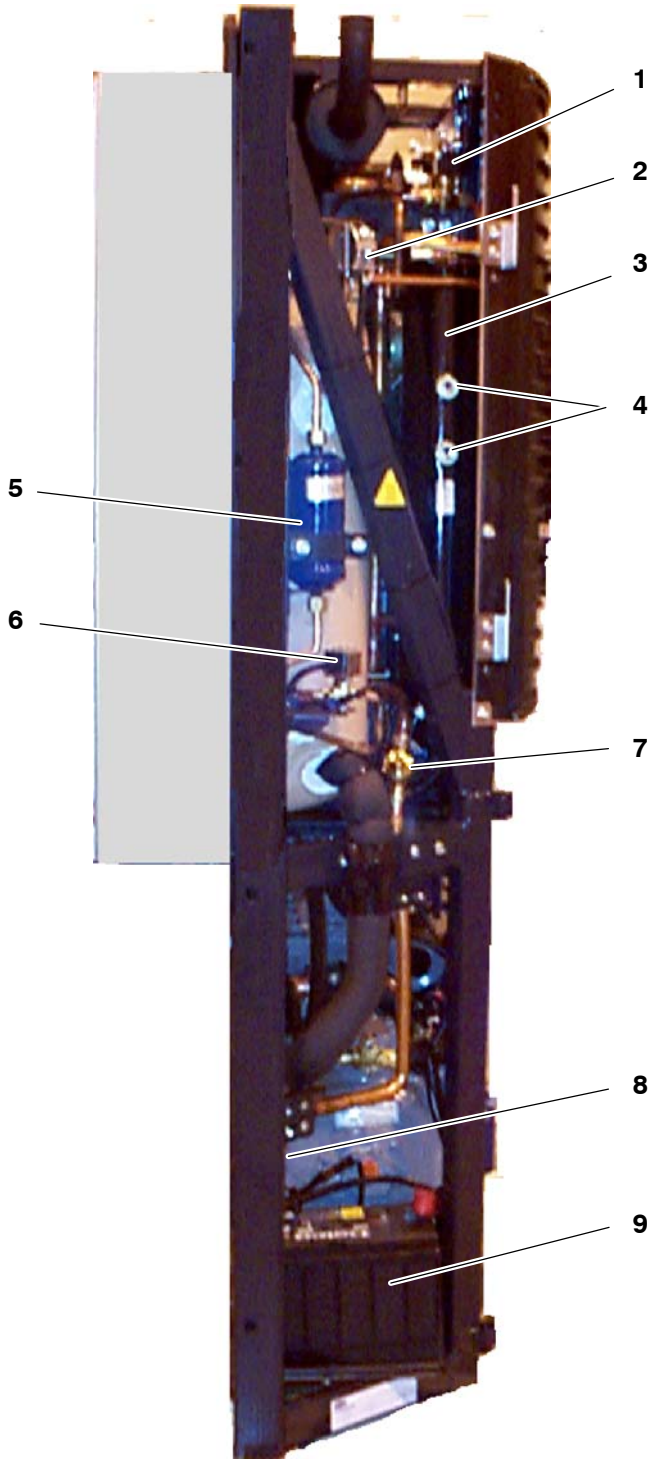
Also the auto start/stop feature is standard equipment.

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).



1. King Valve
2. Hot Gas Solenoid Valve - Large (SV-3)
3. Hot Gas Solenoid Valve - Small (SV-4)
4. Discharge Service Valve
5. High Pressure Cutout Switch (HPS)
6. Compressor Discharge Pressure Transducer (CDP)
7. Unloader Solenoid Valve
8. Compressor – 05G
9. Compressor Oil Sight Glass
10. Compressor Suction Pressure Transducer (CSP)
11. Suction Service Valve
12. Fuel Filter
13. By-pass Oil Filter
14. Engine RPM Sensor (ENRPM)
15. Starter Motor
16. Oil Drain
17. Lube Oil Fill
18. Engine Oil Level Switch (ENOLS)
19. Lube Oil Filter
20. Engine Oil Pressure Switch (ENOPS)
21. Injection Pump
22. Fuel Bleed Valve
23. Speed Control Solenoid (SCS)
24. Ambient Air Temperature Sensor (AAT)

Figure 7-1. Front View - Ultima 53 Shown

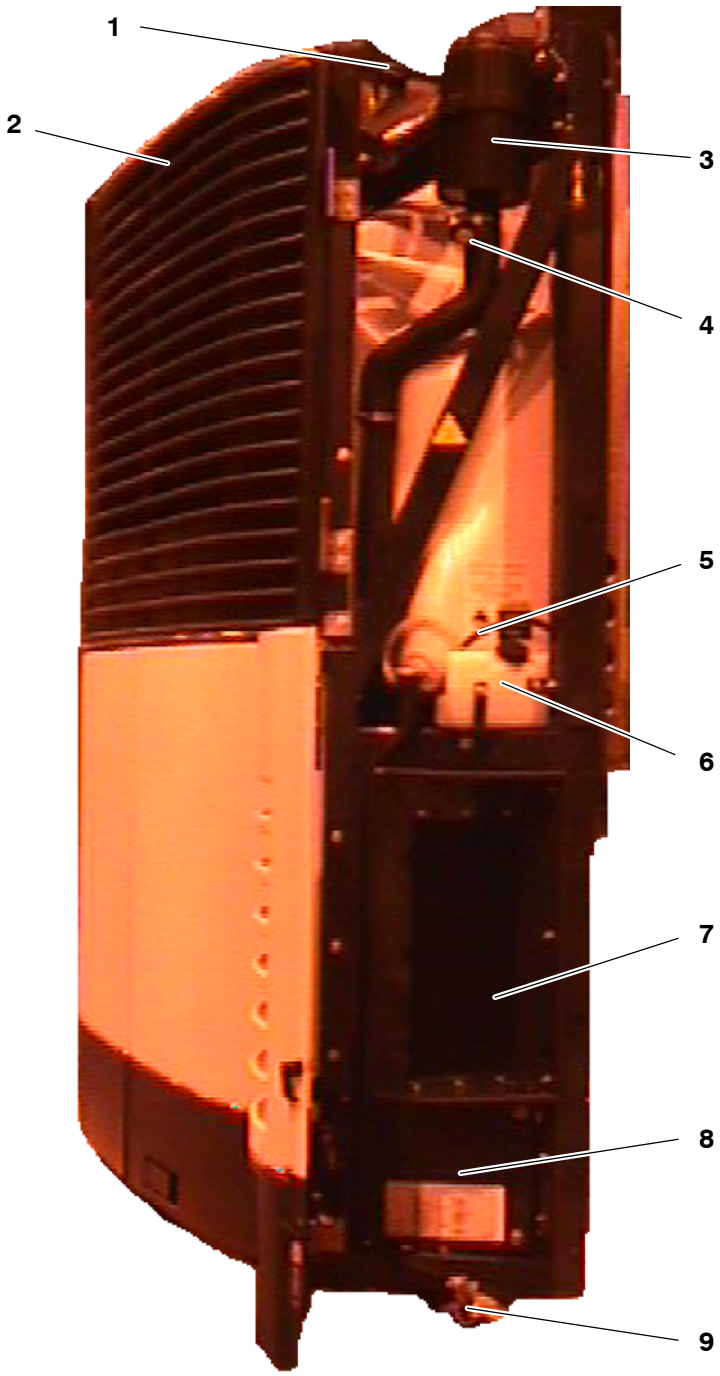


1. Condenser Pressure Control Solenoid Valve (SV-1)
2. Defrost Air Switch
3. Receiver
4. Receiver Sight Glass
5. Filter-Drier
6. Liquid Line Solenoid Valve (SV-2)
7. Discharge Check Valve
8. Model/Serial No. Location
9. Battery Location

Figure 7-2. Curbside - Ultima 53 Shown

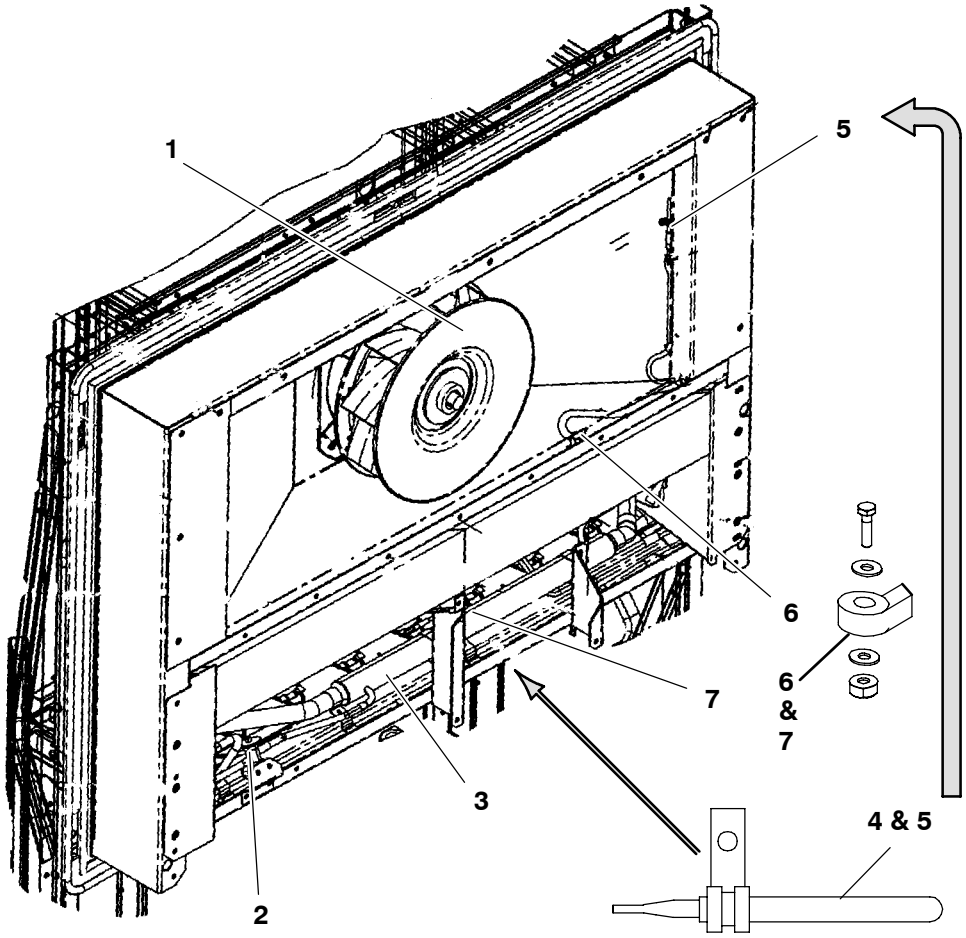
1. Radiator Fill Neck
2. Condenser/Radiator
3. Engine Air Cleaner
4. Coolant Level Switch (ENCLS)
5. Air Cleaner Service Indicator
6. Radiator Overflow Reservoir
7. Control Box Door – See Figure 7-6
8. Serial Port / Downloader Plug (SLP)

Figure 7-3. Roadside - Ultima 53



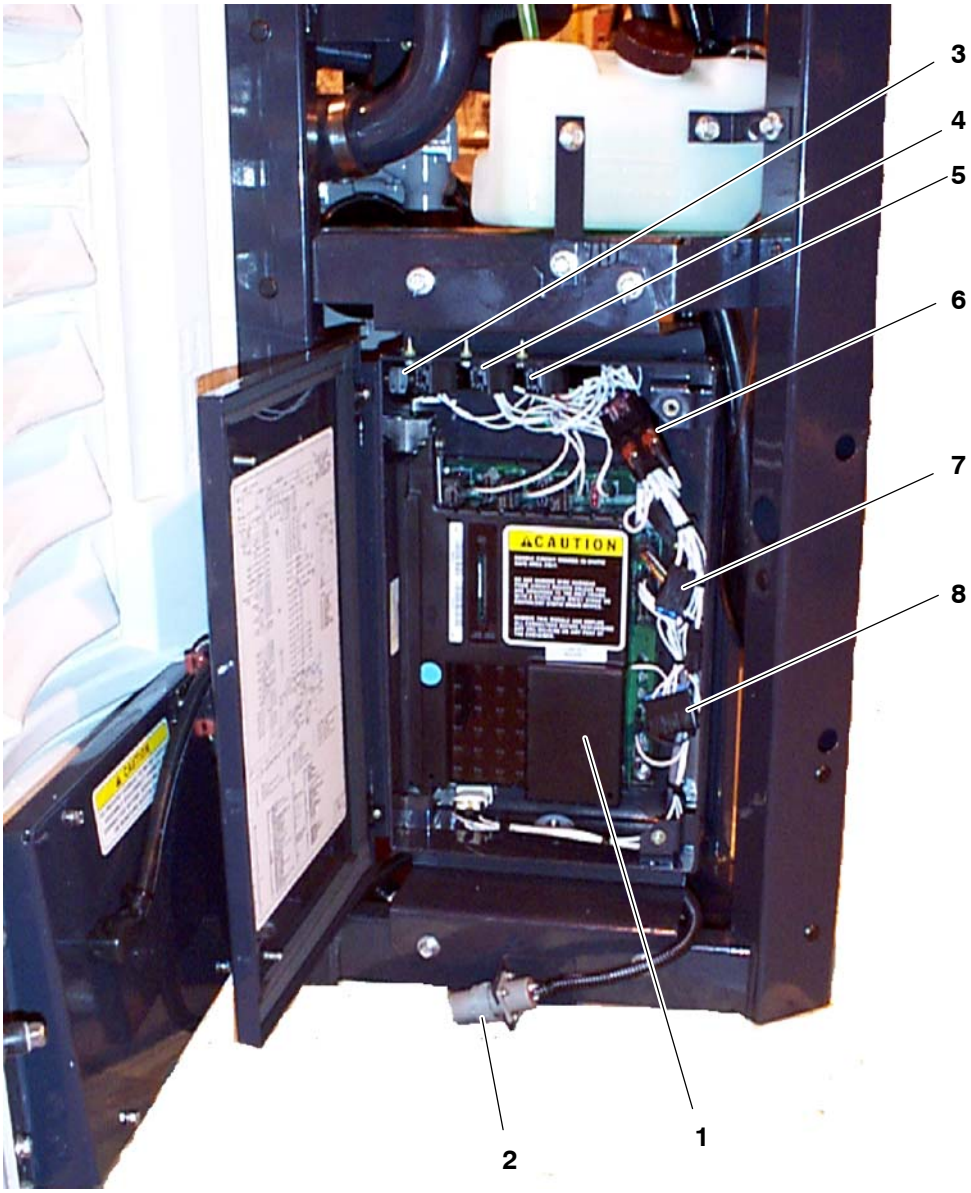
1. Radiator Fill Neck
2. Condenser
3. Engine Air Cleaner
4. Air Cleaner Service Indicator
5. Coolant Level Switch (ENCLS)
6. Radiator Overflow Reservoir
7. Radiator
8. Control Box Door – See Figure 7-7
9. Serial Port / Downloader Plug (SLP)

Figure 7-4. Roadside - Phoenix Ultra



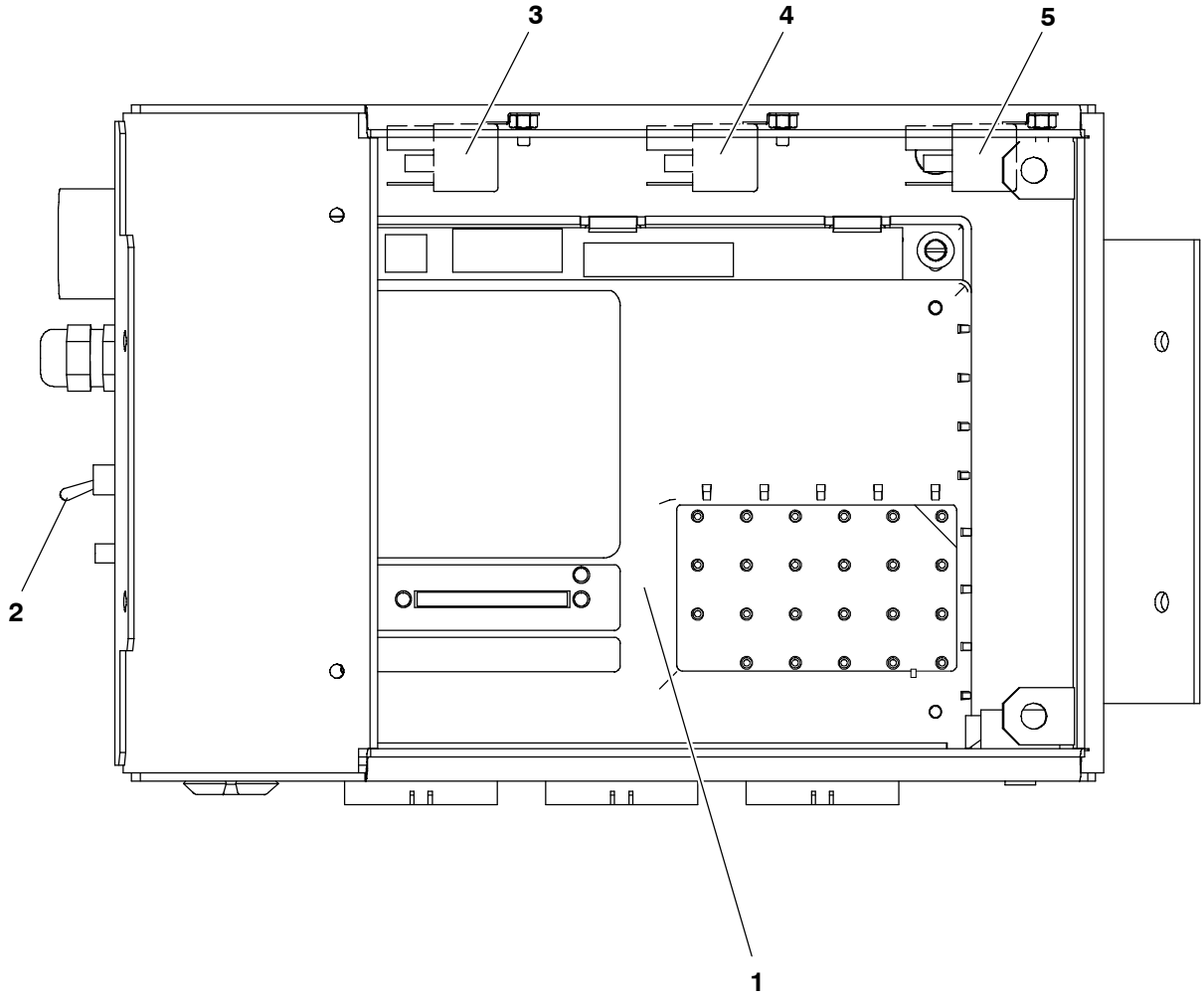
1. Evaporator Fan
2. Expansion Valve
3. Heat Exchanger – R404A Only
4. Return Air Temperature Sensor (RAT)
5. Supply Air Temperature Sensor (SAT)
6. Defrost Termination Temp. (DTT1)
7. Defrost Termination Temp. (DTT2)

Figure 7-5. Evaporator Section - Panels and Grille Removed



1. Control Module (Microprocessor) Refer to Section 3.3
2. Serial Port / Downloader Plug (SLP)
3. Glow Plug Relay (GPR)
4. Starter Solenoid Relay (SSR)
5. Fuel Heater Relay (FHR)
6. Fuse (F8)
7. Fuse (F6)
8. Fuse (F7)

Figure 7-6. Control Box – Ultima 53



1. Control Module (Microprocessor) Refer to Section 3.3
2. Glow/Crank Switch (GCS)
3. Glow Plug Relay (GPR)
4. Fuel Heater Relay (FHR)
5. Starter Solenoid Relay (SSR)

Figure 7-7. Control Box - Ultra / Extra

7.2 Engine Data

Engine Models	CT4-134TV (V2203TV)	CT4-134DI (V2203DI)	CT4-114TV (V1903)
Displacement	134 in^3 (2.2 liters)	134 in^3 (2.2 liters)	114 in^3 (1.9 liters)
No. Cylinders	4	4	4
Rated Horsepower	34 hp @1900 rpm 25 hp @ 1350 rpm	33 hp@1900 rpm 35 hp@2200 rpm	24 hp @1700 rpm 20 hp @1350 rpm
NOTE: See Table 7-1 for actual engine RPM settings for various models			
Weight	417.8 lbs (189.5 kg)		
Coolant Capacity	2 gallons (7.6 liters)		
Thermostat	Starts to open 157 to 162°F (69 to 72°C) fully open 185°F (85°C)	Starts to open 177 to 182°F (81 to 83°C) fully open 203°F (95°C)	
Oil Capacity with Filter	15 quarts (14 liters)		
Injection Setting	1991 to 2133 psi (140 to 150 $kg/cm^{2)}$	3250 to 3400 psi (228.5 to 239 $kg/cm^{2)}$	1991 to 2133 psi (140 to 150 $kg/cm^{2)}$
Fuel	Winter: Diesel No. 1 Summer: Diesel No. 2		
Firing Order	1–3–4–2	1–3–4–2	1–3–4–2
Glow Plug Amperage	7.0 amps per plug at 10.5 vdc (nominal)		
Valve Clearance (Cold) (Intake and Exhaust)	0.0071 to 0.0087 inch (0.18 to 0.22 mm)		
Compression	Engine compression must be above 400 psig		

a. Lubrication System

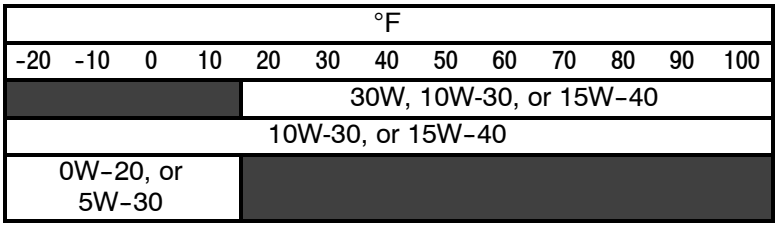
Oil Pressure:

40 to 60 psig (2.8 to 4.2 kg/cm^2) (Engine in high speed)

Oil Pressure Safety Switch Setting Closes:

12 ($\pm$ 3) psig (1.05 kg/cm^2)

Lube Oil Viscosity:



Oil Change Intervals:

See chart below.

CAUTION: The maximum oil change interval is 1 year (for either approved oil). The only approved synthetic lube oil is Mobil Delvac 1. The normal oil change intervals (listed below) should be reduced if the equipment is operated under extreme conditions such as in dirty environments.

ENGINE	API Class CF (Hours)	MOBIL DELVAC 1 (Hours)
TV	1500	3000
DI	2000	4000

b. Engine Oil Pressure Safety Switch (ENOPS)

This switch, set to open below 12 ± 3 psig (1.0 ± 0.2 kg/cm2), will automatically stop the engine upon loss of oil pressure. 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.

c. Engine Coolant Temp. Sensor (ENCT)

This sensor senses engine coolant temperature. The microprocessor will stop the unit when this temperature exceeds 230°F (110°C). If ambient air temperature sensor (AAT) is at 120°F (49°C) or higher, the ENCT limits are increased to 230 to 240°F for 5 minutes or immediately over 240°F (116°C). The sensor is located near the thermostat housing in the cylinder head.

d. Engine RPM Sensor (ENRPM)

The engine RPM sensor is used as an input to the microprocessor to monitor engine speed. It is located on the bell housing between the engine and compressor.

7.3 Engine Screw Threads

All threads used on the diesel engine are metric.

7.4 Engine Air System

The air cleaner is put 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. However, 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 8.5.6)

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.

