Operation and Service Manual

X4™ 7300 and 7500

For Units Prior to Serial Number UAJ91657524

Trailer and Rail Refrigeration Units

62-11637 Rev K

Carrier TRANSICOLD

Operation and Service Manual

for

X4™ 7300 and 7500

Trailer and Rail Refrigeration Units

Manual Revision History 62-11637

Rev.	Date	Reason for Release
C	12/03/15	Updated alarms, format
C, 0916	09/14/16	Updated AL00130 and AL26106, per Rocky. Changed all STOP/RUN references to START/RUN, per Ken S.
D	09/27/16	This book has several questions before release
E	09/22/17	Added decal 62-04222-00
F	05/10/18	Incorporated R-452A Refrigerant to service section per James Gordon
G	10/31/2018	Updated Sections 3 & 5: Page 3-24 Delete ECO Mode; 3-25 Added Temperature Setting heading, changed Temp Control (removed ref to RAT), Delete Perish Sensitive Product; 3-27 Edit Override Remote switch column, Add Override Fuel Level Sensor Shutdown; 5-22 Added Warm Produce Mode settings; edited 5-23 ProductShield Fresh setting; 5-25 Edit both Tech Reset options and Fuel Level Sensor; 5-26 Added Fuel Flow Meter, edited Low Fuel Alarm shutdown percentage; 5-27 edit LP Shutdown Delay and HP Shutdown Delay; 5-29 Separated Remote Temp Sensor 1 & 2, Bolded defaults, edited Rail Override Restart verbiage; 5-30 Edited Door Switch; 5-31 Edited Remote Switch 1; 5-33 Added Number of Comm Modules, Number of Remote Panels, Setpoint Change Alarm
H	12/20/2019	Updated entire manual to include instructions and graphics covering units without SV2. Changes to sections 2, 3, 4, and 5
J	5/15/2020	Updated cover and logos; 8.9.8.2 and 8.9.9.2 – added instruction to “check each pin to chassis ground’ to stepper diagnosis for EVXV and CSMV
K	3/3/2021	Updated Sections 1, 2, and 8 to add references and instructions for R-452A refrigerant; Section Section 5.2.4: Added EVXV and CSMV to list under step 2; Section 5.3.3: Updated step 5 (download folder name), updated USB part number; Section 8.9.8.1, step 3: Updated verbiage to reference CSMV in Component Test mode; Section 8.9.9.1: Updated first paragraph to reference EVXV in Component Test mode; Replaced coolant references and Notices (Use Organic Acid Technology (OAT), nitrite free (NF) extended life coolant) (per BM)

Change Pages

Date	Page	Changes
12/10/14	8-12	If, after placing the system in Economized Mode for 180 seconds, engine speed is not low enough to calibrate the sensor (1700 – 1780 RPM), Changed “not high enough” to “not low enough” Same change for X4 & 8600MT
05/15	8-…	Update MMM & SVM R/R per bulletin from 05/05/15
		Remove AL5017 see 0040
08/15	3-28, 3-29	Added Inspect Mode and Emergency Bypass Mode Change Pages
12/03/15	all	Updated alarms, format. Athens reviewed this material.
03/16/16	RPS Calibration procedures	Changed “ECU” to “ENCU” Added “Ensure the unit will not start automatically by placing the STOP/RUN-OFF switch in the OFF position and disabling the starter.” And “Re-enable the starter and start the unit.”
09/14/16	200, 248	Updated AL00130 and AL26106, per Rocky. 5v to 12v
09/14/16	various	Changed all STOP/RUN references to START/RUN, per Ken S.
10/11/16	2-16	Changed Coolant Capacity from 2.9 gallons (11 liters) to 2.4 gallons (9 liters)
Updated 02/27/2017	multiple	Schematic shows Fuel Solenoid Actuator (did not update schematic) This should be called Fuel/speed actuator not fuel speed actuator or fuel solenoid.
Updated 02/28/17	Multiple	Added tables based on James G & Gary Davis request from 01/09/17
Updated 09/22/17	Safety	Need to add new decal, 62-04222-00

TABLE OF CONTENTS

PARAGRAPH NUMBER **Page**

SECTION 1
Safety Precautions

1.1 Safety Precautions

WARNING

SAFETY CONSIDERATIONS: Installation and servicing of refrigeration equipment can be hazardous due to system pressures, rotating elements and electrical components. Only trained and qualified service personnel should install, repair or service refrigeration equipment. When working on refrigeration equipment, observe precautions in all literature including this manual, the equipment tags and labels attached to the unit, and other safety precautions that may apply. Follow safe work practices and utilize the appropriate protective equipment at all times.

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 START/RUN-OFF switch (SROS) is in the START/RUN position.

NOTICE

Electronic modules MUST be handled with care to prevent accidental damage or degradation from electrical static discharge (ESD), contamination or abuse. Before touching a module, touch your body and/or conductive tool being used to the frame to discharge ESD safely. All electronics should be handled carefully and only held by edges of any exposed board. Care should be taken when inserting/extracting connectors and components to avoid exerting excessive stress on the board which could fracture small components nearby, resulting in future failure of the circuit.

NOTICE

Under no circumstances should a technician electrically probe the modules at any point, other than the connector terminals where the harness attaches. Module 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 module.

Automatic Start-Stop

This refrigeration unit is equipped with Auto-Start in both Start-Stop and Continuous Operation. The unit may start at any time. A buzzer will sound for five seconds before the unit is started. When performing any check of the refrigeration unit (e.g., visually checking belts, checking the oil), place unit in **Inspect Mode** and disconnect the starter solenoid connector.

Engine Coolant

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

Refrigerants

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

Battery

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

1.2 Specific Warning, Caution, and Notice Statements

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

DANGER

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

WARNING

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

CAUTION

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

NOTICE

NOTICE - warns against potential product or property damage.

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

WARNING

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

WARNING

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

WARNING

Do not toggle the START/RUN - OFF switch out of the OFF position when in PC mode or the unit will start.

WARNING

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

WARNING

Beware of moving belts and belt-driven components. When working with belts, beware of pinch points.

WARNING

Never use air or gases containing oxygen for leak testing or operating refrigerant compressors. Pressurized mixtures of air or gases containing oxygen can lead to explosion.

WARNING

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

WARNING

Use the required protective eye wear and clothing when working with solvents.

WARNING

Never use air or gases containing oxygen for leak testing or operating refrigerant compressors. Pressurized mixtures of air or gases containing oxygen can lead to explosion.

WARNING

Do not use a nitrogen cylinder without a pressure regulator. Cylinder pressure is approximately 2350 psig (159.9 bar). Do not use oxygen in or near a refrigerant system as an explosion may occur. (Figure 8.43).

WARNING

Do not unscrew service valve mounting capscrews all the way before breaking seal. Entrapped pressure could result in injury.

WARNING

Do not unscrew replacement compressor lifting eyelet/blankoff plate mounting capscrews all the way before breaking seal. Entrapped pressure could result in injury.

WARNING

Do not unscrew cylinder head mounting capscrews all the way before breaking seal. Entrapped pressure could result in injury.

WARNING

Do not unscrew enclosing tube nut all the way before breaking seal. Entrapped pressure could result in injury.

⚠ WARNING

Do not unscrew unloader valve body mounting bolts all the way before breaking seal. Entrapped pressure could result in injury.

⚠ WARNING

Only a refrigerant cylinder containing R-404A or R-452A should be connected to this refrigeration unit in order to pressurize the system. However, dry nitrogen may be used to increase pressure. Any other gas or vapor will contaminate the system and require additional removal and evacuation.

⚠ 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 the negative and then the positive battery terminal when charging battery in unit.

⚠ CAUTION

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

⚠ CAUTION

Disconnect batteries before doing any electrical welding on unit or chassis to which unit is attached (trailer, container, rail car, metal building, etc).

NOTICE

Under no circumstances should anyone attempt to repair sealed module internal components. Should a problem develop with these components, contact your nearest Carrier Transicold dealer for replacement.

NOTICE

Technician mode should be canceled when work is complete. If Technician mode is not canceled, Technician mode will be available for 60 minutes after the last key press without requiring a code, even after placing the SROS in the OFF and then back in the RUN/STOP position.

NOTICE

Under no circumstances should a technician electrically probe the modules at any point, other than the connector terminals where the harness attaches. Module 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 module.

NOTICE

Electronic modules MUST be handled with care to prevent accidental damage or degradation from electrical static discharge (ESD), contamination or abuse. Before touching a module, touch your body and/or conductive tool being used to the frame to discharge ESD safely. All electronics should be handled carefully and only held by edges of any exposed board. Care should be taken when inserting/extracting connectors and components to avoid exerting excessive stress on the board which could fracture small components nearby, resulting in future failure of the circuit.

NOTICE

Ensure that the clock you are using is accurate. Also, some customers are located in different time zones from the repair location. If you know the owners desired location time, enter that time. If you don’t, enter the current time at your location.

NOTICE

DO NOT leave the air intake circuit energized for the full 5 minutes if full amperage is shown, as the intake air heater element life will be greatly shortened.

NOTICE

Unit uses R404A and POE oil. The use of inert gas brazing procedures is mandatory for all Carrier Transicold refrigeration units; otherwise compressor failure will occur. For more information Refer to Technical Procedure 98-50553-00 Inert Gas Brazing.

NOTICE

Running the engine for an extended period of time with the manual plunger up can cause a priming pump failure.

NOTICE

Torque fuel level sensor mounting screws to 15 to 18 inch/lbs (1.7 to 2.0 Nm). DO NOT over tighten, as little as 20 inch/pounds (2.3 Nm) will damage the sensor.

NOTICE

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

NOTICE

Use only red Extended Life Coolant, Nitrite Free (ELC-NF) that is premixed to a 50/50 concentration of coolant/water. Coolant should meet ASTM specifications D3306 and D6210 and be labeled for at least five years, 12,000 hours service life. Do not add conventional or long life coolant (green, purple, or blue-green) to a cooling system using ELC-NF (Red) coolant except in an emergency. If the ELC-NF coolant is diluted with conventional or long life coolant the change interval reverts to two years, 6,000 hours.

NOTICE

NEVER POUR COLD WATER INTO A HOT ENGINE, however hot water can always be added to a cold engine.

NOTICE

Do not vapor charge R404A or R-452A refrigerants. Only liquid charging through the liquid line service valve is acceptable.

NOTICE

Ensure that thrust washer does not fall off dowel pins while installing oil pump.

NOTICE

An overcharge of oil will reduce system capacity and possibly cause internal compressor damage.

NOTICE

Use only Carrier Transicold approved Polyol Ester Oil (POE). Buy quantities of one gallon or less. When using this hygroscopic oil, immediately reseal. Do not leave container of oil open or contamination will occur.

NOTICE

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.

NOTICE

Unit uses R404A and POE oil. The use of inert gas brazing procedures is mandatory for all Carrier Transicold refrigeration units; otherwise compressor failure will occur. For more information Refer to Technical Procedure 98-50553-00 Inert Gas Brazing.

NOTICE

When a module is replaced, software should be upgraded before switching the unit on. This will ensure software compatibility of all modules.

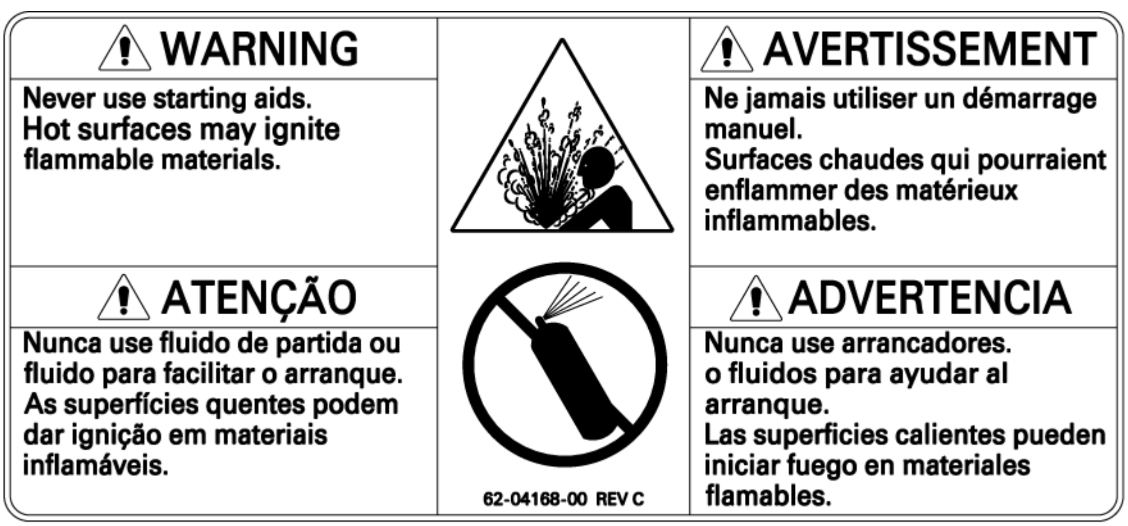
NOTICE

Do not bend the copper tubing on the condenser coil when installing the new condenser. Bend the unit tubing if tubes do not align correctly.

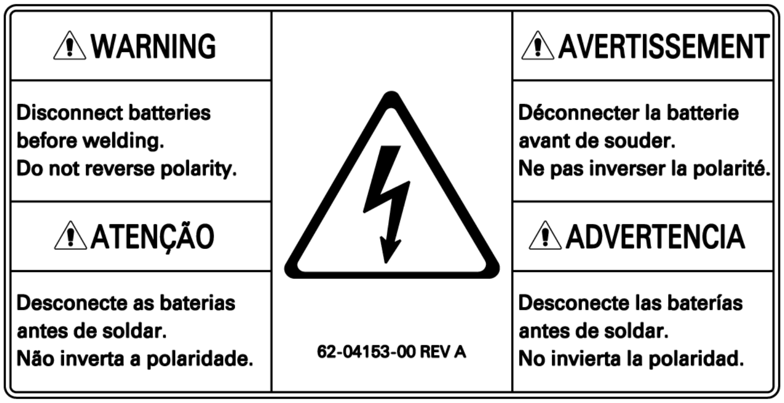

62-04156-00 REV A

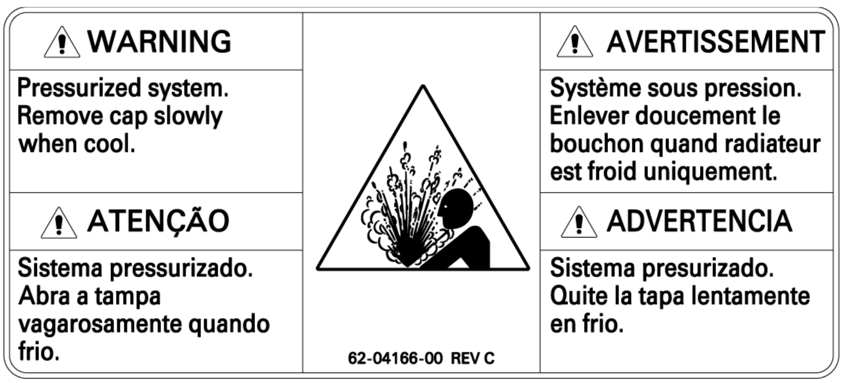

62-03958

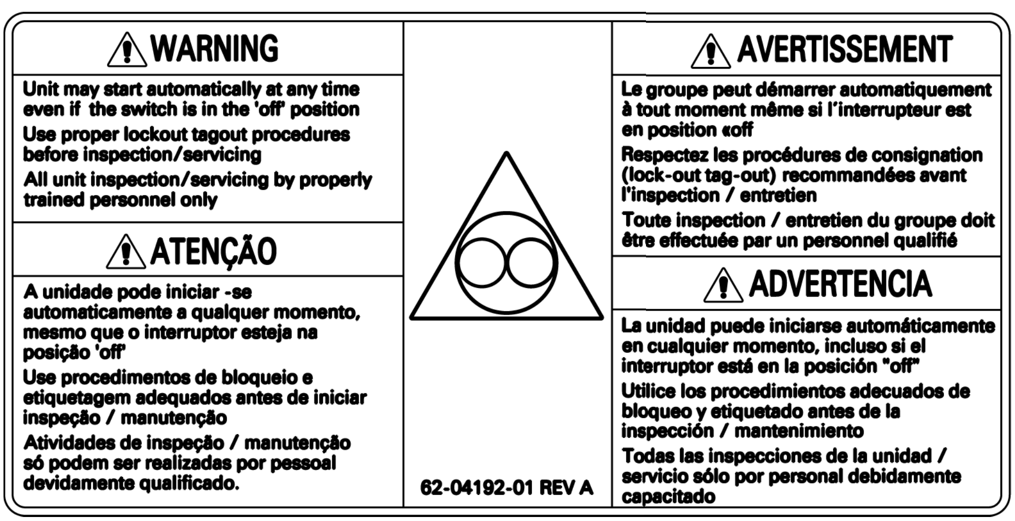

WARNING
Contains hot surfaces that will ignite flammable materials.
Inspect before use.
AVERTISSEMENT
Contient des surfaces chaudes qui pourraient enflammer des matériaux inflammables.
Inspecter avant utilisation
ATENÇÃO
Contem superfícies quentes que podem dar ignição em materiais inflamaveis.
Inspecione antes de usar.
ADVERTENCIA
Contiene superficies calientes que puede fuego con materiales flamables.
Inspeccione antes de usar.
62-04167-00 REV A


WARNING
Never use starting aids.
Hot surfaces may ignite flammable materials.
AVERTISSEMENT
Ne jamais utiliser un démarrage manuel.
Surfaces chaudes qui pourraient enflammer des matérieux inflammables.
ATENÇÃO
Nunca use fluido de partida ou fluido para facilitar o arranque.
As superfícies quentes podem dar ignição em materiais inflamáveis.
ADVERTENCIA
Nunca use arrancadores.
o fluidos para ayudar al arranque.
Las superficies calientes pueden iniciar fuego en materiales flamables.
62-04168-00 REV C

1.4 Safety Decals







1.3 Specific R-452A Refrigerant Warning and Cautions

⚠ WARNING

R-452A is an A1 non-flammable refrigerant blend; however certain of its constituents are considered A2L mildly flammable.

For this reason, it is imperative that the system of a Vector unit utilizing R-452A refrigerant be reclaim to a sufficient vacuum to ensure all residual refrigerant is removed from the system.

Follow the R-452A refrigerant reclaim / recovery procedure before performing any “Hot work” including but not limited to brazing or welding on a unit that has been charged with R-452A, to prevent flare up of residual A2L refrigerant constituents.

Refrigerant must be reclaimed until equipment gauge indicates 20 inHG (-0.6bar) of vacuum.

Refer to Section 8.8 Removing The R- 452A Refrigerant Charge

⚠ CAUTION

As distinct of R404A refrigerant, R-452A has a temperature glide (specific properties) more important and not negligible between vapor state and liquid state.

For a given temperature, the liquid state pressure value and the vapor state pressure value, of the R-452A refrigerant are different.

Refer to Table 8–5 and Table 8–6 for Temperature pressure chart.

⚠ CAUTION

Do not vapor charge R-404A or R-452A. Only liquid charging is acceptable.

⚠ CAUTION

The scroll compressor achieves low suction pressure very quickly. Do not use the compressor to evacuate the system below 0 psig. Never operate the compressor with the suction or discharge service valves closed (frontseated). Internal damage will result from operating the compressor in a deep vacuum.

⚠ CAUTION

Do not direct water or steam into the generator openings. Do not allow any soap and water solutions to enter the generator.

⚠ CAUTION

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

⚠ AVERTISSEMENT

Le groupe peut démarrer automatiquement à tout moment même si l'interrupteur est en position <<off>>.

Respectez les procédures de consignation (lock-out tag-out) recommandées avant l'inspection/entretien.

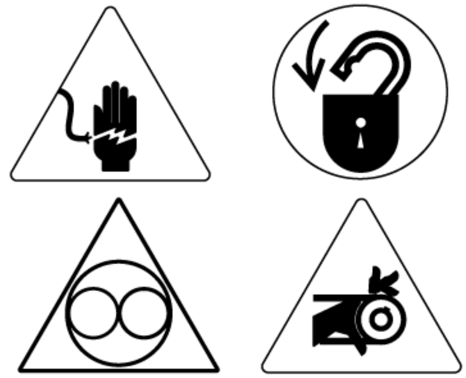
Toute inspection / entretien du groupe doit être effectuée par un personnel qualifié.

⚠ ATENÇÃO

A unidade pode iniciar -se automaticamente a qualquer momento, mesmo que o interruptor esteja na posição 'off'.

Use procedimentos de bloqueio e etiquetagem adequados antes de iniciar inspeção / manutenção.

Atividades de inspeção / manutenção só podem ser realizadas por pessoal devidamente qualificado.



62-04145-02 REV F

⚠ ADVERTENCIA

La unidad puede iniciarse automáticamente en cualquier momento, incluso si el interruptor está en la posición "off".

Utilice los procedimientos adecuados de bloqueo y etiquetado antes de la inspección / mantenimiento.

Todas las inspecciones de la unidad /servicio sólo por personal debidamente capacitado.

⚠ WARNING

Unit may start automatically at any time even if the switch is in the 'off' position.

Use proper lockout tagout procedures before inspection / servicing.

All unit inspection/servicing by properly trained personnel only.

62-04159-00 REV C

⚠ AVERTISSEMENT

Utiliser le couvercle de protection pour éviter un court circuit batterie

⚠ ATENÇÃO

Use capa dos terminais da bateria para evitar curto-circuito

⚠ WARNING

Use terminal covers to avoid battery short circuit

⚠ ADVERTENCIA

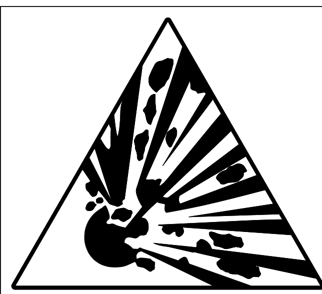
Use las protecciones de las terminales para evitar corto circuito de la batería

⚠ WARNING

Use terminal covers to avoid battery short circuit

⚠ ATENÇÃO

Use capa dos terminais da bateria para evitar curto-circuito



62-04222-00 REV -

⚠ AVERTISSEMENT

Utiliser le couvercle de protection pour éviter un court circuit batterie

⚠ ADVERTENCIA

Use las protecciones de las terminales para evitar corto circuito de la batería

⚠ WARNING	⚠ AVERTISSEMENT
Charge only with R-404A	Charger uniquement avec du R-404A
⚠ ATENÇÃO	⚠ ADVERTENCIA
Carregue somente com R-404A	Carge unicamente R-404A 62-04160-01 REV B

⚠ WARNING	⚠ AVERTISSEMENT
Charge only with R-452A	Charger uniquement avec du R-452A
⚠ ATENÇÃO	⚠ ADVERTENCIA
Carregue somente com R-452A	Carge unicamente R-452A 62-04160-03 REV H

62-04164-00 REV C

⚠ WARNING

Never use gas mixtures containing oxygen to leak test or operate this product.
Charge only with R-404A refrigerant compliant with AHRI Standard 700.

⚠ AVERTISSEMENT

Ne jamais utiliser un mélange de gaz contenant de l'oxygène pour un test de fuite ou en fonctionnement.
Charger uniquement du réfrigérant R-404A conforme au standard AHRI 700.

⚠ ATENÇÃO

Nunca use misturas de gas que contenha oxigênio para teste de vazamento ou operação deste equipamento.
Carregue somente com refrigerante R-404A em conformidade com a norma AHRI 700.

⚠ ADVERTENCIA

Nunca use mezcla de gases que contenga oxigeno para prueba de fugas o para operar este producto.
Carge únicamente refrigerante R-404A que cumpla con el estándar 700 AHRI.

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

The unit may be equipped with the AutoFresh^{TM} Air Exchange which controls air quality and humidity for fresh produce.

The unit can be described as having three major sections:

- The condensing section (**Figure 2.1** and **Figure 2.2**), which includes the unidrive and power train (**Figure 2.2**).
- The evaporator section (**Figure 2.3**).
- The APX Control System (**Figure 2.2** and **Figure 2.7**).

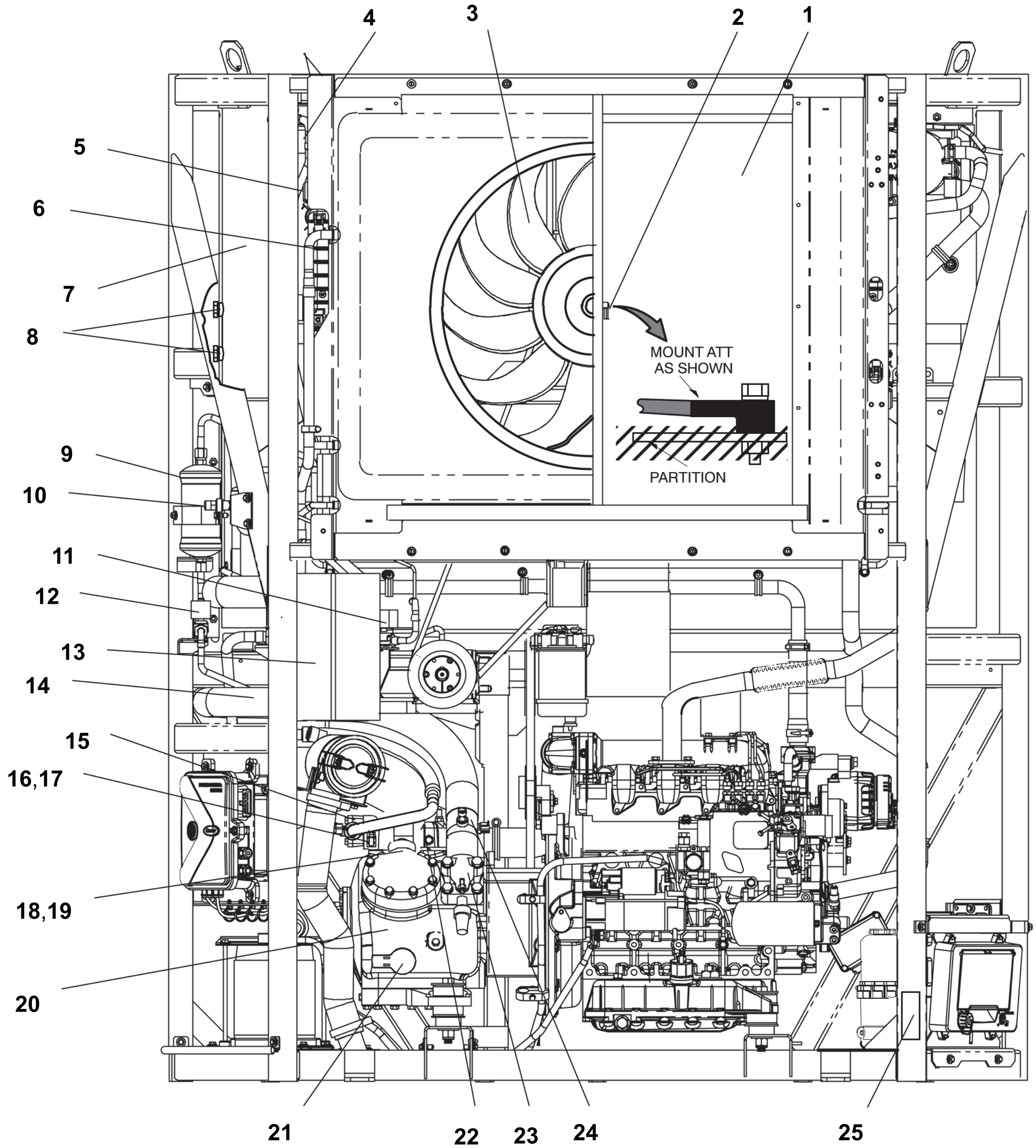
Table 2–1 Model Chart

Model	Refrigerant Type	Refrigerant Charge		Compressor	Engine	Engine Speed
		LB	KG			
X4 7300 NDW136	R-404A	15	6.80	05G 41cfm	V2203L-DI-EF01e	**High** 1800 **Low** 1350
X4 7300 NDW176	R-452A	15	6.80			
X4 7300 (No SV2) NDWB36	R-404A	15	6.80			
X4 7300 (No SV2) NDWB76	R-452A	15	6.80			
X4 7500 NDW236	R-404A	16	7.26			
X4 7500 NDW276	R-452A	16	7.26			
X4 7500 (no SV2) NDWC36	R-404A	16	7.26			
X4 7500 (no SV2) NDWC76	R-452A	16	7.26			

Table 2–2 Additional Support Manuals

Manual Number	Type of Manual
62-11369	Parts Look Up System (PLUS)
62-11644	Operator’s Manual
62-11052	05G Compressor Workshop Manual

Figure 2.1 Front View - Refrigeration System Components



1. Condenser Coil and Sub-Cooler
2. Ambient Air Temperature Sensor (AAT)
3. Condenser Fan
4. Cond. Pressure Control Solenoid Valve (SV1)
5. Defrost Air Switch (DAS)
6. Radiator
7. Receiver
8. Receiver Sight Glasses
9. Filter Drier
10. Liquid Line Service Valve
11. Hot Gas Solenoid Valve (SV4)
12. Liquid Line Solenoid Valve (SV2)*
13. Heat Exchanger
14. Compressor Suction Temperature Sensor (CST)
15. Discharge Service Valve and Strainer
16. High Pressure Switch (HPS - Located in the tee)
17. Compressor Discharge Pressure Transducer (CDP - Located in the elbow)
18. Front Unloader Valve (UL1 - on front head)
19. Rear Unloader Valve (UL2 - on back head)
20. Compressor
21. Compressor Sight Glass
22. Compressor Discharge Temperature Sensor (CDT)
23. Suction Service Valve and Strainer
24. Compressor Suction Pressure Transducer (CSP)
25. Model/Serial Number Nameplate

*For units prior to serial number TAZ91636885

SECTION 2

Unit Description

2.1 Introduction

⚠ WARNING

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

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

Additional support manuals are listed in **Table 2–2**.

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

2.2 Refrigerant Types Used

⚠ WARNING

The unit can be charged with R-404A or R- 452A. Do not mix R-404A and R-452A refrigerant. In addition to the model number, a refrigerant sticker indicates the refrigerant type used by the unit.

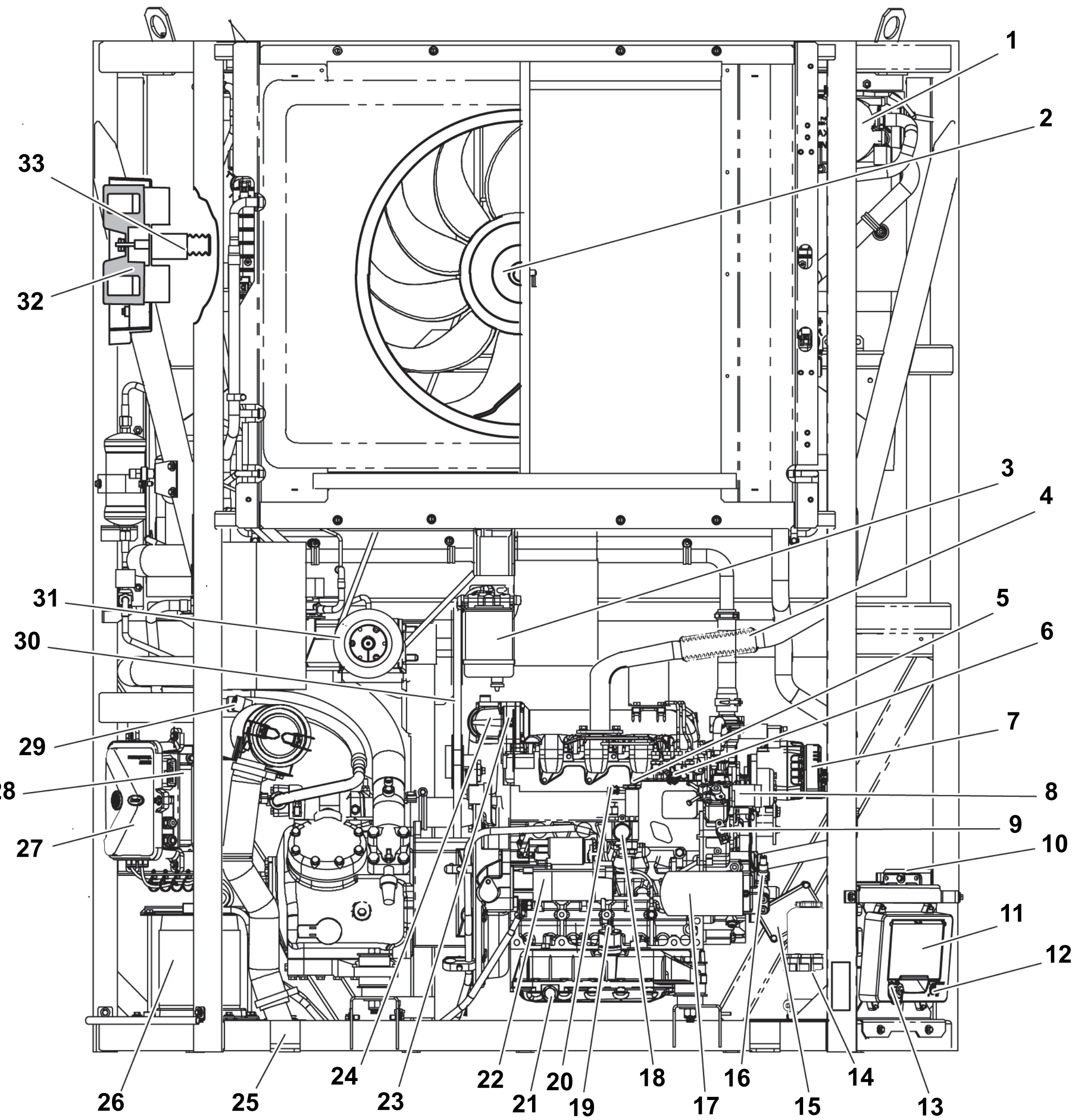
2.3 General Description

The units described in this manual are one-piece, self-contained, fully charged, pre-wired, refrigeration/heating “nosemount” diesel powered units. The units are used on insulated refrigerated compartments to maintain cargo temperatures within very close limits.

The APX Control System includes a manual switch, control modules, fuses, and associated wiring. The unit may be equipped with an optional remote light bar which mounts separately on the front outside corner of the compartment.

Temperature control is provided by the Carrier Transicold APX Control System (Refer to **Section 2.6**). Once the system is set at the desired temperature, the unit will operate automatically to maintain the desired temperature within very close limits. The APX Control System automatically selects high and low speed cooling or high and low speed heating as necessary to maintain the desired temperature within the refrigerated compartment.

Figure 2.2 Front View - Engine, Control System and AutoFresh Components



1. Coolant Bottle
2. Clutch (CLH)
3. Fuel Filter/Heater (FH) or Fuel Head Assembly
4. Exhaust
5. Manual Plunger
6. Bleed Valve
7. Alternator (ALT)
8. Fuel/Speed Actuator (FSA)
9. Engine Speed Sensor (ENSSN)
10. Stepper Valve Module (SVM)
11. Display Module (DM)
12. START/RUN-OFF Switch (SROS)
13. USB Interface Port
14. Suction Side Filter/Heater (If Equipped)
15. Engine Control Unit (ENCU)
16. Engine Oil Pressure Switch (ENOPS)
17. Engine Oil Filter
18. Mechanical Fuel Pump
19. Engine Oil Fill and Dipstick
20. Rack Position Sensor (RPS)
21. Engine Oil Drain
22. Starter (SS,SSC,SM)
23. Engine Preheater (EPH)
24. Engine Coolant Temperature Sensor (ENCT) (Behind Engine Preheater)
25. Intake Air Temperature Sensor (IAT - If Equipped)
26. Battery (BTY)
27. Power Control Module (PCM - Figure 2.7)
28. Main Microprocessor Module (MM)
29. Air Cleaner, Air Cleaner Service Indicator and Manifold Absolute Pressure Transducer (MAP - If Equipped)
30. Lower Belt and Idler
31. Gearbox and Upper Belt
32. AutoFresh Air Exchange
33. AutoFresh Air Exchange Solenoid (AFAS)

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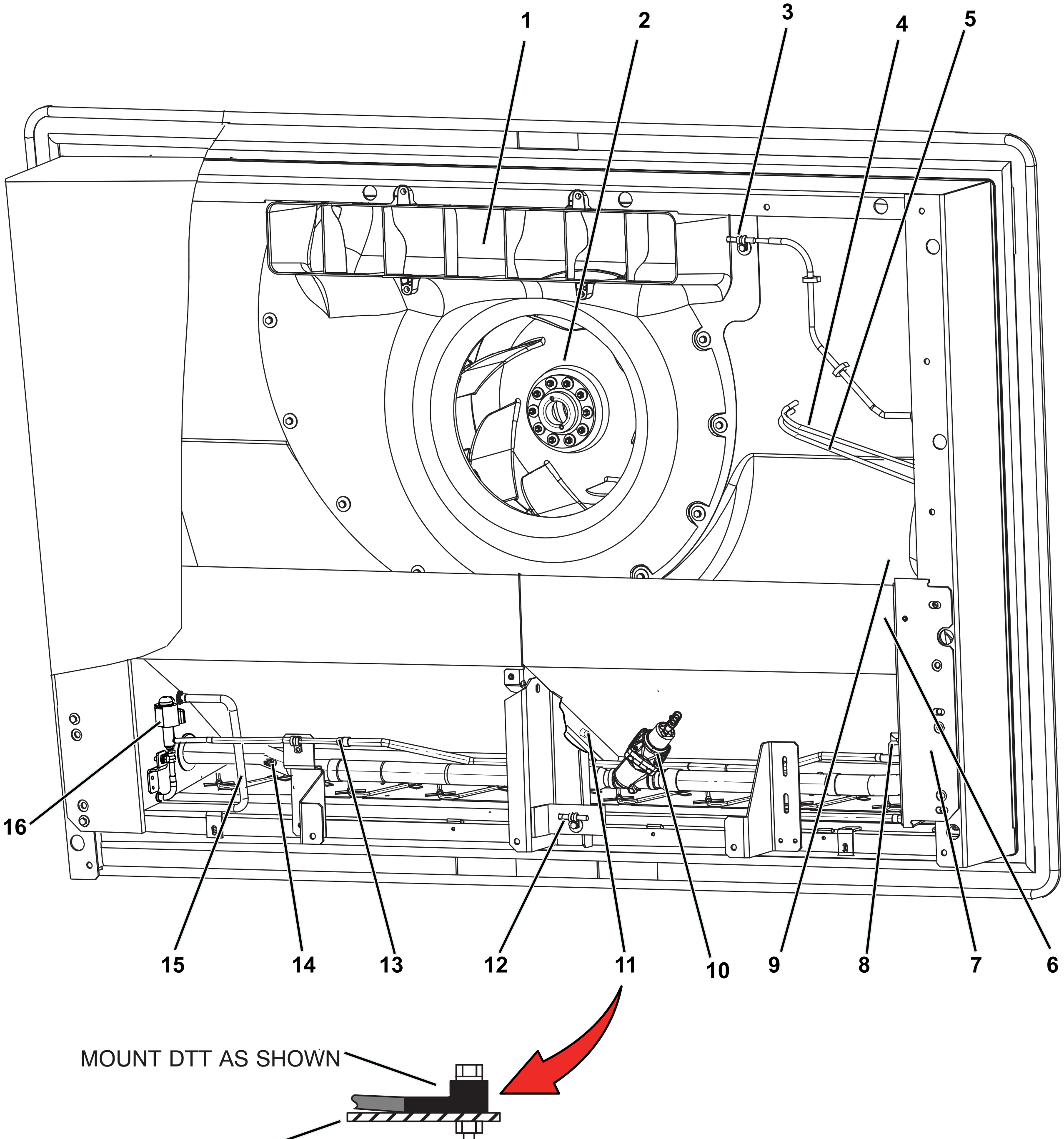
Figure 2.3 Evaporator Section - Grille Removed



1. Evaporator Air Nozzle
2. Evaporator Fan
3. Supply Air Temperature Sensor (SAT)
4. Low Pressure Defrost Air Switch Tubing (Clear)
5. High Pressure Defrost Air Switch Tubing (Red)
6. Evaporator Coil
7. Return Air Temperature Sensor 2 (RAT2) (located behind bracket, if equipped)
8. High Pressure Air Switch Fitting
9. Low Pressure Air Switch Fitting (location)
10. Compressor Suction Modulation Valve (CSMV)
11. Defrost Termination Temperature Sensor (DTT)
12. Return Air Temperature Sensor (RAT)
13. EVXV Inlet Strainer Location
14. Evaporator Outlet Pressure Transducer (EVOP) and Evaporator Outlet Temperature Sensor (EVOT)
15. Hot Gas Line
16. Evaporator Expansion Valve (EVXV)

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2.4 Condensing Section

The condensing section (see Figure 2.1 and Figure 2.2) consists of an engine-compressor drive (unidrive assembly), power train (which drives the fans), AutoFresh Air Exchange, condenser fan, condenser, radiator, heat exchanger, solenoid valves, defrost air switch, piping, wiring, and associated components.

The unidrive assembly (see Figure 2.2) includes the engine, compressor, alternator, air cleaner, coolant system, fuel system, engine oil filter system and engine sensors.

The power train includes the drive belts, gear box, fanshaft and clutch.

2.4.1 Engine

The engine is a four cylinder diesel which gives excellent fuel economy. It drives the compressor directly through a nylon dive gear and adapter. The adapter also includes a V-belt sheave which drives the power train. The engine cooling system consists of the radiator (which is mounted with the condenser coil) and coolant overflow bottle. The engine is equipped with:

- An engine preheater (EPH), which provides easy starting characteristics.
- Spin-on engine oil filter and a spin-on or suction side fuel filters for easier filter changes. The fuel filter may also be equipped with a thermostatically controlled fuel heater.
- An alternator supplies electrical power for the APX Control System and for battery charging.

Refer to Section 2.8 for engine data.

2.4.2 Engine Air System

The air cleaner prolongs the life and performance of the engine by preventing dirt and grit from getting into the engine and causing excessive wear on all operating parts. It is the responsibility of the operator to give the air cleaner equipment regular and constant attention in accordance with the instructions. An air cleaner service indicator is connected at the outlet. Its function is to indicate when the air cleaner filter element requires replacement. (Refer to Section 8.5.10.)

The system may be fitted with an intake air temperature sensor (IAT) and a manifold absolute pressure transducer (MAP). These sensors are installed when Carrier Transicold factory monitoring of the air system is required.

2.4.3 Engine Controls

2.4.3.1 Fuel/Speed Actuator (FSA)

The FSA combines the fuel shutoff solenoid and speed control solenoid into one component. Fuel supply to the injectors and engine speed is controlled by varying rod position in accordance with the signal from the control system. In order to ease the load on the system, speed transition (high to low and low to high) is ramped up or down over a 10 second period. The FSA is located on the front of the injection pump.

2.4.3.2 Engine Speed Sensor (ENSSN)

The ENSSN provides the APX Control System with information on the speed at which the engine is running. The ENSSN is located in the gear case cover above the engine oil filter.

2.4.3.3 Rack Position Sensor (RPS)

The RPS provides the APX Control System with engine fuel rack (throttle) position information to be used to control the engine and refrigeration system. The sensor is located on the injection pump.

2.4.3.4 Engine Oil Pressure Switch (ENOPS)

The ENOPS is normally open and closes on pressure rise to signal to the APX Control System the engine has sufficient oil pressure for operation. There is a 15 second delay after the engine starts to allow the oil pressure to build up before the APX Control System looks at the input from this switch. The switch is located in the oil filter mounting assembly.

2.4.3.5 Engine Coolant Temperature Sensor (ENCT)

The ENCT is a thermistor type sensor that provides the APX Control System with engine coolant temperature information to be displayed, recorded in the DataLink data recorder and used to control the engine and refrigeration system. The sensor is located on the flywheel end of the cylinder head near the #4 Injector.

2.4.4 Alternator

Electrical power for the APX Control System and for battery charging is provided by the 12 VDC alternator.

2.4.4.1 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 the negative and then the positive battery terminal when charging battery in unit.

The alternator converts mechanical and magnetic energy to alternating current (AC) and voltage, by the rotation of an electromagnetic field (rotor) inside a three-phase stator assembly. The alternating current and voltage is changed to direct current and voltage by passing AC energy through a three-phase, full-wave rectifier system. Six silicon rectifier diodes are used.

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

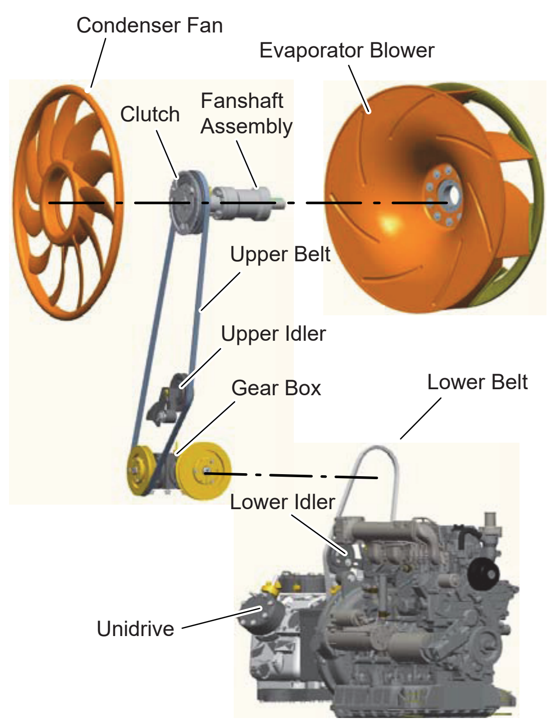
2.4.4.2 Voltage Regulator Operation

The integral 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.

2.4.5 Power Train

The power train (see Figure 2.4) is a belt-driven system that transfers power from the engine to the condenser and evaporator fans. The system consists an upper and lower belt, gear box, fan shaft and clutch.

Figure 2.4 Power Train



2.4.6 Unloaders

The compressor is equipped with unloaders as standard equipment. Unloaders are used as a compressor capacity control to unload the cylinder banks during periods of reduced cooling loads. This provides closer temperature control and reduces the power required to operate the compressor; thus reducing fuel consumption.

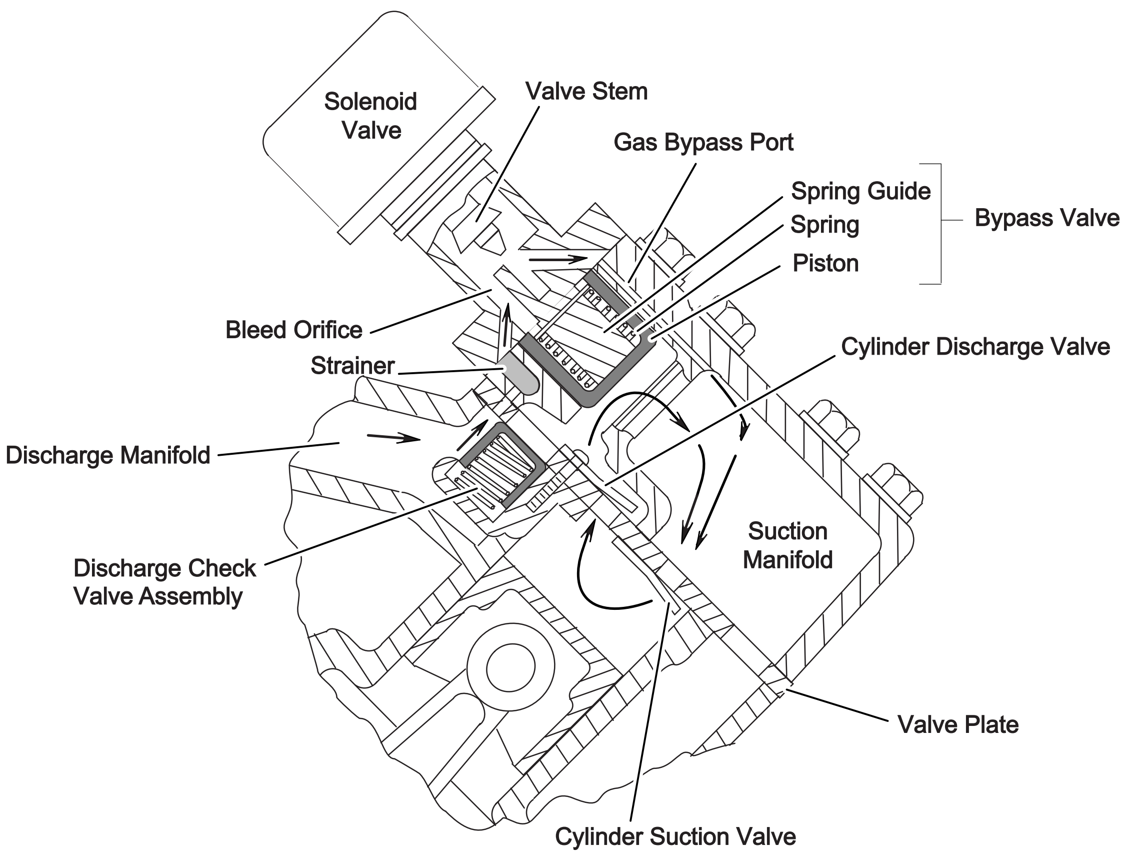
2.4.7 Compressor

The compressor assembly includes the refrigerant compressor, suction and discharge service valves, high pressure switch, compressor discharge temperature sensor and the suction and discharge pressure transducers. The compressor draws refrigerant gas from the evaporator and delivers it to the condenser at an increased temperature and pressure. The pressure is such that refrigerant heat can be absorbed by the surrounding air at ambient temperatures.

2.4.7.1 Major Working Parts

- Solenoid and valve system
- Spring loaded piston type bypass valve
- Spring loaded discharge check valve (located on the valve plate)

Figure 2.5 Compressor Cylinder Head Unloaded



2.4.7.2 Unloaded Operation

Pressure from the discharge manifold (Figure 2.5) passes through the strainer and bleed orifice to the back of the bypass valve piston. Unless bled away, this pressure would tend to close the piston against the spring pressure and load the cylinders in that head.

With the solenoid valve energized the solenoid valve stem will open the gas bypass port.

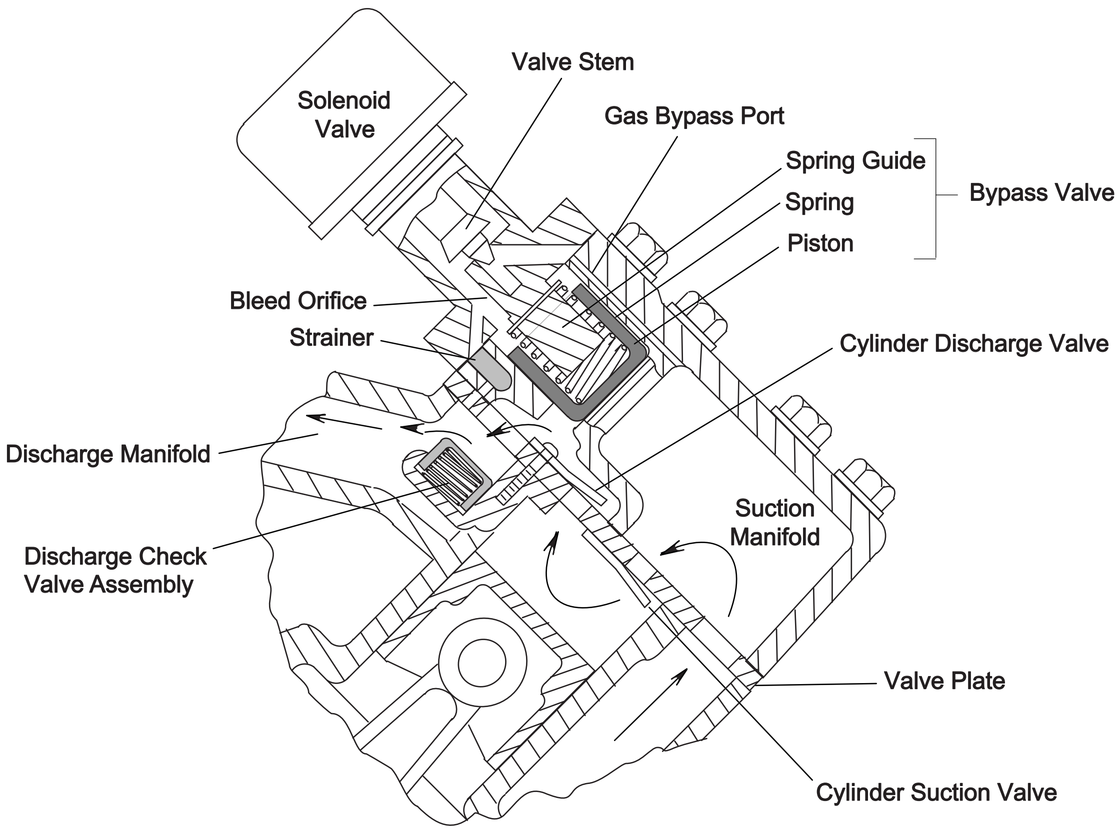
Discharge pressure will be bled to the suction manifold through the opened gas bypass port. A reduction in pressure on the bypass piston valve will take place because the rate of bleed through the gas bypass port is greater than the rate of bleed through the bleed orifice.

When the pressure behind the piston has been reduced sufficiently, the valve spring will force the piston 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 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 is de-energized and the gas bypass port is closed.

Figure 2.6 Compressor Cylinder Head Loaded



2.4.7.3 Loaded Operation

With the solenoid valve (Figure 2.6) de-energized the solenoid valve stem will close the gas bypass port.

Pressure from the discharge manifold through the strainer and bleed orifice will build behind the piston. The increased pressure will overcome the bypass valve spring tension and force the piston forward closing the gas bypass from the discharge manifold to the suction manifold.

Cylinder discharge pressure will force the discharge check valve assembly open. Refrigerant gas will then flow into the compressor discharge manifold.

The loaded cylinder bank will continue to operate fully loaded until the solenoid valve is energized and the gas bypass port is opened.

2.4.8 Compressor Switches, Transducers and Sensors

2.4.8.1 Compressor Discharge Pressure Transducer (CDP)

The CDP provides a signal to the APX Control System equivalent to pressure leaving the compressor. The reading is displayed, recorded in the DataLink data recorder and used to control the refrigeration system. The CDP is located on the compressor center head.

2.4.8.2 Compressor Suction Pressure Transducer (CSP)

The CSP provides a signal to the APX Control System equivalent to pressure entering the compressor cylinders. The reading is displayed, recorded in the DataLink data recorder and used to control the refrigeration system. The CSP is located in the suction line, just above the suction service valve.

2.4.8.3 High Pressure Switch (HPS)

HPS is normally closed and opens on pressure rise to signal to the APX Control System to shut down the engine if discharge pressure rises above switch setting. HPS is located on the compressor center head.

2.4.8.4 Compressor Discharge Temperature Sensor (CDT)

The CDT is a thermistor type sensor that provides a signal to the APX Control System equivalent to the temperature of the gas leaving the compressor. The reading is displayed, recorded in the DataLink data recorder and used to control the refrigeration system. The CDT is located on the compressor center head.

2.4.8.5 Compressor Suction Temperature Sensor (CST)

The CST is a thermistor type sensor that provides a signal to the APX Control System equivalent to the temperature of the gas leaving the heat exchanger and entering the compressor.

The reading is displayed, recorded in the DataLink data recorder and used to control the refrigeration system. The CST is located on the heat exchanger outlet to suction vibrasorber line.

2.4.9 Condenser Coil

The condenser coil is a microchannel type and acts as a heat exchanger in which the compressed refrigerant gas is lowered in temperature and condensed into a liquid. A portion of the condenser coil is occupied by the subcooler, which removes heat from the refrigerant liquid leaving the receiver. Air movement over the condenser/subcooler/radiator is provided by a beltdriven fan mounted in the condensing section.

2.4.10 Heat Exchanger

The heat exchanger is the compact braze plate type and is installed in the main suction line and liquid line. The suction gas is used to cool the warm liquid refrigerant within the heat exchanger. This results in greater system efficiency. The heat exchanger is located below the condenser coil on the curb side.

2.4.11 Ambient Air Temperature Sensor (AAT)

The AAT is a thermistor type sensor that provides the APX Control System with condenser entering air temperature information to be displayed, recorded in the DataLink data recorder and used to control the refrigeration system. The AAT is located behind the front grill.

2.4.12 Solenoid Valves

Flow of refrigerant though the refrigeration system (refer to **Section 2.13** and **Section 2.14**) is controlled by solenoid valves. Solenoid valves are electronic valves that may be opened and closed (energized and de-energized) by the APX Control System as required by the operating conditions. The solenoid valves include the Condenser Pressure Control Solenoid Valve (SV1), Liquid Line solenoid Valve (SV2)* and the Hot Gas Solenoid Valve (SV4), **Figure 2.1**.

2.4.13 Filter Drier

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

2.4.14 Receiver

Liquid refrigerant from the condenser flows into the receiver. The receiver serves as a liquid reservoir when there are surges due to load changes in the system; as a storage space when pumping down the system and as a liquid seal against the entrance of refrigerant gas into the liquid line.

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

2.4.15 AutoFresh Air Exchange

As perishable products respire, they consume oxygen (O_2) and give off carbon dioxide (CO_2). This will eventually cause the atmosphere within a refrigerated compartment to have higher levels of CO_2 and lower levels of O_2. This may adversely affect the shelf life of some sensitive perishable products. When transporting these products, it may be desirable to maintain normal atmospheric conditions (prevent the build up of CO_2 and the depletion of O_2) by using fresh air exchange, in addition to accurate temperature control. The AutoFresh Air Exchange (**Figure 2.2**) controls the amount of fresh air entering the refrigerated compartment without the need for manual intervention while in transit. AutoFresh Air Exchange can also be used to lower the humidity level within a refrigerated compartment if the ambient air has a lower humidity level.

AutoFresh Air Exchange is a factory-installed option, as it requires a modified evaporator pod. It is located at the upper curb side door. When air is being exchanged, two air ports open. The upper port allows fresh ambient air to enter while stale air exits through the lower port.

2.5 Evaporator Section

The evaporator (**Figure 2.3**) fits into a rectangular opening in the upper portion of the front wall of the refrigerated compartment. When installed, the evaporator section is located inside the compartment, and the condensing section is outside.

The evaporator assembly consists of an evaporator coil, evaporator fan, evaporator expansion valve, evaporator outlet pressure transducer, evaporator outlet temperature sensor, defrost termination temperature sensor, supply temperature sensor and return air temperature sensor.

*For units prior to serial number TAZ91636885

2.5.1 Evaporator Coil

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

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

Automatic evaporator coil defrosting is initiated by either the defrost air switch (DAS - which senses the pressure drop across the coil) or by the APX Control System defrost timer. During defrost the system is in the Heat mode, and the clutch is de-energized to stop the evaporator fan.

2.5.2 Evaporator Expansion Valve (EVXV)

The EVXV is an automatic device which controls the flow of liquid to the evaporator according to changes in superheat of the refrigerant leaving the evaporator. The expansion valve maintains a relatively constant degree of superheat in the gas leaving the evaporator regardless of suction pressure. The valve has a dual function - automatic expansion control and prevention of liquid return to the compressor. The valve is located in the liquid line at the entrance to the distributor.

2.5.3 Compressor Suction Modulation Valve (CSMV)

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

2.5.4 Evaporator Switches, Transducers and Sensors

2.5.4.1 Evaporator Outlet Pressure Transducer (EVOP)

The EVOP provides the APX Control System with evaporator outlet pressure information to be displayed, recorded in the DataLink data recorder and used to determine the required position of the evaporator expansion valve. The EVOP is located in the suction line near the evaporator expansion valve.

2.5.4.2 Evaporator Outlet Temperature Sensor (EVOT)

The EVOT provides the APX Control System with evaporator outlet temperature information to be displayed, recorded in the DataLink data recorder and used to determine the required position of the EVXV. The EVOT is a thermistor type sensor located on the suction line near the evaporator expansion valve.

2.5.4.3 Defrost Termination Temperature Sensor (DTT)

The DTT is a thermistor type sensor located on the center tube sheet of the evaporator coil. DTT provides the APX Control System with evaporator temperature information to be displayed, recorded in the DataLink data recorder and used to determine termination of defrost.

2.5.4.4 Return Air Temperature Sensor (RAT / RAT2)

RAT and RAT2 (if equipped) are thermistor type temperature probes which provide the APX Control System information on the temperature of the air entering the evaporator section. The readings are displayed, recorded in the DataLink data recorder and used to control the refrigeration system. RAT is located on a bracket behind the center of the return air grille. RAT2 is located next to the High Pressure Air Switch Fitting.

2.5.4.5 Supply Air Temperature Sensor (SAT)

The SAT is a thermistor type temperature control probe which provides the APX Control System with information on the temperature of air leaving the evaporator section. The reading is displayed, recorded in the DataLink data recorder and used to control the refrigeration system. It is located in the supply air outlet housing.

2.6 System Operating Controls and Components

Temperature control is provided by the Carrier Transicold APX™ Control System. Once the system is set at the desired temperature, the unit will operate automatically to maintain the desired temperature within very close limits.

2.6.1 Multiple Languages

Messages in the MessageCenter can be displayed in English or Spanish. Refer to **Section 3.12** for more information on language selection.

2.6.2 Automatic Start-Stop

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

2.6.3 Special Features

The following additional special features are incorporated into the Carrier Transicold APX Control System:

- An easy to read MessageCenter which clearly displays all required information
- Unit Data and Advanced User selectable Functional Parameters
- Programmable Maintenance Hour Meters
- Bright LED Alarm Light.
- Fully Automated Pre-Trip
- Automated self-test
- DataLink data recorder (uses APX Control System date and time)
- Trip Start to record date/time of trip in DataLink data recorder memory
- USB communication for downloading data, upgrading operational software, and Configuration set up
- Automatic Engine Starting
- Functional Parameter locks
- Alarms are stored for future reference
- “ATM style” menu system (which reduces keystrokes)
- “Dashboard” display screens which display up to five data points simultaneously
- Backlit “Carrier Blue” silicone keypad makes operation easy for drivers

2.6.4 Component Description And Location

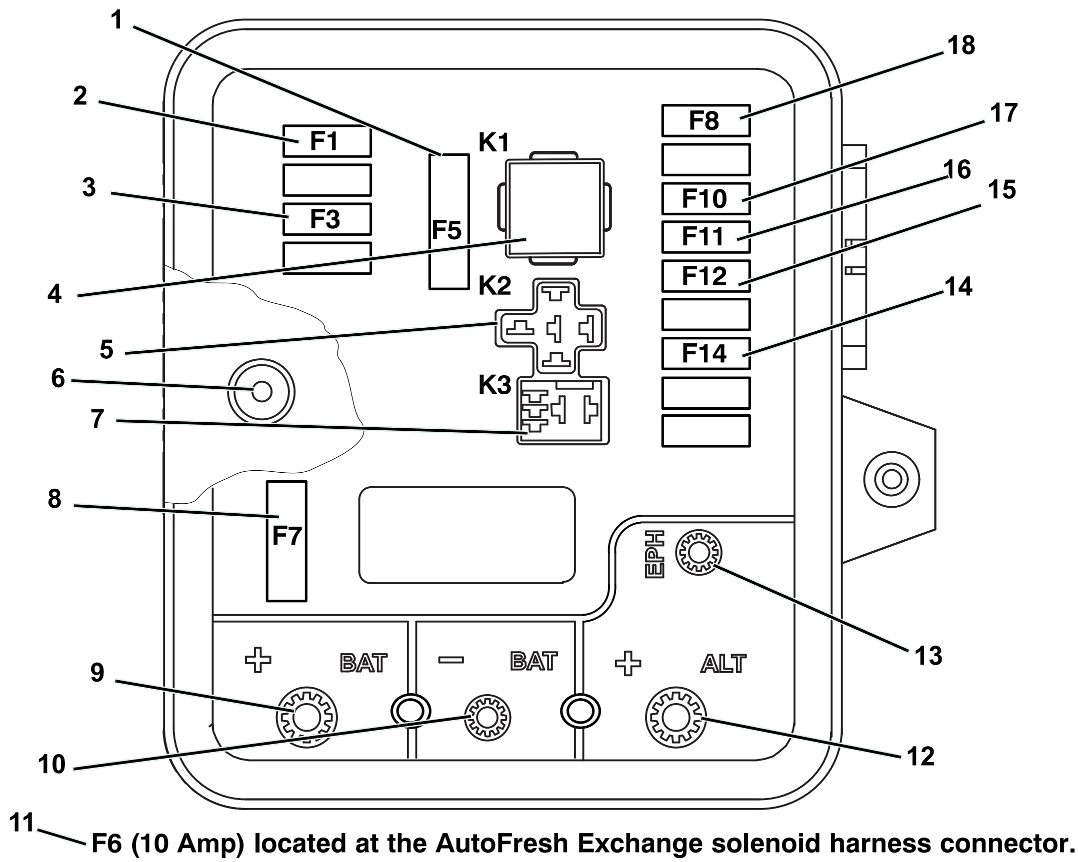
The APX Control System is an automotive style, decentralized, modular system w

ith CAN bus (Controller Area Network) connectivity. Hardware associated with the APX Control System includes the power control module (PCM - item 27, **Figure 2.2**), main microprocessor module (MM - item 28), stepper valve module (SVM - item 10). engine control unit (ENCU - Item 15) and display module (DM - item 11).

NOTICE

Under no circumstances should anyone attempt to repair sealed module internal components. Should a problem develop with these components, contact your nearest Carrier Transicold dealer for replacement.

Figure 2.7 Power Control Module (PCM)



1. Fuse (F5=30 Amp), Power Enable Relay
2. Fuse (F1=5 Amp), Main Microprocessor/Buzzer Power
3. Fuse (F3=5 Amp), Stepper Valve/Engine Control Unit Power
4. Relay, Power Enable
5. Relay, Fuel Heater
6. Buzzer (B)
7. Relay, AutoFresh Air Exchanger
8. Fuse (F7 = 80 Amp) Main Power
9. Battery Positive Connection (T1)
10. Battery Negative Connection (T2)
11. Fuse (F6), AutoFresh Air Exchange
12. Alternator Output Connection (T3)
13. Engine Preheater Power Connection (T4)
14. Fuse (F14 = 15 Amp), Fuel Heater
15. Fuse (F12 = 5 Amp), Satellite Comm. Power
16. Fuse (F11 = 5 Amp), Light Bar
17. Fuse (F10 = 20 Amp), Relay Power
18. Fuse (F8* = 5 Amp), Fuel Level Sensor*
    *With EES installed F8=10 Amp for FLS and EES

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2.6.4.1 Power Control Module

The Power Control Module (PCM - see **Figure 2.7**) distributes power from the battery to system components, when starting, and then from the alternator to system components and to the battery (for charging) once the unit has started.

The PCM houses system relays, fuses and the current transformer (CT). The current transformer provides a reading of the total 12 VDC system current draw (Amps) to the main microprocessor at terminal 2MM12 (see schematic diagram, **Section 10**)

2.6.4.2 Main Microprocessor Module

The main microprocessor module (MM) houses the main system microprocessor, is totally self-contained, and does not contain any serviceable components.

2.6.4.3 SVM Module

The stepper valve module (SVM) houses the microprocessor that controls the operation of the stepper valves; CSMV and EVXV. The SVM communicates with the APX Control System through the CAN network and also sends information on the position of the door switch and remote switch to be displayed as required and recorded in the DataLink data recorder. The module is totally self-contained and does not contain any serviceable components.

2.6.4.4 Microprocessor Status LED

Microprocessor activity within the main microprocessor or SVM Module can be determined by observing the status LED, located just to the right of the module bar code. The LED indicates the following:

- Solid Green = Unit OK but Communication Sync Lost
- Flashing Green = Normal Operation / Communication Sync OK
- Flashing Red/Green = Sending/Receiving Communication
- Flashing Red = Unit Failure but Communication Sync OK
- Solid Red = Internal Failure or Loss of Software
- NO LED = No Power

Figure 2.8 Display Module

1. Display Screen
2. MENU key
3. DEFROST key
4. START/STOP - CONTINUOUS Key
5. Alarm LED
6. Alarm Key
7. Arrow Keys
8. “=” (Select) Key
9. START/RUN-OFF Switch
10. Soft Keys
11. USB Interface Port

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2.6.4.5 Engine Control Unit (ENCU)

The ENCU (Figure 2.2) is a microprocessor based unit which controls the operation of the engine. The ENCU communicates with the APX Control System through the CAN network and sends information on engine speed, oil pressure and coolant temperature to the APX Control System to be displayed in the Advanced User Unit Data and recorded in the DataLink data recorder. The ENCU also communicates with the main microprocessor (MM) to control overall system balance. The ENCU is mounted on the frame near the front of the engine.

2.6.4.6 Display Module (DM) - See Figure 2.8

Display - The APX Control System displays the refrigerated compartment temperature to the left, and current setpoint to the right. Configurations are available to display the setpoint in either whole numbers or with tenths of a degree. The temperature description is followed by a letter indicating degrees Fahrenheit (F) or Centigrade (C).

Message Center - Messages generated by the APX Control System are displayed in the MessageCenter. Details of the messages are described in Section 6.

START/RUN-OFF Switch (SROS) - When placed in the START/RUN position, this switch provides power to start the unit. The main microprocessor performs a self-test. Then setpoint and compartment temperatures are displayed. To stop the unit, place the SROS in the OFF position.

2.6.4.7 Display Module Keys - See Figure 2.8.

- **ALARM** - The ALARM key allows viewing of the alarms stored in the system.
- **UP ARROW and DOWN ARROW** - These keys allow scrolling through the selections presented.
- **EQUAL (ENTER)** - The EQUAL key is used to confirm a selection and lock it into memory.
- **START-STOP/CONTINUOUS** - Pressing this key toggles between Start-Stop and Continuous Operation.
- **DEFROST** - Used to manually initiate a defrost cycle when the required conditions are met.
- **MENU** - Pressing the MENU key displays the various soft keys in the MessageCenter. The selections offered are dependent on the operator's status: Driver, Advanced User or Technician. Refer to **Section 3** for Driver and Advance User mode and **Section 5** for Technician mode menu selection descriptions.
- **USB Interface Port** - Used for installing software updates, options, configurations, functional parameters and downloading of data from the Data Link data recorder.

2.7 Options

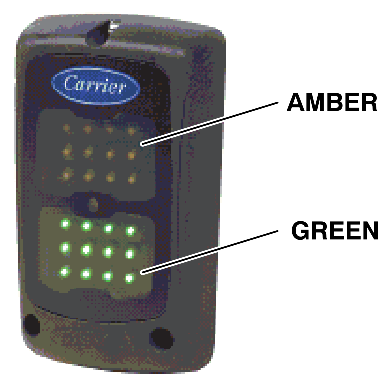
2.7.1 Light Bar

The Light Bar is an external indicator light which can be seen in the driver's rear view mirror from the cab of the tractor.

The green LED indicates "STATUS OK".

The amber LED indicates "CHECK UNIT". The amber light is illuminated when the APX Control System illuminates the alarm light. Alarms can be read on the display.

Figure 2.9 Light Bar



2.7.2 Remote Switch(es)

The unit is provisioned to connect a door switch (DS) and/or a remote switch (REMS1) directly to the APX Control System at the SVM.

- Two types of switches may be used:
  1. A switch with contacts that are open when the door is open or the remote switch is activated.
  2. A switch with contacts that are closed when the door is open or the remote switch is activated.
- Four configurations are available:
  1. Activate an alarm only while the switch is activated.
  2. Activate an alarm and shut the unit down while the switch is activated. The unit will remain shut down for a minimum of three minutes under this setting.
  3. Activate the alarm and bring the engine into low speed while the switch is activated.
  4. Record the switch activation in the DataLink data recorder.
- If configured to shut the unit down or bring the engine to low speed, an additional choice will be available. The additional choice allows the unit to be set so that the configured action will always take place OR the configured action will only take place when the ambient temperature is below a certain temperature. For example, if the

shutdown/low speed temperature choice is set to 77°F (25°C) the unit will only shutdown/go to low speed if the ambient temperature is below 77°F (25°C).

- Additionally, a Functional Parameter “override” setting will be available when the switch is configured to shut the unit down. The Functional Parameter may be set to “YES” or “NO”. If the Parameter is set to “NO” the configured action will not be overridden. If the Parameter is set to “YES”, the alarm will be activated but the unit will not shutdown.

2.7.3 Remote Temperature Sensors

The unit is provisioned to connect one or two remote temperature sensors directly to the APX Control System.

The system may be configured to display the sensor reading in the Unit Data and to record the sensor reading in the DataLink data recorder. A user specified name may be configured for each sensor. This name will be displayed, rather than the default Remote Sensor #1 or Remote Sensor #2, name in the unit data list.

2.7.4 Fuel Level Sensor

An optional fuel level sensor (**Figure 8.10**) supplies an input signal to the APX Control System based on the percent of fuel remaining in the fuel tank. Alarm **00001 Low Fuel Level Warning** will be activated when fuel level reaches 15%, and (if configured to do so) will shut the engine down when fuel level reaches 10%. The alarm is automatically cleared when the fuel level is brought above 25%. The fuel tank level is displayed in Unit Data.

2.7.5 Fuel Heater

The optional fuel heater (**Figure 2.2**) applies heat to fuel in the fuel filter. Heating the fuel dissolves/prevents paraffin wax crystals (and ice) that form when diesel fuel is chilled thus enabling the water separator to work more efficiently and to prevent the filter from plugging with wax and/or ice crystals.

When the ambient air sensor is reading 68°F (20°C) or lower, the APX Control System will enable this circuit. The circuit is disabled when the ambient air sensor reading rises to 77°F (25°C). Also, the heater is fitted with an internal temperature switch which will close on a temperature fall to energize the heater element at temperatures below 45°F (7.2°C), and open on a temperature rise to de-energize the heater element at 75°F (23.9°C).

2.7.6 Electric Fuel Pump

The optional electric fuel pump (**Figure 8.8**) is mounted at the fuel tank and assists the engine mounted mechanical pump in transferring fuel from the fuel tank to the engine. The electric fuel pump is activated by the APX Control System whenever the engine is operating.

2.7.7 Remote Panel

The unit may be fitted with an optional remote control panel. The remote panel, which is very similar to the main control panel, displays compartment setpoint, compartment temperature and operating modes (heat, cool or defrost).

The setpoint may be modified, and the unit may be started and stopped using the remote panel.

This compact remote panel can be mounted to suit the individual operator’s preferences - on the front bulkhead, or in the compartment (including in the wall itself). Remote panel keys, soft keys, and alarm indicators are in the same locations as the main APX Control System display module.

2.8 Engine Data

Unit	Specification
Engine Model	V2203L-DI-EB4-CTD-2 (Base Part Number 26-00132)
Rated Power	24.7 hp (18.5 KW) @1800 rpm
Displacement	135 in^3 (2.2 liters)
No. Cylinders	4
NOTE: Refer to Table 2–1 for engine speed settings	
Weight	439 lbs (199 kg)
Coolant Capacity	2.4 U.S. gallons (9 liters) - 50/50 mix - never to exceed 60/40. **NOTICE** **Recommended to use Extended Life Coolant, Nitrite Free (ELC-NF), which is red in color and labeled for at least five years, 12,000 hours service life.**
Thermostat	Starts to open 177 to 182°F (81 to 83°C). Fully open at 203°F (95°C).
Fuel System	
Fuel	Winter: Diesel No. 1 Summer: Diesel No. 2 (Maximum 5% Bio-Diesel is also allowed)
Fuel Heater Temperature Switch	Close on a temperature fall @ 45°F (7.2°C) Open on a temperature rise @ 75°F (24°C)
Firing Order	1-3-4-2
Engine Preheater (EPH)	42 Amps at 12 VDC, resistance approximately 0.3 Ohms
Lubrication System	
Engine Oil Pressure	40 to 62 psig (2.8 To 4.2 Bar) - Engine in high speed
Engine Oil Pressure Safety Switch (ENOPS)	Closes, on pressure rise, at 18 psig (1.22 Bar) Opens, on pressure fall, at 12 psig (0.82 Bar)
Oil Capacity with Filter	15 quarts (14.2 liters)
Engine Oil Viscosity: API CG or better OR Mobil Delvac 1	If Outdoor Temp below 32°F (0°C), use 10W30 or Mobil Delvac 1 (5W 40) If Outdoor Temp above 32°F (0°C), use 10W30 or Mobil Delvac 1 (5W 40) or 15W 40.
Engine Oil Change Intervals	Refer to **Section 8.2** for information on service intervals.
Battery	12 volt nominal - 90 Amp hour capacity cold cranking amps = 425 DIN, 500 IEC, 725 BCI

2.9 Compressor Data

Unit	Specification
Compressor Model	05G
Type	Semi-hermetic reciprocating
Number of Cylinders	6
Number of Unloaders	2
Weight	137 lbs (62 kg)
Compressor Oil Capacity	5.5 pints (2.8 liters)
Approved Compressor Oil	Mobil Arctic EAL 68

2.10 Refrigeration System Data

Unit	Specification
Defrost Air Switch (DAS)	Initiates Defrost: 1.40 ±07 inch (35 ± 1.8 mm) WG
Defrost Timer	1.5h, 3h, 6h, or 12 hours
Fusible Plug Melting Point	430°F (221°C)
High Pressure Switch (HPS)	Opens, on pressure rise, at: 465 ± 10 psig (32 ± 0.7 bar) Closes, on pressure fall, at: 350 ± 10 psig (24 ± 0.7 bar)
Unit Weight, Less Battery	X4 7300 = 1685 lbs (764 kg), X4 7300R = 1690 lbs (767 kg) X4 7500 = 1690 lbs (767 kg), X4 7500R = 1695 lbs (769 kg)
Battery	50 pounds (23 kg)
Fan Clutch Air Gap	0.011 to 0.085 inch (0.28 to 2.2 mm)
Refrigerant Charge	Refer to **Table 2–1**
Gearbox Oil	Mobil Delvac 75-90W: 15oz (0.44 liters)
Fanshaft Oil	Mobil SHC 630: 2.8oz (0.08 liters)

2.11 Component Resistance and Current Draw

Component	Ohms	Amps
AutoFresh Air Exchange Relay (AFAR)	97 Ohms between pins 1 and 2	
AutoFresh Air Exchange (AFAS)	Pull in - 0.36 Ohms ± 10% Hold - 14.4 Ohms ± 10%	Pull in - 29 Amps Hold - 0.83 Amps
Clutch (CLH)	2.5 ± 0.2 Ohms	3.0 to 5.0 Amps
Condenser Pressure Control Solenoid Valve (SV1)	7.8 ± 0.3 Ohms	0.7 to 2.0 Amps
Engine Preheater (EPH)	0.3 to 0.5 Ohms	38 - 46 Amps
Engine Speed Sensor (ENSSN)		22 mAmps Max
Fuel Heater (FH) - Standard	0.96 Ohms ± 10%	12.5 Amps ± 10%
Fuel Heater (FH) - Suction Side	1.3 Ohms ± 10%	10.7 Amps ± 10%
Fuel Heater Relay (FHR) and Power Enable Relay (PER)	90 Ohms between pins 85 and 86	
Fuel Pump (FP)	11.5 Ohms ± 10%	1.4 Amps @ 16 VDC
Fuel/Speed Actuator (FSA)	2.8 Ohms ± 10% @68°F (20°C)	4 Amps Max
Liquid Line (SV2) and Hot Gas (SV4) Solenoid Valve	10.6 ± 0.3 Ohms	0.75 to 2.0 Amps
Starter Motor (SM)	Less than 1 Ohm but more than 0	270 - 380 Amps
Unloader Solenoid Valve (UL1 and UL2)	9.6 ± 0.8 Ohms	1.0 to 2.0 Amps

2.12 Safety Devices

The system is protected from high pressure conditions which may occur when exposed to very high temperatures by a fusible plug mounted in the receiver. Under very high temperature conditions (refer to **Section 2.10**) the plug will melt, releasing the refrigerant pressure.

System components are protected from damage caused by unsafe operating conditions by automatic shut-down of the unit when such conditions occur. This is accomplished by the safety device listed in the following table and the fuses shown in **Figure 2.7**.

Unsafe Conditions	Safety Device	Device Setting
Excessive operating pressure	High Pressure Switch (HPS)	**Section 2.10**

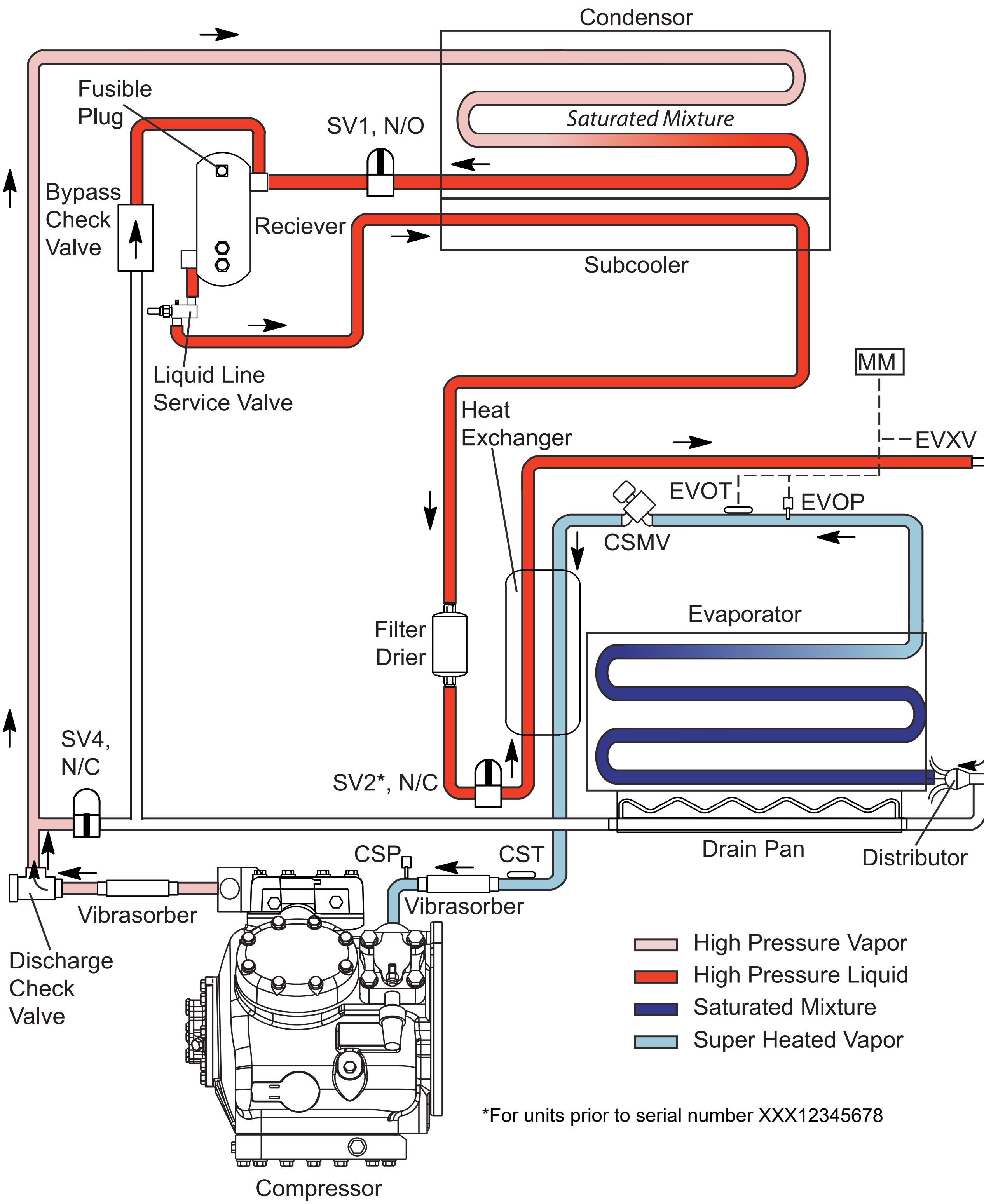
2.13 Refrigeration Circuit - Cooling

When cooling, (See **Figure 2.10**) the unit operates as a vapor compression refrigeration system. The main components of the system are:

- Reciprocating compressor
- Air-cooled condenser
- Evaporator expansion valve
- Direct expansion evaporator

1. The compressor raises the pressure and the temperature of the refrigerant and forces it through the discharge check valve into the condenser channels. The condenser fan circulates surrounding air over the outside of the channels. The channels have fins designed to improve the transfer of heat from the refrigerant gas to the air. This removal of heat causes the refrigerant to condense. Liquid refrigerant leaves the condenser and flows through the condenser pressure control solenoid (SV1) to the receiver.
2. The receiver stores the additional charge necessary for low ambient operation. The receiver is equipped with a fusible plug which melts on occurrence of very high temperature to relieve the refrigerant pressure.
3. The refrigerant leaves the receiver and flows through the liquid line service valve to the subcooler. The subcooler occupies a portion of the main condensing coil surface and gives off further heat to the passing air.
4. The refrigerant then flows through a filter drier where a screen and absorbent keep the refrigerant clean and dry.
5. The refrigerant then flows to the braze plate heat exchanger, passing through the liquid line solenoid valve (SV2), if equipped. In the heat exchanger the liquid is further reduced in temperature by giving off some of it heat to the suction gas.
6. The liquid then flows to the evaporator expansion valve which reduces the pressure of the liquid and meters the flow of liquid refrigerant to the evaporator to obtain maximum use of the evaporator heat transfer surface.
7. The refrigerant pressure drop caused by the expansion valve is accompanied by a drop in temperature so the low pressure, low temperature fluid that flows into the evaporator tubes is colder than the air that is circulated over the tubes by the evaporator fan. The evaporator tubes have aluminum fins to increase heat transfer; therefore heat is removed from the air circulated over the evaporator. This cold air is circulated throughout the refrigerated compartment to maintain the cargo at the desired temperature.
8. The transfer of heat from the air to the low temperature liquid refrigerant causes the liquid to vaporize.
9. This low temperature, low pressure vapor passes through the compressor suction modulation valve (CSMV) and heat exchanger and then returns to the compressor. In the heat exchanger the refrigerant absorbs more heat from the high pressure/high temperature liquid.
10. The CSMV controls the compressor suction pressure thereby matching the compressor capacity to the load.

Figure 2.10 Refrigeration Circuit - Cooling



*For units prior to serial number XXX12345678

2.14 Refrigerant Circuit - Heat and Defrost

2.1.4.1 Units equipped with SV2

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

When the system calls for heating (see **Figure 2.11**):

- The normally closed hot gas solenoid valve (SV4) is energized (opened)
- The normally open condenser pressure control solenoid valve (SV1) is energized (closed)
- The normally closed liquid line solenoid valve (SV2) is de-energized (closed)

Flow of hot discharge gas from the compressor enters the evaporator.

The refrigerant is warmer than the air that is circulated over the tubes by the evaporator fan. The evaporator tubes have aluminum fins to increase heat transfer; therefore heat is transferred to the air circulated over the evaporator. This warm air is circulated throughout the refrigerated compartment to maintain the cargo at the desired temperature.

When additional heating capacity is required, the normally closed Liquid Line Solenoid valve (SV2) is energized (opened) to allow additional refrigerant to be metered into the hot gas cycle (through the evaporator expansion valve). Refrigerant will be forced from the receiver (even though SV1 is closed) by the hot gas bypass line which functions to raise the receiver pressure above evaporator pressure.

If the discharge pressure rises to 350 psig (23.8 bar) when in defrost or 390 psig (26.5 bar) when in heating, SV1 will be de-energized momentarily to lower the discharge pressure.

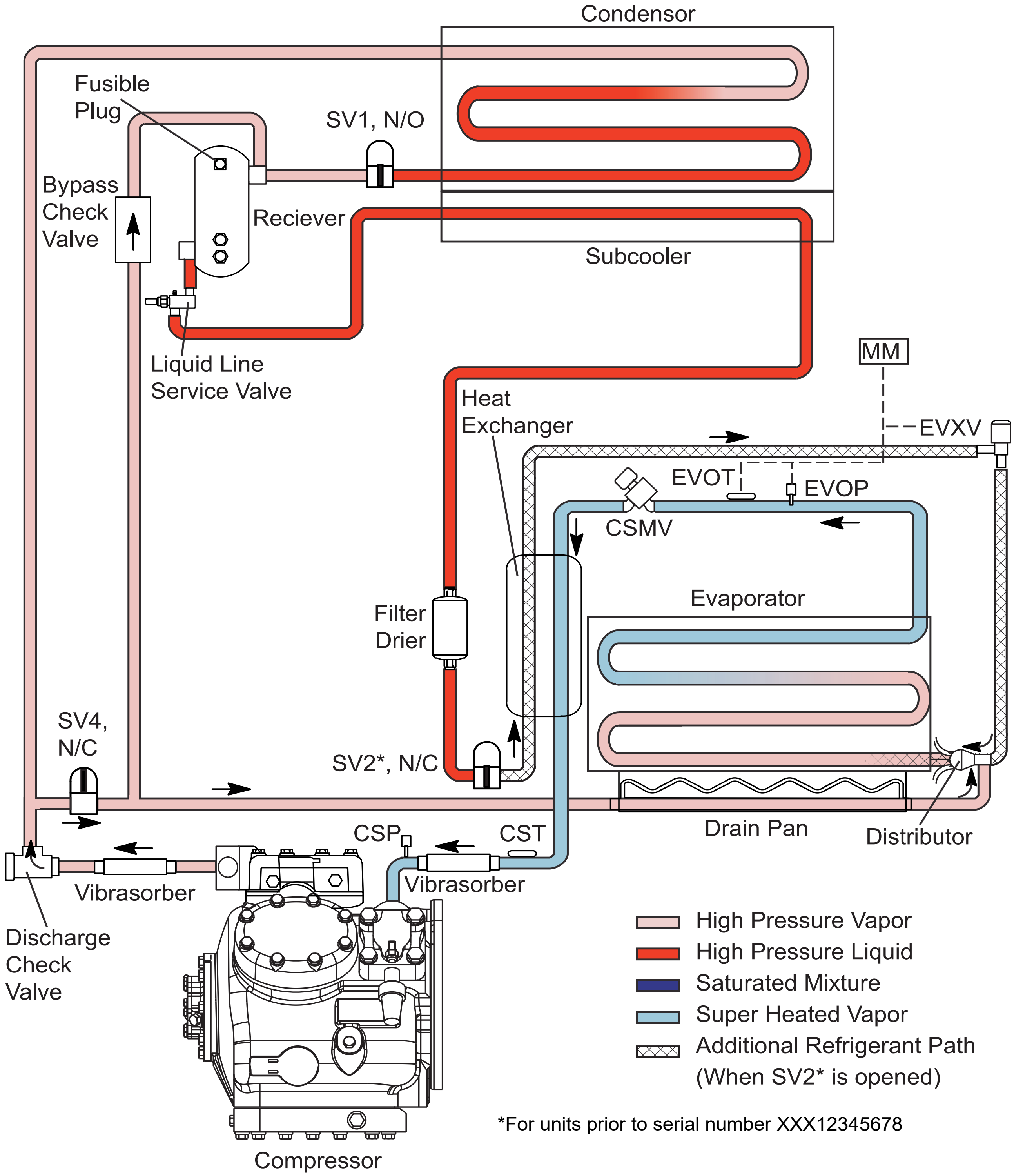
2.1.4.2 Units without SV2

When the system calls for heating (see **Figure 2.11**):

- The normally closed hot gas solenoid valve (SV4) is energized (opened)
- The normally open condenser pressure control solenoid valve (SV1) is energized (closed)
- The EVXV is regulated to control the amount of refrigerant entering the system.

If the compressor discharge pressure rises to greater than 420 psig, the SV1 valve will open (de-energized) momentarily to lower the discharge pressure.

Figure 2.11 Refrigeration Circuit - Heat and Defrost



*For units prior to serial number XXX12345678

SECTION 3
Operation

3.1 Display

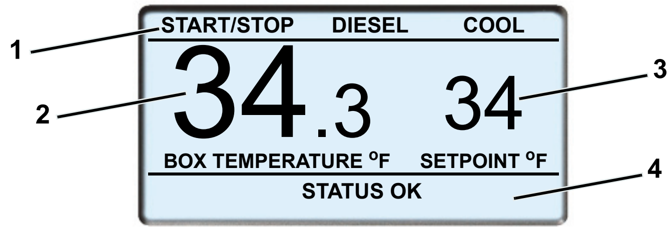
⚠ WARNING

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

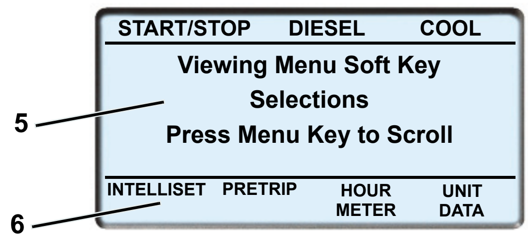
Figure 3.1 Display Module

1. Display Screen
2. MENU key
3. DEFROST key
4. START/STOP - CONTINUOUS Key
5. Alarm LED
6. Alarm Key
7. Arrow Keys
8. “=” (Select) Key
9. START/RUN-OFF Switch
10. Soft Keys
11. USB Interface Port

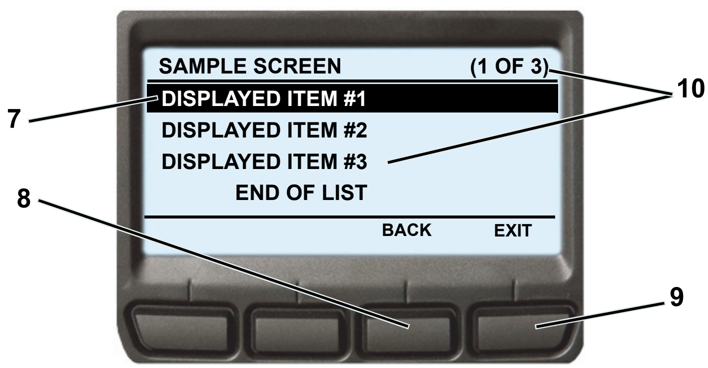
3.2 Display Screens



Default Screen



Typical Menu Screen



1. Status Bar
2. Box Temperature
3. Setpoint
4. Message Center
5. Operator Message Panel
6. Soft Key Descriptions
7. Highlight - White letters on black background
8. BACK key - Used to return to previous screen
9. EXIT key - Used to return to the default screen
10. The position of the highlighted item and total number of items in the list is displayed in the status bar. Up to five items may be displayed at one time. Press the ▼ key to view additional items, or the ▲ key to scroll back up the list. “END OF LIST” will be displayed after the last item in the list.

3.3 Starting

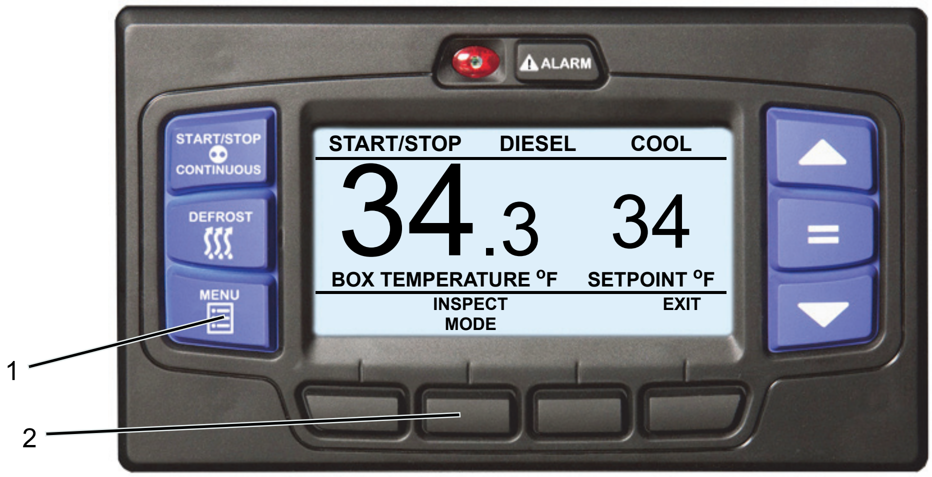
WARNING

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

1. Place the START/RUN-OFF switch in the START/RUN position.
2. The system will display the Carrier Transicold logo, display the default screen, present language selection and the hour meter readings (if configured to do so) along with a test flash of the alarm light and light bar amber LED's. The system will then perform a start sequence, energize the buzzer, and then start the unit automatically.
3. If there is an alarm present, the alarm message will be displayed in the MessageCenter and the alarm LED will flash for five seconds. If one or more shutdown alarms are present, the alarm(s) must be cleared before the unit will start.
4. Observe the MessageCenter. If the word "ACTIVE" or "MODIFIED" is displayed at the right, the unit is equipped with IntelliSet settings, refer to **Section 3.5**.
5. If the display does not illuminate:
   - Check the battery voltage. A booster battery may be needed.
   - Check for blown fuse(s).
   - Verify the harness connector at the back of the display module and all other module connectors are securely attached.

3.4 Inspect Mode

- Inspect mode provides an additional layer of safety for operators and technicians. Inspect mode should be used during all pre-trip inspections of the unit.
- Inspect mode is a user activated feature that forces the unit to shutdown and remain in shutdown regardless of operating state.
- After unit inspection, Inspect mode must be manually disabled, at which point the unit will resume standard operation.
- Inspect mode is not a substitute for proper Lockout/Tagout procedures, which are always required when servicing the unit.



3.4.1 Enter Inspect Mode

1. With the system powered up (START/RUN-OFF switch in the START/RUN position) press the MENU key until INSPECT MODE is displayed.
2. Press the INSPECT MODE soft key, the unit will shut down.

While the unit is in Inspect mode the ALARM light will flash, and the display will indicate that unit operation, including temperature control, has been disabled.

3.4.2 Exit Inspect Mode

While the unit is in Inspect mode, the EXIT soft key will be available, all other keys and functions will be locked out. Press the EXIT soft key to disable Inspect mode, the unit will resume standard operation.

3.5 IntelliSet

Products carried or stored in a refrigerated compartment require a multitude of refrigeration unit settings that must be checked and if required, reset each time a new product is loaded. The APX Control System offers the settings necessary to meet these requirements. IntelliSet is a feature that allows pre-selection and naming of the necessary settings for over 40 different products. The operator may then call up the settings by simply selecting the assigned IntelliSet name.

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

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

NOTES

- The above settings are examples of possible settings. Factory IntelliSets are available from your authorized Carrier Transicold Truck/Trailer dealer.
- An IntelliSet may be pre-programmed as “IntelliSleep” which allows Sleep mode to be entered by simply changing to that IntelliSet.
- Range Protect may be applied to as many IntelliSets as desired. Range Protect is designed to prevent freezing or overheating of non-sensitive cargo by locking the unit in Start-Stop Operation when the compartment temperature is in the preset range (default range is 35 to 70°F, 1.6 to 21.1°C). Range Protect offers increased fuel savings over normal Start-Stop Operation.

1. With the system powered up (START/RUN-OFF switch in the START/RUN position) or in PC mode and the default screen displayed, press the “=” key. If the screen shown just above step 3 below is displayed, proceed to step 3. Otherwise, proceed to step 2.
2. Press the MENU key until INTELLISET is displayed. Then, press the INTELLISET soft key to display the IntelliSet screen.
3. The IntelliSet screen will display with a 10-second timeout and five of the available IntelliSets listed. The IntelliSet that is currently selected will have the word “Active” or “Modified” to the right. There may be more than five IntelliSets available, as displayed in parenthesis on the first line. For example, in the provided illustration there are seven IntelliSets available and the second IntelliSet is highlighted.
4. Press the ▲ or ▼ key to scroll through the list of available IntelliSets. To change to another IntelliSet, highlight the desired IntelliSet and press the “=” key. The highlighted IntelliSet will become active and an “INTELLISET CHANGED” message will display.

5. Press the EXIT soft key to return to the default display.

NOTES

- If setpoint change is allowed, refer to **Section 3.7** for setpoint change instruction.
- If it is desirable to have this machine go directly to the IntelliSet screen on a press of the "=" key, set the "ENABLE INTELLISET AT = KEY" Configuration to "YES". Refer to **Section 5.2.3**.

3.6 Pre-Trip

Pre-Trip is a set of tests run by the APX Control System to check unit operation. It is recommended that a Pre-Trip is run prior to loading the refrigerated compartment. It will indicate a failure if one is detected.

TIP

A Pre-Trip can be started at any box temperature. If Pre-Trip is started while the unit is in a Start-Stop off cycle the unit will start during the course of the test. If the unit is running when Pre-Trip is started, it will shutdown for the first three tests.

TIP

If “CAN NOT START PRE-TRIP” is displayed in the MessageCenter, check to see if the unit is in PC mode (Refer to **Section 5.3.2**) or Defrost mode, or check the alarm list (**Section 3.15**) for active shut-down alarms.

NOTE

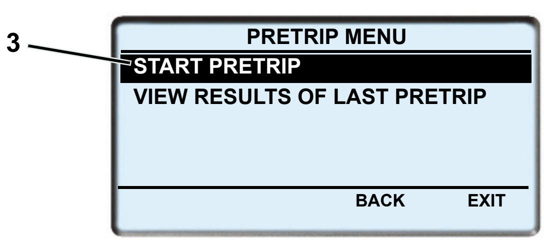
Pre-Trip will run until completed, unless an alarm occurs that causes Pre-Trip to be aborted. Only alarms that will result in other erroneous alarms or will affect future Pre-Trip tests will abort Pre-Trip.

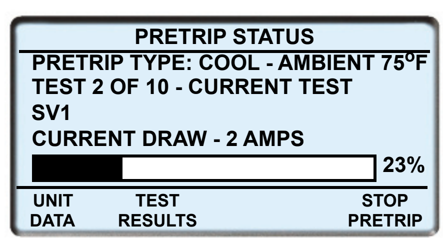
Once Pre-Trip is started: If the unit is running, the APX Control System will shut the unit down for the initial tests, then start it again as it proceeds through the tests.

NOTE

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

1. With the system powered up (START/RUN-OFF switch in the START/RUN position), press the MENU key until PRETRIP is displayed.
2. Press the PRETRIP soft key to display the Pre-Trip Menu screen.
3. The Pre-Trip Menu screen will display with a 15 second timeout. Press the ▲ or ▼ key to scroll through the available selections. With the desired selection highlighted, press the “=” key.





4. If “Start Pre-Trip” is selected, Pre-Trip will begin and the Pre-Trip Status screen will be displayed. Immediately following Pre-Trip OR if “View Results of Last Pre-Trip” is selected the Pre-Trip Summary Screen will be displayed.

NOTE

At any time during Pre-Trip, the UNIT DATA soft key may be pressed to allow the user to view the Unit Data screen (refer to **Section 3.14**). To return to Pre-Trip from the Unit Data screen, press the BACK soft key.

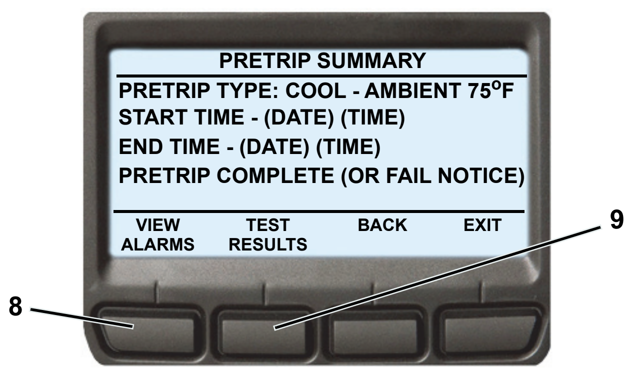
NOTE

During Pre-Trip the ALARM light will illuminate to indicate there is no temperature control.

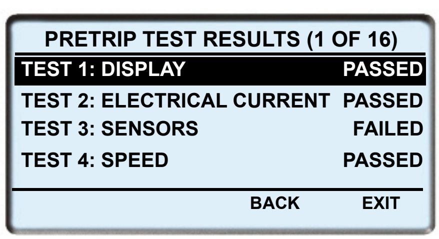
5. During Pre-Trip Test 1, verify that the buzzer is energized, the amber light on the light bar is illuminated (if equipped) and the AutoFresh air port opens and closes (if equipped).
6. The remainder of the Pre-Trip tests will run automatically and take 7 to 15 minutes. The percent of Pre-Trip that has been completed is displayed in the status bar under the test description information.
7. “PRETRIP PASS”, “PRETRIP FAIL IN TEST ##” or “PRETRIP FAILED AND COMPLETE” will be displayed at the end of the testing. The “PASS” message will display until a key is pressed. The Pretrip test “FAIL” results message will display until the alarms are cleared.

TIP

To end Pretrip at any time, press the STOP PRETRIP soft key.



8. Press the VIEW ALARMS key to move to the Alarm Screen (refer to **Section 3.15**) and review any alarms activated during the test.
9. The TEST RESULTS soft key may be pressed at any time during Pre-Trip to view results of any test that has been completed. Press the ▲ or ▼ key to scroll through the results.



Test 1 - Display Test: The APX Control System activates the buzzer. Also, the amber light on the light bar is illuminated (if equipped) and the AutoFresh air port opens and closes (if equipped). This test will last five seconds. This portion of the Pre-Trip requires that the operator determines PASS or FAIL. Anything that fails during this test should be repaired at the conclusion of the Pre-Trip cycle. Pre-Trip will continue regardless of the outcome of this test.

Test 2 - 12VDC Electrical Component Amperage Check: Test 2 will check the amperage (current) draw of the following components:

- Battery Amp Draw (All Components Turned Off).
- AutoFresh Air Exchange Relay (AFAR) if equipped
- Clutch (CLH)
- Front Unloader Solenoid (UL1)
- Rear Unloader Solenoid (UL2)
- SV1
- SV2
- SV4
- Preheat Circuit (EPH)
- Fuel/speed actuator (FSA)

Each component will be individually checked for proper current draw. An alarm will be activated for any component not drawing amperage in the expected range. If equipped the AutoFresh air port opens and closes in Test #2.

Test 3 - Temperature Sensor Check: Check the condition of all of the system temperature sensors. Test 3 will last approximately five seconds. If a problem is detected with any of the sensors, the corresponding alarm will be activated.

Test 4 - Warm Up: The engine is started automatically and the ambient air sensor is read.

If the ambient temperature is above +32°F (0°C), the unit will operate in the “Cool Pre-Trip” mode. If the ambient temperature is at or below +32°F (0°C), the unit will operate in the “Heat Pre-Trip” mode.

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

In the *Heat Pre-Trip* mode, the unit will operate in four cylinder Low Speed Heat. The APX Control System will check for a rise in compressor discharge pressure, fan clutch operation and SV1 operation. Appropriate alarms will be displayed if a problem is detected. Test 4 in Heat Pre-Trip may last up to 12 minutes depending on ambient, compartment temperature and unit condition. During periods when discharge pressure is being read, SV2 may pulse.

Test 5 - UL2 (Rear) Unloader: With the unit still running the same as it was in Test 4, the operation of unloader UL2 is tested. If suction and discharge pressures do not change as expected when UL2 is energized and de-energized, alarm **P00191 Check UL2** will be displayed. Test 5 will last about 20 seconds.

Test 6 - UL1 (Front) Unloader: With the unit still running the same as it was in Test 5, the operation of UL1 is tested. If suction and discharge pressures do not change as expected when UL1 is energized and de-energized, alarm **P00178 Check UL1** will be displayed. Test 6 will last about 20 seconds.

Test 7 - Engine Low Speed: The APX Control System verifies that engine is in the low speed range. If the engine is not operating in the low speed range, alarm **P00174 Check Low Speed RPM** will be activated.

Test 8 - Engine High Speed: The engine switches to high speed. The APX Control System verifies that engine is in the high speed range. If the engine is not operating in the high speed range, alarm **P00175 Check High Speed RPM** will be activated.

Test 9 - Engine Low Speed 2: The engine switches back to low speed. The APX Control System verifies that engine returns to the low speed range within 10 seconds. If not, alarm **P00174 Check Low Speed RPM** will be activated.

Test 10 - Suction Modulation Valve (CSMV): This test is run to ensure that the CSMV is opening and closing properly. If suction pressure doesn’t change as expected with CSMV closed, then alarm **P00180 Check Suction Modulation Valve** will be displayed.

Test 11 - EVXV: This test is an operational check of the EVXV. If evaporator outlet pressure doesn’t change as expected with the EVXV closed then alarm **P00177 Check EXV (EVXV) Superheat** will be displayed.

Test 12 - SV1: The test continues with the unit running in two cylinder low speed cool, SV1 is energized and de-energized. If the valve does not operate correctly, alarm **P00182 Check SV1 Valve** will be displayed. This test may last up to three minutes.

Test 13 - Check SV4:

NOTE

If ambient temperature is above 100°F (37.8°C) this test will not be performed.

With the unit running in two cylinder, low speed heat, SV4 will be energized and de-energized. If the valve does not operate correctly, alarm **P00181 Check SV4 Valve** will be displayed. This test may last up to eight minutes.

Test 14 - Low Side Pump Down: With the unit running in two-cylinder, low speed, SV2 and SV4 will be closed to pump down the unit. For units without SV2, the EVXV will be closed. If the system cannot obtain the required suction pressure, alarm **P00165 Cannot Pump Down** will be displayed.

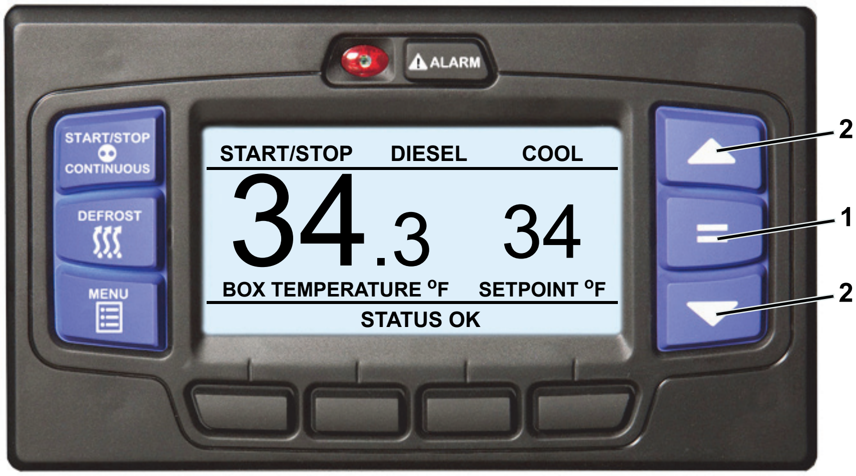
Test 15 - Pressure Hold Check: The unit will shutdown, and check for pressure equalization between the high and low sides. If any leakage is detected, alarm **P00202 High Side Leak** will be displayed. This test will last one minute.

Test 16 - Discharge Check Valve: With the unit off, the discharge check valve is checked for leakage. If any leakage is detected, alarm **P00203 CHK Discharge Check Valve** will be displayed. This test will last 40 seconds.

Test 17 - Check for Other Alarms: The alarm list is checked for any non-pre-trip alarms that may have occurred during the Pre-Trip test. If any operational alarms occurred, Pre-Trip will show FAIL, and the technician will need to review the alarm list and take necessary and appropriate action to clear them. This test will last about five seconds.

Pre-Trip Termination: When the Pre-Trip cycle is completed, the unit will return to normal temperature control operation. “PRETRIP PASS” will be displayed until the operator presses the EXIT key. In the event that the Pre-Trip test activates an alarm(s), either “PRETRIP FAIL & COMPLETE” (if the entire Pre-Trip cycle was completed), or “PRETRIP FAIL IN TEST XX”, (if the Pre-Trip cycle was aborted by an alarm before it was completed) will be displayed.

3.7 Changing Setpoint



1. With the system powered up (START/RUN-OFF switch in the START/RUN position) or in PC mode and the default screen displayed (press the Back soft key if required).
2. Press the ▲ or ▼ key to bring the displayed setpoint to the desired value.

TIP

The setpoint will change one degree with each press and release of an arrow key or the setpoint will scroll if the key is pressed and held.

3. Press the “=” key to save the new setpoint. The MessageCenter will display “SETPOINT CHANGED” for five seconds.
4. If the “=” key is not pressed the setpoint screen will flash, the MessageCenter will display “SETPOINT NOT CHANGED” and then return to original setpoint.

By default, setpoints of -22°F to +90°F (-30°C to +32°C) may be entered using the display mounted keys. The APX Control System always retains the last entered setpoint in memory. The setpoint will change 1° (one full degree) **OR** 0.1° (one tenth of a degree - if configured to do so) for each press and release of the ▲ or ▼ key.

NOTE

The APX Control System may be configured with a minimum and/or maximum setpoint other than the default values listed above. “MAX SETPOINT HAS BEEN REACHED” or “MIN SETPOINT HAS BEEN REACHED” will display in the MessageCenter when either of these conditions is reached.

Setpoint may be changed any time the START/RUN - OFF switch is in the START/RUN position, or when the unit is in PC mode EXCEPT when:

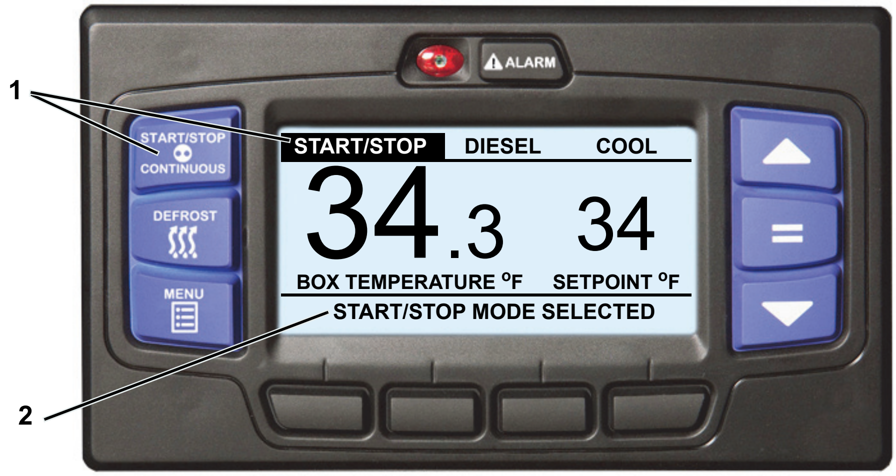
- Viewing the Alarm List, Data List or Functional Parameters **OR**
- When the unit is in Pre-Trip **OR**
- When the unit is in Sleep mode.

Pressing the = key will cause the new displayed setpoint value to become active and “SETPOINT CHANGED” will be displayed. If the new value is not entered, after five seconds of no display mounted key activity, the entire display and Light Bar will flash and the buzzer will be energized for 15 seconds (with “SETPOINT NOT CHANGED” displayed) and then revert back to the last entered setpoint. All other keys are active at this time and if pressed while the display is flashing, will stop the flashing, and perform the requested function.

TIP

The setpoint may be changed quickly by pressing and holding the ▲ or ▼ key until the desired setpoint is reached. The longer the key is held, the faster the setting will change.

3.8 Start-Stop Operation



1. With the system powered up (START/RUN-OFF switch in the START/RUN position) or in PC mode press the START-STOP/CONTINUOUS key until “START/STOP” is highlighted.
2. The message “START/STOP MODE SELECTED” will be displayed in the MessageCenter for 10 seconds.
3. The operation indication in the status bar will no longer be highlighted. The unit is now in Start-Stop Operation.

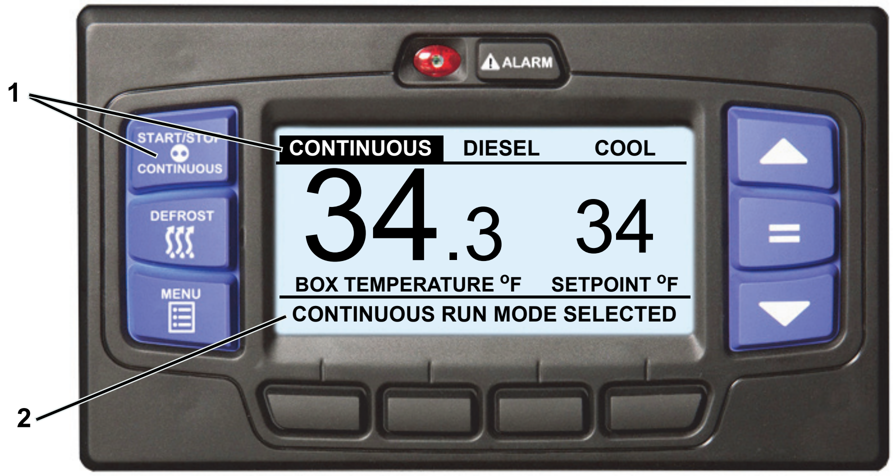
Start-Stop is provided to reduce fuel consumption. This feature allows full automatic control of the engine by monitoring refrigerated compartment temperature, battery charging amps and engine coolant temperature. The main function of Start-Stop Operation is to turn off the engine near setpoint to provide an efficient temperature control system and to initiate a restart sequence after certain conditions are met.

The APX Control System may be configured with Start-Stop operation tied to setpoint ranges for either frozen or perishable loads. The Start-Stop/Continuous key is locked out if “START-STOP LOCKED” displays in the MessageCenter when the key is pressed and the unit is in Start-Stop Operation or “CONTINUOUS LOCKED” displays in the MessageCenter when the key is pressed and the unit is in Continuous Run Operation. Refer to **Section 5.2.3** for Configuration information.

If the unit fails to start after three start attempts alarm **00031 Failed to Start - Auto Mode** will be activated. While running, if the unit shuts down, an internal counter keeps track of the shutdowns. Should the unit shutdown three consecutive times without running a minimum of 15 minutes between shutdowns alarm **00030 Failed to Run Minimum Time** will be activated. The shutdown counter is cleared when the unit has run for 15 minutes.

Refer to **Section 4.6** for more detailed information on Start-Stop Operation.

3.9 Continuous Operation



1. With the system powered up (START/RUN-OFF switch in the START/RUN position) or in PC mode press the START-STOP/CONTINUOUS key until "CONTINUOUS" is displayed and highlighted.
2. The message "CONTINUOUS RUN MODE SELECTED" will be displayed in the MessageCenter for 10 seconds.
3. The operation indication in the status bar will no longer be highlighted. The unit is now in Continuous Operation.

In Continuous Operation, the unit will not shutdown except in response to a shutdown alarm. Refer to **Section 4.7** for more detailed information on Continuous Operation.

The APX Control System may be configured with continuous operation tied to setpoint ranges for either frozen or perishable loads. The START-STOP/CONTINUOUS key is locked out if "CONTINUOUS LOCKED" displays in the MessageCenter when the key is pressed and the unit is in Continuous Operation or "START-STOP LOCKED" displays in the MessageCenter when the key is pressed and the unit is in Start-Stop Operation. Refer to **Section 5.2.3** for more information on Configurations.

If the unit fails to start after three start attempts alarm **00031 Failed to Start - Auto Mode** will be activated. While running, if the unit shuts down, an internal counter keeps track of the shutdowns. Should the unit shutdown three consecutive times without running a minimum of 15 minutes between shutdowns alarm **00030 Failed to Run Minimum Time** will be activated. The shutdown counter is cleared when the unit has run for 15 minutes.

3.10 Data Recorder

The APX Control System contains a built-in DataLink data recorder with 3 megabytes of memory. The recorded data can be downloaded from the DataLink data recorder using a Data Transfer USB memory device.

The DataLink data recorder reads the same input information as the APX Control System (Functional Parameters, Configurations, and Unit Data) at all times. The DataLink data recorder records events as they occur, such as setpoint changes and defrost initiation and termination, and also records all data values including temperature sensors and pressure transducers in either averaged or snapshot format at selected intervals

The following intervals are available for sensor recording:

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

3.10.1 APX Control System Information

The APX Control System information that may be recorded is as follows:

- DataLink data recorder time clock date / time
- Setpoint
- DataLink data recorder settings (Logging Intervals, Events and Sensors)
- Trailer (asset or car) ID
- Unit Serial Number
- Unit Model Number
- Controller (main microprocessor) Serial Number
- Controller (main microprocessor) Software Revision
- Pre-Trip Start/End
- Functional Parameters
- System Configurations
- Current System Operating Mode

3.10.2 Data Recording

The DataLink data recorder data comes from four general categories of information:

1. APX Control System Information as described in the preceding **Section 3.10.1**.

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 average of the sensor readings since the last recording based on one-minute increments. The user can determine which sensor(s) will be recorded, whether snapshot or averaged readings are preferred and at what time intervals. (Snapshot readings are also taken at the beginning and end of defrost and at the time of a shutdown alarm.)

All of the sensors and transducers that may be read under Unit Data (refer to **Table 3–1**) may be included or excluded from the recordings.

3. Event Occurrences

This information is any additional data that is recorded on a "when it occurs" basis. Events are recorded by the recorder as they occur. An Event is defined as something that happens and may include:

- Setpoint change
- Defrost cycle start/Defrost cycle end
- START/RUN - OFF switch on (START/RUN position)
- Pre-Trip start
- Pre-Trip end
- Unit mode
- Control mode
- Door and remote switch activations.
- Hour meter readings - Hour meters are recorded at midnight or the first time of day the START/RUN- OFF switch is toggled from the OFF position. There will be no hour meter readings when the switch is in the OFF position.

4. User Area Data

The User or Service Technician may enter a comment into the DataLink data recorder using the TRU-Tech program.

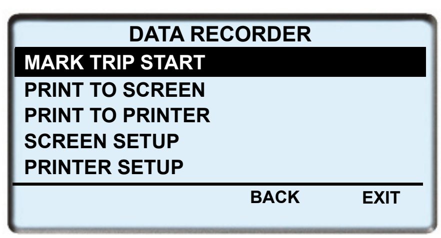
3.10.3 Data Downloading

The data within the DataLink data recorder can be downloaded using a Data Transfer USB memory device (refer to **Section 5.3.1**).

3.10.4 DataLink Data Recorder Power-Up

The DataLink data recorder records data the entire time the START/RUN - OFF switch is in the START/RUN position. A Configuration exists which allows the user to select whether an additional 8 hours of sensor data be recorded after the switch is placed in the OFF position, or to stop recording at the same time the switch is placed in the OFF position. The unit is factory set to record the additional 8 hour so the temperatures will be recorded during the unloading, fueling or other times when it may be necessary to turn the unit off. (Refer to **Section 5.2.3**.)

1. With the system powered up (START/RUN-OFF switch in the START/RUN position) or in PC mode press the MENU key until DATA RECORDER is displayed.
2. Press the DATA RECORDER soft key to display the sub menus.



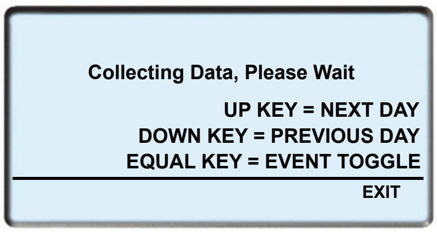
3. The Data Recorder screen will display with a 15 second timeout. Press the ▲ or ▼ key to scroll through the available sub menus. With the desired sub-menu highlighted, press the “=” key to enter the menu.

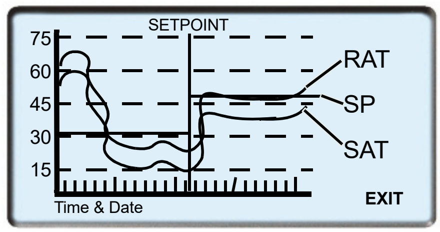
Mark Trip Start

Trip Start places the present time and date as a 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. To enter a Trip Start: with MARK TRIP START highlighted, press the "=" key. If trip start is acknowledged by the data recorder, "TRIP START ENTERED" will be displayed for five seconds and then the display will revert back to the normal display. In the unlikely situation that the data recorder is not functioning properly "CANNOT ENTER TRIP START" will flash and then the display will revert back to the Data Recorder menu.

Print to Screen (Software 04.15.00 and prior)

PRINT TO SCREEN displays a graphical representation of the recorded data. To display the data: with PRINT TO SCREEN highlighted, press the "=" key. NOTE: If configured to do so, the system will prompt for entry of the data protect PIN code (refer to "PROTECT DATA WITH PIN", **Table 5–1**)





Once the graphical display is presented, press the ▲ or ▼ keys to move through the recorded data, day by day. The data is presented with the left horizontal axis as 00:00 (midnight) with 24 dividing lines representing the hours of the day.

Press the "=" key to toggle the event codes on or off. When viewing events with the event codes ON, the following acronyms will be displayed:

c = Door close	o = Door open
d = Defrost start	p = Power up
e = Defrost end	r = Real time clock range
f = Power down	t = Trip Start

3.11 Manual Defrost

1. With the system powered up (START/RUN-OFF switch in the START/RUN position) press the MANUAL DEFROST key.

NOTE

This procedure may be demonstrated in PC mode but the unit will not actually enter defrost.

2. If the conditions for defrost are met, the status bar and the Box Temperature display will change to the word “DEFROST”. The MessageCenter will display “DEFROST CYCLE STARTED” for 10 seconds. At the completion of any defrost cycle, the MessageCenter will return to the default display.

3. If the conditions for defrost are not met, the MessageCenter will display “CANNOT START DEFROST CYCLE” for five seconds. This message will be activated when:
   - The box temperature is too warm. Defrost may be entered when the defrost termination temperature sensor (DTT) is below 40°F (4.4°C) or the supply air temperature sensor (SAT) is below 45°F (7.2°C) **OR**
   - The engine has not run at least 15 seconds after starting **OR**
   - The unit is in PC mode **OR**
   - The unit is in Pre-Trip **OR**
   - There is an active shutdown Alarm.

Defrost may also be initiated automatically at preset intervals by the system defrost timer or by the defrost air switch.

Defrost mode terminates when both the DTT and SAT rise higher than 55°F (12.8°C). Should the defrost cycle not end after a maximum of 45 minutes the defrost cycle will be terminated automatically and alarm **00054 Defrost not Complete** will be activated.

If the alarm is activated, the system will wait 1.5 hours of unit running time before attempting an automatic defrost cycle. Pressing the manual defrost key will override this mode and start a defrost cycle.

TIP

The Manual Defrost key can be used at any time to start a Defrost Cycle as long as the preceding conditions are met.

NOTE

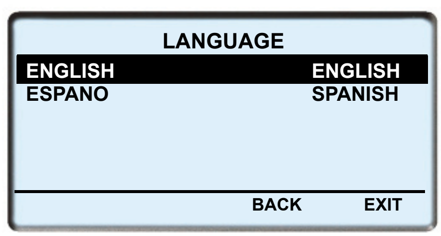
Refer to **Section 4.9** for more detailed information on DEFROST.

3.12 Language Selection

NOTE

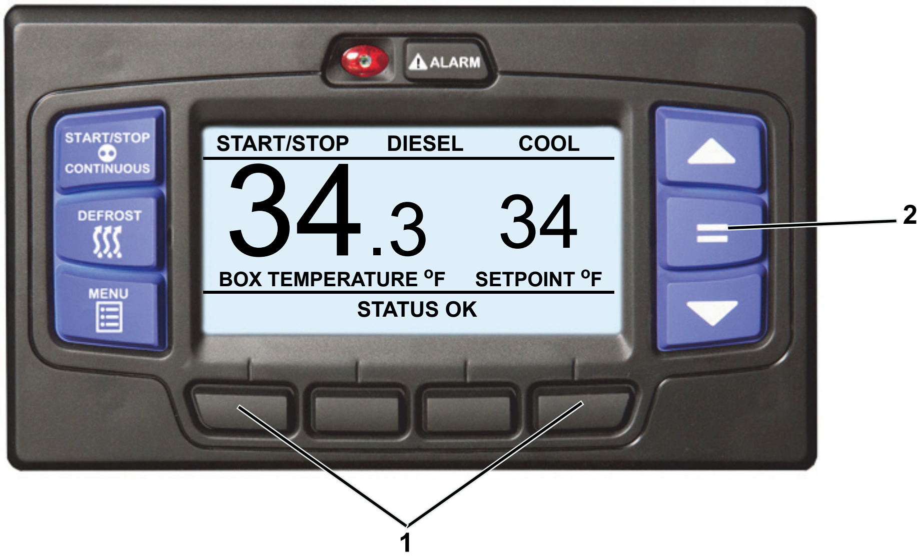
Language Selection may not be available on early software revisions.

1. With the system powered up (START/RUN-OFF switch in the START/RUN position) or in PC mode press the MENU key until LANGUAGE is displayed.
2. Press the LANGUAGE soft key to display the language screen.



3. The language screen will display with a 10 second timeout. Press the ▲ or ▼ key to scroll through the available selections.
4. With the desired language highlighted, press the “=” key. The highlighted language will become active and “LANGUAGE CHANGED” will be displayed.

3.13 Advanced User

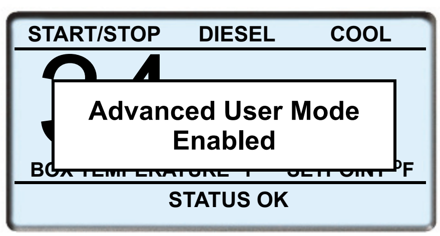


NOTES:

- As shipped from the factory, the system will operate in Driver mode. In Driver mode, some data and menu items covered in this publication will not be available.
- The system may be configured to operate in Advanced User mode. If configured to operate in Advanced User mode, that additional data and those menu items will be available at all times.

If the System is not configured to operate in Advanced User mode, the mode may be entered as follows:

1. With the system powered up (START/RUN-OFF switch in the START/RUN position) or in PC mode press and then release the two outside soft keys simultaneously. (NOTE: The system will not respond.)
2. Then, press the “=” key within five seconds. The operator message panel will display the acknowledgment message.



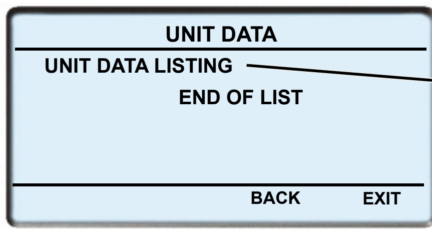
3. The Advanced User menus will be available for 60 minutes or until the START/RUN-OFF switch is placed in the OFF position.
4. The system can be toggled between Driver mode and Advanced User mode by pressing and then releasing the two outside soft keys simultaneously, and then pressing the “=” key.

   When toggling from Advanced User mode to Driver mode, “DRIVERS MODE ENABLED” will display for five seconds.

   When toggling from Driver mode to Advanced User mode, “ADVANCE USER MODE ENABLED” will display for five seconds.

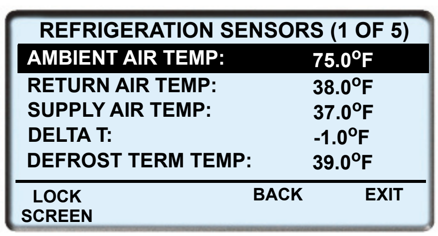
3.14 Unit Data

1. With the system powered up (START/RUN-OFF switch in the START/RUN position) or in PC mode, press the MENU key until the UNIT DATA soft key is displayed.
2. Press the UNIT DATA soft key to open the UNIT DATA screen.



ENGINE
REFRIGERATION SENSORS
REMOTE SENSORS
REFRIGERATION SYSTEM MENU
SYSTEM INFORMATION*
INSTALLED OPTIONS*

3. The Unit Data screen will display with a 15 second timeout. Press the ▲ or ▼ key to scroll through the available unit data sub menus. With the desired sub-menu highlighted, press the “=” key to view the data.
4. The selected sub-menu data will display; for example, the REFRIGERATION SENSORS sub-menu may include:



5. Press the ▲ or ▼ key to scroll through the sub-menu data list.
6. To lock the current display press the LOCK SCREEN soft key. The screen will highlight (white lettering on a black background) to indicate it is locked and the soft key will change to UNLOCK SCREEN.
7. Press the UNLOCK SCREEN soft key to unlock the screen or press the ▲ or ▼ key to unlock the screen and scroll through the sub-menu data selections. Press the BACK key to return to the sub-menu selection screen or the EXIT key to return to the default screen.

UNIT DATA LIST

ENGINE
Fuel Level
Battery: O.K.
Amp Draw (DC)
Engine Coolant Temperature
Engine Speed
Engine Fuel Load

REFRIGERATION SENSORS
Ambient Air Temp
Return Air Temp
Supply Air Temp
Delta-t
Defrost Term Temp

INSTALLED OPTIONS*
Datatrack*
Datatrack Advanced*
Intelliset*

REFRFRIGERATION SYSTEM
Discharge Pressure*
Compressor Discharge Temp*
Suction Pressure
Suction Line Temp*
Evaporator Pressure*
Evaporator Outlet Temperature*
Suction Mod Valve*
Expansion Valve*

SYSTEM INFORMATION*
Date*
Time*
Trailer/Asset/Car ID*
Unit Serial #*
Unit Model #*
Micro Software Revision*
Display Software Revision*
Remote Display Rev*
Main Micro Serial #*

REMOTE SENSORS (Optional)
Remote Sensor 1
Remote Sensor 2
Remote Sensor 3

* Data marked with an asterisk will display in the Advanced User Mode only.

Table 3–1 Unit Data

Data	Definition
Engine	
FUEL LEVEL	This is only displayed when the optional sensor is installed and configured YES. Displays % of fuel in tank.
BATTERY	Battery voltage
AMP DRAW	Battery charging or discharging amps
ENGINE COOLANT TEMP	Engine coolant temperature
ENGINE SPEED	Engine revolutions per minute
ENGINE LOAD	Engine Rack (Throttle) Position (% open)
Refrigeration Sensors	
AMBIENT AIR TEMP	Ambient (air entering condenser) temperature
RETURN AIR TEMP	Return (air entering evaporator) temperature
SUPPLY AIR TEMP	Supply (air leaving evaporator) temperature
DELTA-T	Supply air temperature minus return air temperature (A negative value indicates cooling and a positive value indicates heating.)
DEFROST TERM TEMP	Defrost termination temperature
Remote Sensors	
REMOTE SENSOR (1-2-3)	This is the temperature at remote Temperature Sensor 1 or 2. (These sensors are optional, and may not be applicable to this unit.)
Refrigeration System	
DISCHARGE PRESSURE	Refrigerant pressure leaving the compressor
COMPRESSOR DISCHARGE TEMP	Refrigerant temperature leaving the compressor
SUCTION PRESSURE	Refrigerant pressure entering the compressor
SUCTION LINE TEMP	Refrigerant temperature entering the compressor
EVAPORATOR PRESSURE	Refrigerant pressure leaving the evaporator
EVAPORATOR OUTLET TEMP	Refrigerant temperature leaving the evaporator
SUCTION MOD VALVE	% open of CSMV
EXPANSION VALVE	% open of EVXV
System Information	
DATE	This is the current Date and Time that the system is using. This may be different than your actual time, depending on the time zone and daylight-saving time selections made by the owner of the unit. **NOTE:** The system uses a 24-hour clock. Hours 00 to 11 are AM and hours 12 to 23 are PM.
TIME	
TRAILER ID #	Trailer ID (as entered by the user)
UNIT SERIAL #	Unit serial number
UNIT MODEL #	Unit model number (model number entered in Configuration)
MICRO SOFTWARE REVISION	Revision of software that is operating the main microprocessor module
DISPLAY SOFTWARE REVISION	Revision of software that is operating the display module
REMOTE SOFTWARE REVISION	Revision of software that is operating the Remote Display (if installed)
MAIN MICROPROCESSOR SERIAL #	Serial Number of the main microprocessor module
Installed Options (Will display if one or more options are installed)	
INTELLISET	If displayed, the IntelliSet option is installed.
DATATRAK	If displayed, the DataTrak option is installed.

3.15 View Active Alarms

1. With the system powered up (START/RUN-OFF switch in the START/RUN position) or in PC mode press the ALARM key.
2. If there are active alarms, the alarm number will be displayed preceded by the letter "A" (Active alarm).
   - If the alarm list is viewed in Driver mode, alarm descriptions will only display when the ALARM DESCRIPTIONS Functional Parameter is set to YES. (**Table 3–2**)
   - When viewing the alarm list in Advanced User mode or Technician mode the alarm description will display, following the alarm number.
   - Next to the ACTIVE ALARMS screen name in the status bar, information on the total number of alarms and the position in the list of the highlighted alarm is provided. (In the preceding illustration there are 5 alarms and the second alarm is highlighted.)
   - The last alarm that occurred will be the first alarm displayed and so on.
3. Press the ▲ or ▼ key to scroll through the list of alarms.
4. To clear the alarms, press the CLEAR ALARMS soft key. The display will provide an "ACTIVE ALARMS CLEARED" message to confirm the alarms have cleared.
5. If there are no active alarms, the display will provide a "NO ACTIVE ALARMS" message and then return to the default display after five seconds.

- - - - -

Alarms are stored in the Alarm List in the main microprocessor. Stored alarms may be viewed in the MessageCenter. For a complete list of alarms, alarm descriptions, and troubleshooting recommendations refer to **Section 7.3**.

TIP

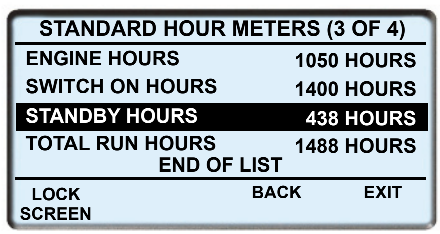
Another way to clear active alarms is to turn the APX Control System OFF and then back on using the START/RUN - OFF switch

TIP

The inactive alarm list may only be viewed while in Technician mode, refer to **Section 5.2.2**. Only qualified refrigeration technicians should access the inactive alarm list. It is not intended for the use of Drivers or Advanced Users.

3.16 View Hour Meters

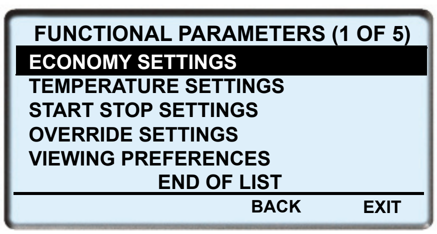
1. With the system powered up (START/RUN-OFF switch in the START/RUN position) or in PC mode, press the MENU key until the HOUR METER soft key is displayed.
2. Press the HOUR METER soft key to open the hour meters screen.
3. The hour meter screen will display with a 15 second timeout.



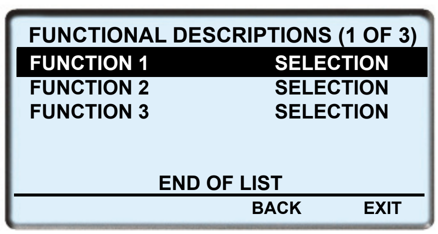
3.17 Functional Parameters

1. With the system powered up (START/RUN-OFF switch in the START/RUN position) or in PC mode, and in Advanced User mode, press the MENU key until the FUNCTIONS soft key is displayed.

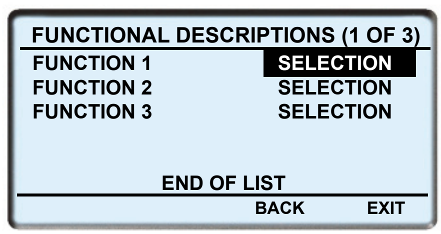
2. Press the FUNCTIONS soft key to display the sub-menus as in Sample Screen A. Press the ▼ key until the desired sub-menu is highlighted, as in Sample Screen B. Then press the “=” key to display the settings. The highlight will move to the current setting, as in Sample Screen C.



Sample Screen A



Sample Screen B



Sample Screen C

3. Press the ▲ or ▼ key to scroll through the selections until the desired setting is highlighted. Press the “=” key to save the setting to memory.

4. Continue as above to set additional Functions as required. Refer to Table 3–2 for additional information on Functional Parameters.

Table 3–2 Functional Parameters

Function	Parameter Selections	Description
NOTES: • Selections in **BOLD** are the default settings. • Any Function displayed with an asterisk (*) has been locked using the TRU-Tech program and cannot be changed using the display mounted keys.		
Economy Settings		
LOW SPEED DELAY S/S	0 MINS TO 255MINS (in one-minute increments) **10 MIN**	Select the length of time the unit is to remain in low speed after starting, before transitioning to high speed, when in Start-Stop Operation.
LOW SPEED DELAY CONT:	0 MINS TO 255MINS (in one-minute increments) **0 MIN**	Select the length of time the unit is to remain in low speed after starting, before transitioning to high speed, when in Continuous Operation.