7.5 Compressor Data

Compressor Models	**05G**
No. Cylinders	6
No. Unloaders	2
Weight	137 lbs (62 kg)
Oil Charge	6.0 pints (2.8 L)

APPROVED COMPRESSOR OIL	
Refrigerant	**05G**
R-404A	Mobil Arctic EAL 68
R-22	Zerol 150 (synthetic)

7.6 Refrigeration System Data

Defrost Air Switch (DAS) Initiates Defrost	1.40 (± .07) inch (35 ± 1.8 mm) WG
Expansion Valve Superheat Setting at 0°F (–17.8°C) box temperature:	Setting: 8 to 10°F (4.4 to 5.6°C)
Expansion Valve MOP:	**Ultra, Ultra XL, & Extra** R22 55 MOP R404A 45 MOP **Ultima** R404A 55 MOP
Fusible Plug Setting	208 to 220°F (97.8° to 104.4°C)
High Pressure Switch (HPS)	Cutout: 465 ± 10 psig (32.7 ± 0.7 kg/cm^2) Cut-in: 350 ± 10 psig (24.6 ± 0.7 kg/cm^2)
Refrigeration Charge	Refer to Table 7-1
Gearbox Oil	Mobil SHC 75–90W: 15oz
Fanshaft Oil	Mobil SHC 630: 3.2oz
Unit Weights (Approximate)	Ultima 53: 1665 lb. (755 kg) Phoenix Ultra: 1610 lb. (730 kg) Extra: 1610 lb. (730 kg)

7.7 Safety Devices

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

The Compressor Discharge Temperature sensor (CDT) will shut the unit down if center compressor head discharge temperature reaches 310°F (154°C) for 3 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 3 minutes.

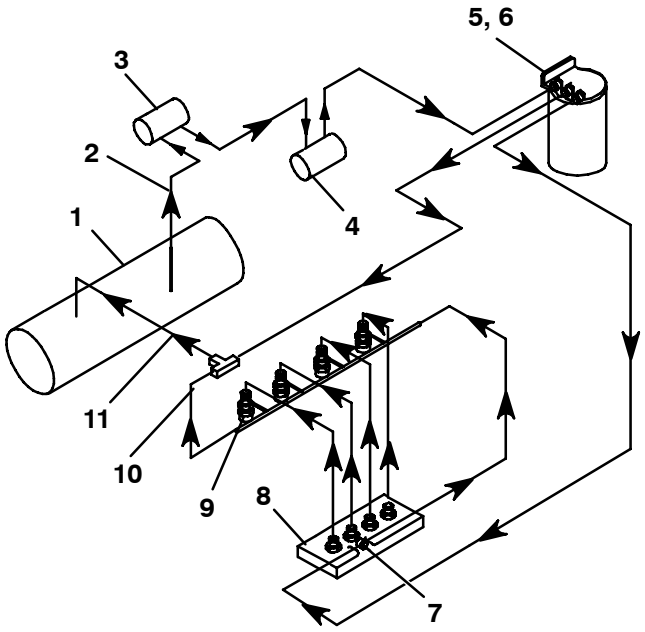
Table 7-2. Safety Devices

Unit Shutdown Safety Devices		
Unsafe Conditions	**Safety Device**	**Device Setting**
Low engine lubricating oil pressure	Oil pressure safety switch (ENOPS) (microprocessor reset)	Opens below 12 ± 3 psig (2.1 ± 1.2 kg/cm^2)
High engine cooling water temperature	Engine coolant temp. (ENCT) (microprocessor reset)	Refer to section 7.2
Excessive current draw by microprocessor	Fuse (F1)	Opens at 7 1/2 amps
Excessive current draw by speed control solenoid	Fuse (F2)	Opens at 10 amps
Excessive current draw by fuel pump	Fuse (F3)	Opens at 7 1/2 amps
Excessive current draw by evap. fan clutch	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 buzzer, light bar and front or rear unloader	Fuse (F6)	Opens at 15 amps
Excessive current draw by glow & crank switch	Fuse (F7)	Opens at 5 amps
Excessive current draw by fuel heater	Fuse (F8)	Opens at 20 amps
Excessive compressor discharge pressure	High pressure cutout switch (HPS) automatic reset	Refer to section 7.6
Excessive compressor discharge temperature	Compressor discharge temperature sensor (CDT) (microprocessor reset)	See Trigger On criteria for Alarm 17 in Section 5
Other Safety Devices		
Unsafe Conditions	**Safety Device**	**Device Setting**
Low Engine Coolant Level	Engine Coolant Level Switch (ENCLS)	Engine coolant level is more than 1 quart low.
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 5
Trailer Door Open (May be configured for alarm only or alarm and shutdown)	Door Switch or Remote Switch	See Trigger On criteria for Alarms 57, 58, and 61 in Section 5
Box Temperature Out Of Range (May be configured for alarm only or alarm and shutdown)	Microprocessor	See Trigger On criteria for Alarm 53 in Section 5

7.8 Data Ohms and Amps

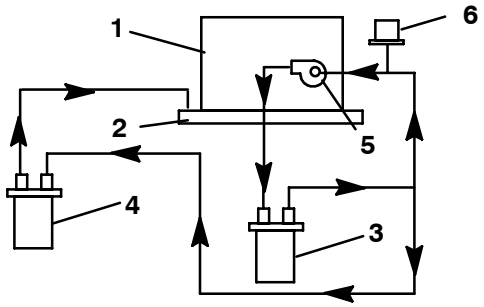
Component	Ohms	Amps
SV-1 & 3	7.8 ± 0.3 Ohms	0.75 to 2.0 Amps
SV-2 & 4	10.6 ± 0.3 Ohms	0.75 to 2.0 Amps
Unloader	10.6 ± 0.3 Ohms	1.0 to 2.0 Amps
Clutch	3.2 ± 0.2 Ohms	3.0 to 5.0 Amps
Speed solenoid	1.5 to 2.5 Ohms	3.0 – 8.0 Amps
Fuel solenoid Red–Black wires:	11.1 Ohms to 13.4 Ohms	0.25 to 2.0 Amps
White–Black wires: Can not be accurately measured with Coil Commander in circuit.		30.0 to 40.0 Amps
Indicator lights	4.8 ± 0.2 Ohms	na
Unit non-running amps (See Note 2 in Section 5.1)		6–9 Amps
Glow Plug Amps Each Plug		6 - 9 Amps
Glow Plug Total Circuit		25 – 35 Amps
Starter Amps	na	270 – 380 amps

7.9 Lube Oil and Fuel Flow Diagrams



1. Fuel Tank
2. Fuel Supply Line
3. Electric 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 7-8. Fuel System Diagram



1. Engine Block
2. Oil Pan
3. Full Flow Oil Filter
4. Bypass Oil Filter (Optional)
5. Engine Oil Connection
6. Oil Pressure Switch

Figure 7-9. Lube Oil Flow Diagram

7.10 Compressor Unloaders

a. Major Working Parts

1. Solenoid and valve system
2. Spring loaded piston type bypass control valve
3. Spring loaded discharge check valve

b. Unloaded Operation

Pressure from the discharge manifold (Figure 7-10, 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.

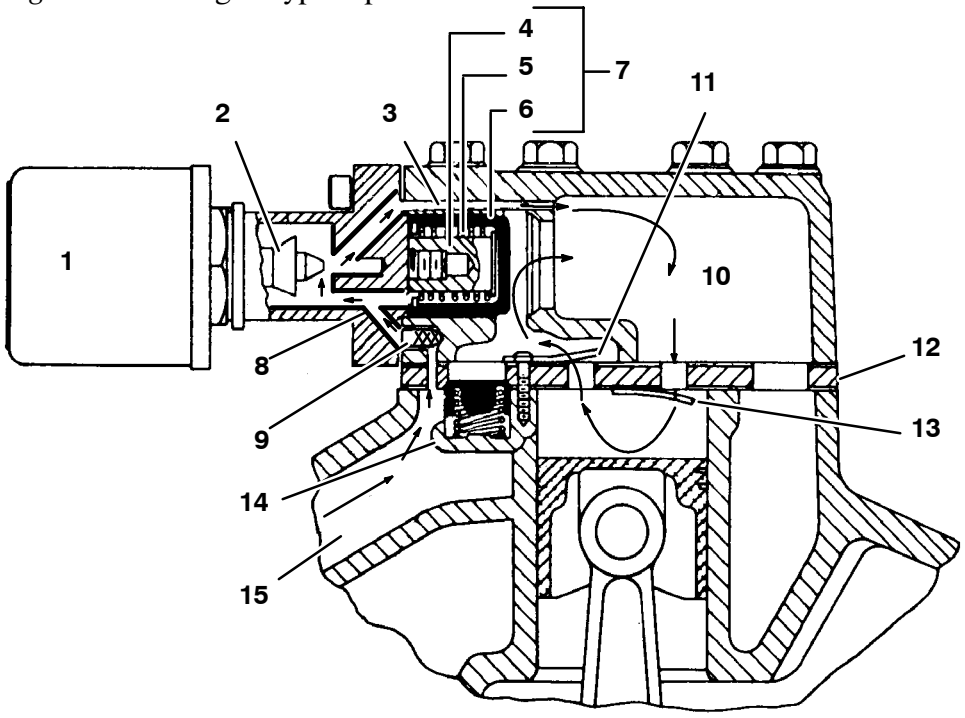
With the solenoid valve (1) *energized* the solenoid valve stem (2) will *open* the gas bypass port (3).

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 7-10. Compressor Cylinder Head Unloaded

c. Loaded Operation

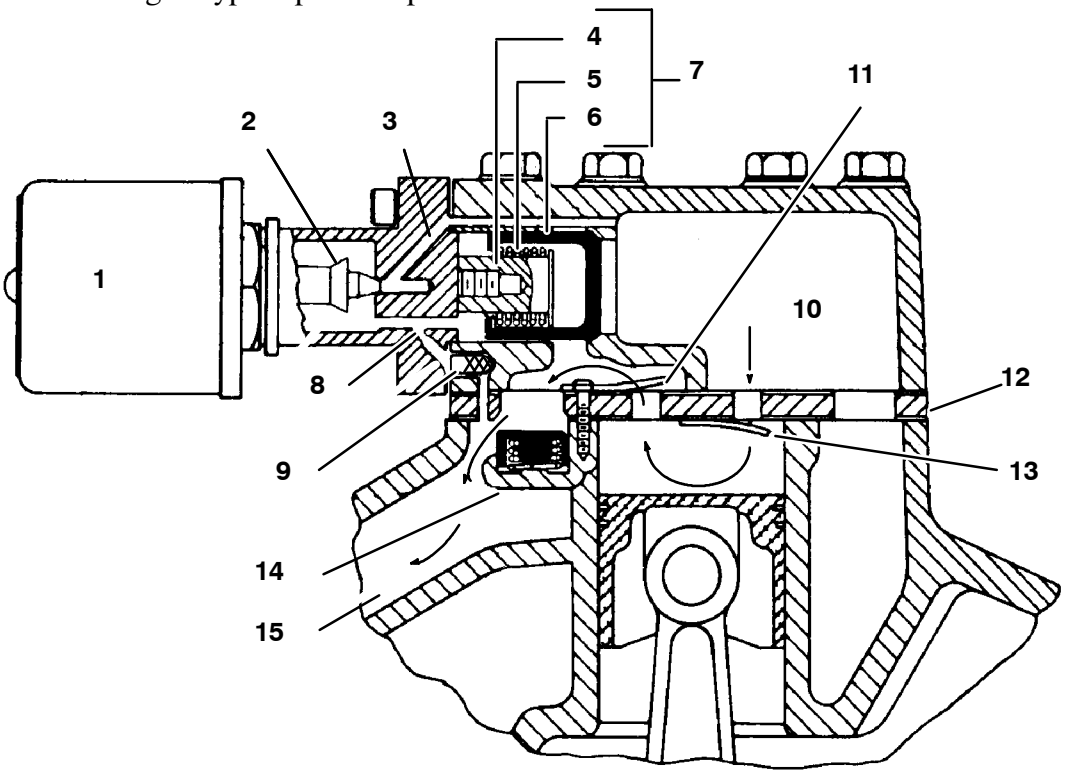
Discharge pressure bleeds from the discharge manifold (Figure 7-11, item 15) through the strainer (9) and (8) bleed orifice to the solenoid valve stem (2) chamber and the back of the piston bypass valve (7).

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.



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

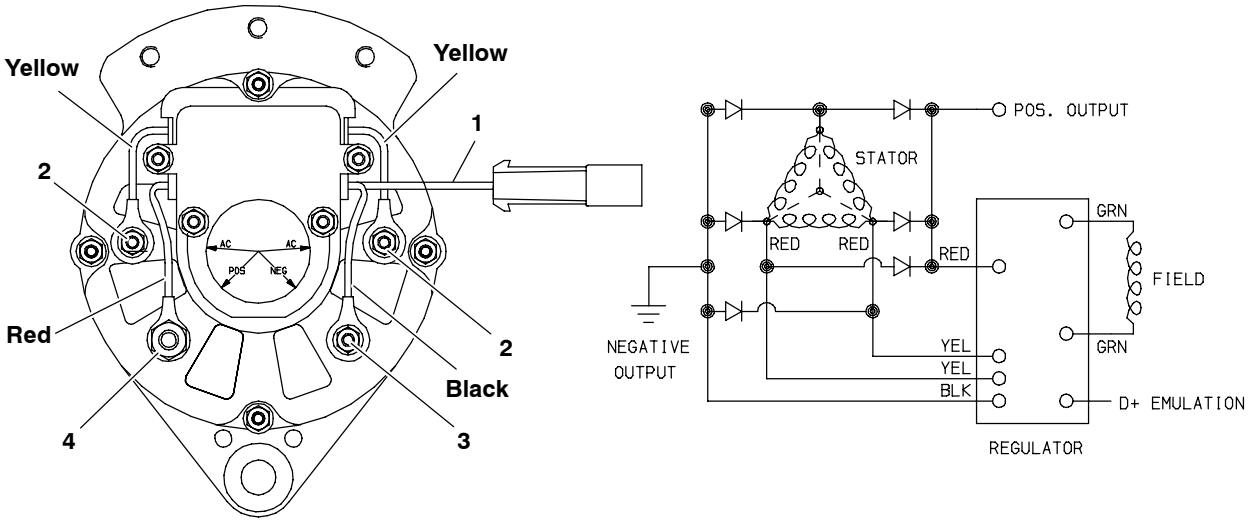
Figure 7-11. Compressor Cylinder Head Loaded

7.11 Battery Charging Alternator

7.11.1 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 (A.C.) 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 A.C. energy through a three phase, full-wave rectifier system. Six silicon rectifier diodes are used.



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 7-12. Alternator and Regulator P/N 30-00409-02

7.11.2 Integral Voltage Regulator Operation (12 volts dc)

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.

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.

7.12 Refrigerant Circuit During Cooling

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. **(See Figure 7-13 or Figure 7-14)**

The compressor raises the pressure and the temperature of the refrigerant and forces it 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 liquefy; thus liquid refrigerant leaves the condenser and flows through the solenoid valve SV-1 (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 receiver shutoff valve (King valve). The refrigerant then flows through 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 (SV-2) which starts or stops the flow of liquid refrigerant.

In R-404A units the refrigerant flows to the “Liquid Line/Suction Line” 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 (TXV) 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; thus, 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 trailer 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.

In R-404A units this low temperature, low pressure vapor passes through the “Liquid Line/Suction Line” heat exchanger where it absorbs more heat from the high pressure/high temperature liquid and then returns to the compressor.

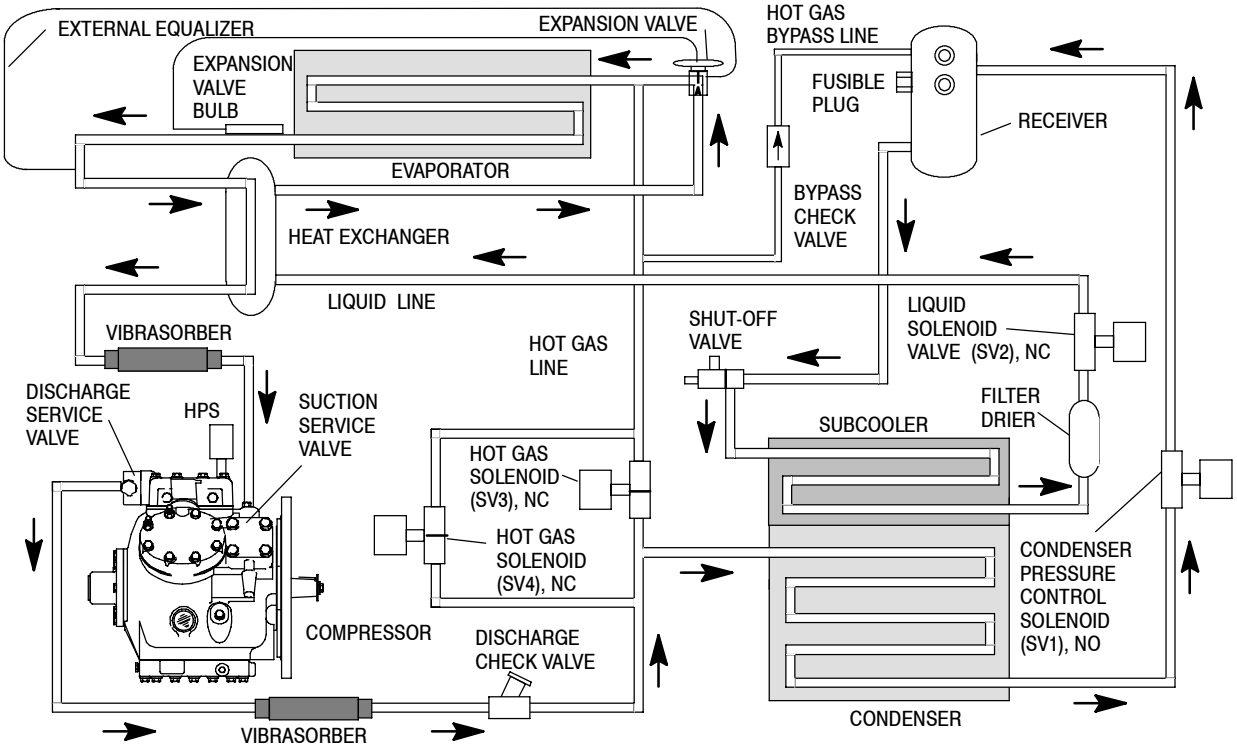


Figure 7-13. R-404A Refrigerant Circuit - Cooling

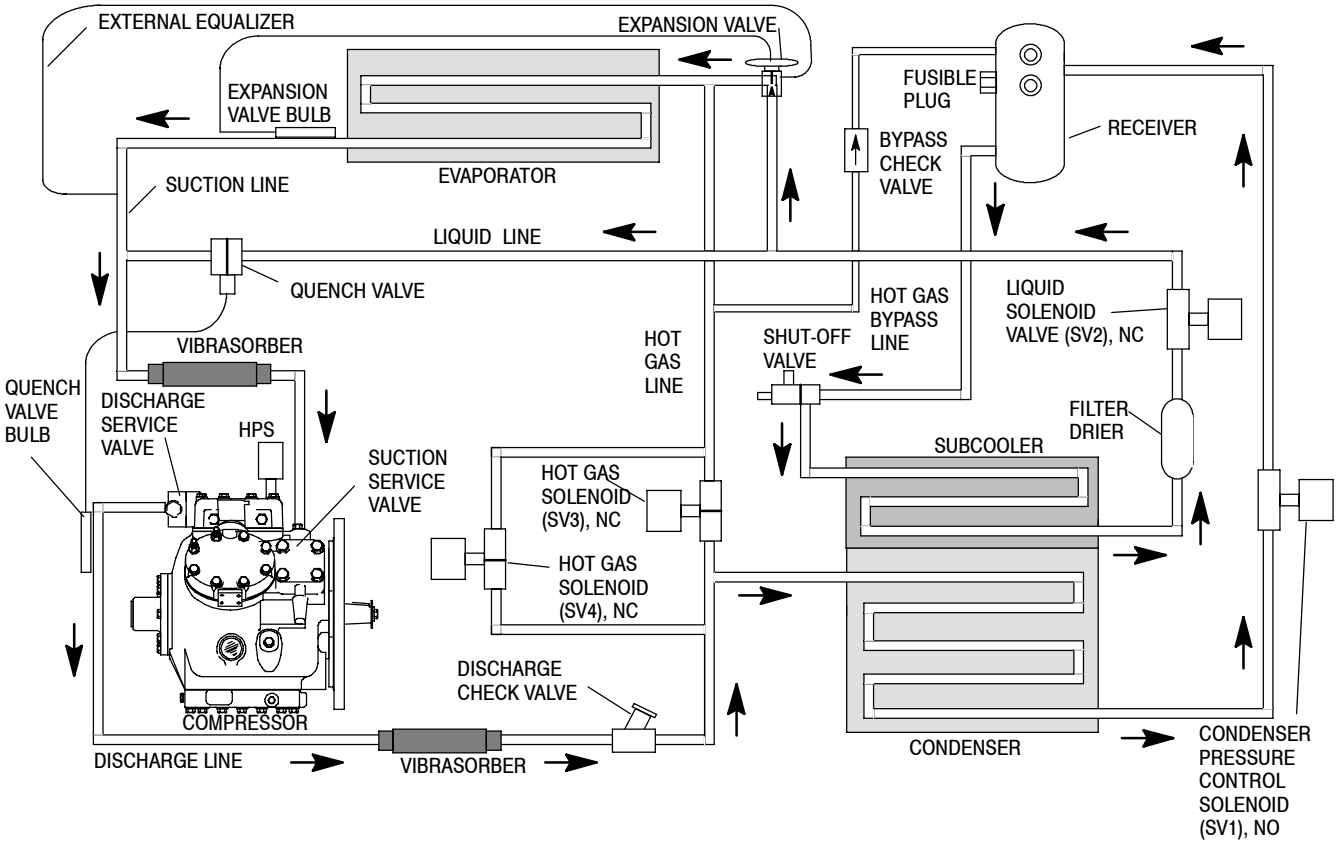


Figure 7-14. R-22 Refrigerant Circuit - Cooling

7.13 Refrigerant Circuit During Heating and Defrosting

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. **(See Figure 7-15 or Figure 7-16)**

7.13.1 Heating and Defrost

NOTES

1. Solenoid valve (SV-2) remains open during heating or defrosting to allow additional refrigerant to be metered into the hot gas cycle (through the expansion valve) providing additional heating capacity until de-energized by the microprocessor.
2. SV-3 will open under the following conditions:

   The unit is operating in High Speed, and
   Ambient Air Temperature (AAT) alarm is not active, and
   SV4 has been open for at least 60 seconds, and
   Ambient Air Temperature is less than 70°F (21.1°C), and
   CDT minus AAT is more than 100°F (55°C).
3. SV−3 will close under the following conditions:

   Ambient Air Temperature (AAT) alarm becomes active, or
   CDT minus AAT becomes less than 50°F (10°C), or
   Ambient Air Temperature rises to 80°F (26.7°C)

When the controller calls for heating, hot gas solenoid valve (SV-4) opens and the condenser pressure control solenoid valve (SV-1) closes. The condenser coil then fills with refrigerant, and hot gas from the compressor enters the evaporator. Also the liquid line solenoid valve (SV-2) will remain energized (valve open) until the compressor discharge pressure increases to cut-out setting in the microprocessor.

The microprocessor de-energizes the liquid line solenoid valve (SV-2) and the valve closes to stop the flow of refrigerant to the expansion valve.

When the compressor discharge pressure falls to cut-in setting, the normally closed liquid solenoid valve (SV-2) energizes and opens, allowing refrigerant from the receiver to enter the evaporator through the expansion valve.

When in engine operation and the discharge pressure exceeds pressure settings detailed in section 7.6, 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 0°F / −17.8°C) so that refrigerant flows from the receiver to the evaporator when needed.

7.13.2 Defrost with Greater Than 80°F (26.7°C)Ambient

If the ambient is greater than 80°F (26.7°C) the following stages are performed for defrost (Refer to Table 7-3). The first stage (Pump Down) runs for a minimum of thirty seconds and then checks the suction pressure. When the suction pressure is less than 10 PSIG, it will continue to stage 2. The total time in stage one cannot be greater than 330 seconds. If 330 seconds is reached stage two (Defrost Begins) will automatically be entered regardless of suction pressure. Stage 2 is defrost. Stage 3 (Defrost Termination) is the termination of defrost. When defrost is terminated SV4 will remain energized for 15 seconds.

Table 7-3. Stages for Defrost with Greater Than 80 °F (26.7°C) Ambient

STAGE	SV1	SV2	SV3	SV4	UR	UF	SPEED	CLH
1	OPEN	CLOSED	CLOSED	CLOSED	Energ	Energ	De-energ	Energ
2	CLOSED	HP2	CLOSED	OPEN	De-energ	Energ	Energ	De-energ
3	OPEN	OPEN	CLOSED	OPEN	De-energ	Energ	De-energ	Energ
De-energ = De-energized Energ = Energized								

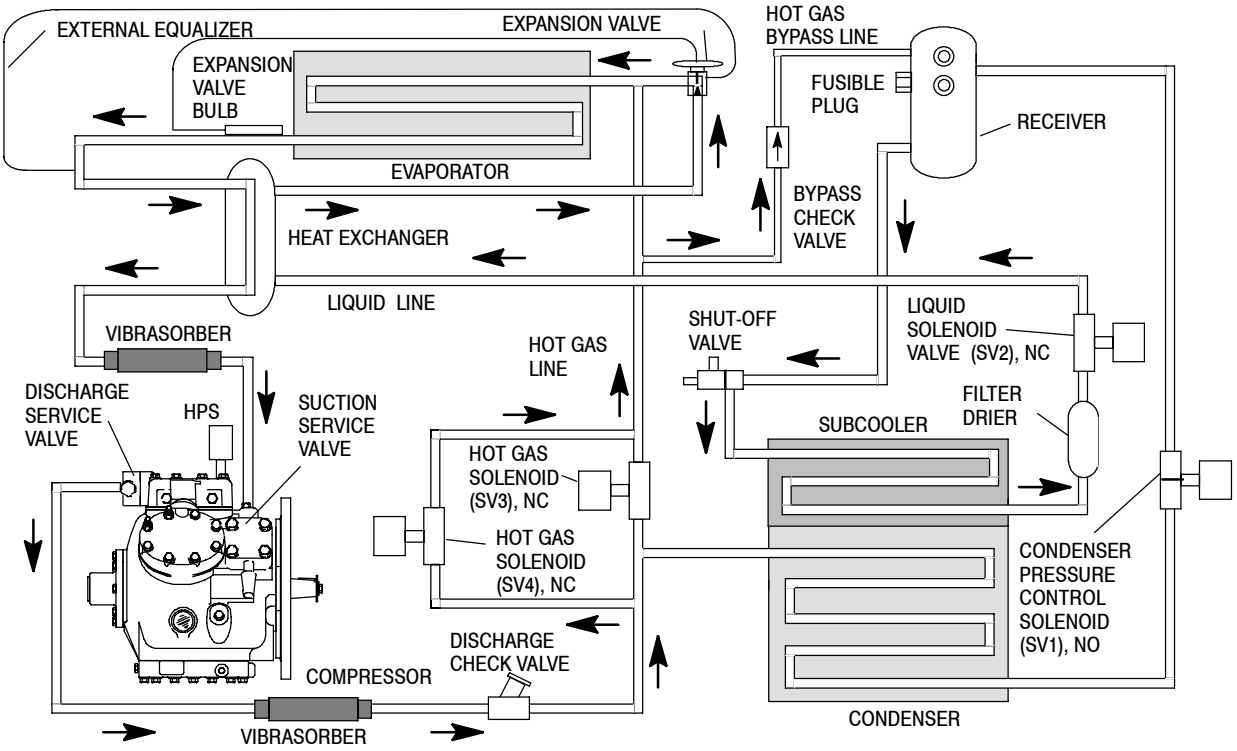


Figure 7-15. R-404A Refrigerant Circuit - Heating and Defrosting

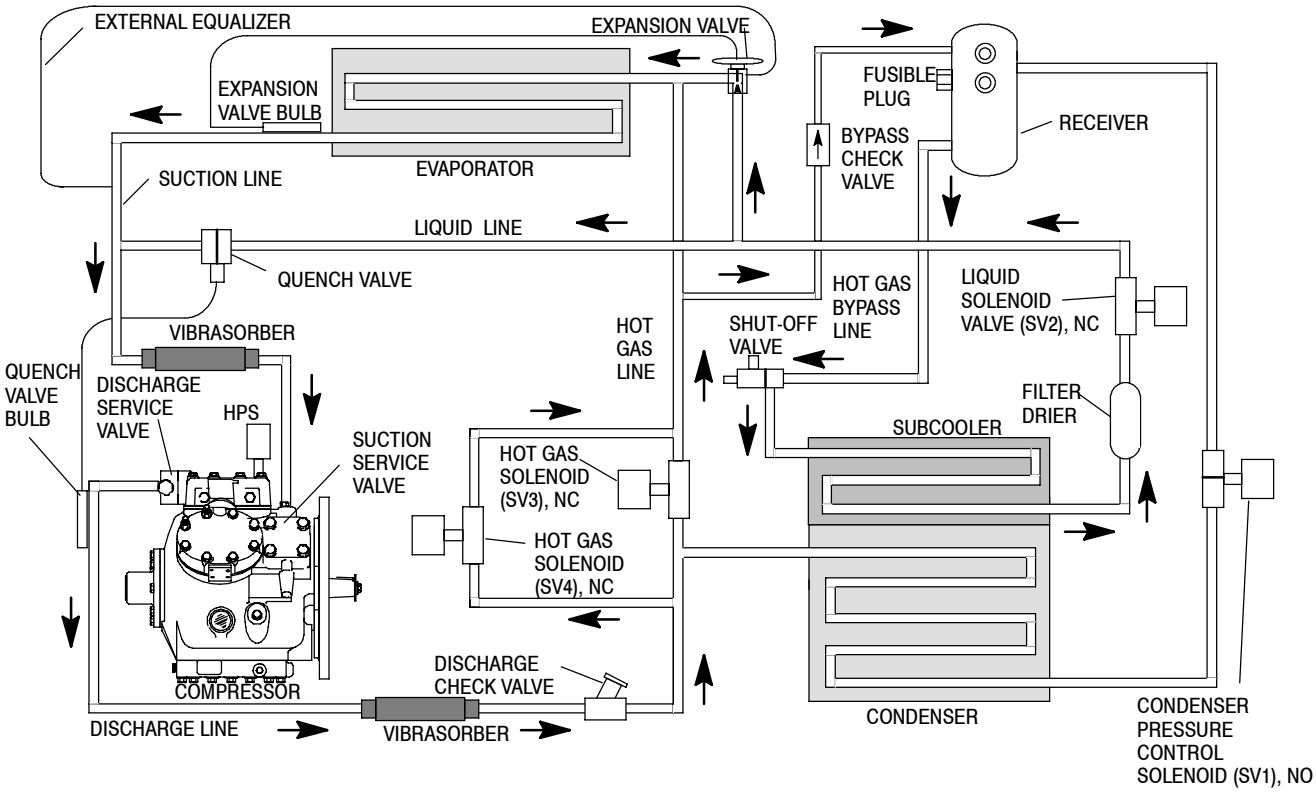


Figure 7-16. R-22 Refrigerant Circuit - Heating and Defrosting

Section 8 - Service

Section 8 - Service

WARNING: Beware of V-belts and belt driven components as the unit may start automatically. Before servicing unit, make sure the Run-Stop switch is in the STOP position. Also disconnect the negative battery cable.

CAUTION: Unit with R404A and POE oil, the use of inert gas brazing procedures is mandatory; otherwise compressor failure will occur. For more information see Technical Procedure 98-50553-00 Inert Gas Brazing

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.

8.1 Maintenance Schedule

UNIT		OPERATION	REFERENCE SECTION
ON	OFF		
a. Daily Maintenance			
X		1. Pre-Trip Inspection	Check
X		2. Check engine hours and hours to engine maintenance	Check
b. Every 1500 Hour or Annual Maintenance (Other hour intervals may apply. See Section 7.2)			
X	X	1. Perform 1500 hour Preventive Maintenance Inspection Form 62-02522-01. (Refer to Section 7.2 for oil change intervals.)	Check
	X	2. Tighten engine, compressor and unit mounting bolts	None
	X	3. Tighten all electrical connection in control box	Tighten
	X	4. Calibrate defrost air switch	8.27
	X	5. Clean air cleaner, check hose and connections	8.5.6
	X	6. Check water pump bearing end play	None
	X	7. Check alternator brushes	None
	X	8. Clean evaporator and condenser coils	8.28/8.29
	X	9. Check fuel pump (FP) filter	8.3
	X	10. Replace fuel filter(s) Reset Engine Maintenance Hour Meter in Function Change List	8.3
c. Every 3000 Hour Maintenance			
X	X	1. Complete a 1500 Hour Maintenance	8.1.b
	X	2. Clean crankcase breather	8.5.7
	X	3. Replace all V-belts	8.6
	X	4. Check starter condition	Engine Manual
	X	5. Check and adjust injector nozzles	Engine Manual
d. Every 6000 Hour or 2 Years Maintenance			
	X	1. Check and adjust injector nozzles	Engine Manual
	X	2. Check engine compression	Engine Manual
	X	3. Adjust engine valves	Engine Manual
X	X	4. Drain and flush cooling system	8.5.1

8.2 Priming Fuel System

a. Mechanical Fuel Pump

The mechanical fuel lift pump is mounted on the engine next to the injection pump. (Refer to Section 8.3) This pump has a manual plunger for bleeding fuel when the fuel tank has been run dry.

Since the unit employs a closed fuel circuit, it is recommended to use the following steps:

1. Turn the top of the manual plunger counter-clockwise to unlock it. (See Figure 7-1) Then, slowly (up/down once per second) pump the manual plunger up and down until a positive pressure (resistance) is felt, which will indicate fuel flow (about 100 strokes). This will bleed the air out of the fuel lines, and the fuel filter.
2. Turn bleed valve (Red) counter-clockwise until fully opened (See Figure 7-1).
3. Continue slowly pumping the manual plunger until the fuel system is completely full (about another 150 strokes). This will bleed any remaining air out of the fuel filter, and out of the injection pump.
4. Depress and turn the top of the manual plunger clockwise to lock in place.
5. Start engine.
6. When engine is running properly, turn bleed valve clockwise until fully closed.

b. Electrical Fuel Pump

If the unit is equipped with an optional electrical fuel pump, it will be mounted on the fuel tank mounting bracket.(Refer to Section 8.3) It is recommended to use the following steps to bleed out the fuel system:

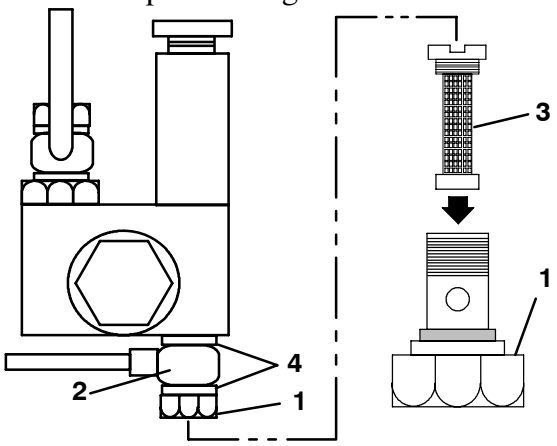
1. Open bleed valve located on top of the injection pump. (See Figure 7-1)
2. Place unit in Manual Start Mode. (Hold Glow/Crank Switch in the Glow position, then turn the Start/Run–Stop Switch to the Run position. Continue holding the Glow/Crank switch until the Main Display lights up.) This will turn on the electric fuel pump.
3. Allow the electric pump to operate for 2–3 minutes.
4. Start engine.
5. When engine is running properly, turn bleed valve clockwise until fully closed.

8.3 Servicing Fuel Pump

a. Mechanical Pump (See Figure 8-1)

Due to foreign particles in the fuel and wax as a result of using the wrong grade of fuel or untreated fuel in cold weather, the fuel filter may become plugged or restricted, and the engine will loose 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 8.1).

1. Turn nut counter-clockwise to loosen and remove (item 1, Figure 8-1).
2. Remove banjo fitting (item 2) and let it hang loose, making sure to keep copper rings (item 4) for replacement.
3. Turn filter (item 3) counter-clockwise and remove. Check and clean.
4. To install reverse steps 1 through 3.



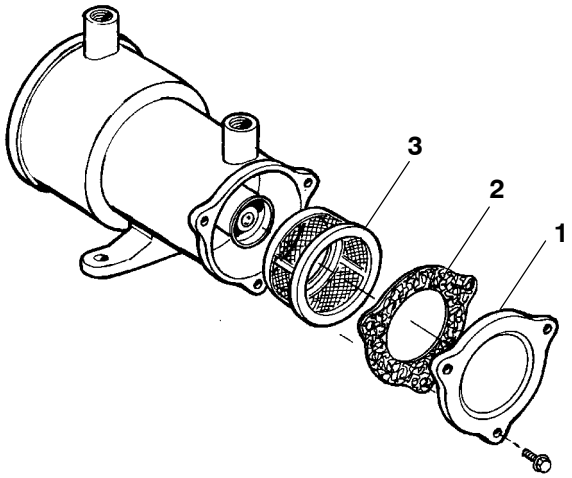
1. Nut
2. Banjo
3. Filter
4. Copper Rings

Figure 8-1. Mechanical Fuel Pump

b. Electrical Pump (See Figure 8-2)

To Check or Replace Filter

1. Remove 3 screws from cover (item 1, Figure 8-2).
2. Remove cover, gasket and filter.
3. Wash filter in cleaning solvent and blow out with air pressure. Clean cover.
4. To Install reverse above steps.



1. Cover
2. Gasket
3. Filter

Figure 8-2. Electric Fuel Pump (Optional)

8.4 Fuel Level Switch and Fuel Level Sensor

An optional fuel level switch or fuel level sensor is available for Advance Microprocessor units. Earlier units used a fuel level switch (p/n 12-00461-00) which have the ability to turn on the Check Fuel Level Alarm. Current units use a fuel level sensor (p/n 12-01147-00) which supplies an input signal to the microprocessor as to the % of fuel remaining in the fuel tank. The microprocessor then determines, based on the input signal, to turn on the Check Fuel Level Alarm when the level reaches 15%, and (if configured to do so) will turn the engine off when the level reaches 10%.

The 12-00461-00 switch has a fixed point within the extended rod that reacts to a full or low fuel level. There is no calibration required with this switch.

The 12-01147-00 sensor has the capability of sending the fuel level (from 0% to 100%) to the microprocessor. The fuel tank level will be displayed in the Unit Data List. This sensor may be calibrated if necessary.

8.4.1 Calibrating the 0 - 100% Fuel Level Sensor

NOTE: Both the Empty and the Full level settings should be calibrated whenever a new sensor is installed into a fuel tank.

a. Verify that the wiring is correct. See Figure 8-3 for correct wiring.

b. To adjust the Empty setting, make certain that the fuel tank is empty, and that the sensor is dry. If the sensor has been in the fuel, let it hang to dry for 2 hours before attempting to calibrate.

c. With the sensor in the tank, dry, and the tank empty, turn both the Full and Empty Adjustments to the full *clockwise* position.

d. Place Start/Run–Off switch in Start/Run position and place unit in Manual Start Mode.

e. Press the Select Key to bring up the Unit Data List. Scroll through the list until you reach Fuel Level :___%. Press the = key to lock the fuel level into the Message Center.

f. Slowly turn the Empty screw counter–clockwise until the display indicates 0%. DO NOT ADJUST ANY FURTHER.

g. Fill the tank with fuel until full.

h. Slowly turn the Full adjusting screw counter–clockwise until the display indicates 100%. DO NOT ADJUST ANY FURTHER.

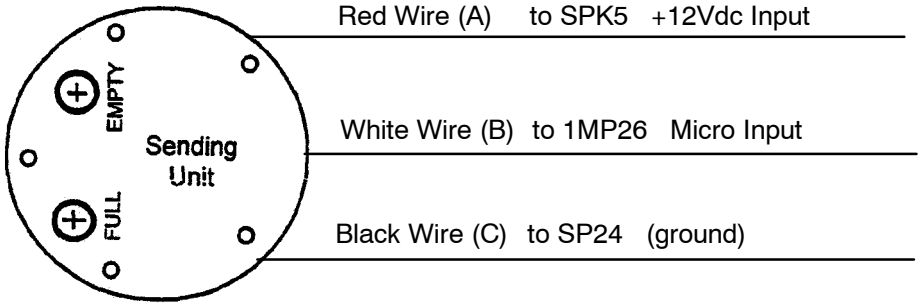


Figure 8-3. Fuel Sensor Wiring

8.4.2 Testing the 0 - 100% Fuel Level Sensor

a. Verify that the wiring to sensor is correct.

b. Check voltage at the Fuel Level Sensor with the SROS in the 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.

8.4.3 Testing the Fuel Level Switch

a. Verify that the wiring to switch is correct. See wiring schematic

b. Check voltage at the Fuel Level Switch with the Run Relay energized (Unit running, Unit off, Manual Start Mode selected, and test must be completed within 5 minutes – before the Failed To Start Manual Mode occurs, or Component Test Mode will energize the Run Relay for 5 minutes without starting the unit.)

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 Blue Wire (output) from the unit wiring. Voltage between Black Wire (negative) and Blue Wire (output) should be 12 VDC when the switch is immersed in fuel.

e. When the switch is removed from the fuel, residual fuel will evaporate quickly from the end of the switch. Once the fuel has evaporated, the voltage reading between Black Wire (negative) and Blue Wire (output) should be 0 VDC.

Figure 8-4. Fuel Level Switch Wiring

8.5 Engine Service and Components

8.5.1 Cooling System

Air flows through the radiator (Ultra, Ultra XL, & Extra units) or condenser/radiator (Ultima).

The radiator, externally and internally, must be clean for adequate cooling. The water pump V-belt must be adjusted periodically to provide maximum air flow. (Refer to Section 8.6.2)

Do the following to service the cooling system:

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 or equal.

a. Remove all foreign material from the radiator or condenser/radiator coil by reversing the normal air flow. (Air is pulled in through the front and discharges over the engine.) 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.

b. Drain coolant completely by removing lower radiator hose and radiator cap.

c. Install hose and fill system with clean water to which an akaline based radiator cleaner is added (use a good brand name heavy duty radiator flush, and follow the manufacturer's directions).

d. Run engine 6 to 12 hours and drain system while warm. Rinse system three times after it has cooled down. Refill system with water.

e. Run engine to operating temperature. Drain system again and fill with 50/50 water/anti-freeze mixture. (see Caution Note and refer to Section 7.2) NEVER POUR COLD WATER INTO A HOT ENGINE, however hot water can always be added to a cold engine.

8.5.2 Testing the Coolant Level Switch

a. Verify that the wiring to switch is correct. See wiring schematic,

b. Check voltage at the Coolant Level Switch with the Run Relay energized (Unit running, Unit off, Manual Start Mode selected, and test must be completed within 5 minutes – before the Failed To Start Manual Mode occurs, or Component Test Mode will energize the Run Relay for 5 minutes without starting the unit.)

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 Blue Wire (output) from the unit wiring. Voltage between Black Wire (negative) and Blue Wire (output) should be 12 VDC when the switch is immersed in coolant.

e. When the switch is removed from the coolant, residual coolant will evaporate quickly from the end of the switch. Once the coolant has evaporated (approximately 30 seconds), the voltage reading between Black Wire (negative) and Blue Wire (output) should be 0 VDC.

NOTE: Perform this test using 50–50 ethelene glycol and water mixture only. This test will not perform correctly if only water is used.

8.5.3 Testing the RPM Sensor

a. Verify that the wiring to sensor is correct. See wiring schematic section.

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 5 minutes – before the Failed To Start Manual Mode occurs, or Component Test Mode will energize the Run Relay for 5 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 worn wire) the Message Center will show

Suction Pressure: -14.7 psig
Discharge Pressure: 0 psig
Engine RPM: 0.

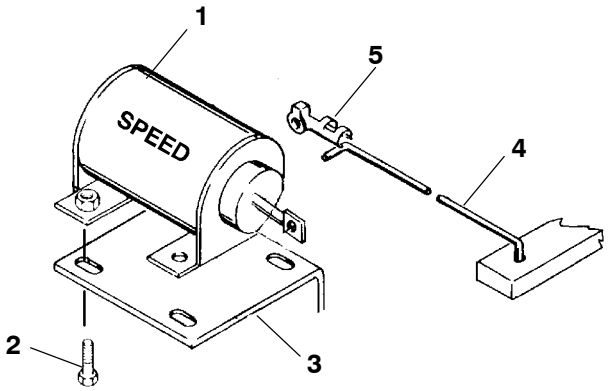
8.5.4 Lube Oil Filters

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 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 7.2) Warm up engine and check for leaks.

8.5.5 Servicing the Speed Control Solenoid and Linkage



1. Solenoid
2. Bolt
3. Solenoid Bracket
4. Linkage (Speed)
5. Clip

Figure 8-5. Speed Control Solenoid

a. Disconnect wiring to solenoid. Disconnect linkage arm (item 4, Figure 8-5) 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.

d. Hold the speed lever against the low speed stop and check the RPM's. Adjust the low speed stop screw if necessary. See Section 7.1.

e. Check engine speed. With the engine stopped, place a mark on the crankshaft sheave (white paint for example). Speed may be verified in the microprocessor Data List by locking in the RPM in the display, or using a Strobette model 964 (strobe-tachometer) Carrier Transicold P/N 07-00206.

f. Hold the speed lever against the high speed stop and check the RPM's.

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 86-03027-00 speed solenoid adjusting bracket with solenoid adjusting bolt and lockout (on the bracket).

If high speed adjustment is required:

1. Loosen but do not remove the 4−speed solenoid mounting nuts.
2. Adjust low speed as normal using the low speed adjusting screw on the engine speed lever plate. This screw is not seal wired.
3. 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.

8.5.6 Engine Air Cleaner

a. Inspection

The dry type air cleaner should be inspected regularly for leaks. A damaged air cleaner or hose can seriously affect the performance and life of the engine. The air cleaner is designed to effectively remove contaminants from the air stream entering the engine. An excessive accumulation of these contaminants in the air cleaner will impair its operation, therefore, a service schedule must be set up and followed. Remember that the air cleaner cleans the air, but the air cleaner requires cleaning. The following simple service steps are easily made while the engine is being serviced in the field.

The simple inspection steps are as follows:

1. Check all connections for mechanical tightness. Be sure cleaner 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.*

b. Air Cleaner Service Indicator

The air cleaner indicator is connected to the engine air intake manifold and its function is to indicate when the air cleaner requires replacing. In operation: When a plugged air cleaner decreases intake manifold pressure to 20" (500 mm) WG, the indicator moves to the red line. The air cleaner should be replaced and the indicator reset by pressing the reset button.