Table 3–2 Functional Parameters

Function	Parameter Selections	Description
AIR FLOW	**NORMAL** HIGH	NORMAL = allows the engine to cycle from High Speed to Low Speed, based on compartment temperature. HIGH = Some products generate a considerable amount of heat (due to respiration) during transportation. This frequently occurs with produce. The HIGH selection is used for these loads, if continuous high air flow is 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 is not active with setpoints below +10.4°F (-12.0°C).
Temperature Settings		
DEFROST TIMER SET FOR	1.5 HRS 3 HRS **6 HRS** 12 HRS	The defrost timer will automatically put the unit into the defrost cycle at the interval selected if DTT is below 40°F (4.4°C) or the SAT is below 45°F (7.2°C). Shorter times are generally used for warm, humid products like produce. Longer times can be used for dry and frozen products. **NOTE:** The defrost timer is active only when DTT is below 40°F and the unit is running.
FRESH PROTECT	OFF A, B, **C**, D, E	OFF = FreshProtect is turned off. A through E each place an individual flexible limit on how far below setpoint the supply air temperature can drop when in Continuous Operation with a setpoint above 32°F (0°C). Refer to Section **Section 4.10.1** for more information on FreshProtect.
TEMP CONTROL	**RETURN AIR** SUPPLY AIR CURB RETURN AIR	The evaporator has both a Return Air Sensor and a Supply Air Sensor. RETURN AIR = With this setting the unit will operate so that the return air (air entering the evaporator) will be controlled to setpoint. Return air temperature is generally considered to be a good sampling of the actual product temperature. SUPPLY AIR = The unit will operate so that the supply air (air leaving the evaporator) will be controlled to setpoint whenever the setpoint is in the perishable range (greater than 10.4°F (-12°C). When the setpoint is in the frozen range the unit will control the return air as described in the RETURN AIR selection. CURB RETURN AIR = For units equipped with CURB RAT, the unit will control temperature based on the return air entering the evaporator at the location of CURB RAT
OUT OF RANGE ALARM	Metric English OFF OFF 2°C 4°F 3°C 5°F **4°C 7°F**	The value entered here is the number of degrees away from setpoint the temperature may drift before it is considered “Out-Of-Range” and the configured alarm or alarm and shutdown action will be activated. Refer to alarm **00053 Box Temp Out-of-Range** for more information.

Table 3–2 Functional Parameters

Function	Parameter Selections	Description
AUTOFRESH AIR	**CLOSED** OPEN CFM CONTROL	CLOSED = AutoFresh Air Exchange assembly will be closed. OPEN = Assembly will be open if the engine is running and the setpoint is greater than 28.0°F (-2.22°C). CFM CONTROL = Assembly will be cycled open and closed over a 20 minute time period. The length of time the assembly is opened or closed is based on the Auto Fresh Air Control Functional Parameter. The CFM CONTROL will only be active if the engine is running and the setpoint is greater than 28.0°F (-2.22°C).
AUTOFRESH AIR CONTROL	5 to 50 CFM (in 5 CFM increments) **25 CFM**	When CFM Control is selected, this setting is used to set the amount of air to be exchanged during each 20 minute cycle.
START-STOP Settings (Time and temperature values that control Start-Stop Operations)		
The system may be configured so that: 1. The same settings apply to any setpoint = "Together" **OR** 2. The settings are different between setpoints in perishable range and frozen range = "Separate". • If "Together" is configured, there will be six settings with only the sixth applicable to just frozen range. • If "Separate" is configured there will be eleven settings five labeled perishable and six labeled frozen.		
MINIMUM RUN TIME	**4 MINS** TO 60 MINS (in one-minute increments)	This determines the Minimum Run Time for perishable/frozen setpoints in Start-Stop Operation.
MINIMUM OFF TIME	10 to 90 MINS (in one-minute increments) **30 MINS**	This determines the Minimum Off Time for perishable/frozen setpoints in Start-Stop Operation.
RESTART TEMPERATURE	5 to 18°F (0.28 to 10°C) (in 0.5° increments) **5.4°F (3°C)**	Following the Minimum Off Time, if a compartment temperature drifts this far above or below setpoint in Perishable Range or above setpoint in Frozen Range, the unit will restart.
OVERRIDE TEMPERATURE	3.6 to 18°F (2 to 10°C) (in 0.5° increments) **3.6°F (2.0°C)**	Sets the override temperature for the Minimum Off Time portion of the Auto Start-Stop Off Cycle. During Minimum Off Time, if the refrigerated compartment temperature drift this far above or below setpoint in Perishable Range, or above setpoint in Frozen Range, the unit will override the Minimum Off Time and restart.
MAXIMUM OFF TIME	**OFF** 10 MINS to 255 MINS (in one-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 an Auto Start/Stop Off cycle (in Perishable or Frozen). When this time expires, the unit will restart and run for the Minimum Run Time, regardless of any temperature change inside the compartment.
FROZEN SHUTDOWN OFFSET	**0°F** to 1.1°F (**0°C** to 0.6°C) (in 0.1° increments)	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 compartment temperature when considering temperature rises during off cycles.

Table 3–2 Functional Parameters

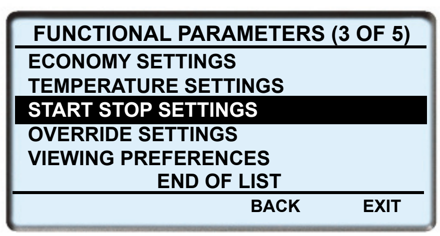
Function	Parameter Selections	Description
SLEEP MODE	For complete instructions on entering and setting parameters for Sleep mode refer to **Section 3.18**.	
	Overrides	
OVERRIDE REMOTE SWITCH 1 SHUTDOWN (REMS1) **AND** OVERRIDE DOOR SWITCH SHUTDOWN (DS)	**NO** YES (RESET)	If the switches are all configured "Switch Not Installed", this parameter will not display. NO = The system will respond to the switch as configured. YES (NO RESET) = The configured action on activation of the switch will be overridden and the action will be alarm only. The purpose of this setting to temporarily override the Configuration setting in situations where shutdown or speed change is not desired. YES (RESET) = The configured action on activation of the switch will be overridden and the action will be alarm only. The purpose of this setting to temporarily override the Configuration setting in situations where shutdown or speed change is not desired. This will revert back to NO on a power cycle. If the fuel sensor is configured to NO, this parameter will not display.
OVERRIDE FUEL LEVEL SENSOR SHUTDOWN	**NO** YES (NO RESET) YES (RESET)	NO = The system will respond to the switch as configured. YES (NO RESET) = The fuel level sensor shutdown will be overridden until the function is changed back to NO YES (RESET) = The fuel level sensor shut down will be overridden until a power cycle of the unit occurs. At which time it will automatically revert back to NO
	Viewing Preferences	
DISPLAY TEMPERATURE IN	**°F** °C	Temperatures will display in either Fahrenheit (°F) or Celsius (°C). (for North American Units, this function may be locked)
DISPLAY PRESSURE IN	**PSIG** BAR	Pressure will display in either psig or (bar). (for North American Units, this function may be locked)
DATE FORMAT	**MM/DD/YYYY** DD/MM/YYYY	Date will display in either US (MM/DD/YYYY) or European (DD/MM/YYYY) format.
ALARM DESCRIPTIONS	**YES** NO	YES = In Driver mode, the alarm code and alarm description will be displayed. NO = In Driver mode, only the alarm code will be displayed.
CONTRAST	0 TO 63 (in single digit increments) **35**	Higher numbers increase the contrast of the display screen.

3.18 Sleep Mode

1. To place the unit in Sleep mode, enter the Advanced User Functional parameter screen as described in **Section 3.17**.

2. Press the FUNCTIONS soft key to display the Functional Parameter Screen.

3. Press the ▼ key until the START-STOP SETTINGS sub-menu is highlighted and then press the “=” key to enter the menu.



4. Press the ▼ key until the Functional Parameter “SLEEP MODE SETTINGS” is highlighted. Press the “=” key.

5. Press either the ▲ or ▼ key until “ON” is highlighted. Press the “=” key to save the setting to memory, the unit is now in Sleep mode.

6. Additional Functional Parameter sub menu selections for “wake up time” and “run pretrip at wake” will now be available and may be saved to memory following the key stroke sequence in the preceding step. Refer to the following for information on these settings.

To Exit Sleep Mode

- Place the START/RUN-OFF switch in the OFF position, then back to the START/RUN position.
- Sleep mode is generally used in cold ambients when the unit will be off for an extended period of time with no product inside the refrigerated compartment. Many times units are difficult to start due to a discharged battery, thickened engine oil, etc. after time in cold ambient.
- There is **NO TEMPERATURE CONTROL** in Sleep mode and it should never be used if the compartment contains perishable or frozen products.
- In Sleep mode the unit will “Wake Up” periodically and start the engine to keep the battery charged and the engine warm.

Additional Sub-Menus:

1. "WAKE UP TIME" may be set to ON or OFF, the default setting is OFF.

   a. When "WAKE UP TIME" is set to OFF the unit will remain in Sleep mode until it is taken out manually (refer to the preceding "TO EXIT SLEEP MODE" instruction).

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

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

- Month (1 to 12).
- Day (1 to 31).
- Year (2009 to 2099).
- Hour (0 to 23).
- Minute (0 to 59).

NOTE

The system uses a 24-hour clock. Hours 00 to 11 are AM and hours 12 to 23 are PM.

2. "RUN PRETRIP TEST AT WAKE" may be set to YES or NO, the default setting is NO.

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

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

If Sleep mode is selected when the unit is not running during a Start-Stop Off Cycle, any remaining Minimum Off Time will be ignored, and the engine will start. It will run for four minutes (minimum), until the engine coolant temperature is above 95°F (35°C), the battery is charged ("OK" is displayed in the battery unit data reading) and charging amps are less than the configured setting.

When the unit is running while in Sleep mode, "SLEEP WARNING: NO TEMP CONTROL" will flash in the MessageCenter.

If the unit is already running when Sleep mode is selected, it will continue to run until the conditions described above are met.

While the unit is cycled off in Sleep mode, "SLEEP MODE, OFF/ON TO WAKE" will be displayed in the MessageCenter. The display backlight will turn off after five minutes.

While in Sleep mode, Unit Data and Alarm Lists may be viewed, and Functional Parameters may be viewed and changed as necessary. However, Start-Stop/Continuous Run selections and setpoint can not be changed. Manual Defrost and Pre-Trip can be initiated.

The unit will restart when engine coolant temperature drops below the configured restart temperature value or if the battery voltage drops below the configured battery restart value.

NOTE

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

- In ambients above 32°F (0°C), the unit will run as above, and will monitor battery voltage and charging amps only (according to the Configuration setting).
- In ambients below 32°F (0°C), the unit will run for 20 minutes minimum run time, then restart every 60 minutes (maximum off time). Battery voltage and amperage will be monitored normally.

3.19 Stopping the Unit

To stop the unit, place the START/RUN-OFF switch in the OFF position. The unit will shutdown immediately while the system completes a shutdown sequence and then the display will go blank. The engine will stop and the display will turn off.

NOTES:

- The system will close the compressor suction modulation valve (CSMV) and evaporator expansion valve (EVXV) to 0% open before turning off.
- Due to internal processing, turning the START/RUN - OFF switch OFF then back to the START/RUN position will result in a 4 to 50 second delay between the display going off and coming back on again.

3.20 DataTrak (Option)

DataTrak allows remote communication with the APX Control System (cellular, satellite, etc).

One Way Communication providers can request data from the System and transmit it via their equipment to another location. This is typically done via the Internet to any destination in the world.

WARNING

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

Two-way Communication providers can also send commands via their equipment to the APX Control System to start or stop the unit, change settings and the way the System is operating the unit.

DataTrak is an optional feature. The DataTrak option is generally factory installed, however it can be installed in the field by inserting a DataTrak option USB memory device into the USB interface port and following the on-screen instructions.

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

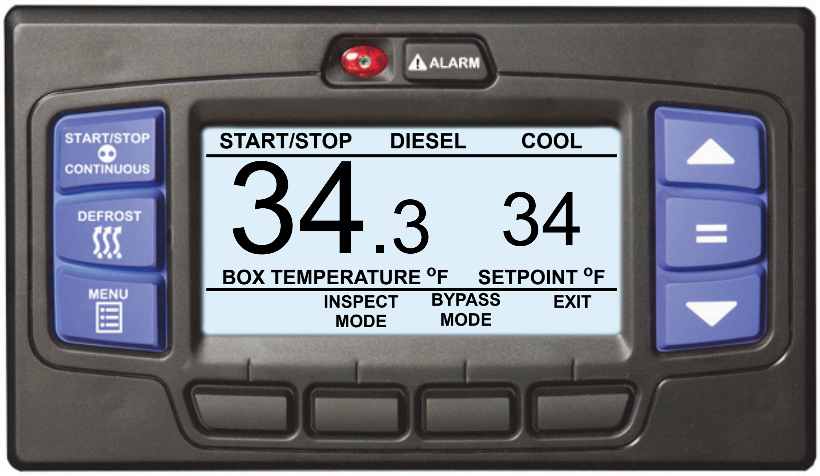
Once DataTrak is installed, the APX Control System must be configured for the provider that will be connecting to it (refer to **Section 5.2.3**). The Satellite Com Configuration can be set for “Qualcomm” or “Other”. If the provider is “Qualcomm” and the original Qualcomm TrailerTracs system is being used then the “Qualcomm” selection must be made. If the provider is Qualcomm and the newer TrailerTracs T2 system is being used or another communications provider is used, the “Other” selection must be made.

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

3.21 Emergency Bypass Mode

In the event of an alarm caused by a failure of the display module, the unit will go into shutdown. In order to temporarily bypass this shutdown state, Emergency Bypass mode can be activated.

Once Emergency Bypass mode has been activated, the unit will operate normally for 24 hours, a countdown timer will be shown on the display. This 24-hour window of operation will keep the load safe and provide enough time to contact the nearest Carrier Transicold Service Center for repair of the unit.



Enter Emergency Bypass Mode:

1. When the unit is in a shutdown state due to the display module alarm, press the MENU key until BYPASS MODE is displayed.
2. Press the BYPASS MODE soft key, the unit will resume operation until Emergency Bypass mode is disabled, or after 24 hours of unit operation in Emergency Bypass mode.

Exit Emergency Bypass Mode:

3. Press the MENU key until the EXIT BYPASS soft key is displayed.
4. Press the EXIT BYPASS soft key, the unit will shut down. Once Emergency Bypass mode is turned off, it cannot be restarted and the unit will remain in shutdown until it is repaired.

After repairs have been made and the display module alarm has been cleared, the unit will operate normally and Emergency Bypass mode will no longer be available.

3.22 Remote Panel

The unit may be fitted with an optional remote control panel. The remote panel, which is very similar to the display module, displays compartment setpoints, compartment temperatures and operating modes (heat, cool or defrost). The setpoint may be modified and the unit may be started and stopped using the remote panel. This compact remote panel can be mounted to suit the individual operator's preferences - on the front bulkhead, or in the compartment (even in the wall itself). Remote Panel keys, soft keys and alarm indicators are in the same locations as the main APX display module.

1. MENU key
2. DEFROST key
3. START/STOP - CONTINUOUS Key
4. Alarm LED
5. Alarm Key
6. “=” (Select) Key
7. Arrow Keys
8. Soft Keys
9. Display

- - - - -

The Remote Panel can be used to:

- Turn the Refrigeration System On and Off - The Remote Panel does not remove power from the APX Control System. In order to shut down the APX Control System, place the SROS in the OFF position.
- Check compartment temperatures
- Check and change setpoints
- Initiate manual defrost
- Check mode of operation
- Initiate Pre-Trip

The Remote Panel cannot be used to:

- Enter Advance User and Technician modes
- Access any USB Functions; USB menus, PC Mode, Print

The Remote Panel does not have the following features:

- There is no USB port on the remote panel
- There is no START/RUN-OFF switch at the remote panel. Remote Panel unit On/Off is controlled by the “UNIT ON/OFF” soft key (replaces the Engine Hours soft key in the main display)

The following unit functions are controlled the same as the main display:

- Display compartment temperatures - **Section 3.2**
- Display the current mode of operation for each compartment - **Section 3.2**
- Intelliset selection - **Section 3.5**
- Initiate Pre-Trip - **Section 3.6**
- Initiate Manual Defrost/Defrost Indication - **Section 3.11**
- Control display indication lock - **Section 3.14**

Turning the Unit ON/OFF Using the Remote Panel:

The unit can be shutdown using either the remote panel or the START/RUN-OFF switch on the Main Panel. The remote panel cannot operate if the START/RUN-OFF switch is in the OFF position.

In order to prevent a constant drain on the battery, the remote panel illuminates when the START/RUN-OFF switch is turned on, but the remote panel will turn off after 30 minutes of inactivity. To turn the remote panel back on, simply press any button on the remote panel. The remote panel will turn off again after 30 minutes of inactivity.

1. On the remote panel press and release the "MENU" key until the "UNIT ON/OFF" soft key is displayed.

NOTE

The "UNIT ON/OFF" soft key on the remote panel takes the place of the "ENGINE HOURS" soft key in the main display.

2. To turn the unit ON, press the "UNIT ON/OFF" soft key. The remote display will read "UNIT ON"
3. To turn the unit OFF, press the "UNIT ON/OFF" soft key. The remote display will read "UNIT SHUT DOWN BY REMOTE PANEL"

SECTION 4

Engine and Temperature Control

NOTES

1. If the unit is in an alarm condition, the control system alarm response may override the following unit operation descriptions. If an alarm is displayed in the MessageCenter, refer to the specific alarm description in **Section 9** for “Unit Control” descriptions.
2. With the complex control interactions in use with the APX Control System there are many user selected and preprogrammed software overrides which may change the operation of the unit. Refer to **Section 4.10** and **Section 4.11** for complete descriptions of these features.

4.1 Introduction

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

For descriptions and flow diagrams of the refrigerant system component interaction while in cooling and heating, refer to **Section 2.13** and **Section 2.14**.

4.2 Sequence of Operation - Electrical

Electrical schematic is located in Section 10

With the battery connected, power is available from the battery through fuse F7:

- and fuse F1 to the module logic circuit at main microprocessor module (MM) terminal 1MM-6, through the stepper valve module (from 1MM-8 to 1SMV-6) and to the display module (from 1SVM-8 to DM-10),
- and fuse F3, PCM-34 and SP-6 to SVM at 2SVM-22 (for operation of the valves),
- and through SP-6 to the engine control unit (ENCU) at ENCU-22.

Potential power is also established for the starter solenoid contactor (SSC) normally open contacts, the engine preheat transistor (EPHT), fuel heater relay (FHR) normally open contacts, AutoFresh Air relay (AFAR) normally open contacts, power enable relay (PER) normally open contacts (through fuse F5), the buzzer (B - through fuse F1) and the START/RUN - OFF switch (SROS).

Once the module logic circuit is powered, the modules begin to communicate over the controlled area network (CAN).

The “HI” CAN connectivity is established from the main microprocessor (1MM-2) through SP-1 to the stepper valve module (1SVM-5) and from the stepper valve module (1SVM-2) to the display module (DM-2). The connectivity also continues from SP-1 to the engine control unit (ENCU-23).

The “LO” CAN connectivity is established from the main microprocessor (1MM-4) through SP-4 to the stepper valve module (1SVM-7) and from the stepper valve module (1SVM-4) to the display module (DM-6). The connectivity also continues from SP-4 to the engine control unit (ENCU-24).

To start the unit, SROS is placed in the START/RUN position. Power flows from SROS through the J1 jumper and high pressure switch (HPS) to the power enable relay (PER) coil. Confirmation of power circuits are established from splice point SP-9 back to the main microprocessor at 2MM-35 and SP-5 to 3MM-16. If either of these circuits is broken, the appropriate alarm will be activated.

If conditions are correct for operation, the main microprocessor will energize PER by providing ground through PCM16 from 3MM18. Energizing PER closes its normally open contacts to provide power:

- through fuse F10 to the main microprocessor at 3MM-34 and 3MM-23.
- through fuse F12 for satellite communication (SATPWR).
- through fuse F11 for the light bar (LB) green LED’s.
- Potential power is also established through fuse F10 for the AFAR coil and FHR coil, and through fuse F8 for the fuel level sensor (FLS).

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

Once the SROS is placed in the START/RUN position, the compressor suction modulating valve (CSMV) and evaporator expansion valve (EVXV) will open to a predetermined position, to equalize system pressure, and then close (minimum allowed % open) before the unit starts.

NOTE

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

4.3 Engine Control

Engine control consists of engine start-up and speed control.

4.3.1 Engine Start-Up Sequence

On command to perform a Start-up the main microprocessor will supply power from 3MM-10 to the fuel pump (FP) and from 3MM-9 to ENCU-44. This signals the ENCU that engine operation is required. The control system will then enter the engine start sequence. During the start sequence the engine is operated in low speed. Following start, the refrigeration system will then operate in the mode(s) required for temperature control.

The engine start sequence consists of periods of time with the engine preheater (EPH - power from 3MM-14 through PCM -27 to EPHT) and starter (SM - power from 3MM-12 to SS, closing the SSC contacts) energized and de-energized for up to three start attempts (Figure 4.1). Pre-heat time varies in duration based on engine coolant temperature (see Table 4–1).

Figure 4.1 Auto Start Sequence

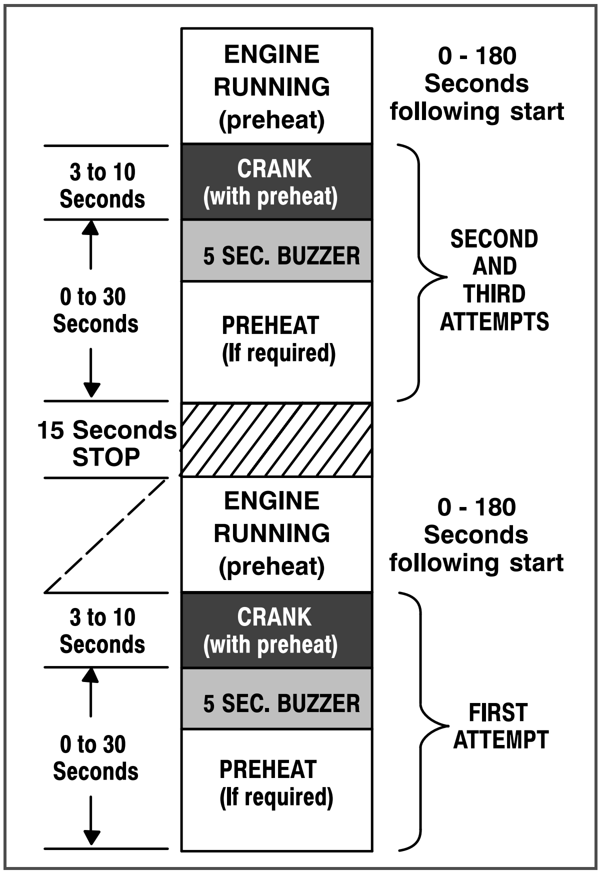


Table 4–1 Engine Preheat Time

Engine Coolant Temperature	Heat Time in Seconds	
	Preheat	Post Heat
Less than 33°F (1.0°C)	30	180
33°F to 51°F (1.0°C to 11°C)	20	120
51°F to 78°F (11°C to 26°C)	10	60
Greater than 78°F (26°C) 0	0	0

If alarm **00129 Check Engine Coolant Sensor** is active, the ambient temperature sensor will be used. If both alarm **00129 Check Engine Coolant Sensor** and **00121 Check Ambient Air Sensor** are active the control system assumes a temperature of less than 32°F (0°C) for the preheat timing.

During the last five seconds of preheat **OR** for five seconds before a start attempt, if no preheat is required, the buzzer (B) is energized; then the starter solenoid contactor (SSC) will be energized for a maximum of ten seconds while the engine condition is checked during the cranking period.

The engine is considered to be running, and the start sequence will be stopped, when engine speed is greater than 1000 rpm and the engine oil pressure switch (ENOPS) is closed.

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

- When the engine speed reading is less than 1000 rpm, ambient temperature is above 32°F (0°C) and the ENOPS is closed, alarm **00130 Check Engine RPM Sensor** will be activated and the engine will be considered running.
- When the engine speed reading is less than 1000 rpm, ambient temperature is below 32°F (0°C), the ENOPS is closed and DC current is more than 2 amps, alarm **00130 Check Engine RPM Sensor** will be activated and the engine will be considered running.

Once the engine is considered running, the control system will keep the preheater energized for an additional 0 to 180 seconds of Post Heat, depending on engine coolant temperature (refer to Table 4–1).

During the start sequence the control system monitors engine speed while cranking. If engine speed drops below 50 rpm for three seconds the starter solenoid contactor will be de-energized and alarm **00035 Check Starter Circuit** will be activated.

If the unit fails to start after three attempts, alarm **00031 Failed to Start - Auto Mode** will be activated.

If the unit is equipped with a fuel heater, the control system will monitor ambient temperature. If ambient is below 77°F (25°C) the fuel heater relay (FHR) will be energized. Energizing FHR closes its normally open contacts to supply power from fuse F14, through the fuel heater temperature switch (FHTS) to the heater. Refer to Section 2.8 for FHTS settings.

4.3.2 Transition To High Speed

After a successful start, the control system may call for the engine to transition to high speed. When high speed is required, the main microprocessor will provide a signal through the CAN system to the ENCU, calling for the speed change. Three factors control this transition.

1. Transition may be delayed if a time value is entered in the HIGH SPEED DELAY Configuration. The delay may be set to 0 to 10 minutes. The factory default setting is one-minute.
2. If the engine is started when the coolant temperature is 79°F (26°C) or below it will remain in low speed until the coolant temperature reaches 79°F (26°C) or it has operated for a minimum of 15 seconds. Once the coolant temperature reaches 79°F (26°C) the engine may transition to high speed.
3. Transition will be based on the need for temperature control. Generally, the engine will operate in high speed when the unit is in Pulldown or Pull-Up mode (full capacity required) and in low speed when less than full capacity is required.

4.4 Modes of Operation

Once the engine is started, the system will operate in Start-Stop or Continuous Operation energizing and de-energizing the following components:

- SV1 - Energized (closed) through main microprocessor terminal 3MM-1.
- SV2 - Energized (opened) through main microprocessor terminal 3MM-2.
- SV4 - Energized (opened) through main microprocessor terminal 3MM-3.
- SPEED - Transition to high speed when main microprocessor provides a signal through the CAN system to the ENCU.
- CLUTCH - Energized (engaged) through main microprocessor terminal 3MM-11.
- UL1 - Energized (unloaded) through main microprocessor terminal 3MM-6.
- UL2 - Energized (unloaded) through main microprocessor terminal 3MM-8.
- CSMV - Opened and closed by the Stepper Valve Module (SVM) through module terminals 2SVM-2, 2SVM-3, 2SVM-4 and 2SM-5.
- EVXV - Opened and closed by the Stepper Valve Module (SVM) through module terminals 2SVM-6, 2SVM-7, 2SVM-8, 2SVM-9 and 2SVM-10.

4.4.1 Pull Down/Pull-Up

When in Pulldown or Pull-up, the refrigeration system will operate with the compressor loaded (six cylinders) and in high speed.

Pulldown/Pull-Up will be entered:

- following a Start-Up.
- following a setpoint change.
- following an operational change (Start-Stop Operation vs Continuous Operation).
- following a defrost termination.
- following a pretrip termination.
- when in a Start-Stop ON Cycle and all other Stop Parameters have been met except the compartment temperature Stop Parameter.

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

- when the control system is calling for low speed.
- when in Start-Stop Operation and the compartment temperature Stop Parameter has been satisfied while one or more of the other Stop Parameters has not.
- when in continuous operation and the control system has calculated pulldown or pull-up is to end.

4.4.2 Cooling

In the Cool mode, the control system will operate the unit controls as follows (refer to **Section 2.13**):

SV1	SV2 (when applicable)	SV4	Engine Speed
Open	Open	Closed	See Note 1
Clutch Output	**UL1 and UL2**	**CSMV**	**EVXV**
Engage	See Note 2	See Note 2	See Note 3

NOTES

1. The selected temperature control sensor determines if the unit is running high or low speed.
2. The control system monitors the suction pressure and ambient temperature and calculates the system load. If required, the system will unload cylinders and modulate the CSMV to keep the load within required limits. Refer to **Section 4.11.3** and **Section 4.11.4**.
3. Modulated to control superheat.

4.4.3 Heating

4.4.3.1 For units with SV2

When in Heat mode, the control system will operate the unit controls as follows (refer to **Section 2.14**):

- **SV4**: SV4 is open.
- **CSMV/EVXV**: CSMV and EVXV are 100% open.
- **Clutch**: The clutch is engaged.
- **SV1**: SV1 is closed. If discharge pressure rises to 390psig (26.5 bar), SV1 will open for 1 second and continue to cycle as often as every 30 seconds to reduce the pressure to less than 390psig (26.5 bar).
- **Engine Speed**: When in Start-Stop Operation the engine will remain in high speed to raise the control temperature as quickly as possible. When in Continuous Operation the engine will be in high speed when control temperature is greater than 3.6°F (2°C) below set point and will remain in high speed until the control temperature is raised to 3.2°F (1.8°C) below setpoint.
- **Unloaders**: When in Start-Stop Operation the compressor will remain fully loaded to raise the control temperature as quickly as possible. When in Continuous Operation the compressor will be fully loaded when control temperature is greater than 2.7°F (1.5°C) below set point. UL1 and UL2 will unload when the control temperature is raised to 2.3°F (1.3°C) below setpoint.
- **SV2**: SV2 is closed. When conditions allow, additional heating capacity is obtained by opening SV2 to allow additional refrigerant to be metered into the hot gas cycle (through the evaporator expansion valve). This flow is established (even though SV1 is closed) by the hot gas bypass line which functions to raise the receiver pressure.

As the system operates in the Heat mode with SV2 closed, discharge pressure tends to decrease. As the system operates in the Heat mode with SV2 open discharge pressure tends to increase. Control of the valve is dependent on discharge pressure and ambient temperature. The valve is opened (on a discharge pressure fall) at 200 PSIG (13.6 bar), the valve is closed (on a discharge pressure rise) at 300 PSIG (20.4 bar).

When the ambient temperature is below 50°F (10°C) SV2 will be opened when discharge pressure decreases to the opening pressure and remain open until discharge pressure rises to the close pressure.

When the ambient temperature is above 50°F (10°C) SV2 will be pulsed, open for one second and then closed for 10 seconds. During the 10 second closed period the system pressures will be allowed to balance out due to the additional refrigerant in the hot gas cycle. The pulse will continue, one second open and ten seconds closed, until discharge pressure increases to the close pressure.

4.4.3.2 For units without SV2

When in heating mode, the control system will operate as follows:

- **SV4:** SV4 is open
- **CSMV:** CSMV will open 100%
- **EVXV:** EVXV will control the amount of refrigerant required to allow for efficient heat.
- **SV1:** SV1 is closed. If discharge pressure rises to 420 psig or higher, SV1 or if suction pressure is greater than 75 PSIG. SV1 will remain open until the average engine load is less than 95%, discharge pressure is less than 420 psig, and suction pressure is less than 75 psig.
- **Engine Speed:** When in Start-Stop Operation the engine will remain in high speed to raise the control temperature as quickly as possible. When in Continuous Operation the engine will be in high speed when control temperature is greater than 3.6°F (2°C) below set point and will remain in high speed until the control temperature is raised to 3.2°F (1.8°C) below setpoint.
- **Unloaders:** When in Start-Stop Operation the compressor will remain fully loaded to raise the control temperature as quickly as possible. When in Continuous Operation the compressor will be fully loaded when control temperature is greater than 2.7°F (1.5°C) below set point. UL1 and UL2 will unload when the control temperature is raised to 2.3°F (1.3°C) below setpoint.

As the system operates in Heat mode, the EVXV will open and close to maintain the proper discharge and suction pressure required for heat.

4.4.4 UltraFresh Temperature Control

UltraFresh 3 is an advanced method of temperature control for both Perishable and Frozen ranges. It produces a reduced capacity state by throttling the CSMV and pulsing the refrigerant control solenoid valves.

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

The sensor selected in the TEMP CONTROL Functional Parameter is the probe that will be used to determine when the temperature is at setpoint.

Reduced capacity is produced between heating and cooling by a set of modes known as Cool Pulsed mode, Heat Pulsed mode and Null Pulsed mode. These modes are not constant operating modes, they operate for a few seconds at a time. During null, the heat and cool valves are opened simultaneously to reduce either the heating or cooling capacity. In these modes (Refer to the following charts), the unit will pulse between cool and null, or heat and Null in 10 second increments. The capacity is varied by adjusting the pulse rate.

4.4.4.1 Cool Pulsed Mode

SV1	SV2 (when applicable)	SV4	Engine Speed
Open	Open	Closed	Low
Clutch Output	**UL1 and UL2**		**CSMV/ EVXV**
Engage	Unload		See Note

NOTE

For CSMV/EVXV control, see following step d.

4.4.4.2 Null Pulsed Mode

SV1	SV2 (when applicable)	SV4	Engine Speed
Open	Open	Open	Low
Clutch Output	**UL1 and UL2**		**CSMV/ EVXV**
Engage	Unload		See Note

NOTE

For CSMV/EVXV control, see following step d.

4.4.4.3 Heat Pulsed Mode

SV1	SV2 (when applicable)	SV4	Engine Speed
Closed	Closed	Open	Low
Clutch Output	**UL1 and UL2**		**CSMV/ EVXV**
Engage	Unload		See Note

NOTE

For CSMV/EVXV control, see following step d.

UltraFresh will modify the length of each mode in 10 second cycles. That is, if the unit is in Cool Pulse mode, the unit may run in cool for up to nine seconds, then null for one second, if the Control Temperature is away from setpoint. As the Control Temperature comes closer to setpoint, the length of cool pulse 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 Pulse mode.

4.4.4.4 UltraFresh 3 CSMV/EVXV Control

The CSMV will automatically go to 30% when Ultra Fresh 3 is entered. The CSMV will usually control between 30% and 4% depending on the controlling probe temperature and suction pressure. However, it can go above 30% for short periods of time. For example, high ambients and low setpoints may cause the CSMV to open higher than 30%. The EVXV will be modulated to control super heat when in cooling and discharge pressure when in heating. For units equipped with a SV2 the EVXV will open to 100% when heating.

4.4.5 UltraFreeze Temperature Control

For frozen setpoints, a modified temperature control will be used to keep the unit from over cooling and driving the box temperature far below setpoint. UltraFreeze operates similar to UltraFresh and acts to control the compartment temperature from exceeding 3° F (1.6° C) below setpoint When UltraFreeze is active it is normal to hear the refrigerant solenoid valves energize and de-energize every few seconds. UltraFreeze is always active in Continuous Operation, should the unit be required to continue to run after the box temperature is satisfied in Start-Stop Operation - due to either low battery condition or low engine coolant temperature - the UltraFreeze logic will control to the 3° F (1.6° C) below setpoint offset until all conditions for an off cycle are met and the unit cycles off.

4.4.6 Defrost

Refer to **Section 4.9** for a description of defrost.

4.4.7 Overrides

With the complex control interactions in use with the APX Control System there are many user selected and preprogrammed software overrides and Configuration settings which may change the operation of the unit. Refer to **Section 4.10** and **Section 4.11** for complete descriptions of these features.

4.5 Temperature Control

4.5.1 Temperature Determination

The APX Control System monitors temperature readings from supply and return temperature sensors to determine the mode of operation required to maintain compartment temperature based on the setpoint.

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

- If the selection is RETURN AIR the return air sensor (RAT) will be used, for any setpoint.
- If the selection is SUPPLY AIR the APX Control System will switch to the supply air sensor (SAT) when operating with a perishable setpoint (refer to **Section 4.5.2** for more information on frozen and perishable setpoints) and the return air sensor will be used for frozen setpoints.

4.5.2 Perishable And Frozen Setpoint Ranges

There are two ranges defined for setpoint.

- Perishable = setpoints above +10.4°F (-12°C).
- Frozen = setpoints at or below +10.4°F (-12°C).

4.6 Start-Stop Operation

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

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

NOTE

The control system may be locked so that the unit will always operate in Start-Stop whenever the setpoint is within a specific range. Refer to Range Lock (**Section 4.10.2**) for additional information.

4.6.1 Start-Stop Configuration

Start-Stop Operation is dependent on both Configuration and Functional Parameter settings. The first setting to be considered is the START-STOP PARAMETERS Configuration. This setting determines control actions when in Perishable or Frozen Range. Available settings are TOGETHER and SEPARATE.

- When SEPARATE is selected the control actions will be different, depending on whether the setpoint is in Perishable Range or in Frozen Range (refer to **Section 4.5.2**).
- When TOGETHER is chosen, the same control actions apply to any setpoint.

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

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

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

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

NOTE

In the event that this Configuration was set to SEPARATE and the eleven Functional Parameters for Perishable and Frozen have been set and then the Configuration is changed from SEPARATE to TOGETHER, the Perishable settings will be used.

4.6.2 Stop Parameters

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

1. Unit has run for the selected Minimum Run Time

The MINIMUM RUN TIME is selected in the Functional Parameters. The purpose of MINIMUM RUN TIME is to force the unit to run long enough to completely circulate the air inside the compartment, and to ensure that the product temperature is at setpoint. This value may be set from 4 to 60 minutes in one-minute intervals. The factory default setting is four minutes.

2. Engine coolant temperature has warmed

Each time the unit is started it must continue to run until the coolant temperature rises to 95°F (35°C) to ensure it has fully warmed up before shutdown is allowed.

3. Battery is fully charged - Voltage

A good battery is defined as having 13.4 VDC at 77°F (25°C). The control system will calculate the equivalent voltage based on the ambient temperature and shutdown will be allowed when battery voltage is at or above the calculated value.

4. Battery is fully charged - Amperage

The control system will calculate the average current draw over a 20 second period. Once this average drops below the selected value, shutdown will be allowed. The CURRENT FOR S/S SHUTOFF is selected in the Configurations. The value may be set from 1 to 10 amps in 0.5 amp intervals. The factory default setting is 7 amps.

5. Compartment temperature

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

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

The FROZEN SHUTDOWN OFFSET Functional Parameter may be set from 0 to 3.6°F (0 to 2°C) in 0.5° increments. The factory default setting is 0°F (0°C).

4.6.3 Re-Start Parameters

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

NOTE

In Start-Stop Operation when the setpoint is in frozen range (below +10.4°F = -12°C), the unit will not restart when the temperature is below setpoint except as indicated in the following.

1. Engine coolant temperature drops below selected Configuration value

The control system will monitor coolant temperature. If coolant temperature drops below the ENGINE TEMPERATURE FOR RESTART Configuration value the engine will be started. The Configuration value may be set from 10 to 32°F (-12.2 to 0°C) in 0.5° increments. The factory default setting is 32°F (0°C).

If this is the only reason operation is required, the unit will operate as if it is in Continuous Operation until the requirement has been met.

2. Battery voltage falls below selected Configuration value

The control system will monitor battery voltage. If battery voltage is at or below the VOLTAGE FOR START-STOP RESTART Configuration value the engine will be started. The value may be set from 12.0 to 12.8 volts. The factory default setting is 12.2 volts.

If this is the only reason operation is required, the unit will operate as if it is in Continuous Operation until the requirement has been met.

3. Maximum Off Time has expired

In some ambient conditions there are times when the unit may remain in a Start-Stop Off cycle for extended periods of time. To ensure that the entire load stays within the normal restart temperature range, the MAXIMUM OFF TIME Functional Parameter may be used to force the unit to restart to circulate air in the compartment. This will ensure there are no hot spots and the temperature sensor reading accurately reflects product temperature. The parameter value may be set to 0 minutes or from 10 to 225 minutes in one-minute intervals.

If the MAXIMUM OFF TIME is 0 minutes, there is no maximum off time for Start-Stop and the unit will remain off. The factory default setting is 0 minutes.

If this is the only reason operation is required, the unit will operate as if it is in Continuous Operation until the requirement has been met.

4. Minimum Off Time has expired

The MINIMUM OFF TIME Functional Parameter allows the unit to remain off for extended periods of time, maximizing fuel/power economy. The unit may not be restarted until the MINIMUM OFF TIME has expired and the compartment temperature is greater than the PERISHABLE RESTART TEMPERATURE value selected in the Functional Parameters away from setpoint. In Frozen Range, restart is allowed when the compartment temperature is calculated to be greater than 0.5°F above setpoint. The MINIUMUM OFF TIME parameter value may be set from 10 to 90 minutes in one-minute intervals. The factory default setting is 20 minutes. The RESTART TEMPERATURE value may be set from 0.5 to 18°F (0.28 to 10°C) in 0.5° increments. The factory default is 3.6°F (2°C).

If this is the only reason operation is required, the unit will operate as if it is in Continuous Operation until the requirement has been met.

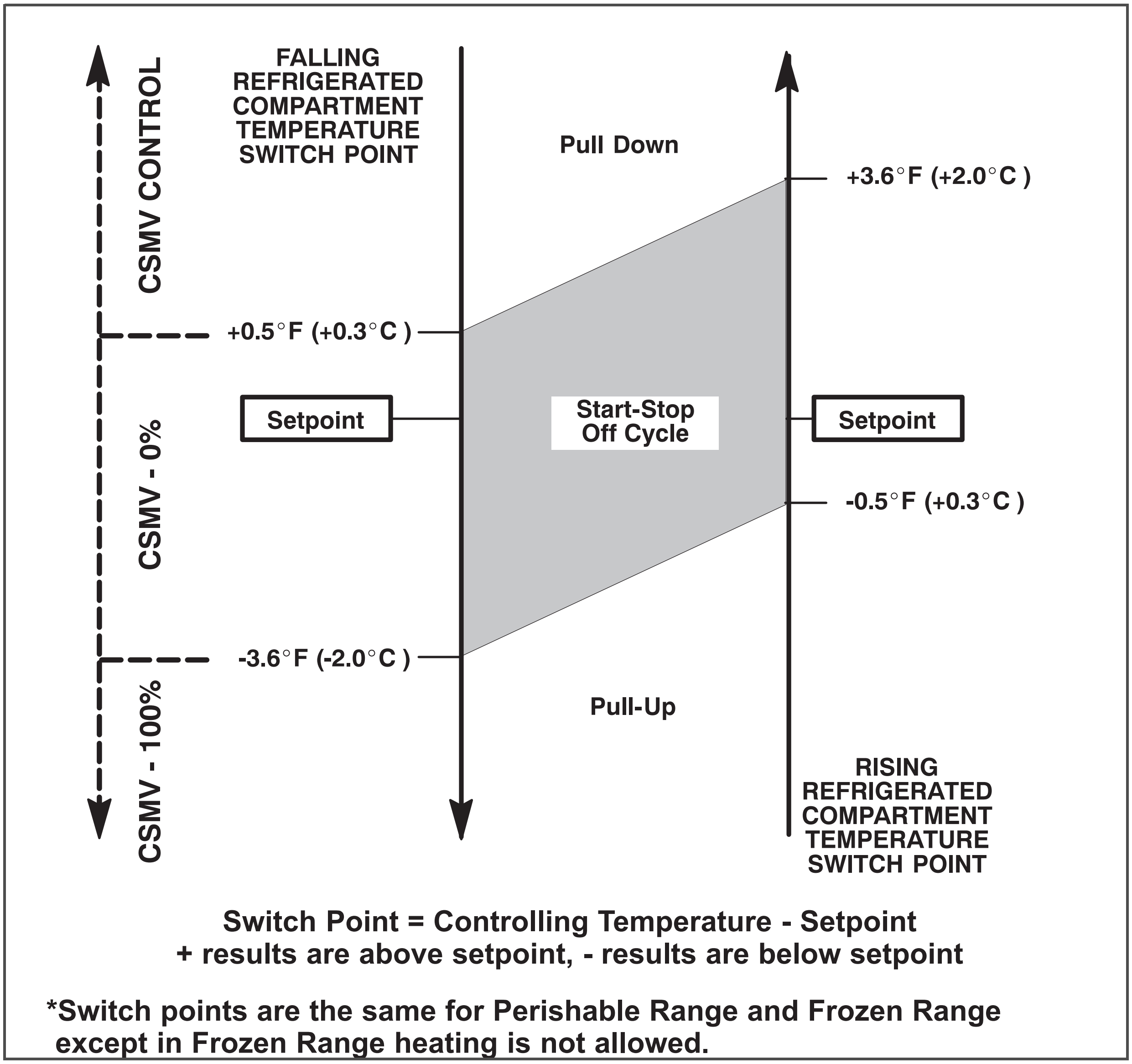
5. Compartment temperature has exceeded the Override Functional Parameter value

During MINIMUM OFF TIME the control system continually monitors the refrigerated compartment temperature and the override functional parameter value. During the Minimum Off Time, if the refrigerated compartment temperature drifts this far above or below setpoint in Perishable Range, or above setpoint in Frozen Range, the unit will override the Minimum Off Time, and restart. The value may be set from 0.5 to 18°F (0.28 to 10°C) in 0.5° increments. The factory default setting is 5.5°F (3°C).

Whenever the unit restarts, temperature control will be in the Pulldown or Pull-Up mode (refer to **Section 4.4.1**).

4.6.4 Start-Stop Operating Sequence

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



4.7 Continuous Operation

In Continuous Operation, the unit will only shutdown in response to a shutdown alarm. Temperature control in the compartment will operate under Pulldown, Pull-Up, Cooling, Heating and Ultra Fresh.

Continuous Operation is normally used for fresh produce and other sensitive product loads. The Start-Stop/ Continuous key is pressed to switch between Continuous Operation and Start-Stop Operation. The mode of operation will be indicated in the status bar.

NOTE

> The control system may be locked so that the unit will always operate in Start-Stop or in Continuous whenever the setpoint is within a specific range. Refer to Range Lock (**Section 4.10.2**) for additional information.

In Continuous Operation, Pulldown or Pull-up will continue until the proper temperature has been reached. The temperature calculation determines the average temperature using the formula:

(SAT -RAT) / 2 = Calculated Average Temperature

When the Control Temperature is within the calculated average temperature of set point, Pulldown or Pull-up ends. Once Pulldown or Pull-up ends the system will operate in accordance with **Table 4–2** and **Figure 4.2**.

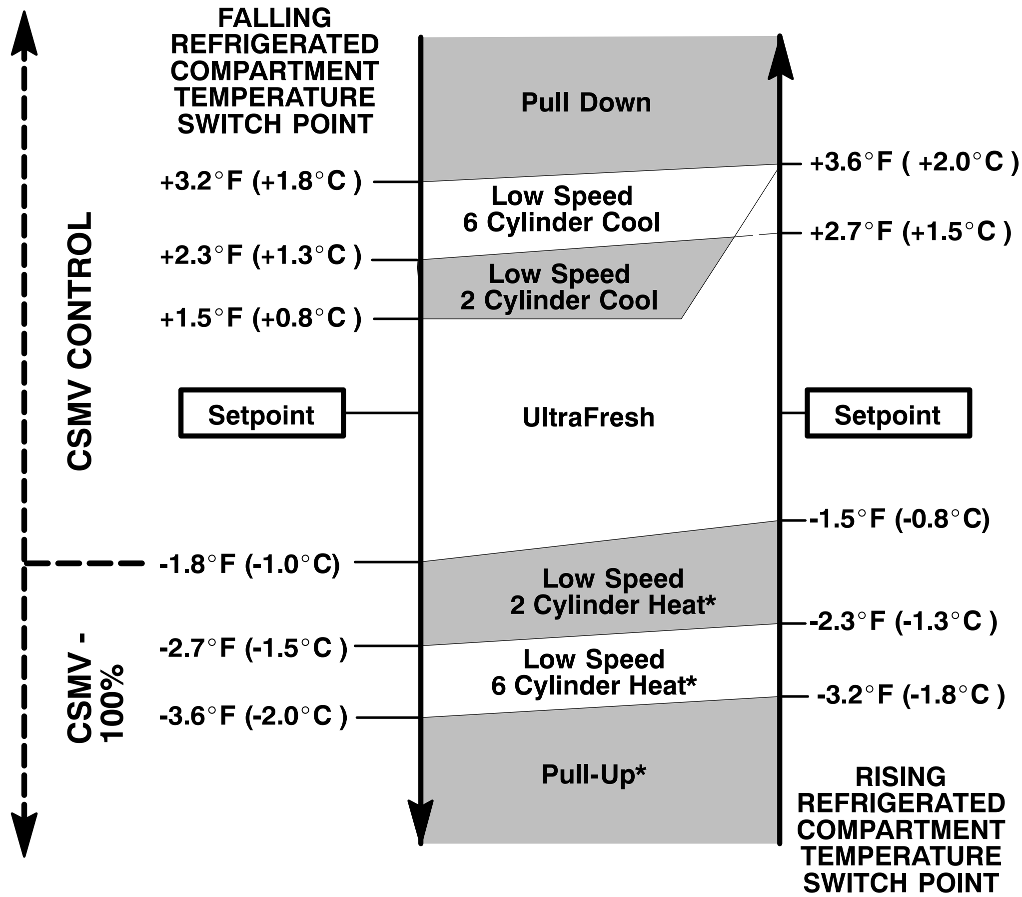
The operating sequence for Continuous Operation under the default Configuration and Functional Parameter settings is provided in Figure 4.2.

Table 4–2 Continuous Operation Modes

SETPOINT	ALLOWED OPERATION
32°F (0.0°C) and above	UltraFresh with FreshProtect (if Configured*)
Below 32°F (0.0°C) and Above 10.4°F (-12°C)	UltraFresh (FreshProtect Not Applicable)
Less than 10.4°F (-12°C)	Cooling (only) with UltraFreeze

* Refer to Section 4.10.1 for information on FreshProtect.

Figure 4.2 Continuous Default Operating Sequence



Switch Point = Controlling Temperature - Setpoint
+ results are above setpoint, - results are below setpoint

***Switch points are the same for Perishable Range and Frozen Range except in Frozen Range heating is not allowed.**

4.8 AutoFresh Air Exchange

AutoFresh Air Exchange is a factory installed option that allows control of the atmospheric conditions within the refrigerated compartment. When air is being exchanged, two air ports open. The upper port allows fresh ambient air to enter while stale air exits through the lower port. Exchange is available with setpoints above 28°F (-2.2°C). It is always closed when in defrost or in a Start-Stop OFF cycle regardless of Configuration or Functional Parameter settings.

Operation is dependent on two Configurations and one or two Functional Parameters. When AutoFresh Air is installed at the factory, the AUTO FRESH AIR Configuration is set to INSTALLED. The control point at which it becomes active is set in the Configurations. The AUTO FRESH AIR DELAY Configuration may be set to SETPOINT or a time value of 0 to 48 hours. If set to SETPOINT, control will begin when the temperature is 1.5°F (0.8°C) away from setpoint. If a time value is entered, it will become active after the time has expired and the system is no longer in Pulldown or Pull-up even if the control temperature has not reached 1.5°F (0.8°C) away from setpoint.

The first parameter is the AUTOFRESH AIR Functional Parameter. It may be set to CLOSED, OPEN or CFM CONTROL. When set to CLOSED, AutoFresh Air is not operational. When set to OPEN, the ports will always be open with setpoints above 28°F (-2.2°C).

When set to CFM CONTROL the AUTOFRESH AIR CONTROL Functional Parameter becomes available. The Parameter may be set form 5 to 50 CFM in 5 CFM increments. Under CFM CONTROL, AutoFresh Air will operate on a 20 minute cycle. During the cycle the ports will open until the required CFM has been exchanged and then close for the remainder of the cycle.

4.9 Defrost

Defrost is an independent cycle overriding cooling and heating functions in order to de-ice the evaporator. When the unit enters defrost the MessageCenter will display DEFROST CYCLE STARTED for the first 10 seconds and then display the default message for the remainder of the cycle. DEFROST is displayed in the Operator Message Panel, along with the setpoint while the unit is in Defrost. Defrost is allowed when the DTT is less than 40.0°F (4.4°C) or the SAT is less than 45.0°F (7.2°C), unless the alarms for both DTT and SAT are activated, then defrost can be initiated when the RAT is less than 45.0°F (7.2°C).

4.9.1 Defrost Initiation And Start

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

4.9.1.1 Defrost based on coil condition

Defrost based on coil condition will be initiated when blockage is sufficient to cause an air pressure differential across the coil great enough to close the contacts of the defrost air switch (DAS).

TIP

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

4.9.1.2 Defrost based on time

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

NOTE

The defrost timer will not count when the unit is in defrost, a Start/Stop off cycle, or the DTT is greater than 40.0°F (4.4°C).

NOTE

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

4.9.2 Normal Defrost Operation, Ambient Air Temperature less than 80°F (26.7°C)

SV1	SV2 (when applicable)	SV4	Engine Speed
Note 3	Note 1	Open	High
Clutch Output	**UL1 and UL2**		**CSMV**
Disengage	Note 2	Load	100% Open

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

NOTE

When in defrost, the unit will operate the same as in heat with the clutch disengaged.

4.9.3 Normal Defrost Termination

Defrost terminates when the defrost termination temperature (DTT) and supply air temperature (SAT) **both** rise higher than 55°F (12.8°C).

4.9.3.1 Normal Defrost Termination Sequence

The following sequence will be used to perform a Normal Defrost Termination:

1. The control system will place the engine in low speed and open SV1 and SV2 (if equipped).
2. The control system will return the CSMV to the same % it was prior to the initiation of defrost.
3. After a three second delay, SV4 will be closed.
4. After a few seconds the Clutch will be engaged. There will be a short delay before the engine can return to High Speed.
5. At this point, the control system will return to normal temperature control and the data recorder will record a Defrost Termination Event.

4.9.4 High Ambient Defrost Operation

High ambient defrost is used if the ambient air temperature is greater than 80°F (26.7°C). The high ambient defrost cycle consists of the following:

4.9.4.1 Pump Down

The system 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. The controls will be as follows:

<table>
<tr><th>SV1</th><th>SV2 (when applicable)</th><th>SV4</th><th>Engine Speed</th></tr>
<tr><td>Open</td><td>Close</td><td>Close</td><td>Low</td></tr>
<tr><th>Clutch Output</th><th colspan="2">UL1 and UL2</th><th>CSMV</th></tr>
<tr><td>Engage</td><td colspan="2">Unload</td><td>100% Open</td></tr>
</table>

The unit will remain in pump down until the following conditions are met:

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

4.9.4.2 High Ambient Defrost

Following pump down, the defrost cycle will begin. The controls will be as follows:

<table>
<tr><th>SV1</th><th>SV2 (when applicable)</th><th>SV4</th><th>Engine Speed</th></tr>
<tr><td>Note 3</td><td>Note 1</td><td>Open</td><td>High</td></tr>
<tr><th>Clutch Output</th><th colspan="2">UL1 and UL2</th><th>CSMV</th></tr>
<tr><td>Disengage</td><td>Note 2</td><td>Load</td><td>100% Open</td></tr>
</table>

NOTE

When in defrost, the unit will operate the same as in heat with the clutch disengaged.

4.9.5 High Ambient Defrost Termination

The following sequence will be used for high ambient defrost termination:

1. The unit will remain in High Speed and the CSMV will reset to the position it was in at the start of defrost.
2. The control system will open SV1, open SV2 (if equipped) and unload UL1.
3. When suction pressure has risen 10 PSIG (0.7 bar) above start point or after 15 seconds, the control system will place the unit in low speed, close SV4 and unload UL2.
4. After five seconds, the clutch will be engaged.
5. After an additional five seconds, the control system will return to normal temperature control and the data recorder will record a Defrost Termination Event.

4.10 User Selected Override Operation

Four optional software override programs are available to the user. These programs include: Temperature Range Lock, ProductShield, FreshProtect and Air Flow. Information on how the unit operates under these programs is provided in the following sub-paragraphs.

4.10.1 FreshProtect^{TM} Supply Air Control

FreshProtect operates when:

- The FRESHPROTECT Functional Parameter is not OFF **and**
- The setpoint is above 32°F (0°C) **and**
- The TEMPERATURE CONTROL Functional Parameter is set for Return Air **and**
- The unit is in Continuous Operation with the return air temperature less than 10°F (5.6°C) above setpoint or the unit is in Start–Stop Operation, return air temperature is within 5°F (2.8°C) of setpoint and criteria for shutdown other than compartment temperature has not been met.

The FRESHPROTECT Functional Parameter may be set to:

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

FreshProtect places a flexible limit on how far below setpoint the supply air temperature can drop while the unit is running under the above listed conditions.

4.10.2 Temperature Range Lock 1 and 2

Range Lock is a group of configurations which may be set to lock the unit into Start-Stop or Continuous Operation for various setpoint ranges.

Two ranges are available for selection. Each range can be independently set to lock setpoint temperatures into either Start-Stop or Continuous operation.

Each Range has a selectable minimum and maximum temperature, 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.

Figure 4.3 Range Lock Settings - Non Overlapping

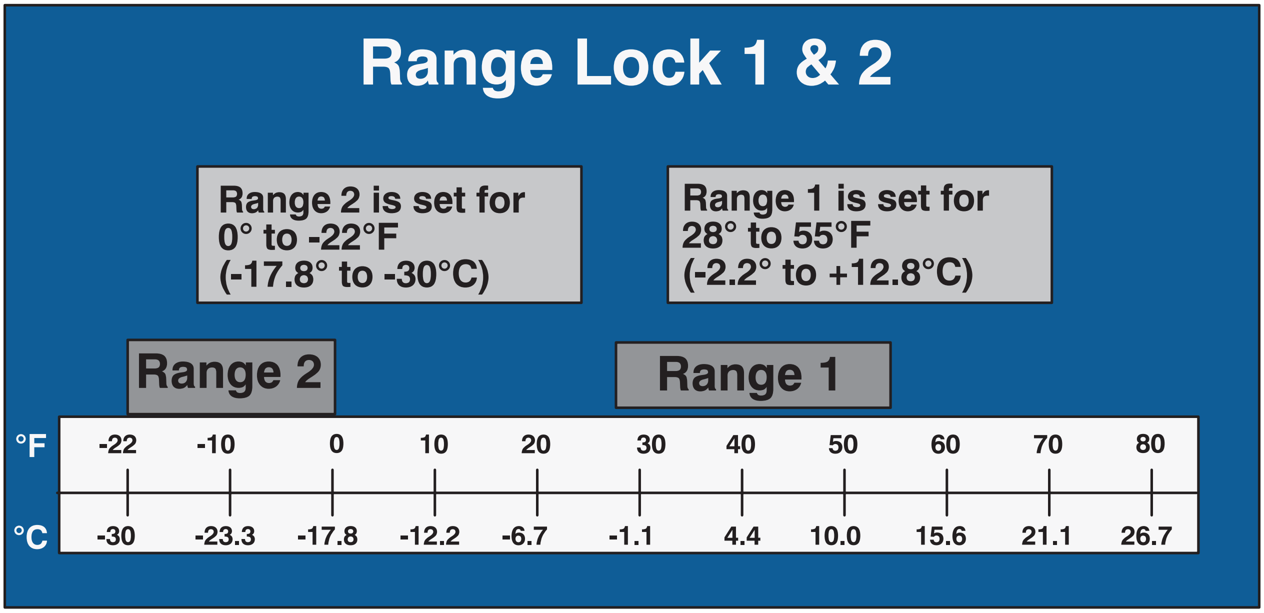
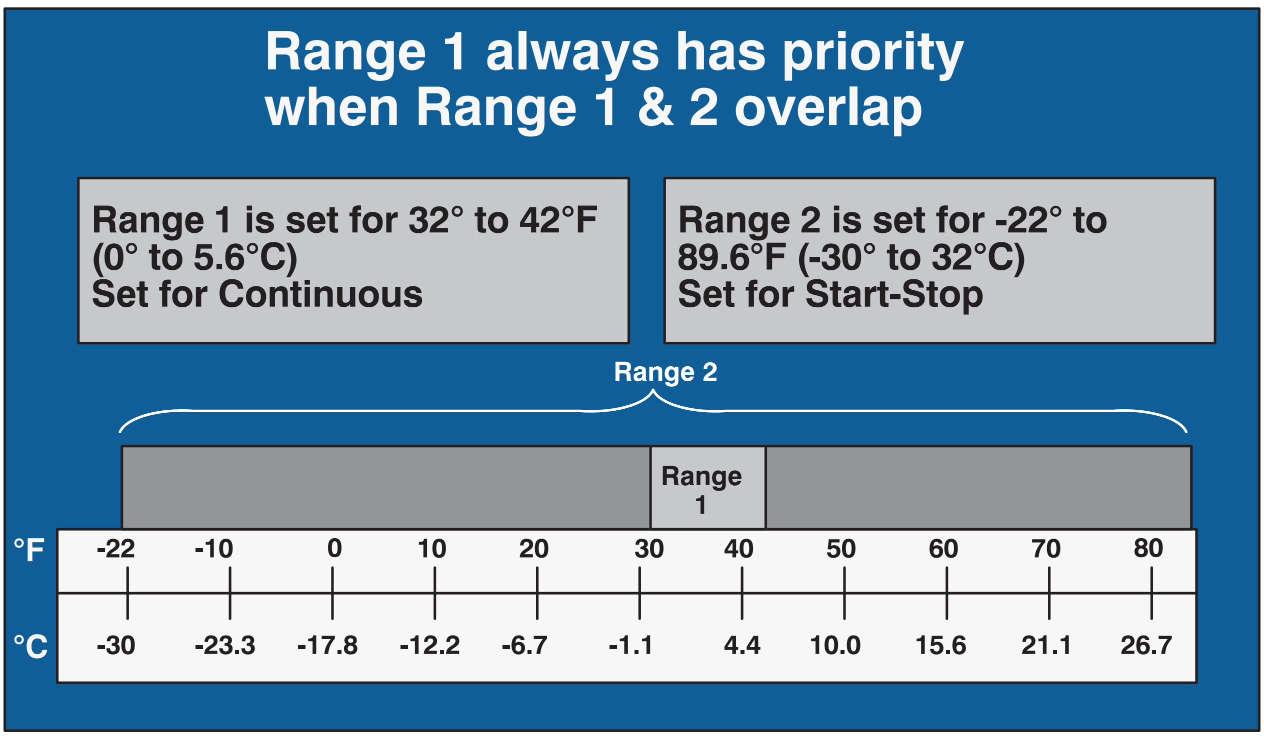


Figure 4.4 Range Lock Settings - Overlapping



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

For example (see Figure 4.3), if Continuous Operation is ALWAYS required whenever the setpoint is between 28°F and 55°F (-2.2°C and +12.8°C), Range 1 will be set for Continuous, with a Minimum Temperature of 28°F (-2.2°C) and a Maximum Temperature of 55°F (-12.8°C). Should Continuous Operation ALWAYS also be required with setpoints between -22 and 0°F (-30 and -17.8°C), then Range 2 will be set for Continuous, with a Minimum Temperature of -22°F (-30°C) and a Maximum Temperature of 0°F (-17.8°C). Any setpoint outside of Range 1 or 2 will allow changes between Start-Stop and Continuous.

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

4.10.3 ProductShield

ProductShield is a group of Configurations that work together to allow improved operating efficiency while providing customized product protection.

Each ProductShield setting allows the user to select an ambient temperature range in which to operate. The Minimum and Maximum range values can be set to OFF, or the allowed value range.

4.10.3.1 ProductShield: Econo

ProductShield Econo allows the APX Control System to automatically switch between Start/Stop Operation and Continuous Operation. This allows maximum product protection while providing power savings when ambient temperature is in the preset range. While running in ProductShield Econo the FRESHROTECT Functional Parameter settings will be effective.

ProductShield Econo - Go to Start-Stop Operation.

When the unit is set to Continuous Operation, ProductShield Econo allows the unit to run in Start/Stop Operation when:

- The ProductShield Econo Configuration is set to GO TO S/S **AND**
- The unit has run in Continuous Operation for a minimum of either 15 minutes, or the Minimum Run Time Functional Parameter setting (whichever time is longer) **AND**
- The ambient temperature falls **within** the pre-programmed temperature range **AND**
- The unit is not already running in ProductShield Winter.

The operator can also pre-program a maximum evaporator coil temperature differential (delta-t) between the return air and supply air temperatures as an additional criteria for switching to Start/Stop Operation. The unit must bring the delta-t below this setting before going to Start/Stop Operation if this option is chosen.

NOTE

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

Once the control system detects that the above criteria have been met, the unit will switch from Continuous Operation to a Start/Stop Off Cycle for the MINIMUM OFF TIME Functional Parameter setting. During the Minimum Off Time, the RESTART OVERRIDE TEMPERATURE Functional Parameter setting can cause the unit to restart to protect the load. After the Minimum Off Time has expired the unit will return to Continuous Operation when the return air temperature is more than ±3.6° F (± 2° C) away from setpoint in the perishable range, or +3.6°F (+2°C) above setpoint in the frozen range.

When the unit restarts, it will return to Continuous Operation for a minimum of 15 minutes or the MINIMUM RUN TIME Functional Parameter setting, whichever time is longer. The original activation conditions must then be met in order for the unit to return to ProductShield Econo: Start/Stop.

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

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

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

ProductShield Econo: Go To Start/Stop Examples:

The following examples apply in situations where all other Start/Stop conditions have been met.

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

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

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

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

ProductShield Econo - Go to Continuous Operation.

When the unit is set for Start/Stop, ProductShield Econo allows the unit to run in Continuous Operation when:

- ProductShield Econo configuration is set to GO TO CONTINUOUS **AND**
- The unit has run in Start/Stop Operation for a minimum of 15 minutes OR the MINIMUM RUN TIME Functional Parameter setting (whichever time is longer) **AND**
- The ambient temperature falls outside the pre-programmed temperature range **AND**
- The unit is not already running in ProductShield Winter.

Once the control system detects that the above criteria have been met, the unit will switch from Start/Stop to Continuous Operation for a minimum of 30 minutes. After 30 minutes the unit will return to Start/Stop if the ambient temperature enters the pre-programmed temperature range. While the unit is running, the FRESHPROTECT Functional Parameter settings will be effective.

NOTE

Delta-t logic is not used or available when ProductShield Econo - Go To Continuous is active.

ProductShield Econo: Go To Continuous Examples

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

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

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

Example 4: If both the Minimum and Maximum are set to OFF, ProductShield Econo: Go To Continuous can not operate as there is no range for the ambient to fall outside of.

4.10.3.2 ProductShield: High Air

ProductShield High Air allows the control system to automatically switch the engine from low speed to high speed, and thereby provide high evaporator air flow. This allows maximum product protection when certain conditions are met while providing for power savings when High Air is not required.

Operation in High Air is controlled by four Configurations; PRODUCTSHIELD HIGH AIR, HIGH AIR MINIMUM TEMPERATURE, HIGH AIR MAXIMUM TEMPERATURE and HIGH AIR DELTA-T.

- The PRODUCT SHIELD HIGH AIR Configuration may be set to OFF or ON. ProductShield High Air is only active when the Configuration is set to ON.
- The High Air ambient air temperature range is defined by the HIGH AIR MAXIMUM TEMPERATURE Configuration setting and the HIGH AIR MINIMUM TEMPERATURE Configuration setting. When a value is entered for both of these configurations, the unit will enter High Air when ambient temperature is above the high setting or below the low setting.

- When the HIGH AIR MAXIMUM TEMPERATURE Configuration is set for a value and High Air Minimum Temperature Configuration is set to OFF, the engine will switch to high speed when the ambient temperature is above the setting.
- When the HIGH AIR MINIMUM TEMPERATURE Configuration is set for a value and High Air Maximum Temperature Configuration is set to OFF, the engine will switch to high speed when the ambient temperature is below the setting.
- When both the HIGH AIR MINIMUM TEMPERATURE Configuration and the HIGH AIR MAXIMUM TEMPERATURE Configuration are set to OFF, ProductShield High Air is not active.
- If a value is entered in the HIGH AIR DELTA-T Configuration, delta-t must be above the value before the engine will switch to High Speed.

Once the APX Control System determines that the criteria have been met, the unit will switch to High Air. The unit will continue to operate in High Air for a minimum of 30 minutes. After 30 minutes the unit will return to normal operation if ambient temperature falls inside the pre-programmed temperature range by ±3.6°F (±2°C).

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

4.10.3.3 ProductShield: Winter

When the unit is set for Start/Stop operation, ProductShield Winter allows it to switch to Continuous Operation when the ambient temperature falls below the pre-programmed temperature. This helps protect the unit from the possibility of cold weather issues.

Once the control system detects that the ambient temperature has dropped below the pre-programmed temperature, the unit will switch into ProductShield Winter which will force the unit to operate in Continuous Operation.

The unit will continue to operate in Continuous Operation for a minimum of 30 minutes. After 30 minutes, the unit will return to auto Start/Stop if the ambient temperature has risen above the pre-programmed ProductShield Winter temperature.

4.10.3.4 ProductShield Fresh:

- When the unit is operating with the FreshProtect Functional Parameter active, the ProductShield Fresh Configuration may be used to override the FreshProtect setting when the unit is operating under high ambient conditions.
- Operation in ProductShield Fresh is controlled by three Configurations; PRODUCTSHIELD FRESH, PRODUCTSHIELD FRESH TEMPERATURE and PRODUCTSHIELD FRESH PROTECT.
- The PRODUCTSHIELD FRESH Configuration may be set to OFF or ON. With the Configuration set to ON, the override is allowed.
- The PRODUCT SHIELD FRESH TEMP Configuration may be set from 70 to 90°F (21 to 48°C). Override will be allowed when ambient temperature is above the setting. The unit will return to the FreshProtect setting when ambient falls to 3.6°F (2°C) below the setting.
- The PRODUCT SHIELD FRESH PROTECT setting establishes the overriding limit on how far below setpoint the supply air temperature can drop. The settings displayed for selection will depend on the FreshProtect Functional Parameter setting for this application. Only the values that allow less temperature drop will be available for selection. For example, if the FreshProtect Functional Parameter is set to C, then the ProductShield FreshProtect overrides displayed for selection will be A and B.

NOTE

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

4.10.4 Air Flow

The AIR FLOW Functional Parameter may be set to place the unit in continuous high air flow when the setpoint is in perishable range. The Parameter may be set to NORMAL or HIGH. The factory default setting is NORMAL.

Some products generate a considerable amount of heat (due to 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, unless a low speed override (refer to **Section 4.11.2**) is active.

4.11 Preprogrammed Software Overrides

4.11.1 Cargo Protect Mode

The control system will activate Cargo Protect mode when alarms **00122 Check Return Air Sensor (RAT)** and **00123 Check Air Supply Sensor** activate at the same time.

- If the setpoint is in the perishable range (refer to **Section 4.5.2**), the unit will shutdown.
- If the setpoint is in the Frozen Range the engine will go to low speed.

The MessageCenter will display “WARNING: NO TEMPERATURE CONTROL” when the unit is operating in Cargo Protect mode.

4.11.2 Engine Speed Overrides

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

Speed Control Overrides in priority order are:

1. High Ambient

If ambient temperature is 120°F (48.9°C) or above during the engine starting sequence, the unit will run in low speed for the first two minutes of operation. This applies to Heat and Cool modes only - not Defrost.

2. Low Suction/High Discharge Pressure

If UL1 has unloaded and the suction pressure is less than 3 PSIG (0.2 bar) for at least 20 seconds or the discharge pressure is greater than the calculated maximum for more than five seconds, the engine will be forced to run in low speed for a minimum of five minutes. After five minutes, the engine can return to high speed if suction pressure is greater than 3 PSIG (0.2 bar) for 30 seconds or discharge pressure is less than the calculated maximum for 30 seconds.

3. Engine Coolant Warm-Up

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

4. Defrost.

The engine is generally in high speed but will run in low speed during the high ambient pump down and at the end of the defrost cycle while the refrigerant control solenoids are realigned.

5. Door/Remote Switch Configuration

If the DOOR/REMOTE SWITCH Configuration is set for low speed, the engine will run in low speed when the door/remote switch is open/active.

6. RAT and SAT Alarms

When alarms **00122 Check Return Air Sensor (RAT)** and **00123 Check Air Supply Sensor** are both active at the same time the control system will enter Cargo Protect Mode. Refer to **Section 4.11.1**.

7. Frozen Setpoint Override

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

8. Air Flow

When setpoint is in the perishable range and the AIR FLOW Functional Parameter is set to HIGH, the engine will operate in high speed.

9. Product Shield High Air

The engine is forced to high speed if the PRODUCT SHIELD HIGH AIR Configuration is active, refer to **Section 4.10.3**

10. High Speed Delay.

Whenever the engine starts, the unit will remain in low speed according to the Continuous or Start-Stop High Speed Delay Functional Parameter setting.

11. Start-Stop Frozen Range.

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

12. High Speed Delay

Whenever the engine is in low speed, transition to high speed will be delayed for the HIGH SPEED DELAY Configuration setting.

13. Range Protect

When the unit is operating in Range Protect and the compartment temperature is inside the protected range, while all other conditions to allow an off cycle are not met the engine will operate in low speed.

4.11.3 Unloader Control Overrides

This section lists the different factors that determine the operation (de-energizing / loading and energizing / unloading) of the unloaders in addition to the unloader control used in temperature control.

There is a minimum delay of 10 seconds between LOADING and UNLOADING cylinders under all operating conditions except when the engine is starting.

NOTE

In all of the following instances UL1 refers to the Front Unloader and UL2 refers to the Rear Unloader.

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

1. High Ambient

If ambient temperature is above 120°F (48.9°C) when the engine starts UL1 and UL2 will both be unloaded for the first 2 minutes of unit operation.

2. Discharge Pressure

If discharge pressure is greater than 414.7 PSIG (22.22 bar) UL1 and UL2 will unload.

3. Engine Power Unloading

If the actual engine RPM is less than the desired RPM, this is defined as engine RPM droop. When the system is running in heat or cool with the CSMV controlling maximum operating pressure (refer to **Section 4.11.4**) and the engine RPM droop is greater than 30 RPM, UL2 will unload for a minimum of two minutes. If, the system is operating in cool and, after 10 seconds in 4 cylinder operation, the engine RPM drop is still greater than 30 RPM, UL2 will unload for a minimum of two minutes.

4. Throttle Position Delay

If the unit is running in two or four cylinder operation due to engine power unloading, and the rack position sensor is greater than 90%, loading of cylinders will be delayed until the rack position is less than 90% or for a maximum of 80 seconds.

5. Low Suction Pressure/High Discharge Pressure

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

Therefore, if the engine is running in high speed 6-cylinder operation and one of the conditions listed above occurs, UL1 will be unloaded (6 to 4 cylinders) and the engine will remain in high speed. If the discharge pressure does not drop to less than 410 PSIG or suction pressure does not increase to above 5 PSIG, the engine will transition to low speed and the compressor will remain running on 4 cylinders. If the condition still does not change, UL2 will unload and the compressor will operate on 2 cylinders, still in low speed.

Once the engine transitions to low speed, or one or both of the unloaders unload due to these conditions the unit will remain in low speed, and the unloader(s) will remain unloaded for a minimum of 5 minutes.

6. Defrost

Refer to **Section 4.9**.

7. Cargo Protect Mode

Refer to **Section 4.11.1**.

8. Start/Stop Override

If the system is running in a Start/Stop run cycle, and the minimum run time has expired and the compartment temperature is not at setpoint, both unloaders will be loaded to increase unit capacity so that set point may be reached more quickly, and allow an Off Cycle.

9. Continuous Run Low Speed Null Mode

UL1 and UL2 will load and unload periodically as the APX Control System makes capacity adjustments to maintain compartment temperature when it is close to setpoint.

10. Range Protect

When the unit is operating in Range Protect IntelliSet and the box temperature is inside the protected range, and at least one other condition to allow an Off Cycle is not met (i.e. Battery Volts, Battery Charging Amps, Minimum Run Time, Engine Coolant Temperature) UL1 and UL2 will unload.

4.11.4 CSMV Control Overrides

1. Engine Rack (Throttle) Position Limit

The APX Control System monitors the engine throttle position reading provided by the ENCU rack position sensor (RPS). If the position is greater than or equal to the maximum position the CSMV will move toward the closed position as required to lower the engine load, and thereby, the rack position.

2. Engine RPM

When the engine throttle position has been more than 90% for three seconds the APX Control System will monitor actual engine RPM verses desired engine RPM (if the actual RPM is less than the desired RPM, this is defined as engine RPM droop.) If the droop is above 30 RPM, the CSMV will move toward the closed position as required to eliminate the droop by lowering the load on the engine.

3. Discharge Pressure Control

The APX Control System monitors discharge pressure. When the pressure is above the calculated maximum (absolute maximum is 435.3 PSIG = 29.62 bar), the CSMV will move toward the closed position as required to bring the pressure below 400.0 = 27.22 bar).

4. High Suction Pressure Control

The APX Control System monitors suction pressure. When the pressure is above the calculated maximum the CSMV will move toward the closed position as required to lower the pressure.

5. Low Suction Pressure Control

The APX Control System monitors suction pressure. When both UL1 and UL2 are unloaded and the pressure is below the calculated minimum the CSMV will move toward the open position as required to raise the pressure.

SECTION 5
Control System Interface

5.1 Interface Methods

There are four methods for interfacing with the APX Control System:

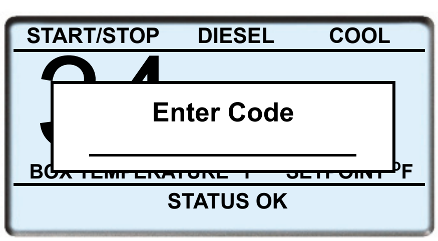
1. Driver/Advanced User Interface: Driver and Advanced User Interface activities such as start, stop, Pretrip, reading alarms, reading data and changing Functional Parameters may all be performed using the display mounted keys (refer to **Section 3**).
2. Technician Mode: Code based access. Technician mode includes: technician hour meters, inactive alarms, configuration settings, Component Test mode and Service mode.
3. USB memory device: Activities using the USB memory device include, PC mode, downloading data files, installing software, and transferring configuration files.
4. TRU-Tech/TRU-View: Access using a computer and service cable.

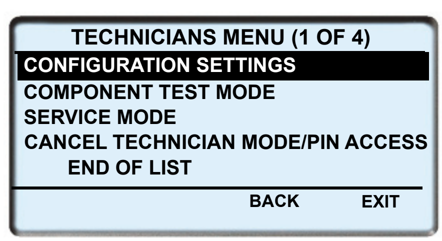
5.2 Technician Mode

Technician mode allows the technician to view inactive alarms, view additional hour meters, work with Configurations, test unit components and service the refrigeration system. Instructions for entering Technician mode are provided below.

Figure 5.1 Technician Mode

1. With the system powered up (START/RUN-OFF switch in the START/RUN position) or in PC mode press the MENU key until the TECH MODE soft key is displayed. If TECH MODE does not display, place the system in Advanced User mode (refer to **Section 3.13**).
2. Press the TECH MODE soft key. Enter the master technician PIN code. The factory installed master technician PIN code is 7435. Enter this code by pressing the 3 and 4 keys simultaneously, then pressing the 4 key, then the 3 key, then the 1 and 4 keys simultaneously. Once the code is entered, press the "=" key to enter the Technicians Menu.





3. Press the ▲ or ▼ key to scroll through the list of menu items. Press the “=” key to enter the settings or test modes.

NOTICE

Technician mode should be canceled when work is complete. If Technician mode is not canceled, Technician mode will be available for 60 minutes after the last key press without requiring a code, even after placing the SROS in the OFF and then back in the RUN/STOP position.

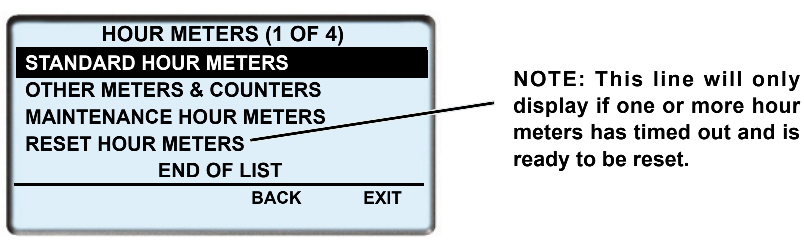
4. Once activity requiring use of Technician mode is complete, Technician mode should be manually canceled.
   - To cancel from the TECHNICIANS MENU screen, highlight CANCEL TECHNICIAN MODE/PIN ACCESS and then press the “=” key. This will return he system to the Advance User mode.
   - To cancel from any screen, press and then release the two outside soft keys simultaneously (NOTE: the system will not respond) and then press the “=” key. The system will return to Driver mode.

5.2.1 Technician Hour Meters

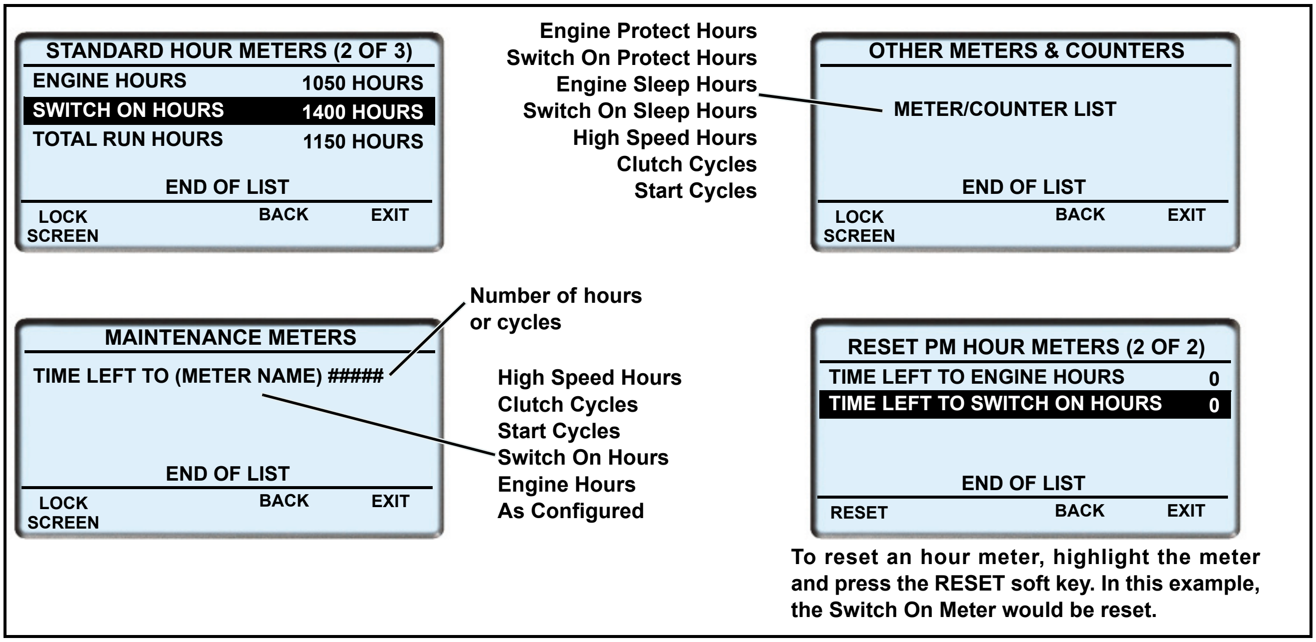
Hour meters, other than the standard hour meters, are available for viewing when the control system is in Technician mode. Instructions for viewing these hour meters are provided below.

Figure 5.2 Technician Hour Meters

1. Enter Technician mode. While in the TECHNICIANS MENU screen, press the BACK or EXIT key and then press the MENU key until HOUR METERS is displayed.
2. Press the HOUR METER soft key to display the hour meter screen.



3. The hour meter screen will display with a 15 second timeout. Press the ▲ or ▼ key to scroll through the available selections. With the desired sub-menu highlighted, Press the “=” key to view the data.



4. The number of meters displayed depends on the settings for this unit. Press the BACK key to return to the HOUR METERS screen or the EXIT key to return to the default screen. Once activity requiring use of Technician mode is complete, Technician mode should be manually canceled.

5.2.2 Inactive Alarms

There are two sections in the Alarm list: an active alarm section and an inactive alarm section. The APX Control System can hold up to 16 alarms in the combined lists. The lists can be read via the display screen or using TRU-Tech. Alarms in these sections are in the order in which the alarms activate and inactivate, respectively. On startup, all alarms are moved to the inactive list. If an inactive alarm becomes active, the alarm is moved from the inactive list to the active list.

Each alarm can only be present in either the active or inactive list at any given time. As conditions change, alarms may be moved from the active list to the inactive list and back.

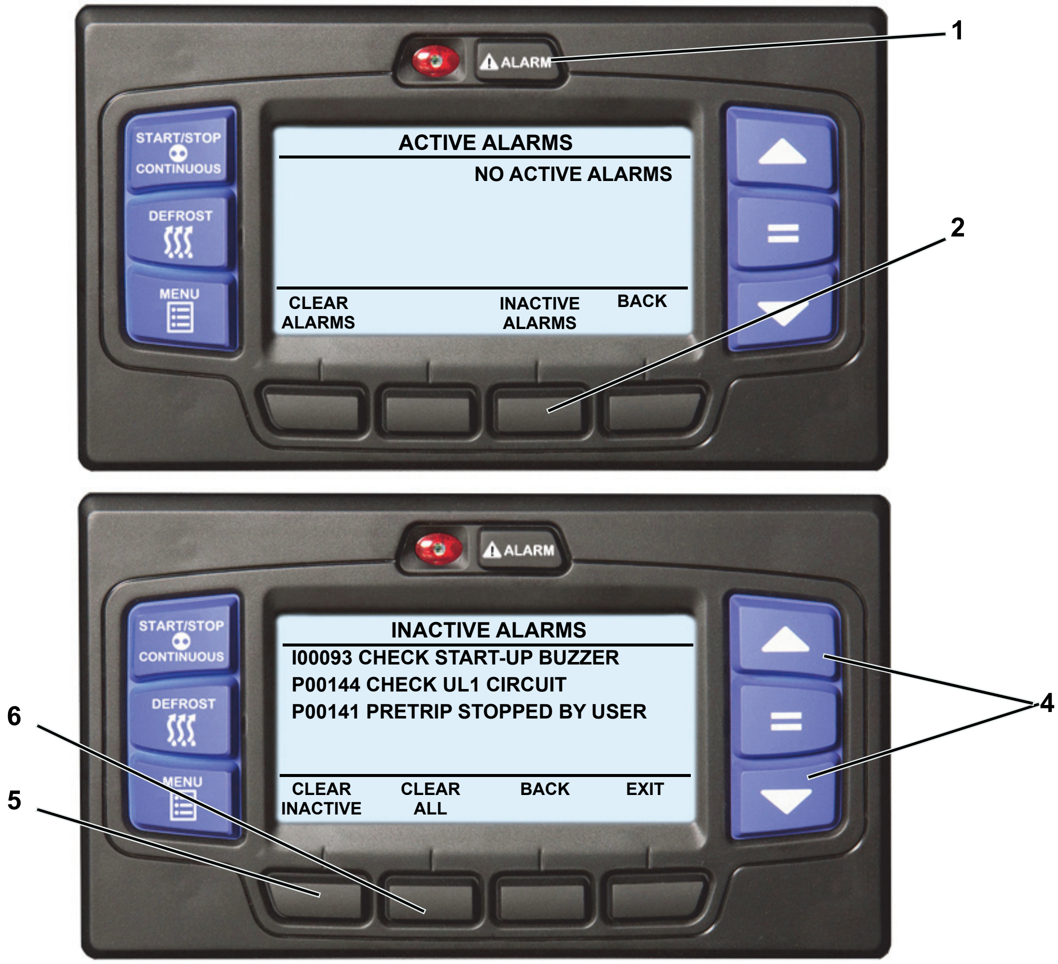
Alarms are also recorded in the DataLink data recorder. They are recorded at the time they become active, and the time they become inactive.

Instructions for reading and clearing the Inactive Alarms are provided in Figure 5.3. For a complete list of Alarms and troubleshooting information Refer to Section 9.

NOTE

The Inactive Alarm List is also called the Technician’s List. Only qualified refrigeration technicians should access the inactive list. It is not intended for the use of drivers or Advanced Users.

Figure 5.3 Inactive Alarms



1. Enter the Technician mode, then press the ALARM key.
2. Press the INACTIVE ALARMS soft key.
3. If there are inactive alarms, the alarm number will be displayed preceded by the letter “I” (inactive alarm) or “P” (inactive Pretrip alarm). The last alarm that occurred will be the first alarm displayed and so on.
4. Press the ▲ or ▼ key to scroll through the list of alarms.
5. To clear only the inactive alarms and leave the active alarms, press the CLEAR INACTIVE soft key. The display will provide an “INACTIVE ALARMS CLEARED” message to confirm the alarms have cleared.
6. To clear both the active and inactive alarms, press the CLEAR ALL soft key. The operators message panel will provide an “ALL ALARMS CLEARED” message to confirm the alarms have cleared.
7. If there are no inactive alarms, the operators message panel will provide a “NO INACTIVE ALARMS” message and return to the default display after five seconds.

NOTICE

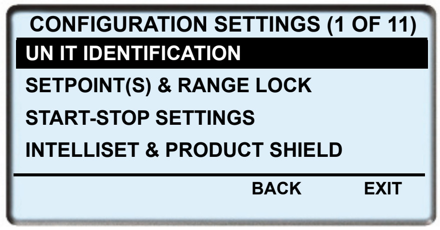
Technician mode should be canceled when work is complete. If Technician mode is not canceled, Technician mode will be available for 60 minutes after the last key press without requiring a code, even after placing the SROS in the OFF and then back in the RUN/STOP position.

8. Once activity requiring use of Technician mode is complete, Technician mode should be manually canceled.

5.2.3 Configuration Settings

Configuration settings match the control system to the unit and define control system action under various operational conditions. Instructions for working with Configurations are provided below.

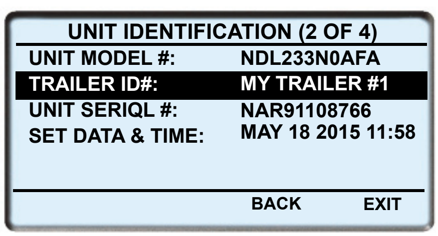
1. Enter the Technicians Menu, highlight CONFIGURATION SETTINGS and then press the “=” key.

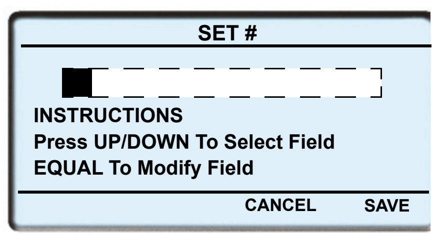


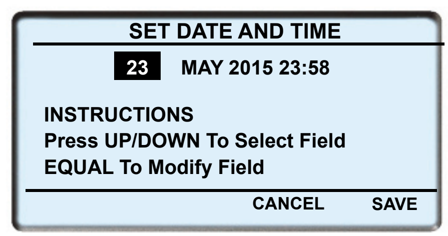
2. Eleven Configuration sub-menus will be available. To scroll through the Configuration sub-menu list, press the ▲ or ▼ key. The sub-menus will highlight as the list is scrolled. The available sub-menus are listed in Table 5–1.

3. With the desired sub-menu highlighted, press the “=” key. The individual Configurations within the sub-menu will display. There are two types of Configuration screens, data entry screens and value selection screens.

4. Data entry screens are displayed for the UNIT MODEL #, TRAILER ID #, UNIT SERIAL #, SET DATE & TIME and SET NEW HOURS (in a replacement main microprocessor) Configurations. To change a data entry screen press the “=” key with the configuration highlighted.







a. A data entry screen will be displayed with the entry points in a horizontal row of “fields”. The first selection “field” will be highlighted. Press the “=” key to enter the field then press the ▲ or ▼ key to scroll through the available selections.

   - When setting a number, the numbers 1 to 9 and the letters A to Z will be displayed.
   - When entering the date and time the day, month, year, hour or minute will be displayed. The system uses a 24 hour clock. Hours 00 to 11 are AM and hours 12 to 23 are PM.
   - With the desired selection in the field, press the “=” key to save the field entry.

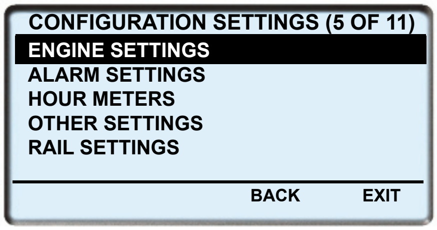
b. Press the ▲ or ▼ key to move to the next field or to the desired field. Press the “=” key to enter the field then press the ▲ or ▼ key to scroll through the available selections. With the desired selection in the field, press the “=” key to save the field entry.

c. Continue as above to enter additional field changes as required.

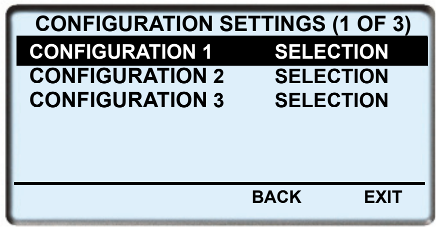
d. When all the fields are displayed as desired, press the SAVE soft key to save the setting into memory.

e. Continue as above to enter additional UNIT IDENTIFICATION changes as required.

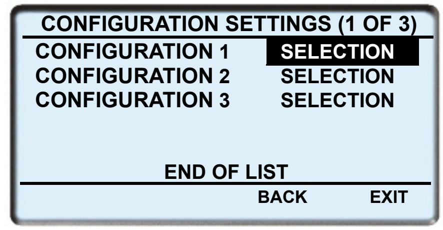
5. To change a value selection screen, press the “=” key with the desired Configuration sub-menu highlighted as in Sample Screen A. The individual Configurations within the sub-menu will display as in Sample Screen B. Press the ▲ or ▼ key to scroll through the individual Configurations. The individual Configurations will highlight as the list is scrolled.



Sample Screen A



Sample Screen B



Sample Screen C

a. With the desired individual Configuration highlighted, press the “=” key. The highlight will move to the present setting. As in Sample Screen C. Press the ▲ or ▼ key to scroll through the available settings. With the desired setting highlighted, press the “=” key to select. Refer to Table 5–1 for information on the settings in each sub-menu and resultant System actions.

b. Continue as above to enter additional sub-menus and set additional individual Configurations as required.

NOTICE

Technician mode should be canceled when work is complete. If Technician mode is not canceled, Technician mode will be available for 60 minutes after the last key press without requiring a code, even after placing the SROS in the OFF and then back in the RUN/STOP position.

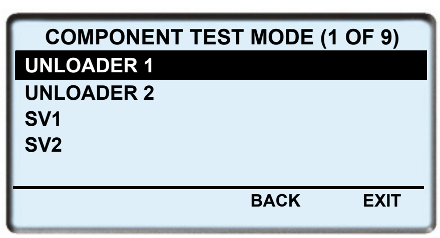
6. Once activity requiring use of Technician mode is complete, Technician mode should be manually canceled.

5.2.4 Component Test Mode

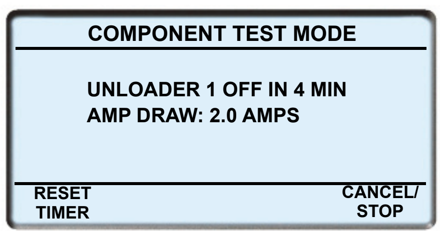
Component Test mode allows the technician to energize individual circuits for five minutes at a time. The engine is not allowed to start when the System is in Component Test mode. Instructions for entering the Component Test mode are provided below.

1. Enter the Technicians Menu, highlight COMPONENT TEST MODE and then press the “=” key.

Figure 5.4 Component Test Mode



2. To scroll through the tests press the ▲ or ▼ key. The tests will highlight as the list is scrolled. The available tests include:
   - UNLOADER 1 - MM output @ 3MM-6
   - UNLOADER 2 - MM output @ 3MM-8
   - SV1 - MM output @ 3MM-1
   - SV2 - MM output @ 3MM-2
   - SV4 - MM output @ 3MM-3
   - Clutch Relay - MM output @ 3MM-11
   - ENCU Power Circuit (Run Relay) - MM output @ 3MM- 9
   - Engine Preheat (Glow Plug Relay) - MM output @ 3MM- 14
   - Buzzer - MM ground @ 3MM- 15
   - EVXV - 0% to 100% and 100% to 0%
   - CSMV - 0% to 100% and 100% to 0%
3. With the desired test highlighted, press the “=” key. For example, if UNLOADER 1 is selected, the unloader will come on, and “UNLOADER 1 OFF IN 5 MINUTES” will display. The minutes will count down to 0 at which time the circuit will be de-energized, and the operator message panel will return to the test selection screen.



4. When a component is energized in Component Test mode, the AMP DRAW display initially shows the current draw of the system, after a few seconds the display will change to reflect the current draw of the system plus the added component. For example, if a component is energized in Component Test mode, the AMP DRAW display might initially show 0.75 Amps, then after a few seconds, the AMP DRAW display will change to 1.0 Amps. The difference between the two readings reflects the current draw of the component being tested; in this case the component is drawing 0.25 Amps.
5. To extend the test time, press the RESET TIMER soft key. The time will reset to 5 minutes. To stop the test press the CANCEL/STOP soft key.
6. Continue as above to test additional components as required.

NOTICE

Technician mode should be canceled when work is complete. If Technician mode is not canceled, Technician mode will be available for 60 minutes after the last key press without requiring a code, even after placing the SROS in the OFF and then back in the RUN/STOP position.

7. Once activity requiring use of Technician mode is complete, Technician mode should be manually canceled.

5.2.5 Service Mode

⚠ CAUTION

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

NOTE

If the START/RUN - OFF switch is toggled to the OFF position, the System will exit Service mode.

Enter Service Mode:

1. Enter the Technicians Menu, highlight SERVICE MODE and then press the "=" key.
2. "TRANSITION TO SERVICE MODE" and then "ENTERING SERVICE MODE" will display in the operator message panel. When entering Service mode the system brings the CSMV and EVXV to 100% open and energizes SV2 (if equipped) and UL1.
3. Once the CSMV and EVXV are 100% open, "RECOVER/ LEAK CHK / EVAC MODE" is displayed in the operator message panel.
4. Refrigerant recovery, leak checking, or evacuation may be performed on the unit at this time. Refer to Service **Section 8**.
5. The unit should remain in the RECOVER / LEAK CHK / EVAC MODE as refrigerant recovery or leak testing procedures are performed.
6. If the message in the operator message panel changes to "CHARGE MODE - HOLD = TO EXIT" do not continue refrigerant recovery, leak testing or evacuation procedures. Exit Service mode and then re-enter, ensuring that "RECOVER / LEAK CHK / EVAC MODE" is displayed in the operator message panel before continuing refrigerant recovery or leak testing.
7. During evacuation, the control system will monitor the pressure transducer readings.
8. The System will remain in "RECOVER / LEAKCHK / EVAC mode" as evacuation is started.
9. As the refrigeration system is evacuated, the system pressure will go into a deep vacuum. Once the CSP is less than 20 inhg and the CDP is less than+5 psig the operator message panel will change to "EVAC/ CHARGE MODE". The position of the CSMV, EVXV, SV2 (if equipped) and UL1 do not change in this mode.
10. Following the evacuation, as the charging procedures are started the control system will bring the CSMV and EVXV to 0% open and de-energize SV2 (if equipped) and UL1 when both of the transducers rise above +5 psig (0.34 bar).
11. When the CSMV and EVXV are closed, "CHARGE MODE – HOLD = TO EXIT" is displayed in the operator message panel. This action is taken to prevent refrigerant migration to the compressor during charging.
12. To exit Service mode at any time, press the EXIT soft key. "EXITING SERVICE MODE" will then display in the operator message panel. When Service mode is exited, the control system brings the CSMV and EVXV to 0% open and SV2 and UL–1 will be de-energized.

NOTICE

Technician mode should be canceled when work is complete. If Technician mode is not canceled, Technician mode will be available for 60 minutes after the last key press without requiring a code, even after placing the SROS in the OFF and then back in the RUN/STOP position.

13. Once activity requiring use of Technician mode is complete, Technician mode should be manually canceled.

5.3 USB Memory Devices

Instructions for using USB memory devices with the APX Control System are provided below.

5.3.1 Data Transfer USB Memory Device

Carrier Transicold APX USB Flash Drive, CTD P/N 12-00814-00 must be used:

- The device may be used to enter PC mode.
- Data files from the DataLink data recorder may be transferred from the APX Control System to the "DOWNLOAD' folder.
- Software files may be transferred to the "PROGRAM" folder and then transferred to the APX Control System.
- IntelliSet/Configuration files may be transferred to the "CONFIG" folder and then transferred to the APX Control System.

5.3.2 PC Mode

PC mode allows the technician to access the control system without the engine running. When in PC mode the System is fully functional, all operator interfaces may be performed and the operation of the system may be demonstrated, again, without the unit actually operating. Instruction for entering and using PC mode are provided below.

WARNING

Do not toggle the START/RUN - OFF switch out of the OFF position when in PC mode or the unit will start.

Figure 5.5 PC Mode

1. With the START/RUN - OFF switch in the OFF position, remove protective cover from the USB interface port and insert a data transfer USB. The USB activity LED will flash, the Carrier Transicold logo will display and then the MessageCenter will display one or more USB soft key descriptions.

NOTES:

a. A PC–USB service cable (Carrier Transicold P/N 22-04253–20) may be used.

b. If Configured to do so, the System will prompt for entry of the data protect PIN code (refer to "PROTECT DATA WITH PIN", **Table 5–1**).

2. Press the "PC MODE' soft key. DO NOT remove USB or cable at this time.
3. The MessageCenter will display "PC MODE". The System is now in PC mode. The purpose of PC mode is to allow demonstration of the System features and allow changes to the System while the engine is not actually running. It is important to note that any changes saved to memory while in PC mode will remain after leaving PC mode.

NOTICE

Technician mode should be canceled when work is complete. If Technician mode is not canceled, Technician mode will be available for 60 minutes after the last key press without requiring a code, even after placing the SROS in the OFF and then back in the RUN/STOP position.

4. If Technician mode is entered while in PC mode, once Technician mode activity is complete, re-enter the Technicians Menu, highlight "CANCEL TECHNICIAN MODE/PIN ACCESS" and then press the "=" key to take the system out of Technician mode before taking the System out of PC mode.
5. When use of PC mode is completed, remove the USB or cable. "SHUTTING DOWN - PLEASE WAIT" may be displayed or after a few seconds, the display will go blank. Replace the cover on the USB port.

5.3.3 Downloading Data Files

Instructions for downloading data from the DataLink data recorder to a data transfer USB memory device are provided below.

Figure 5.6 Downloading Data Files

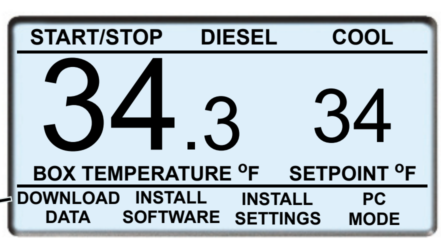
1. Data may be downloaded with the system powered up or turned off. Remove protective cover from the USB interface port and insert the Carrier Transicold APX USB Flash Drive, CTD P/N 12-00814-00. The MessageCenter will display READING USB.

NOTE

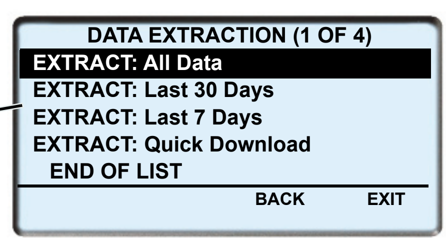
If configured to do so, the System will prompt for entry of the data protect PIN code (refer to "PROTECT DATA WITH PIN", Table 5–1).

2. The Message Center will then display the USB soft keys. (The INSTALL SOFTWARE and INSTALL SETTINGS soft keys will not display if the applicable files are not loaded on the data transfer USB device.)

2



3



3. Press the DOWNLOAD DATA soft key. Four extraction choices will be available as shown above. To scroll through the choices press the ▲ or ▼ key. The choices will highlight as the list is scrolled. With the desired choice highlighted, press the "=" key. The System will begin downloading data to the USB and the operator message panel will display COPYING DATA - PLEASE WAIT ##%. The percent downloaded will display as the data is copied and then the operator message panel will display COPY COMPLETE, PRESS ANY KEY. Press any key to return to the USB soft keys.

4. The MessageCenter will return to the USB soft key display and the USB may be removed.

5. The downloaded data will now be on the data transfer USB memory device in the “DOWNLOAD” folder. A folder will be created each day data is extracted to the USB. The folder naming convention will begin with the letters “DX” followed by the last two digits of the year, two digits representing the month and two digits representing the day. For example a folder named DX210120 would contain data extracted January 20, 2021.

6. Two files will be created inside the folder for each download. The file naming convention used is the last eight characters of the Trailer ID followed by .zdx for the first file and a secondary file with the same name followed by .zax.

NOTE

If the same unit (with the same asset, trailer or car ID) is downloaded twice or more on the same day, the earlier files will be overwritten. If the earlier files will be required for later review, ensure they are transferred off the device before starting another download.

5.3.4 Installing Software

Instructions for installing software into the control system from a data transfer USB memory device are provided below. If power is lost or USB removed this procedure should be repeated. The screen may be blank until the USB is reinserted.

TIP

Whenever installing new software, it is always a good idea to start the unit and give it a quick check over prior to performing the operation. All units should have the software upgraded to the latest version, provided for Carrier Transicold dealers on the TransCentral web site.

Figure 5.7 Installing Software

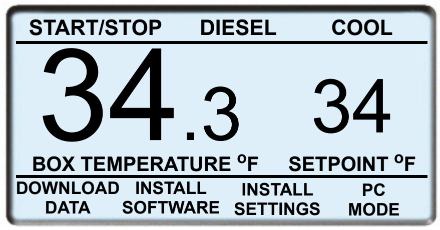
1. Ensure the desired software version folder is the only folder loaded in the “PROGRAM” folder on a data transfer USB memory device.

2. With the system powered or off, remove the protective cover from the USB port and insert USB. The MessageCenter will display READING USB.

NOTE

If configured to do so, the system will prompt for entry of the data protect PIN code (refer to "PROTECT DATA WITH PIN", **Table 5–1**).

3. In less than two minutes time, the MessageCenter will display the USB soft keys. (The INSTALL SETTINGS soft key will not display if files are not loaded in the CONFIG folder and DOWNLOAD DATA does not display if the DATAEXT folder is not present.)



4. Press the INSTALL SOFTWARE soft key. The System will enter the software install menu and display the software version presently in the System, and the software version on the USB.

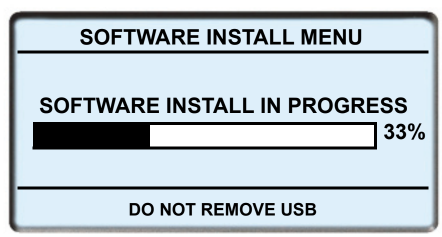
NOTE

Once a software version is installed, the same version cannot be installed but a newer or older version can be.

NOTE

Once a software version is installed the same version cannot be loaded, but a newer or older version can

5. Press the "=" key to start the installation. Press any other key to exit and return to the USB soft keys.



6. Once the "=" key is pressed, the operator message panel will display "UNIT AND MICRO WILL STOP NOW" and the unit will stop. The system will begin downloading software from the USB memory device and the operator message panel will display "SOFTWARE INSTALL IN PROGRESS". The percent downloaded will display as the software is copied and then the operator message panel will display "SOFTWARE INSTALL COMPLETE - MICRO WILL RESTART NOW - REMOVE USB.

7. After install is complete, reinstall the USB, press the INSTALL SOFTWARE soft key and then the "=" key to verify the software matches that on the USB.

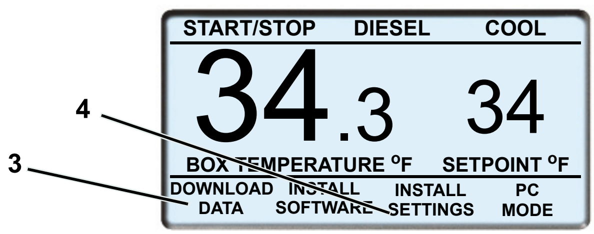
8. Remove the USB and reinstall USB the cover.

5.3.5 Transferring Configuration Files

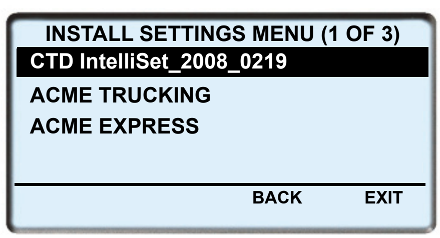
Instructions for installing configuration files into the control system from a data transfer USB memory device are provided in Figure 5.8. Configuration” (*.set) files consist of one of the following types of files. A “Configuration” file contains a complete set of Configuration, Functional Parameter and Data Recorder settings for the system. An “IntelliSet” file contains multiple Configurations which are programmed using easily recognizable names that can then be selected using the display mounted keys by the operator. A “Maintenance” file contains one or more individual settings. For example: Remote Sensor Yes/No, Fuel Level Sensor: Yes/No. etc. Unit specific and time sensitive data cannot be loaded to a configuration file. This data includes: model number, serial number, trailer ID hour meter readings, date and time. These configurations must be set using the display mounted keys or TRU-Tech and a service cable.

1. Ensure the desired setting file(s) are loaded to the “CONFIG” folder on a data transfer USB memory device.
2. With the System powered or off, remove protective cover from the USB interface port and insert the device. The MessageCenter will display READING USB. NOTE: If configured to do so, the System will prompt for entry of the data protect PIN code (refer to “PROTECT DATA WITH PIN”, Table 5–1).
3. The Message Center will then display the USB soft keys. (The INSTALL SOFTWARE soft key will not display if a file is not loaded In the PROGRAM folder.)
4. Press the INSTALL SETTINGS soft key. The System will enter the INSTALL SETTINGS menu.

Figure 5.8 Transferring Configuration Files

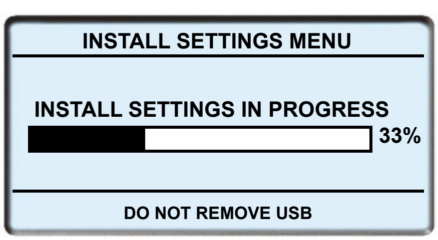


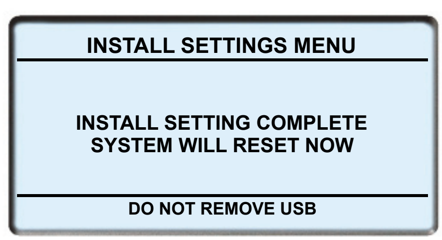
5. If one or more configuration file(s) are loaded on the data transfer USB memory device a listing of available files will be displayed. To scroll through the files press the ▲ or ▼ key. The files will highlight as the list is scrolled.



NOTE

Earlier software versions may have a display limit of 10 files. If the desired file is not displayed, reduce the USB CONFIG directory content to 10 files or less.





6. With the desired file highlighted, press the “=” key to start the installation. Press any other key to exit and return to the USB soft keys.
7. The unit will shutdown and the settings will be installed. If a single configuration is installed, the system will reset and the unit will restart. If IntelliSets are installed, following the system reset, the user will be prompted to select one of the new IntelliSets before the unit can be started. Reinstall USB cover.

5.4 TRU-Tech and TRU-View

The TRU-Tech and TRU-View program allows the user to access and download data, using a computer, when the unit is not running and without starting the eight-hour DataLink data recorder timer. Using the computer will provide additional programming and configuring capabilities that will not be available using the display mounted keys. The DataLink data recorder may also be configured using the TRU-Tech program.

For complete instructions on using TRU-Tech and TRU-View, refer to the manual supplied with the TRU-Tech/TRU-View software.

NOTE

For diagnoses of problems with the control system, DataLink data recorder downloading, file analysis using TRU-View or use of USB memory devices, refer to **Section 5.3**.

5.4.1 TRU-Tech

The TRU-Tech Program enables the user to do the following:

- Monitor in real-time via the USB interface port the current status of the control system inputs, outputs, refrigeration, electrical, engine and temperature sensors and alarms.
- Record sensor data to a file for diagnostic purposes.
- Display, edit and send unit model number, unit serial number and trailer ID to the main microprocessor.
- Display, edit and send Functional Parameters and Configuration settings to the System (including the DataLink data recorder) or to a data transfer USB memory device.
- Write hour meter values to a replacement main microprocessors (during the first 25 hours).
- Initiate Pretrip and Defrost operations.
- Support Download, Configuration and Program USB operations.
- Provide a security log on system controlled by a System Administrator.

5.4.2 TRU–View

The TRU-View Program enables the user to do the following:

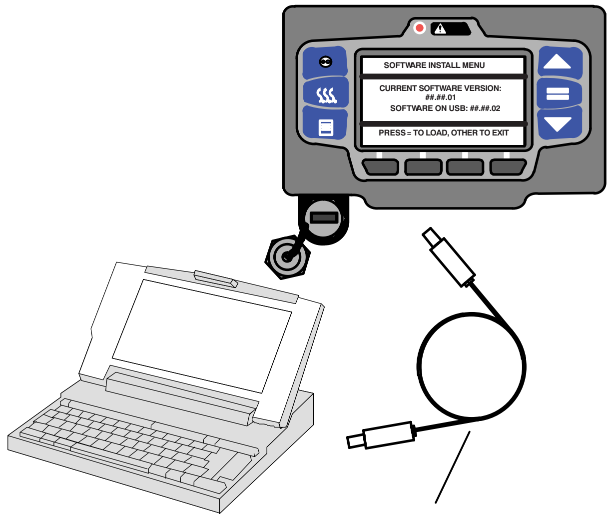
- Read download files from the System.
- Create various customized text reports that include setpoint, sensors, and events.
- Create various customized graphical reports.
- Print numerical, graphical, and event reports.
- View and print refrigeration system historical settings and changes.
- Filter download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

5.4.3 Connecting Computer and Control System

To connect the control system and computer:

1. Locate the USB interface port (**Figure 2.2**) and remove the protective cover to gain access.
2. Plug a PC–USB service cable into the port and a USB port on the computer (see **Figure 5.9**). If SROS is off, the System will power up, and display “PC MODE”. If Configured, the System will prompt for entry of the data protect PIN code (refer to “PROTECT DATA WITH PIN”, **Table 5–1**).
3. Start the TRU-Tech and TRU-View program by double clicking on the icon on your computer desktop and entering the required password. Verify that the correct COM port is selected in the PC Setup. For complete instructions on using TRU-Tech and TRU-View, refer to the manual supplied with the TRU-Tech/TRU-View software.
4. When work is complete, remove the interface cable and install the protective cover back onto the USB port. The control system will return to normal operation.

Figure 5.9 TRU-Tech/TRU-View Connection



PC–USB Service Cable. Carrier Transicold Part #: 22–04253–01 = 20 foot/6.1 meter long)

NOTE: Only this cable will communicate correctly. An "off the shelf" USB to USB cable will not provide the required communication.

5.5 Main Microprocessor Replacement

NOTICE

Under no circumstances should a technician electrically probe the modules at any point, other than the connector terminals where the harness attaches. Module 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 module.

Some main microprocessor inputs operate at voltage levels other than the conventional 12 VDC. These inputs include but are not limited to the pressure transducers and temperature sensors. Under no circumstances should 12 VDC be applied at these connection points.

NOTICE

Electronic modules MUST be handled with care to prevent accidental damage or degradation from electrical static discharge (ESD), contamination or abuse. Before touching a module, touch your body and/or conductive tool being used to the frame to discharge ESD safely. All electronics should be handled carefully and only held by edges of any exposed board. Care should be taken when inserting/extracting connectors and components to avoid exerting excessive stress on the board which could fracture small components nearby, resulting in future failure of the circuit.

When field diagnosis of a Carrier Transicold refrigeration unit determines that an APX main microprocessor is not performing properly and must be replaced, the replacement microprocessor must be setup for this unit and customer by entering the required Configurations, Functional Parameters and DataLink data recorder settings.

If the replacement microprocessor is not loaded with the most recent software, it should be updated. If software is loaded, it should be verified that it is the approved revision for this model.

When a module is replaced, software should be upgraded before switching the unit on. This will ensure software compatibility of all modules.

The preferred method for setup of the main microprocessor is to use the display mounted keys or a data transfer USB memory device. All required changes, except unit specific and time sensitive data, may be performed using the device.

If a USB is not available the main microprocessor may be setup using TRU-Tech. TRU-Tech allows entry of all required data. If neither a USB memory device or TRU-Tech and service cable is available, the main microprocessor may be setup for immediate use using the display mounted keys. Changes to the default DataLink data recorder settings may not be entered using the display mounted keys. If the main microprocessor is setup using the display mounted keys and this feature is needed, it may be loaded at a later date.

5.5.1 Pre-Replacement Steps

Before the unit can be started using the replacement main microprocessor certain unit specific and time sensitive data must be known.

TIP

Print this page and fill out the following for use when entering the data.

That information includes:

- Unit Serial Number ______________________
- Unit Model Number ______________________
- Engine Protect Hours ____________________
- Switch On Protect Hours__________________
- Engine Sleep Hours _____________________
- Switch On Sleep Hours___________________
- High Speed Hours_______________________
- Clutch Cycles __________________________
- Start Cycles____________________________
- Date and Time__________________________
- ID Number_____________________________

1. If possible, power the original system up by entering PC mode, or by placing the START/RUN - OFF switch in the START/RUN position.
2. Insert a data transfer USB memory device and download all data from the DataLink data recorder.
3. Scroll through the data list and hour meter readings and make note of the unit specific data listed above. If the original main microprocessor will not power up, gather the unit specific data from the model/serial number nameplate and estimate hour meter readings from the unit maintenance records. If a data transfer USB memory device will be used to setup the replacement main microprocessor, write the required data to the device. Also, if the current configuration file is available for this customer from the TransCentral web site, it should be transferred to the device prior to beginning work.

5.5.2 Main Microprocessor Replacement

1. Ensure the unit will not start automatically by placing the START/RUN–OFF switch in the OFF position and removing the negative battery cable.
2. Release the tabs on and remove the two 35 pin connectors and 8 pin connector from the front of the module.
3. Replace module. Tighten mounting hardware to 96 inch/lbs (10.8 Nm).
4. Reinstall connectors ensuring tabs are fully locked in place.

5.5.3 Main Microprocessor Setup

1. Ensure that the replacement main microprocessor is in place, all wires connected and the negative battery cable is reconnected.

2. Make sure the latest software has been loaded to ensure all modules are compatible, refer to Section 5.3.2

NOTICE

When a module is replaced, software should be upgraded before switching the unit on. This will ensure software compatibility of all modules.

3. Power up the system by replacing the negative battery cable and placing the START/RUN - OFF switch in the START/RUN position. The display will immediately go into the Unit Identification Configuration screen. The unit model information must be entered before the System can display the correct screens for this unit.

4. Select the correct model and then enter the correct model number by using the ▲ and ▼ keys. Scroll through the list until the correct model number appears (verify by reading the Model/Serial Plate on the unit). Press the "=" key to enter the new model number.

5. Press the ▲ key again, and the unit serial number field will appear. Refer to Section 5.2.3 for instructions on entering the unit serial number.

6. Press the ▲ key again, and the Trailer ID field will appear. Refer to Section 5.2.3 for instructions on entering the Trailer ID.

NOTICE

Ensure that the clock you are using is accurate. Also, some customers are located in different time zones from the repair location. If you know the owners desired location time, enter that time. If you don't, enter the current time at your location.

7. Now, press the ▼ key until "SET DATE & TIME" appears. Refer to Section 5.2.3 for instructions on entering the date and time.

8. Press the ▲ key to go to "SET NEW HOURS". Press the "=" key then the ▲ key to enter that menu.

9. The first hourmeter is Engine Protect Hours. Press the "=" key to select this meter. The cursor will be blinking on the ten-thousands place. Press the ▲ and ▼ key to select the correct value, then press the "=" key. If the correct number in any of the locations is 0 (zero), just press the "=" key to enter 0 as the value and move the cursor to the next place. For example, if you are entering 567 hours, you will press the "=" key twice to leave a 0 for the first two numbers, then use the ▲ and ▼ keys to scroll through the numbers to enter the correct hours. When the correct hours for Engine Protect Hours has been entered, press the "=" key to advance to the next hourmeter. If an invalid number is entered, a warning message will flash in the MessageCenter. For example, you can not enter a higher number of hours for Engine Protect than the number of Switch On Hours.

NOTES

- None of the "Total" hourmeters are listed. When the hours for all the hourmeters are entered, the system will add the correct hours together and calculate the Total Engine Hours and Total Switch On Hours. When the end of the list is reached "PRESS = TO SAVE HOURS" will be displayed. Pressing the "=" key will save the hours, and return you to the configuration list.
- If you do not press the "=" key, none of the time hours or cycles you just entered will be saved.
- Hour meters may be changed for 60 minutes following the initial hour entry. If an error has been made, be certain to correct it within the 60 minute time period. Following that time, the hourmeters will count the appropriate hours because the unit switch is on and the unit is operating, and no further manual changes will be allowed.

NOTES

- If a data transfer USB memory device will be used to setup the remainder of the main microprocessor settings, proceed to **Section 5.5.7** after the settings are entered.
- After the unit specific and time sensitive configuration settings are complete use the ▲ or ▼ key until “CONFIGS COMPLETE, = TO EXIT” is displayed in the MessageCenter. Press the “=” key to save.
- If the Configurations, Functional Parameters and DataLink data recorder setup will be set using the display mounted keys and /or TRU-Tech, continue with following steps.

5.5.4 Configurations Via Display Mounted Keys

Refer to **Table 5–1** for a list of available Configurations. Refer to **Section 5.2.3** for instructions on how to access them.

5.5.5 Functional Parameters Via Display Mounted Keys

1. Refer to **Table 3–2** for a list of available Functional Parameters and **Section 3.17** for directions on how to access them.
2. Leave the system powered up as you continue with the next section.

5.5.6 DataLink Data recorder Via TRU-Tech

NOTE

If the factory settings are used, this section can be skipped.

1. Refer to **Section 3.10** for list of DataLink data recorder setups.
2. Connect a computer to the USB interface port of the unit and start the TRU-Tech program (refer to **Section 5.4**).
3. In TRU-Tech, click on the REEFER SETUP LIVE/ Data Recorder Tab.
4. Select the Sensors to be recorded and whether you wish averaged or snapshot recordings (averaged is recommended for RAT, SAT, AAT and the remote sensors; snapshot is recommended for all others).
5. When the setup is correct, press the Send button to send the new settings to the system.
6. From the “Confirm Send Information” Pop Up, check the data that is to be sent and un-check the data that is not to be sent. Click the OK button.
7. Verify that the settings were sent by waiting for the confirmation pop up message.

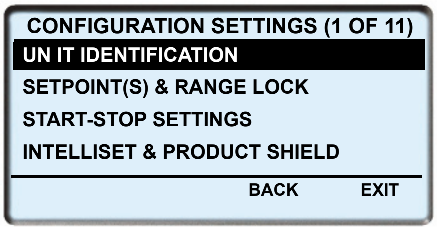
NOTE

If the DataLink data recorder date and time were not set earlier, they can be set from TRU-Tech.

5.5.7 System Final Checkout

1. Start the unit and allow it to run for a few minutes.
2. While the unit is running, scroll through the Data List. Verify that all the data is now accurately displayed.
3. Initiate a Pretrip test. Allow the unit to complete the Pretrip and check for any alarms. Make any necessary repairs before returning the unit into service.

Table 5–1 Configuration Settings

<table>
<tr><th>Configuration</th><th>Selections</th><th>Description</th></tr>
<tr><td colspan="2">
</td><td>Press the ▲ or ▼ keys to display configurations:
UNIT IDENTIFICATION
SETPOINT(S) & RANGE LOCK
START-STOP SETTINGS
INTELLISET & PRODUCT SHIELD
ENGINE ALARMS
ALARM SETTINGS
HOUR METERS
REMOTE SENSORS
OTHER SETTINGS
RAIL SETTINGS
AUTO FRESH AIR SETTINGS</td></tr>
<tr><td colspan="3">UNIT IDENTIFICATION</td></tr>
<tr><td>UNIT MODEL NUMBER #</td><td>A list of configurable model numbers</td><td>Indicates to the main microprocessor the model number of the unit. There are several model numbers provided in the list. Select the model number printed on the Model/Serial Number nameplate.</td></tr>
<tr><td colspan="3">NOTE
The unit model number selection may have an asterisk (*) in the place of the 7th character. If that is the case, then that number may be selected as long as all of the other numbers and letters match exactly.</td></tr>
<tr><td>TRAILER ID #</td><td></td><td>A customer-assigned ID number may be entered. This may be up to 10 characters long. Numbers, letters, and spaces may be entered by scrolling through the available list. Refer to Section 5.2.3 for instructions on entering the Trailer ID.</td></tr>
<tr><td colspan="3">NOTE
The default display for this Configuration is “TRAILER ID #”. The display may be modified if the “UNIT OPERATION’” Configuration in the Rail Settings group is set to “RAIL”. If this Configuration is set to “RAIL” then “ASSET ID #” or “CAR ID #” may display rather than the “TRAILER ID #” default. Refer to the UNIT OPERATION Configuration later in this table.</td></tr>
<tr><td>UNIT SERIAL NUMBER</td><td></td><td>The unit S/N may be entered. Numbers, Letters, and a space are available by scrolling through the available list. Refer to Section 5.2.3 for instructions on entering the unit serial number.</td></tr>
<tr><td>SET NEW HOURS</td><td colspan="2">This Configuration will display when a replacement main microprocessor is installed. It allows entry of the hours (from the existing microprocessor) into the replacement microprocessor. This Configuration will only display until one of the hour meters reaches 25 hours. Changes to these values may be made for up to 60 minutes.</td></tr>
<tr><td>SET DATE AND TIME</td><td colspan="2">Indicates to the main microprocessor the current date and time. Refer to Section 5.2.3 for instructions on entering the date and time.

NOTE
Date and Time may also be configured under “Other Settings”.</td></tr>
</table>

Table 5–1 Configuration Settings

Configuration	Selections	Description
SETPOINT(S) and RANGE LOCK		
DECIMAL	DISPLAYED **NOT DISPLAYED**	DISPLAYED = setpoint will be shown with a decimal and temperatures may be selected to a tenth of a degree. NOT DISPLAYED = setpoint will not be shown with a decimal. All other temperatures will still be displayed with a decimal.
MIN SETPOINT	**-22°F** TO 90°F (**-30C** to 32°C) (in 0.1°F or °C increments)	Indicates to the main microprocessor the minimum allowable set point.
MAX SETPOINT	-22°F TO **90°F** (-30C to **32°C**) (in 0.1°F or °C increments)	Indicates to the main microprocessor the maximum allowable setpoint.
RANGE 1 LOCK OR RANGE 2 LOCK	**OFF** START-STOP CONTINUOUS	OFF = If both Range Locks are OFF, the unit will operate normally. If either Range 1 or Range 2 is not OFF, the unit will operate as selected whenever the setpoint is within that range. START-STOP = The unit will always operate in Start-Stop whenever the setpoint is between the minimum and maximum temperatures for that range (refer to the following sub-configurations). CONTINUOUS = The unit will always operate in Continuous Run whenever the setpoint is between the minimum and maximum temperatures for that range (refer to the following sub-configurations).
• RANGE 1 (or 2) MINIMUM TEMPERATURE	-22°F TO **90°F** (-30C to **32°C**) (in 0.1°F or °C increments)	Select the lowest temperature desired for this range.
• RANGE 1 (or 2) MAXIMUM TEMPERATURE	-22°F TO **90°F** (-30C to **32°C**) in 0.1°F or °C increments	Select the highest temperature desired for this range
START-STOP SETTINGS		
CURRENT FOR S/S SHUTOFF	**7.0A** 1A TO 10A (in 0.5A increments)	In Start-Stop Operation the charging current must drop below this value before the unit is allowed to shut down.
VOLTAGE FOR S/S RESTART	**12.2V** 12.0 TO 12.8V	The engine will restart from a Start-Stop Off cycle or a Sleep mode Off cycle when the battery drops to this value. A lower selection may result in a longer off cycle (based on battery voltage) and possibly overall shorter battery life. A higher selection may result in a shorter off cycle (based on battery voltage) and possibly overall longer battery life.
ENGINE TEMP FOR S/S RESTART	**32°F (0°C)** 10°F to 32°F (-12.2°C to 0°C)	The engine will restart from a Start-Stop Off cycle or a Sleep mode Off cycle when the engine coolant temperature drops to this value.

Table 5–1 Configuration Settings

Configuration	Selections	Description
S/S PARAMETERS	**TOGETHER** SEPARATE	TOGETHER = When the Minimum Run Time, Minimum Off Time, Restart Temperature, 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, Restart Temperature, Maximum Off Time, and Override Temperatures are set in the Functional Parameter List, different values may be entered for Perishable and Frozen setpoints.
INTELLISET and PRODUCTSHIELD		
ENABLE INTELLISET AT = KEY	**NO** YES	YES = Allows access to the IntelliSet menu using the = key. NO = Allows access to the IntelliSet menu using the SELECT key.
WARM PRODUCE INSIDE	ON **OFF**	ON = Warm Produce mode active OFF = Warm Produce mode inactive
WARM PRODUCE MIN TEMP	29°F – 32°F (-1.7°C – 0°C) Adjustable in 0.1 degree	Used to set the minimum temperature of the supply air when warm produce mode is active.
PRODUCTSHIELD: ECONO	**OFF** GO TO S/S GO TO CONT	OFF = ProductShield Econo is OFF GO TO START/STOP = Allows unit to be set for and operate in Continuous Run until ambient temperature falls **within** a user-defined range when unit will go to START/STOP. This allows energy savings while offering Continuous Run operation protection when ambient is outside range. Unit will return to Continuous Run when ambient goes beyond range. GO TO CONTINUOUS = Allows unit to be set for and operate in START/STOP until ambient temperature falls **outside** a user-defined range when unit will go to Continuous Run. This provides continuous air flow and good product protection for extreme ambient temperatures. Unit will return to START/ STOP when ambient comes back inside range.
• ECONO MIN. TEMP	**OFF** or -20°F to +119.0°F (-28.9°C to +48.4°C) (in 0.5° increments) Default: **119.0°F (48.4°C**)	OFF = There is no lower limit for this parameter. Select the lowest ambient temperature desired to activate ProductShield Econo. If ProductShield Econo is Go To Continuous there is a minimum 10°F range. Therefore, this parameter's upper limit is ProductShield Econo Maximum Temperature minus 10°F (5.5°C).
• ECONO MAX. TEMP	**OFF** or -20°F to +119.0°F (-28.9°C to +48.4°C) (in 0.5° increments) Default: **119.0°F (48.4°C**)	OFF = There is no upper limit for this parameter. Select the highest ambient temperature desired to activate ProductShield Econo. If ProductShield Econo Install is Go To Continuous there is a minimum 10°F range. Therefore, this parameter's lower limit is ProductShield Econo Min Temp plus 10°F (5.5°C).

Table 5–1 Configuration Settings

Configuration	Selections	Description
• ECONO DELTA-T NOTE: This is available for "Go to S/S" only. Not available for "Go to Continuous".	**OFF** +3.6°F to +27.0°F (+2°C to 15°C) (in 0.5° increments)	OFF = Delta-t is not used in determining when the unit will go into Econo: Go To Start/Stop Mode. Select the desired delta-t value for activation of ProductShield Econo. When delta-t is below this setting and within the minimum/maximum range go to start/stop will be allowed
PRODUCTSHIELD: HIGH AIR	**OFF** ON	OFF = The unit will operate normally in high and low speeds. ON = The unit will operate in high speed when the ambient air temperature is outside a user defined range. This provides increased air flow and good product protection for extreme ambient temperatures. Unit may return to low speed when ambient comes back within the range.
HIGH AIR MIN. TEMP	**OFF** -19°F to +119°F (-28.3°C to +48.3°C) (in 0.5°F or °C increments)	OFF = There is no lower limit for this parameter. Select the lower limit of the ambient range desired for this parameter. Refer to **Section 4.10.3** for more information on High Air Min. Temp.
HIGH AIR MAX. TEMP	**OFF** -19°F to +119°F (-28.3°C to +48.3°C) (in 0.5°F or °C increments)	OFF = There is no upper limit for this parameter. Select the upper limit of the ambient range desired for this parameter. Refer to **Section 4.10.3** for more information on High Air Max. Temp.
HIGH AIR DELTA-T	**OFF** +3.6°F to +27°F (+2°C to +15°C) (in 0.5°C or °F increments)	OFF = Delta-t is not used for determining the activation/de-activation of High Air Delta-T Select the desired Delta-T value for activation of ProductShield High Air. Refer to **Section 4.10.3** for more information on High Air Delta-T.
PRODUCTSHIELD: WINTER	**OFF** -20°F to +32°F (-28.9°C to +0°C) (in 0.5°C or °F increments)	Select the desired ambient temperature below which ProductShield Winter will operate (forced Continuous Run operation).
PRODUCTSHIELD FRESH	**OFF** **ON**	OFF = ProductShield Fresh is turned off. ON - The FreshProtect value in the system will be overridden when operating under high ambient conditions. Refer to **Section 4.10.3** for more information on FreshProtect.
PRODUCTSHIELD FRESHPROTECT	**OFF** A through F: A = 2 to 5°F (1.1 to 2.8°C) B = 4 to 7°F (2.2 to 3.9°C) C = 6 to 9°F (3.3 to 4.9°C) D = 8 to 10°F (4.4 to 6.1°C) E = 10 to 13°F (5.6 to 7.2°C)	This Configuration is used to override the FreshProtect Functional Parameter value already in the system. The values displayed will depend on the FreshProtect Functional Parameter setting for this application. Only the values that allow less temperature drop will be displayed, available for selection. For example, if the FreshProtect Functional Parameter is set to C, then the ProductShield FreshProtect overrides displayed for selection will be A and B.
PRODUCTSHIELD FRESH TEMP	70° F to 118°F (21°C to 48°C) in 1° C or °F increments. Default: **90°F (32°C)**	Ambient temperature above which ProductShield Fresh will be active.

Table 5–1 Configuration Settings

Configuration	Selections	Description
ENGINE SETTINGS		
GLOW TIME	SHORT LONG **INTAKE HEATER**	Indicates to the main microprocessor which engine is in the system. LONG = Glow Plug equipped and longer glow times are used (TV engines). SHORT= Glow Plug equipped and shorter glow times are used (DI engines). INTAKE HEATER = Engine preheat equipped (Tier 4 engines). NOTE: Refer to **Table 4–1** for glow times.
ENGINE OIL LEVEL SWITCH	YES / **NO**	Use of an oil level device is not recommended at this time. USE FACTORY DEFAULT SETTING ONLY, DO NOT OPERATE UNIT WITH DIFFERENT SETTING.
TECH RESET: HIGH ENGINE TEMP SHUTDOWN	YES / **NO**	YES = When alarm **00012 High Coolant Temperature** alarm has been activated three times in the last two hours of engine operation alarm **00021 Technician Reset Required** will be activated. NO = When alarm **00012 High Coolant Temperature** has been activated three times in the last two hours of engine operation alarm **00021 Technician Reset Required** will not be activated.
TECH RESET: ENGINE OIL PRESS SHUTDOWN	YES / **NO**	YES = When alarm **00011 Check Engine Oil Pressure** has been activated three times in the last two hours of engine operation, alarm **00021 Technician Reset Required** will be activated. NO = When alarm **00011 Check Engine Oil Pressure** has been activated three times in the last two hours of engine operation alarm **00021 Technician Reset Required** will not be activated.
FUEL LEVEL SENSOR	**NO** 0.25 – 4.75v 0.0 – 5.0v 3rd Party	NO = There is no fuel level sensor 0.25 – 4.75v = Fuel Level Sensor with an operating range of 0.25 to 4.75v 0.0 – 5.0v = Fuel Level Sensor with an operating range of 0.0 to 5.0v 3rd Party = A 3rd Party fuel Level sensor has Been Installed
LOW FUEL ALARM PERCENT	Adjustable from 15% to 50%	Percentage of fuel remaining in the tank when the LOW FUEL LEVEL alarm becomes active
LOW FUEL ALARM	**UNIT SHUTDOWN** ALARM ONLY	UNIT SHUTDOWN = The unit will alarm at the preset fuel percentage and shutdown at 10%. ALARM ONLY = An alarm will be generated if level reaches 15% and the engine will continue to run.
FUEL FLOW METER	**NO** YES	NO = No fuel flow meter has been installed YES = There is a fuel flow meter installed on the unit
FUEL HEATER	**NOT INSTALLED** INSTALLED	NOT INSTALLED = A Fuel Heater is not installed. INSTALLED = A Fuel Heater is installed.

Table 5–1 Configuration Settings

Configuration	Selections	Description
MAX THROTTLE POSITION	80 - 125 **125** default	IF THIS CONFIGURATION IS AVAILABLE, USE FACTORY DEFAULT ONLY, DO NOT OPERATE WITH A DIFFERENT SETTING.
EES SYSTEM INSTALLED (DPF Installed)	**Not Installed** Installed	Indicates if Diesel Particulate Filter is installed.
ALARM SETTINGS		
OUT OF RANGE SHUTDOWN	YES / **NO**	YES = When the refrigerated compartment temperature has been out-of-range for 45 minutes, the alarm light will come on, and the unit will shut down. NO = When the refrigerated compartment temperature has been out-of-range for 30 minutes, the alarm light will come on and the unit will continue to run. Refer to alarm **00053 Box Temp Out-of-Range** for more information.
RPM ALARM SHUTDOWN	**YES** / NO	YES = When alarm **00039 Check Engine RPM** is activated the alarm light will illuminate and the engine will shut down. NO = When alarm **00039 Check Engine RPM** is activated the alarm light will illuminate and the engine will continue to run.
LOW PRESSURE SHUTDOWN	**YES** / NO	YES = When alarm **00018 Low Refrigerant Pressure** is activated the alarm light will illuminate and the unit will shut down. NO = When alarm **00018 Low Refrigerant Pressure** is activated the alarm light will illuminate and the unit will continue to run.
LP SHUTDOWN DELAY	(0 - 255 seconds in one second increments) **120 SECS**	If the Low Pressure Shutdown Configuration is set to YES, shutdown is to be delayed for this amount of time after the Low Pressure Shutdown signal is received.
HIGH SUCT PRESS SHUTDOWN	**YES** / NO	YES = When alarm **00027 High Suction Pressure** is activated the alarm light will illuminate and the unit will shut down. NO = When alarm **00027 High Suction Pressure** is activated the alarm light will illuminate and the unit will continue to run.
HP SHUTDOWN DELAY	NO **YES**	NO = Unit will require manual restart after HP limit is met. YES = Unit will restart 15 minutes after HP limit is met, up to three times in a one hour time
REFRIGERATION SYSTEM SHUTDOWN	**YES** / NO	YES = When alarm **00028 Check Refrigeration System** is activated the alarm light will illuminate and the unit will shut down. NO = When alarm **00028 Check Refrigeration System** is activated the alarm light will illuminate and the unit will continue to run.

Table 5–1 Configuration Settings

Configuration	Selections	Description
COMPRESSOR ALARM SHUTDOWN (This Configuration is an option, it will not display if the option is not installed.)	**YES** / NO	If the "Compressor Alarm Shutdown" option has been installed (refer to Unit Data), this setting will be available. YES = The unit will shutdown and not restart when **00013 High Discharge Pressure**, **00017 High Comp Discharge Temp**, **00018 Low Refrigerant Pressure**, **00027 High Suction Pressure**, **00028 Check Refrigeration System** or **00056 Check Evaporator Air Flow** occur 3 times within 2 hours of continuous engine operation. NO = Normal shutdown rules for above alarms.
ALTERNATOR CHECK SHUTDOWN	YES / **NO**	YES = When alarm **00051 Alternator not Charging** is activated the alarm light will illuminate and the unit will shut down. NO = When alarm **00051 Alternator not Charging** is activated the alarm light will illuminate and the unit will continue to run.
CONFIGURE HOUR METERS		
VIEWABLE STANDARD METERS		
DISPLAY TOTAL ENGINE HR	**YES** / NO	YES = This hour meter will be displayed during the startup messaging sequence and will be in hour meter menu. NO = This hour meter will not be displayed during the startup messaging sequence. It will be displayed with the "other meters and counters".
DISPLAY TOTAL SWITCH ON HR	**YES** / NO	YES = This hour meter will be displayed during the startup messaging sequence and will be in hour meter menu. NO = This hour meter will not be displayed during the startup messaging sequence. It will be displayed with the "other meters and counters".
SET PM CONFIGURATIONS		
PM (METER NUMBER) CONFIGS Meters available are PM-1 through PM-5.	**OFF** HIGH SPEED HOURS START CYCLES CLUTCH CYCLES SWITCH ON HOURS ENGINE HOURS	OFF = This meter will turn OFF (will not display). ENGINE HOURS = This meter will count engine hours until the next reset interval. SWITCH ON HOURS = This meter will count switch on hours until the next reset interval. START CYCLES = This meter will count how many times the engine has started until the next reset interval. CLUTCH CYCLES = This meter will count how many times the clutch is engaged until the next reset interval. HIGH SPEED HOURS = This meter will count the number of hours the engine operated in high speed until the next reset interval. If a meter is configured, the following sub-configuration will be available.