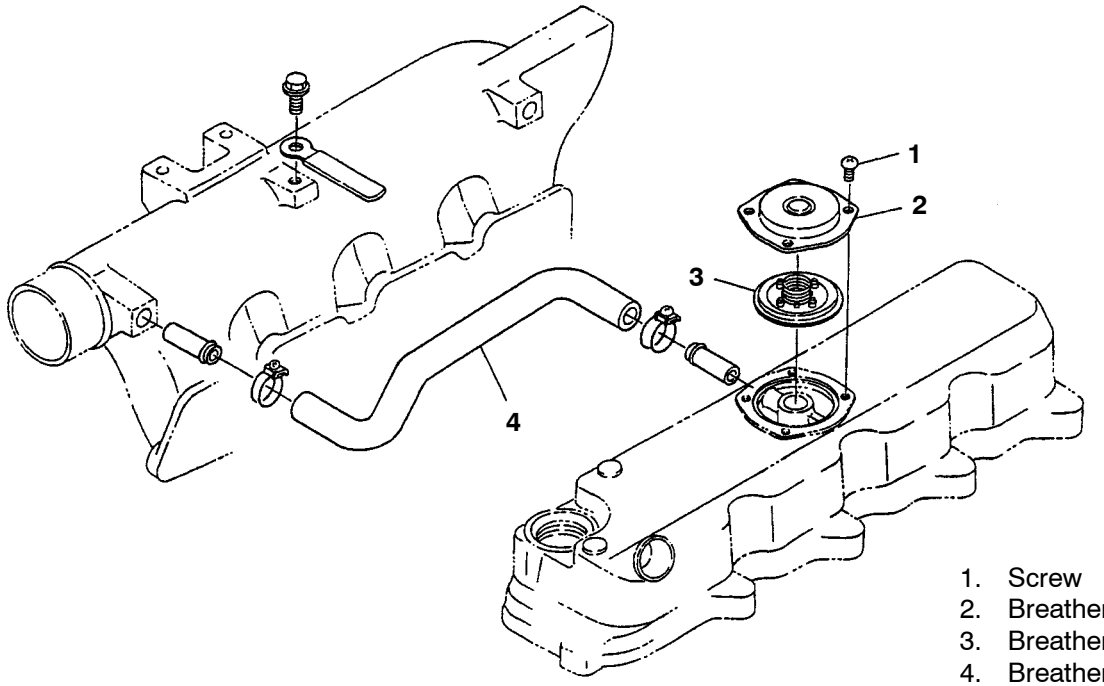
c. Service Procedure

1. Stop the engine, remove air cleaner. Install new air cleaner.

8.5.7 Engine Crankcase Breather

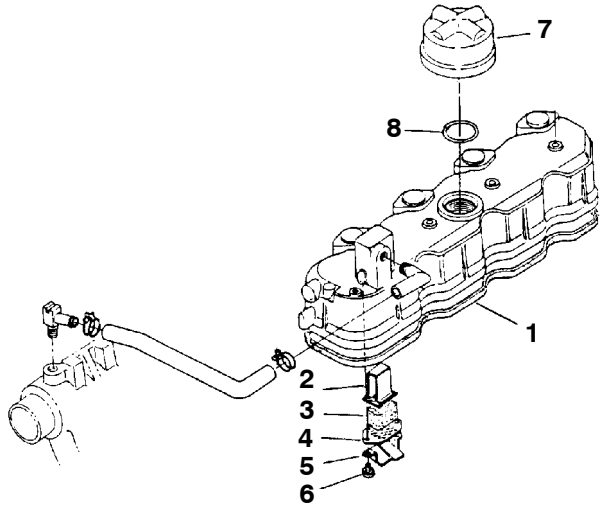
The engine uses a closed type breather with the breather line attached to the cylinder head cover. (See Figure 8-6 or Figure 8-7)

The breather assembly should be cleaned once a year or at every 3000 hours maintenance interval (whichever comes first).



1. Screw
2. Breather Cover
3. Breather Valve
4. Breather Tube

Figure 8-6. DI Engine Crankcase Breather



1. Cylinder Head Cover
2. Breather Cover
3. Breather Element
4. Plate
5. Breather Oil Shield
6. Bolt
7. Breather Assembly
8. O-Ring

Figure 8-7. TV Engine Crankcase Breather

8.5.8 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 7 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).

Checking for a Defective Glow Plug

a. The entire circuit may be tested using Component Test Mode. (Refer to Section 2.17.3)

b. 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).

c. 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.

8.6 Servicing and Adjusting V-belts

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

8.6.1 Belt Tension Gauge

It is recommended using a belt tension gauge (tester) P/N 07-00253, shown in Figure 8-8 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 8-9)

The V-belts must be kept in good condition with the proper tension to provide adequate air movement across the coils.

Table 8-1. Belt Tension (See Figure 8-8)

BELTS	Tension
Water pump to Crankshaft	35 to 40
Clutch/Gearbox to Fan shaft	70 to 80
Clutch/Gearbox to Compressor	70 to 80
Gearbox to Alternator **- Ultima 53**	40 to 50
Clutch/Gearbox to Alternator **- Ultra/Extra**	40 to 50

Figure 8-8 Belt Tension Gauge (Part No. 07-00253)

8.6.2 Water Pump V-Belt

The water pump 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.

When replacing V-belt, avoid excessive force when applying tension to the V-belt to prevent damage to the water pump bearings. (Refer to Table 8-1)

8.6.3 Alternator V-Belt

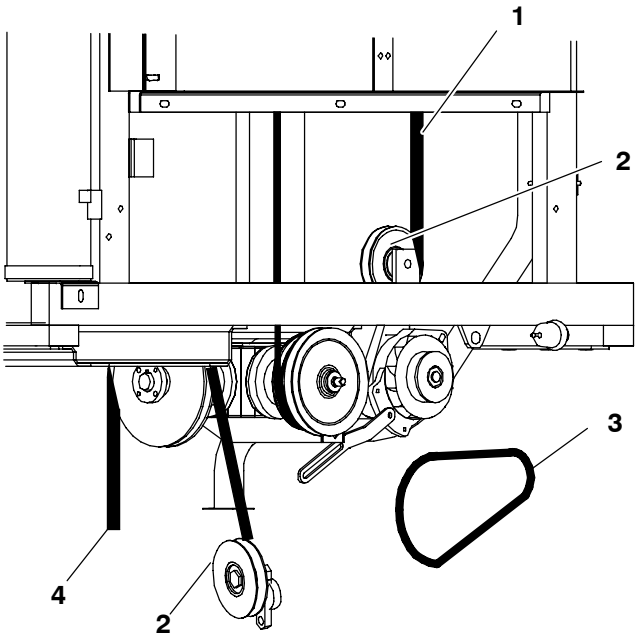
a. Make sure negative battery terminal is disconnected and remove old belt.

b. Place V-belt on alternator sheave and then install alternator with two bolts loosely in position.

c. Check the center alignment of the Gearbox/Clutch (Ultra, Ultra XL & Extra) or Gearbox (Ultima) drive pulley and alternator pulley, to ensure proper alignment. Pulley misalignment will create excess belt wear and shorten alternator bearing life. The center line of the alternator sheave, and the drive sheave 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 8-1. Tighten pivot and adjustment bolts.

e. Reinstall negative battery cable.



1. Evaporator/Condenser Fan V-Belt
2. Idler Pulley
3. Alternator V-Belt
4. Drive V-Belt

Figure 8-9. V-Belt Arrangement

8.6.4 Driveshaft to Gearbox and Gearbox To Fan Shaft V-Belt

a. Gearbox to Fan Shaft V-Belt

To Replace V-belt:

1. Disconnect negative battery cable and remove V-belt guard.
2. Loosen idler pulley.
3. Remove old belt and replace with new belt. (See Figure 8-9)
4. Using a belt tension gauge (Figure 8-8) on the belt, rotate idler pulley so that the gauge reads the correct tension (Refer to Table 8-1).
5. Tighten idler, carriage bolt, and bolts.

NOTE: Both belts must be checked and retensioned, if necessary, after a brief run-in period. (see step 6)

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.

6. Reconnect negative battery cable, and operate unit in high speed for 5–10 minutes. Repeat steps 4 and 5.
7. Replace belt guard.

b. Driveshaft to Gearbox 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 8-10A) for ease of assembly.
3. Remove six bolts (5/16-18 x 1 lg) securing adapter drive sheave to engine flywheel, Figure 8-10A.
4. Insert 2 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 2 screws from adapter. Insert a pry bar between engine flywheel and adapter, Figure 8-10A and slide the adapter-sheave toward the compressor enough to change the V-belt as shown in Figure 8-10B. 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 will start in the 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 8-1. Install V-belt guard. DO NOT START UNIT UNTIL V-BELT GUARD IS INSTALLED.

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.

7. Reconnect negative battery cable. Start unit and run for 10 minutes to allow for belt stretch.
8. Turn unit off and recheck belt tension. Install belt guard.

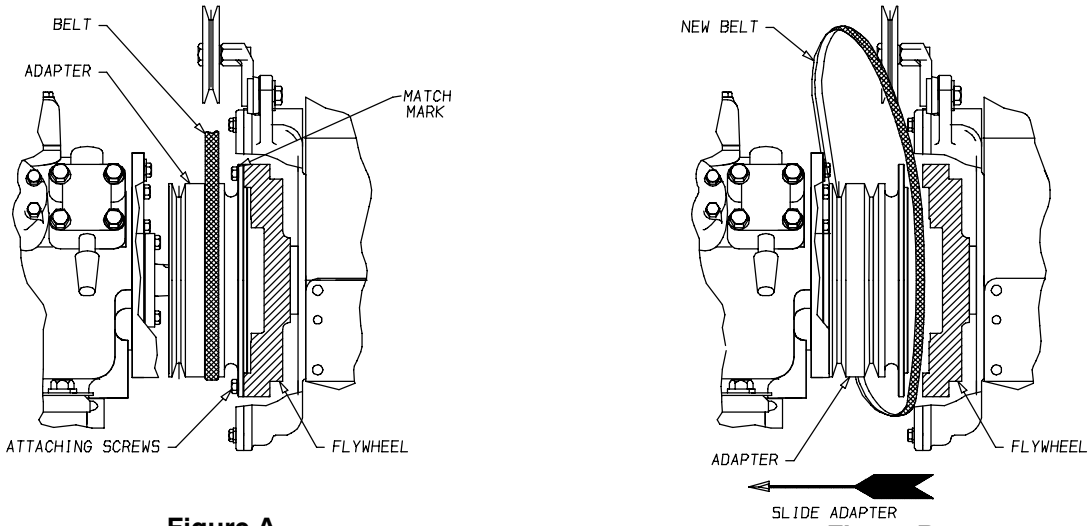
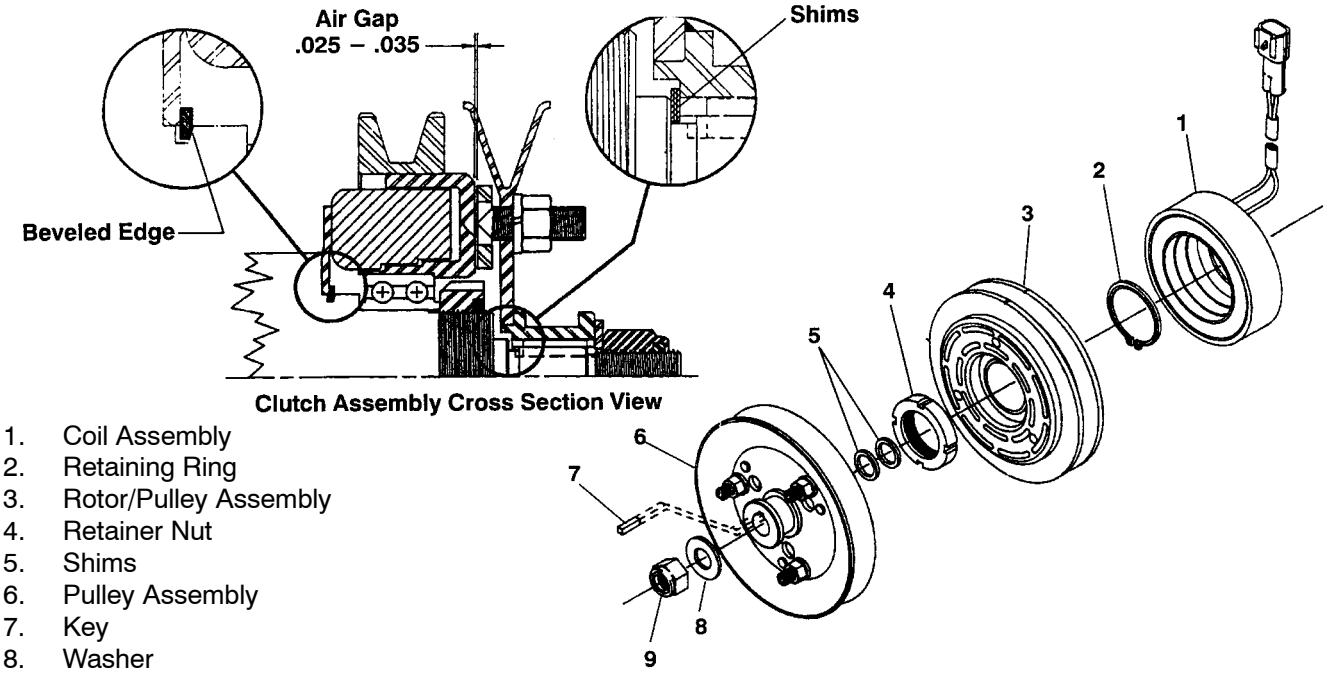


Figure A **Figure B**

Figure 8-10. Removing V-Belt from Engine Adapter Drive Sheave

8.7 Gearbox Clutch (Ultra, Ultra XL, & Extra)



1. Coil Assembly
2. Retaining Ring
3. Rotor/Pulley Assembly
4. Retainer Nut
5. Shims
6. Pulley Assembly
7. Key
8. Washer
9. Nut

Figure 8-11. Gearbox Clutch

a. Clutch Removal

1. Disconnect electrical input.
2. Remove armature/pulley assembly (Figure 8-11, 6)
   a. Remove shaft nut (9) and washer (8).
   b. Using a standard 2– or 3–jaw gear puller, pull the armature (6) off the shaft. Apply the puller jaws to the pulley hub, not the rim of the pulley.
   NOTE: The armature pulley has been located to the shaft.
   c. Remove the shaft key (7) and shims (5).
3. Remove rotor/pulley assembly (3)
   a. Remove bearing retainer nut (4) using removal tool 07-00303-01.
   b. Slide rotor/pulley assembly (3) from gearbox housing.
4. Remove the field coil assembly (1)
   a. Remove field coil assembly retaining ring (2).
   b. Remove field coil assembly (1) from gearbox.

b. Clutch Installation

1. Install field coil assembly (1)
   a. Place field coil assembly (1) on pilot diameter of gearbox. Align slot in field coil assembly with locator pin in gearbox housing.
   b. Install field coil retaining ring (2). **IMPORTANT: The retaining ring's beveled or tapered edge must face away from the gearbox to obtain proper retention force.**
2. Install rotor/pulley assembly (3)

a. Slide rotor/pulley onto gearbox housing. **DO NOT POUND** on rotor assembly; rock back and forth gently with hand pressure until unit slides on.

b. Install bearing retainer nut (4). Tighten nut to 65 lb-ft. Rotor should spin free without noise.

3. Install armature/pulley assembly (6)

a. Slide armature assembly (6) onto gearbox shaft. Measure air gap between armature face and rotor face using Air Gap Tool 07−00360−01, or a wire type feeler gauge. Three access holes are provided in the pulley face.

b. If the air gap is less than 0.020 in., remove armature assembly and add shim(s) (5) to shaft as shown in Figure 8-11. Use only new shims.

c. Repeat steps a. and b. until an average air gap of 0.020 to 0.025 in. is obtained.

d. Install a new key (7) in shaft.

e. Apply Loctite #609 to shaft and pulley hub bore. Slide armature/pulley onto gearbox shaft.

f. Install washer (8) and lock nut (9). NOTE: two types of locking nuts may be used −

- Standard nylon locknut uses flat washer and requires 65−70 ft/lbs. torque.
- Upset thread type with integral washer DOES NOT use a separate washer and requires 55−60 ft/lbs. torque − DO NOT over−tighten this type.

8.8 Replacing Condenser/ Evaporator Fan Shaft or Bearing (Ultra, Ultra XL, & Extra)

WARNING: Beware of V-belts and belt driven components as the unit may start automatically. Before servicing unit, make sure the Run-Stop switch is in the OFF position. Also disconnect the negative battery cable.

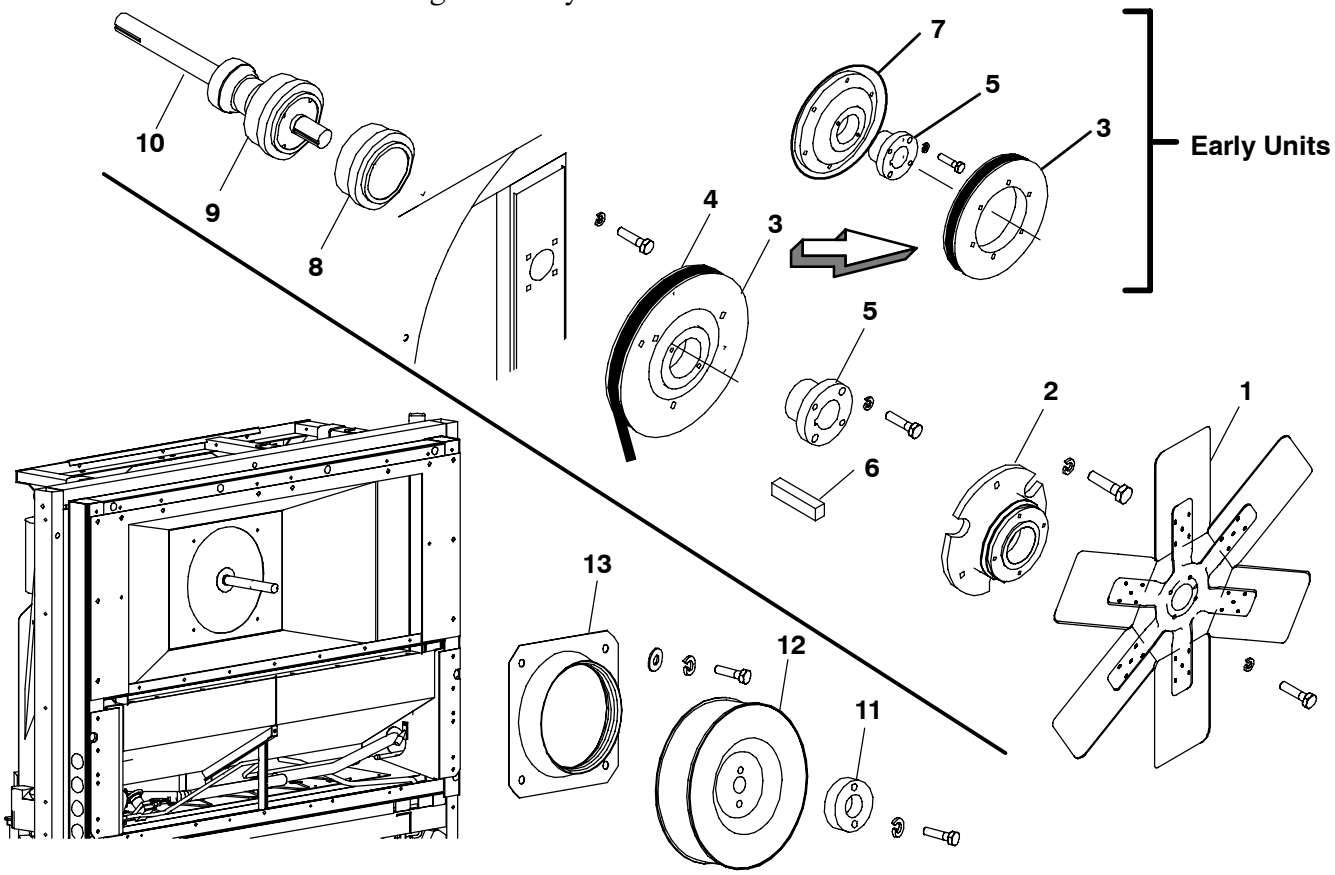
a. To Remove the Fan Shaft

1. Disconnect negative battery cable.
2. Remove 4 screws securing condenser fan (item 1, Figure 8-12) to adapter.
3. Remove V-Belt. (Refer to Section 8.6.4.)
4. Remove 3 screws securing adapter (item 2).
5. Remove 3 screws securing sheave (item 3).
6. Remove tapered bushing (item 5) and flange (item 7) on early units.
7. Remove evaporator panels.
8. Remove two screws securing split tapered bushing, to blower wheel (items 12 and 13, Figure 8-12). Place the two screws in the threaded holes of the taper bushing and use screws as jacking bolts to remove bushing from blower wheel.
9. Remove venturi ring (item 13, Figure 8-12) by removing 4 screws.
10. Remove 4 screws from the bearing housing (item 9, Figure 8-12).
11. Remove the shaft and bearing housing.
12. Install bearing housing assembly into unit by reversing steps 1 through 9 with a new gasket (item 8) or using caulk. Torque taper bushing bolt to 10−11 ft/lbs.
13. Locate the fan and key so that 1/3 of the condenser fan extends beyond the leaving edge of the fan shroud. Secure fan and hub to shaft.

14. Install evaporator fan venturi ring. Then install tapered hub and blower wheel loosely. Adjust blower wheel and tighten.
15. Install evaporator panels.

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

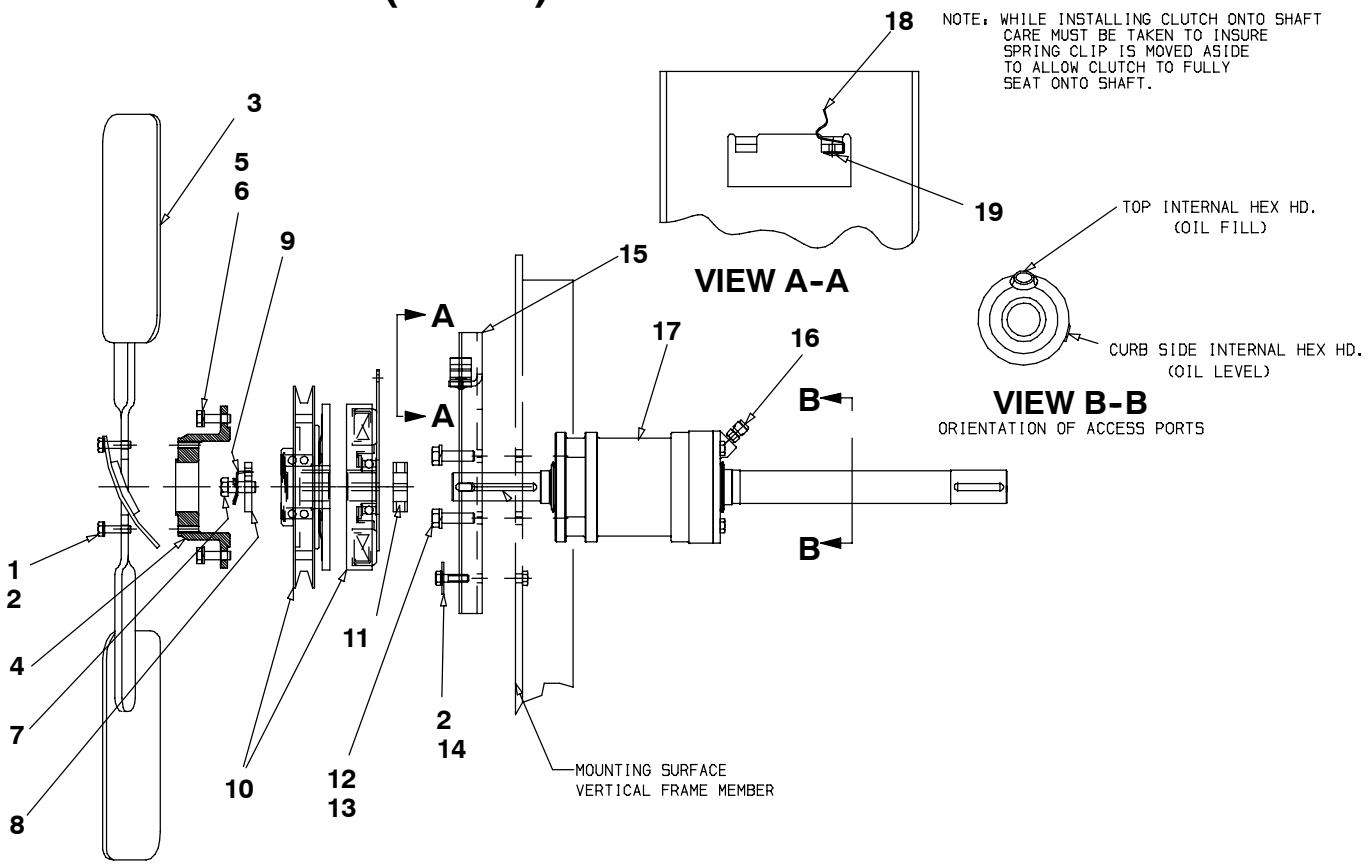
16. Start unit and check refrigeration cycle.



1. Condenser Fan
2. Adapter Condenser Fan
3. Sheave
4. V-Belt
5. Split Tapered Bushing
6. Key
7. Flange Condenser Fan
8. Gasket (Prior to S/N DAF90213555)
9. Bearing Housing
10. Shaft
11. Bushing
12. Blower Wheel
13. Venturi Ring

Figure 8-12. Evaporator/Condenser Fan Shaft Assembly (All Models Except Ultima)

8.9 Replacing Condenser/Evaporator Fan Shaft or Fan Clutch (Ultima)



1. Screw Hex Head 1/4-20 X 1lg
2. Lock Washer 1/4
3. Condenser Fan
4. Adapter
5. Screw Hex Head 5/16-18 X 1lg
6. Lock Washer 5/16
7. Screw Hex Head 3/8-16 X 1lg
8. Special Washer
9. Retainer Washer
10. Clutch
11. Special Washer
12. Screw Hex Head 3/8-16 X 1.5lg
13. Lock Washer 3/8
14. Special Washer
15. Plate
16. Pressure Relief Valve
17. Bearing Housing
18. Clip
19. Screw Hex Head #10-32 X .25lg

Figure 8-13. Evaporator/Condenser Fan Shaft Assembly (Ultima)

WARNING: Beware of V-belts and belt driven components as the unit may start automatically. Before servicing unit, make sure the Run-Stop switch is in the OFF position. Also disconnect the negative battery cable.

a. To Remove the Clutch (See Figure 8-13)

NOTE: The air gap between the clutch contact surfaces is non-adjustable. The original air gap is set to 0.020" and can wear up to 0.040" before replacement is needed.

1. Disconnect the negative battery cable.
2. Remove top 8 bolts (4 along top edge and 2 down each side) that hold fan shroud to condenser frame. Remove top frame cross member (6 bolts).
3. Pry top of shroud away from frame and hold it open by inserting any object about 3.50" deep between frame and shroud on each side (short pieces of 2 X 4's works well).
4. Loosen the fan belt idler and remove belt.

5. Remove the 3 bolts (item 5) which secure the condenser fan and hub assembly (items 3, 4) to the clutch and carefully remove condenser fan assembly from unit.
6. Bend the lock tabs of the retaining washer (item 9) away from the clutch mounting bolt (item 7).
7. Using an 1/4" Allen wrench or rod, slide it through the notch on either side of the backer plate (item 15) until it touches the washer behind the clutch. Slowly rotate the fan shaft while applying a slight pressure to the rod until the rod slips into one of the anti-rotation holes in the washer. With the rod in place, remove the bolt and washers (items 7, 8 & 9) which secure the clutch onto the shaft.
8. Remove the clutch pulley/armature from the shaft (be careful not to get the anti-seize compound on the clutch engagement surfaces if clutch is to be reused).
9. Unplug the wire connector to the clutch rotor/field assembly and remove from the shaft.
10. Remove the spacer washer which was behind coil. Discard this washer and use new (improved) washer included in kit.
11. Remove key from key way (if damaged).
12. Install clutch on fan shaft assembly by reversing steps 1-7. Add a thin coating of anti-seize compound to new clutch bore. Do not get anti-seize compound on clutch contact surfaces. Be sure to align anti-rotation tang of rotor/field assembly (12 o'clock position) between the two backer plate supports while sliding it into position and also pull the tension clip (item 18) out of the way (about 1") to fully seat this clutch half. Orient retainer washer (9) so that bent tab is inserted into key way, then bend two tabs over the bolt. Clutch bolts torque is 25 to 30 ft/lbs.

b. To Remove the Fanshaft / Bearing Assembly (See Figure 8-13)

1. First complete clutch removal refer to steps above.
2. Remove washer (item 11) from shaft (behind clutch).
3. Remove evaporator panels.
4. Remove two screws securing split tapered bushing, to blower wheel (items 12 and 13, Figure 8-13). Place the two screws in the threaded holes of the fan hub and use screws as jacking bolts to remove bushing from blower wheel.
5. Remove venturi ring (item 13, Figure 8-13) by removing 4 screws.
6. Remove clamp from rubber boot on the back of the fan shaft housing and remove the 6 bolts and ring securing the boot to the pod.
7. Remove 4 screws from the bearing housing (item 17).
8. Remove the shaft and bearing housing.
9. Install bearing housing assembly into the unit by reversing steps 1 through 8. Torque 45 to 50 in/lb the 6 bolts which hold the boot and ring to the pod.

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

10. Start unit and check refrigeration cycle.

8.10 Pumping Unit Down or Removing Refrigerant Charge

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.

a. Pumping the Unit Down

To service the filter-drier, liquid line solenoid valve (SV-2), expansion valve, quench valve, evaporator coil, or heat exchanger pump most of refrigerant into condenser coil and receiver as follows:

1. Backseat suction and discharge service valve (turn counterclockwise) to close off gauge connection and attach manifold gauges to valves.
2. Open valves two turns (clockwise). Purge gauge line.
3. Close the receiver outlet valve (King Valve) by turning clockwise. Start unit and run in high speed cooling. Place Run-stop switch in the STOP position when unit reaches 1 psig (0.1 kg/cm^2).
4. Frontseat (close by turning clockwise) suction service valve and the refrigerant will be trapped between the compressor suction service valve and the King Valve.
5. Before opening up any part of the system, a slight positive pressure should be indicated on the pressure gauge.
6. When opening up the refrigerant system, certain parts may frost. Allow the part to warm to ambient temperature before dismantling. This avoids internal condensation which puts moisture in the system.
7. After making necessary repairs, leak test and evacuate the low side of the refrigeration system. (Refer to Section 8.12)
8. Open (backseat) King valve and midseat suction service valve.
9. Start the unit in cooling and check for noncondensibles.
10. Check the refrigerant charge. (Refer to Section 8.13.f)

NOTE: Store the refrigerant charge in an evacuated container if the system must be opened between the compressor discharge valve and receiver. Whenever the system is opened, it must be evacuated and dehydrated. (Refer to Section 8.12)

b. Removing the Refrigerant Charge

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

8.11 Refrigerant Leak Checking

a. If system was opened and repairs completed, leak check the unit.

b. The recommended procedure for finding leaks in a system is with an electronic leak detector or halide torch. Testing joints with soapsuds is satisfactory only for locating large leaks, or pinpointing small leaks once a general area has been located.

c. If system is without refrigerant, charge system with refrigerant to build up pressure between 30 to 50 psig (2.1 to 3.5 kg/cm^2). Remove refrigerant drum and leak check all connections.

NOTE: It must be emphasized that only the correct refrigerant drum be connected 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.

d. Remove refrigerant using a refrigerant recovery system and repair any leaks. Evacuate and dehydrate the unit. (Refer to Section 8.12) Charge unit with refrigerant. (Refer to Section 8.13)

8.12 Evacuation and Dehydration

8.12.1 General

Moisture is the deadly enemy of refrigerant systems. The presence of moisture in a refrigeration system can have many undesirable effects. The most common are copper plating, acid sludge formation, "freezing-up" of metering devices (TXV) by free water, and formation of acids, resulting in metal corrosion.

8.12.2 Preparation

a. Evacuate and dehydrate only after pressure leak test. (Refer to Section 8.11)

b. Essential tools to properly evacuate and dehydrate any system include a good vacuum pump (5 cfm / 8m^{3}H volume displacement, P/N 07-00176-11) and a good vacuum indicator such as a thermocouple vacuum gauge (vacuum indicator). (Available through Robinair Manufacturing, Montpelier, Ohio, Part Number 14010.)

NOTE: It is not recommended using a compound gauge because of its inherent inaccuracy.

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

8.12.3 Procedure for Evacuation and Dehydrating System

a. Remove refrigerant using a refrigerant recovery system.

b. The recommended method to evacuate and dehydrate the system is to connect three evacuation hoses (Do not use standard service hoses, as they are not suited for evacuation purposes.) as shown in Figure 8-14 to the vacuum pump and refrigeration unit. Also, as shown, connect a evacuation manifold, with evacuation hoses only, to the vacuum pump, electronic vacuum gauge, and refrigerant recovery system.

c. With the unit service valves closed (back seated) and the vacuum pump and electronic vacuum gauge valves open, start the pump and draw a deep vacuum. Shut off the pump and check to see if the vacuum holds. This operation is to test the evacuation setup for leaks, repair if necessary.

d. Midseat the refrigerant system service valves.

e. Then open the vacuum pump and electronic vacuum gauge valves, if they are not already open. Start the vacuum pump. Evacuate unit until the electronic vacuum gauge indicates 2000 microns. Close the electronic vacuum gauge and vacuum pump valves. Shut off the vacuum pump. Wait a few minutes to be sure the vacuum holds.

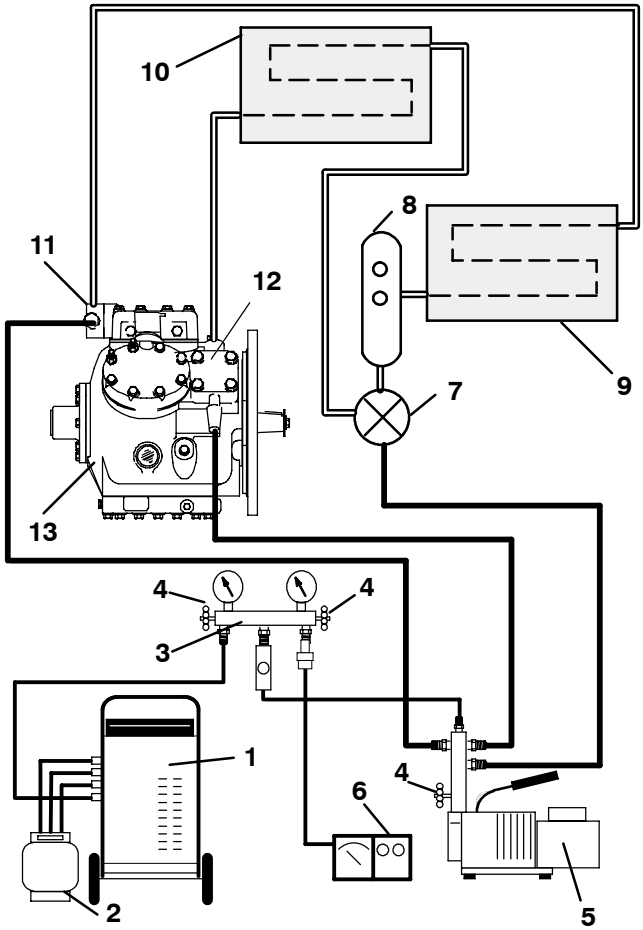
f. Break the vacuum with clean dry refrigerant. Use refrigerant that the unit calls for. Raise system pressure to approximately 2 psig.

g. Remove refrigerant using a refrigerant recovery system.

h. Repeat steps e through g one time.

i. Evacuate unit to 500 microns. Close off vacuum pump valve and stop pump. Wait five minutes to see if vacuum holds. This checks for residual moisture and/or leaks.

j. With a vacuum still in the unit, the refrigerant charge may be drawn into the system from a refrigerant container on weight scales. The correct amount of refrigerant may be added by observing the scales. (Refer to Section 8.13)



1. Refrigerant Recovery Unit
2. Refrigerant Cylinder
3. Evacuation Manifold
4. Valve
5. Vacuum Pump
6. Vacuum Gauge
7. King Valve
8. Receiver
9. Condenser
10. Evaporator
11. Discharge Valve
12. Suction Valve
13. Compressor

Figure 8-14. Vacuum Pump Connection

8.13 Adding Refrigerant to System

8.13.1 Full Charge – R-22 or R-404A

a. Dehydrate unit and leave in deep vacuum. (Refer to Section 8.12)

b. Place drum of refrigerant on scale and connect charging line from drum to King Valve. Purge charging line at outlet valve.

c. Note weight of drum and refrigerant.

d. Open liquid valve on drum. Open King Valve half way and allow the liquid refrigerant to flow into the unit until the correct weight of refrigerant has been added as indicated by scales. Correct charge will be found in Section 7.1.

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 start the unit. The liquid will be pulled into the system. Unit must be operating in the cooling mode.

e. When drum weight (scale) indicates that the correct charge has been added, close liquid line valve on drum and backseat the King Valve.

f. Start unit in cooling mode. Run approximately ten minutes (until the refrigeration system is warmed up and balanced). Partially block off air flow to condenser coil so discharge pressure rises to 230 psig (16 kg/cm^2).

Refrigerant should appear at center line of lower receiver sight glass.

8.13.2 Partial Charge Using Vapor – R-22 Only

CAUTION: Do not vapor charge R-404A. Only liquid charging through the liquid line King Valve is acceptable.

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 charging line between center port of manifold gauge set and drum. Open VAPOR valve on drum and purge charging line.

b. Run the unit in cooling for ten minutes (until the refrigeration system is warmed up and balanced) and then partially block off air flow to condenser coil so discharge pressure will rise 10 psig (0.7 kg/cm^2). Refrigerant should appear at center line of the lower receiver sight glass . If charge is inadequate, add refrigerant charge with condenser coil still blocked.

c. Open suction valve of the manifold gauge set. Add charge until level appears at center line of the lower receiver sight glass. Close valve.

d. Backseat (close) discharge and suction service valves. Close vapor valve on refrigerant drum, noting weight. Vent charging line and replace all caps.

e. Start unit and check for noncondensibles.

8.13.3 Partial Charge Using Liquid – R-22 or R-404A

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. Purge line. Connect a charging line between the center tap of the second gauge set and refrigerant drum. Open the LIQUID valve on drum and purge charging line.

b. Start the unit. Adjust the setpoint so that the unit will run in the cool mode.

c. Run the unit in cooling for ten minutes (until the refrigeration system is warmed up and balanced) and then partially block off air flow to condenser coil so discharge pressure will rise 10 psig (0.7 kg/cm2). Refrigerant should appear at center line of the lower receiver sight glass . If charge is inadequate, continue with step d.

d. Frontseat the King Valve, and monitor the manifold gauge set. 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.

e. Carefully weigh the refrigerant into the system. Never allow more than 5 lbs. of refrigerant into the system at a time, since with the unit in this charging state, it is not possible to accurately determine when the system will be full.

f. After metering 5 lbs. of refrigerant into the system, close the valve of the manifold gauge set connected to the King Valve. Open the King Valve, partially block the air flow to the condenser coil and allow the system to balance out (approximately 4–5 minutes). Refrigerant should appear at center line of the lower receiver sight glass. If charge is inadequate, repeat steps d thru f until system is full.

8.14 Replacing the Compressor

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 8.10.a)

If compressor does not operate, frontseat both suction and discharge service valves, and remove refrigerant charge from compressor (Refer to Section 8.10.b)

a. Disconnect negative battery cable.

b. Remove the two rear compressor bracket mounting bolts (compressor shockmount end).

c. Block up engine.

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

e. Remove oil filter and bracket from 05G compressor.

f. 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 8-16)

g. Remove 10 bolts from the engine-compressor spacer.

h. Disconnect ground strap from frame.

i. Remove Compressor Suction Pressure Transducer from compressor .

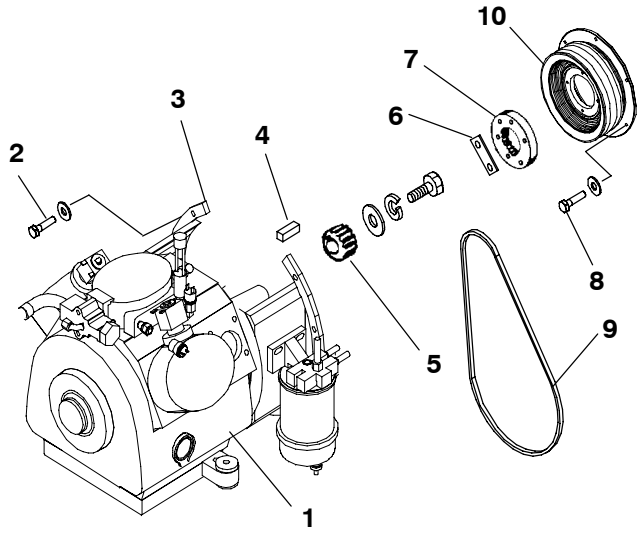
j. Attach sling or other device to the compressor.

k. Slide compressor enough to clear nylon drive gear, Figure 8-15, and remove compressor from unit.

l. Drain oil from defective compressor before shipping.

m. 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.

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 shipping. Customer should retain the original capacity unloader valves for use on replacement compressor. Check oil level in service replacement compressor. (Refer to Section 8.15)



1. Compressor
2. Bolts
3. Spacer
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 8-15. Compressor Drive Assembly

n. Remove the complete High Pressure Switch assembly (HPS) (See Figure 8-16) 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).

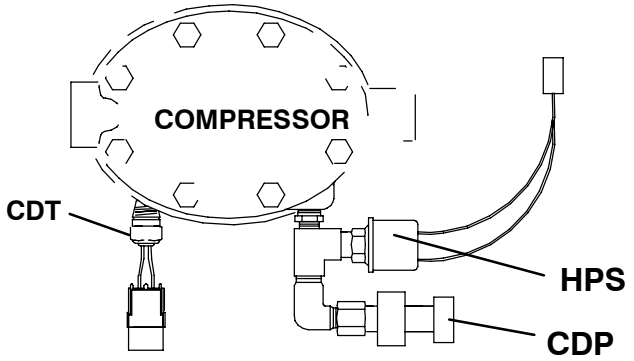


Figure 8-16. Pressure Switch and Sensor

o. Install compressor in unit by reversing step 4.12.b through n. It is recommended using new locknuts 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 8.31.1 driver gear installation.

p. 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.

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

r. Remove vacuum pump lines and install manifold gauges.

s. Start unit and check for noncondensibles.

t. Check refrigerant level

u. Check compressor oil level. (Refer to Section 8.15) Add oil if necessary.

v. Check compressor unloader operation. (Refer to Section 8.16)

w. Check refrigerant cycles. (Refer to Section 2.9)

8.15 Checking Compressor Oil Level

a. To Check The Oil Level In The Compressor:

1. Operate the unit in high speed, fully loaded cool for at least 15 minutes. Unplug wires to the unloaders if necessary to insure 6 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 excessively, check the refrigerant system for flood-back of liquid refrigerant. Correct this situation before performing step 2.

2. 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.

3 After 3—5 minutes of defrost operation, turn the unit off and wait 5—15 seconds. Observe the compressor oil level in the sightglass. (See Figure 8-17). Oil level should be between the Minimum and Maximum marks.

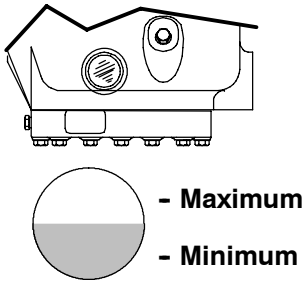


Figure 8-17. Oil Level in Sight Glass

b. Adding Oil with Compressor in System

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

1. 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 (item4, Figure 8-18). Also there is no need to remove pump from can after each use.

When the compressor is in operation, the pump check valve prevents the loss of refrigerant, while allowing servicemen to develop sufficient pressure to overcome the operating suction pressure to add oil as necessary.

Backseat suction service valve and connect oil charging hose to oil fill (item4, Figure 8-18). Purge the oil hose at oil pump. Add oil as necessary (Refer to Section 7.5).

2. Closed System Method

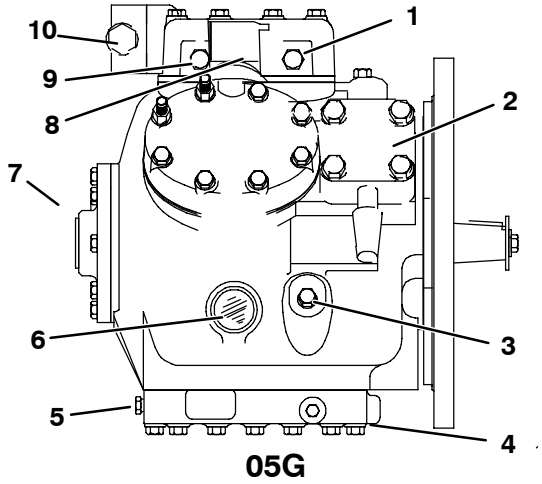
When an oil pump is not available, oil may be drawn into the compressor through the oil fill port.

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

CAUTION: Extreme care must be taken to ensure the hose is immersed in the oil at all times. Otherwise air and moisture will be drawn into the compressor.

Connect the suction connection of the gauge manifold to the compressor suction service valve port, and 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 sightglass. As it reaches the minimum mark, stop the flow of oil from the container. (Refer to Section 7.5).

Break any remaining vacuum (raise to 0 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.



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 8-18. Compressor

c. 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 7.5) through the suction service valve flange cavity or by removing the oil fill plug (See Figure 8-18)

d. To remove oil from the compressor:

1. Close suction service valve (frontseat) and pump unit down to 1 to 2 psig (0.07 to 0.1 kg/cm^2). Frontseat discharge service valve and slowly bleed remaining refrigerant.
2. Slowly remove the oil drain plug from the compressor and drain the proper amount of oil. Replace the plug securely back into the compressor.
3. Open service valves and run unit to check oil level, repeat as required to ensure proper oil level.

8.16 Compressor Unloader Valve

The compressor unloaders (located on the compressor cylinder heads) are controlled by the Advance Microprocessor. (Refer to Section 7.10)

a. Checkout Procedure

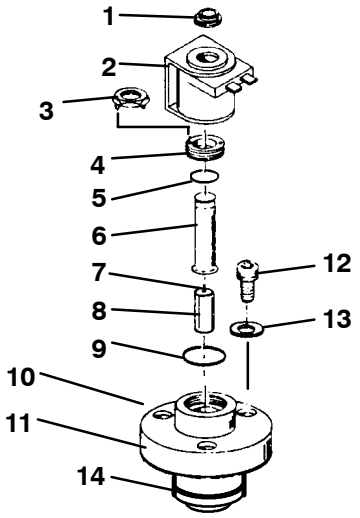
1. Connect manifold gauges to the compressor suction and discharge service valves and start unit in cooling with the set point within 1°F–2°F (0.6°C–1.1°C) of the trailer temperature.
2. Unplug both unloader coils. The compressor should be operating with all 6 cylinders. Note suction pressure.
3. Plug UL1 (front unloader) in. Note discharge and suction pressures, the suction pressure should rise approximately 3 psig (0.2 kg/cm^2), and the discharge should drop approximately 5–15 psig (0.35 to 1.05 kg/cm^2).
4. Unplug UL1 and note pressures. Suction pressure should drop and discharge pressure should rise by the same amounts they changed in step 3 above.
5. Repeat steps 3 & 4 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.

b. Solenoid Coil Replacement

NOTE: The coil may be removed without pumping the unit down.

1. Disconnect leads. Remove retainer. Lift off coil. (See Figure 8-19)
2. Verify coil type, voltage and frequency of old and new coil. This information appears on the coil housing.
3. Place new coil over enclosing tube, retainer and connect wiring.