Table 5–1 Configuration Settings

Configuration	Selections	Description
DIESEL RESET VALUE (Refer to Table 8–1 for oil/ filter change intervals.)	**OFF** 50 to 30,000 hours in 50 hour increments	When the engine maintenance hour meter is reset, the value selected here will be added to the present meter reading to indicate to the microprocessor when the next service interval alarm will be activated. If the value entered is “0” the alarm feature is turned off.
SWITCH ON RESET VALUE	**OFF** 50 to 30,000 hours in 50 hour increments	When the switch on maintenance hour meter is reset, the value selected here will be added to the present meter reading to indicate to the microprocessor when the next service interval alarm will be activated. If the value entered is “0” the alarm feature is turned off.
PM 1-5 RESET INTERVAL **NOTE:** This Configuration will not display for those meters that are configured for zero hours.	ENGINE HOURS 0 or 50 TO 30,000 hours in 50 hour increments SWITCH ONHOURS 0 or 50 TO 30,000 hours in 50 hour increments START CYCLES 0 or 1,000 TO 90,000 CYCLES in 1,000 cycle increments CLUTCH CYCLES 0 or 1,000 TO 90,000 CYCLES in 1,000 cycle increments HIGH SPEED HOURS 0 or 50 TO 30,000 hours in 50 hour increments	The value to be entered here is the desired number of hours or cycles between PM Maintenance Alarms for this meter. When the meter is reset, the value selected here will be added to the to the present meter reading to indicate to the main microprocessor when the next service interval alarm is to be activated.
REMOTE SENSORS		
REMOTE TEMP SENSOR 1	**Not Installed** Installed	Not Installed = There is no remote sensor 1 connected to this unit Installed = There is a remote sensor 1 connected to this unit
REMOTE TEMP SENSOR 2	**Not Installed** Installed RAT-2 CURB RAT	Not Installed = There is no remote sensor 1 connected to this unit Installed = There is a remote sensor 1 connected to this unit
DOOR SWITCH	**NOT INSTALLED** DOOR OPEN SWITCH OPEN DOOR OPEN SWITCH CLOSED 3rd PARTY	NOT INSTALLED = There is no door switch. DOOR OPEN SWITCH OPEN = A door switch has been in- stalled. The switch contacts will be OPEN whenever the door is OPEN. DOOR OPEN SWITCH CLOSED = A door switch has been installed. The switch contacts will be CLOSED whenever the door is OPEN. 3rd PARTY = A 3rd party switch has been installed.

Table 5–1 Configuration Settings

Configuration	Selections	Description
DOOR SWITCH	**ALARM ONLY** UNIT SHUTDOWN LOW ENGINE SPEED DATA RECORDER ONLY	ALARM ONLY = When a door switch indicates that the door is open, a warning alarm will be displayed in the MessageCenter. UNIT SHUTDOWN = When a door switch indicates that the door is open, a warning alarm will be displayed in the MessageCenter, and the unit will shutdown. If this setting is chosen the following sub-setting will also be available. LOW ENGINE SPEED = When a door switch indicates that the door is open, the engine will be forced to low speed. If this setting is chosen the following sub-setting will also be available. DATA RECORDER ONLY = The DataLink data recorder will record every time the door is opened or closed. There will be no alarms or messages displayed in the MessageCenter.
UNIT SHUTDOWN BELOW (ambient air temperature)	**OFF** 120 to -20°F (49 to -29°C)	If Door Switch = Unit Shutdown is selected: OFF = the unit will shutdown at any ambient temperature. Value = when ambient temperature is below the entered value, shut down will be allowed. (When ambient temperature is above the entered value, the unit will not shutdown.)
RUN LOW SPEED BELOW (ambient air temperature)	**OFF** 120 to -20°F (49 to -29°C)	If Door Switch = Low Engine Speed is selected: OFF = the unit will transition to low speed at any ambient temperature. Value = when ambient temperature is below the entered value, transition to low speed will be allowed. (When ambient temperature is above the entered value, the unit will not transition to low speed.)
REMOTE SWITCH 1	**NOT INSTALLED** SWITCH ON CONTACTS CLOSED SWITCH ON CONTACTS OPEN DOOR OPEN SWITCH CLOSED DOOR OPEN SWITCH OPEN 3rd PARTY	NOT INSTALLED = There is no remote switch. SWITCH ON CONTACTS CLOSED = 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. 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. DOOR OPEN SWITCH CLOSED = The remote switch will be used as a door switch. The switch contacts will be CLOSED whenever the door is OPEN. DOOR OPEN SWITCH OPEN = The remote switch will be used as a door switch. The switch contacts will be OPEN whenever the door is OPEN. 3rd PARTY = A 3rd party switch has been installed.

Table 5–1 Configuration Settings

Configuration	Selections	Description
REMOTE SWITCH 1	**ALARM ONLY** UNIT SHUTDOWN LOW ENGINE SPEED DATA RECORDER ONLY	ALARM ONLY = When the switch is activated, a warning alarm will be displayed in the MessageCenter. UNIT SHUTDOWN = When the switch is activated, a warning alarm will be displayed in the MessageCenter, and the unit will shutdown. LOW ENGINE SPEED = When the switch is activated, the engine will be forced to low speed. DATA RECORDER ONLY = The DataLink data recorder will record every time the switch is activated. There will be no alarms or messages displayed in the MessageCenter.
OTHER SETTINGS		
ENABLE ADVANCED USER MODE:	YES **NO**	YES = Advanced User mode is automatically enabled when the unit is powered on. NO = Driver mode is automatically enabled when the unit is powered on and Advanced User mode may be enabled manually.
PROTECT DATA WITH PIN	YES **NO**	**NOTE** Master technician PIN code is described in Section 5.2. Using the TRUtech program, a data protect PIN code, which can override the master technician PIN code, may be entered into the control system. YES = The data protect PIN code will override the master technician PIN code and the data protect code must be entered to use the USB Interface port or data recorder print functions. NO = The data protect PIN code, if entered, will not override the master technician PIN code when using the USB Interface port or data recorder print functions
PARAMETERS LOCKOUT	YES **NO**	YES = All Functional Parameters are locked and cannot be changed using the display mounted keys. NO = Functional Parameters can be changed using the display mounted keys, unless individually locked out by TRU-Tech.
8 HOURS ADDITIONAL DATA	**YES** NO	YES = When the START/RUN-OFF switch is placed in the OFF position, the DataLink data recorder will continue to record data for an additional 8 hours. NO = When the START/RUN-OFF switch is placed in the OFF position, the DataLink data recorder will stop recording data.
SATELLITE COMM (This configuration is an option, it will not display if the option is not installed.)	**OTHER** QUALCOMM	OTHER = The microprocessor is set for communication from Qualcomm T2 (Trailer Tracs 2) or any other supplier. QUALCOMM =- The microprocessor is set for communication from Qualcomm Trailer Tracs.

Table 5–1 Configuration Settings

Configuration	Selections	Description
HIGH SPEED DELAY	**One Minute** 0 to 10 minutes in 0.5 minute increments	Select the length of time unit remains in low speed before transitioning to high speed.
LIGHT BAR	**NOT INSTALLED** 2 LIGHT	NOT INSTALLED = a remote light bar is not installed 2 LIGHT = a two light bar is installed.
SET DATE AND TIME	Indicates to the main microprocessor the current date and time. Refer to Section 5.2.3 for instructions on entering the date and time. **NOTE** Date and Time may also be configured under "Unit Identification"	
ULTRAFREEZE OFFSET ENABLED	NO **YES**	NO = UltraFreeze offset is not enabled YES = UltraFreeze offset is enabled
NUMBER OF COMM MODULES	**NOT INSTALLED** 1 OPTIONAL COMM MODULE INSTALLED (Not for TDO or Remote Panel)	NOT INSTALLED = There is no optional comm module installed on this unit. 1 OPTIONAL COMMMODULE INSTALLED = There is a optional comm module installed.
NUMBER OF REMOTE PANELS	**NOT INSTALLED** 1 REMOTE PANEL INSTALLED	NOT INSTALLED = there is no remote panel installed on this unit. 1 REMOTE PANEL INSTALLED = There is a remote panel installed.
SETPOINT CHANGE ALARM	**No** YES	NO = There will be no alarm for a setpoint not entered YES = Unit will alarm if equal key is not pressed following a setpoint change.
RAIL SETTINGS		
UNIT OPERATION	**STANDARD** RAIL	RAIL = The system is set to control rail refrigeration operation. When this Configuration is set to "RAIL" the following "VEHICLE ID", "RAIL SHUTDOWN OVERRIDE" and "RAIL OVERRIDE RESTARTS" Sub-Configurations will be available.
VEHICLE ID	ASSET **TRAILER** CAR	This Configuration modifies the prefix wording used for display of the customer assigned ID number entered in the "TRAILER ID" Configuration. For example, if the customer assigned ID number entered is 12345: ASSET = will display "ASSET # 12345" TRAILER = will display "TRAILER # 12345" CAR = will display "CAR # 12345"

Table 5–1 Configuration Settings

Configuration	Selections	Description
RAIL SHUTDOWN OVERRIDE (Only available when unit operation is set to rail)	NO **YES**	NO = When alarm **00030 Failed to Run Minimum Time** or **00031 Failed to Start - Auto Mode** is activated, the system will not override the alarm(s) and the unit will not restart until the alarms are cleared manually. YES = When either alarm **00030 Failed to Run Minimum Time** or **00031 Failed to Start - Auto Mode** is activated, the unit will automatically override and clear the alarm(s) and attempt a restart after 4 hours. When this Configuration is set to “YES” the following “RAIL OVERRIDE RESTARTS” Sub-Configurations will be available.
	1-20 **3**	With the default setting the system is allowed to override and clear **00030 Failed to Run Minimum Time** or **00031 Failed to Start - Auto Mode** three consecutive times before the override is locked out and no further restart attempts will be allowed until the alarm(s) are cleared manually. The number of restart attempts allowed before the override is locked out may be changed by entering the desired number in this Sub-Configuration. Setting this number too high may result in a discharged or damaged battery if the unit never actually starts or fails to run long enough to charge the battery prior to shutting down again.

Table 5–1 Configuration Settings

Configuration	Selections	Description
AUTO FRESH AIR SETTINGS		
AUTOFRESH AIR	**NOT INSTALLED** STANDARD	NOT INSTALLED = AutoFresh Air Exchange is not installed. STANDARD = AutoFresh Air Exchange is installed.
AUTOFRESH AIR DELAY	**SETPOINT** 0-48 HOURS IN 1 HOUR INCREMENTS	SETPOINT - Once the compartment temperature has reached setpoint 1.5°F (0.8°C), the Auto- Fresh Air Exchange will start to operate based on the selected Functional Parameters. 0 to 48 Hours - After this length of time, AutoFresh Air Exchange will begin if the unit is no longer running in Pulldown, even though the compartment temperature may not have reached setpoint.

SECTION 6
MessageCenter Messages

6.1 MessageCenter Messages

The following table lists all of the messages which do not appear in other lists in this manual and a description of their meaning. Refer to **Section 9** for a list of Alarm messages. Refer to **Section 3.14** for a list of Unit Data messages. Refer to **Section 3.17** for a list of Functional Parameter messages. Refer to **Section 5.2.3** for a list of Configuration messages.

Table 6–1 MessageCenter Messages

Message	Description
ACTIVE	This message will appear in the MessageCenter along with the current IntelliSet indicating that the IntelliSet is active and none of its settings have been modified.
ACTIVE ALARM LIST CLEARED	The list of active alarms in the microprocessor has been erased. (This does *not* remove alarms from the DataLink data recorder.)
ALL ALARMS CLEARED	The list of active and inactive alarms in the microprocessor alarm lists have been erased. (This does *not* remove alarms from the DataLink data recorder.)
BUZZER OFF IN X MINS	The Buzzer circuit has been energized in Component Test mode. The Buzzer circuit will continue to be energized for the number of minutes shown.
CANNOT ENTER TRIP START	Cannot enter Trip Start. A problem has been detected within the DataLink data recorder.
CANNOT START DEFROST CYCLE	Due to current unit conditions, the defrost cycle cannot be started. Refer to Defrost **Section 3.11** and **Section 8.9.13**.
CANNOT START PRETRIP	Due to current unit conditions a Pretrip test cannot be started. Refer to Pretrip **Section 3.6**.
CHANGE INTELLISET TO EXIT	The IntelliSleep IntelliSet is active. Alternates with “INTELLI- SLEEP MODE” at five second interval whether unit is running or not.
CHARGE MODE-HOLD = TO EXIT	Service mode has the refrigeration system set so that it can be charged with refrigerant through the liquid line service valve. Press the = key to manually exit, or wait until the charging is complete.
CHECK AT NEXT SERVICE INTERVAL	The unit needs to be checked at next service interval. There is currently an active non-shutdown alarm in the alarm list.
CHECK DOOR	The door switch indicates that a refrigerated compartment door is not closed.
CHECK FUEL LEVEL (Requires Optional Sensor)	The level in the fuel tank is very close to empty.
COMPONENT TEST MODE	Pressing the = key while this message is highlighted will allow user access to Component Test mode.
CONTINUOUS LOCKED	The current setpoint is within a range that has been locked into the Continuous Run mode. Start-Stop can not be selected.
CONTINUOUS RUN MODE SELECTED	The unit operating mode has been changed from Start-Stop to Continuous Run.
DATA RECORDER FAILURE	The microprocessor has stopped recording Unit Data.
DEFROST CYCLE STARTED	The unit has gone into Defrost.
DOOR OPEN	A refrigerated compartment door is open.

Table 6–1 MessageCenter Messages

Message	Description
DOOR OPEN - LOW SPEED	A refrigerated compartment door is open forcing the unit to run in low speed.
ENTERING SERVICE MODE	The initial message for Service mode.
ERROR: ENG HRS > SWITCH ON HRS	When setting up a replacement microprocessor, incorrect hours have been entered.
ERROR: HI SP HRS > TOTAL ENG HRS	
EVAC / CHARGE MODE	The unit is in Service mode, and the refrigeration system is ready to be evacuated then charged with refrigerant. Refer to **Section 5.2.5**
EXITING PRETRIP MODE	Pretrip has been aborted either by user or by a pre-trip alarm.
EXITING SERVICE MODE	Service mode has been turned off and unit is returning to normal operation.
INACTIVE ALARMS IN MEMORY	There are inactive alarms in the microprocessor alarm list which have not yet been cleared.
INTELLI-SLEEP MODE	The IntelliSleep IntelliSet is active. This message alternates with “CHANGE INTELLISET TO EXIT” at five second intervals whether unit is running or not.
KEYPAD (display mounted keys) LOCKED-BATTERY TOO LOW	Once the battery voltage goes below 7.0 Volts for 10 seconds, all of the keys on the display will be locked.
LOSS OF COMMUNICATIONS	There is a loss of communications between the display module or other module(s). If a specific module is involved, the module name will be indicated.
MAX SETPOINT HAS BEEN REACHED	Maximum setpoint allowed by configuration settings has been reached.
MICRO WILL RESET & RESTART NOW	The microprocessor program software has just been changed, or a new configuration has been programmed into the microprocessor. The microprocessor will turn itself off then on again (similar to a computer reboot) in order for the changes to be effective.
MIN SETPOINT HAS BEEN REACHED	Minimum setpoint allowed by configuration settings has been reached.
MODIFIED	This message will appear in the MessageCenter along with the current IntelliSet indicating that the IntelliSet is active and one or more of its settings have been modified.
NO ACTIVE ALARMS	There are no active alarms in the Alarm list.
NO INACTIVE ALARMS	There are no inactive alarms in the Alarm list
PC MODE	The START/RUN-OFF switch is in the OFF position, the engine is not running in order to enter PC mode.
PM DUE	Preventative maintenance is now due on the unit. Information on what meter(s) has timed out and the reset feature is provided under Technician Hour Meters. Refer to **Section 5.2.1**.
PRETRIP FAIL & COMPLETED	The Pre-Trip test is completed, and some of the Pre-Trip tests did not pass. Check the Alarm list for Pre-Trip alarms.
PRETRIP FAIL IN TEST XX	Some of the Pre-Trip tests did not pass and the Pre-Trip was not completed. Check the Alarm list for Pre-Trip alarms.
PRETRIP PASS	All of the Pre-Trip tests were ok.
PRETRIP STOPPED BY USER	Pre-Trip has been stopped by user.

Table 6–1 MessageCenter Messages

Message	Description
PRODUCTSHIELD: ECONO ON	The unit is operating in ProductShield Econo which overrides normal unit Start-Stop or Continuous Run operation. Refer to Section 4.10.3.
PRODUCTSHIELD: HIGH AIR ON	The unit is operating in ProductShield High Air which overrides normal unit speed operation. Refer to Section 4.10.3.
PRODUCTSHIELD: WINTER ON	The unit is operating in ProductShield Winter which overrides normal unit operation. Refer to Section 4.10.3.
RECORDING DATA - PLEASE WAIT MICRO WILL RESTART WHEN COMPLETE	This message will be displayed when the unit is starting and the main microprocessor is completing communicating with another module.
RECOVER / LEAK CHK / EVAC MODE	This message will be displayed when the unit is in Service mode and the system is ready for recovery and leak testing.
REMOTE SWITCH 1 OPEN	Remote switch is open. May be connected to a refrigerated compartment door or a remote control switch.
REMOTE SWITCH 1 OPEN - LOW SPEED	Shows that the remote switch is open and that the unit is running in low speed. Switch may be connected to a refrigerated compartment door or a remote control switch.
SERVICE MODE	Selection which is used when servicing the refrigeration system. Refer to Section 5.2.5.
SETPOINT CHANGED	The new setpoint has been entered (saved into microprocessor memory), the new setpoint will be used.
SETPOINT NOT CHANGED	The new setpoint has NOT been entered (NOT saved into micro- processor memory), the old setpoint will be used.
SETTING SMV: XXX %	The START/RUN-OFF switch has been toggled out of the OFF position and the CSMV is opening.
SLEEP MODE, OFF / ON TO WAKE	The unit is cycled off in Sleep mode. Place the START/RUN-OFF switch in the OFF position, then back to the START/RUN position to wake the microprocessor up.
SLEEP WARNING: DOOR OPEN	The unit is configured for Rail mode and the unit is in Sleep mode and a refrigerated compartment door is open. The unit will start as needed for Sleep mode.
SLEEP WARNING: NO TEMP CONTROL	The unit is running in Sleep mode to charge the battery and (in Engine Operation) warm the engine coolant. It is not running to provide temperature control.
SLEEP WARNING: REMS1(2) OPEN	The unit is configured for Rail mode and the unit is in Sleep mode and a remote switch is open. The switch may be connected to a refrigerated compartment door or to a remote control switch. The unit will start as needed for Sleep mode.
SMV CLOSING: WAIT XXX SECONDS	Power Up and the CSMV is closing. XX indicates the number of seconds remaining until valve is fully closed.
START STOP LOCKED	The setpoint has been locked into Start-Stop Operation. Continuous Run can not be selected.
START-STOP MODE SELECTED	Start-Stop Operation has been selected.
STATUS OK	The unit is operating correctly.
TECHNICIAN RESET REQUIRED (AL00021)	**00011 Check Engine Oil Pressure** or **00012 High Coolant Temperature** has been activated three times in the last two hours and the unit has been locked out. Refer to alarm descriptions for further information.

Table 6–1 MessageCenter Messages

Message	Description
TIME SELECTION NOT CHANGED	A time change was started but not entered (saved) in teh Configuration List.
TRIP START ENTERED	The Trip Start marker has been placed in the DataLink data recorder.
UNIT BATTERY TOO LOW	The unit battery has dropped below 7 volts for more than 10 seconds.
UNIT SHUTDOWN - DOOR OPEN	The unit has shutdown because the refrigerated compartment door is open.
UNIT SHUTDOWN - SEE ALARM LIST	An active shutdown alarm has shut the unit down, refer to **Section 7**.
UNIT SHUTDOWN - RMS1	The unit has shutdown because a switch is open. May be connected to a door or a remote control switch.
USE UP/DOWN KEY TO SCROLL USE = KEY TO SELECT ITEM TO CHANGE	Available items are being displayed or additional items are available for selection. Use the ▲ or ▼ key to highlight the desired selection and then use the “=” key to select it.
VIEWING MENU SOFT KEY SELECTIONS PRESS MENU KEY TO SCROLL	Additional soft key selections are available and the MENU key can be used to scroll and view them.
WARNING: NO TEMP CONTROL	The temperature sensors have failed and the unit has entered Cargo Protect mode. Refer to **Section 4.11.1**.

SECTION 7

Alarm Troubleshooting

WARNING

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

7.1 Introduction

This section provides guidance for troubleshooting alarms. The alarm light will be illuminated when there is at least one alarm stored in the system. Instructions for reviewing the active alarm list are provided in **Section 3.15** while instructions for reviewing the inactive alarm list are provided in **Section 5.2.2**.

When an alarm occurs, look through both active and inactive alarm lists and make note of all alarms. Each alarm begins with an A (active) or I (inactive) followed by an alarm number and description. Alarms are listed in this guide by alarm number in ascending order. Alarms that are only activated during a Pretrip will begin with a capital “P”.

Before beginning to troubleshoot an alarm, visually inspect the unit, in particular the area of the unit that is causing a problem. In many cases the cause of the problem will be obvious once a visual inspection is performed. For those cases where the cause of the problem is not obvious, this troubleshooting guide will be of assistance.

Troubleshooting should begin with the first alarm that appears in the active alarm list. The first alarm that appears is the last alarm that was recorded. Other alarms in the list may have contributed to the occurrence of the first alarm.

The corrective actions 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 lead to the use of a different order. For example, if the trailer is loaded, condensing section checks should be done first, even though some evaporator section checks may be listed before them.

When the cause of the problem is corrected, it is not necessary to continue through the remainder of the steps. Some active alarms will inactivate themselves automatically once the cause has been corrected. Alarms that do not inactivate themselves automatically must be cleared manually. (Refer to Note 1 in **Section 7.2**)

When repairs are completed, run the unit through a Pretrip cycle and verify that no further active alarms occur. Also, the inactive alarm list should be cleared so that there are no inactive alarms in memory when the unit leaves the repair facility.

When working on the refrigeration system, an accurately calibrated manifold gauge set should always be installed to read compressor suction and discharge pressure. Compressor suction pressure is displayed under Unit Data when in the Driver mode. In the Advance User mode (**Section 3.13**), compressor discharge pressure and temperature will also be displayed.

In high or low ambient it may be necessary to cool or warm the refrigerated compartment temperature before performing specific tests, providing that the compartment is not loaded with temperature sensitive product.

WARNING

The alarm related troubleshooting procedures in this section are to be performed by properly trained personnel only.

7.2 Notes

NOTE

Note 1: The active alarm list may be cleared when in the Driver mode or Advanced User mode by pressing the CLEAR ALARMS soft key. That is: the alarm is “cleared” from the active alarm list and moved to the inactive alarm list for later review if the condition that caused the alarm has been corrected. When Shutdown Alarms are cleared, the unit will attempt to restart. When non-Shutdown Alarms are cleared, there will be no noticeable change in the unit’s operation.

The Inactive Alarm list may be cleared when in the Technician mode in the same way. From the inactive alarm list the technician has the option to “Clear Inactive” alarms only or to “Clear All” alarms. Clearing the inactive alarm list removes the alarm from the system. However alarms that have been activated will remain in the data recorder.

NOTE

Note 2: The Virtual Tech system may provide a “signal” voltage when a circuit is not energized (nominal 3 to 5 volts). This signal voltage is used by the control system to activate an alarm message if there is a problem in the circuit but should not be used for component testing.

When instructed to test for voltage, energize the component using Component Test mode to ensure the correct voltage is being read. Refer to **Section 5.2.4**. Also, testing may be performed without the unit starting. To do this, place the unit in PC mode before using Component Test mode. Refer to **Section 5.3.2**.

NOTE

Note 3: Sensors may be tested by taking a resistance measurement, at the sensor side of the harness connector, at the sensor location. To do this, being careful not to damage the connector pins, disconnect the sensor from the harness and measure resistance. Refer to **Section 8.9.21** for chart of resistances for different sensors.

The interconnecting wiring may also be tested by checking for continuity between the harness side of the connector at the sensor location and the harness side of the connector at the module.

NOTE

Note 4: Switches (door/remote, high pressure, engine oil pressure and defrost air) may be tested by checking continuity, at the switch side of the harness connector, at the switch location. To do this, being careful not to damage the connector pins, disconnect the switch from the harness and check continuity to determine if the switch is open or closed.

The interconnecting wiring for the door/remote, engine oil pressure and defrost air switches may also be tested by checking for continuity between the harness side of the connector at the switch location and the harness side of the connector at the module.

The high pressure switch (HPS) interconnecting wiring may be tested by checking for continuity between the harness side of the connector at the high pressure switch location and the PCM or JP-1 harness connector.

NOTE

Note 5: Some tests can only be conducted while the unit is operating. The unit may be started automatically by placing the SROS in the Start/Run position.

7.3 Alarms

00001 Low Fuel Level Warning

NOTE

This is an optional alarm which will only occur when a fuel level sensor is present and configured "YES".

- ACTIVATION: The ENCU circuit is energized (3MM-9) and fuel level is 15% or less for more than 30 seconds.
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Auto Reset when the ENCU circuit is energized (3MM-9) and fuel level is above 17% for more than 30 seconds, or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check For Low Fuel Level**: Add fuel as needed to the fuel tank.
2. **Check Fuel Level Sensor**: Refer to procedure for alarm **00126 Check Fuel Sensor Circuit**. Alarm condition must be corrected and the alarm cleared to continue.

00011	Check Engine Oil Pressure

NOTE

This alarm may be activated if too high a viscosity oil is used in cold ambient.

- ACTIVATION: The ENCU circuit is energized (3MM-9) and engine oil pressure is below 12 psig (0.82 bar) for longer than five seconds while the engine is running.
- UNIT CONTROL: Shutdown and alarm.
- RESET CONDITION: Auto reset or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Engine Oil Level:** Check engine oil dipstick, add engine oil as needed to fill.
2. **Check Engine Oil Pressure Switch (ENOPS) Power and Wiring**
   a. Inspect switch, connector pins and terminals. Verify that there is no physical damage to the switch. Check the connections for damage and corrosion.
   b. Using Component Test mode, energize the ENCU Power Circuit. Check for power at the switch connector. Must have minimum 11 VDC. If not, check the connectors and wiring between terminals for damage, moisture or corrosion.
   c. Check for continuity from switch connector terminal A to ENCU-15. If good continuity is not present, check connectors and wiring between terminals for damage, moisture or corrosion.
   d. Check for continuity from switch connector terminal B to ENCU-18. If good continuity is not present, check connectors and wiring between terminals for damage, moisture or corrosion.
3. **Check ENOPS Switch:** Remove switch, connect to an external pressure source and test. Contacts close on a pressure rise at 15 psig (1.02 bar). Contacts open on a pressure fall at 12 psig (0.82 bar).
4. **Check Engine Oil Pressure:** Connect mechanical oil gauge. Oil pressure must be greater than 15 psig (1.02 bar.).

00012 High Coolant Temperature

- ACTIVATION:

  Condition 1: Ambient temperature is below 120°F (48.9°C) and engine coolant temperature is above 230°F (110°C).

  Condition 2: Ambient temperature is above 120°F (48.9°C) and engine coolant temperature is above 241°F (116°C).

  Condition 3: Ambient temperature is at or above 120°F (48.9°C) and the engine coolant temperature has remained between 230 and 241°F (110 and 116°C) for more than five minutes.

- UNIT CONTROL: Shutdown and alarm.
- RESET CONDITION: Auto reset after 15 minutes if engine coolant temperature falls below 212°F (100°C), or alarm may be manually reset using the display mounted keys or by turning the unit off and back on again.

NOTE

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

Corrective Actions:

1. **Check Coolant Level**

⚠ WARNING

Do not remove the cap from a hot coolant system. If the cap must be removed, do so very slowly in order to release the pressure without spray.

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

b. Inspect connecting tube between overflow bottle and radiator. Connections must be airtight. No leakage or holes in tube.

2. **Check Freeze Point Of Coolant:** Use Coolant Tester to check concentration of anti-freeze mixture. Must be between 40% to 60% Ethylene Glycol to water mixture.
3. **Check Airflow Through Radiator and Condenser Coil**

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

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

c. Check upper and lower fan belt tension and condition. Verify no glazing, cracking, or slipping. Replace if required. Refer to Section 8.6.

4. **Check Water Pump/Alternator Belt Tension and Condition:** Verify no glazing, cracking, or slipping. Refer to Figure 8.15. Replace if required.

Alarm continued on next page...

00012 High Coolant Temperature (continued)

5. **Check Engine Coolant Temperature Sensor (ENCT)**
   a. Refer to procedure for alarm **00129 Check Engine Coolant Sensor**. Alarm condition must be corrected and the alarm cleared to continue.
   b. Inspect sensor, and connector pins and terminals. Verify no damage to sensor. Verify no damage, moisture, or corrosion in connector.
   c. Check sensor resistance. (Refer to Note 3 in **Section 7.2**) 10,000 Ohms @ 77°F (25°C.) Refer to **Table 8–3** for complete table of temperatures and resistance values.
6. **Check Engine Coolant Temperature Sensor Wiring**
   a. Inspect harness and control box connector pins and terminals. (See wiring schematic **Section 10.3**). Verify no physical damage to harness and no damage or corrosion in connectors.
   b. Check voltage at the sensor connector with the microprocessor powered up. Voltage reading should be 2.5 ± 0.1 VDC. This verifies microprocessor output and wiring connections to sensor.
7. **Check Engine Cooling System**
   a. Compare actual engine temperature to the Unit Data reading. Refer to **Section 3.14**. Temperature must be within ± 20°F (± 11.1°C).
   b. Test operation of thermostat. Must operate correctly.
   c. Check water pump operation. Verify no seepage at weep hole, bearings tight and quiet, and impeller firmly attached to shaft.
   d. Check cooling system for scale, sludge, rust, etc. Coolant must be clean and clear with no foreign particles or substances in it. Flush and clean the coolant system as necessary.
   e. Check water pump bypass hose to thermostat housing for internal blockage. Must be clear and open.

00013 High Discharge Pressure

- ACTIVATION: Compressor discharge pressure switch (HPS) contacts are open. HPS contacts open when the discharge pressure rises to 465 psig (32 bar).
- UNIT CONTROL: Shutdown and alarm.
- RESET CONDITION: Auto reset after 15 minutes if the compressor discharge pressure falls below 350 psig (24 bar), or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **If Alarm Occurs During Pretrip Test 12, 13 or 14 (Pretrip descriptions can be found in Section 3.6)**

   Check that SV1 is opening. During Pretrip tests 12, 13 and 14, SV1 may be de-energized for 1 second to reduce discharge pressure (Refer to **Figure 2.10**). If SV1 fails to open during the 1 second that it is de-energized, this alarm may occur. Repair SV1 as required.

2. **Check System Pressures:** Install a manifold gauge set to check and compare actual compressor discharge and suction pressures with those shown in Unit Data. Refer to **Section 8.9.12** for instruction on comparison. If discharge pressure is in normal range, proceed to step 6.

3. **Check Airflow Through Radiator and Condenser Coil**

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

   b. Check airflow (with unit running). Verify even airflow through the entire coil, and no "dead" spots.

   c. Check upper and lower fan belt tension and condition. Verify no glazing, cracking, or slipping. Replace if required. Refer to **Section 8.6**.

4. **Perform Pretrip (Section 3.6):** Check for Pretrip alarms. Any active alarms must be corrected and cleared before proceeding.

5. **Check Refrigerant Charge:** Refer to **Section 8.7.2**.

6. **Check HPS Power And Wiring**

   a. Inspect switch, connector pins and terminals. Verify that there is no physical damage to the switch. Check the connections for damage and corrosion.

   b. Disconnect switch connector and check for power at the A position (includes J1, SROS, and SP-9). If a minimum of 11 VDC is not present, check connectors and wiring between terminals for damage, moisture or corrosion.

   c. Check continuity from the switch connector B position to PCM-15 (includes SP-5). If good continuity is not present, check connectors and wiring between terminals for damage, moisture or corrosion.

7. **Check HPS Switch**

   a. With discharge pressure below the switch closing pressure (refer to **Section 2.10**), disconnect switch connector and check continuity across the switch. Switch closed.

   b. Check/test switch operation. Refer to **Section 8.9.11**

8. **Refer to Refrigeration Troubleshooting** (**Section 9.3**): Discharge pressure must be in range for the current ambient and refrigerated compartment conditions.

00015 Battery Voltage Too High

- ACTIVATION: Battery voltage at the main microprocessor is greater than 17 VDC.
- UNIT CONTROL: Shutdown and alarm.
- RESET CONDITION: Auto reset after 15 minutes when the voltage at the main microprocessor is between 11 and 14 VDC, or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Battery Voltage**
   a. Test voltage at battery with unit off. Must be between 11-16 VDC.
   b. Test voltage at battery with unit running. Must be between 12-16 VDC.

NOTE

Voltage with unit running should always be higher than voltage with unit off due to battery charging.

2. **Check Alternator Voltage**
   a. Test voltage at PCM-T3 with unit off. Must be between 11-16 VDC.
   b. Test voltage at PCM-T3 with unit running. Must be between 12-16 VDC.
3. **Check Voltage At Main Microprocessor**
   a. Check voltage reading at 3MM-23 and 3MM-34. Must be between 11-16 VDC.
   b. Check Unit Data voltage reading. Must be within 0.5 VDC of reading obtained at 3MM-23 and 3MM-34.

00016 Battery Voltage Too Low

- ACTIVATION: Battery voltage at the main microprocessor is less than 10 VDC (except when the engine starter is engaged).
- UNIT CONTROL: Shutdown and alarm. Alarm condition only if activated while starting unit.
- RESET CONDITION: Auto reset after 15 minutes when the voltage at the main microprocessor is between 11 - 14 VDC, or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check For 00051 Alternator not Charging**
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 reading with unit off.

   NOTE

   Voltage with unit running should always be higher than voltage with unit off due to battery charging.

   d. Perform load test on battery. Follow battery manufacturer's procedure.
3. **Check Connections to Main Microprocessor**

   a. Check connections at PCM-T1, T2 and T3. Verify that connections are not damaged or corroded.

   b. Check voltage reading at 3MM-23 and 3MM-34. Must be above 11 VDC.

   c. Check Unit Data voltage reading. Must be within 0.5 VDC of reading obtained at 3MM-23 and 3MM-34.

00017 High Comp Discharge Temp

- ACTIVATION: Alarm **00125 Check Comp Discharge Sensor** is not active AND:

  Ambient temperature is below 120°F (48.9°C) and discharge temperature is greater than 309°F (154.4°C) for three minutes, or ambient temperature is above 120°F (48.9°C) and discharge temperature is greater than 340°F (171.1°C) for three minutes, or discharge temperature exceeded 350°F (176.7°C).
- UNIT CONTROL: Shutdown and alarm.
- RESET CONDITION: Auto Reset after 15 minutes with the ambient temperature below 120°F (48.9°C), when the discharge temperature falls below 300°F (148.8°C); or auto reset after 15 minutes with the ambient temperature above 120°F (48.9°C) when the discharge temperature falls below 330°F (165.4°C); or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **If Alarm Occurs During Pretrip Test 14 (Pretrip descriptions can be found in Section 3.6):** Check compressor by performing a compressor test. Refer to **Section 8.8.1**.
2. **Check Airflow Through Radiator and Condenser Coil**
   a. Inspect condenser and radiator. Ninety percent or more of the coil surface must be undamaged. Condenser/Radiator coil must be clean.
   b. Check airflow (with unit running). Even airflow through the entire coil. No “dead” spots.
   c. Check upper and lower fan belt tension and condition. Verify no glazing, no cracking, and no slipping. Refer to **Section 8.6**. Replace if required.
3. **Check Refrigerant Charge:** Refer to **Section 8.7.2**.
4. **Check System Pressures**: Install a manifold gauge set to check and compare actual compressor discharge and suction pressures with those shown in Unit Data. Refer to **Section 8.9.12** for instruction on comparison.
5. **Check Compressor Discharge Sensor (CDT):** Refer to procedure for alarm **00125 Check Comp Discharge Sensor**. Alarm condition must be corrected and the alarm cleared to continue.
6. **If alarm occurred during Defrost, check DTT**
   a. Visually inspect the mounting of DTT. Must be mounted tightly to the tube sheet, with the center screw properly torqued. Ensure sensing side is in contact with the tube sheet. Refer to **Figure 2.3**.
   b. Using a service (test) thermometer check temperature of evaporator tube sheet at DTT location and compare actual temperature to the Unit Data reading. Must be within ±2°F (1°C).
7. **Perform Pretrip Check:** Clear Active Alarm list, then run Pretrip and check for any new alarms. Any active alarms must be corrected and cleared before proceeding.
8. **Check System For Non-Condensables**: Check refrigeration system for non-condensable gas(es). No non-condensable gas(es) may be present. Refer to **Section 8.7.2**.
9. **Check Compressor Cylinder Valves and Gaskets:** Remove compressor heads and inspect condition of cylinder suction valves, cylinder discharge valves and gaskets. Must be in good condition. Install new parts and gaskets as required. Refer to **Section 8.8**.

00018 Low Refrigerant Pressure

- ACTIVATION: The compressor is operating with the suction pressure less than -3 psig (-0.20 bar) for more than the LP SHUTDOWN DELAY Configuration (up to five minutes) with RAT above -10°F (-23.3°C) or less than -8 psig (-0.53 bar) with RAT at any temperature.
- UNIT CONTROL: Alarm only or (if configured for shutdown) shutdown and alarm.
- RESET CONDITION: Auto reset after 15 minutes if suction pressure is more than -2 psig (-0.13 bar) or alarm may be manually reset using the display mounted keys or by turning the unit OFF, then ON again.

NOTE

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

Corrective Actions:

1. **Visually Inspect Unit**: Look for damage to the liquid line causing a restriction or any signs of temperature drop at the filter drier. Verify all tubing from the receiver to the evaporator section is in good condition. Verify there is no temperature drop at the filter drier or anywhere on the liquid line.
2. **Check Airflow Through Evaporator Coil/Section**
   a. Inspect coil. Ninety percent or more of the coil surface must be undamaged. Coil must be clean.
   b. Check airflow (with unit running). Even airflow through the entire coil. No “dead” spots.
   c. Check return air bulkhead, air chute. Good air flow. Return air not restricted. Air chute in good condition.
   d. Check fan clutch. Must be fully engaged.
   e. Check upper and lower fan belt tension and condition. Verify no glazing, cracking, or slipping. Refer to **Section 8.6**. Replace if required.
3. **Check Refrigerant Charge:** Refer to **Section 8.7.2**.
4. **Check System Pressures:** Install manifold gauge set and check and compare compressor discharge, suction and evaporator outlet pressure to the Unit Data readings. Suction pressure must be above -3 psig (-0.2 bar). Refer to **Section 8.9.12** for instruction on comparison.
5. **Manually Defrost Unit**: Defrost unit and terminate automatically. Typical defrost cycle time is 5-20 minutes. Visually verify that all ice is cleared from evaporator coil.
6. **Perform Pretrip Check:** Clear Active Alarm list, then run Pretrip and check for any new alarms. Any active alarms must be corrected and cleared before proceeding.
7. **Check Unloader Operation:** Check Front (UL1) and Rear (UL2) Unloaders. Refer to alarm **00085 Check UL1 Circuit** and **00086 Check UL2 Circuit**.
8. **Check Compressor Suction Modulation Valve (CSMV):** Refer to **Section 8.9.8**.
9. **Check Expansion Valve (EVXV):** Refer to **Section 8.9.9**.

00019 Low Fuel Shutdown

NOTE

This is an optional alarm. This alarm will only occur if the Fuel Level Sensor Configuration is YES.

- ACTIVATION: The fuel level is 10% or less for more than 30 seconds AND Alarm **00126 Check Fuel Sensor Circuit** is not active.
- UNIT CONTROL: Alarm only or (if configured for shutdown) shutdown and alarm.
- RESET CONDITION: Auto reset when fuel level is above 25% for more than one minute, or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check For Low Fuel Level**: Add fuel as needed.
2. **Check Low Fuel Level Sensor**: Refer to procedure for alarm **00126 Check Fuel Sensor Circuit**. Alarm condition must be corrected and the alarm cleared to continue.

00020 Maximum Compressor Alarms

- ACTIVATION: This option must be installed and alarm must be enabled by configuring the Compressor Alarm Shutdown to YES. Alarms **00013 High Discharge Pressure**, **00017 High Comp Discharge Temp**, **00018 Low Refrigerant Pressure**, **00027 High Suction Pressure**, **00028 Check Refrigeration System**, **00029 Check Heat Cycle** or **00056 Check Evaporator Air Flow** individually occur 3 times within the last 2 hours.
- UNIT CONTROL: Shutdown and alarm.
- RESET CONDITION: Clear the alarm from inactive alarm list. This alarm and the alarm(s) that caused it can not be reset by turning switch OFF and then ON again.

NOTE

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

Corrective Actions:

1. **Determine Which Alarm Activated This Alarm**
   a. Check active alarm list for **00013 High Discharge Pressure**, **00017 High Comp Discharge Temp**, **00018 Low Refrigerant Pressure**, **00027 High Suction Pressure**, **00028 Check Refrigeration System**, **00029 Check Heat Cycle** or **00056 Check Evaporator Air Flow**. One or more of these alarms will be present.
   b. Follow the troubleshooting steps for the alarm(s) found, and correct the alarm condition. All alarm conditions must be corrected.
2. **Reset Alarm**: Clear all inactive alarms (**Section 5.2.2**). All alarms must be cleared to start unit.

00021 Technician Reset Required

- ACTIVATION: The High Engine Temperature Shutdown Configuration and/or Engine Oil Pressure Shutdown Configuration is/are set to YES, and Alarm **00011 Check Engine Oil Pressure**, **00012 High Coolant Temperature**, or **00129 Check Engine Coolant Sensor** - Check Engine Coolant sensor has become active and shut the unit down three times within the past 2 hours.
- UNIT CONTROL: Shutdown and alarm.
- RESET CONDITION: Clear the alarm from inactive alarm list. This alarm and the alarm(s) that caused it can not be reset by turning switch OFF and then ON again.

NOTE

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

Corrective Actions:

1. **Determine Which Alarm Activated This Alarm:** Check active alarm list for **00011 Check Engine Oil Pressure**, **00012 High Coolant Temperature**, or **00129 Check Engine Coolant Sensor**. One of these alarms will be present. Follow the troubleshooting steps for the alarm(s) found, and correct the alarm condition. All alarm conditions must be corrected.
2. **Reset Alarm:** Clear all inactive alarms (**Section 5.2.2**). All alarms must be cleared to start unit.

00022 Low Suction Superheat

- ACTIVATION: Alarms **00127 Check Suction Temp Sensor** and/or **00131 Check Evap Temp Sensor** are not active and Compressor Suction Superheat (Compressor Suction Temperature (CST) minus saturated temperature for Compressor Suction Pressure (CSP)) is less than 5°C (9°F) for more than two minutes.
- UNIT CONTROL: Shutdown and alarm.
- RESET CONDITION: Auto reset after 15 minutes, or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check System Pressures**: Install manifold gauge set and check and compare compressor discharge, suction and evaporator outlet pressure to the Unit Data readings. Refer to **Section 8.9.12**.
2. **Check Evaporator Section**: Check return air bulkhead, air chute, and the evaporator coil (for cleanliness and airflow). Refer to **Section 9.3.12**.
3. **Perform Pretrip Check**: Clear Active Alarm list, then run Pretrip and check for any new alarms. Any active alarms must be corrected and cleared before proceeding.
4. **Check Expansion Valve (EVXV)**: Refer to **Section 8.9.9**.

00027 High Suction Pressure

- ACTIVATION: The refrigeration system is running and suction pressure has been greater than 98 psig (6.7 bar) for more than 10 minutes.
- UNIT CONTROL: Alarm only or (if configured for shutdown) engine and unit shutdown and alarm.
- RESET CONDITION: Auto reset when suction pressure is less than 75 psig (5.1 bar) for five minutes and configured for Alarm Only, or Auto Reset after 15 minutes if configured as a Shutdown Alarm or, alarm may be manually reset via keypad or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check System Pressures**: Install manifold gauge set and check and compare compressor discharge and suction pressures with those shown in Unit Data. Suction pressure must be above 3 psig (0.2 bar) and should be in the normal range for ambient and refrigerated compartment conditions. Refer to **Section 8.9.12**.
2. **Check Compressor Drive Coupling**: Verify that compressor coupling is intact and the compressor crankshaft is turning. Repair as required.
3. **Check Refrigerant Charge**: Refer to **Section 8.7.2**.
4. **Perform Pretrip Check**: Clear Active Alarm list, then run Pretrip and check for any new alarms. Any active alarms must be corrected and cleared before proceeding.
5. **Check Compressor**
   a. Perform Pump-Down Test. Refer to **Section 8.8.1**. Must hold a vacuum and not equalize in a short period of time.
   b. Cover condenser and build-up discharge pressure. Must be able to raise pressure to 400 psig (27.2 bar).
   c. Disassemble and inspect compressor valve plates, cylinder suction valves, cylinder discharge valves and pistons, etc. Must be intact, clean, and in good working order. Refer to **Section 8.8**.
6. **Check Expansion Valve (EVXV)**
   a. Visually inspect valve. Check coil is seated properly.
   b. Check valve. Refer to **Section 8.9.9**.

00028 Check Refrigeration System

- ACTIVATION:

  Condition 1: When system has been operating in Pulldown for more than five minutes and delta-t (SAT - RAT) is between -3.0°F (-1.7°C) and +5°F (+2.8°C).

  Condition 2: Discharge pressure is not at least 5 psig (0.34 bar) higher than suction pressure for more than 10 minutes.

- UNIT CONTROL:

  Condition 1: If the DTT and/or SAT temperatures are cool enough to allow a defrost the unit will go into defrost. Following defrost, if activation criteria for Condition 1 reoccur within 45 minutes of the defrost cycle, alarm or alarm and shutdown as Configured. If, following the defrost and the 45 minute wait time, the activation criteria for Condition 1 reoccur the unit will go into defrost again. If the DTT and SAT temperatures are too warm to allow a defrost, alarm or alarm and shutdown as Configured.

  Condition 2: Alarm or alarm and shutdown as Configured.

- RESET CONDITION: Auto reset when discharge pressure is more than 20 psig (1.26 bar) above the suction pressure for five minutes, or alarm has been active and unit has been shutdown more then 14 minutes or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Compressor Drive Coupling:** Verify that compressor couping is intact and the compressor crankshaft is turning. Repair as required.
2. **Check Sensors and/or Transducers:** Using an accurate temperature measurement device or pressure measurement device, check SAT, RAT, CDP, EVOP and CSP readings. Readings must be the same on measurement device and Unit Data. Refer to **Section 8.9.12** for instruction on pressure reading comparison.
3. **Perform Pretrip Check:** Clear Active Alarm list, then run Pretrip and check for any new alarms. Any active alarms must be corrected and cleared before proceeding.
4. **Check Compressor**
   a. Perform Pump-Down Test. Refer to **Section 8.8.1**. Must hold a vacuum and not equalize in a short period of time.
   b. Cover condenser and build-up discharge pressure. Must be able to raise pressure to 400 psig (27.2 bar).
   c. Disassemble and inspect compressor valve plates, cylinder suction valves, cylinder discharge valves and pistons, etc. Must be intact, clean, and in good working order. Refer to **Section 8.8**.

00029	Check Heat Cycle

- ACTIVATION: The unit has been operating in the heat cycle for more than five minutes, and the SAT is more than 5.5°F (3°C) colder than the RAT constantly for more than 60 seconds. (Unit is actually cooling the air going through the evaporator).
- UNIT CONTROL: Shutdown and alarm.
- RESET CONDITION: Auto reset after 15 minutes or alarm may be manually reset using the display mounted keys or by turning the START/RUN-OFF switch OFF and then back On again.

NOTE

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

Corrective Actions:

1. **Perform Pretrip Check:** Run Pretrip and check for alarms. Any active alarms must be corrected and cleared before proceeding.
2. **Refer to Section 9.3.6, Refrigeration System Not Heating**

00030	Failed to Run Minimum Time

- ACTIVATION:

  If Configured STANDARD: The unit has shutdown on an alarm three times without having run for at least 15 minutes between each shutdown (not including door switch shutdowns).

  If Configured RAIL: The unit has shutdown on an alarm and attempted to restart for the configured number of times without having run for at least 15 minutes between each shutdown (not including door switch shutdowns).
- UNIT CONTROL: Alarm only or shutdown and alarm.
- RESET CONDITION: Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again. If the Configuration is set to Rail mode, this alarm will reset after 4 hours and a rail alarm reset will be recorded in the data recorded.

NOTE

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

Corrective Actions:

Check For Shutdown Alarms: Alarm conditions must be corrected and alarm(s) cleared to continue.

00031 Failed to Start - Auto Mode

- ACTIVATION: Engine has tried to start three times unsuccessfully.
- UNIT CONTROL: Shutdown and alarm.
- RESET CONDITION: Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again. If the Configuration is set to Rail mode, this alarm will reset after 4 hours. Rail alarm reset will be recorded in the data recorder.

NOTE

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

Corrective Actions:

1. **Check For Additional Alarms**: If this alarm is activated in conjunction with other alarms (00041 Engine Stalled, 05012 Check ENCU Power Circuit, 00078 Check SV1 Circuit, 00079 Check SV4 Circuit, 05013 Check Clutch Circuit, 00085 Check UL1 Circuit or 00086 Check UL2 Circuit) check F5 and F10. Fuses must be good. Replace fuse(s) as required. Clear alarms, restart and check for repeat alarm(s).
2. **Check For Low Fuel Level:** Add fuel as needed to the fuel tank.
3. **Check for Alarms:** Check for 00040 Check Engine Preheat Circuit and 00035 Check Starter Circuit. Alarm conditions must be corrected and the alarm cleared to continue.
4. **Check Engine Control Unit (ENCU) and Fuel Speed Actuator (FSA)**

   a. Check voltage from fuse F3 through PCM-34 and SP-6 to ENCU-22. Verify correct fuse, see Figure 2.7. Must have minimum 11 VDC with the battery connected and SROS in the OFF position.

   b. Check voltage from 3MM-9 to ENCU-44. Must have minimum 11 VDC with SROS in the START/RUN position. If not, energize the run relay output using Component Test mode (refer to Section 5.2.4) and retest.

   c. Check for ground at ENCU-19 and ENCUGND-A (at the battery negative cable connection). If ground not good, check connectors and wiring between terminals for damage, moisture or corrosion.

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

   e. Check resistance and amp draw of FSA. Refer to Section 2.11 for specifications.

   f. Check FSA plunger. Must move in and out freely. Refer to engine manual.
5. **Check Engine Air-intake System**

   a. Check air cleaner indicator. Flag must not be visible.

   b. Inspect air intake system. Verify hoses and tubes in good condition, with no kinks or restrictions.
6. **Check For Correct Engine Oil**: Check viscosity is correct for ambient conditions. Refer to Section 2.8.
7. **Check Engine Exhaust System**: Exhaust system must be clear and unobstructed.
8. **Check Engine Compression:** Refer to Engine Workshop manual.

00034 Engine Failed to Stop

- ACTIVATION: Engine is turning more than 500 RPM for 20 seconds after unit shutdown or cycled off.
- UNIT CONTROL: Shutdown and 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). (Refer to Note 1 in **Section 7.2**) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

1. **Check to Ensure Engine is Running**: Verify that engine is still running. Engine should not be running.
2. **Check Start/Run-Off Switch and Circuit**
   a. Check SROS. It must be in the OFF position.
   b. Check two way communication equipment. It must not be wired so unit can start with SROS in the OFF position. Correct wiring as needed.
   c. Check voltage to 2MM-35: 0 VDC at 2MM-35 (including SP-9) and 3MM-16.
3. **Check For Alarm 00130 Check Engine RPM Sensor**.
4. **Check Fuel Speed Actuator (FSA) and Circuit**
   a. Check voltage to ENCU-44. Must have 0 VDC between 3MM-9 and ENCU-44.
   b. Check FSA plunger. Must move in and out freely. Refer to engine manual.

00035 Check Starter Circuit

- ACTIVATION: Engine speed fails to reach 50 rpm during 2 start attempts.
- UNIT CONTROL: Shutdown and alarm.
- RESET CONDITION: Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Starting Sequence**: Check to see if engine starts, runs for a few seconds then shuts off. If not, continue with Step 2. If yes, check engine speed sensor. Refer to procedure for alarm **00130 Check Engine RPM Sensor**.
2. **Check Fuse**: Check Fuse F10. Replace fuse as required. Clear alarms, restart and check for repeat alarm(s).
3. **Check Starter Solenoid Circuit**
   a. Place SROS in START/RUN position. After buzzer sounds, check for power at starter solenoid and 3MM-12. If there is not a minimum of 11 VDC, check connectors and wiring between terminals for damage, moisture or corrosion.
   b. Inspect wiring to starter motor. (See wiring schematic **Section 10**.) Verify there is no physical damage to wiring or battery cable end, and no damage or corrosion in connections.
4. **Check Starter**
   a. Inspect starter and wiring. (See wiring schematic **Section 10**.) Verify there is no damage or corrosion. Wiring and battery cable must be clean and tight.
   b. Check voltage to starter motor. Must be above 10 VDC while cranking.
   c. Check resistance of starter motor. Refer to **Section 2.11** for specifications.
   d. Check amperage draw of starter. Refer to **Section 2.11** for specifications.
5. **Check Battery Voltage**
   a. Inspect cable ends and posts. Must be clean and tight, with no corrosion.
   b. Test voltage at battery with unit off. Must have minimum 11 VDC.
   c. Perform load test on battery. Follow battery manufacturer's procedure.
6. **Check Engine Control Unit (ENCU) and Fuel Speed Actuator (FSA)**
   a. Check voltage from fuse F3 through PCM-34 and SP-18 to ENCU-22. Verify correct fuse, see **Figure 2.7**. Must have minimum 11 VDC with the battery connected and SROS in the OFF position.
   b. Check voltage from 3MM-9 to ENCU-44. Must have minimum 11 VDC with SROS in START/ RUN. If not, energize the run relay output using Component Test mode (refer to **Section 5.2.4**) and retest.
   c. Check for ground at ENCU-19 and ENCUGND-A (at the negative battery cable connection). If ground not good, check connectors and wiring between terminals for damage, moisture or corrosion.
   d. Inspect fuel/speed actuator (FSA), engine speed sensor (ENSSN) and engine speed control unit (ENCU) connector pins and terminals. Verify there is no physical damage to components, and no damage or corrosion in connectors.
   e. Check resistance and amp draw of FSA. Refer to **Section 2.11** for specifications.
   f. Check FSA plunger. Must move in and out freely. Refer to engine manual.
7. **Check For Correct Engine Oil**: Check viscosity is correct for ambient conditions. Refer to **Section 2.8**.

00036 Check Coolant Temperature

- ACTIVATION: Coolant temperature is below 32°F (0°C) after the engine has been running for five minutes.
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Auto reset when coolant temperature is higher than 36°F (2.2°C) or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

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

00037 Check Low Speed RPM

- ACTIVATION: The control system is calling for low engine speed operation, and engine speed is less than 1200 rpm or greater than 1500 rpm for more than 60 seconds (120 seconds when the control system calls for a change from high to low speed, or when unit first starts).
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Auto reset if control system is calling for low engine speed operation and signal is within 1220 and 1480 rpm for 60 seconds or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Force Low Speed Operation:** Set the High Speed Delay Functional Parameter to 10 minutes and restart unit. (Reset following testing) System should run in low speed. (If not, check speed overrides, **Section 4.11.2**.) Ensure System is calling for low speed when performing steps 3 and 4.
2. **Check Engine Speed**

   a. Check actual engine speed using hand held tachometer. Speed must be within range shown above.

   b. Compare actual speed with that shown in Unit Data. Readings must be within ± 50 rpm.
3. **Check Fuel/Speed Actuator (FSA)**: Check FSA plunger. Must move in and out freely. Refer to engine workshop manual.
4. **Check Engine Air-Intake System**

   a. Check air cleaner indicator. Flag must not be visible.

   b. Inspect air intake system. Verify hoses and tubes in good condition, with no kinks or restrictions.
5. **Check Engine Exhaust System**: Inspect the exhaust system. Must be clear and unobstructed.

00038 Check High Speed RPM

- ACTIVATION: The control system is calling for high speed operation, and engine speed is less than 1650 rpm, or greater than 1950 rpm for more than 60 seconds (120 seconds when the control system calls for a change from low to high speed, or when unit first starts).
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Auto reset if control system is calling for high speed operation and the speed is within 1670 and 1930 rpm for 60 seconds or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Force High Speed Operation:** Place unit in continuous run, adjust setpoint above 11°F (-12°C) and set the Air Flow Functional Parameter to HIGH. (Reset following testing). System should run in high speed. (If not, check speed overrides, **Section 4.11.2**.) Ensure System is calling for high speed when performing steps 3 and 4.
2. **Check Engine Speed**

   a. Check actual engine speed using hand held tachometer. Refer to **Table 2–1**. Speed must be within range shown above.

   b. Compare actual speed with that shown in Unit Data. Readings must be within ± 50 rpm.
3. **Check Fuel/Speed Actuator (FSA)**: Check FSA plunger. Must move in and out freely. Refer to engine manual.
4. **Check Engine Air Intake System**

   a. Check air cleaner indicator. Flag must not be visible.

   b. Inspect air intake system. Verify hoses and tubes in good condition, with no kinks or restrictions.
5. **Check Engine Exhaust System**: Inspect the exhaust system. Must be clear and unobstructed.

00039 Check Engine RPM

- ACTIVATION: Alarm **00130 Check Engine RPM Sensor** is not active and engine speed is less than 1200 rpm or greater than 1950 rpm for five minutes.
- UNIT CONTROL: Alarm only or (if configured for shutdown) shutdown and alarm.
- RESET CONDITION: Auto reset if engine speed is within the specified range for five minutes or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Fuel/Speed Actuator (FSA)**: Check FSA plunger. Must move in and out freely. Refer to engine manual.
2. **Check Engine Air-Intake System**

   a. Check air cleaner indicator. Flag must not be visible.

   b. Inspect air intake system. Verify hoses and tubes in good condition, with no kinks or restrictions.
3. **Force Low Speed Operation**: Set the High Speed Delay Functional Parameter to 10 minutes and restart unit. (Reset following testing). System should run in low speed. (If not, check speed overrides, **Section 4.11.2**.) Ensure System is calling for low speed when performing step 4.
4. **Check Low Speed Engine RPM**

   a. Check actual engine speed using hand held tachometer. Refer to **Table 2–1**. Speed must be within range provided above.

   b. Compare actual speed with that shown in Unit Data. Readings must be within ± 50 rpm.
5. **Force High Speed Operation:** Place unit in continuous run, adjust setpoint above 11°F (-12°C) and set the Air Flow Functional Parameter to HIGH. (Reset following testing). The System should run in High Speed. (If not, check speed overrides, **Section 4.11.2**.) Ensure System is calling for high speed when performing step 6.
6. **Check High Speed Engine RPM**

   a. Check actual engine speed using hand held tachometer. Refer to **Table 2–1**.

   b. Compare actual speed with that shown in Unit Data. Readings must be within ± 50 rpm.

00040 Check Engine Preheat Circuit

- ACTIVATION: Engine Operation: Intake Air Heater amperage is less than 25 Amps, **or** greater than 70 Amps after 14 seconds of glow time (NOTE: This can only occur when the Engine Coolant Temperature is below 50°F (11°C) due to preheat time allowed.

  Refer to **Table 4–1** for preheat times.

  Electric Operation: This alarm will not activate in Electric Operation.
- UNIT CONTROL: Engine and Electric Operation: Alarm Only
- RESET CONDITION: Auto Reset if amperage is between 4 to 55 amps for at least 14 seconds during the glow cycle, or alarm may be manually reset via keypad or by turning the unit off, then back on again.

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

CORRECTIVE ACTIONS:

1. **Check For Alarm 05017 CHECK ENG PREHEAT ENABLE CIRCUIT** - Alarm conditions must be corrected and the alarm cleared to continue.
2. **Check Engine Preheater Circuit**

   a. Using Component Test mode, refer to **Section 5.2.4**, energize engine preheat circuit. Check displayed amp draw, must be greater than 70 amps.

   NOTICE

   DO NOT leave the air intake circuit energized for the full five minutes if full amperage is shown, as the intake air heater element life will be greatly shortened.

   b. Check for power at PCM-T4 and EPH +. Must have minimum 11 VDC. If not, check connectors and wiring between terminals for damage, moisture or corrosion.

   c. Replace PCM with known good component.
3. **Check Engine Preheater Circuit** - Check resistance of EPH. Refer to **Section 2.7** for specifications.

00041	Engine Stalled

- ACTIVATION: The control system is calling for the engine to run, Engine speed sensor is good, and engine speed is less than 10 rpm; **or** Alarm **00130 Check Engine RPM Sensor** is ON, and the oil pressure switch contacts are open.
- UNIT CONTROL: Shutdown and alarm.
- RESET CONDITION: Auto Restart after 15 minutes, or Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check for Additional Alarms**

   a. If this alarm is activated in conjunction with other alarms (**00031 Failed to Start - Auto Mode**, **05012 Check ENCU Power Circuit**, **00078 Check SV1 Circuit**, **00079 Check SV4 Circuit**, **05013 Check Clutch Circuit**, **00085 Check UL1 Circuit** or **00086 Check UL2 Circuit**) check F5 and F10. Fuses must be good. Replace fuse as required. Clear alarms, restart and check for repeat alarm(s).

   b. Check for alarm **00130 Check Engine RPM Sensor**. When alarms 00130 and 00041 occur at the same time, generally the engine has run out or is running out of fuel. This causes the engine speed to surge and drop. Check fuel tank and add fuel as necessary. Check fuel lines between the fuel tank and the fuel pump inlet for air leakage.

2. **Check Start/Run-Off Switch and Circuit**

   a. Check SROS. Must be in the START/RUN position

   b. Check two way communication equipment. Must be set to allow operation and calling for operation.

3. **Check Fuel System**

   a. Check for Alarm **00001 Low Fuel Level Warning**. Fill tank as needed.

   b. Check fuel flow. Unrestricted fuel flow through system. Pump screen(s) clean. Fuel not gelled.

   c. Check fuel system prime. No air in fuel system.

4. **Check Engine Control Unit (ENCU) and Fuel Speed Actuator (FSA)**

   a. Check voltage from fuse F3 through PCM-34 and SP-6 to ENCU-22. Verify correct fuse, see **Figure 2.7**. Must have minimum 11 VDC with the battery connected and SROS in the OFF position.

   b. Check voltage from 3MM-9 to ENCU-44. Must have minimum 11 VDC with SROS in the START/RUN position. If not, energize the run relay output using Component Test mode (refer to **Section 5.2.4**) and retest.

   c. Check for ground at ENCU-19 and ENCUGND-A (at the negative battery cable connection). If ground not good, check connectors and wiring between terminals for damage, moisture or corrosion.

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

   e. Check resistance and amp draw of FSA. Refer to **Section 2.11** for specifications.

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

Alarm continued on next page...

00041	Engine Stalled (continued)

5. **Check Engine Speed Sensor (ENSSN)**: Inspect harness, connector pins and terminals. (See wiring schematic **Section 10**.) Verify no physical damage to harness, and no damage, moisture, or corrosion in connectors.
6. **Check Engine Air-Intake System**

   a. Check air cleaner indicator. Flag must not be visible.

   b. Inspect air intake system. Verify hoses and tubes in good condition, with no kinks or restrictions.
7. **Check Engine Exhaust System**: Inspect the exhaust system. Must be clear and unobstructed.
8. **Check Engine**

   a. Check injection pump timing. Timing must be correct.

   b. Check engine valve adjustment. Rocker arm clearance must be correct.

   c. Check engine compression. Compression must be above 400 psig (27.2 bar).
9. **Check Refrigeration System**: Check discharge and suction pressures. Must be within normal operating range for conditions.

00051 Alternator not Charging

- ACTIVATION: Unit is running and the current flow is less than -1.0 amps (discharge) between the alternator and the battery for three continuous minutes.
- UNIT CONTROL: Alarm only, or if Alternator Check Shutdown Configuration is set to "YES" shutdown and alarm.
- RESET CONDITION: Auto reset (if not shutdown) when alternator is charging or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Water Pump/Alternator Belt Tension and Condition:** Verify no glazing, cracking, or slipping. Refer to **Section Figure 8.15** . Replace if required.
2. **Check Current Transformer (CT)**
   a. Check current value. Power up control system in PC mode. (Refer to **Section 5.3.2**.) Check Unit Data. Must be -2.0 to 1.5A with no load.
   b. Check CT power from main microprocessor. Must have +5 VDC from terminal 2MM-29 to PCM-31.
   c. Check CT ground to main microprocessor. Check wiring from terminal 2MM-23 to PCM-30.
   d. Check CT signal to main microprocessor. Check wiring from terminal 2MM-12 to PCM-29.
3. **Check Alternator Wiring and Output**
   a. Check output and ground wiring (with unit OFF). Ground from alternator G terminal to PCM-T2. Positive from alternator B+ terminal to PCM-T3.
   b. Check output (with unit running). When the unit is started, voltage at the battery will begin near 12.0 VDC, and slowly rise toward 13.5 VDC as the battery charges.
4. **Check for Add-on Equipment Drawing Too Much Current:** Check amperage of added-on components and accessories. Total current draw including the actual unit current draw and all add-on components and accessories must be less than alternator rating.
5. **Perform Pretrip Check:** Clear Active Alarm list, then run Pretrip and check for any new alarms. Any active alarms must be corrected and cleared before proceeding.

00053 Box Temp Out-of-Range

- ACTIVATION:

  Condition One: If the unit is running in Pulldown and the SAT is not greater than 1°F (0.56°C) below the RAT or if the unit is running in Pull-Up and the SAT is not above the RAT, the configured action (Alarm only after 30 minutes or Alarm and Shutdown after 45 minutes) will be activated.

  NOTE: If the Out-Of-Range Alarm Functional Parameter is set to OFF, the following conditions will not trigger an alarm or shutdown.

  Condition Two: If the refrigerated compartment temperature has been within ± 2.7°F (± 1.5°C) for perishable setpoints or + 2.7°F (± 1.5°C) for frozen of setpoint at least once since the unit was started and is now further away from setpoint than the limit set in the Out-Of-Range Alarm Functional Parameter [4°, 5°, or 7°F (2°, 3°, or 4°C)], the configured action (Alarm only after 30 minutes or Alarm and Shutdown after 45 minutes) will be activated.

  Condition Three: If a shutdown alarm occurs and the RAT is further away from setpoint than the limit set in the Out-Of-Range Alarm Functional Parameter [4°, 5°, or 7°F (2°, 3°, or 4°C)], the configured action (Alarm only after 30 minutes or Alarm and Shutdown after 45 minutes) will be activated regardless if the refrigerated compartment temperature has been in-range or not.

- UNIT CONTROL: If the alarm is not Configured for shutdown, alarm only. If the alarm is Configured for shutdown the unit will shutdown and alarm.
- RESET CONDITION:

  Condition 1: Auto reset; If the unit is running in Pulldown and the SAT is greater than 1°F (0.56°C) below the RAT or if the unit is running in Pull-Up and the SAT is greater than the RAT.

  Condition 2 and 3: Auto reset when the temperature is within ±2.7°F (±1.5°C) for perishable setpoints or + 2.7°F (± 1.5°C) for frozen setpoint.

  For Any Condition: Alarm may be manually reset using the display mounted keys OR by turning the unit off, then back on again.

NOTE: The 30 or 45 minute timer is reset and starts again whenever:

- The unit cycles off and restarts in Start-Stop.
- The unit goes into and comes out of Defrost.

NOTE: This alarm does not go into the Inactive Alarm List when it becomes inactive or is cleared.

NOTE: This alarm will not be activated in Sleep mode.

NOTE: For Condition Two, the temperature criteria for this alarm is reset, and the refrigerated compartment temperature must again go In Range before this alarm can be activated if any of the following occur:

- Pretrip is started.
- Setpoint is changed.
- A door switch or remote switch is installed and configured as a door switch, and the switch is opened indicating that the compartment door has been opened.

NOTE

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

Alarm continued on next page...

00053 Box Temp Out-of-Range (continued)
Corrective Actions: 1. **Check Compartment Doors**: Must be closed, and not allowing any air leakage. 2. **Defrost Evaporator**: Initiate manual defrost cycle. Defrost must terminate automatically. Verify that all ice is cleared from the evaporator coil. 3. **Check for Shutdown Alarm(s)**: Alarm conditions must be corrected and alarm(s) cleared to continue. 4. **Check for Alarm 00018 Low Refrigerant Pressure**: Alarm conditions must be corrected and the alarm cleared to continue. 5. **Check Refrigerant Charge**: Refer to **Section 8.7.2**. 6. **Check System Pressures**: Install manifold gauge set to check and compare actual compressor discharge and suction pressures with those shown in Unit Data. Refer to **Section 8.9.12** for instruction on comparison. 7. **Check for Alarm 00056 Check Evaporator Air Flow**: Alarm conditions must be corrected and the alarm cleared to continue. 8. **Perform Pretrip Check**: Clear Active Alarm list, then run Pretrip and check for any new alarms. Any active alarms must be corrected and cleared before proceeding. 9. **Check for Low Delta-T**: Read delta-t from Unit Data. In Cool, the delta-t must be greater than (cooling more than) -1°F (-0.56°C). In Heat the delta-t must be greater than 0 (SAT must be higher than RAT).