1. Retainer
2. Coil Assembly
3. Installation/RemovalTool
4. Enclosing TubeCollar
5. “O” Ring
6. Enclosing Tube
7. Plunger Spring
8. Plunger Assembly
9. Gasket
10. Valve Body
11. Gasket
12. Bolt
13. Gasket, Bolt
14. Piston Ring

Figure 8-19. Unloader Solenoid Valve

c. Replacing Solenoid Valve Internal Parts (See Figure 8-19)

1. Pump down the unit. Frontseat both service valves to isolate the compressor.
2. Remove coil retainer, and coil.

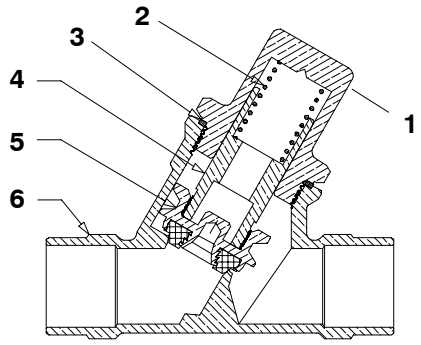
3. Remove enclosing tube collar (item 4, Figure 8-19) using installation/removal tool supplied with repair kit (item 3).
4. Check plunger for restriction due to: (a) Corroded or worn parts; (b) Foreign material lodged in valve; (c) Bent or dented enclosing tube.
5. Install new parts. Do not over tighten enclosing tube assembly. Torque to a value of 100 inch pounds (1.15 mkg).
6. Remove supplied installation/removal tool. Install coil, voltage plate, and retainer.
7. Evacuate and dehydrate the compressor. (Refer to Section 8.14.p through 8.14.w.)
8. Start unit and check unloader operation (Refer to Section 8.16.a).

8.17 Servicing Check Valve – Serviceable Type

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 8-20. Check Valve – Serviceable Type

a. To replace check valve, store the refrigerant into an evacuated container. (Refer to Section 8.10)
b. Replace necessary parts.
c. Evacuate and dehydrate unit. (Refer to Section 8.12)
d. Add refrigerant charge. (Refer to Section 8.13)

8.18 Checking and Replacing Filter-drier

To Check Filter-Drier

Check for a restricted or plugged filter-drier by feeling the liquid line inlet and outlet connections of the drier cartridge. If the outlet side feels cooler than the inlet side, then the filter-drier should be changed.

To Replace Filter-Drier

a. Pump down the unit per section 8.10. 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. Leak test drier connections.

d. Check refrigerant level.

8.19 Thermostatic Expansion Valve

The Thermal Expansion Valve (TXV) is an automatic device which maintains constant superheat of the refrigerant gas leaving the evaporator regardless of suction pressure. The valve functions are: (a) automatic response of refrigerant flow to match the evaporator load and (b) prevention of liquid refrigerant entering the compressor. Unless the valve is defective, it seldom requires any maintenance.

a. Replacing Expansion Valve & Screen

1. Pump down the unit by closing the King Valve. (Refer to Section 8.10.a)
2. Remove insulation (Presstite) from expansion valve bulb and then remove bulb from suction line.
3. Remove Presstite from the expansion valve power head. Unscrew power head if only the element is being changed and replace by reversing steps 1 through 3.
4. Use a wet rag to keep TXV cool whenever brazing or unbrazing. Unbraze inlet, outlet and equalizer connection to valve body. Clean all tube stubs so new valve fits on easily.
5. Install new valve and screen, with cone of screen pointing into liquid line at inlet to the valve by reversing steps 1 through 4.
6. The thermal bulb is located below the center of the suction line (See Figure 8-21). 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.
7. Evacuate by placing vacuum pump on suction service valve.
8. Open King Valve and then check refrigerant level.
9. Check superheat. (Refer to Section 7.6)

b. Checking Superheat

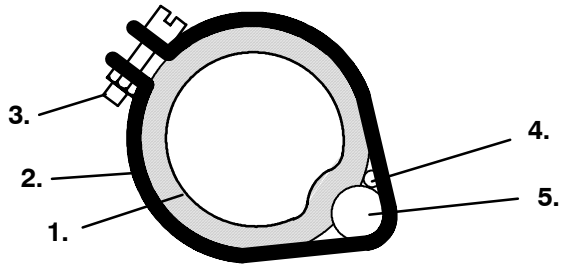
NOTE: It is not recommended adjusting expansion valves unless absolutely necessary.

Due to the time involved in adjusting the superheat, replace the valve rather than adjusting it.

c. To Measure Superheat

NOTE: The expansion valve and bulb location are shown in Figure 7-5.

1. Remove evaporator panel from rear of unit and then pull loose the Presstite insulation from one end of the expansion valve bulb.
2. Loosen one TX bulb clamp and make sure area under clamp (above TXV bulb) is clean.
3. Place thermocouple above (parallel) TXV bulb and then secure loosened clamp making sure both bulbs are firmly secured to suction line as shown in Figure 8-21. 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 8-21. Thermostatic Expansion Valve Bulb and Thermocouple

NOTE: When conducting this test the suction pressure must be 6 psig (0.4 kg/cm^2) below expansion valve maximum operating pressure (MOP) Refer to Section 7.6
For example: R-22 units use an expansion valve with a 55 MOP. The recommended test pressure should be below 49 psig(3.44 kg/cm^2).

6. Connect an accurate gauge to the 1/4" port on the suction service valve.
7. Run unit until stabilized. Set controller 10°F (5.5°C) below box temperature.
8. From the temperature/pressure chart, determine the saturation temperature corresponding to the evaporator outlet pressure.
9. Note the temperature of the suction gas at the expansion valve bulb.

Subtract the saturation temperature determined in Step 6 from the average temperature measured in Step 7. The difference is the superheat of the suction gas.

8.20 Checking and Replacing High Pressure Cutout Switch (HPS)

8.20.1 Replacing High Pressure Switch

a. Pump down the unit. (Refer to Section 8.10.a) Frontseat both suction and discharge service valves to isolate compressor.

b. *Slowly* release compressor pressure through the service valve gauge ports.

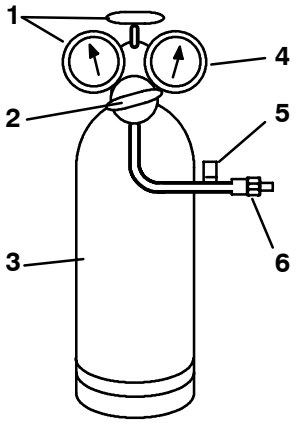
c. Disconnect wiring from defective switch, and remove old switch. The HPS is located at the side of the center compressor cylinder head. (See Figure 8-18)

d. Install new cutout switch after verifying switch settings. (Refer to Section 8.20.2)

e. Evacuate and dehydrate the compressor. (Refer to Section 8.14.p through 8.14.w)

8.20.2 Checking High Pressure Switch

WARNING: Do not use a nitrogen cylinder without a pressure regulator. Cylinder pressure is approximately 2350 psi (165 kg/cm^2). Do not use oxygen in or near a refrigerant system as an explosion may occur. (See Figure 8-22)



1. Cylinder Valve and Gauge
2. Pressure Regulator
3. Nitrogen Cylinder
4. Pressure Gauge (0 to 400 psig = 0 to 28 kg/cm^2)
5. Bleed-Off Valve
6. 1/4 inch Connection

Figure 8-22. Typical Setup for Testing High Pressure Switch

a. Remove switch as outlined in Section 8.20.1

b. Connect ohmmeter or continuity light across switch terminals. Ohmmeter will indicate resistance and continuity light will be lighted if switch closed after relieving pressure.

c. Connect switch to a cylinder of dry nitrogen. (See Figure 8-22)

d. Set nitrogen pressure regulator higher than cutout point on switch being tested. Pressure switch cutout and cut-in points are shown in Sections 7.6.

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 light is used, light will go out and 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 (light will light or ohmmeter will move).

8.21 Compressor Discharge Pressure Transducer (CDP)

8.21.1 Calibrating Compressor Discharge Pressure Transducer

The Compressor Discharge Pressure Transducer (CDP) has a range of 0 psig to 500 psig. 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, there is a calibration feature for the CDP built into the microprocessor.

To calibrate the CDP, it *must* be removed from the compressor, and be exposed to 0 psig. 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 psig, even if it is exposed to a vacuum (such as when evacuating the system). Because of this, just because the transducer reads 0 does not mean that it is accurately calibrated. 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 2.16), or place unit in Manual Start Mode.

b. Press the Select Key until "Press ↑ ↓ to View Data" appears in the Message Center.

c. Press the ↑ Up Arrow until "Discharge Pressure" is showing in the Message Center.

d. Press and hold the Equal Key for 6 seconds. The Message Center will blink 5 times. When it quits blinking, the display will either show 0.0 psig pressure, or the message "Calibration Unsuccessful".

e. When Discharge Pressure: 0.0 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 psig on the transducer, or the transducer is further away from 0 than an offset will allow. The transducer must be replaced.

8.21.2 Testing Compressor Discharge Pressure Transducer

a. Verify that the wiring to the transducer is correct. (See wiring diagram)

b. Power up the transducer circuit. Place unit into PC Mode (Refer to Section 2.16), or place unit in Manual Start Mode.

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 1MP5.

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.

Compressor Discharge Pressure Transducer					
Psig	**Voltage**	**Psig**	**Voltage**	**Psig**	**Voltage**
0	0.5	80	1.1	250	2.5
10	0.6	90	1.2	275	2.7
20	0.7	100	1.3	300	2.9
30	0.7	125	1.5	325	3.1
40	0.8	150	1.7	350	3.3
50	0.9	175	1.9	375	3.5
60	1.0	200	2.1	400	3.7
70	1.1	225	2.3	450	4.1

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 Message Center will show

Suction Pressure: -14.7 psig
Discharge Pressure: 0 psig
Engine RPM: 0.

8.21.3 Replacing Compressor Discharge Pressure Transducer

a. Pump down the compressor. (Refer to Section 8.10.a) Frontseat both suction and discharge service valves to isolate compressor.

b. Equalize compressor discharge and suction pressures through the service valve gauge set. Slowly purge off the high side pressure to 0 psig.

c. Disconnect wiring from defective transducer and remove. The CDP is located at the side of the center compressor cylinder head. (See Figure 8-18)

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.

d. Calibrate new discharge transducer before installing in compressor. (Refer to Section 8.21.1)

e. Install new discharge transducer, being careful to obtain the correct transducer for your unit. R-22 CDPs have a white dot on the side. R-404A CDPs have a red dot on the side. (See Figure 8-16)

f. Evacuate and dehydrate the compressor. (Refer to Section 8.14.p through 8.14.w)

8.22 Compressor Suction Pressure Transducer (CSP)

8.22.1 Calibrating Compressor Suction Pressure Transducer

The Compressor Suction Pressure Transducer (CSP) has a range of −14.7 psig (29.92" mercury) to 100 psig. Because of this much smaller range, calibration of the CSP is not required. (A general rule is that 2 inches of vacuum equals −1 psig)

8.22.2 Testing Compressor Suction Pressure Transducer

a. Verify that the wiring to the transducer is correct. (See wiring diagram)

b. Power up the transducer circuit. Place unit into PC Mode (Refer to Section 2.16), 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 resistance between C (output to microprocessor) and 1MP6.

e. Place +5.0 VDC on transducer terminal B and Ground on transducer terminal A. Test voltage between B and C. The reading should be as shown in table below.

Compressor Suction Pressure Transducer					
Psig	**Voltage**	**Psig**	**Voltage**	**Psig**	**Voltage**
-10	0.7	30	2.1	70	3.5
-5	0.8	35	2.2	75	3.6
0	1.0	40	2.4	80	3.8
5	1.2	45	2.6	85	4.0
10	1.4	50	2.8	90	4.1
15	1.5	55	2.9	95	4.3
20	1.7	60	3.1	100	4.5
25	1.9	65	3.3		

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 Message Center will show

Suction Pressure: -14.7 psig
Discharge Pressure: 0 psig
Engine RPM: 0.

TIP: A reading of 14.7 will occur if there is an open circuit between the transducer and the microprocessor.

8.22.3 Replacing Compressor Suction Pressure Transducer

a. Pump down the unit (at the King Valve) until the suction pressure is approximately 5 psig. (Refer to Section 8.10.a)

b. Disconnect wiring from defective transducer. Slowly remove the transducer. The pressure remaining in the suction line will be held in place by a Schrader valve located inside the fitting. The CSP is located on the suction line just above the Suction Service Valve. (See Figure 7-1)

c. Install the new transducer in compressor. Check for leaks.

d. Open the King Valve and check operation.

e. Install new suction transducer, being careful to obtain the correct transducer for your unit. R-22 CSPs have a green dot on the side. R-404A CSPs have a blue dot on the side. (Refer to Section 8.22.2)

f. Evacuate and dehydrate the compressor. (Refer to Section 8.14.p through 8.14.w)

8.23 Replacing Receiver Sight Glass Assembly

a. Store the refrigerant in an evacuated container. (Refer to Section 8.10.b)

b. Unscrew the sight glass assembly. Wrap threads with teflon tape or spread some sealing compound on pipe threads of new sight glass assembly and install.

c. Leak check receiver sight glass per Section 8.11.

d. After leak checking unit, evacuate and dehydrate as outlined in Section 8.12.

e. Add refrigerant charge. (Refer to Section 8.13)

f. Check for noncondensibles.

8.24 Servicing Solenoid Valves

8.24.1 Solenoid Valves - Alco SV2/SV4

CAUTION: Do not damage or over tighten the enclosing tube assembly. Torque to 200-inch pounds (2.3 mkg). Also make sure all parts are placed on the enclosing tube in proper sequence to avoid premature coil burnout.

a. Replacing the Coil

NOTE: The coil may be replaced without removing the refrigerant or pumping the unit down.

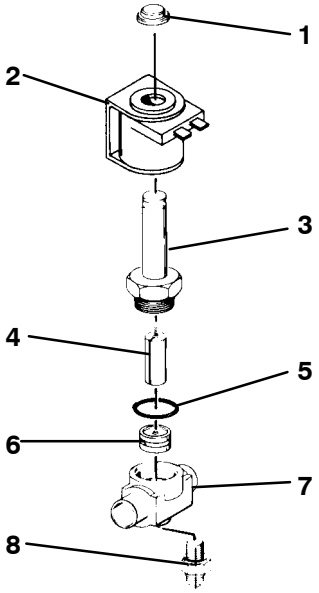
1. Unplug from wiring harness, remove coil retainer and coil assembly.
2. Verify coil type, voltage and frequency. This information appears on the coil housing.
3. Place new coil over enclosing tube, retainer and connect wiring.

b. Replacing Solenoid Valve Internal Parts (See Figure 8-23)

The liquid line solenoid valve (SV2) may be serviced by pumping the unit down. (Refer to Section 8.10.a)

Remove and store the refrigerant charge in an evacuated container to service hot gas solenoid valve (SV4). (Refer to Section 8.10.b)

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.
4. Tighten enclosing tube assembly to a torque value of 200 inch pounds (2.3 mkg) and leak check the valve. (Refer to Section 8.11)
5. Install coil assembly and retainer.
6. Start unit and check refrigerant charge per Section 8.13.f.
7. Check refrigeration cycles.



1. Retainer
2. Coil Assembly
3. Enclosing Tube Assembly
4. Plunger Assembly
5. Gasket
6. Piston Assembly
7. Body
8. Bracket Adapter

Figure 8-23. Solenoid Valves - Alco

8.24.2 Solenoid Valve - Sporlan SV1/SV3

a. Replacing the Coil

NOTE: The coil may be replaced without removing the refrigerant or pumping the unit down.

1. Remove top locknut, spacer cup and nameplate (SV1). For SV3, remove screw and nameplate.
2. Disconnect wiring and remove coil.
3. Replace coil by reversing steps 1 and 2.

b. Replacing Internal Components (See Figure 8-24)

1. Remove and store the refrigerant charge in an evacuated container. (Refer to Section 8.10.b)
2. Remove the top locknut, spacer cup, nameplate, coil assembly and spacer (SV1). For SV3, remove screw and nameplate.
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. For SV3 install stem and plunger (item 11, Figure 8-24)
8. 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.
9. Install coil assembly, nameplate and top locknut or screw.
10. Dehydrate and evacuate the system. (Refer to section 8.12) Charge unit with refrigerant per sections 8.13.
11. Start unit and check operation.

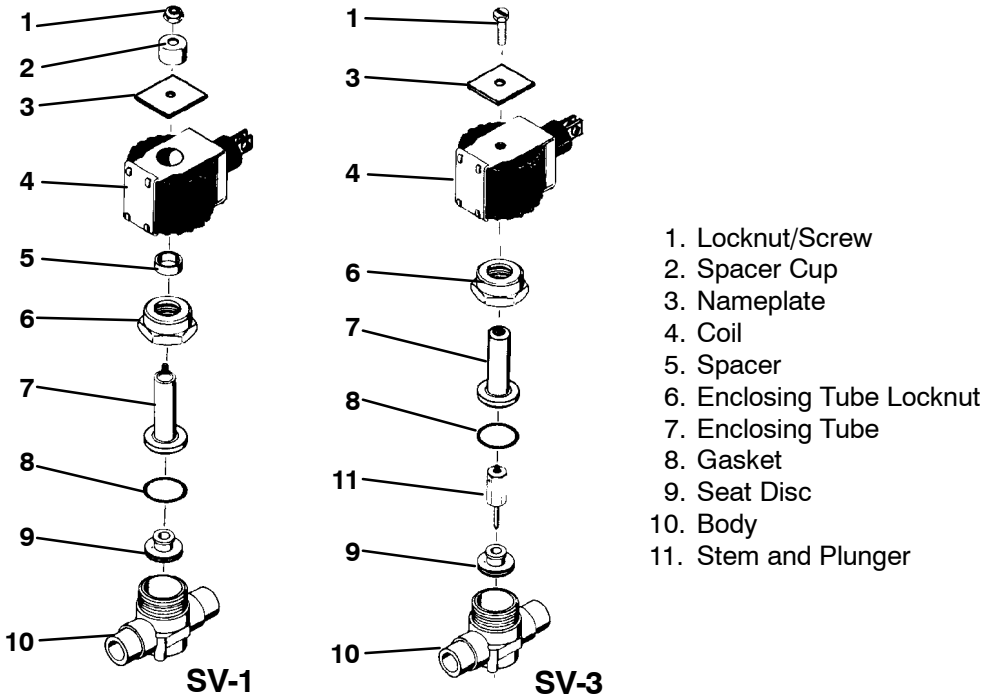


Figure 8-24. Solenoid Valves - Sporlan

8.25 Solenoid Valve SV-1 Checkout Procedure

To obtain proper heating and defrost, the normally open (N.O.) SV-1 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.

a. 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 (6.3 to 7.0 kg/cm^2).

(3) Discharge pressure will drop quickly, but begin to rise to a minimum of 250 psig (17.5 kg/cm^2) within 15 to 20 minutes.

b. 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 liquid line valve (King Valve) leaving the receiver tank.

(3) With the trailer 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 SV-1 coil.

(4) With a separate 12 vdc negative voltage, energize SV-1 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.

Operate the unit until discharge pressure reaches 200 psig (14 kg/cm^2) and disconnect jumper wire to SV-1 valve. Discharge and receiver pressure should be within 5 to 15 psig (0.4 to 1.0 kg/cm^2) of each other.

8.26 Checking Defrost or Heating Cycle

NOTE: DTT1 or DTT2 must be 40°F (4.4°C) or lower, before any checks can be made.

a. Hot Gas Solenoid Valve (SV-1, SV-3 & SV-4) Heating and Defrosting

1. Connect a discharge pressure gauge to the King Valve and another gauge to the compressor discharge service valve. Connect a gauge to the compressor suction service valve.
2. Start unit with controller set at least 10°F (5.5°C) below indicated box temperature to obtain high speed cooling. Press the MANUAL DEFROST key to initiate defrost. (DTT1 or DTT2 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 (0.70 to 1.05 kg/cm^2) after 5 minutes on unit operation. Refer to Section 8.25 if unit does not heat properly.
3. SV-3 will open under the following conditions:

   The unit is operating in High Speed, and
   Ambient Air Temperature (AAT) alarm is not active, and
   SV4 has been open for at least 60 seconds, and
   Ambient Air Temperature is less than 70°F (21.1°C), and
   CDT minus AAT is more than 131°F (55°C).
4. SV−3 will close under the following conditions:

   Ambient Air Temperature (AAT) alarm becomes active, or
   CDT minus AAT becomes less than 82°F (27.8°C), or
   Ambient Air Temperature rises to 80°F (26.7°C)
5. Unit should remain in defrost until DTT1 (located in the blower housing) reaches 45°F (7.2°C) and DTT2 (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.

b. Defrost Air Switch (DAS)

1. To check the Defrost Air Switch, run unit in high speed cooling and jump 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.

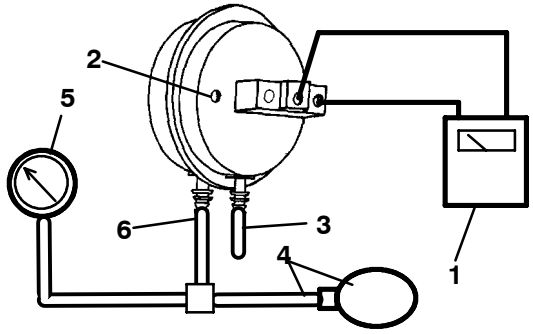
NOTE: If both DTT1 & DTT2 are above 40°F (4.4°C), the Message Center will show "Can Not Start Defrost Cycle".

2. Unit should remain in defrost until DTT1 (located in the blower housing) reaches 45°F (7.2°C) and DTT2 (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.
3. If the above test indicates satisfactory operation, test Defrost Air Switch (DAS) settings using a Dwyer Magnehelic gauge (P/N 07-00177) or similar instrument. (Refer to Section 8.27)

c. Solid State Defrost Timer

Refer to Section 4.7 for description.

8.27 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 8-25. 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 CALIBRATED.

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 8-25)

c. Install tee in pressure line to high side connection. Tee should be approximately half-way 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 7.6 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.

8.28 Evaporator Coil Cleaning

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

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

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

a. Remove rubber check valves (Kazoo) from drain lines (front of trailer).

b. 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. Run unit until defrost mode can be initiated to check for proper draining from drain pan.

8.29 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.) 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.

8.30 Controller Sensor Checkout

An accurate ohmmeter must be used to check resistance values shown in Table 8-2.

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 8-2.

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 8-2. Sensor Resistance (ENCT, RAT, SAT, ATT, DTT)

°F	Ohms	°F	Ohms	°F	Ohms	°F	Ohms
-40	336,500	18	49,060	76	10,250	134	2,809
-38	312,600	20	46,230	78	9,760	136	2,697
-36	290,600	22	43,580	80	9,299	138	2,590
-34	270,300	24	41,100	82	8,862	140	2,488
-32	251,500	26	38,780	84	8,449	142	2,390
-30	234,200	28	36,600	86	8,057	144	2,297
-28	218,200	30	34,560	88	7,686	146	2,208
-26	203,400	32	32,650	90	7,334	148	2,124
-24	189,700	34	30,850	92	7,000	150	2,042
-22	177,000	36	29,170	94	6,684	155	1,855
-20	165,200	38	27,590	96	6,384	160	1,687
-18	154,300	40	26,100	98	6,099	165	1,537
-16	144,200	42	24,700	100	5,828	170	1,402
-14	134,800	44	23,390	102	5,571	175	1,281
-12	126,100	46	22,160	104	5,327	180	1,171
-10	118,100	48	20,990	106	5,095	185	1,072
-8	110,500	50	19,900	108	4,874	190	983
-6	103,600	52	18,870	110	4,665	195	902
-4	97,070	54	17,900	112	4,465	200	829
-2	91,030	56	16,980	114	4,275	205	762
0	85,400	58	16,120	116	4,095	210	702
2	80,160	60	15,310	118	3,923	215	647
4	75,270	62	14,540	120	3,759	220	598
6	70,720	64	13,820	122	3,603	225	553
8	66,460	66	13,130	124	3,454	230	511
10	62,500	68	12,490	126	3,313	235	473
12	58,790	70	11,880	128	3,177	240	438
14	55,330	72	11,310	130	3,049	245	406
16	52,090	74	10,760	132	2,926	250	378

Table 8-3. Sensor Resistance (CDT)									
°F	Ohms	°F	Ohms	°F	Ohms	°F	Ohms	°F	Ohms
-40	3,360,000	18	189,690	76	102,460	134	28,160	260	3,290
-38	3,121,020	20	461,170	78	97,600	136	27,040	270	2,850
-36	2,900,710	22	434,790	80	92,990	138	25,970	280	2,490
-34	2,697,500	24	410,080	82	88,630	140	24,960	290	2,170
-32	2,509,940	26	386,940	84	84,510	142	23,980	300	1,910
-30	2,336,720	28	365,260	86	80,600	144	23,050	310	1,680
-28	2,186,670	30	344,930	88	76,890	146	22,160	320	1,480
-26	2,028,680	32	325,860	90	73,380	148	21,310	330	1,310
-24	1,891,780	34	307,970	92	70,040	150	20,500	340	1,160
-22	1,765,060	36	291,180	94	66,880	155	18,980	350	1,040
-20	1,647,700	38	275,410	96	63,880	160	16,940	360	920
-18	1,538,950	40	260,590	98	61,040	165	15,450	370	830
-16	1,438,120	42	246,670	100	58,330	170	14,070	380	740
-14	1,344,580	44	233,570	102	55,770	175	12,870	390	670
-12	1,257,770	46	221,260	104	53,330	180	11,750	400	600
-10	1,177,150	48	209,670	106	51,010	185	10,750	410	540
-8	1,102,240	50	198,760	108	48,800	190	9,870	420	490
-6	1,032,600	52	188,490	110	46,710	195	9,050	430	450
-4	967,830	54	178,820	112	44,710	200	8,320	440	410
-2	907,560	56	169,700	114	42,820	205	7,650	450	370
0	851,450	58	161,100	116	41,010	210	7,050	460	340
2	799,180	60	152,990	118	39,290	215	6,510	470	310
4	750,470	62	145,340	120	37,660	220	6,000	480	280
6	705,060	64	138,120	122	36,100	225	5,540	490	260
8	662,690	66	131,310	124	34,610	230	5,130	500	240
10	623,150	68	124,870	126	33,200	235	4,760		
12	586,230	70	118,790	128	31,850	240	4,410		
14	551,740	72	113,040	130	30,560	245	4,090		
16	519,500	74	107,600	132	29,330	250	3,800		

8.31 Unidrive Torque Requirements (See Figure 8-26)

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 bellhousing. The recommended sealant is Loctite screw lock no. 262.

The following figures show the torque value, size and grade of the hardware to be used when reassembling the unidrive assembly.

8.31.1 Drive Gear

When installing a nylon drive gear always:

1. Install with black dot facing steel gear.
2. Use new bolts and locking tabs included in drive gear kit.
3. Use Locktite or a similar thread locking compound on threads of drive gear bolts.
4. DO NOT use never-seize or any other lubricating compound on the nylon drive gear or compressor steel gear. The gear must be assembled dry.
5. Torque the (6 bolt) nylon drive gear bolts to 30 ft-lbs.

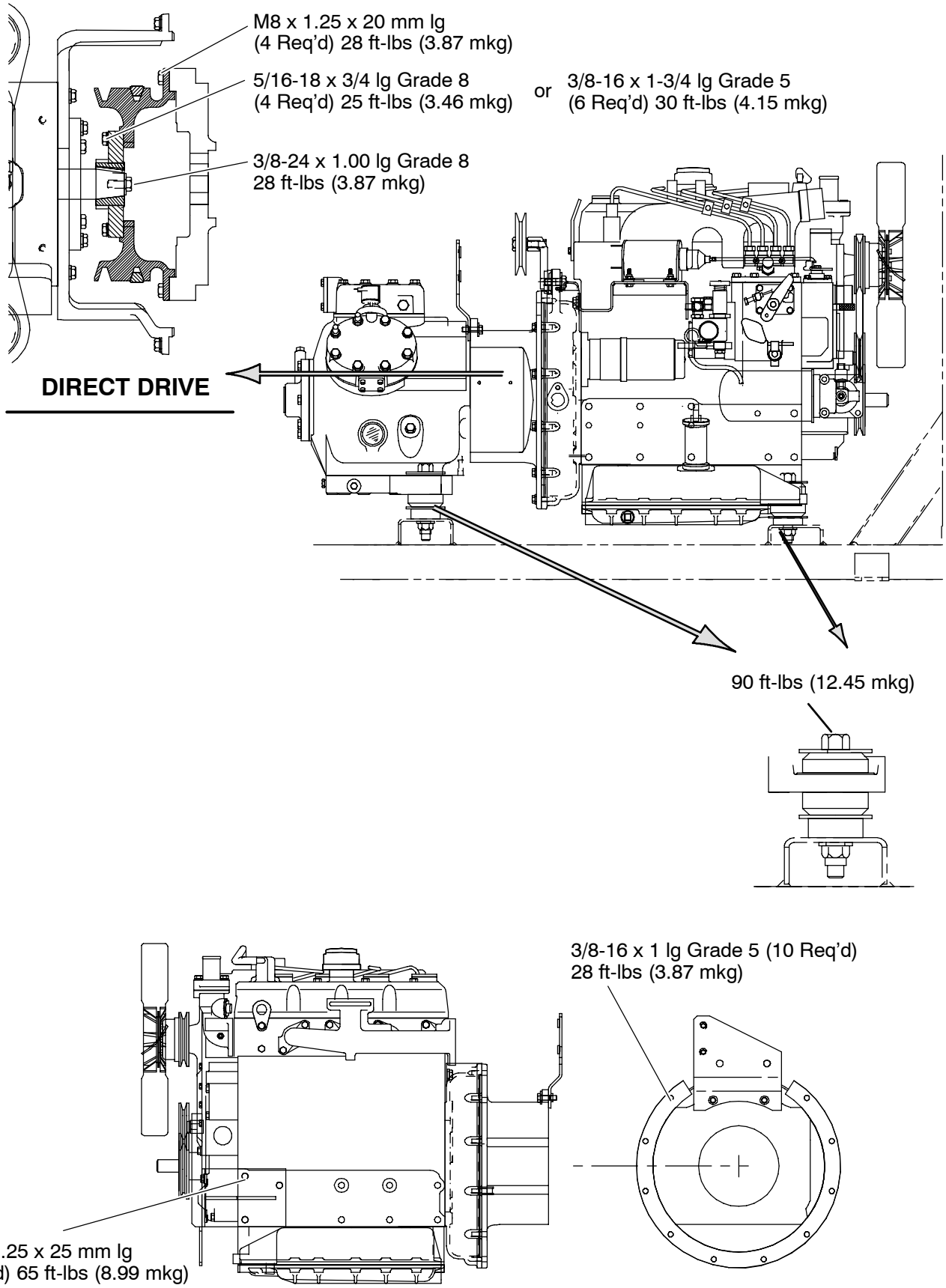


Figure 8-26. Unidrive Torque Requirements

Table 8-4. R-404A Temperature-Pressure Chart

Temperature		Pressure			Temperature		Pressure		
°F	°C	Psig	Kg/cm2	Bar	°F	°C	Psig	Kg/cm2	Bar
-40	-40	4.5	0.32	0.31	32	0	72.5	5.10	5.00
-35	-37	7.1	0.50	0.49	34	1	75.6	5.32	5.21
-30	-34	9.9	0.70	0.68	36	2	78.8	5.54	5.43
-25	-32	12.9	0.91	0.89	38	3	82.1	5.77	5.66
-20	-29	16.3	1.15	1.12	40	4	85.5	6.01	5.90
-18	-28	17.7	1.24	1.22	42	6	89.0	6.26	6.14
-16	-27	19.2	1.35	1.32	44	7	92.5	6.50	6.38
-14	-26	20.7	1.46	1.43	46	8	96.2	6.76	6.63
-12	-24	22.3	1.57	1.54	48	9	99.9	7.02	6.89
-10	-23	23.9	1.68	1.65	50	10	103.7	7.29	7.15
-8	-22	25.6	1.80	1.77	55	13	115.4	8.11	7.96
-6	-21	27.3	1.92	1.88	60	16	126.1	8.87	8.69
-4	-20	29.1	2.05	2.01	65	18	137.4	9.66	9.47
-2	-19	30.9	2.17	2.13	70	21	149.4	10.50	10.30
0	-18	32.8	2.31	2.26	75	24	162.1	11.40	11.18
2	-17	34.8	2.45	2.40	80	27	175.5	12.34	12.10
4	-16	36.8	2.59	2.54	85	29	189.6	13.33	13.07
6	-14	38.9	2.73	2.68	90	32	204.5	14.38	14.10
8	-13	41.1	2.89	2.83	95	35	220.2	15.48	15.18
10	-12	43.3	3.04	2.99	100	38	236.8	16.65	16.33
12	-11	45.6	3.21	3.14	105	41	254.2	17.87	17.53
14	-10	48.0	3.37	3.31	110	43	272.4	19.15	18.78
16	-9	50.4	3.54	3.47	115	46	291.6	20.50	20.11
18	-8	52.9	3.72	3.65	120	49	311.8	21.92	21.50
20	-7	55.5	3.90	3.83	125	52	332.9	23.41	22.95
22	-6	58.1	4.08	4.01	130	54	355.0	24.96	24.48
24	-4	60.9	4.28	4.20	135	57	378.1	26.58	26.07
26	-3	63.7	4.48	4.39	140	60	402.3	28.28	27.74
28	-2	66.5	4.68	4.59	145	63	427.6	30.06	29.48
30	-1	69.5	4.89	4.79	150	66	454.0	31.92	31.30

Table 8-5. R-22 Pressure - Temperature Chart

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

Section 9 - Troubleshooting

SECTION 9 TROUBLESHOOTING

CAUTION

Under no circumstances should anyone attempt to service the Advance Microprocessor! Should a problem develop with the Advance Microprocessor, contact your nearest Carrier Transicold dealer for replacement.

INDICATION/ TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
9.1 DIESEL ENGINE **9.1.1 Engine Will Not Start**		
Starter motor will not crank or low cranking speed	Battery insufficiently charged Battery terminal post dirty or defective Bad electrical connections at starter Starter motor malfunctions Starter motor solenoid defective Open starting circuit Incorrect grade of lubricating oil Unloaders not unloaded	Check Check Check 9.1.3 Engine Manual 9.1.4 7.2 8.16
Starter motor cranks but engine fails to start	No fuel in tank Air in fuel system Water in fuel system Plugged fuel filter(s) Plugged fuel lines to injector(s) Fuel control operation erratic Glow plug(s) defective Fuel solenoid defective Fuel pump (FP) malfunction	Check 8.2 Drain Sump Replace Check Engine Manual 8.5.8 Engine Manual 8.2
Starter cranks, engages, but dies after a few seconds	Engine lube oil too heavy Voltage drop in battery cable(s)	7.2 Check
9.1.2 Engine Starts Then Stops		
Engine stops after several rotations	Fuel supply restricted No fuel in tank Leak in fuel system Faulty fuel control operation Fuel filter restricted Injector nozzle(s) defective Injection pump defective Air cleaner or hose restricted Safety device open Fuel solenoid defective Fuel pump (FP) malfunction	Check Check Check Engine Replace Engine Manual Engine Manual 8.5.6 7.7 Engine Manual 8.2

INDICATION/ TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
9.1.3 Starter Motor Malfunction		
Starter motor will not crank or turns slowly	Battery insufficiently charged Battery cable connections loose or oxidized Battery cables defective Starter brushes shorted out Starter brushes hang up or have no contact Starter solenoid damaged Glow/Crank switch defective Engine lube oil too heavy	Check Check Replace Engine Manual Engine Manual Engine Manual Replace 7.2
Starter motor turns but pinion does not engage	Pinion or ring gear obstructed or worn	Clean both, remove burrs, or replace; apply grease
Starter motor does not disengage after switch was depressed	Glow/Crank switch defective Starter motor solenoid defective Engine is already running	Replace Engine Manual Check
Pinion does not disengage after engine is released	Defective starter	Engine Manual
9.1.4 Malfunction In the Engine Starting Circuit		
No power to starter motor solenoid (SS)	Battery defective Loose electrical connections	Check Tighten
Fuel solenoid does not energize or does not remain energized	Battery defective Loose electrical connections Oil pressure safety switch (ENOPS) defective Run relay (RR) defective Engine coolant temp. (ENCT) defective Fuel solenoid defective Run-Stop switch defective	Check Tighten Replace Replace Replace Engine Manual Replace

INDICATION/ TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
9.2 ALTERNATOR (12 Volt DC)		
Alternator fails to charge	Limited charging system operating time Battery condition Alternator belt loose/broken Loose, dirty, corroded terminals, or broken leads Excessively worn, open or defective brushes Open blocking diode Regulator faulty Open isolation diode Open rotor (field coil)	Check Check 8.6 Check/Repair Check Check Check Check Replace
Low or unsteady charging rate	Alternator belt loose Loose, dirty, corroded terminals, or broken leads Excessively worn, sticky or intermittent brushes Faulty regulator Grounded or shorted turns in rotor Open, grounded or shorted turns in stator	8.6 Check/Repair Check Check Check 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 Defective regulator	Clean/Repair Check
Noisy alternator	Defective or badly worn V-belt Worn bearing(s) Misaligned belt or pulley Loose pulley	8.6 Replace 8.6 Tighten

INDICATION/ TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
9.3 REFRIGERATION **9.3.1 Unit Will Not Cool**		
Diesel engine	Malfunction(s)	9.1
Compressor malfunction	Compressor drive defective Compressor defective	8.14 8.14
Refrigeration system	Defrost cycle did not terminate Abnormal pressure Solenoid valve malfunction Clutch Failure (Ultima)	9.3.5 9.3.6 9.3.11 8.9
9.3.2 Unit Runs But Has Insufficient Cooling		
Compressor	Compressor valves defective Unloader malfunction	8.14 8.16
Refrigeration system	Abnormal pressure Unloader malfunction Expansion valve malfunction No or restricted evaporator airflow Clutch Failure (Ultima)	9.3.6 8.16 9.3.10 9.3.9 8.9
Engine does not develop full rpm	Speed control linkage Engine malfunction	8.5.5 9.1
9.3.3 Unit Operates Long or Continuously in Cooling		
Trailer	Hot Load Defective box insulation or air leak	Allow time to pull down Correct
Refrigeration system	Abnormal pressure Temperature controller malfunction	9.3.6 9.3.8
Compressor	Defective	8.14
9.3.4 Unit Will Not Heat or Has Insufficient Heating		
Refrigeration	Abnormal pressure Temperature controller malfunction Solenoid valve malfunction 1/4” check valve (bypass) defective Clutch Failure (Ultima)	9.3.6 9.3.8 9.3.11 8.17 8.9
Compressor	Compressor drive defective Compressor defective	8.14 8.14
Engine does not develop full rpm	Speed control linkage Engine malfunction	8.5.5 9.1

INDICATION/ TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
9.3.5 Defrost Cycle Malfunction		
Will not initiate defrost automatically	Defrost air switch (DAS) out of calibration Both DTT1 & DTT2 are above 40°F (4.4°C) Defrost air switch (DAS) defective Loose terminal connections Air sensing tubes defective or disconnected	8.27 Cool Box Down 8.26 & 8.27 Tighten Check
Will not initiate defrost manually	Microprocessor defective Loose terminal connections Both DTT1 & DTT2 are above 40°F (4.4°C) Unit has been running less than 15 seconds	Replace Tighten Cool Box Down Try again
Initiates but does not defrost	Low refrigerant charge Solenoid valve malfunction Clutch/Gearbox defective	8.13 9.3.11 Replace
Frequent defrost	Defrost air switch (DAS) out of adjustment Wet load	8.26 & 8.27 Normal
Does not terminate or cycles on defrost	Low refrigerant charge Defrost air switch (DAS) out of adjustment	8.13 8.26 & 8.27
9.3.6 Abnormal Pressure **9.3.6.1 Cooling**		
High discharge pressure	Condenser coil dirty Condenser fan defective V-belt broken or loose Discharge check valve restricted Noncondensibles or refrigerant overcharge Solenoid valve (SV-1) malfunction	8.29 8.9 8.6 8.17 Replace 8.25
Low discharge pressure	SV3 or SV4 leaking by Compressor valves(s) worn or broken	8.24 8.14
High suction pressure	SV3 or SV4 leaking by Compressor valves(s) worn or broken Compressor gasket(s) defective	8.24 8.14 8.14
Low suction pressure	Suction service valve partially closed King valve partially closed Filter-drier partially plugged Low refrigerant charge Expansion valve malfunction No evaporator air flow or restricted air flow Excessive frost on coil Solenoid valve (SV-2) defective Clutch Failure (Ultima)	Open Open 8.18 8.13 9.3.10 9.3.9 8.26 8.24 8.9
Suction and discharge pressures tend to equalize when unit is operating	Compressor valves defective	8.14

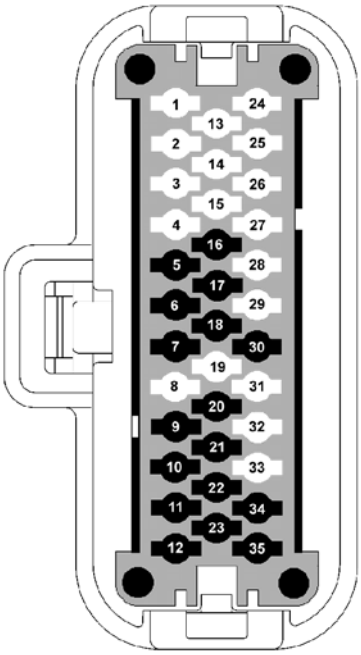
INDICATION/ TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
9.3.6.2 Heating		
High discharge pressure	Solenoid valves (SV-1, SV-3 and SV-4) malfunction Condenser fan defective V-belts broken or loose Non-condensibles in system	9.3.11 8.9 8.6 Check
Low discharge pressure	Compressor valve(s) worn or broken Solenoid valve (SV-1) malfunction Low refrigerant charge	8.14 9.3.11 8.13
Low suction pressure	Refrigerant shortage Solenoid (SV-1) open	8.13 9.3.11
9.3.7 Abnormal Noise		
Compressor	Loose mounting bolts Worn bearings Worn or broken valves Liquid slugging Insufficient oil	Tighten 8.14 8.14 9.3.10 8.15
Condenser or evaporator fan	Loose or striking shroud Bearings defective Bent shaft	Check 8.9 8.9
Clutch/Gearbox	Defective	Replace
V-belts	Cracked or worn	8.6
9.3.8 Control System Malfunction		
Will not control	Sensor defective Relay(s) defective Microprocessor controller malfunction	8.30 Check Check
9.3.9 No Evaporator Air Flow or Restricted Air Flow		
Evaporator coil blocked	Frost on coil Dirty coil	8.26 8.28
No or partial evaporator air flow	V-belt broken or loose Clutch/Gearbox defective Evaporator fan loose or defective Evaporator fan rotating backwards Evaporator air flow blocked in trailer (box)	8.6 Replace 8.9 8.6 Check

INDICATION/ TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
9.3.10 Expansion Valve Malfunction		
Low suction pressure with high superheat	Low refrigerant charge External equalizer line plugged Ice formation at valve seat Wax, oil or dirt plugging valve or orifice Broken capillary Power assembly failure or partial Loss of element/bulb charge Superheat setting too high	8.11/8.13 Clean 8.12 8.19 8.19 Replace 8.19
Low superheat and liquid slugging in compressor	Superheat setting too low External equalizer line plugged Ice holding valve open Foreign material in valve Pin and seat of expansion valve eroded or held open by foreign material	8.19 Open 8.12 Clean 8.19
Fluctuating suction pressure	Improper bulb location or installation Low superheat setting	8.19 8.19
High superheat	Broken capillary	8.19
9.3.11 Solenoid Valve Malfunction		
Solenoid valve does not function properly	No power to valve Improper wiring or loose connections Coil defective Valve improperly assembled Coil or coil sleeve improperly assembled Movement of plunger restricted due to: a. Corroded or worn parts b. Foreign material lodged in valve c. Bent or dented enclosing tub	Check Check 8.24 8.24 8.24 8.24 8.24 8.24
Solenoid valve closes but refrigerant continues to flow	Foreign material lodged under seat Defective seat	Clean Replace

Section 10 - Electrical Diagrams

Plugs Used With Schematic 62-10499-00

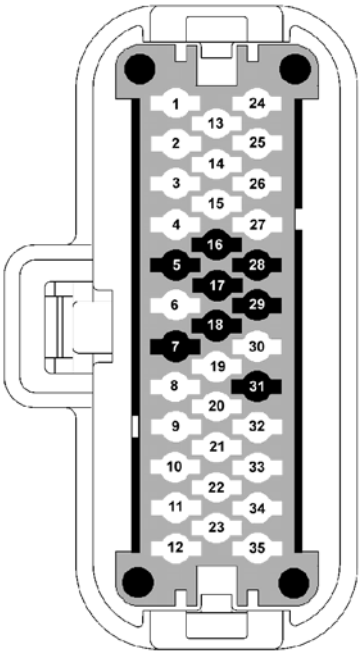
1 MP - White



Component	Terminal
DPT	5 (16) (30)
SPT	6 (17) (30)
WTS	7 (18)
CDT	9 (20)
DTS2	10 (21)
ATS	11 (22)
RAS	12 (23)
CLI	13 (2)
DPT	16 (5) (30)
SPT	17 (6) (30)
WTS	18 (7)
CSTB	19 (32)
CDT	20 (9)
DTS1	21 (34)
DTS2	21 (10)
ATS	22 (11)
SAS	23 (35)
RAS	23 (12)
DPT	30 (5) (16)
SPT	30 (6) (17)
DTS1	34 (21)
SAS	35 (23)

Unused terminals: 1, 2, 3, 4, 8, 13, 14, 15, 19, 24, 25, 26, 27, 28, 29, 31, 32, & 33.

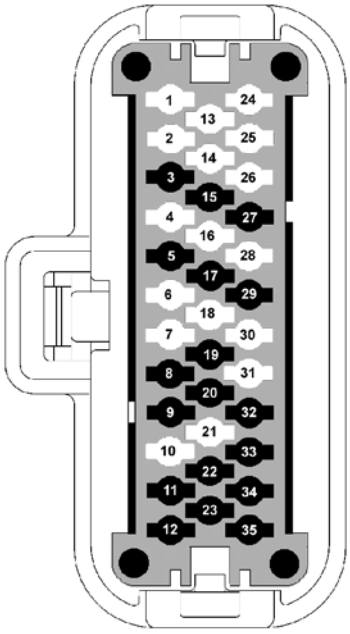
2 MP - Black



Component	Terminal
DA	6
RPM	7 (18) (31)
DS	16
OP	17
RPM	18 (7) (31)
HC9	25
EOL	28
HP1	29
RPM	31 (7) (18)

Unused terminals: 1, 2, 3, 4, 6, 8, 9, 10, 11, 12, 13, 14, 15, 19, 20, 21, 22, 23, 24, 26, 27, 30, 32, 33, 34, & 35.