00054	Defrost not Complete

- ACTIVATION: Defrost cycle did not terminate automatically. (DTT and SAT did not reach termination temperature of 55°F/12.8°C within 45 minutes or the SAT rose to 120°F/48.9°C during the cycle.)
- UNIT CONTROL: Alarm Only. While this alarm is active, the defrost timer will be temporarily set to initiate a defrost cycle 1.5 hours of unit running time after the alarm comes on.
- RESET CONDITION: Auto Reset when defrost cycle is started again, or alarm may be manually reset via keypad or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Evaporator Fan Clutch In Defrost:** Must completely disengage fan.
2. **Check Refrigerant Charge:** Refer to **Section 8.7.2**. Charge must be correct.
3. **Check for Alarm 00018 Low Refrigerant Pressure**: Alarm conditions must be corrected and the alarm cleared to continue.
4. **Check DTT**
   a. Using a service (test) thermometer check temperature of evaporator tube sheet at DTT location and compare with Unit Data. Must be within 2°F (1°C)
   b. Check DTT and RAT wiring. Verify that RAT temperature is being displayed as RAT in unit Unit Data and that DTT is being displayed as DTT. Correct wiring if required.
   c. Check DTT and SAT resistance. 10K Ohms @ 77°F (25°C). Refer to **Section 8.9.21** for chart of resistances for different sensors.
   d. Inspect DTT Should be fastened securely in place. Flat area of DTT must be against metal surface.
5. **Perform Pretrip Check**: Run Pretrip and check for alarms. Any active alarms must be corrected and cleared before proceeding.
6. **Refer to Section 9.3.6: Refrigeration System Not Heating**

00055 Check Defrost Air Switch (DAS)

- ACTIVATION: The defrost air switch has called for a defrost cycle within eight minutes of a defrost termination for two consecutive defrost cycles. (The air switch contacts were closed continuously for 15 seconds before the defrost cycle was started.)
- UNIT CONTROL: Alarm only. While this alarm is active, the defrost air switch will NOT be used to initiate a defrost cycle; however the Defrost Timer will initiate a defrost cycle 90 minutes after the alarm comes on, and the manual defrost switch will remain operative.
- RESET CONDITION: Auto reset when defrost cycle terminates correctly, and the air switch does not call for a defrost cycle within the eight minutes following defrost termination, or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Condition of Refrigerated Compartment and Load**

   a. Check condition of refrigerated compartment doors and seals. Doors must be closed, and door seals must seal and prevent entrance of outside air.

   b. Check condition of evaporator. Check for blockage sufficient to cause an air pressure differential across the coil great enough to close the contacts of the defrost air switch. Coil must be free of ice following defrost.

   c. Check condition of product. If product is warm and moist, frequent defrost cycles can be expected.

2. **Check DAS Power and Wiring**

   a. Inspect switch, connector pins and terminals. Verify no physical damage to switch. No damaged or corrosion in connections.

   b. If required, power switch by placing the unit in PC mode. Check for power at switch connector. Must have minimum 11 VDC. If not, check connectors and wiring between terminals for damage, moisture or corrosion.

   c. Check for continuity from switch connector plus terminal to 3MM-19. If good continuity is not present, check connectors and wiring between terminals for damage, moisture or corrosion.

   d. Check for continuity from switch connector minus terminal to 3MM-29. If good continuity is not present, check connectors and wiring between terminals for damage, moisture or corrosion.

3. **Check Defrost Air Switch and Tubing**: Check tubing and perform testing as required. Refer to **Section 8.9.13**.

00056 Check Evaporator Air Flow

- ACTIVATION: In Heat mode, the suction pressure has been higher than 100 PSIG (6.8 bar) for more than 60 seconds OR

  In Cool mode, SAT is 5°F (2.8°C) or more warmer than RAT for 3.5 minutes. After the first occurrence of this alarm, the MessageCenter will display “NO TEMP CONTROL - SEE ALARM LIST”.

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 and Alarm.
- RESET CONDITION: Auto reset in 15 minutes if Alarm **00030 Failed to Run Minimum Time** is not also active or, alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Airflow Through Evaporator Coil/Section**
   a. Inspect coil. Ninety percent or more of the coil surface must be undamaged. Coil must be clean.
   b. Check airflow (with unit running). Even airflow through the entire coil. No “dead” spots.
   c. Check return air bulkhead, air chute. Verify good air flow, and Return Air not restricted. Air chute in good condition.
   d. Check fan clutch. Must be fully engaged. Check upper and lower fan belt tension and condition. Verify no glazing, cracking, or slipping. Refer to **Section 8.6**. Replace if required.
2. **Check System Pressures:** Install manifold gauge set to check and compare actual compressor discharge and suction pressures with those shown in Unit Data. Refer to **Section 8.9.12** for instruction on comparison.
3. **Check Refrigerant Charge:** Refer to **Section 8.7.2**.
4. **Perform Pretrip Check**: Run Pretrip and check for alarms. Any active alarms must be corrected and cleared before proceeding.
5. **Check SV4**: Refer to SV4 Checkout Procedure, **Section 8.9.6**.
6. **Refer to Refrigeration Troubleshooting**: Check low cooling capacity causes. Refer to **Section 9.3.2** and **Section 9.3.4**.

00057 Check Remote Switch1 (REMS1)

- ACTIVATION: REMS1 is set to trigger an alarm if the switch is activated (opened or closed, depending on switch type) for more than five seconds.
- UNIT CONTROL: May be configured as alarm only, alarm and force low engine speed, or alarm and shutdown.
- RESET CONDITION:
  Alarm Only: Auto reset after the switch has deactivated for more than five seconds.
  Shutdown: Auto reset after three minutes (minimum off time for switch activated condition) and the switch has deactivated for more than five seconds.

NOTE

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

Corrective Actions:

If a switch is installed:

1. **Determine What REMS1 is Activated By**: REMS1 may be connected to a compartment door or some other device. Locate the device used as REMS1.
2. **Check to See if REMS1 has Activated**: Inspect device used to activate REMS1. For example, Compartment door must be closed, and switch must be deactivated.
3. **Check Configuration for REMS1**: Verify that Configuration is set for the type of switch being used (i.e. when switch is activated, switch contacts are closed; etc). Configuration must agree with switch type. Refer to **Section 5.2.3**.
4. **Check Wiring**

   a. Visually inspect wiring to REMS1. Wiring must be connected.

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

   c. Check circuit. (See wiring schematic **Section 10**.) With the switch contacts closed, check for minimum 11 VDC from 2SVM-15 through the wiring and switch back to 2SVM-26.
5. **Temporary Solution Tip**: In the event of a defective switch that can not be repaired or replaced, and the switch is forcing the unit into shutdown or low speed, this action may be temporarily overridden by setting the OVERRIDE REMS1 SHUTDOWN Functional Parameter to YES.

If a switch is not installed:

1. **Check Configurations**: Any switch/sensor not present in the unit should not be Configured "ON". Correct Configurations.
2. **Check REM Connector**: Locate and inspect 10 position connector for optional sensors and switches (see wiring schematic **Section 10**). Connector must have cap on. Verify no corrosion or moisture inside connector. If there is a problem with the connector and there are no remote sensors or switches in the unit, the connector may be removed and each individual wire separated from the others, terminated and insulated with heat shrink.

00059	DataLogger (DataLink data recorder) Not Recording

- ACTIVATION: No data is being recorded by the DataLink data recorder.
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Alarm may be manually reset using the display mounted keys.

NOTE

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

Corrective Actions:

1. **Clear Alarm**

   a. Clear Active Alarm(s).

   b. Check for Active Alarm re-occurrence. If Inactive, download all data and retain. If Active, go to next step.

2. **Main Microprocessor Defective**

   a. Download previous data using a Data Transfer USB memory device, or TRU-Tech. Data retrieval OK.

   b. Replace and setup main microprocessor. Refer to **Section 5.5**.

NOTE

Specific Configurations may be found on the TransCentral Website (Authorized Carrier Transicold Dealers only).

00060	DataLogger (DataLink data recorder) Time Wrong

- ACTIVATION: The real time clock in the DataLink data recorder does not contain a valid date.
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Auto reset when the DataLink 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 (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

1. **Check Real Time Clock**: Check Real Time Clock in the Unit Data, or using TRU-Tech. Must show correct date and time. Change as needed. Refer to **Section 5.2.3**.

2. **Reset Microprocessor**

   a. Place the SROS in the OFF position for 30 seconds and then return it to the START/RUN position. Verify microprocessor powers up correctly.

   b. Check for valid real time clock reading in Unit Data. Alarm is cleared automatically.

   c. Real Time Clock can not be changed. Proceed to step 3.

3. **Main Microprocessor Defective**

   a. Download previous data using a Data Transfer USB memory device, or TRU-Tech. Verify data retrieval OK.

   b. Replace and setup main microprocessor. Refer to **Section 5.5**.

00061	Door Open (DS1)

- ACTIVATION: DS1 is set to trigger an alarm if the switch is activated (opened or closed, depending on switch type) for more than five seconds.
- UNIT CONTROL: May be configured as alarm only, alarm and force low engine speed, or alarm and shutdown.
- RESET CONDITION:
  Alarm Only: Auto reset after the switch has deactivated for more than five seconds.
  Shutdown: Auto reset after three minutes (minimum off time for door open condition) and the switch has deactivated for more than five seconds.

NOTE

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

Corrective Actions:

<u>If a switch is installed:</u>

1. **Determine What DS1 is Activated By**: DS1 may be connected to a compartment door or some other device. Locate the device used as DS1.
2. **Check to See if DS1 has Activated**: Inspect device used to activate DS1. For example, compartment door must be closed, and switch must be deactivated.
3. **Check Configuration for DS1**: Verify that Configuration is set for the type of switch being used (i.e. when switch is activated, switch contacts are closed; etc). Configuration must agree with switch type. Refer to **Section 5.2.3**.
4. **Check Wiring**

   a. Visually inspect wiring to DS1 to make sure it is connected.

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

   c. Check circuit. (See wiring schematic **Section 10**.) With the switch contacts closed, check for minimum 11 VDC from 2SVM-14, through the wiring and switch back to 2SVM-25.
5. **Temporary Solution Tip**: In the event of a defective switch that can not be repaired or replaced, and the switch is forcing the unit into a shutdown or low speed, this action may be temporarily overridden by setting the OVERRIDE DOOR SWITCH SHUTDOWN Functional Parameter to YES.

<u>If a switch is not installed:</u>

1. **Check Configurations**: Any switch/sensor not present in the unit should not be Configured "ON". Correct Configurations.
2. **Check Connector**: Locate and inspect the DS or REM 10 position connector for optional sensors and switches (see wiring schematic **Section 10**). Connector must have cap on. No corrosion or moisture inside connector. If there is a problem with the DS connector and no switch is installed, the connector may be removed and both wires separated, terminated and insulated with heat shrink. If there is no DS connector, there is a problem with the REM connector and there are no remote sensors or switches in the unit, the connector may be removed and each individual wire separated from the others, terminated and insulated with heat shrink.

00066	Check Evap Sensor Group

- ACTIVATION: The unit has been shut off for at least 48 hours. During wake up, a temperature comparison of the Evaporator Temperature Sensors (RAT, SAT, DTT) is performed. If the highest and the lowest temperature readings are more than 3.6°F (2.0°C) apart this alarm will be activated.

  The Evaporator Temperature Sensors test for this alarm is only run when main power is off and the unit is not running. When this alarm is in the inactive alarm list, the MessageCenter will display “Check at Next Service Interval” instead of “Status OK”
- UNIT CONTROL: Engine and Electric Operation: Alarm only.
- RESET CONDITION: The system will continue to monitor the Evaporator Temperature Sensors during each wake up. If the temperature sensors read within 2.7°F (1.5°C) the alarm will clear. If the alarm doesn't clear, the alarm will be displayed as a non-shutdown alarm when the unit is powered up to alert the operator.

NOTE

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

1. Check Unit Data, or take a download to determine which sensor is out of range.
2. Check Temperature Sensors: Refer to **Section 8.9.21**.

00078 Check SV1 Circuit

- ACTIVATION: A problem has been detected in the SV1 coil circuit. If this alarm is activated while the unit is operating in heat or defrost, the circuit is detected shorted. If this alarm is activated while the unit is operating in cool, the circuit is detected open.
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Auto reset when the control system calls for SV1 to energize (heat, defrost or pulse) and the SV1 coil circuit is normal, or when the control system calls for SV1 to be de-energized (cooling) and the circuit is not shorted or Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (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.

Corrective Actions:

1. **Check for Additional Alarms**: If this alarm is activated in conjunction with other alarms (**00031 Failed to Start - Auto Mode**, **05012 Check ENCU Power Circuit**, **00079 Check SV4 Circuit**, **05013 Check Clutch Circuit**, **00085 Check UL1 Circuit** or **00086 Check UL2 Circuit**) check F5 and F10. Fuses must be good. Replace fuse as required. Clear alarms, restart and check for repeat alarm(s).
2. **Check Coil**
   a. Inspect coil and connector pins and terminals. Verify no damage to coil. No damaged or corroded pins.
   b. Check resistance of coil. Refer to **Section 2.11** for specifications.
   c. Use Component Test mode (Refer to **Section 5.2.4**) to test actual current draw of the circuit. Refer to **Section 2.11** for specifications. Verify the actual current is within the specifications.
3. **Check Power and Wiring**
   a. Use Component Test mode (Refer to **Section 5.2.4**) to energize circuit. Check for power at SV1 terminal A and 3MM-1. Minimum 11 VDC. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.
   b. Check for ground at SV1 terminal B (including SP-3) to GND RING1. Good ground. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.

00079 Check SV4 Circuit

- ACTIVATION: A problem has been detected in the SV4 coil circuit. If this alarm is activated while the unit is operating in heat or defrost, the circuit is detected shorted. If this alarm is activated while the unit is operating in cool, the circuit is detected open.
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Auto reset when the control system calls for SV1 to energize (heat, defrost or pulse) and the SV1 coil circuit is normal, or when the control system calls for SV1 to be de-energized (cooling) and the circuit is not shorted or Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (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.

Corrective Actions:

1. **Check for Additional Alarms**: If this alarm is activated in conjunction with other alarms (**00031 Failed to Start - Auto Mode**, **00041 Engine Stalled**, **05012 Check ENCU Power Circuit**, **00078 Check SV1 Circuit**, **05013 Check Clutch Circuit**, **00085 Check UL1 Circuit** or **00086 Check UL2 Circuit**) check F5 and F10. Fuses must be good. Replace fuse as required. Clear alarms, restart and check for repeat alarm(s).
2. **Check Coil**
   a. Inspect coil and connector pins and terminals. No damage to coil. No damaged or corroded pins.
   b. Check resistance of coil. Refer to **Section 2.11** for specifications.
   c. Use Component Test mode (Refer to **Section 5.2.4**) to test actual current draw of the circuit. Refer to **Section 2.11** for specifications. Verify the actual current is within the specifications.
3. **Check Power and Wiring**
   a. Use Component Test mode (Refer to **Section 5.2.4**) to energize circuit. Check for power at SV4 terminal A and 3MM-3. Minimum 11 VDC. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.
   b. Check for ground at SV4 terminal B (including SP-3) to GND RING1. Good ground. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.

00081 Check FHR Circuit

- ACTIVATION: A problem has been detected in the fuel heater relay coil circuit. If this alarm occurs while the fuel heater circuit is operating, the circuit is detected shorted. If this alarm occurs while the fuel heater circuit is not operating, the circuit is detected open.
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Auto reset when the circuit is normal, or Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (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.

Corrective Actions:

1. **Check Relay**
   a. Inspect relay socket and connection pins inside PCM. No damage to relay. No damaged or corroded connections.
   b. Check resistance of coil (terminals 85 and 86). Refer to **Section 2.11** for specifications.
2. **Check Power and Wiring**
   a. Check for power at fuse F10 terminal A inside PCM. Minimum 11 VDC. If not, check PER circuit and fuse F5. (NOTE: FLS, SATPWR and LB will also be without power.)
   b. Check fuses F5 and F10. Verify correct fuse, see **Figure 2.7**.
   c. Check for power at FHR + terminal. Replace PCM.
   d. If the ambient temperature is below 77°F (25°C) the fuel heater relay (FHR) will be grounded by the main microprocessor at 3MM-17. Power up control system in PC mode. (Refer to **Section 5.3.2**). Check ground from 3MM-17 through PCM-17 to the FHR - connection. If ambient is above 77°F (25°C), place the SROS in the OFF position and check continuity of the wiring from 3MM-17 through PCM-17 to the FHR - connection. Good ground. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.
   e. Check resistance of heater element. Refer to **Section 2.11** for specifications.

00084 Check Remote Alarm Light

This alarm may be activated with earlier software revisions, follow procedure for alarm **05016 Check Remote Amber Light**.

00085 Check UL1 Circuit

- ACTIVATION: A problem has been detected in the front unloader (UL1) coil circuit. If this alarm is activated while the control system is calling for UL1 to be energized, the circuit is detected shorted. If this alarm occurs at any other time, the circuit is detected open.
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Auto reset when the circuit is normal, or Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (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.

Corrective Actions:

1. **Check for Additional Alarms**: If this alarm is activated in conjunction with other alarms (**00031 Failed to Start - Auto Mode**, **00041 Engine Stalled**, **05012 Check ENCU Power Circuit**, **00078 Check SV1 Circuit**, **00079 Check SV4 Circuit**, **05013 Check Clutch Circuit** or **00086 Check UL2 Circuit**) check F5 and F10. Fuses must be good. Replace fuse(s) as required, clear alarms, restart and check for repeat alarm(s).
2. **Check Coil**
   a. Inspect coil and connector pins and terminals. Verify no damage to coil. Verify no damaged or corroded pins.
   b. Check resistance of coil. Refer to **Section 2.11** for specifications.
   c. Use Component Test mode (Refer to **Section 5.2.4**) to test actual current draw of the circuit. Refer to **Section 2.11** for specifications. Verify that the actual current is within specifications.
3. **Check Power and Wiring**
   a. Use Component Test mode (Refer to **Section 5.2.4**) to energize circuit. Check for power at UL1 terminal A and 3MM-6. Minimum 11 VDC. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.
   b. Check for ground at UL1 terminal B (including SP-2) to GND1RING2. Good ground. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.

00086 Check UL2 Circuit

- ACTIVATION: A problem has been detected in the front unloader (UL2) coil circuit. If this alarm is activated while the control system is calling for UL2 to be energized, the circuit is detected shorted. If this alarm occurs at any other time, the circuit is detected open.
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Auto reset when the circuit is normal, or Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (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.

Corrective Actions:

1. **Check for Additional Alarms**: If this alarm is activated in conjunction with other alarms (**00031 Failed to Start - Auto Mode**, **00041 Engine Stalled**, **05012 Check ENCU Power Circuit**, **00078 Check SV1 Circuit**, **00079 Check SV4 Circuit**, **05013 Check Clutch Circuit** or **00085 Check UL1 Circuit**) check F5 and F10. Fuses must be good. Replace fuse(s) as required, clear alarms, restart and check for repeat alarm(s).
2. **Check Coil**
   a. Inspect coil and connector pins and terminals. Verify no damage to coil. Verify no damaged or corroded pins.
   b. Check resistance of coil. Refer to **Section 2.11** for specifications.
   c. Use Component Test mode (Refer to **Section 5.2.4**) to test actual current draw of the circuit. Refer to **Section 2.11** for specifications. Verify that the actual current is within specifications.
3. **Check Power and Wiring**
   a. Use Component Test mode (Refer to **Section 5.2.4**) to energize circuit. Check for power at UL2 terminal A and 3MM-8. Minimum 11 VDC. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.
   b. Check for ground at UL2 terminal B (including SP-2) to GND1RING2. Good ground. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.

00090 CHK AFA Solenoid Circuit

- ACTIVATION: A problem has been detected in the AutoFresh Air Exchange relay coil circuit. If this alarm is activated while the control system is calling for AFAR to be energized, the circuit is detected shorted. If this alarm occurs at any other time, the circuit is detected open.
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Auto reset when circuit is normal, or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Relay**

   a. Inspect relay socket and connection pins inside PCM. Verify there is no damage to relay, and no damaged or corroded connections.

   b. Check resistance of coil (terminals 1 and 2). Refer to **Section 2.11** for specifications.

2. **Check Power and Wiring**

   a. Check for power at fuse F10 terminal A inside PCM. Must have minimum 11 VDC. If not, check PCM circuit and fuse F5.

   b. Check fuses F5 and F10. Verify correct fuse, see **Figure 2.7**.

   c. Check for power at AFAR + terminal. Replace PCM.

   d. Set the AutoFresh Air Functional Parameter to OPEN and ensure the set point is above 30°F (-1.0°C). The AutoFresh air relay coil will be grounded by the main microprocessor at 3MM-13. Check ground from 3MM-13 through PCM-26 to the AFAR - connection. Reset AutoFresh Air Functional Parameter and setpoint as required following testing. If ground not good, check connectors and wiring between terminals for damage, moisture or corrosion.

00093 Check Starter Buzzer

- ACTIVATION: The Buzzer (B) circuit is shorted or open. (The Buzzer output from the microprocessor [PCM-23 to 3MM15] 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.

NOTE

RESET CONDITION: Auto reset when Buzzer amp draw is normal, or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Buzzer**

   a. Inspect Buzzer and wire connections. No damage to buzzer. No damage or corrosion.

   b. Check resistance of buzzer. Cannot be opened (infinite ohms) or shorted (zero ohms).

   c. Use Component Test mode (Refer to **Section 5.2.4**) to test actual current draw of the circuit. Buzzer provides audible signal. View current draw in Component Test mode screen. Verify the actual current is within the specifications.

2. **Check Buzzer Wiring**

   Inspect PCM sub-harness connector pins and terminals. (See wiring schematic **Section 10**.) Verify there is no physical damage to harness, and no damage, moisture, or corrosion in connectors.

3. **Is the component functioning? Are there additional alarms?**

   a. If the component is functioning, and additional alarms are present (often within 3MM01 - 3MM12 or 3MM13 - 3MM18) check related fuses, wires, and connectors.

   b. If the fuses/wires/connectors are OK, it indicates an internal problem with the MM or the PCM. Download data and replace main microprocessor. For complete Main Microprocessor Module replacement instructions refer to **Section 5.5.2**.

   c. If problem persists reinstall the old MM, and replace the PCM. Refer to **Section 8.9.16**.

00097 Check SV2 Circuit

- ACTIVATION: A problem has been detected in the SV2 coil circuit. If this alarm is activated while the control system is calling for SV2 to be energized, the circuit is detected shorted. If this alarm is activated at any other time, the circuit is detected open.
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Auto reset when unit calls for cooling and the SV2 coil circuit is normal, or Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (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.

Corrective Actions:

1. **Check Coil**
   a. Inspect coil and connector pins and terminals. Verify no damage to coil. Verify no damaged or corroded pins.
   b. Check resistance of coil. Refer to **Section 2.11** for specifications.
   c. Use Component Test mode (Refer to **Section 5.2.4**) to test actual current draw of the circuit. Refer to **Section 2.11** for specifications. Verify that the actual current is within specifications.
2. **Check Power and Wiring**
   a. Use Component Test mode (Refer to **Section 5.2.4**) to energize circuit. Check for power at SV2 terminal A and 3MM-2. Minimum 11 VDC. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.
   b. Check for ground at SV2 terminal B (including SP-3) to GND RING1. Good ground. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.

00121 Check Ambient Air Sensor

- ACTIVATION: Ambient Air Temperature Sensor (AAT) is not within range of -53 to +158°F (-47° to +70° C).
- UNIT CONTROL: Alarm and a value of 122°F (50°C) will be used for any calculations.
- RESET CONDITION: Auto reset when sensor is in range or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Sensor**

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

   b. Check sensor resistance. (Refer to Note 3 in **Section 7.2**) 10,000 Ohms @ 77°F (25°C). Refer to **Section 8.9.21** for chart of resistances for different sensors.

2. **Check Sensor Wiring**

   a. Inspect connector pins and terminals at sensor and connector 2MM. (See wiring schematic **Section 10**.) Verify there is no physical damage to harness, and no damage, moisture, or corrosion in connectors.

   b. Place the system in PC mode. Refer to Note 2 in **Section 7.2**. Disconnect sensor from harness. Check for 3.0 ± 0.1 VDC at harness plug between pins. Voltage should be 3.0 ± 0.1 VDC volts at harness plug between pins. This verifies microprocessor output and wiring connections to the sensor.

00122 Check Return Air Sensor (RAT)

- ACTIVATION: Return Air Temperature Sensor (RAT) is not within range of -53 to +158°F (-47 to +70° C).
- UNIT CONTROL: If Alarm **00123 Check Air Supply Sensor** is not active: Alarm and switch to supply air control. If Alarm **00123 Check Air Supply Sensor** is active: Alarm and the System will enter Cargo Protect mode. Refer to **Section 4.11.1**.
- RESET CONDITION: Auto reset when sensor is in range or, alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Sensor**

   a. Inspect sensor and connectors. Verify there is no damage to sensor, and no damage, moisture, or corrosion in connectors.

   b. Check sensor resistance. (Refer to Note 3 in **Section 7.2**) 10,000 Ohms @ 77°F (25°C). Refer to **Section 8.9.21** for chart of resistances for different sensors.

2. **Check Sensor Wiring**

   a. Inspect connector pins and terminals at sensor connector 2MM. (See wiring schematic **Section 10**.) Verify there is no physical damage to harness, and no damage, moisture, or corrosion in connectors.

   b. Place system in PC mode. Refer to Note 2 in **Section 7.2**. Disconnect sensor from harness. Check for 3.0 ± 0.1 VDC at harness plug between pins. Voltage should be 3.0 ± 0.1 VDC volts at harness plug between pins. This verifies microprocessor output and wiring connections to the sensor.

00123	Check Air Supply Sensor

- ACTIVATION: Supply Air Temperature Sensor (SAT) is not within range of -53 to +158°F (-47 to +70° C).
- UNIT CONTROL: If Alarm **00122 Check Return Air Sensor (RAT)** is not active, Functional Parameter Temperature Control is set for Supply Air and setpoint is in perishable range: Alarm and switch to return air control. If Alarm **00122 Check Return Air Sensor (RAT)** is active, alarm and system will enter Cargo Protect mode. Refer to **4.11.1**.
- RESET CONDITION: Auto reset when sensor is in range or, alarm may be manually reset using the display mounted keys or by turning the unit off and then back on again.

NOTE

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

Corrective Actions:

1. **Check Sensor**

   a. Inspect sensor and connectors. Verify there is no damage to sensor, and no damage, moisture, or corrosion in connectors.

   b. Check sensor resistance. Refer to Note 3 in **Section 7.2**. 10,000 Ohms @ 77°F (25°C). Refer to **Section 8.9.21** for chart of resistances for different sensors.

2. **Check Sensor Wiring**

   a. Inspect connector pins and terminals at sensor connector 2MM. (See wiring schematic **Section 10**.) Verify there is no physical damage to harness, and no damage, moisture, or corrosion in connectors.

   b. Place the system in PC mode. Refer to Note 2 in **Section 7.2**. Disconnect sensor from harness. Check for 3.0 ± 0.1 VDC volts at harness plug between pins. This verifies microprocessor output and wiring connections to the sensor.

00125	Check Comp Discharge Sensor

- ACTIVATION: Compressor Discharge Temperature Sensor (CDT) is not within the range of -40° to +392°F (-40° to +200°C).
- UNIT CONTROL: Alarm Only.
- RESET CONDITION: Auto reset when sensor is in range or, alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Sensor**

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

   b. Check sensor resistance. (Refer to Note 3 in **Section 7.2**) 90,000 Ohms @ 77°F (25°C). Refer to **Section 8.9.21** for chart of resistances for different sensors.

2. **Check Sensor Wiring**

   a. Inspect connector pins and terminals 2MM. (See wiring schematic **Section 10**.) Verify there is no physical damage to harness, and no damage, moisture, or corrosion in connectors.

   b. Place the system in PC mode. Refer to Note 2 in **Section 7.2**. Disconnect sensor from harness. Check for 3.0 ± 0.1 VDC volts at harness plug between pins. This verifies microprocessor output and wiring connections to the sensor.

00126	Check Fuel Sensor Circuit

- ACTIVATION: The fuel level sensor is configured “YES” and the reading (in Unit Data) 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 using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check For Low Fuel Level**: Check fuel level in tank. Add fuel as needed.
2. **Check Sensor Fuse F8 and Wiring**
   a. Verify correct fuse, and check fuse holder for damage, see **Figure 2.7**. Replace fuse as required. Clear alarms, restart and check for repeat alarm(s).
   b. Inspect wiring from at PCM-22, and 2MM-24. Verify there is no physical damage to harness, and no damage, moisture, or corrosion in connectors.
   c. Perform sensor check procedure. Refer to **Section 8.5.7**.

NOTE

If new sensor is not available, the sensor may be configured OFF temporarily. Refer to **Section 5.2.3** Configurations.

00127	Check Suction Temp Sensor

- ACTIVATION: Compressor Suction Temperature Sensor (CST) is not within the range of -53 to +158°F (-47 to +70°C.)
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Auto reset or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Sensor**

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

   b. Check sensor resistance. Refer to Note 3 in **Section 7.2**. 10,000 Ohms @ 77°F (25°C.) See **Table 8–3** for complete table of temperatures and resistance values.

2. **Check Sensor Wiring**

   a. Inspect connector pins and terminals at sensor and connector 2MM. (See wiring schematic **Section 10**.) Verify there is no physical damage to harness, and no damage, moisture, or corrosion in connectors.

   b. Place the system in PC mode. Refer to Note 2 in **Section 7.2**. Disconnect sensor from harness. Check for 3.0 ± 0.1 VDC volts at harness plug between pins. This verifies microprocessor output and wiring connections to the sensor.

00129	Check Engine Coolant Sensor

- ACTIVATION: Engine Coolant Temperature Sensor (ENCT) is not within the range of -58 to +266°F (-50 to +130°C).
- UNIT CONTROL: Alarm Only.
- RESET CONDITION: Auto reset when sensor is in range or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Sensor**

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

   b. Check sensor resistance. Refer to Note 3 in **Section 7.2**. 10,000 Ohms @ 77°F (25°C). Refer to **Section 8.9.21** for chart of sensor resistances.

2. **Check Sensor Wiring**

   a. Inspect connector pins and terminals at ENCU. (See wiring schematic **Section 10**) Verify there is no physical damage to harness, and no damage, moisture, or corrosion in connectors.

   b. Place the system in PC mode. Refer to Note 2 in **Section 7.2**. Disconnect sensor from harness. Check for 3.0 ± 0.1 VDC volts at harness plug between pins. This verifies microprocessor output and wiring connections to sensor.

00130 Check Engine RPM Sensor

- ACTIVATION: If ambient temperature is above 32°F (0°C), and this is the second or third start attempt, and the engine oil pressure switch is closed (oil pressure good), and engine speed is sensed at less than 1000; **OR**, if ambient is below 32°F (0°C) and the DC amp draw is more than 2 amps, and this is the second or third start attempt, and engine speed is sensed at less than 1000.
- UNIT CONTROL: Alarm Only and engine will be considered running.
- RESET CONDITION: Auto reset when engine speed is greater than 1,000 rpm or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check for Alarm 00041 Engine Stalled**: When alarms 00041 and 00130 occur at the same time, generally, the engine has run out or is running out of fuel. This causes the engine to surge.
   a. Check fuel in tank and add fuel as necessary.
   b. Check fuel lines between the fuel tank and the fuel pump inlet to ensure air is not being drawn in.
2. **Check Engine Speed Sensor (ENSSN)**
   a. Check actual engine speed using a hand held tachometer and compare with speed shown in unit data. Must be ± 20 rpm. Must be a steady reading.
   b. Inspect sensor, connector pins and terminals. Verify there is no physical damage to sensor, and no damage or corrosion in connections.
   c. Check power from ENCU. Should read approximately +12 VDC from terminal ENCU-43 to ENSSN-3.
   d. Check ground to ENCU. Check wiring from terminal ENCU-20 to ENSSN-1.
   e. Check signal to ENCU. Check wiring from terminal ENCU-2 to ENSSN-2.
3. **Check Circuits with Test Sensor**: Substitute known good sensor and check unit data reading (Refer to **Section 3.14**). Must be within ± 50 rpm of reading on tachometer.

00131 Check Evap Temp Sensor

- ACTIVATION: Evaporator Outlet Temperature Sensor (EVOT) is not within the range of -53 to +158°F (-47 to +70°C)
- UNIT CONTROL: Alarm only and superheat for EVXV will be calculated using SAT or DTT if alarm **00123 Check Air Supply Sensor** is active.
- RESET CONDITION: Auto reset when EVOT is in range or, alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Sensor**
   a. Inspect sensor and connector. Verify there is no damage to sensor, and no damage, moisture, or corrosion in connector.
   b. Check EVOT resistance. Refer to Note 3 in **Section 7.2**. Should be 10,000 Ohms @ 77°F (25°C.) See **Table 8–3** for complete table of temperatures and resistance values.
2. **Check Sensor Wiring**
   a. Inspect connector pins and terminals at sensor and connector 2MM. (See wiring schematic **Section 10**.) Verify there is no physical damage to harness, and no damage, moisture, or corrosion in connectors.
   b. Place the system in PC mode. Refer to Note 2 in **Section 7.2**. Disconnect sensor from harness. Check for 3.0 ± 0.1 VDC volts at harness plug between pins. This verifies microprocessor output and wiring connections to sensor.
3. **Check Airflow Through Evaporator Coil/Section**
   a. Inspect coil. Ninety percent or more of the coil surface must be undamaged. Coil must be clean.
   b. Check coil airflow (with unit running). Even airflow through the entire coil. No “dead” spots.
   c. Check return air bulkhead, air chute. Verify good air flow and make sure return air not restricted. Air chute should be in good condition.

00132 Check Defrost Term 2 Sensor

NOTE

The APX Control System uses one Defrost Termination Sensor (DTT) and that sensor will activate this “CHECK DEFROST TERM 2 SENSOR” alarm.

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

NOTE

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

Corrective Actions:

1. **Check Sensor**

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

   b. Check sensor resistance. (Refer to Note 3 in **Section 7.2**) 10,000 Ohms @ 77°F (25°C.) See **Section 8.9.21** for complete table of temperatures and resistance values.

2. **Check Sensor Wiring**

   a. Inspect connector pins and terminals at sensor at connector 2MM. (See wiring schematic **Section 10**.) Verify there is no physical damage to harness, and no damage, moisture, or corrosion in connectors.

   b. Place the system in PC mode. Refer to Note 2 in **Section 7.2**. Disconnect sensor from harness. Check for 3.0 ± 0.1 VDC volts at harness plug between pins. This verifies microprocessor output and wiring connections to sensor.

00133	Check Remote Temp Sensor 1
00134	Check Remote Temp Sensor 2

- ACTIVATION: Remote Temperature Sensor (REMSN1 or REMSN2) is not within the range of -53 to +158°F (-47 to +70°C.)
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Auto Reset when 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 (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

If a Sensor is Installed:

1. **Check Sensor**

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

   b. Check sensor resistance Refer to Note 3 in **Section 7.2**. Should be 10,000 Ohms @ 77°F (25°C). Refer to **Section 8.9.21** for chart of resistances for different sensors.

2. **Check Sensor Wiring**

   a. Inspect connector pins and terminals at sensor, REM connector and 2CCB. (See wiring schematic **Section 10**.) Verify there is no physical damage to harness, and no damage, moisture, or corrosion in connectors.

   b. Place the system in PC mode. Refer to Note 2 in **Section 7.2**. Disconnect sensor from harness. Check for 3.0 ± 0.1 VDC volts at harness plug between pins. This verifies microprocessor output and wiring connections to sensor.

If a Sensor is Not Installed

1. **Check Configurations**: Any switch/sensor that is not present in the unit should not be Configured “ON”. Correct Configurations.

2. **Check REM Connector**: Locate and inspect 10 position connector for optional sensors and switches. (see wiring schematic **Section 10**). Connector must have cap on, no corrosion or moisture inside connector. If there is a problem with the connector and there are no remote sensors or switches in the unit, the connector may be removed and each individual wire separated from the others, terminated and insulated with heat shrink.

P00141 Pretrip Stopped by User

- ACTIVATION: Pretrip cycle was stopped by user before the Pretrip cycle ended automatically.
- UNIT CONTROL: Alarm Only.
- RESET CONDITION: Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check for any Pretrip Alarms**: Check the alarm list for any Active Pretrip alarms. Alarm conditions must be corrected and the alarm cleared to continue.
2. **Rerun Pretrip Check**

   a. Clear Active Alarm List, then run Pretrip and check for any new alarms.

   b. Allow to terminate automatically. Pretrip cycle operates normally.

P00143 Check Clutch Circuit

- ACTIVATION: The circuit current draw is outside the normal range.
- UNIT CONTROL: Pretrip will fail in Test #2 and display “PRETRIP FAIL AND COMPLETED”.
- RESET CONDITION: Auto reset if Pretrip is started again, or Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Coil**

   a. Inspect coil and connector pins and terminals. Verify no damage to coil. Verify no damaged or corroded pins.

   b. Check resistance of coil. Refer to **Section 2.11** for specifications.

   c. Use Component Test mode (Refer to **Section 5.2.4**) to test actual current draw of the circuit. Refer to **Section 2.11** for specifications. Verify that the actual current is within specifications.

2. **Check Power and Wiring**

   a. Use Component Test mode (Refer to **Section 5.2.4**) to energize circuit. Check for power at CLH terminal A and 3MM-11. Minimum 11 VDC. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.

   b. Check for ground at CLH terminal B (including SP-3) to GND 1RING1. Good ground. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.

P00144 Check UL1 Circuit

- ACTIVATION: The circuit current draw is outside the normal range.
- UNIT CONTROL: Pretrip will fail in test 2 and display “PRETRIP FAIL AND COMPLETED”.
- RESET CONDITION: Auto reset if Pretrip is started again, or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

Corrective Actions:

Check UL1 Operation: Refer to procedure for alarm **00085 Check UL1 Circuit**. Alarm condition must be corrected and the alarm cleared to continue.

P00148 Check SV1 Circuit

- ACTIVATION: The circuit current draw is outside the normal range.
- UNIT CONTROL: Pretrip will fail in test 2 and display “PRETRIP FAIL AND COMPLETED”.
- RESET CONDITION: Auto reset if Pretrip is started again, or Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

Corrective Actions:

Check SV1 Operation: Refer to procedure for alarm **00078 Check SV1 Circuit**. Alarm condition must be corrected and the alarm cleared to continue.

P00150 Check SV4 Circuit

- ACTIVATION: The circuit current draw is outside the normal range.
- UNIT CONTROL: Pretrip will fail in test 2 and display “PRETRIP FAIL AND COMPLETED”.
- RESET CONDITION: Auto reset if Pretrip is started again, or Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

Corrective Actions:

Check SV4 Operation: Refer to procedure for alarm **00079 Check SV4 Circuit**. Alarm condition must be corrected and the alarm cleared to continue.

P00151 Check Engine Preheat Circuit

- ACTIVATION: The circuit current draw is outside the normal range.
- UNIT CONTROL: Pretrip will fail in test 2 and display “PRETRIP FAIL AND COMPLETED”.
- RESET CONDITION: Auto reset if Pretrip is started again or alarm may be manually reset using the display mounted keys or by turning the unit off then back on again.

Corrective Actions:

Check Glow Plug Operation: Refer to procedure for alarm **00040 Check Engine Preheat Circuit**. Alarm condition must be corrected and the alarm cleared to continue.

P00152 Check Fuel/Speed Actuator Circuit

- ACTIVATION: The circuit current draw is outside the normal range.
- UNIT CONTROL: Pretrip will fail in test 2 and display “PRETRIP FAIL AND COMPLETED”.
- RESET CONDITION: Auto reset if Pretrip is started again or alarm may be manually reset using the display mounted keys or by turning the unit off then back on again.

NOTE

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

Corrective Actions:

Check ENCU Operation: Refer to procedure for alarm **05012 Check ENCU Power Circuit**. Alarm condition must be corrected and the alarm cleared to continue.

P00153 Check Return Air Sensor

- ACTIVATION: Return Air Temperature Sensor (RAT) is not within the range of -53 to +158°F (-47 to +70°C).
- UNIT CONTROL: Pretrip will fail and display “PRETRIP FAIL AND COMPLETED”.
- RESET CONDITION: Auto reset if Pretrip is started again, or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

Corrective Actions:

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

P00154 Check Supply Air Sensor

- ACTIVATION: Supply Air Temperature Sensor (SAT) is not within the range of -53 to +158°F (-47 to +70°C).
- UNIT CONTROL: Pretrip will fail and display “PRETRIP FAIL AND COMPLETED”.
- RESET CONDITION: Auto reset if Pretrip is started again, or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

Corrective Actions:

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

P00155 Check Coolant Temp Sensor

- ACTIVATION: Engine Coolant Temperature Sensor (ENCT) is not within the range of -58 to +266°F (-50 to +130°C).
- UNIT CONTROL: Pretrip will fail and display “PRETRIP FAIL AND COMPLETED”.
- RESET CONDITION: Auto reset if Pretrip is started again, or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

Corrective Actions:

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

P00157 Check Battery Current

- ACTIVATION: With all circuits off, current flow of more than +1.5 to -2.0 amps is detected in the 12 VDC electrical circuits. If this alarm occurs, Pretrip Test #2 will be skipped and Pretrip Test #3 will start. Refer to **Section 3.6** for Pretrip information.
- UNIT CONTROL: Pretrip will fail and display “PRETRIP FAIL AND COMPLETED”.
- RESET CONDITION: Auto reset if Pretrip is started again, or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check DC Current Draw and Sensor**

   a. Observe current draw reading in unit data. Reading must be between +1.5 to -2.0 Amps.

   b. Check power between 2MM-29 and 2MM-23 and between PCM-31 and PCM-30 5 VDC. If not, check connectors and wiring between terminals for damage, moisture or corrosion.

   c. Check for continuity from 2MM-12 to PCM-29. If good continuity not present, check connectors and wiring between terminals for damage, moisture or corrosion.

2. **Check Individual Circuits**: Isolate individual circuits and test amp draw. Must be in range. (Refer to **Section 2.11** for correct electrical values.)
3. **Check for Parasitic Loads**: Check for electrical loads that are drawing current with all circuits OFF. Check for non-factory installed devices such as lift gates, inside lights, satellite systems, etc. These devices must be wired so as to not draw current during Pretrip testing.

P00158 Check Ambient Air Sensor

- ACTIVATION: Ambient Air Temperature Sensor (AAT) is not within the range of -53 to +158°F (-47 to +70°C).
- UNIT CONTROL: Pretrip will fail and display “PRETRIP FAIL AND COMPLETED”.
- RESET CONDITION: Auto reset if Pretrip is started again, or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

Corrective Actions:

Check Sensor Operation: Refer to procedure for alarm **00121 Check Ambient Air Sensor**. Alarm condition must be corrected and the alarm cleared to continue.

P00160 Check Discharge Temp Sensor

- ACTIVATION: Compressor Discharge Temperature Sensor (CDT) is not within the range of -40 to +392°F (-40 to +200°C.)
- UNIT CONTROL: Pretrip will fail and display “PRETRIP FAIL AND COMPLETED”.
- RESET CONDITION: Auto reset if Pretrip is started again or alarm may be manually reset using the display mounted keys or by turning the unit off then back on again.

Corrective Actions:

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

P00161 Check Suction Temp Sensor

- ACTIVATION: Compressor Suction Temperature Sensor (CST) is not within the range of -40 to +392°F (-40 to +200°C.)
- UNIT CONTROL: Pretrip will fail and display "PRETRIP FAIL AND COMPLETED".
- RESET CONDITION: Auto reset if Pretrip is started again or alarm may be manually reset using the display mounted keys or by turning the unit off then back on again.

Corrective Actions:

Check Sensor Operation: Refer to procedure for alarm **00127 Check Suction Temp Sensor**. Alarm condition must be corrected and the alarm cleared to continue.

P00162 Check AFA Solenoid Circuit

- ACTIVATION: The (AFAR) circuit current draw is outside the normal range.
- UNIT CONTROL: Pretrip will fail and display "PRETRIP FAIL AND COMPLETED".
- RESET CONDITION: Auto reset if Pretrip is started again, or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

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

Corrective Actions:

Check Relay Operation: Refer to procedure for alarm **00090 CHK AFA Solenoid Circuit**. Alarm condition must be corrected and the alarm cleared to continue.

P00164 Check UL2 Circuit

- ACTIVATION: The circuit current draw is outside the normal range.
- UNIT CONTROL: Pretrip will fail in Test #2 and display "PRETRIP FAIL AND COMPLETED".
- RESET CONDITION: Auto reset if Pretrip is started again, or alarm may be manually reset using the display mounted keys or 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). (Refer to Note 1 in **Section 7.2**) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

Check UL2 Operation: Refer to procedure for **00086 Check UL2 Circuit**. Alarm condition must be corrected and the alarm cleared to continue.

P00165 Cannot Pump Down

- ACTIVATION: With SV1, SV2, and SV4 in the closed position, the compressor is not able to pull the low side of the refrigerant system down to 10 PSIG (0.68 bar).
- UNIT CONTROL: Pretrip will abort and “PRETRIP FAILED IN TEST 12, 13 or 14” will be displayed in MessageCenter.
- RESET CONDITION: Auto reset if Pretrip is started again, or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Compressor Drive Coupling:** Verify that compressor coupling is intact and the compressor crankshaft is turning. Repair as required.
2. **Check System Pressure**: Check and compare compressor discharge and suction pressures with those shown in unit data. Refer to Section 8.9.12 for instruction on comparison.
3. **Manually Check Refrigeration System**: Perform a low side pump down, refer to Section 8.7.2. Suction pressure must drop to at least 0 psig. If this check does not pass, continue to Check Compressor Pump Down.
4. **Manually Test Refrigeration System**: See Refrigeration Troubleshooting, Section 9.3.3, for “System Will Not Pump Down”. Must pass all tests.

P00174 Check Low Speed RPM

- ACTIVATION:
  - In Test #7: With the CAN calling for low speed, engine speed is NOT between: 1200 and 1500 rpm.
  - In Test #9: 15 seconds after the High Speed Pretrip Test #8, engine speed has NOT dropped back to the low speed range (within 15 seconds) as shown above.

NOTE

Test will be skipped if engine speed sensor alarm **00130 Check Engine RPM Sensor** is active.

- UNIT CONTROL: Pretrip will fail and display “PRETRIP FAIL AND COMPLETED”.
- RESET CONDITION: Auto reset if Pretrip is started again or alarm may be manually reset using the display mounted keys or by turning the unit off then back on again.

NOTE

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

Corrective Actions:

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

P00175 Check High Speed RPM

- ACTIVATION: In Test #8 with the CAN calling for high speed, engine speed is NOT between 1650 and 1950 rpm.
- UNIT CONTROL: Pretrip will fail and display “PRETRIP FAIL AND COMPLETED”.
- RESET CONDITION: Auto reset if Pretrip is started again, or Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

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

P00177 Check EXV (EVXV) Superheat

- ACTIVATION: With the unit running in Test #11, after the control system closes the EVXV to 0%, evaporator pressure fails to drop by 20 psig (1.36 bar) or fails to go below 0 psig / bar **OR** the EVXV appears not to be opening to the full capacity position.
- UNIT CONTROL: Pretrip will fail and display “PRETRIP FAIL AND COMPLETED”.
- RESET CONDITION: Auto reset if Pretrip is started again or alarm may be manually reset using the display mounted keys or by turning the unit off then back on again.

NOTE

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

Corrective Actions:

1. **Check Refrigerant Level**: Refer to **Section 8.7.2**.
2. **Check System Pressures**: Install manifold gauge set to check and compare actual compressor discharge and suction pressures with those shown on the microprocessor display. Suction and Evaporator Outlet pressures must be above 3 psig (0.2 bar.) Refer to **Section 8.9.12** for instruction on comparison.
3. **Check EVXV**

   a. Visually inspect EVXV for damage. Check to see if coil is seated on valve properly.

   b. Inspect EVXV coil and wire connections. Verify there is no physical damage to harness, and no damage, moisture, or corrosion in connectors.

   c. Check EVXV operation. See **Section 8.9.9**.

   d. Check basic refrigeration system. Pressures normal. Compressor operation normal.

   e. Check the EVXV electrical system for good continuity in all circuits from microprocessor to EVXV.

   f. Inspect component and wire connections. No physical damage to harness.

   g. Inspect harness connector pins. (See wiring schematic **Section 10**.) Verify there is no damage, moisture, or corrosion in connectors.
4. **Check EVOT**: Check the sensor. Refer to procedure for alarm **00131 Check Evap Temp Sensor**.

P00178 Check UL1

- ACTIVATION: The pressure differential between suction and discharge pressures did not change as expected when the Front Unloader (UL1) was de-energized / loaded (discharge pressure should rise and suction pressure should drop) or when it was energized / unloaded (discharge pressure should drop and suction pressure should rise.
- UNIT CONTROL: Pretrip will fail in Test #5 and display “PRETRIP FAIL AND COMPLETED”.
- RESET CONDITION: Auto reset if Pretrip is started again or alarm may be manually reset using the display mounted keys or by turning the unit off then back on again.

NOTE

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

Corrective Actions:

1. **Check Wiring to CDP and CSP**

   a. Verify that correct wires are connected to each transducer. Plugs to transducers are the same. The correct wire plug must be connected to the proper transducer. The CDP connector is identified with a red tape band while the CSP connector is identified with a blue band.

   b. Verify that correct transducer is being used in each position. Mechanical connections to transducers are the same. The discharge transducer should have a red marking dot on it. The suction transducer should have a blue marking dot on it.

2. **Check for Alarms**: Check for alarm **00085 Check UL1 Circuit** or **P00144 Check UL1 Circuit**. Alarm conditions must be corrected and the alarm cleared to continue.

3. **Check System Pressures**

   a. Install manifold gauge set to check and compare actual compressor discharge and suction pressures with those shown in Unit Data. Suction and Evaporator Outlet pressures must be above 3 psig (0.2 bar). Refer to **Section 8.9.12** for instruction on comparison.

   b. Check transducer operation. Refer to **Section 8.9.12**.

4. **Check Front Unloader (UL1) Operation**: Refer to **Section 8.8.5.5**, Unloader must load and unload properly.

P00180 Check Suction Modulation Valve

- ACTIVATION: With the unit running in Pretrip Test #10, after the microprocessor attempts to close CSMV, the suction pressure fails to drop to the proper range.
- UNIT CONTROL: Pretrip will fail and display “PRETRIP FAIL IN TEST 10”.
- RESET CONDITION: Auto reset if Pretrip is started again or alarm may be manually reset using the display mounted keys or by turning the unit off then back on again.

NOTE

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

Corrective Actions:

1. **Check Wiring to CDP and CSP**
   a. Verify that correct wires are connected to each transducer. Plugs to transducers are the same. The correct wire plug must be connected to the proper transducer. The CDP connector is identified with a red tape band while the CSP connector is identified with a blue band.
   b. Verify that correct transducer is being used in each position. Mechanical connections to transducers are the same. The Discharge Transducer should have a red marking dot on it. The Suction Transducer should have a blue marking dot on it.
2. **Check Compressor Operation**: Check compressor operation. If compressor does not pass all tests, repair or replace compressor. Refer to **Section 8.8.1**.
3. **Check Suction Modulating Valve**
   a. Visually inspect CSMV. No damage to valve.
   b. Inspect CSMV coil and wire connections. Refer to **Section 8.9.8**. Verify there is no damage to coil, and no damage, moisture, or corrosion in connector.
   c. Check CSMV operation. Refer to **Section 8.9.8**. Must perform correctly.
   d. Check wires from CSMV to microprocessor. Verify there is no visual damage to wires. Continuity test verifies that each wire is good.

P00181 Check SV4 Valve
• ACTIVATION: Suction pressure did not rise within range and discharge pressure did not drop within range when SV4 was energized (opened). • UNIT CONTROL: Alarm only. • RESET CONDITION: Auto reset if Pretrip is started again or alarm may be manually reset using the display mounted keys or by turning the unit off then back on again. **NOTE** Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (Refer to Note 1 in **Section 7.2**) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary. **Corrective Actions:** 1. **Check for Alarms**: Check for alarm **00079 Check SV4 Circuit** or **P00150 Check SV4 Circuit**. Alarm conditions must be corrected and the alarm cleared to continue 2. **Check System Pressures**: Check and compare compressor discharge and suction pressures with those shown in unit data. Refer to **Section 8.9.12** for instruction on comparison. 3. **Repair SV4:** Refer to SV4 Checkout Procedure in **Section 8.9.6**.

P00182 Check SV1 Valve
• ACTIVATION: Discharge pressure did not decrease when SV1 was de-energized (opened) as expected in Heat Pretrip, or discharge pressure did not increase as expected when SV1 was energized (closed) in Cool Pretrip. • UNIT CONTROL: Alarm only. • RESET CONDITION: Auto reset if Pretrip is started again or alarm may be manually reset using the display mounted keys or by turning the unit off then back on again. **NOTE** Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (Refer to Note 1 in **Section 7.2**) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary. **Corrective Actions:** 1. **Check for Alarms**: Check for **00078 Check SV1 Circuit** or **P00148 Check SV1 Circuit**. Alarm conditions must be corrected and the alarm cleared to continue. 2. **Check System Pressures**: Check and compare compressor discharge and suction pressures with those shown in unit data. Refer to **Section 8.9.12** for instruction on comparison. 3. **Check SV1:** Refer to SV1 Checkout Procedure in **Section 8.9.5**.

P00186 Check Evap Outlet Temp
• ACTIVATION: Evaporator Outlet Temperature Sensor (EVOT) is not within the range of -53 to +158°F (-47 to +70°C.) • UNIT CONTROL: Pretrip will fail and display “PRETRIP FAIL AND COMPLETED”. • RESET CONDITION: Auto reset if Pretrip is started again, or alarm may be manually reset via keypad or by turning the unit off, then back on again. **Corrective Actions:** **Check Sensor**: Refer to procedure for alarm **00131 Check Evap Temp Sensor**.

P00191 Check UL2

- ACTIVATION: The pressure differential between suction and discharge did not change as expected when the Rear Unloader (UL2) was de-energized / loaded (discharge pressure should rise and suction pressure should drop) or when it was energized / unloaded (discharge pressure should drop and suction pressure should rise.
- UNIT CONTROL: Pretrip will fail in Test #5 and display “PRETRIP FAIL AND COMPLETED”.
- RESET CONDITION: Auto reset if Pretrip is started again, or Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Wiring to CDP and CSP**
   a. Verify that correct wires are connected to each transducer. Plugs to transducers are the same. The correct wire plug must be connected to the proper transducer. The CDP connector is identified with a red tape band while the CSP connector is identified with a blue band.
   b. Verify that correct transducer is being used in each position. Mechanical connections to transducers are the same. The Discharge Transducer should have a red marking dot on it. The Suction Transducer should have a blue marking dot on it.
2. **Check Alarms**: Check for **00086 Check UL2 Circuit** or **P00164 Check UL2 Circuit** (Check UL2). Alarm conditions must be corrected and the alarm cleared to continue
3. **Check System Pressures**: Install manifold gauge set and check and compare compressor discharge and suction pressures with those shown in Unit Data. Refer to **Section 8.9.12** for instruction on comparison.
4. **Check Rear Unloader (UL2) Operation**: Check operation of Rear Unloader (UL2) See **Section 8.8.5.5**. Unloader must load and unload properly.

P00192 Check SV2 Circuit

- ACTIVATION: The circuit current draw is outside the normal range.
- UNIT CONTROL: Pretrip will fail in Test #2 and display “PRETRIP FAIL AND COMPLETED”.
- RESET CONDITION: Auto reset if Pretrip is started again, or alarm may be manually reset via keypad or by turning the unit off, then back on again.

Corrective Actions:

Check SV2 Speed Operation: Refer to procedure for alarm **00097 Check SV2 Circuit**. Alarm condition must be corrected and the alarm cleared to continue.

P00194 High Suction Pressure

- ACTIVATION: This alarm is generated during Test #4 in Cool Pretrip, suction pressure is higher than normal.
- UNIT CONTROL: Alarm Only
- RESET CONDITION: Auto reset if Pretrip is started again, or Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Wiring to CDP and CSP**
   a. Verify that correct wires are connected to each transducer. Plugs to transducers are the same. The correct wire plug must be connected to the proper transducer. The CDP connector is identified with a red tape band while the CSP connector is identified with a blue band.
   b. Verify that correct transducer is being used in each position. Mechanical connections to transducers are the same. The Discharge Transducer should have a red marking dot on it. The Suction Transducer should have a blue marking dot on it.
2. **Check Alarms**: Check for **P00181 Check SV4 Valve**. Alarm conditions must be corrected and the alarm cleared to continue.
3. **Check System Pressures**
   a. Install manifold gauge set and check and compare compressor discharge and suction pressures with those shown in Unit Data. Refer to **Section 8.9.12** for instruction on comparison.
   b. Check transducer operation Refer to **Section 8.9.12**.
4. **Check Low Side Operating Conditions:** Refer to procedure for alarm **00027 High Suction Pressure**. Alarm condition must be corrected and the alarm cleared to continue.
5.

P00196 High Discharge Pressure

- ACTIVATION: This alarm is generated during Test #4 in Cool Pretrip. Discharge pressure is higher than normal. (*"Normal" discharge pressure for systems operating in Cool mode can be estimated by taking the temperature of the air entering the condenser coil (Ambient Air Temperature AAT) and adding 30°F (16.6° C) to it, then looking at a pressure temperature chart-see* **Table 8–3** *for the corresponding pressure.*)
- UNIT CONTROL: Alarm Only
- RESET CONDITION: Auto reset if Pretrip is started again, or Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Wiring to CDP and CSP**
   a. Verify that correct wires are connected to each transducer. Plugs to transducers are the same. The correct wire plug must be connected to the proper transducer. The CDP connector is identified with a red tape band while the CSP connector is identified with a blue band.
   b. Verify that correct transducer is installed in each position. Mechanical connections are the same. The CDT should have a red dot on it while the CST has a blue dot.
2. **Check System Pressures**: Install manifold gauge set and check and compare compressor discharge and suction pressures with those shown in Unit Data. Refer to **Section 8.9.12** for instruction on comparison.
3. **Check High Side Operating Conditions:** Refer to procedure for alarm **00013 High Discharge Pressure**. Alarm condition must be corrected and the alarm cleared to continue.

P00197 Check Clutch

- ACTIVATION: Return Air Temperature - Supply Air Temperature is outside the normal range.
- UNIT CONTROL: Alarm Only
- RESET CONDITION: Auto reset if Pretrip is started again, or Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

Check Clutch: Check fan clutch. Check upper and lower fan belt tension and condition. Verify no glazing, cracking, or slipping. Refer to **Section 8.6**. Replace if required.

P00198 Low Discharge Pressure

- ACTIVATION: In Pretrip heat, the compressor discharge pressure did not rise to normal. ("Normal" discharge pressure for systems operating in Pretrip heat can be estimated by adding 80 psig (5.5 bars) toe the saturation temperature of the air entering the condenser (ATS reading).
- UNIT CONTROL: Pretrip will abort and "PRETRIP FAILED IN TEST 4" will be displayed in MessageCenter.
- RESET CONDITION: Auto reset if Pretrip is started again, or Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Wiring to CDP and CSP**
   a. Verify that correct wires are connected to each transducer. Plugs to transducers are the same. The correct wire plug must be connected to the proper transducer. The CDP connector is identified with a red tape band while the CSP connector is identified with a blue band.
   b. Verify that correct transducer is installed in each position. Mechanical connections are the same. The CDT should have a red dot on it while the CST has a blue dot.
2. **Check for Alarms**
   a. Check for **00121 Check Ambient Air Sensor** or **P00158 Check Ambient Air Sensor**. Alarm conditions must be corrected and the alarm cleared to continue.
   b. Check Ambient Sensor reading. Must be within ±10°F (±5.5°C) of actual temperature.
3. **Check System Pressures**
   a. Install manifold gauge set and check and compare compressor discharge and suction pressures with those shown in Unit Data. Refer to **Section 8.9.12** for instruction on comparison.
   b. Check transducer operation. Refer to **Section 8.9.12**.
4. **Check Refrigerant Charge:** Refer to **Section 8.7.2**.
5. **Check SV1**: Refer to SV1 Checkout Procedure in **Section 8.9.5**.
6. **Check Compressor**
   a. Check the operation of the high side of the compressor by covering the condenser inlet air. Discharge pressure must rise a minimum of 50 to 100 psig (3.4 to 6.9 bars).
   b. Remove compressor heads and inspect condition of cylinder suction valves, cylinder discharge valves and gaskets. Must be in good condition. Refer to **Section 8.8**.

P00200 Check UL1 Cylinders

- ACTIVATION: A problem has been detected inside the front cylinder head of the compressor with a cylinder suction valve, cylinder discharge valve, head gasket or valve plate gasket.
- UNIT CONTROL: Alarm Only
- RESET CONDITION: Auto reset if Pretrip is started again, or Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Refrigerant Charge:** Refer to **Section 8.7.2**.
2. **Check System Pressures:** Install manifold gauge set to check and compare actual compressor discharge and suction pressures with those shown in Unit Data. Refer to **Section 8.9.12** for instruction on comparison.
3. **Check Compressor Front Head Cylinder Valves and Gaskets:** Remove compressor front head and inspect condition of cylinder suction valves, cylinder discharge valves and gaskets. Must be in good condition. Refer to **Section 8.8**.

P00201 Check UL2 Cylinders

- ACTIVATION: A problem has been detected inside the rear cylinder head of the compressor with a cylinder suction valve, cylinder discharge valve, head gasket or valve plate gasket.
- UNIT CONTROL: Alarm Only
- RESET CONDITION: Auto reset if Pretrip is started again, or Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check System Pressures:** Install manifold gauge set to check and compare actual compressor discharge and suction pressures with those shown in Unit Data. Refer to **Section 8.9.12** for instruction on comparison.
2. **Check Compressor Rear Head Cylinder Valves and Gaskets**: Remove compressor front head and inspect condition of cylinder suction valves, cylinder discharge valves and gaskets. Must be in good condition. Refer to **Section 8.8**.

P00202 High Side Leak

- ACTIVATION: Refrigerant pressure is leaking past one of the components in the high pressure side of the refrigeration system into the low pressure side.
- UNIT CONTROL: Alarm Only
- RESET CONDITION: Auto reset if Pretrip is started again, or Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check System Pressures:** Install manifold gauge set to check and compare actual compressor discharge and suction pressures with those shown in Unit Data. Refer to **Section 8.9.12** for instruction on comparison.
2. **Check Compressor**
   a. Perform Pump-Down Test. Refer to **Section 8.8.1**. Must hold a vacuum and not equalize in a short period of time.
   b. Cover condenser and build-up discharge pressure. Must be able to raise pressure to 400 psig (27.2 bar).
   c. Disassemble and inspect compressor valve plates, cylinder suction valves, cylinder discharge valves and pistons, etc. Must be intact, clean, and in good working order. Refer to **Section 8.8**.

P00203 CHK Discharge Check Valve

- ACTIVATION: Refrigerant is leaking backwards through the Discharge Check Valve.
- UNIT CONTROL: Alarm Only
- RESET CONDITION: Auto reset if Pretrip is started again, or Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Pump Down Low Side:** Perform pump down and check valve for leakage. Refer to **Section 8.9.10**.
2. **Disassemble and Check Condition:** Refer to **Section 8.9.10**.

P00204 Low Suction Pressure

- ACTIVATION: Suction Pressure is less than -10inHg (-0.34 bar) for more than 30 continuous seconds, or less than -16inHg (-0.54 bar) for more than five seconds at any time during Pretrip.
- UNIT CONTROL: Pretrip will abort and “PRETRIP FAILED IN TEST X” will be displayed in MessageCenter indicating in which test the suction pressure was too low.
- RESET CONDITION: Auto reset if Pretrip is started again, or Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Fan Belts:** Check upper and lower fan belt tension and condition. Verify no glazing, no cracking, no slipping. Refer to **Section 8.6**. Replace if required.
2. **Check System Pressures:** Install manifold gauge set to check and compare actual compressor discharge and suction pressures with those shown in Unit Data. Refer to **Section 8.9.12** for instruction on comparison.
3. **Manually Defrost Unit:** Defrost unit and terminate automatically. Typical defrost cycle time is 5-20 minutes. Suction pressure should rise gradually during cycle.
4. **Check Airflow Through Evaporator Coil/Section**
   a. Inspect coil Ninety percent or more of the coil surface must be undamaged. Coil must be clean.
   b. Check airflow (with unit running). Even airflow through the entire coil. No “dead” spots.
   c. Check return air bulkhead, air chute. Good air flow. Return air not restricted. Air chute in good condition.
   d. Check fan clutch. Must be fully engaged.
   e. Check upper and lower fan belt tension and condition. Verify no glazing, cracking, or slipping. Refer to **Section 8.6**. Replace if required.
5. **Check Refrigerant Charge**: Refer to **Section 8.7.2**.
6. **Check Expansion Valve (EVXV)**
   a. Visually inspect valve. Check that coil is seated properly.
   b. Check valve. Refer to **Section 8.9.9**.
7. **Check CSMV**: Check compressor suction modulation valve. Refer to **Section 8.9.8**.

P00205 CHK Defrost TERM 2 Sensor

NOTE

The APX Control System uses one Defrost Termination Sensor (DTT) and that sensor will trigger this "CHK DEFROST TERM 2 SENSOR" alarm.

- ACTIVATION: Defrost Termination Temperature Sensor is not within the maximum range of -53°F to +158°F (-47°C to +70°C).
- UNIT CONTROL: Alarm and defrost cycle will terminate.
- RESET CONDITION: Auto reset if Pretrip is started again, or Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Defrost Termination Temperature Sensor 2 (DTT)**
   a. Inspect Defrost Termination Temperature Sensor 2 and connector, no damage to sensor, no damage or corrosion in connector 1MP plug is connected tightly to microprocessor. No wires are pushed back through plug.
   b. Check Defrost Termination Temperature Sensor 2 resistance. 10,000 Ohms @ 77°F (25°C). Refer to **Section 8.9.21** for chart of resistances for different sensors.
2. **Check Defrost Termination Temperature Sensor 2 Wiring**: Inspect harness and control box connector pins and terminals (See wiring schematic **Section 10**.) No physical damage to harness. No damaged or corroded pins.

00223 Engine Maintenance Due

- ACTIVATION: 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 using the display mounted keys.

Corrective Actions:

1. **Check Unit Maintenance Records**: Schedule unit into service facility for maintenance. Must be done soon!
2. **Perform Maintenance**: Perform appropriate engine and unit maintenance. Follow instructions on proper maintenance form.
3. **Reset Engine Maintenance Hour Meter**
   a. Check that the Engine Maintenance Hour Meter interval is set for your requirements. Reset configured Interval if required.
   b. Reset Engine Maintenance Hour Meter for the next service interval. Hour Meter reset is a Functional Parameter. Follow maintenance interval recommendations in **Section 8.2**.

00225	General Maintenance Due

- ACTIVATION: 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 using the display mounted keys.

Corrective Actions:

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

00226	Service Soon - PM #1 Due

- ACTIVATION: 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.

Corrective Actions:

1. **Check Unit Maintenance Records**: Schedule unit into service facility for maintenance. Must be done soon!
2. **Perform Maintenance**: Perform appropriate engine and unit maintenance. Follow instructions on proper maintenance form.
3. **Reset Maintenance Hour Meter #1**
   a. Check that the Maintenance Hour Meter #1 interval is set for your requirements. Reset configured Interval if required.
   b. Reset Maintenance Hour Meter #1 for the next service interval. Hour Meter reset is a Functional Parameter. Follow maintenance interval recommendations in Section 8.2.

00227 Service Soon - PM #2 Due

- ACTIVATION: 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 using the display mounted keys.

Corrective Actions:

1. **Check Unit Maintenance Records**: Schedule unit into service facility for maintenance. Must be done soon!
2. **Perform Maintenance**: Perform appropriate engine and unit maintenance. Follow instructions on proper maintenance form.
3. **Reset Maintenance Hour Meter #2**
   a. Check that the Maintenance Hour Meter #2 interval is set for your requirements. Reset configured Interval if required.
   b. Reset Maintenance Hour Meter #2 for the next service interval. Hour Meter reset is a Functional Parameter. Follow maintenance interval recommendations in **Section 8.2**.

00228 Service Soon - PM #3 Due

- ACTIVATION: 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 using the display mounted keys.

Corrective Actions:

1. **Check Unit Maintenance Records**: Schedule unit into service facility for maintenance. Must be done soon!
2. **Perform Maintenance**: Perform appropriate engine and unit maintenance. Follow instructions on proper maintenance form.
3. **Reset Maintenance Hour Meter #3**
   a. Check that the Maintenance Hour Meter #3 interval is set for your requirements. Reset configured Interval if required.
   b. Reset Maintenance Hour Meter #3 for the next service interval. Hour Meter reset is a Functional Parameter. Follow maintenance interval recommendations in **Section 8.2**.

00229 Service Soon - PM #4 Due

- ACTIVATION: 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.

Corrective Actions:

1. **Check Unit Maintenance Records**: Schedule unit into service facility for maintenance. Must be done soon!
2. **Perform Maintenance**: Perform appropriate engine and unit maintenance. Follow instructions on proper maintenance form.
3. **Reset Maintenance Hour Meter #4**
   a. Check that the Maintenance Hour Meter #4 interval is set for your requirements. Reset configured Interval if required.
   b. Reset Maintenance Hour Meter #4 for the next service interval. Hour Meter reset is a Functional Parameter. Follow maintenance interval recommendations in **Section 8.2**.

00230 Service Soon - PM #5 Due

- ACTIVATION: 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.

Corrective Actions:

1. **Check Unit Maintenance Records**: Schedule unit into service facility for maintenance. Must be done soon!
2. **Perform Maintenance**: Perform appropriate engine and unit maintenance. Follow instructions on proper maintenance form.
3. **Reset Maintenance Hour Meter #5**
   a. Check that the Maintenance Hour Meter #5 interval is set for your requirements. Reset configured Interval if required.
   b. Reset Maintenance Hour Meter #5 for the next service interval. Hour Meter reset is a Functional Parameter. Follow maintenance interval recommendations in **Section 8.2**.

00232 Setpoint Error

- ACTIVATION: There is an error in the setpoint that is stored in the main microprocessor memory.
- UNIT CONTROL: Shutdown and 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 (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

1. **Check Setpoint**

   a. Check setpoint setting. Must be between -22 and +90°F (-30° and +32°C)

   b. Enter new setpoint.

2. **Reset Microprocessor**

   a. Place the START/RUN-OFF switch in the OFF position. Disconnect positive battery cable, remove the F7 fuse or unplug 1MM connector, wait 20 seconds and reinstall. Then place the START/RUN-OFF back in the START/RUN position. The microprocessor powers up OK and the latest setpoint appears in the display.

   b. Valid setpoint can not be entered and alarm 00232 remains active. Download data and replace the main microprocessor module (MM). Refer to **Section 5.5**.

00233 Model # Error

- ACTIVATION: There is an error in the Model Number that is stored in the main microprocessor memory.
- UNIT CONTROL: Shutdown and 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 (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

1. **Check Model Number**

   a. Check Model Number in microprocessor.

   b. Enter correct Model Number. Check Model Number on Nameplate. Select the correct model number in the “MODEL NUMBER” Configuration. If correct model number is not found, install (or have Carrier Transicold dealer install) latest software revision.

2. **Reset Microprocessor**

   a. Place the START/RUN-OFF switch in the OFF position. Disconnect positive battery cable, remove F7 fuse or unplug 1MM connector, wait 20 seconds and reinstall. Then place the START/RUN-OFF back in the START/RUN position. The microprocessor powers up OK and the latest setpoint appears in the display.

   b. Check for valid model number in Unit Data. Valid number is present. Alarm is cleared.

   c. Valid model number can not be entered and alarm remains active. Download data and replace the main microprocessor module (MM). Refer to **Section 5.5**.

00237 Function Parameters Error
• ACTIVATION: There is an error in one or more of the Functional Parameters that are stored in the main microprocessor memory. • UNIT CONTROL: Incorrect Functional Parameter(s) will be automatically set for default value. • 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 (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary. **Corrective Actions:** 1. **Check Functional Parameters**: Check Functional Parameters. All must be set for selectable values. 2. **Check Software Version**: Check microprocessor Software version. Upgrade to the latest version of software. Newer versions may contain functional parameters that were not present in older versions of microprocessor software. Refer to **Section 5.3.4**. 3. **Reset Microprocessor** a. Place the START/RUN-OFF switch in the OFF position. Disconnect positive battery cable, remove F7 fuse or unplug 1MM connector, wait 20 seconds and reinstall. Then place the START/RUN-OFF back in the START/RUN position. The microprocessor powers up OK and the latest setpoint appears in the display. b. Check for valid Functional Parameters in Functional Parameters List. Valid number is set for all parameters. Alarm is cleared. c. Valid Functional Parameter(s) can not be entered and alarm remains active. Download data and replace the main microprocessor module (MM). Refer to **Section 5.5**.

00238 Configurations Error

- ACTIVATION: There is an error in the Configuration settings stored in the main microprocessor memory.
- UNIT CONTROL: Incorrect Configuration(s) will be automatically set for default value.
- 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 (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

1. **Check Configurations**: Check Configurations. All must be set for selectable values.
2. **Check Software Version**: Check microprocessor software version. Upgrade to the latest version of software. If changes were made using a newer version of TRU-Tech, that version may contain Configurations that were not present in older versions of control system software.
3. **Reconfigure Microprocessor**: Send settings to microprocessor. Using the latest version of TRU-Tech or a Data Transfer USB Memory Device, write the desired Configuration file to the device, then load the file into the microprocessor. Allow the microprocessor to reboot itself.
4. **Reset Microprocessor**

   a. Place the START/RUN-OFF switch in the OFF position. Disconnect positive battery cable, remove F7 fuse or unplug 1MM connector, wait 20 seconds and reinstall. Then place the START/RUN-OFF back in the START/RUN position. The microprocessor powers up OK and the latest setpoint appears in the display.

   b. Check for valid Configuration settings in Configuration List. Values are set correctly for all parameters. Alarm is cleared.

   c. Disconnect positive battery cable from the battery, wait 30 seconds, then reconnect and place the START/RUN-OFF switch in the START/RUN. The microprocessor powers up OK and the latest setpoint appears in the display.

   d. Check for valid Configuration settings in Configuration List. Values are set correctly for all parameters. Alarm is cleared.

   e. Valid Configurations can not be entered and alarm remains active. Download data and replace the main microprocessor module (MM). Refer to **Section 5.5**.

00245 Cannot Save Setting

- ACTIVATION: There is an error in sending and saving new settings in the main microprocessor memory.
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Microprocessor Software Revision**: Check microprocessor software. Unit should have the software upgraded to the latest version, provided for Carrier Transicold dealers on the TransCentral site.
2. **Reset Microprocessor**

   a. Place the START/RUN-OFF switch in the OFF position. Disconnect positive battery cable, remove F7 fuse or unplug 1MM connector, wait 20 seconds and reinstall. Then place the START/RUN-OFF back in the START/RUN position. The microprocessor powers up OK and the latest setpoint appears in the display.

   b. Check Active Alarm List. Alarm is cleared: microprocessor is OK.

   c. If this alarm remains active, unit will operate, but changes to the settings will not be retained in the microprocessor memory. Download data and replace the main microprocessor module (MM). Refer to **Section 5.5**.

00246 EEPROM Write Failure

- ACTIVATION: There is an error in the ability to write information to be stored in the main microprocessor memory.
- UNIT CONTROL: Alarm only
- RESET CONDITION: Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Microprocessor**

   a. Check setpoint. Must be between -22 and +90°F (-30 and +32°C).

   b. Enter new setpoint. Must be between -22 and +90°F (-30 and +32°C).
2. **Reset Microprocessor**

   a. Place the START/RUN-OFF switch in the OFF position. Disconnect positive battery cable, remove F7 fuse or unplug 1MM connector, wait 20 seconds and reinstall. Then place the START/RUN-OFF back in the START/RUN position. The microprocessor powers up OK and the latest setpoint appears in the display.

b. If this alarm remains active, download data and replace the main microprocessor module (MM). Refer to **Section 5.5**.

00248 CONFIG Mode / HP2 Error

- ACTIVATION: EEPROM Configuration is out of range.
- UNIT CONTROL: Shutdown and alarm.
- RESET CONDITION: Auto reset only when valid info is entered.

NOTE

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

Corrective Actions:

1. **Check Microprocessor**

   a. Check setpoint setting. Must be between -22 and +90°F (-30 and +32°C).

   b. Check Functional Parameters. All settings must be valid.

2. **Check Software Revision**

   a. Check microprocessor software revision. Upgrade to the latest revision of software. The latest revision may contain Configurations that were not present in older revisions.

   b. Check Functional Parameters. All settings must be valid. Send desired settings to microprocessor using the latest version of TRU-Tech or a USB data transfer device. (Do NOT use the display mounted keys.)

   c. Check Configurations. All settings must be valid. Send desired settings to microprocessor using the latest version of TRU-Tech or a USB data transfer device. (Do NOT use the display mounted keys.)

3. **Reset Microprocessor**

   a. Place the START/RUN-OFF switch in the OFF position. Disconnect positive battery cable, remove F7 fuse or unplug 1MM connector, wait 20 seconds and reinstall. Then place the START/RUN-OFF back in the START/RUN position. The microprocessor powers up OK and the latest setpoint appears in the display.

   b. If this alarm remains active, download data and replace the main microprocessor module (MM). Refer to **Section 5.5**.

00255 Microprocessor Error

- ACTIVATION: If alarm 21100 “NO COMM FROM MICRO TO DISPLAY” is not active and main microprocessor input and/or output board configuration is incorrect.
- UNIT CONTROL: Shutdown and alarm.
- RESET CONDITION: Auto reset when board communications are valid, or alarm 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, clear the alarm(s). (Refer to Note 1 in **Section 7.2**) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

1. **Check Software Revision**: Check microprocessor software. Unit should have the software upgraded to the latest version, provided for Carrier Transicold dealers on the TransCentral site.

2. **Reset Microprocessor**

   a. Place the START/RUN-OFF switch in the OFF position. Disconnect positive battery cable, remove F7 fuse or unplug 1MM connector, wait 20 seconds and reinstall. Then place the START/RUN-OFF back in the START/RUN position. The microprocessor powers up OK and the latest setpoint appears in the display.

   b. If this alarm remains active, download data and replace the main microprocessor module (MM). Refer to **Section 5.5**.

02000 Update Software

- ACTIVATION: The software version in one or more of the modules is not compatible with the remainder of the control system.
- UNIT CONTROL: Shutdown and alarm.
- RESET CONDITION: Auto reset when all module software versions are compatible. Or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

Reload Software: Unit should have the software upgraded to the latest version, provided for Carrier Transicold dealers on the TransCentral site.

02003 Display Module Error
• ACTIVATION: The APX Control system has detected 50 or more On/Off transitions of the SROS within a four minute period. • UNIT CONTROL: Shutdown and Alarm. • RESET CONDITION: The system can be temporarily reset by enabling Emergency Bypass mode. The system will be permanently reset after replacing the Display Module. **NOTE** Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (refer to reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary. **Corrective Actions:** **1. Enable Emergency Bypass Mode**: This is a temporary solution that will only allow the system to function for 24 hours. a. In the event of an alarm caused by a failure of the display module, the unit will go into shutdown. In order to temporarily bypass this shutdown state, Emergency Bypass mode can be activated, refer to **Section 3.21**. b. Once Emergency Bypass mode has been activated, the unit will operate normally for 24 hours, a countdown timer will be shown on the display. This 24 hour window of operation will keep the load safe, and provide enough time to contact the nearest Carrier Transicold Service Center for repair of the unit. 2. **Remove and replace the Display Module, refer to Section 8.9.18**

03001 Engine Load Calibration

- ACTIVATION: Activate alarm if:

  Condition 1 = At engine start if engine throttle sensor (Rack Position Sensor) value is less than 90%.

  Condition 2 = After start if the sensor value does not drop below 90% within five seconds.

  Condition 3 = At engine shutoff if the sensor value does not drop below 10% within five seconds.
- UNIT CONTROL: Alarm only. Control system will modulate CSMV as required.
- RESET CONDITION: Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Rack Position Sensor (RPS) Power And Wiring**

   a. Inspect sensor, connector pins and terminals. No physical damage to sensor. No damaged or corrosion in connections.

   b. If required, power sensor by placing the unit in PC mode, check for power. Voltage reading between connector position 1 (positive) and position 2 (negative) should be 5 volts DC. Check connectors and wiring between terminals for damage, moisture or corrosion.

   c. Check for continuity from connector terminal 3 to ENCU-7. If good continuity is not present, check connectors and wiring between terminals for damage, moisture or corrosion.
2. **Perform Engine Load Calibration**: Perform Engine Load Calibration as referenced in **Section 8.5.13**.
3. **Replace Rack Position Sensor (RPS)**: Replace sensor with known good component. Calibrate sensor and ENCU. Refer to **Section 8.5.13**.

04004 No Setpoint Change

- ACTIVATION: Operator failed to press '=' key after entering a setpoint change
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Setpoint change entered correctly.

NOTE

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

Corrective Actions:

Enter setpoint change, and then press the “=” key. Refer to **Section 3.7**

05006 Power Enable Relay Fuse Alarm

- ACTIVATION: Fuses F8: F13 must be in a failed state in order to trigger the Power Enable Relay (PER) Fuse Alarm.
- UNIT CONTROL: Shutdown and Alarm.
- RESET CONDITION: Replace fuse or fix fuse issue.

NOTE

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

Corrective Actions:

1. **Check Fuse F5**

   a. Visually check fuse. Verify correct fuse, and check fuse holder for damage, see **Figure 2.7**. Replace fuse as required. Clear alarms, restart and check for repeat alarm(s).

   b. Check voltage. Check voltage through the fuse, if fuse is blown, replace it.

   c. Check wiring. Verify there is no physical damage to harness, and no damage, moisture, or corrosion in connectors.

2. **Check Fuses F8 - F13**

   a. Visually check fuses. Verify correct fuse, and check fuse holder for damage, see **Figure 2.7**. Replace fuse as required. Clear alarms, restart and check for repeat alarm(s).

   b. Check voltage. Check voltage through the fuse, if fuse is blown, replace it.

   c. Check wiring. Verify there is no physical damage to harness, and no damage, moisture, or corrosion in connectors.

05007	Bad F3 Fuse

- ACTIVATION: Stepper Board Fuse Alarm; Feedback from Stepper Board indicates fuse is missing or blown. Signal must be present for at least three seconds .
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Replace fuse or fix fuse issue.

NOTE

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

Corrective Actions:

Check Fuse F3

a. Visually check fuse. Verify correct fuse, and check fuse holder for damage, see **Figure 2.7**. Replace fuse as required. Clear alarms, restart and check for repeat alarm(s).

b. Check voltage. Check voltage through the fuse, if fuse is blown, replace it.

c. Check wiring from PCM34 - SP-6 - ENCU - 2SVM22. Verify there is no physical damage to harness, and no damage, moisture, or corrosion in connectors.

05008	Bad F10 Fuse

- ACTIVATION: Output Board Fuse Alarm; Feedback from Output Board indicates fuse is missing or blown. Signal must be present for at least three seconds.
- UNIT CONTROL: Shutdown and Alarm.
- RESET CONDITION: Replace fuse or fix fuse issue.

NOTE

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

Corrective Actions:

1. **Check Fuse F10**

   a. Visually check fuse. Verify correct fuse, and check fuse holder for damage, see **Figure 2.7**. Replace fuse as required. Clear alarms, restart and check for repeat alarm(s).

   b. Check voltage. Check voltage through the fuse, if fuse is blown, replace it.

   c. Check wiring from PCM8 - 3MM34 - PCM9 - 3MM23. Verify there is no physical damage to harness, and no damage, moisture, or corrosion in connectors.

2. **Check FP, FS, ENCU**

   a. Visually verify there is no physical damage to harness, and no damage, moisture, or corrosion in connectors.

   b. Check for high amp draw. Refer to **Section 2.11** for correct electrical values. Use ammeter.

05012 Check ENCU Power Circuit

NOTE

When operation of the engine is required the main microprocessor will provide a signal from terminal 3MM-9. This signal has been referred to as the “run relay”, based on pre-APX Control Systems that had an actual relay in place. Whenever the term “run relay” is used in APX Control System discussion, it is referring to the engine run output from 3MM-9 to the ENCU at terminal ENCU-44.

- ACTIVATION: A problem has been detected in the ENCU-44 terminal circuit. If this alarm is activated while the circuit is energized, the circuit is detected shorted. If this alarm is activated at any other time, the circuit is detected open.
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Auto reset when the circuit is normal, or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Wiring**

   a. Inspect main microprocessor 3MM and ENCU connectors. Verify there is no damage to module, and no damage, moisture, or corrosion in connector.

   b. Use Component Test mode (Refer to **Section 5.2.4**) to energize the circuit. Must have minimum 11 VDC at 3MM-9. If no voltage at 3MM-9, download data and replace main microprocessor. Refer to **Section 5.5**.

   c. With circuit still in Component Test mode check voltage at ENCU-44. Must have minimum 11 VDC at ENCU-44. If no voltage at ENCU- 44, check connectors and wiring between terminals for damage, moisture or corrosion.

   d. Place the SROS in the OFF position and check continuity of the wiring from ENCU-19 to the “ENCUGND” connector extending from the battery negative cable connection. Check connectors and wiring between terminals for damage, moisture or corrosion.

2. **Check ENCU**: Replace ENCU with a known good component. Calibrate sensor and ENCU. Refer to **Section 8.5.13**

05013	Check Clutch Circuit

- ACTIVATION: A problem has been detected in the clutch coil (CLH) circuit. If this alarm is activated while the control system is calling for CLH to be energized, the circuit is detected shorted. If this alarm occurs at any other time, the circuit is detected open.
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Auto reset when the control system calls for CLH to energize and the coil circuit is normal, or when the control system calls for CLH to be de-energized and the circuit is not shorted or Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Fuses**

   Check F5 and F10. Fuses must be good. Replace fuse(s) as required, clear alarms, restart and check for repeat alarms.

2. **Check Coil**

   a. Inspect coil and connector pins and terminals. Verify no damage to coil. Verify no damaged or corroded pins.

   b. Check resistance of coil. Refer to **Section 2.11** for specifications.

   c. Use Component Test mode (Refer to **Section 5.2.4**) to test actual current draw of the circuit. Refer to **Section 2.11** for specifications. View current draw in Unit Data. Verify the actual current is within the specifications.

3. **Check Power and Wiring**

   a. Use Component Test mode (Refer to **Section 5.2.4**) to energize circuit. Check for power at CLH terminal A and 3MM-11. Minimum 11 VDC. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.

   b. Check for ground at CLH terminal B (including SP-3) to GND RING1. Good ground. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.

05014	Check Starter Solenoid Circuit

- ACTIVATION: A problem has been detected in the starter solenoid coil (SS) circuit. If this alarm is activated while the control system is calling for SS to be energized, the circuit is detected shorted. If this alarm occurs at any other time, the circuit is detected open.
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Auto reset when the control system calls for SS to energize and the coil circuit is normal, or when the control system calls for SS to be de-energized and the circuit is not shorted or Alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Starter Solenoid Coil**

   a. Inspect coil and connector terminal. Verify there is no damage to coil. Special connector at starter is tight and locked. Harness connector is not damaged or corroded.

   b. Check resistance of coil. Verify coil not open or shorted.

2. **Check Power and Wiring**

   a. Place Start/Run-Off switch in the OFF position and then back into the Start/Run position. Following buzzer, check for power at SS terminal and 3MM-12. Must have minimum 11 VDC. If not, check connectors and wiring between terminals for damage, moisture or corrosion.

   b. Check starter. Refer to engine workshop manual.

05016	Check Remote Amber Light

- ACTIVATION: A problem has been detected in the alarm (amber) light circuit (LB). If this alarm is activated while the circuit is energized, the circuit is detected shorted. If this alarm is activated at any other time, the circuit is detected open.
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Auto reset when the circuit is normal, or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Light Bar Wiring**: Inspect light bar and connector. No damage to light bar. No damage, moisture, or corrosion in connector. Place the SROS in the OFF position and check: Fuses F5 and F11 in the PCM. Continuity of the wiring from PCM-7 to LB-B. Continuity of the wiring from LB-G -including SP-2 to ground. Continuity of the wiring from LB-H to 3MM-7. Verify correct fuse, see Figure 2.7. Check connectors and wiring between terminals for damage, moisture or corrosion.

2. **Check Light Bar**: Check operation of 2-Light Bar. Refer to Section 8.9.20 for information on testing the light bar.

05017	Check Glow Plug Relay

- ACTIVATION: A problem has been detected in the engine preheat enable circuit (EPHT). If this alarm is activated when the circuit is energized, the circuit is detected shorted. If this alarm is activated at any other time, the circuit is detected open.
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Auto reset when circuit is normal, or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check EPHT Wiring**: Inspect 3MM and PCM connectors. Verify there is no damage to modules, and no damage, moisture, or corrosion in connector.
2. **Check Engine Preheat Enable Circuit**

   a. Using Component Test mode, refer to **Section 5.2.4**, energize engine preheat circuit. Verify the circuit is energized and amp draw is displayed.

   NOTICE

   DO NOT leave the air intake circuit energized for the full five minutes if full amperage is shown, as the intake air heater element life will be greatly shortened.

   b. Check for power at 3MM-14. Must have minimum 11 VDC. If not, download data and replace main microprocessor. For replacement instructions refer to **Section 5.5.2**.

   c. Check for power at PCM-27. Must have minimum 11 VDC. If not, check wiring and connectors between 3MM-14 and PCM-27. Good continuity, no damage, moisture, or corrosion in connectors.

   d. Replace PCM. Refer to **Section 8.9.16**.
3. **Is the component functioning? Are there additional alarms?**

   a. If the component is functioning, and additional alarms are present (often within 3MM-01 - 3MM-12 or 3MM-13 - 3MM-18) check related fuses, wires, and connectors.

   b. If the fuses/wires/connectors are OK, it indicates an internal problem with the MM or the PCM. Download data and replace main microprocessor. For complete Main Microprocessor Module replacement instructions refer to **Section 5.5.2**.

   c. If problem persists reinstall the old MM, and replace the PCM. Refer to **Section 8.9.16**.

05018	Check Power Enable Control

- ACTIVATION: The Power Enable Control Circuit Feedback is sensed out of range.
- UNIT CONTROL: Engine and Electric Operation: Alarm only.
- RESET CONDITION: Auto reset when circuit is normal, or alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

Check PER Relay on the Power Control Module: Refer to Figure 2.7

a. Check resistance of PER coil Refer to **Section 2.11**.

b. Check wiring No damage, moisture, or corrosion.

07008	Check Return Air Sensor (RAT2)

- ACTIVATION: Return Air Temperature Sensor 2 (RAT2) is not within range of -53 to +158°F (-47 to +70° C).
- UNIT CONTROL: If RAT2 is selected as control sensor, switch to RAT sensor.
- RESET CONDITION: Auto reset when sensor is in range or, alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check Sensor**

   a. Inspect sensor and connectors. Verify there is no damage to sensor, and no damage, moisture, or corrosion in connectors.

   b. Check sensor resistance. (Refer to Note 3 in **Section 7.2**) 10,000 Ohms @ 77°F (25°C). Refer to **Section 8.9.21** for chart of resistances for different sensors.

2. **Check Sensor Wiring**

   a. Inspect connector pins and terminals at sensor connector 2MM. (See wiring schematic **Section 10**.) Verify there is no physical damage to harness, and no damage, moisture, or corrosion in connectors.

   b. Place system in PC mode. Refer to Note 2 in **Section 7.2**. Disconnect sensor from harness. Check for 3.0 ± 0.1 VDC at harness plug between pins. Voltage should be 3.0 ± 0.1 VDC volts at harness plug between pins. This verifies microprocessor output and wiring connections to the sensor.

07009	Return Air Sensors RAT and RAT2 Out-of-Range

- ACTIVATION: RAT2 is installed and configured. RAT and RAT2 show different air temperature readings of greater than 3.6°F (2° C) for 10 consecutive minutes, or 25 out of 30 minutes.
- UNIT CONTROL: If RAT or RAT2 is selected as control sensor, switch to SAT sensor.
- RESET CONDITION: Auto reset when sensor is in range or, alarm may be manually reset using the display mounted keys or by turning the unit off, then back on again.

NOTE

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

Corrective Actions:

1. **Check RAT and RAT2 Sensors**

   a. Inspect sensors and connectors. Verify there is no damage to sensor, and no damage, moisture, or corrosion in connectors.

   b. Check sensor resistance. (Refer to Note 3 in **Section 7.2**) 10,000 Ohms @ 77°F (25°C). Refer to **Section 8.9.21** for chart of resistances for different sensors.

2. **Check Sensor Wiring**

   a. Inspect connector pins and terminals at sensor connector 2MM. (See wiring schematic **Section 10**.) Verify there is no physical damage to harness, and no damage, moisture, or corrosion in connectors.

   b. Place system in PC mode. Refer to Note 2 in **Section 7.2**. Disconnect sensor from harness. Check for 3.0 ± 0.1 VDC at harness plug between pins. Voltage should be 3.0 ± 0.1 VDC volts at harness plug between pins. This verifies microprocessor output and wiring connections to the sensor.

20100	No COMM From Micro to Display

NOTE

This alarm will be available in the inactive alarm list and download only. It is an indication that an intermittent failure is occurring, causing a break in the circuit sufficient to activate the alarm.

- ACTIVATION: If alarm **21100 No COMM From Any Board to Main Micro** is not active and main microprocessor cannot communicate with the display module over the CAN bus.
- UNIT CONTROL: Alarm only, unit will continue to run. Module may display "LOSS OF COMMUNICATIONS".
- RESET CONDITION: Auto reset when CAN communication is restored, 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, clear the alarm(s). (Refer to Note 1 in **Section 7.2**) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

Check CAN bus

a. Inspect connector pins and terminals on 1MM, 1SVM, DM and ENCU. Verify no damage or corrosion in connections.

b. Check display LOSS OF COMMUNICATIONS message is displayed.

c. Check for CAN circuit continuity:

CAN Hi; Check entire circuit, 1MM-2 to DM-2. If circuit is open, check individual paths as follows: 1MM-2 through SP-1 to 1SVM-5 and ENCU-23 and 1SVM-2 and DM-2

CAN Lo; Check entire circuit, 1MM-4 to DM-6. If circuit is open, check individual paths as follows:1MM-4 through SP-4, to 1SVM-7 and ENCU-24, and 1SVM-4 and DM-6

d. Check for good continuity. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.

20101 No COMM From Micro to Remote Display

- ACTIVATION: Alarm **21100 No COMM From Any Board to Main Micro** is not active, the number of remote panels installed is configured as 1, and no sync responses have been received from the Remote Panel Module for 10 seconds.
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Auto reset when communication is restored, 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, clear the alarm(s). (Refer to Note 1 in **Section 7.2**) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

1. **Does the Remote Panel Work?**: If panel is working, this may be an intermittent alarm caused by a bad connection. Check connection from Comm Module to Remote Panel. Verify no damage or corrosion in connections.
2. **Check for other CAN bus alarms:** This alarm may accompany other alarms, complete troubleshooting steps for alarms found. If repairs have been made and the other alarms have cleared, further troubleshooting may not be required.
3. **Check for Power into Remote Panel**: Check for battery power at pins C and D. Verify power.
4. **Check CAN Circuit to Remote Panel**: At the Remote Panel connector, check resistance between pin A and pin B. Verify 120 ohms.
5. **Replace Remote Panel with a Known Good Panel**

   a. If problem re-occurs replace the Comm Module.

   b. If problem goes away replace the Remote Panel.

21100	No COMM From Any Board to Main Micro

NOTE

This alarm will be available in the inactive alarm list and download only. It is an indication that an intermittent problem has occurred and a careful diagnosis is required.

- ACTIVATION: Main microprocessor cannot communicate with any modules over the CAN bus.
- UNIT CONTROL: Shutdown and alarm. Display module may display “LOSS OF COMMUNICATIONS”.
- RESET CONDITION: Auto reset when CAN communication is restored, or alarm 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, clear the alarm(s). (Refer to Note 1 in **Section 7.2**) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

1. **Check CAN Bus**

   a. Inspect connector pins and terminals on 1MM, 1SVM, DM and ENCU. Verify no damage or corrosion in connections.

   b. Check for CAN continuity:

   CAN Hi; 1MM-2 through SP-1 to 1SVM-5 and ENCU-23 and 1SVM-2 and DM-2.

   CAN Lo; 1MM-4 through SP-4, to 1SVM-7 and ENCU-24, and 1SVM-4 and DM-6.

   Check for good continuity. If not, check connectors and wiring between terminals. Verify no damage, moisture or corrosion.

2. **Check for other CAN Bus Alarms**: This alarm may accompany by other alarms, complete troubleshooting steps for alarms found. If repairs have been made and the other alarms have cleared, further troubleshooting may not be required. If this alarm reoccurs, check CAN bus as described in the proceeding step.

3. **Perform and Analyze a Data Download**

22100	No COMM From Micro to INPBD1

- ACTIVATION: Main microprocessor cannot communicate internally.
- UNIT CONTROL: Shutdown all modules except the display and alarm. (The alarm will only display if the display module is communicating.) Main microprocessor status LED will illuminate steady green (not pulsing).
- RESET CONDITION: Auto reset when internal communication is restored, alarm 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, clear the alarm(s). (Refer to Note 1 in **Section 7.2**) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

Replace Main Microprocessor: Download data and replace main microprocessor. For complete Main Microprocessor Module replacement instructions refer to **Section 5.5.2**.

22101	Sensor Input Voltage Low INP1

NOTE

This alarm is an indication that there is a short in the transducer or DC current transformer wiring and the voltage supply in the main microprocessor is overloaded.

- ACTIVATION: Voltage from main microprocessor to the components is less than 4.5 VDC
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Auto reset when voltage is correct, alarm 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, clear the alarm(s). (Refer to Note 1 in **Section 7.2**) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

1. **Check System Pressures**: Install manifold gauge set and check and compare compressor discharge, evaporator outlet and suction pressures with those shown in Unit Data. Refer to **Section 8.9.12** for instruction on comparison.
2. **Check Wiring**: If a transducer reading is not within a reasonable range of gauge reading, check wires to sensors for short.

   For CSP, check wiring from 2MM-20, 2MM-30 and 2MM-9.

   For EVOP, check wiring from 2MM-25, SP-20 and 2MM-17.

   For CDP, check wiring from 2MM-21, SP-20 and 2MM-10. For ECOP, check wiring from 2MM-28, SP-20 and 2MM-14.
3. **Check CT Wiring**: Check wires to sensor for short. Check wiring from 2MM-29, 2MM-12 and 2MM-23 to PCM.
4. **Replace Main Microprocessor**: Download data and replace main microprocessor. For complete Main Microprocessor Module replacement instructions refer to **Section 5.5.2**.

22102 Sensor Input Voltage High INP1

NOTE

This alarm is an indication that there is a short in the DC current transformer wiring from another (nominal 12 VDC) circuit into the transducer or CT sensor circuit.

- ACTIVATION: Voltage from main microprocessor to the sensors is greater than 5.5 VDC
- UNIT CONTROL: Alarm only.
- RESET CONDITION: Auto reset when sensor voltage is correct, alarm 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, clear the alarm(s). (Refer to Note 1 in **Section 7.2**) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

1. **Check Transducer Wiring**

   Check wires to sensors for short.

   For CSP, check wiring from 2MM-20, 2MM-30 and 2MM-9.

   For EVOP, check wiring from 2MM-28, SP-7 and 2MM-17. 0

   For CDP, check wiring from 2MM-21, SP-7 and 2MM-10.

2. **Check CT Wiring**: Check wires to sensor for short from another circuit. Check wiring from 2MM-29, 2MM-12 and 2MM-23 to PCM.
3. **Replace Main Microprocessor**: Download data and replace main microprocessor. For complete Main Microprocessor Module replacement instructions refer to **Section 5.5.2**.

22103 Input Lost Configuration

- ACTIVATION: Input Board reports an invalid configuration
- UNIT CONTROL: Required Shutdown.
- RESET CONDITION: Auto reset when communication is restored, 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, clear the alarm(s). (Refer to Note 1 in **Section 7.2**) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

1. **Check Wiring**: Check logic power connections. Check wiring at 1MM-6 and 1MM-1.
2. **Replace Main Microprocessor**: Download data and replace main microprocessor. For complete Main Microprocessor Module replacement instructions refer to **Section 5.5**.

23100	No COMM From Micro to OUTPBD1

- ACTIVATION: Main microprocessor cannot communicate internally.
- UNIT CONTROL: Shutdown all modules except the display and alarm. (The alarm will only display if the display module is communicating.) Main microprocessor status LED will illuminate steady green (not pulsing).
- RESET CONDITION: Auto reset when internal communication is restored, alarm 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, clear the alarm(s). (Refer to Note 1 in **Section 7.2**) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

Replace Main Microprocessor: Download data and replace main microprocessor. For complete Main Microprocessor Module replacement instructions refer to **Section 5.5.2**.

23101	Output Lost Configuration

- ACTIVATION: Output Board reports an invalid configuration.
- UNIT CONTROL: Required Shutdown.
- RESET CONDITION: Auto reset when communication is restored, 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, clear the alarm(s). (Refer to Note 1 in **Section 7.2**) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

1. **Check Wiring**: Check logic power connections. Check wiring at 1MM-6 and 1MM-1.
2. **Replace Main Microprocessor**: Download data and replace main microprocessor. For complete Main Microprocessor Module replacement instructions refer to **Section 5.5.2**.

25100	No COMM From Micro to STP1

- ACTIVATION: Main microprocessor cannot communicate with stepper valve module over the CAN bus.
- UNIT CONTROL: Shut down and alarm. The stepper valve module status LED may be on steady green (not pulsing) or red.
- RESET CONDITION: Auto reset when CAN communication is restored, alarm 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, clear the alarm(s). (Refer to Note 1 in **Section 7.2**) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

1. **Check Both Active and Inactive Alarms for other “NO COMM” Alarms**

   a. If more than one alarm, record all and proceed to step 2.

   b. If this is the only “NO COMM” alarm, replace module.

2. **Check CAN Bus**

   a. Inspect connector pins and terminals on 1MM and 1SVM. Verify no damage or corrosion in connections.

   b. Check CAN circuits:

   CAN Hi: 1MM-2 through SP-1 to 1SVM-5

   CAN Lo: 1MM-4 through SP-4, to 1SVM-7

   CAN (+ 12 VDC): 1MM-8 to 1SVM-6.

   CAN 12 VDC: negative: 1MM-3 to 1SVM-1.

3. **Check System**: Clear active and inactive alarms. Start unit and monitor for additional “NO COMM” alarms.

25101	Over Current STP1

- ACTIVATION: The stepper current is reported to be too high by stepper board 1 (Indicated by Stepper Output Voltage < 5V) for three seconds as timed at stepper board.
- UNIT CONTROL: Alarm only. Steppers on board with problem disabled (Powered OFF) until good power reported from Stepper Board at which point they are re-enabled.
- RESET CONDITION: 10 Seconds of good current range reported from all steppers.

NOTE

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

Corrective Actions:

1. **Check wires**: Check wiring to Stepper Valves to SVM. Verify there is no physical damage to harness, and no damage, moisture, or corrosion in connectors.

2. **Check power:** Check power at 2SVM-11 and 2SVM-22. Verify battery power.

25102	Check Input Voltage STP1

- ACTIVATION: The stepper input voltage is reported out of valid range (9V to 17V) by stepper board 1 for three seconds.
- UNIT CONTROL: Alarm only. Steppers on board with problem disabled (Powered OFF) until good power reported from Stepper Board at which point they are re-enabled.
- RESET CONDITION: 10 Seconds of good voltage reported from all steppers.

NOTE

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

Corrective Actions:

1. **Check voltages**: Check input voltage at SVM1.
2. **Check Fuse F3**

   a. Visually check fuse. Verify correct fuse, and check fuse holder for damage, see **Figure 2.7**. Replace fuse as required. Clear alarms, restart and check for repeat alarm(s).

   b. Check voltage through the fuse. If fuse is blown, replace it.

   c. Check wiring from PCM34 - SP-6 - ENCU - 2SVM-22. Verify there is no physical damage to harness, and no damage, moisture, or corrosion in connectors.
3. **Disconnect Stepper Valve(s):** If alarm goes away check operation of suspected valve. Refer to **Section 8.9.8** / **Section 8.9.9**.

26100	No COMM From Micro to ENCU

- ACTIVATION: Main microprocessor cannot communicate with the engine control unit over the CAN bus.
- UNIT CONTROL: Shutdown and alarm.
- RESET CONDITION: Auto reset when CAN communication is restored, alarm 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, clear the alarm(s). (Refer to Note 1 in Section 7.2) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

1. Check Both Active and Inactive Alarms for other “NO COMM” Alarms

   a. If more than one alarm, record all and proceed to step 2.

   b. If this is the only alarm, check for continuity:

      CAN Hi: 1MM-2 through SP-1 to ENCU-23.
      CAN Lo: 1MM-4 through SP-4, to ENCU-24.

   c. Replace ENCU.

2. **Check CAN Bus**

   a. Inspect connector pins and terminals on 1MM and1SVM. No damaged or corrosion in connections.

   b. Check for CAN continuity:

      CAN Hi: 1MM-2 through SP-1 to ENCU-23.
      CAN Lo: 1MM-4 through SP-4, to ENCU-24.

      If good continuity is not present, check connectors and wiring between terminals for damage, moisture or corrosion.

3. **Check System**: Clear active and inactive alarms. Start unit and monitor for additional “NO COMM” alarms.

26101	Engine Over Heat ENCU

- ACTIVATION: Engine water temperature > or = 262°F (128° C)
- UNIT CONTROL: Alarm only.
- RESET CONDITION: If trigger on message not received for five seconds, alarm 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, clear the alarm(s). (Refer to Note 1 in Section 7.2) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

Refer to 00012 High Coolant Temperature.

26102 Water Temp Low ENCU

- ACTIVATION: Voltage of water temperature sensor is 0.1 V or less
- UNIT CONTROL: Alarm only.
- RESET CONDITION: If trigger on message not received for five seconds, alarm 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, clear the alarm(s). (Refer to Note 1 in **Section 7.2**) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

Refer to:
00129 Check Engine Coolant Sensor
P00155 Check Coolant Temp Sensor

26103 Water Temp High ENCU

- ACTIVATION: Voltage of water temperature sensor is 4.9 V or above
- UNIT CONTROL: Alarm only.
- RESET CONDITION: If trigger on message not received for five seconds, alarm 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, clear the alarm(s). (Refer to Note 1 in **Section 7.2**) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

Refer to:
00129 Check Engine Coolant Sensor
P00155 Check Coolant Temp Sensor

26104 Battery Voltage High ENCU

- ACTIVATION: ECU recognition of battery voltage is above 18 V.
- UNIT CONTROL: Required Shutdown.
- RESET CONDITION: If trigger on message not received for five seconds, alarm 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, clear the alarm(s). (Refer to Note 1 in **Section 7.2**) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

Refer to 00015 Battery Voltage Too High

26105 Engine Overrun ENCU

- ACTIVATION: Engine speed out of range
- UNIT CONTROL: Required Shutdown.
- RESET CONDITION: If trigger on message not received for five seconds, alarm 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, clear the alarm(s). (Refer to Note 1 in **Section 7.2**) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

Refer to:
00038 Check High Speed RPM, **00039 Check Engine RPM**

26106 SENSOR SUPPLY VOLTAGE 1 LOW

- ACTIVATION: Voltage to sensor is below 4.0 V
- UNIT CONTROL: Required Shutdown.
- RESET CONDITION: If trigger on message not received for five seconds, alarm 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, clear the alarm(s). (Refer to Note 1 in **Section 7.2**) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

CORRECTIVE ACTIONS:

1. **Check Engine Speed Sensor (ENSSN)**

   a. Check actual engine speed using a hand held tachometer and compare with speed shown in unit data. Must be ± 20 rpm. Must be a steady reading.

   b. Inspect sensor, connector pins and terminals. (See wiring schematic **Section 10.3**.) Verify there is no physical damage to sensor, and no damage or corrosion in connections.

   c. Check power from ENCU. Should read approximately +12 VDC from terminal ENCU-43 to ENSSN-3.

   d. Check power from ENCU. +5 VDC from terminal ENCU-29 to RPS-1

   e. Check ground to ENCU. Check wiring from terminal ENCU-20 to ENSSN-1

   f. Check signal to ENCU. Check wiring from terminal ENCU-2 to ENSSN-2

2. **Check Rack Position Sensor (RPS). Refer to Section 8.5.13.**

26108 RACK POSITION SENSOR ABNORMAL

- ACTIVATION: Sensor voltage > 4.9 V or < 0.3V
- UNIT CONTROL: Alarm only.
- RESET CONDITION: If trigger on message not received for five seconds, alarm 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, clear the alarm(s). (Refer to Note 1 in **Section 7.2**) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

CORRECTIVE ACTIONS:

1. **Check Rack Position Sensor (RPS)**: Inspect sensor, connector pins and terminals. (See wiring schematic **Section 10.3**.) No physical damage to sensor. No damaged or corrosion in connections.
2. **Check Rack Position Sensor (RPS).** Refer to **Section 8.5.13**
3. **Refer to 26106 SENSOR SUPPLY VOLTAGE 1 LOW**

26109 Actuator Abnormal ENCU

- ACTIVATION: Actuator current >3.0A or < 80mA
- UNIT CONTROL: Engine Operation: Required Shutdown.
  Electric Operation: Will not activate in electric operation.
- RESET CONDITION: If trigger on message not received for five seconds, alarm 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, clear the alarm(s). (Refer to Note 1 in **Section 7.2** Section, page 7-2.) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

1. **Refer to 05012 Check ENCU Power Circuit**
2. **Check Engine Control Unit (ENCU) and Fuel Speed Actuator (FSA)**
   a. Check voltage from fuse F3 through PCM-34 and SP-6 to ENCU-22. Verify correct fuse, see **Figure 2.7**. Must have minimum 11 VDC with the battery connected and SROS in the OFF position.
   b. Check voltage from 3MM-9 to ENCU-44. Must have minimum 11 VDC with SROS in the START/ RUN position. If no, energize the run relay output using component test mode (refer to **Section 5.2.4**) and retest.
   c. Check for ground at ENCU-19 and ENCUGND-A (at the battery negative cable connection). If ground not good, check connectors and wiring between terminals for damage, moisture or corrosion.
   d. Inspect fuel/speed actuator (FSA), engine speed sensor (ENSSN) and engine speed control unit (ENCU) connector pins and terminals. Verify no physical damage to components, and no damage or corrosion in connectors.
   e. Check resistance and amp draw of FSA. Refer to **Section 2.11** for specifications.
   f. Check FSA plunger. Must move in and out freely. Refer to engine manual.

26110	Engine Speed Sensor Abnormal

- ACTIVATION: Engine speed out of range
- UNIT CONTROL: Required Shutdown.
- RESET CONDITION: If trigger on message not received for five seconds, alarm 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, clear the alarm(s). (Refer to Note 1 in **Section 7.2**) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

Refer to 00130 Check Engine RPM Sensor

27200	No COMM From Micro to COMM Module

- ACTIVATION: Alarm **21100 No COMM From Any Board to Main Micro** is not active, and Number Of Comm Modules Configuration is set to 1, and no sync responses have been received from the Comm Module for 10 seconds.
- UNIT CONTROL: Engine and Electric Operation: Alarm only.
- RESET CONDITION: Sync response received from the Comm Module in the past 10 seconds, alarm 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, clear the alarm(s). (Refer to Note 1 in **Notes** Section, page 7-2.) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

1. **Check for other CAN bus alarms**: This alarm may accompany other alarms, complete the troubleshooting steps for alarms found. If repairs have been made and the other alarms have cleared, further troubleshooting may not be required.
2. **Replace Comm Module**

28001	No COMM From Fuel Sensor

- ACTIVATION: The fuel sensor is configured as 3rd party and no communications have been received from the sensor for at least 15 minutes.
- UNIT CONTROL: Engine and Electric Operation: Alarm only.
- RESET CONDITION: Communications have been received from the fuel sensor.

NOTE

Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (Refer to Note 1 in **Notes** Section, page 7-2.) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

1. **Check for proper APX Control System Configuration**: Refer to **Section 5.2.3** and **Table 5–1**.
2. **Make sure that all third party configurations are correct and software is current**.
3. **Check Fuel Sensor and Wiring**: Inspect sensor, connector pins and terminals. No physical damage to sensor. No damaged or corrosion in connections.

28002	No COMM From Door Switch

- ACTIVATION: The door switch configuration is configured as 3rd Party and no communications have been received for 15 minutes.
- UNIT CONTROL: Engine and Electric Operation: Alarm only.
- RESET CONDITION: Communications have been received from the door switch.

NOTE

Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (Refer to Note 1 in **Notes** Section, page 7-2.) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

1. **Check for proper APX Control System Configuration:** Refer to **Section 5.2.3** and **Table 5–1**.
2. **Make sure that all third party configurations are correct and software is current.**
3. **Check Switch and Wiring**: Inspect switch, connector pins and terminals. No physical damage to sensor. No damaged or corrosion in connections.

28003	Invalid Door Switch

- ACTIVATION: The Door Switch configuration is configured as 3rd Party and data received from the switch is invalid.
- UNIT CONTROL: Engine and Electric Operation: Alarm only.
- RESET CONDITION: Valid data received from door switch.

NOTE

Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (Refer to Note 1 in **Notes** Section, page 7-2.) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

1. **Check for proper APX Control System Configuration:** Refer to **Section 5.2.3** and **Table 5–1**.
2. **Make sure that all third party configurations are correct and software is current.**

Check Switch and Wiring: Inspect switch, connector pins and terminals. No physical damage to sensor. No damaged or corrosion in connections.

28004 Invalid REMS1
28005 Invalid REMS2

- ACTIVATION: The Remote Switch configuration is configured as 3rd Party and data received from the switch is invalid.
- UNIT CONTROL: Engine and Electric Operation: Alarm only.
- RESET CONDITION: Valid data received from remote switch.

NOTE

Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (Refer to Note 1 in **Notes** Section, page 7-2.) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.

Corrective Actions:

1. **Check for proper APX Control System Configuration:** Refer to **Section 5.2.3** and **Table 5–1**.
2. **Make sure that all third party configurations are correct and software is current.**
3. **Check Switch and Wiring**: Inspect switch, connector pins and terminals. No physical damage to sensor. No damaged or corrosion in connections.

SECTION 8

Service

⚠ WARNING

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

⚠ WARNING

Beware of moving belt and belt-driven components. When working with belts, beware of pinch points.

⚠ WARNING

Never use air or gases containing oxygen for leak testing or operating refrigerant compressors. Pressurized mixtures of air or gases containing oxygen can lead to explosion.

⚠ WARNING

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

⚠ WARNING

Disconnect batteries before doing any electrical welding.

⚠ CAUTION

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

⚠ WARNING

R-452A is an A1 non-flammable refrigerant blend. However certain of its constituents are considered A2L mildly flammable.

For this reason, it is imperative that the system of a Vector unit utilizing R-452A refrigerant be reclaimed to a sufficient vacuum to ensure all residual refrigerant is removed from the system.

Follow the Removing Charge R-452A procedure before performing any "Hot work," including but not limited to brazing or welding on a unit that has been charged with R-452A, to prevent flare up of residual A2L refrigerant constituents.

Refrigerant must be reclaimed until equipment gauge indicates 20 inHG (-0.6bar) of vacuum.

Refer to Section 8.7.2.7 Removing Charge R-452A .

Refer to the Service Bulletin SB06-16 for additional information.

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.

⚠ CAUTION

As distinct from R404A refrigerant, R-452A has a temperature glide (specific properties) more important and not negligible between vapor state and liquid state.

For a given temperature, the liquid state pressure value and the vapor state pressure value, of the R-452A refrigerant are different.

Refer to Table and Table 8–6 for Temperature pressure chart.

8.1 Section Layout

Service and Maintenance procedures are presented in the following sections:

- Scheduled Maintenance - **Section 8.2**
- Pretrip Inspection - **Section 8.3**
- External Surface Service (automatic fresh air exchange, grille, surround, and doors) - **Section 8.4**
- Engine And Engine Related Systems Service - **Section 8.5**
- Refrigerant System Service - **Section 8.7**
- Compressor and Unloader Service - **Section 8.8**
- Refrigerant System Component Service **Section 8.9**
- Electrical System Component Service Including Display Module - **Section 11.**

Refer to the Table of Contents to locate specific topics.

8.2 Scheduled Maintenance

For the most reliable operation and for maximum life, this unit requires regular maintenance. This includes oil and filter changes, fuel and air cleaner replacement, coolant replacement and Pretrip inspections. Maintenance is to be performed in accordance with the procedures provided in **Table 8–1**.

8.3 Pretrip Inspection-

Pretrip inspection should be performed before every trip and at regular maintenance intervals. Pretrip procedures are provided in the Trailer Refrigeration Pretrip Inspection document 62-90483.

Table 8–1 Maintenance Schedule

WARNING

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

System	Operation	Reference Section
a. Pretrip Inspections		
	1. Pretrip Inspection: Before starting	Section 8.3
	2. Pretrip Inspection: After starting	Section 8.3
	3. Run Microprocessor Pretrip: Before loading	Section 3.6
	4. Check Engine Hours	Section 3.16
b. Every Service Interval or Yearly		
Engine	1. Check engine oil and filter change interval (refer to Section d. of this table)	Section d.
	2. Check low oil pressure switch	Check
	3. Clean crankcase breather	Section 8.5.16
	4. Check fuel injectors every 1,500 hours*	Engine Manual
	5. Check injection pump every 3,000 hours*	Engine Manual
	6. Check and adjust engine valves every 4,000 hours	Engine Manual
Fuel System	1. Clean mechanical and electric (if equipped) fuel pump screens	Section 8.5.3 and Section 8.5.4
	2. Change fuel filter	Section 8.5.5
	3. Check fuel heater (if equipped)	Section 8.5.8
Cooling System	1. Check coolant change interval (refer to Section e. of this table). If replacement is not required, check antifreeze concentration using a refractometer (Carrier Transicold part number 07-00435-00)	Section 8.5.14
	2. Clean condenser/radiator surfaces	Section 8.5.14
	3. Check water pump	Check
	4. Check water temperature sensor	Check
Exhaust System	1. Check mounting hardware 2. Check muffler and exhaust pipes	Check
Air Intake System	1. Change air cleaner element 2. Check and reset air cleaner indicator	Section 8.5.10
Starting Circuit	1. Clean battery connections and cables for chafing, rub spots and corrosion	Check/Replace
	2. Check battery hold down clamps	Check/Replace
	3. Check battery condition	Check
	4. Check starter operation	Check
Charging Circuit	1. Check alternator brushes, replace if needed 2. Check alternator output	Section 8.9.19
*Based upon EPA 40 CFR Part 89		

Table 8–1 Maintenance Schedule

⚠ WARNING

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

System	Operation	Reference Section
Unit	1. Check unit mounting bolts	Check
	2. Check engine and compressor mounting bolts	Check
	3. Check door latches and hinges	Section 8.4.4
	4. Check all belt tensions, adjust as necessary	Check
	5. Check gearbox and fanshaft for oil leaks	Check
	6. Check fanshaft, idler and gearbox bearings	Check
	7. Check clutch air gap, adjust as required	Section 8.6.4
Refrigeration System	1. Check compressor drive coupling	Section 8.6
	2. Check defrost air switch and calibrate as necessary	Section 8.9.13
	3. Check and clean the evaporator coil and all defrost drain hoses	Section 8.9.1
	4. Install manifold gauge set and check refrigerant pressure	Check
	5. Run APX Control System Pretrip	Section 3.6
	6. Check manual defrost operation	Section 3.11
Electrical System	1. Check unit switches and electrical connections 2. Check condition of all modules 3. Check Engine Wiring Harness for chafing, rub spots and corrosion	Check/Replace
c. 5 year or 12,000 Hour Maintenance		
Coolant System	1. Drain and flush cooling system 2. Refill with ELC-NF extended life coolant	Section 8.5.14
d. Oil Change Intervals		
Oil Type	**Oil Change / ESI Filter Change**	
Petroleum	3000 hours or two years (Maximum oil drain interval is two years.)	
Mobile Delvac 1*	4000 hours or two years (Maximum oil drain interval is two years.)	
* Mobil Delvac1 is the only approved synthetic oil		

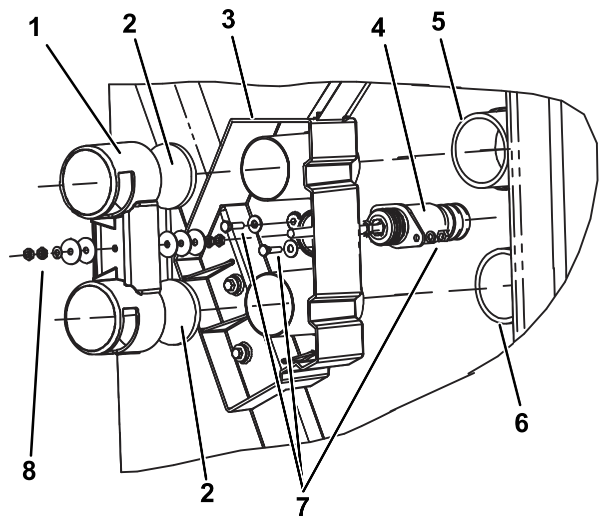
These maintenance schedules are based on the use of approved oils and regular Pretrip inspections of the unit. Failure to follow the recommended maintenance schedule may affect the life and reliability of the refrigeration unit.

8.4 External Surface Service

Procedures for servicing or maintaining the automatic fresh air exchange, grille, surround, doors, door latches and display module are provided below.

8.4.1 AutoFresh Fresh Air Exchange

Figure 8.1 Automatic Fresh Air Exchange



1. Cover
2. Gasket
3. Housing
4. Solenoid
5. Inlet Connection
6. Outlet Connection
7. Solenoid Hardware
8. Cover Hardware

8.4.1.1 Replace Cover and/or Cover Gaskets

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter.
2. Loosen outermost cover mounting nut (8, **Figure 8.1**) to unlock hardware and remove hardware holding cover (1) in place.
3. Slide cover off solenoid shaft (4), remove and replace gaskets (2). Slide cover in place against inner hardware to ensure cover gasket is slightly compressed to form a good seal. If required, adjust inner hardware and re-lock in place.
4. Install outer hardware (two plain washers, a lock washer and two nuts). Torque nut against cover lock washer to 120 inch/lbs (13.6 Nm) and then re-lock outer nut.
5. Re-enable the starter, start unit and run Pretrip to check operation.

8.4.1.2 Replace Solenoid

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter.
2. Remove cover in accordance with preceding step. Loosen innermost cover mounting nut to unlock and remove remaining cover hardware.
3. Disconnect the solenoid connector, remove hardware (7) attaching old solenoid and bring new solenoid in place. Torque mounting hardware to 120 inch/lbs (13.6 Nm), and reconnect connector.
4. If housing (3) is replaced, torque all mounting hardware to 120 inch/lbs (13.6 Nm).
5. Reinstall and adjust cover in accordance with preceding step.
6. Re-enable the starter, start unit and run Pretrip to check operation.

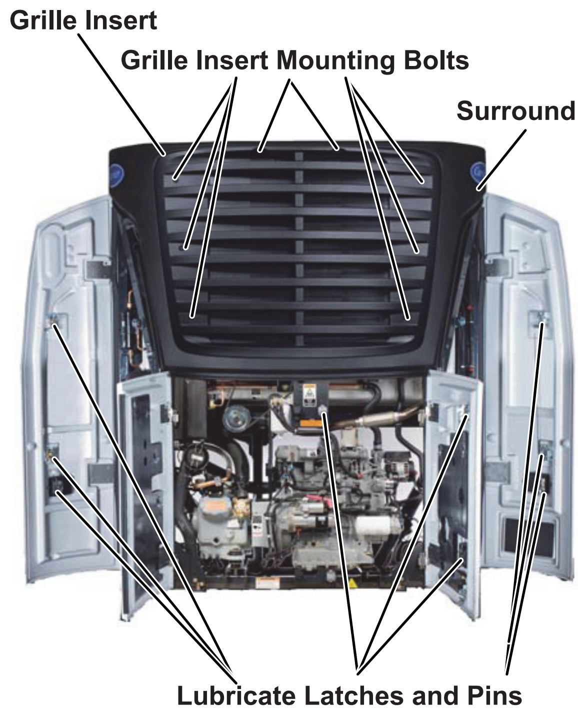
8.4.2 Remove Grille Insert

NOTE

If difficulty is experienced when attempting to remove the grille mounting bolts, the grille may be removed with the surround attached to allow access to the mounting clips. (Refer to **Section 8.4.3**.)

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter.
2. Remove the three grille insert mounting bolts on each side of the grille insert (**Figure 8.2**).
3. Remove the two grille insert mounting bolts on top of the grille insert.
4. The grille is fitted with locating tabs along the bottom. To remove, swing insert down and lift out of locating slots.
5. Reverse above steps to install grille insert.
6. Re-enable the starter, start unit and run Pretrip to check operation.

Figure 8.2 Grille Insert Removal and Door Latch Maintenance



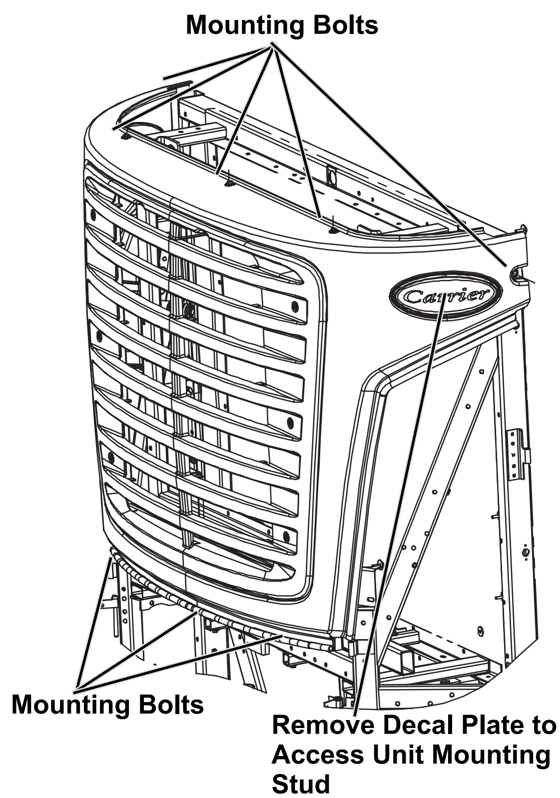
8.4.3 Remove Surround

NOTE

It is not necessary to remove the grille before removing the surround.

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter.
2. Open both side and front doors.
3. Remove the bolts that secure the surround to the unit (see **Figure 8.3**).
4. Reverse above steps to install surround.
5. Re-enable the starter, start unit and run Pretrip to check operation.

Figure 8.3 Surround Removal



8.4.4 Door Latch Maintenance and Cable Replacement

8.4.4.1 Door Latch Maintenance

Proper maintenance is important for smooth operation of the latch assemblies and the latch pins that are mounted on the unit frame (see **Figure 8.2**). In order to keep the movable parts clean and lubricated, the use of a de-greasing cleaner and LPS 2 lubricant is recommended. This lubricant should be available at any local automobile and truck parts supplier.

8.4.4.2 Cable Replacement

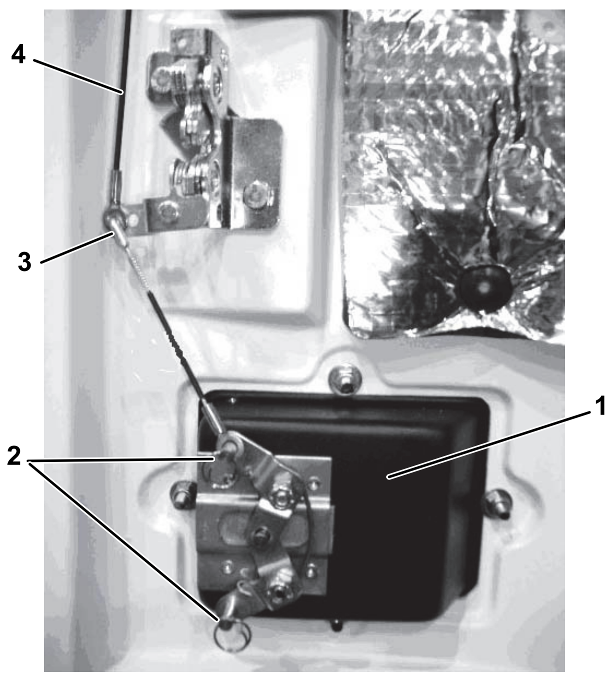
1. Remove circular clip that secures the cable to the paddle assembly (see **Figure 8.4**.)
2. Slide cable from paddle and rotate other end out of latch assembly.

NOTE

The side door lower cable is inserted through the upper cable eyelet. The lower cable is to be removed to gain access to the upper cable.

3. Reverse above steps to install new cable.

Figure 8.4 Door Latch Cable Removal



1. Paddle Assembly (Typical, Front and Side Doors)
2. Circular Clips (Typical, Front and Side Doors)
3. Lower Cable Upper Connection (Side Doors Only)
4. Upper Cable (Side Doors Only)

8.5 Engine and Engine Related Service

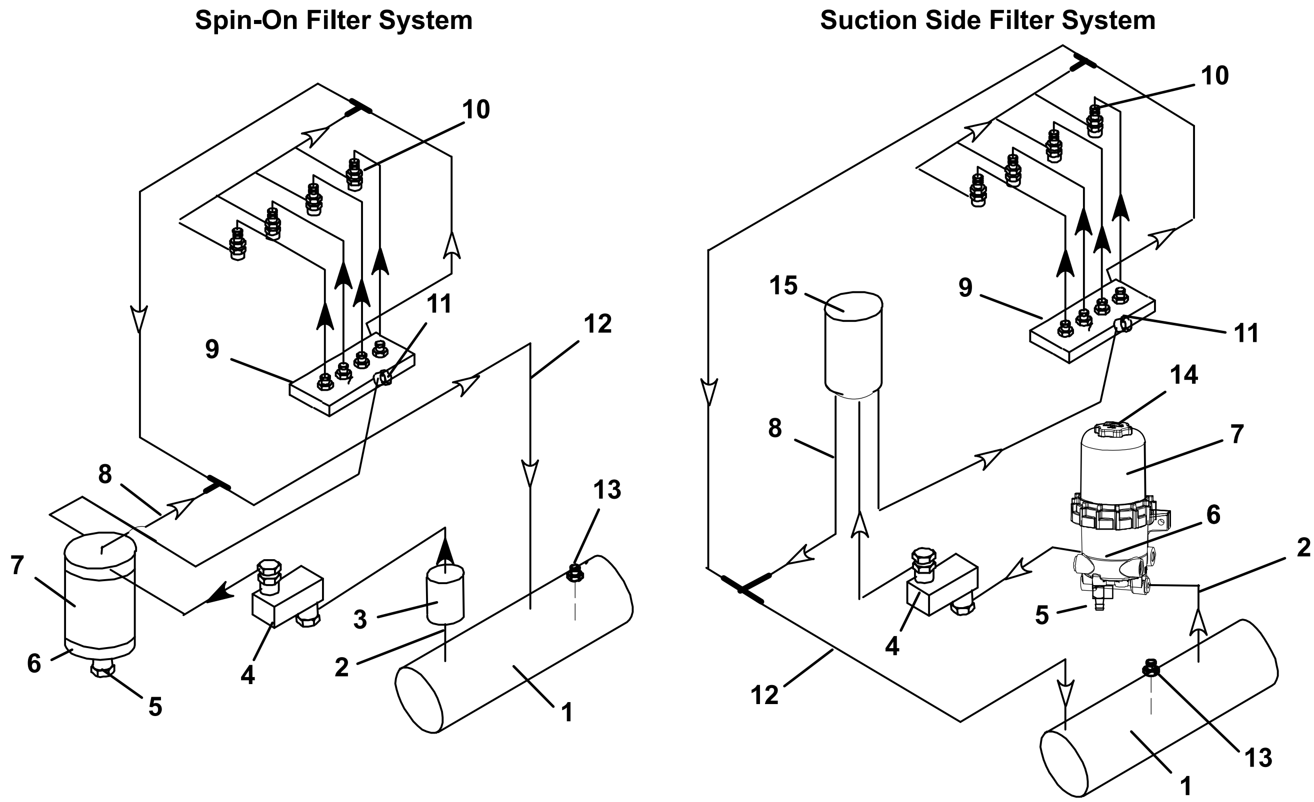
Procedures for servicing the engine, fuel system, engine cooling system and air cleaner are provided in the following sub-paragraphs.

8.5.1 Fuel System

The fuel system consists of the fuel tank, mechanical fuel pump, fuel filter, fuel injection pump, the injectors and interconnecting tubing. The fuel system may also be equipped with an optional electric pump and/or optional electric fuel heater.

Two fuel system configurations are available, the standard extended life spin-on filter system and the extra heavy-duty suction side filter system (see **Figure 8.5**).

Figure 8.5 Fuel System Diagram



1. Fuel Tank
2. Supply Line
3. Electric Pump
4. Mechanical Pump
5. Water Drain Valve
6. Fuel Heater
7. Filter
8. Filter or Fuel Head Leak-Off Line
9. Injection Pump
10. Injector Nozzles
11. Bleed Screw
12. Return Line
13. Level Sensor
14. Vent Cap
15. Fuel Head Assembly

8.5.2 Priming the Fuel System

The mechanical fuel pump (**Figure 8.6**) is mounted on the engine next to the injection pump. This pump has a manual plunger for priming the fuel system when the fuel tank has been run dry.

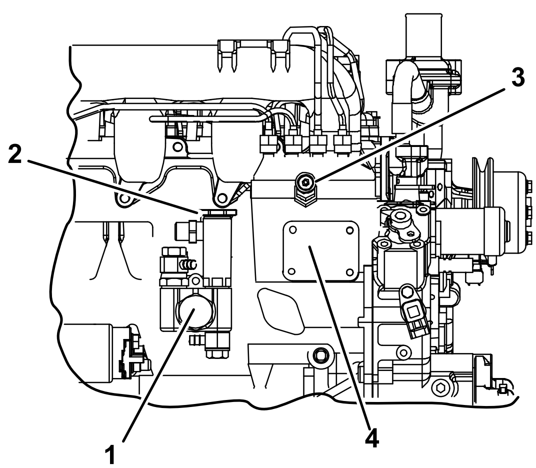
1. If bleeding a spin-on system, considerable effort may be saved by changing the filter and filling the new element with clean diesel fuel before priming the remainder of the system. Refer to **Section 8.5.5**. If bleeding a suction side filter system remove the vent cap from the filter bowl and add fuel until level is about even with the top of the filter element, reinstall cap. Do not allow fuel level to fall below the visible level in the bowl as the bleeding procedure is accomplished, add more fuel if required.
2. Turn the bleed valve (red) counter-clockwise until fully opened.
3. Turn the top of the manual plunger counter-clockwise to unlock it. **S-L-O-W-L-Y** (up/down once per second) pump the manual plunger until positive pressure (resistance) is felt. This may take up to 200 strokes. This will indicate fuel flow.
4. Continue to pump **S-L-O-W-L-Y** (up/down once per second) approximately 100 more strokes to fill the filter and bleed the air out of the lines.
5. Start engine. It may be necessary to continue to pump until the engine starts.

NOTICE

Running the engine for an extended period of time with the manual plunger up can cause a priming pump failure

6. Depress and turn the top of the manual plunger clockwise to lock in place.
7. When engine is running smoothly, turn bleed valve clockwise until fully closed. If bleeding a suction side filter system, loosen the vent on the cover until fuel level lowers to the collar clamp then hand tighten vent.

Figure 8.6 Fuel Bleed Components

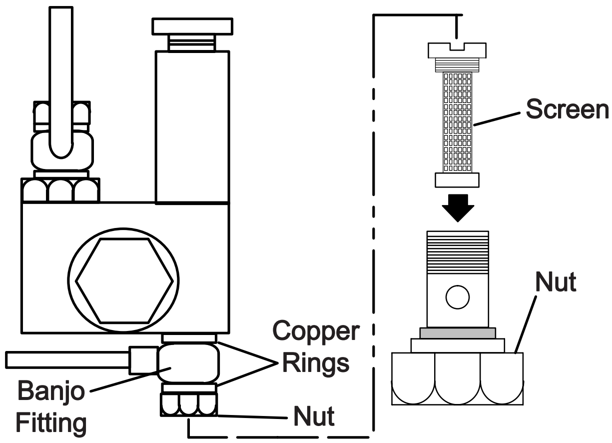


1. Mechanical Fuel Pump
2. Manual Plunger
3. Bleed Valve
4. Injection Pump

8.5.3 Mechanical Fuel Pump Screen, Check/Replace

The fuel screen (**Figure 8.7**) may become plugged or restricted with foreign particles or wax as a result of using the wrong grade of fuel or untreated fuel in cold weather. This will cause the engine to lose power. The screen must be cleaned on a regular schedule such as unit Pretrip or when the oil and fuel filters are changed.

Figure 8.7 Mechanical Fuel Pump



1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter.
2. Turn nut (**Figure 8.7**) counter-clockwise to loosen and remove it.
3. Remove banjo fitting and let it hang loose. Discard copper rings and replace with new ones.
4. Turn screen counter-clockwise and remove. Check and clean, or replace as required.
5. To install reverse above steps.
6. Re-enable the starter, start unit and check for leaks.

8.5.4 Electric Fuel Pump Screen Check/Replace

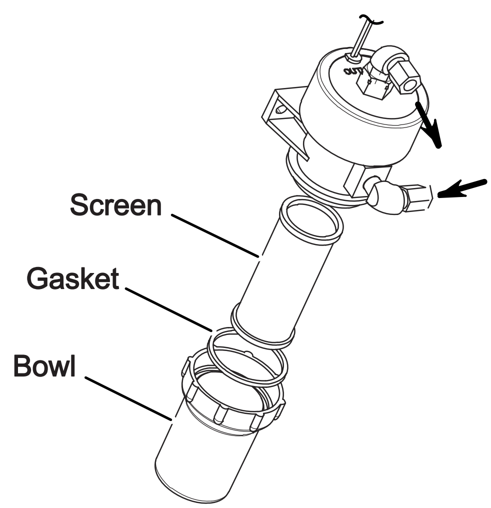
1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter.
2. Remove bowl ((**Figure 8.8**).
3. Remove gasket and screen.

⚠ WARNING

Use the required protective eye wear and clothing when working with solvents.

4. Wash screen in cleaning solvent and blow out with air pressure. Clean bowl.
5. To install, reverse above steps.
6. Re-enable the starter, start unit and check for leaks.

Figure 8.8 Electric Fuel Pump



8.5.5 Spin–On Fuel Filter Replacement

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter.
2. Place a shallow pan under Filter (**Figure 8.5**) and open Water Drain Valve to drain contents.
3. Remove water separator and O-ring or heater bowl and then remove element.
4. Install water separator on new element using new O-ring or heater bowl on new element using new gasket.
5. Fill new element with clean diesel fuel, lubricate the seal and install. Tighten firmly by hand.
6. Re-enable the starter, start unit and check for leaks.

8.5.6 Suction Side Fuel Filter Replacement

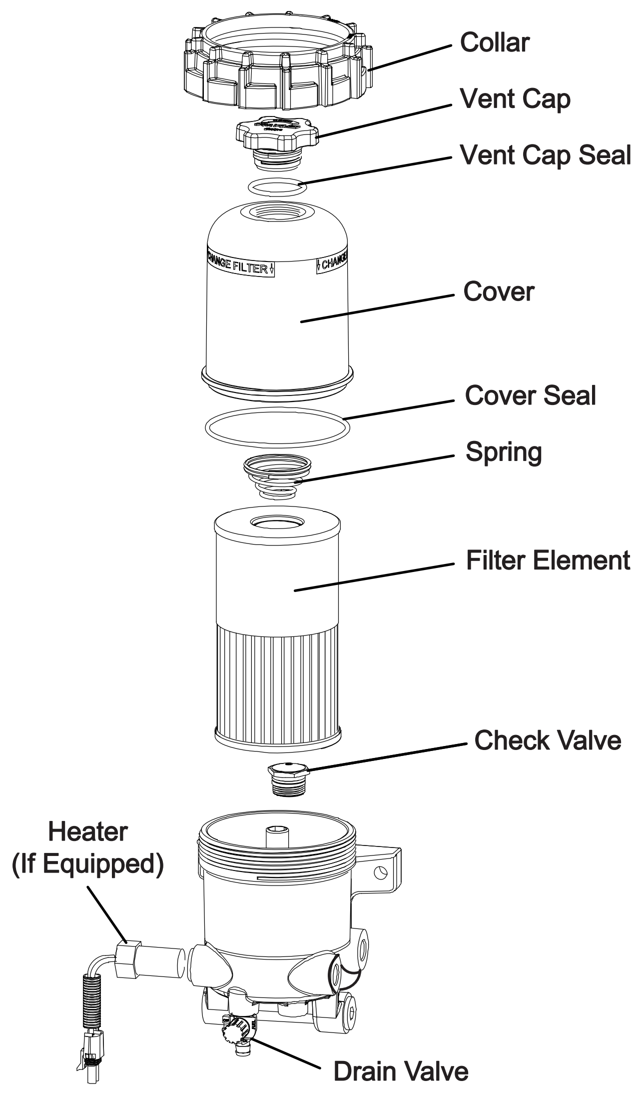
1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter.