3 MP - Grey

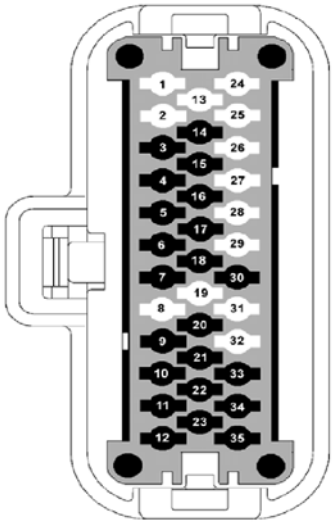


Component	Terminal
SAT	3 (15) (27)
SLP	5 (17) (29)
ORL	8
CL	9
SV2	11
UF	12
SAT	15 (3) (27)
SLP	17 (5) (29)
FL	19
DL	20
SV3	22
UR	23
SAT	27 (3) (15)
SLP	29 (5) (17)
ARL	32
HL	33
SV4	34
SV1	35

Unused terminals: 1, 2, 4, 6, 7, 10, 13, 14, 16, 18, 21, 24, 25, 26, 28, 30, & 31.

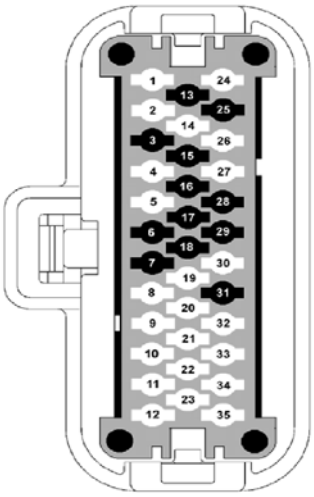
Plugs used with Schematic 62-10499-03 Rev C & E

1 MP - White



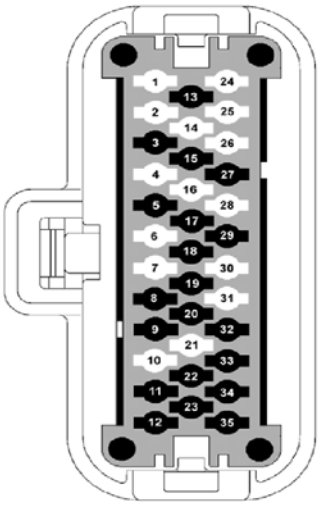
Component	Terminal
REMSN1	3 (14)
REMSN2	4 (14)
CDP	5 (16) (30)
CSP	6 (17) (30)
ENCT	7 (18)
CDT	9 (20)
DTT2	10 (21)
AAT	11 (22)
RAT	12 (23)
REMSN1 (SP23)	14 (3)
REMSN2 (SP23)	14 (4)
REMSN3	15 (33)
CDP	16 (5) (30)
CSP	17 (6) (30)
ENCT	18 (7)
CDT	20 (9)
DTT1 (SP11)	21 (34)
DTT2 (SP11)	21 (10)
AAT	22 (11)
SAT (SP12)	23 (35)
RAT (SP12)	23 (12)
FLS	26
CDP (SPK4)	30 (5) (16)
CSP (SPK4)	30 (6) (17)
REMSN3	33 (15)
DTT1	34 (21)
SAT	35 (23)
Unused terminals: 1, 2, 8, 13, 19, 24, 25, 26, 27, 28, 29, 31 & 32.	

2 MP - Black



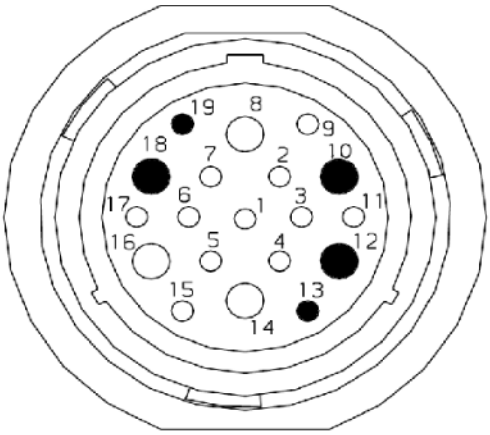
Component	Terminal
REMS1	3
DAS	6
ENRPM	7 (18) (31)
REMS2	13
ENCLS	15
DS	16
ENOPS	17
ENRPM	18 (7) (31)
HC9	25
ENOLS	28
HPS	29
ENRPM	31 (7) (18)
Unused terminals: 1, 2, 4, 5, 8, 9, 10, 11, 12, 14, 19, 20, 21, 22, 23, 24, 26, 27, 30, 32, 33, 34, & 35.	

3 MP - Grey

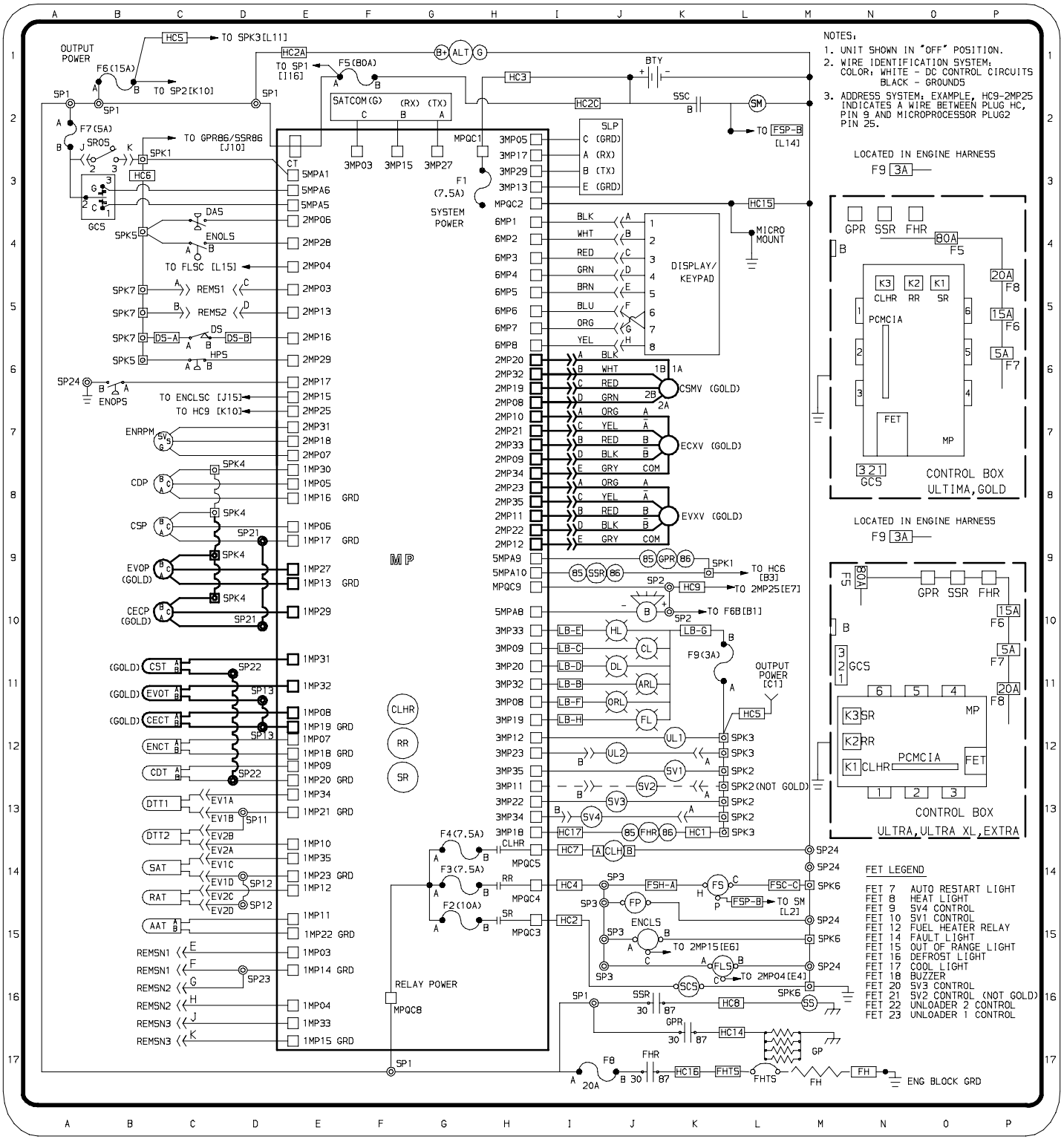


Component	Terminal
SATCOM (C)	3
SLP (C)	5
ORL	8
CL	9
SV2	11
UL1 (Front)	12
SLP (E)	13
SATCOM (B)	15
SLP (A)	17
FHR (HC-17)	18
FL	19
DL	20
SV3	22
UL2 (Rear)	23
SATCOM (A)	27
SLP (B)	29
ARL	32
HL	33
SV4	34
SV1	35
Unused terminals: 1, 2, 4, 6, 7, 10, 14, 16, 21, 24, 25, 26, 28, 30, & 31.	

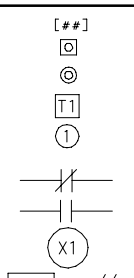
HC Plug



Component	Terminal
+12vdc Input from SPK3 to Fuel Heater Relay Coil	1
+12vdc Output from Speed Relay to Speed Solenoid (SCS)	2
+12vdc Input unswitched Power from Battery (BTY+) To Main Power In (MPQCI)	3
+12vdc Output from Run Relay to SP3	4
+12vdc Output unswitched to – SPK2 SPK3	5
+12vdc Output from SROS to – SPK5 SPK7 or +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 (FHT)	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	

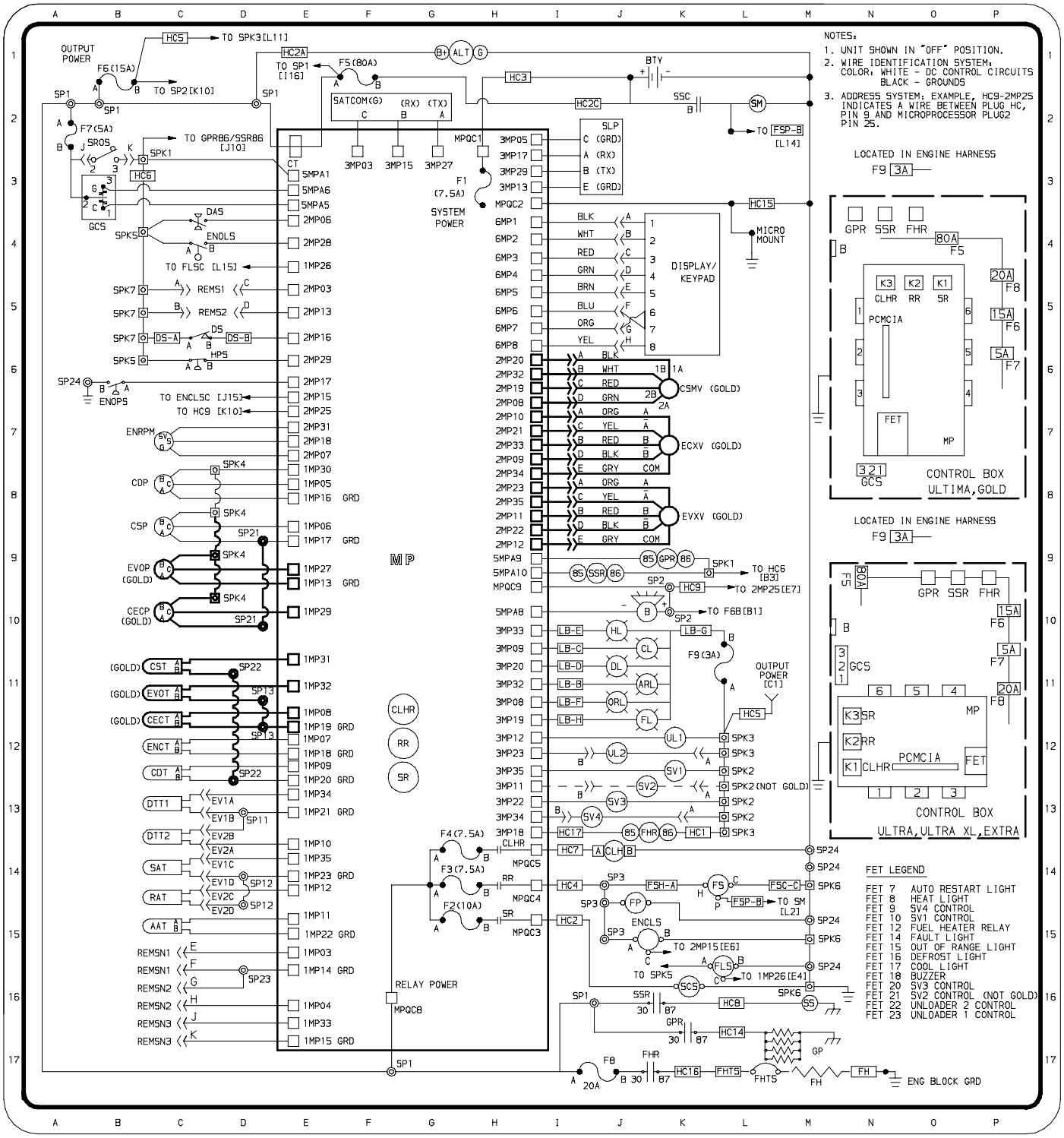


Schematic 62-10499-00 Rev B



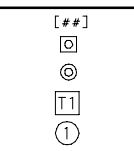
[##] ZONE
SPLICE PACK
INDICATES A SOLDERED SPLICE POINT.
T1 PIN CONNECTION
1 COMPONENT CONNECTION NUMBER OR LETTER
NORMALLY CLOSED CONTACTS.
NORMALLY OPEN CONTACTS.
X1 INDICATES CONNECTION
HC1 OR MULTIPLE PLUG CONNECTION NUMBER
SWITCH SYMBOL INDICATES MOMENTARY CONTACTS.
INDICATES A WIRE GROUND.
INDICATES A CHASSIS GROUND (NO WIRE).
INDICATES A CONNECTION,WIRE,LUG,ETC.

ZONE	SYMBOL	DESCRIPTION
C15	AAT	AMBIENT AIR TEMPERATURE
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
C12	CECT	COMPRESSOR ECONOMIZER TEMPERATURE (GOLD)
C10	CECP	COMPRESSOR ECONOMIZER PRESSURE (GOLD)
J11	CL	COOL LIGHT (LIGHT BAR)
J14	CLH	CLUTCH
H14	CLHR	CLUTCH RELAY
C8	CSP	COMPRESSOR SUCTION PRESSURE
J6	CSMV	COMPRESSOR SUCTION MODULATION VALVE (GOLD)
C11	CST	COMPRESSOR SUCTION TEMPERATURE (GOLD)
E2	CT	CURRENT TRANSFORMER
C4	DAS	DEFROST AIR SWITCH
J11	DL	DEFROST LIGHT (LIGHT BAR)
C6	DS	DOOR SWITCH
C13	DTT	DEFROST TERMINATION TEMPERATURE
K7	ECXV	ECONOMIZER EXPANSION VALVE (GOLD)
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
C9	EVOP	EVAPORATOR OUTLET PRESSURE (GOLD)
C11	EVOT	EVAPORATOR OUTLET TEMPERATURE (GOLD)
K9	EVXV	EVAPORATOR EXPANSION VALVE (GOLD)
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)
L14	F9	FUSE LB (3 AMPERE)
L17,M17	FH	FUEL HEATER
J17,K14	FHR	FUEL HEATER RELAY
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.)
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
B2	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



62-10499-03 Rev C
NDA UNITS - STARTING WITH
S/N GAX90527303

NDX UNITS - STARTING WITH
S/N GAT90515415



[##] ZONE

SPLICE PACK

INDICATES A SOLDERED SPLICE POINT.

T1 PIN CONNECTION

1 COMPONENT CONNECTION NUMBER OR LETTER

NORMALLY CLOSED CONTACTS.

NORMALLY OPEN CONTACTS.

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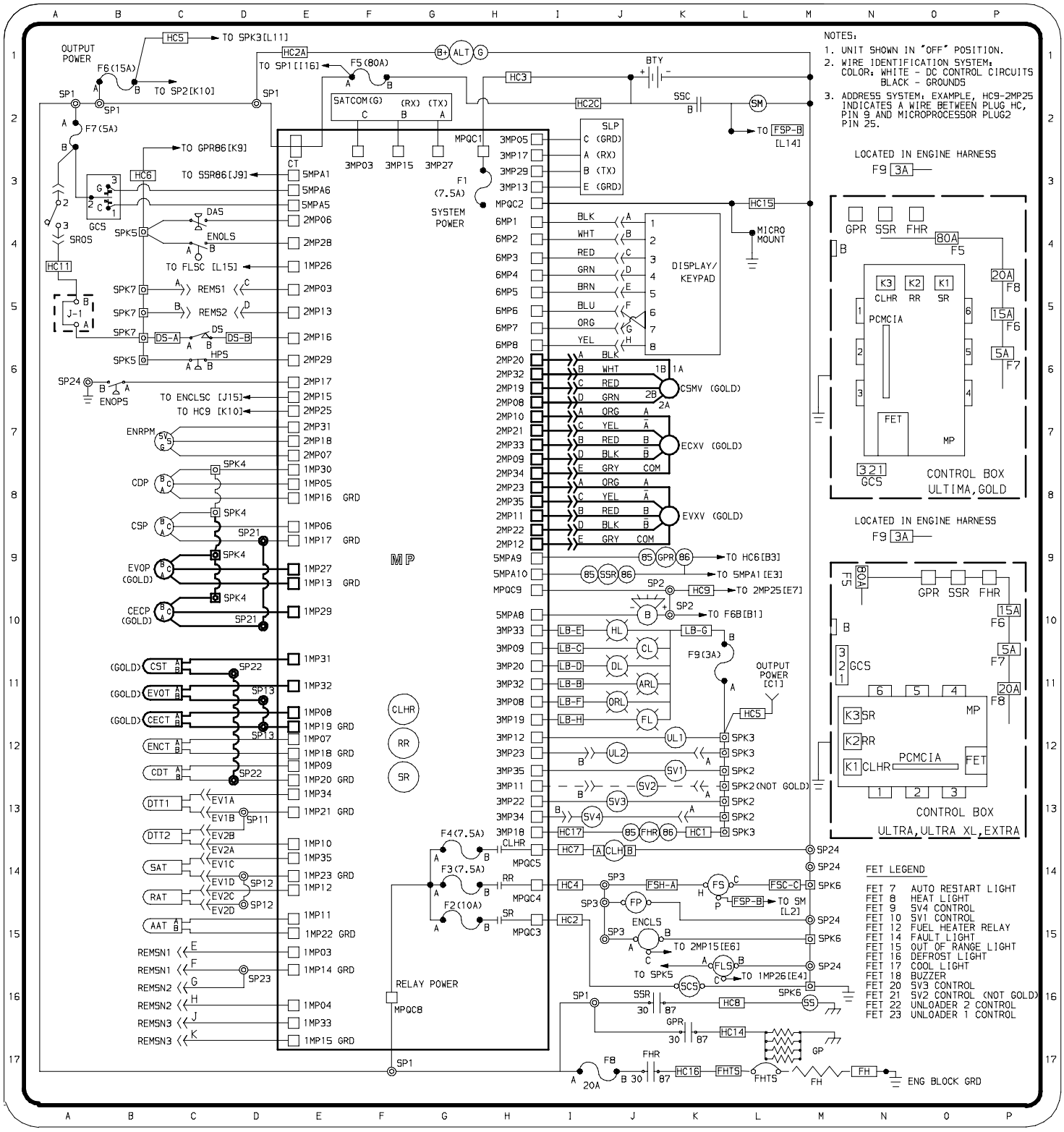
SWITCH SYMBOL INDICATES MOMENTARY CONTACTS.

INDICATES A WIRE GROUND.

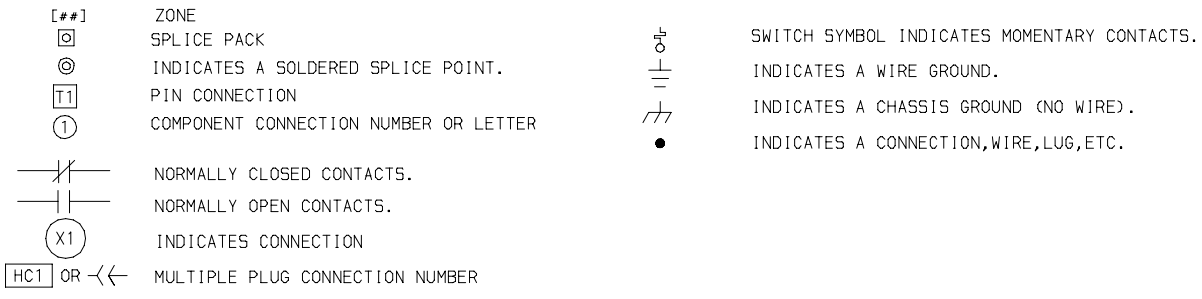
INDICATES A CHASSIS GROUND (NO WIRE).

INDICATES A CONNECTION,WIRE,LUG,ETC.

ZONE	SYMBOL	DESCRIPTION
C15	AAT	AMBIENT AIR TEMPERATURE
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
C12	CECT	COMPRESSOR ECONOMIZER TEMPERATURE (GOLD)
C10	CECP	COMPRESSOR ECONOMIZER PRESSURE (GOLD)
J11	CL	COOL LIGHT (LIGHT BAR)
J14	CLH	CLUTCH
H14	CLHR	CLUTCH RELAY
C8	CSP	COMPRESSOR SUCTION PRESSURE
J6	CSMV	COMPRESSOR SUCTION MODULATION VALVE (GOLD)
C11	CST	COMPRESSOR SUCTION TEMPERATURE (GOLD)
E2	CT	CURRENT TRANSFORMER
C4	DAS	DEFROST AIR SWITCH
J11	DL	DEFROST LIGHT (LIGHT BAR)
C6	DS	DOOR SWITCH
C13	DTT	DEFROST TERMINATION TEMPERATURE
K7	ECXV	ECONOMIZER EXPANSION VALVE (GOLD)
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
C9	EVOP	EVAPORATOR OUTLET PRESSURE (GOLD)
C11	EVOT	EVAPORATOR OUTLET TEMPERATURE (GOLD)
K9	EVXV	EVAPORATOR EXPANSION VALVE (GOLD)
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)
L14	F9	FUSE LB (3 AMPERE)
L17,M17	FH	FUEL HEATER
J17,K14	FHR	FUEL HEATER RELAY
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.)
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
B2	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



62-10499-03 Rev E
UNITS WITH J-1 JUMPER



ZONE	SYMBOL	DESCRIPTION
C15	AAT	AMBIENT AIR TEMPERATURE
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
C12	CECT	COMPRESSOR ECONOMIZER TEMPERATURE (GOLD)
C10	CECP	COMPRESSOR ECONOMIZER PRESSURE (GOLD)
J11	CL	COOL LIGHT (LIGHT BAR)
J14	CLH	CLUTCH
H14	CLHR	CLUTCH RELAY
C8	CSP	COMPRESSOR SUCTION PRESSURE
J6	CSMV	COMPRESSOR SUCTION MODULATION VALVE (GOLD)
C11	CST	COMPRESSOR SUCTION TEMPERATURE (GOLD)
E2	CT	CURRENT TRANSFORMER
C4	DAS	DEFROST AIR SWITCH
J11	DL	DEFROST LIGHT (LIGHT BAR)
C6	DS	DOOR SWITCH
C13	DTT	DEFROST TERMINATION TEMPERATURE
K7	ECXV	ECONOMIZER EXPANSION VALVE (GOLD)
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
C9	EVOP	EVAPORATOR OUTLET PRESSURE (GOLD)
C11	EVOT	EVAPORATOR OUTLET TEMPERATURE (GOLD)
K9	EVXV	EVAPORATOR EXPANSION VALVE (GOLD)
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)
L14	F9	FUSE LB (3 AMPERE)
L17,M17	FH	FUEL HEATER
J17,K14	FHR	FUEL HEATER RELAY
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

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