NOTE

If required, use a lock collar wrench (Carrier Transicold part number 07–00423–00) to loosen the collar or vent cap. Do not use the wrench to install vent cap or collar, hand tighten only.

2. Place a shallow pan under filter (**Figure 8.9**). Remove the vent cap and open the drain valve to drain the fuel below the collar level.
3. Remove the collar then remove the clear cover.
4. Remove filter element spring, cover seal and vent cap seal. Dispose of the filter element and seals properly.
5. Using a clean shop rag, clean the cover, collar and threads on the filter body.
6. Install new filter element, cover seal and vent cap seal. Install filter with spring at top and hand tighten collar.
7. Prime the system by removing the vent cap from the filter bowl and add fuel until level is about even with the top of the filter element. Reinstall cap and hand tighten.
8. Re-enable the starter, start the engine and run for one minute. Slowly open the vent cap and allow the fuel level to drop to about one inch above the collar.
9. Hand tighten the vent cap.

Figure 8.9 Suction Side Fuel Filter



8.5.7 Fuel Level Sensor (FLS)

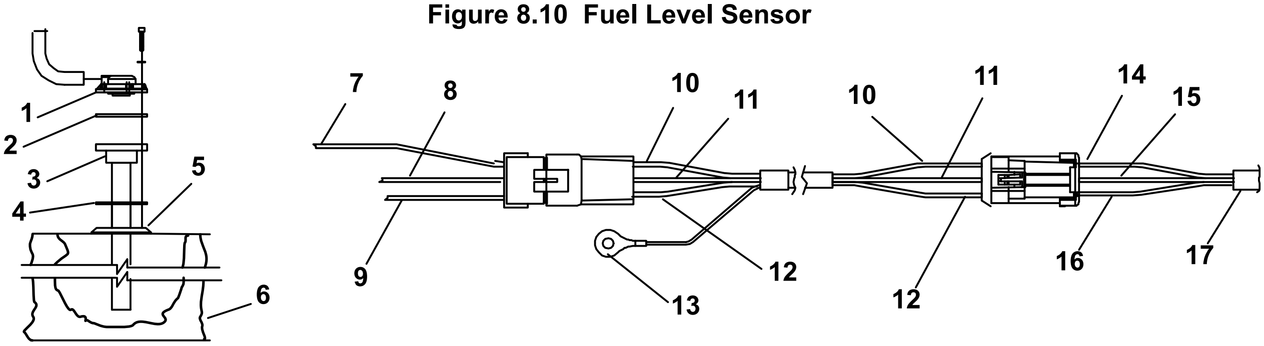
An optional Fuel Level Sensor (**Figure 8.10**) supplies an input signal to the control system as to the percent of fuel remaining in the fuel tank.

The control system will activate alarm **00001 Low Fuel Level Warning** when fuel level reaches 15%, and (if configured to do so) shuts the engine down when fuel level reaches 10%. The fuel level is also displayed in Unit Data.

8.5.7.1 Check the Fuel Level Sensor:

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter.
2. Verify that the wiring is correct, cable shield is properly grounded and condition of connectors. No damage to sensor; no damage, moisture or corrosion in connectors.
3. Energize sensor circuit, (MM calling for engine operation). Check power (approximately 12 VDC) from PCM-22 (9, **Figure 8.10**) through to connector (13). Check ground from 2MM-24 (8) through connector (12). Check signal (greater than 0.24 VDC and less than 5VDC) at 2MM-13.
4. If checks in the preceding step are OK, remove the fuel level sensor, focus tube andand gaskets. With the trailer level, verify that the fuel level sensor flange is within one-half bubble of level using a 24 inch level. Adjust tank mounting as required.

Figure 8.10 Fuel Level Sensor



1. Fuel Level Sensor
2. Gasket
3. Focus Tube
4. Sensor Flange
5. Fuel Level Sensor Flange
6. Fuel Tank
7. Wire FLSC to 2MM-13 (Connection C)
8. Wire FLSB to 2MM-24 (Connection B)
9. Wire PCM-22 to FLSA (Connection A)
10. White Wire (Connection C)
11. Black Wire (Connection B)
12. Red Wire (Connection A)
13. Ground (Shield)
14. Yellow Wire (Connection C)
15. Black Wire (Connection B)
16. Red Wire (Connection A)
17. Wires From Sensor

- - - - -

NOTICE

Torque fuel level sensor mounting screws to 15 to 18 inch/lbs (1.7 to 2.0 Nm). DO NOT over tighten, as little as 20 inch/pounds (2.3 Nm) will damage the sensor.

5. Using new gaskets, reinstall fuel level sensor components. The mounting holes are not symmetrical, there is an alignment hole in the sensor, alignment holes and index dimples in the gaskets and an alignment notch in the focus tube flange to assist in aligning the components. Install mounting screws and washers in all mounting holes and bring to finger tight. Tighten in accordance with the instructions provided in the preceding NOTICE.
6. With the fuel tank empty the output reading should be approximately 0.25 VDC.
7. With the fuel tank full, the output reading should be approximately 4.75 VDC.
8. Re-enable the starter, start unit and check for leaks.

8.5.8 Fuel Heater

The optional Fuel Heater (**Figure 8.5**) applies heat to the fuel in the fuel filter. Heating the fuel dissolves/prevents paraffin wax crystals (and ice) that form when diesel fuel is chilled thus enabling the water separator to work more efficiently and to prevent the filter from plugging with wax and/or ice crystals. When the ambient air sensor is reading 77°F (25°C) or higher, the APX Control System will not enable this circuit. Also, the heater is fitted with an internal temperature switch (FHTS - see schematic diagram, **Section 10**). The heater used in spin on type filter systems closes on a temperature fall, to energize the heater element at temperatures below 45°F (7.2°C), and opens on a temperature rise to de-energize the heater element at 75°F (23.9°C). The heater used in suction side filter systems closes at temperatures below 53 ± 7°F (11.7 ± 3.9°C).

8.5.8.1 Test the Fuel Heater:

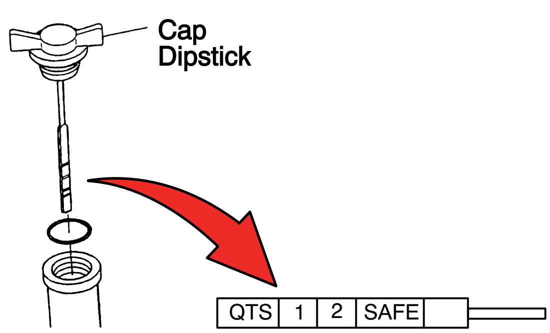
1. Using Unit Data (refer to **Section 3.14**), check to ensure the Ambient Air Temperature reading is below 77°F (25°C), if the reading is below this temperature the fuel heater relay (FHR) should be energized. If the relay does not energize, check for power from PCM fuse F10 to the relay coil + terminal and ground from the coil negative connection through PCM-17 to 3MM-17.
2. With the relay contacts closed, check for power from F7, through the relay contacts, fuse F14, through PCM-14 and 3 through SP-8 to the fuel heater connector at terminal A. Check also for ground from the fuel heater connector terminal B through SP-3 to GND1RING1.
3. If the wiring is good and the fuel heater temperature is below the actuation temperature of 77°F (25°C), replace the fuel heater. If the wiring is good but the fuel heater temperature is above the actuation temperature, the internal temperature switch may be open. Retest at a temperature below the actuation temperature as soon as conditions allow.
4. Start unit and check for leaks.

8.5.9 Engine Oil And Oil Filter

8.5.9.1 Check Engine Oil Level

1. Warm up the engine and then stop it by placing the START/RUN-OFF switch in the OFF position.
2. Unscrew the cap/dipstick (**Figure 8.11**). Wipe the dipstick clean and insert the cap into the oil fill tube without threading into tube.
3. Remove the dipstick again and check oil level. DO NOT add oil if the level is in the “safe” range. If needed, add oil as indicated by markings on dipstick until level is in the “safe” range.
4. After checking or adding oil as necessary, ensure cap is threaded back onto oil fill tube.

Figure 8.11 Engine Oil Level



8.5.9.2 Change Engine Oil

1. Warm up the engine and then stop it by placing the START/RUN-OFF switch in the OFF position.
2. Ensure the unit will not start automatically by disabling the starter.
3. If available, install oil drain tool (CTD part number 68-15763-01) (**Figure 8.12**.)The Oil Drain Tool not only directs the oil over the door latch pin bracket and bottom panel on units so equipped, but also holds a typical drain bucket in place while the oil is draining from the engine.
4. Remove drain plug, drain engine oil. Replace plug and refill engine with oil. Continue with step c. and change oil filter.

Figure 8.12 Oil Drain Tool

8.5.9.3 Change Engine Oil Filter

1. If not continuing from the previous step, warm up the engine and then stop it by placing the START/RUN-OFF switch in the OFF position.
2. Ensure the unit will not start automatically by disabling the starter.
3. Remove oil filter. Ensure filter mounting is clean.

NOTICE

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

4. Lightly oil gasket on new filter before installing. Tighten 3/4 to 1 turn after seal makes contact.
5. Re-enable the starter, start unit and check for leaks.

8.5.10 Air Cleaner

The 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 remove contaminants from the air entering the engine. An excessive accumulation of contaminants in the air cleaner will impair its operation; therefore, a service schedule must be set up and followed.

An air cleaner service indicator is connected to the intake manifold. Its function is to indicate when the air cleaner filter element requires replacement. During operation, when a plugged air filter element causes the intake manifold pressure to drop to 20” (500 mm) WG, the indicator will move to the red line. The filter element should then be replaced and the indicator reset by pressing the reset button.

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter.
2. Check all connections for mechanical tightness. Be sure filter outlet pipe is not fractured.
3. Release 2 clips on air cleaner housing and remove the cover.
4. Remove filter element, wipe inside of air cleaner housing clean inspect filter element and replace if required.

5. Wipe inside of the cover and re-install.
6. Re-secure 2 clips on air cleaner housing.
7. Re-enable the starter, start unit and check for leaks. Reset air cleaner service indicator.

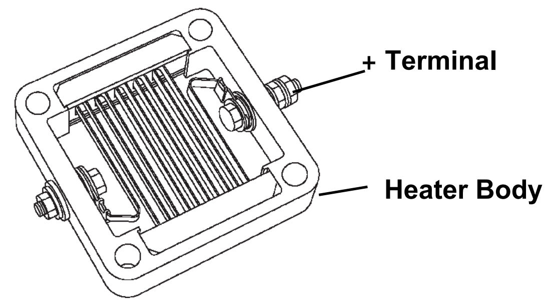
8.5.11 Engine Preheater

Current draw for the preheat circuit is checked during Pretrip (**Section 3.6**). Refer to **Section 2.11** for proper amperage and resistance values.

8.5.11.1 Engine Preheater (EPH) Troubleshooting

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter.
2. Disconnect the lead.
3. Measure the resistance between the + terminal and the heater body. Refer to **Section 2.8** for correct resistance value.
4. If the resistance is infinite or zero, the engine preheat element is faulty and must be replaced.

Figure 8.13 Engine Preheater



8.5.11.2 Replace Engine Preheater

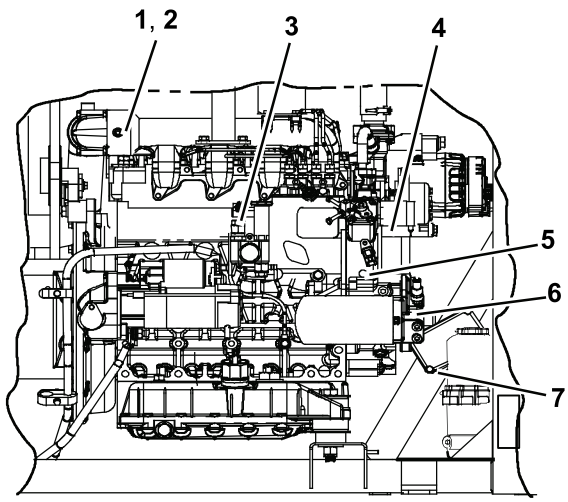
1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter.
2. Remove the inlet hose.
3. Disconnect the lead.
4. Remove the flange, engine preheater and gaskets.

NOTE

To avoid short-circuiting the heater, ensure the heater and heater elements are vertical when assembling to the intake manifold. The plus terminal is to be mounted towards the front of the unit.

5. Clean gasket surfaces and reinstall engine preheater and flange using new gaskets. Torque flange bolts to 15 to 20 ft/lbs (20.3 to 27.1 nm).
6. Re-enable the starter, start unit and run Pretrip to check operation.

Figure 8.14 Engine Control System



1. Engine Preheater (EPH)
2. Engine Coolant Temperature Sensor (ENCT) (Behind Engine Preheater)
3. Rack Position Sensor (RPS)
4. Fuel/Speed Actuator (FSA)
5. Engine Speed Sensor (ENSSN)
6. Engine Oil Pressure Switch (ENOPS)
7. Engine Control Unit (ENCU)

8.5.12 Engine Control System

The engine is controlled by the engine control unit (ENCU), the fuel/speed actuator (FSA), the engine speed sensor (ENSSN), the rack position sensor (RPS), the engine oil pressure switch (ENOPS) and the engine coolant temperature sensor (ENCT). Refer to **Figure 8.14**.

- The ENCU starts, stops and controls engine speed by varying the position of the FSA rod. It also provides oil pressure, coolant temperature, engine load and speed signals to the APX Control System over the CAN.
- The FSA combines the fuel shutoff solenoid and speed control solenoid into one component; opening and closing the fuel rack (throttle) in accordance with signals from the ENCU.
- The ENSSN provides the speed signal to the ENCU.
- The ENOPS is connected to the engine oil pump outlet. It provides an open or closed signal to the ENCU.
- The RPS provides the position of the rack to the ENCU.
- The ENCT provides the engine coolant temperature signal to the ENCU.
- If any of these components is not functioning correctly, a corresponding alarm will be activated.

8.5.13 Rack Position Sensor (RPS) Calibration

The Rack Position Sensor calibration procedure is a software function that can only be initiated in Technician Mode. This calibration procedure should be performed after replacing the Engine, the ENCU, or the Rack Position Sensor.

To Start the Rack Position Sensor Calibration Procedure:

1. Put the system into Technician Mode, refer to **Section 5.2**.
2. Select the Component Calibration Mode soft key.
3. Press “=” to start the Rack Position Sensor calibration.

During calibration, the display will show the Engine Load (percent), RPM, current calibration offset (the offset in the Engine ECU), and calibration status.

The RPS is calibrated at an engine speed of 1700 - 1780 RPM. In order to reach the required engine speed, the system will incrementally increase engine load.

If engine speed is not low enough to calibrate the sensor (1700 – 1780 RPM), the system will indicate that the load is too low for calibration. In this case you will have to manually increase the system load by slowly blocking the condenser coil until the load is increased enough for the engine to reach calibration RPM, the calibration should complete successfully.

If the Engine Speed still does not reach 1700-1780 RPM, a Gate Valve Assembly can be used to restrict engine air intake using the following steps:

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter.
2. Disconnect the air intake hose (if applicable) from the air cleaner inlet and install the gate valve assembly to the air cleaner inlet. Make sure the gate valve is fully open.
3. Remove the kazoo from the air cleaner and install the plug in its place.
4. Re-enable the starter and start the unit.
5. Slowly close the gate valve to reduce flow and bring engine speed between 1700 and 1780 RPM. Once proper RPM is achieved, the calibration process will begin.

After the calibration process is finished, the system will indicate that the calibration was successful, and the engine will shut down.

8.5.14 Cooling System

8.5.14.1 Cleaning and Flushing

Air flows through the condenser and then the radiator. The cooling surfaces must be clean and the interior of the radiator must be clean for adequate cooling.

NOTICE

Use only red Extended Life Coolant, Nitrite Free (ELC-NF) that is premixed to a 50/50 concentration of coolant/water. Coolant should meet ASTM specifications D3306 and D6210 and be labeled for at least five years, 12,000 hours service life. Do not add conventional or long life coolant (green, purple, or blue-green) to a cooling system using ELC-NF (Red) coolant except in an emergency. If the ELC-NF coolant is diluted with conventional or long life coolant the change interval reverts to two years, 6,000 hours.

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and removing the negative battery cable.
2. Remove all foreign material from the condenser and radiator 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.

WARNING

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

NOTE

Draining the coolant from the engine petcock will leave approximately 1 quart (.9 liters) of coolant in the block.

3. Drain coolant completely by removing radiator cap and then the lower radiator hose or drain plug located at the opposite end of the radiator.

NOTICE

NEVER POUR COLD WATER INTO A HOT ENGINE, however hot water can always be added to a cold engine.

4. Install hose or drain plug and fill system with clean, untreated water.

NOTE

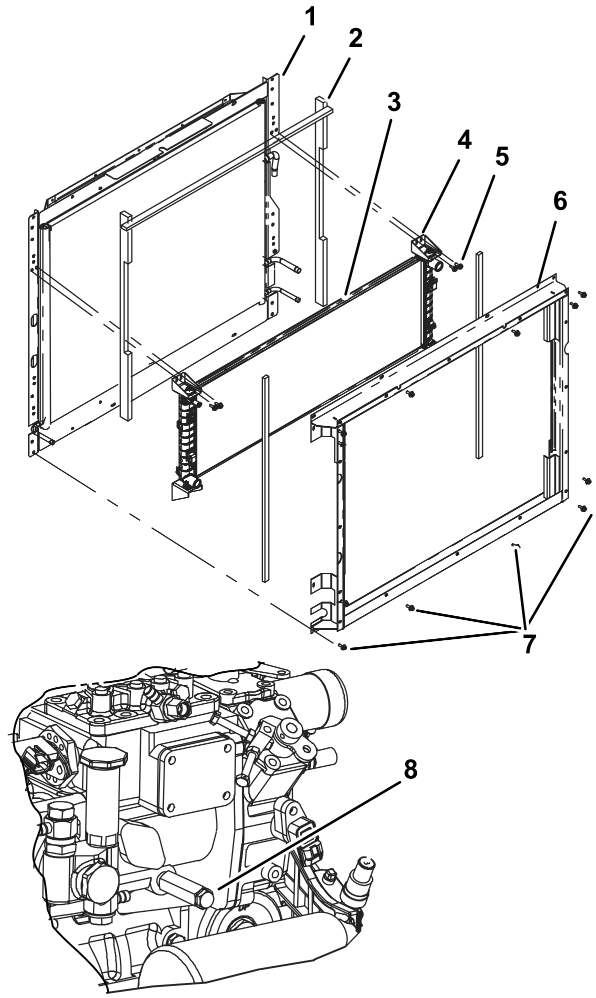
Only clean water should be used to flush the cooling system. Do not use any radiator flush or detergents to clean the radiator.

5. Start the engine and drain system while warm. Rinse system three times after it has cooled down. Refill system with water.
6. Run engine to operating temperature. Drain system again and fill with 50/50 water/anti-freeze mixture. (refer to the Notice at the beginning of this section.)
7. Reinstall the negative battery cable, start unit and check for leaks.

8.5.14.2 Radiator Replacement

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and removing the negative battery cable.
2. To access the radiator, remove the surround with grill attached, refer to **Section 8.4.3**. Then remove the condenser fan support bracket at the top of the frame.
3. Drain coolant into a suitable container by removing coolant bottle cap and then the engine drain plug (see **Figure 8.15**).
4. Remove condenser fan, refer to **Section 8.6.3**, and then remove the lower fan shroud.
5. Remove the rear condenser frame mounting bolts and slide the frame back.
6. Remove the radiator inlet, outlet, and coolant bottle hoses at the radiator fittings. Remove top radiator mounting brackets.
7. Lift curb side of radiator and work coolant bottle and outlet fitting between frames. Using a catch pan at the radiator inlet, lift radiator vertical. Work inlet fitting between frames at the curb side, in the same manner as the outlet fitting, and remove radiator through the top of the unit.
8. Re-assemble in reverse order of removal. Torque frame and radiator mounting bolts 36 to 60 inch/lbs (4.1 to 6.8 Nm) and condenser fan support bracket bolts 95 to 119 inch/lbs (10.7 to 13.4 Nm).
9. Fill radiator with 50/50 water/anti-freeze mixture.
10. Reinstall the negative battery cable, start unit and check for leaks.

Figure 8.15 Radiator Assembly



1. Front Condenser Frame and Condenser
2. Gasket (Typical)
3. Radiator
4. Radiator Mounting Bracket
5. Radiator Mounting Bracket Bolts
6. Rear Condenser Frame
7. Rear Condenser Frame Mounting Bolts
8. Engine Drain Plug

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8.5.15 Water Pump/Alternator Belt

The water pump/alternator 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 alternator.

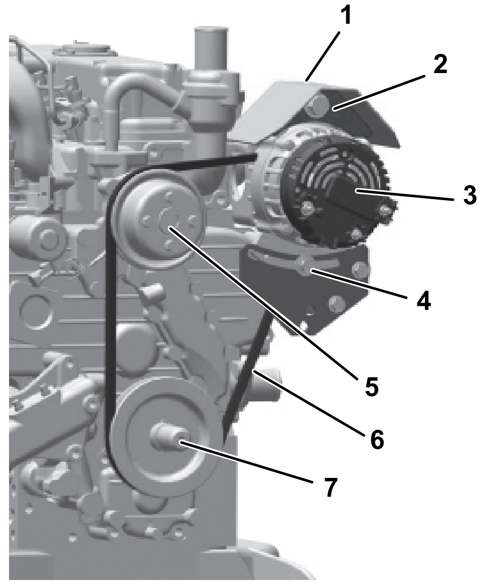
⚠ WARNING

Beware of moving belt and belt-driven components. When working with belts, beware of pinch points.

When replacing a belt, avoid excessive force when applying tension to the belt to prevent damage to the water pump bearings.

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and removing the negative battery cable.
2. Loosen pivot bolt and adjusting bolt, and remove old belt (**Figure 8.16**). Place new belt on sheaves and then loosely position alternator.

Figure 8.16 Water Pump/Alternator Belt



1. Rain Shield
2. Pivot Bolt
3. Alternator
4. Adjustment Bolt
5. Water Pump
6. Water Pump/Alternator Belt
7. Crankshaft Sheave

3. Check the center alignment of the engine drive, alternator and water pump sheaves to ensure proper alignment. Pulley misalignment will create excess belt wear and shorten alternator bearing life. The center line of all three sheaves must be in line.
4. 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*. Check belt tension, using belt tension tool Carrier Transicold part number 07-00203-00 or 07-00253-00, in accordance with the following chart. Tighten pivot bolt 80 to 90 ft/lbs (108.5 to 122.0 Nm) and adjustment bolt 14 to 19 ft/lbs (19.0 to 25.8 Nm).

Replacement Belt Initial Tension		Replacement Belt Tension After 15 Minutes of Running Time	
Lbs	**Nm**	**Lbs**	**Nm**
45 to 55	62 to 76	45 to 55	62 to 76

5. Reinstall the negative battery cable, run unit for15 minutes. Remove negative battery cable, recheck belt tension and then reconnect negative battery cable.

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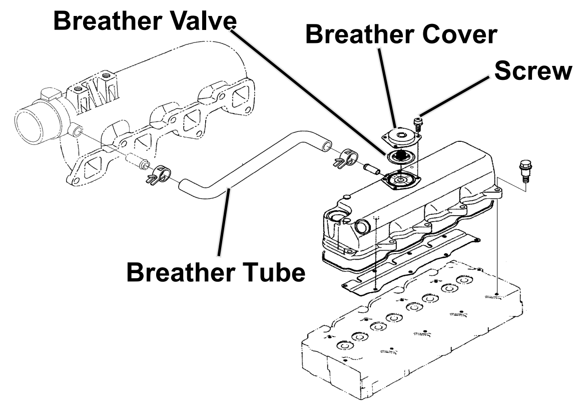
8.5.16 Crankcase Breather

The engine uses a closed type breather with the breather line attached to the cylinder head cover (Figure 8.17). The breather assembly should be cleaned once a year or at every oil change interval (whichever comes first) (Table 8–1).

Figure 8.17 Engine Crankcase Breather



8.6 Power Train Service

WARNING

Beware of moving belt and belt-driven components. When working with belts, beware of pinch points.

The power train (Figure 2.4) is a belt drive system that transfers power from the engine to the condenser and evaporator fans. The system consists an upper and lower belt, gear box, fanshaft and clutch. Service instructions for the power train system are provided in the following sub paragraphs.

NOTE

Coverage of the water pump/alternator belt is provided in Section Figure 8.15 while coverage of the alternator is provided in Section 8.9.19.

Figure 8.18 Lower Belt

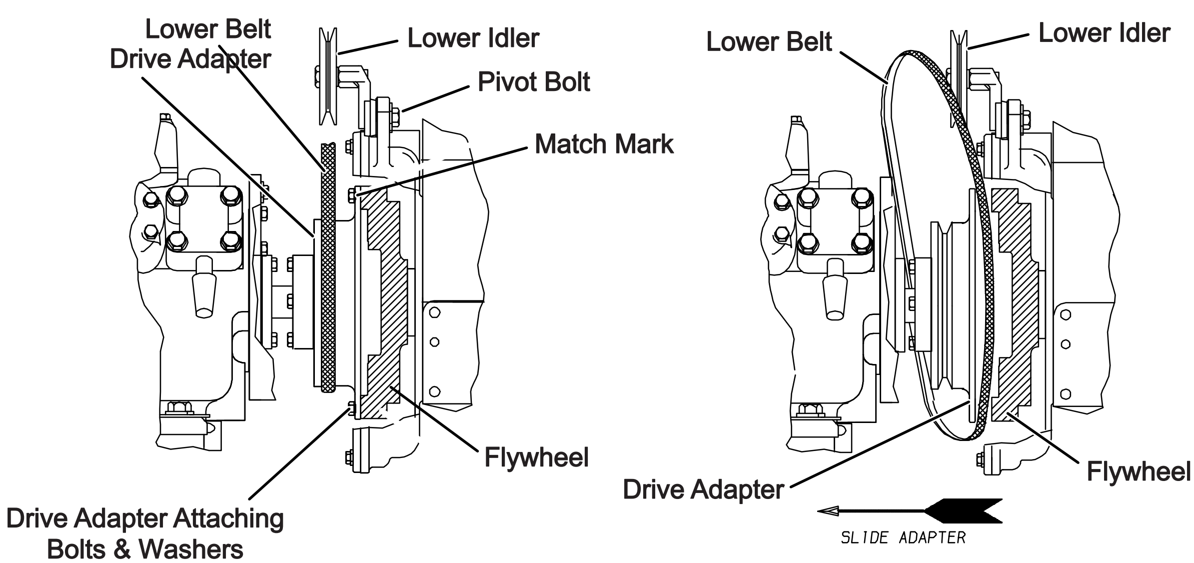


Figure A

Figure B

8.6.1 Lower Belt Replacement

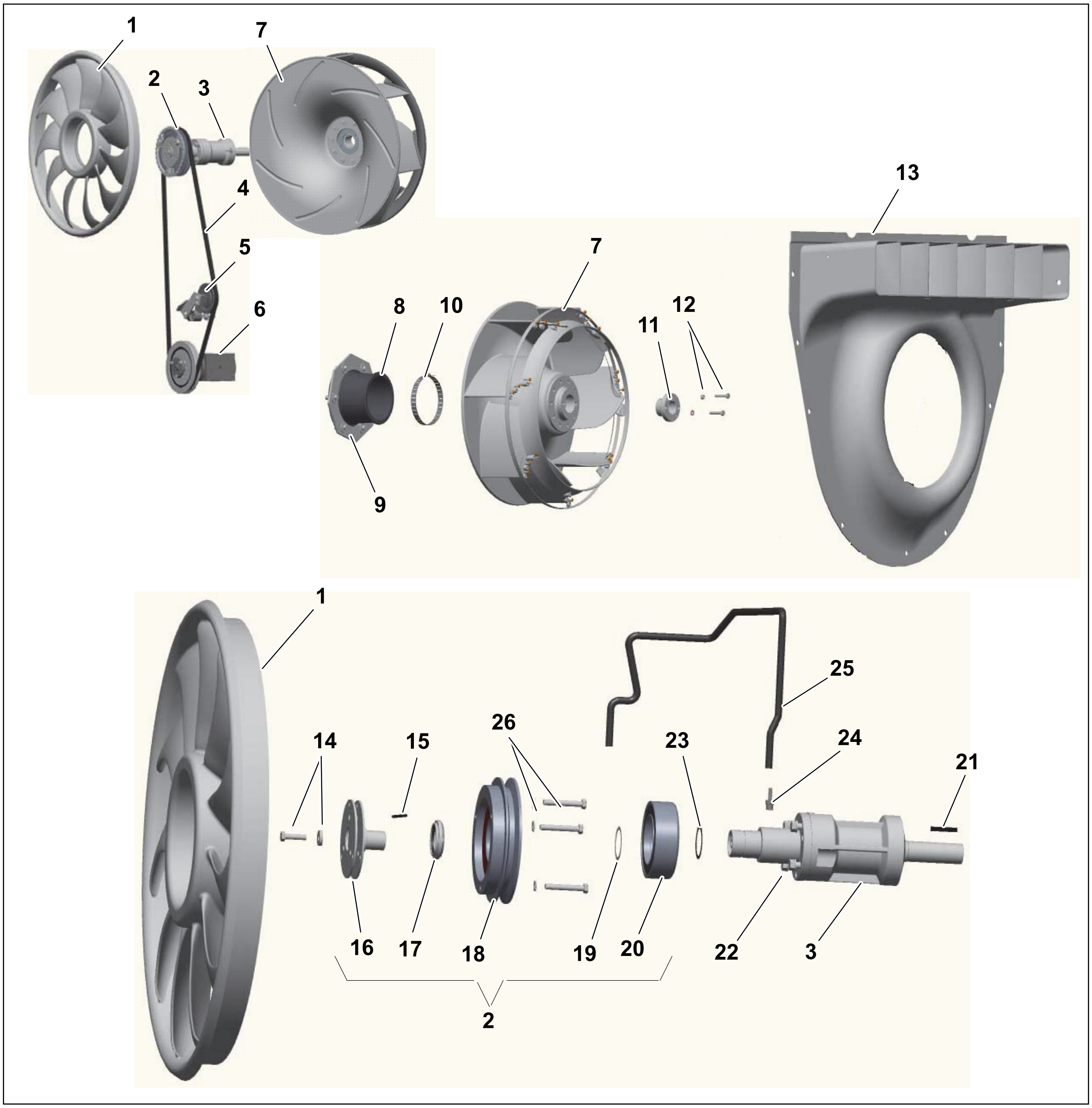
To remove and reinstall the lower belt, refer to **Figure 8.18**.

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and removing the negative battery cable.
2. Match mark drive adapter to flywheel at position shown for ease of reassembly.
3. Loosen the lower idler pivot bolt and slide adjustment bolt to release belt tension.
4. Remove six bolts, securing drive adapter to flywheel.
5. Insert two of the six bolts into the threaded holes (jacking holes) provided on drive adapter. Tighten these bolts evenly to push the drive adapter from the flywheel. After separating the adapter from the flywheel, remove the two bolts from adapter. Insert a pry bar between flywheel and drive adapter and slide the adapter toward the compressor enough to change the belt as shown in **Figure 8.18** *Figure B*. Remove and replace belt.
6. Reinstall by prying the adapter back toward the engine flywheel or use 5/16-18 x 2-1/2 lg bolts in every other hole of adapter and take up evenly on the bolts until the original 5/16-18 x 1 lg bolts engage flywheel.
7. Apply thread sealer (Loctite #262) to the bolts. Take up on all bolts evenly and then torque bolts 26 to 30 ft/ lbs (35.3 to 40.7 Nm).
8. Fit new belt in grooves and check the center alignment of the drive adapter, upper idler and gearbox sheaves to ensure proper alignment. Pulley misalignment will create excess belt wear and shorten alternator bearing life. The center line of all three sheaves must be in line.
9. Pivot idler to place tension on belt and set belt tension, using belt tension tool Carrier Transicold part number 07-00203-00 or 07-00253-00, in accordance with the following chart. Tighten idler pivot and adjustment slide bolts.

Replacement Belt Initial Tension		Replacement Belt Tension After 15 Minutes of Running Time	
Lbs	Nm	Lbs	Nm
140 to 150	190 to 203	70 to 80	95 to 108

10. Reinstall the negative battery cable and run unit for 15 minutes.
11. Remove battery negative cable, recheck belt tension and then reconnect negative battery cable.

Figure 8.19 Upper Power Train



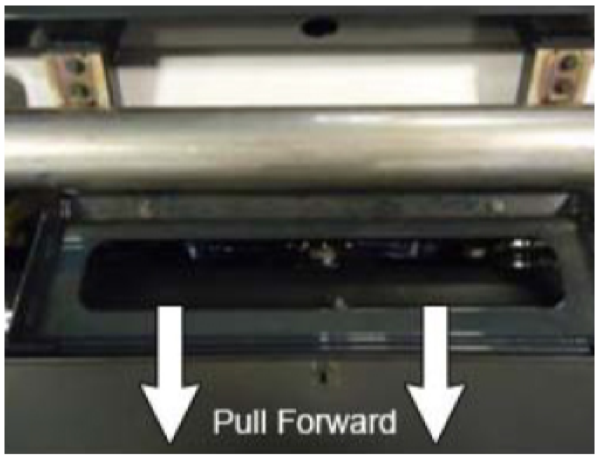
1. Condenser Fan
2. Clutch
3. Fanshaft
4. Upper Belt
5. Upper Idler
6. Gear Box
7. Evaporator Fan
8. Seal Ring
9. Compression Ring
10. Seal Ring Clamp
11. Bushing
12. Bushing Bolts and Washers
13. Nozzle Cover
14. Armature Retaining Bolts and Washers
15. Key (Round End)
16. Armature
17. Rotor Retaining Nut
18. Clutch Rotor
19. Rotor Spacer
20. Coil
21. Key (Square End)
22. Fanshaft bolts and washers
23. Shims
24. Vent Fitting
25. Vent Tube
26. Fan/Clutch Bolts and Washers

8.6.2 Upper Belt Replacement

To remove and reinstall the upper belt, refer to **Figure 8.19**:

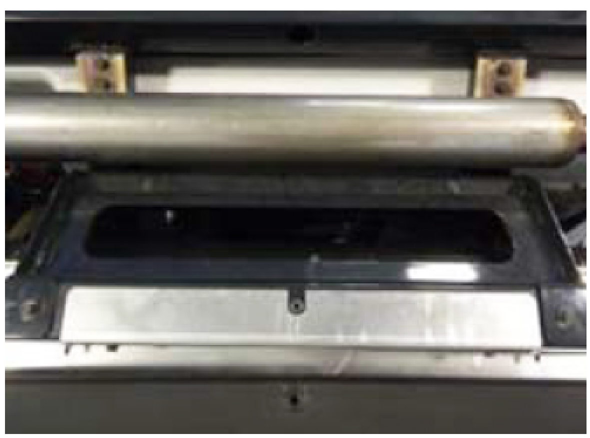
1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and removing the negative battery cable.
2. Loosen the Upper Idler pivot bolt and release tension.
3. Open the front doors.
4. Remove the top five bolts that secure the surround to the unit (**Figure 8.3**).
5. Remove the upper frame support.
6. Pull the unattached surround towards the front of the unit to gain access to the upper frame support.

Figure 8.20 Surround



7. Remove the upper fan shroud bolts, and remove the shroud.

Figure 8.21 Upper Frame Support



8. Remove three bolts (27) that secure condenser fan (1) to clutch rotor (19). Slide the fan away from the clutch (2) sufficient to remove the belt.
9. Remove the belt.
10. Reinstall by sliding belt into clutch groove, reposition fan and securing with the three bolts. Torque bolts 18 to 22 ft/lbs (24.4 to 29.8 Nm).
11. Fit belt in place in grooves and check the center alignment of the clutch, upper idler and gearbox sheaves to ensure proper alignment. Pulley misalignment will create excess belt wear and shorten alternator bearing life. The center line of all three sheaves must be in line.

12. Pivot the idler to place tension on belt using hand force only. *Do not use pry bar or excessive force as it may cause bearing failure*. Use a 10” adjustable wrench to pivot idler and set belt tension. Use belt tension tool Carrier Transicold part number 07-00203-00 or 07-00253-00, in accordance with the following chart. Tighten upper idler pivot bolt.

Replacement Belt Initial Tension		Replacement Belt Tension After 15 Minutes of Running Time	
Lbs	**Nm**	**Lbs**	**Nm**
140 to 150	190 to 203	70 to 80	95 to 108

13. Reinstall upper fan shroud and upper frame support.
14. Reinstall the five upper mounting bolts to secure the surround (**Figure 8.3**).
15. Reconnect the negative battery cable. Run unit for 15 minutes. Remove battery negative cable, recheck belt tension and then reconnect negative battery cable.

8.6.3 Condenser Fan

To remove and reinstall the condenser fan, refer to **Figure 8.19**.

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and removing the negative battery cable.
2. Remove the upper frame support and upper fan shroud.
3. Remove the three Fan/Clutch Bolts that secure the condenser fan to the clutch rotor and remove from unit.
4. Slide new fan in place and secure with three bolts. Torque 18 to 22 ft/lbs (24.4 to 29.8 Nm).
5. Reinstall shroud. Torque all shroud bolts 36 to 70 inch/ lbs (4.1 to 6.8 Nm). Reinstall upper frame support, torque bolts 96 to 120 inch/lbs (10.8 to 13.6 Nm).
6. Reinstall the negative battery cable, start unit and run Pretrip to check operation.

8.6.4 Clutch

To remove and reinstall the clutch, refer to **Figure 8.19**.

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and removing the negative battery cable.
2. Remove the upper belt and condenser fan. Refer to **Section 8.6.2** and **8.6.3**.

NOTE

When working with the clutch it is important to note that the armature retaining bolt and rotor retaining nut are both left hand thread. Turn clockwise to remove.

3. Place the three pins of a spanner wrench (Carrier Transicold part number 07-00396-01) into the holes on the face of the armature. Place the tool handle between the fanshaft frame support and pod (10 o’clock position) to prevent rotation, then loosen and remove the armature retaining bolts and washers. Ensure the key is not lost during disassembly. If required, a standard 5/8-11 X 1 inch long right hand thread bolt can be threaded through the center to jack the armature off the shaft.
4. Using a spanner socket (Carrier Transicold part number 07-00303-02) remove the rotor retaining nut, rotor and rotor spacer.
5. Disconnect the coil connector and remove the coil. Note assembly sequence of shims on fanshaft housing for re-assembly.
6. Procure kits (clutch, coil or mounting) for reassembly as required.
7. Place shims onto the fanshaft. Slide coil in place with harness on the bottom, at the 6 o’clock position.
8. Using new spacer, install rotor and spacer onto fanshaft. Thread rotor retaining nut onto fanshaft and, using spanner socket, tighten 80 to 85 ft/lbs (108 to 115 Nm).

9. Ensuring key is properly positioned. If force is required to install key, support the shaft while tapping key into groove. Install armature onto fanshaft. With spanner wrench in position, thread new armature bolt and washer into fanshaft and tighten 25 to 30 ft/lbs (33.9 to 40.7 Nm).

10. Using air gap measuring tool (Carrier Transicold part number 07-00432-00) check gap. (Refer to Technical Instruction 98-50180 for air gap tool usage instructions.) The gap should be between 0.015 and 0.095 inch (0.38 and 2.3 mm).

11. If the gap is less than 0.015, remove enough shims to increase the gap to approximately 0.020 inch (0.25 mm). Shims (Carrier Transicold part number 50-00232-30) are 0.010 inch (0.25 mm) each. If the gap is more than 0.090 inch add enough shims to reduce the gap to approximately 0.020 inch.

12. Reinstall the condenser fan and upper belt. Refer to **Section 8.6.2** and **8.6.3**.

13. Reinstall the negative battery cable, start unit and run Pretrip to check operation.

8.6.5 Evaporator Fan

To remove and reinstall the evaporator fan refer to **Figure 8.19**.

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and removing the negative battery cable.

2. Remove the bulkhead and air chute (if equipped) and then remove the evaporator back panel.

3. Mark insertion depth on supply air sensor (SAT) to aid in reassembly and remove from the nozzle cover. Care should be taken to prevent cutting wires on the evaporator coil.

4. Remove the bushing bolts from the split taper bushing, insert them into the threaded holes and tighten evenly to push fan away from the bushing. Ensure key is not lost during disassembly.

5. To reinstall the evaporator fan, ensure key is properly positioned. If force is required to install key, support the shaft while tapping key into groove. Slide the fan onto the fanshaft, and install the bushing with screws finger tight.

6. Position so that fan just touches pod. This will set approximate gap between fan and pod as bushing is tightened. Tighten bolts evenly and then torque 11 to 14 ft/lbs (14.4 to 19.0 Nm).

7. Reinstall nozzle cover. Ensure there is even clearance between evaporator fan and pod and between evaporator fan and nozzle cover (approximately 1/4 inch both sides). Nozzle cover center venturi lip should overlap into evaporator fan inside diameter slightly. Torque bolts to 66 to 80 inch/lbs (7.5 to 9.0 NM).

8. Reinstall supply air temperature sensor and air chute/ bulkhead as required.

9. Reinstall the negative battery cable, start unit and run Pretrip to check operation.

8.6.6 Fanshaft

To remove and reinstall the fanshaft refer to **Figure 8.19**.

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and removing the negative battery cable.

2. Remove the upper belt, condenser fan, clutch and evaporator fan. Refer to **Section 8.6.2** through **8.6.5**.

3. Remove the seal ring clamp, compression ring and carefully peel seal ring from pod (use a putty knife if required).

4. Remove vent hose and 1/8 inch barbed fitting from fanshaft front hub. Install a plug to prevent oil from spilling out during removal.

5. Remove the four fanshaft bolts and washers securing the fanshaft in place and remove shaft.
6. Check oil level in fanshaft. With the vent connection at the top, oil is to be at the level of the oil level plug located in the housing. Add oil as required. Apply thread sealer and re-install level plug in vent to prevent oil from spilling out during installation. Refer to **Section 2.10** for fanshaft oil specification and capacity.
7. To aid in fanshaft alignment, install two 3/8 -16 x 1-1/2 inch studs (bolts with heads cut off) in place of the fanshaft mounting bolts. Reinstall with the vent opening at the top and secure with two bolts and washers. Remove studs and install remaining two bolts and washers. Torque bolts 21 to 23 ft/lbs (28.5 to 31.2 Nm).
8. Apply thread sealer and re-install 1/8 inch barbed fitting and vent hose in front hub. Torque to 120 inch/lbs (13.6 Nm)
9. Reinstall and reseal seal ring, compression ring and clamp. Torque compression ring/seal ring bolts 45 to 50 inch/lbs (5.1 to 5.7 Nm). Suggested torque for the clamp is 38 inch/lbs (4.3 Nm), maximum torque is 50 inch/lbs (5.7 Nm).
10. Reinstall the upper belt, condenser fan, clutch and evaporator fan. Refer to **Section 8.6.2** through **8.6.5**.
11. Reinstall the negative battery cable, start unit and run Pretrip to check operation.

8.6.7 Gearbox

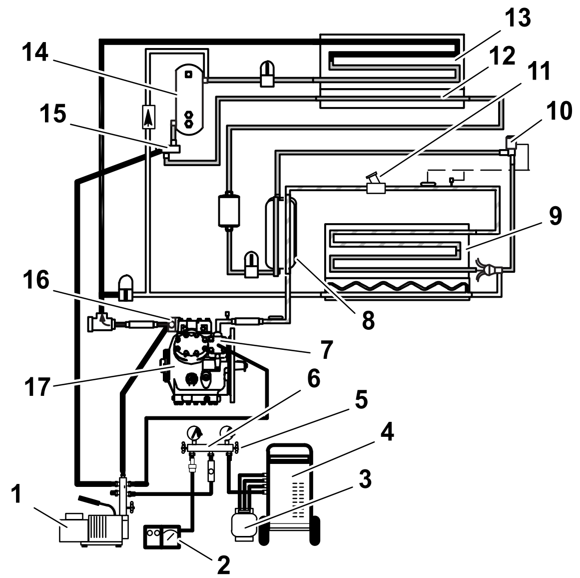
To remove and reinstall the gearbox (right angle drive) refer to **Figure 8.19**.

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and removing the negative battery cable.
2. Remove the lower and upper belts. Refer to **Section 8.6.1** and **8.6.2**.
3. Note location of sheaves. The input sheave is the larger diameter, while the fan drive sheave is the smaller. To remove a sheave, remove the two bolts from the split taper bushing, insert them into the threaded holes and tighten evenly to push sheave away from the bushing. Ensure the key is not lost during disassembly.
4. Remove vent hose and 1/8 inch barbed fitting from gearbox. Install a plug to prevent oil from spilling out during removal.
5. Remove gearbox and drive mounting plate and then remove mounting plate if required.
6. Check oil level in gearbox. With the vent connection at the top, oil is to be at the level of the oil level plug located in the side of the housing. Add oil as required, apply thread sealer and re-install level plug. Reinstall plug in vent to prevent oil from spilling out during installation. Refer to **Section 2.10** for gearbox oil specification and capacity.
7. Re-install by reversing preceding steps. Torque mounting plate to gearbox bolts 16 to 18 ft/lbs (21.7 to 24.4 Nm), mounting plate to frame bolts 30 to 32 ft/lbs (40.7 to 43.4 Nm), bushing bolts 10 to 11 ft/lbs (13.6 to 14.9 Nm), and fitting 22 to 31 ft/lbs (29.8 to 42 Nm).
8. Reinstall the negative battery cable, start unit and run Pretrip to check operation.

8.7 Refrigerant System Service

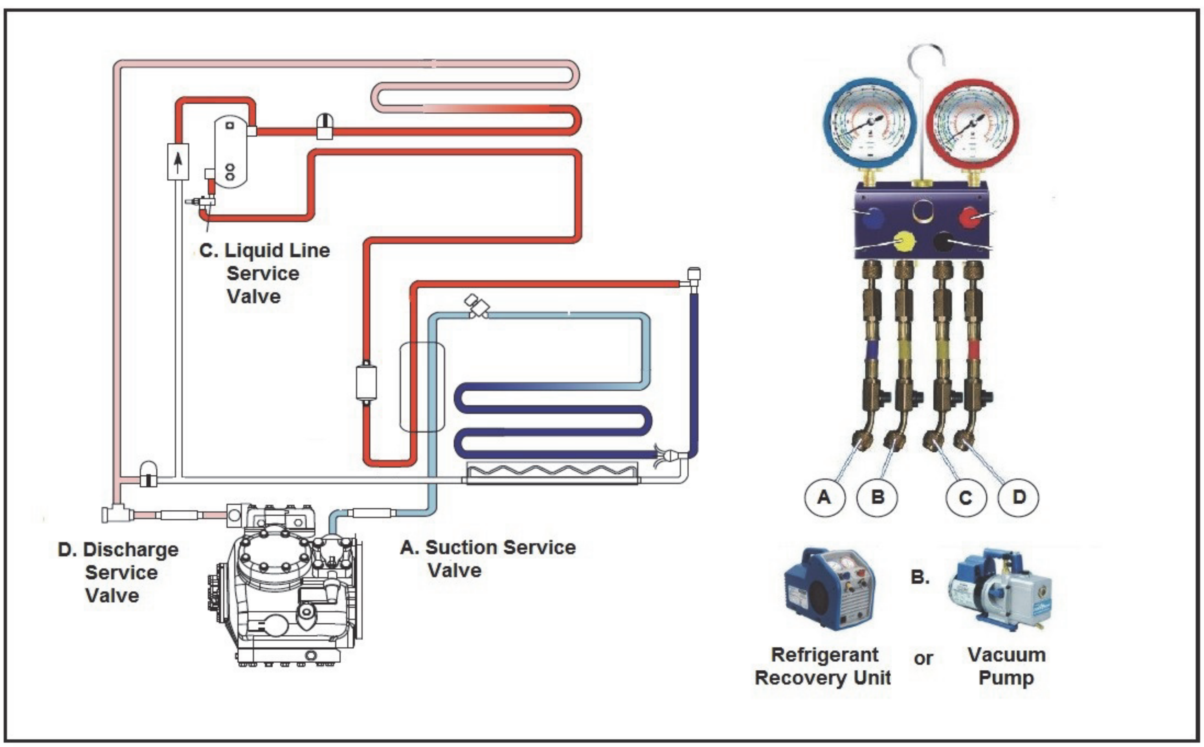
Service of refrigerant system equipment, refrigerant charge, leak checking and evacuation.

Figure 8.22 Typical Refrigerant System Service Equipment



1. Vacuum Pump
2. Vacuum Indicator
3. Refrigerant Cylinder
4. Refrigerant Recovery Unit
5. Valve
6. Manifold Gauge Set
7. Suction Service Valve
8. Heat Exchanger
9. Evaporator
10. Evaporator Expansion Valve
11. Compressor Suction Modulation Valve (CSMV)
12. Subcooler
13. Condenser
14. Receiver
15. Liquid Line Service Valve
16. Discharge Service Valve
17. Compressor

Figure 8.23 Four Port Manifold Gauge Option



8.7.1 Refrigerant System Service Connections

To service the refrigerant system, service equipment is connected at the compressor discharge service valve, compressor suction service valve and/or the liquid line service valve.

When connecting to a valve, backseat the valve (turn counterclockwise) to close off gauge connection and attach service line to the valve. Open valve 1/4 to 1/2 turn (clockwise) and then purge the service line. See **Figure 8.22** for an example of a typical connection setup. See **Figure 8.23** for 4-Port Manifold Gauge option.

NOTE

To avoid damage to the Earth's ozone layer, use a refrigerant recovery system whenever removing refrigerant from a refrigeration system. When working with refrigerants you must comply with all local government environmental laws, U.S.A. EPA section 608.

8.7.2 Servicing the Refrigerant Charge

Servicing of the refrigerant charge includes: checking the charge level, checking for noncondensibles, removing the charge, pumping down the low side, pumping down the compressor, adjusting the charge level and adding a complete charge. Procedures for charge service are provided in the following sub paragraphs.

8.7.2.1 Checking Charge Level

Check the refrigerant charge before adding any refrigerant to the system. Only add refrigerant if charge is low. If charge is low, leak checking must be performed (see **Section 8.7.3**) and all leaks repaired before adding refrigerant.

1. Install a manifold gauge set to allow reading of discharge pressure. Refer to **Figure 8.22** or **Figure 8.23**.
2. Start unit in Continuous Operation. Adjust setpoint so that unit is running in high speed, fully loaded and operating in cooling. Run approximately ten minutes - until the refrigeration system is warmed up and the refrigerated compartment temperature is approaching setpoint.
3. Partially block off air flow to condenser coil so discharge pressure rises to 230 psig (15.7 bar).
4. Check the receiver sight glasses to determine charge. The system is correctly charged when the lower sight glass is not empty and the upper sight glass is not full.
5. If the system appears to be overcharged or under charged, adjust charge. Refer to following step f.

8.7.2.2 Checking For Noncondensibles

1. Install a manifold gauge set to allow reading of suction and discharge pressure. Refer to **Figure 8.22** or **Figure 8.23**.
2. Stabilize the system to equalize pressure between the suction and discharge side of the system. The refrigerant system needs to be off for several hours.
3. Measure temperature at the copper tubing leaving the condenser (not the sub-cooler).
4. Record compressor discharge pressure.
5. Determine saturation pressure as it corresponds to the condenser temperature using the temperature pressure chart (**Table**).
6. If gauge reading is not close to the calculated saturation pressure in step 5, noncondensibles or mixed refrigerants are present.
7. Remove refrigerant. Refer to step c., **Removing Charge.**
8. Leak check, evacuate and recharge the system.

8.7.2.3 Removing Charge R-404A

1. Install a manifold gauge set to allow reading of suction and discharge pressure. Refer to **Figure 8.22** or **Figure 8.23**.

WARNING

Only a refrigerant cylinder containing R404A should be connected to this refrigeration unit in order to pressurize the system. However, dry nitrogen may be used to increase pressure. Any other gas or vapor will contaminate the system and require additional removal and evacuation.

2. Place the unit in Service Mode (Refer to **Section 5.2.5**). Ensure that the operator message panel displays "RECOVER/LEAK CHK/EVAC MODE" during the refrigerant removal procedures. If the control system switches to charge mode during the process, switch it back to the "RECOVER/LEAK CHK/EVAC MODE".
3. Connect a refrigerant recovery device and a clean refrigerant recovery cylinder as shown in **Figure 8.22** or **Figure 8.23** and remove any remaining refrigerant from the system.
4. Refer to instructions provided by the manufacturer of the refrigerant recovery unit.
5. After making necessary repairs, leak check, evacuate and recharge the system.

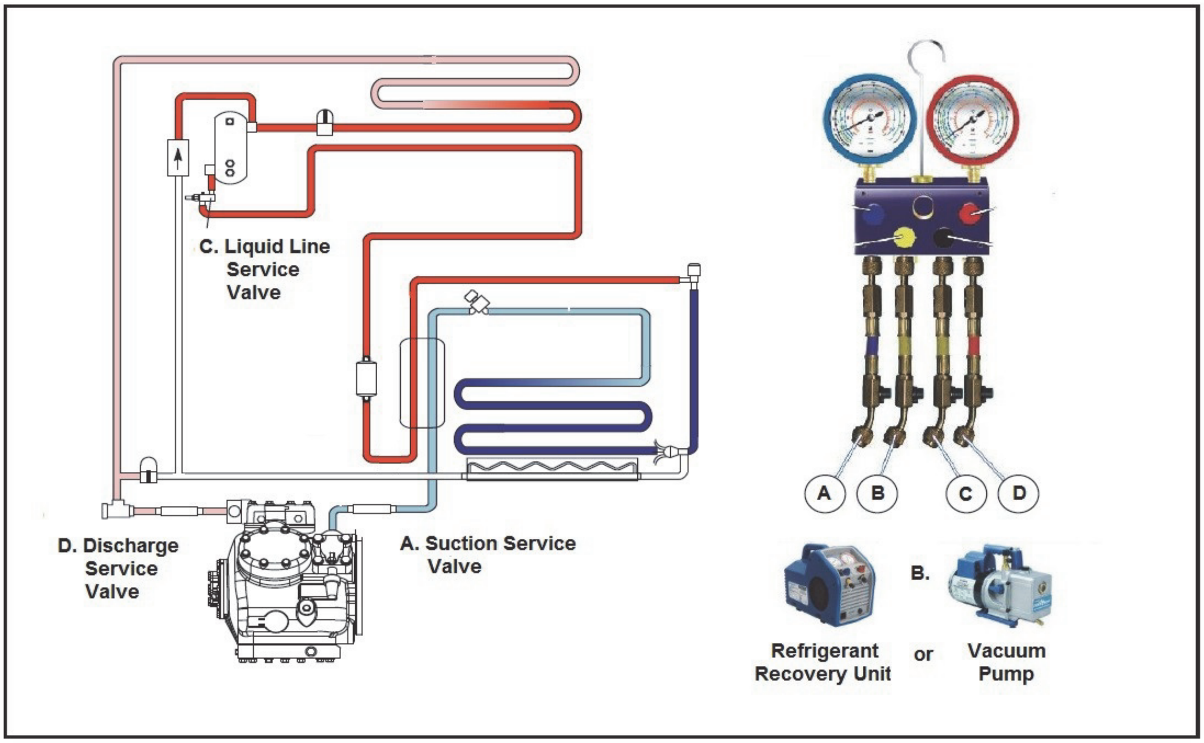
8.7.2.4 Removing Charge R-452A

WARNING

R-452A refrigerant is an A1 non-flammable refrigerant blend which includes some mildly flammable constituents. As such, please follow all proper service and maintenance procedures.Ensure that proper evacuation procedure is strictly followed before performing any "hot work," including, but not limited to brazing or welding, on these units to prevent flare-up of residual refrigerant.

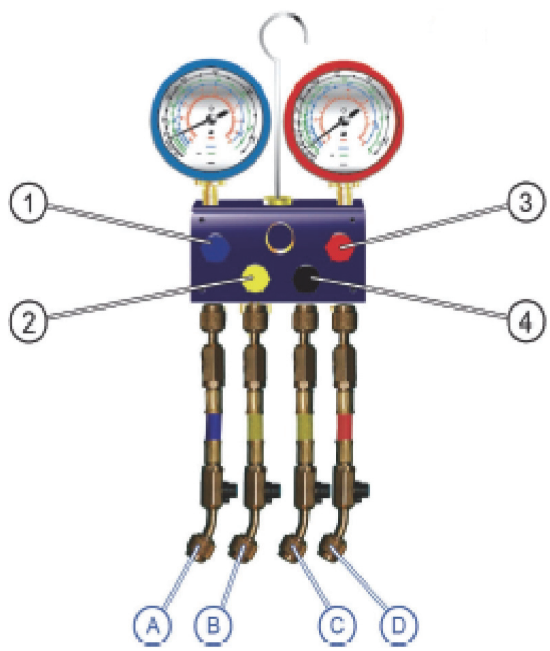
- Refrigerant must be reclaimed until manifold gauge set indicates -20 inHG (-0.67bar/ -9,82 Psia) of vacuum.
- Before performing any service work, make sure the Start-Stop switch is off.
- When repairing a leak on the refrigeration circuit, ensure the minimum pressure is reached per the recovery machine and ensure a nitrogen purge procedure is used during the unbrazing operation.
- In the event of brazing on the low side, store the refrigerant in the receiver and follow the reclaim procedure on the low side of the system.

Figure 8.24 Four Port Manifold Gauge Option



8.7.2.5 Unit Connection

Figure 8.25 Unit Connection



1. Connect the manifold gauge set to the unit (refer to **Figure 8.25**)
    - Hose A to low-pressure compressor service valve
    - Hose B to vacuum pump
    - Hose C to high-pressure compressor service valve
    - Hose D to high-pressure receiver king valve
2. Start the vacuum pump.
3. Open the manifold gauge valves (1,2,3,4).
4. Open the hose B service valve and wait for one minute.
5. Check the manifold gauge values. Readings must be at the lowest and most stable.
6. Close hose B service valve.
7. Stop the vacuum pump.
8. Disconnect the vacuum pump.

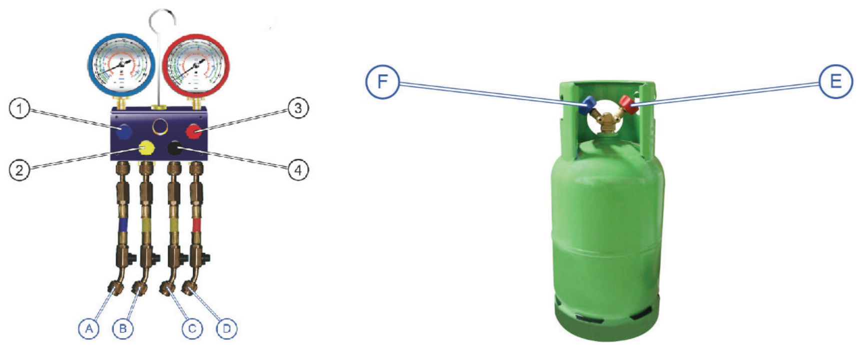
The manifold gauge (I) is installed

Before continuing with the next steps:

- Ensure the manifold installation procedure is completed correctly.
- Ensure all unit valves are opened
- Ensure there are no refrigerant traps
- Place the unit in service mode ((Refer to **Section 5.2.5**)
- Ensure the microprocessor display reads: **“RECOVER/LEAK CHK/EVAC MODE”**

8.7.2.6 Recovery System Installation

Figure 8.26 Recovery System



1. Connect recovery machine to hose (B).
2. Place the R-452A recovery bottle onto the scale and note the weight.
3. Check the admissible charge indicated in the R-452A recovery bottle information.
4. Connect the liquid valve (E) of the R-452A recovery bottle to the recovery machine.
5. Adjust high- and low-pressure compressor service valves to the mid-seat position.
6. Adjust receiver king valve (liquid line service valve) to the mid-seat position.
7. Open hoses A,B,C,D service valves.

The system is ready for recovery.

8.7.2.7 R-452A Liquid Recovery

1. Open liquid valve (E) and start the recovery machine.
2. Open hose B service valve.
3. Open the manifold gauge valve (2,3). The R-452A liquid will be transferred from the unit receiver to the R-452A recovery bottle.
4. Check weight on the scale. The R-452A recovery bottle weight must be stable.
5. Close hose B service valve.
6. Stop the recovery machine.Close liquid valve (E).

The R-452A liquid is recovered

1. Disconnect the R-452A recovery bottle from the recovery machine.
2. Connect the vapor valve (F) of the R-452A recovery bottle to the recovery machine.

The system is ready for vapor recovery

8.7.2.8 R-452A Vapor Recovery

1. Open vapor valve (F).
2. Start the recovery machine.
3. Open hose B service valve.
4. Open the manifold gauge valve (1,4)

The R-452A vapor will be transferred from the compressor to the R-452A recovery bottle.

5. Check the pressure values indicated on the two manifold gauges.
   - Wait until the dials from the two manifold gauges indicate -0,67 bar (-20 inHg)
   - In order to prevent flare-up or residual refrigerant, do not move to the next step before reaching -0,67 bar (-20 inHg). This specific effect must be taken into consideration especially in cases of working in heights where there may be a fall risk.

The R-452A is recovered

6. Close hose B service valve.
7. Close the two manifold gauge service valves.
8. Stop the recovery machine.
9. Wait for 15 minutes.
   - If after 15 minutes the pressure has risen, repeat the recovery procedure starting with step 1.
   - If -0,67 bar (-20 inHg) is maintained, proceed to step 10.
10. Disconnect the recovery machine and dispose of the R-452A recovery bottle according to local regulation.

End of recovery procedure

Purge with Nitrogen.

For more information about nitrogen instruction, refer to Carrier Transicold document #98-60068-00 (Brazing Instructions).

8.7.2.9 Pumping Down The Low Side

Components on the low side of the refrigeration system (filter drier, EVXV, evaporator coil, CSMV, heat exchanger, suction line etc.) may be serviced or replaced without having to completely remove the refrigerant charge from the system by pumping down the low side and temporarily storing the refrigerant in the condenser and receiver.

1. Install a manifold gauge set to allow reading of suction and discharge pressure. Refer to **Figure 8.22**.
2. Start the unit.
3. Frontseat the liquid line service valve.
4. Shutdown the unit when suction pressure drops to 2 psig (0.2 bar). There should be very little refrigerant remaining in the low side of the system at this point.
5. Monitor the gauges. Suction pressure should not rise rapidly. If suction pressure continues to rise, the liquid line service valve or bypass check valve may not be closing properly. In this case, the low side cannot be pumped down and the entire refrigerant charge must be removed from the system. (Refer to preceding step c.)
6. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter.
7. Frontseat (close by turning clockwise) the discharge service valve and the refrigerant will be trapped between the compressor discharge service valve and the liquid line service valve.

8. Before opening up any part of the low side of the system, a slight positive pressure should be indicated on the pressure gauge. If the pressure is below 0 psig/ bar slowly open the liquid line service valve slightly and then frontseat the valve again. Repeat as necessary in order to raise the pressure above zero.

9. Connect a refrigerant recovery device and a clean refrigerant recovery cylinder to the suction and discharge service valves and remove any remaining refrigerant from the low side. DO NOT bring the low side pressure below 0 psig/bar.

10. After making necessary repairs, leak check and evacuate the low side of the refrigeration system. Refer to **Section 8.7.3** and **8.7.4**.

8.7.2.10 Pumping Down the Compressor

The compressor or any of the components attached to it (unloaders, high pressure switch, discharge and suction pressure transducers, discharge temperature sensor, compressor heads and oil, etc.) may be serviced or replaced by pumping the compressor down, and isolating the compressor from the rest of the system.

1. Install a manifold gauge set to allow reading of suction and discharge pressure. Refer to **Figure 8.22** or **Figure 8.23**.

2. **If the compressor is operational**, start the unit and slowly frontseat the suction service valve. shutdown the unit when the suction pressure drops to 2 psig (0.2 bar). Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter. Frontseat the discharge service valve to isolate compressor. There should be very little refrigerant remaining in the compressor at this point.

3. **If the compressor is not operational**, Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter. Frontseat both the discharge and suction service valve to isolate the compressor.

4. Connect a refrigerant recovery device and a clean refrigerant recovery cylinder to the suction and discharge service valves and remove any remaining refrigerant from the compressor. DO NOT bring the compressor pressure below 0 psig/bar.

5. After making necessary repairs, leak check and evacuate the compressor. Refer to **Section 8.7.3** and **8.7.4**.

8.7.2.11 Adjusting the Charge Level

Adjustment of the charge level may be required when there has been a leak or the system was not correctly charged during a previous service.

1. Check charge level by performing the procedures of the preceding step a.

2. **If charge removal is required**: connect a clean evacuated refrigerant recovery cylinder to the liquid line service valve. Open liquid valve on cylinder. Midseat liquid line service valve and monitor the liquid refrigerant flow into the cylinder. If the unit is operating, close the cylinder valve and backseat the liquid line service valve when the ball in the upper sight glass drops to the bottom of the glass. It the unit is not operating, when approximately 5 lbs. (2.3 kg) have been removed close the cylinder valve and backseat the liquid line service valve. Proceed to step 7.

3. **If charge is to be added**: place refrigerant cylinder on a scale and connect a charging line and gauge from cylinder to liquid line service valve. Start unit in Continuous Operation with a setpoint lower than refrigerated compartment temperature. Wait until unit switches to high speed operation. Run approximately ten minutes.

4. Note weight of cylinder and refrigerant.

5. Frontseat the liquid line service valve (turn clockwise) and watch the pressure on the manifold gauge. When the pressure falls below the pressure in the refrigerant cylinder [or to 50 psig (3.4 bar)], open the cylinder valve and monitor the liquid refrigerant to flow into the unit.

6. When approximately 5 lbs. (2.3 kg) have been added, close the cylinder valve, and backseat the liquid line service valve.

7. Recheck for the correct refrigerant charge. (Refer to preceding step a.) Repeat preceding steps as required. When charge level adjustment is complete, remove refrigerant service equipment.

8.7.2.12 Adding a Complete Charge

1. Evacuate unit and leave in deep vacuum. Refer to **Section 8.7.4**.
2. Determine charge required for this unit (refer to the model/serial number nameplate or **Table 2–1**) and procure a refrigerant cylinder with sufficient weight of refrigerant. Place cylinder on a scale and connect the charging line from cylinder to the liquid line service valve.
3. Note weight of the refrigerant cylinder.
4. Open the liquid valve on the cylinder. Midseat the liquid line service valve and allow liquid refrigerant to flow into the unit until the correct weight of refrigerant has been added.

NOTE

It is possible that all the required liquid may not be pulled into the receiver, as outlined in step 4. In this case, add the additional refrigerant in accordance with the charge adjustment procedures, refer to preceding step f.

5. When the scale indicates that the correct charge has been added, close the liquid valve on the cylinder and backseat the liquid line service valve. Remove charging hose.
6. Re-enable the starter, start unit and run Pretrip to check operation.

8.7.3 Leak Checking

WARNING

Never use air or gases containing oxygen for leak testing or operating refrigerant compressors. Pressurized mixtures of air or gases containing oxygen can lead to explosion.

The condition that the system may be in when leak checking is required include; when the system is charged, when the system is without charge, when the low side has been pumped down and when only the compressor is to be leak checked. Procedures for each condition are provided in the following subsections.

8.7.3.1 Leak Checking a Charged System

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter.

NOTE

Service Mode is not required for this procedure.

2. Verify that the suspected leak area (high or low side) has sufficient pressure (minimum 20 psig = 1.4 bar) to detect the leak. The larger the leak the less pressure is required. The smaller the leak, the greater the pressure required.
3. The recommended procedure for finding leaks from a system is with an electronic leak detector. Checking joints with soapsuds is satisfactory only for locating large leaks, or pinpointing small leaks once a general area has been located.
4. Some leaks may be repaired by simply tightening a connection. Others may require removal of the charge, refer to **Section 8.7.2**.
5. Re-enable the starter, start unit and run Pretrip to check operation.

8.7.3.2 Leak Checking a System Without Charge

The refrigeration system must be leak checked once it is closed and all repairs complete.

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter.
2. Connect refrigerant system equipment if not already connected. Refer to **Figure 8.22** or **Figure 8.23**.

⚠ WARNING

Only a refrigerant cylinder containing R-404A or R-452A should be connected to this refrigeration unit in order to pressurize the system. However, dry nitrogen may be used to increase pressure. Any other gas or vapor will contaminate the system and require additional removal and evacuation.

⚠ CAUTION

Do not vapor charge R-404A or R-452A. Only liquid charging through the liquid line service valve is acceptable.

3. Ensure that the operator message panel displays “RECOVER/LEAK CHK/EVAC MODE” during the pressurizing and leak checking procedures. Refer to **Section 5.2.5**. If the control system switches to Charge Mode during the process, switch it back to the “RECOVER/LEAK CHK/EVAC MODE”.
4. Pressurize the system 5 to 10 psig (0.3 to 0.7 bar) with refrigerant at the liquid line service valve.

⚠ WARNING

Do not use a nitrogen cylinder without a pressure regulator. Cylinder pressure is approximately 2350 psig (159.9 bar). Do not use oxygen in or near a refrigerant system as an explosion may occur. Refer to Figure 8.43.

5. Connect a cylinder of dry nitrogen. Use the dry nitrogen to increase the pressure as necessary 20 to 150 psig (1.4 to 10.2 bar) to detect the leak. The larger the leak the less pressure is required. The smaller the leak, the greater pressure is required.
6. The recommended procedure for finding leaks from a system is with an electronic leak detector. Checking joints with soapsuds is satisfactory only for locating large leaks, or pinpointing small leaks once a general area has been located.
7. Once leak checking is complete, remove the refrigerant/nitrogen vapor out of the system.
8. If no leaks are found the system is ready for evacuation, skip to Step 11.
9. If any leaks are found they must be repaired before proceeding.
10. Repeat steps 4 - 9 as necessary.
11. Evacuate the system after all leaks are repaired. Refer to **Section 8.7.4**.

8.7.3.3 Leak Checking with Low Side Pumped Down

The low side of the system must be leak checked once it is closed and all repairs complete.

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter.

WARNING

Only a refrigerant cylinder containing R404A or R452A should be connected to this refrigeration unit in order to pressurize the system. However, dry nitrogen may be used to increase pressure. Any other gas or vapor will contaminate the system and require additional removal and evacuation.

2. Connect refrigerant system equipment if not already connected. Refer to **Figure 8.22** or **Figure 8.23**.

NOTICE

Do not vapor charge R404A or R452A. Only liquid charging through the liquid line service valve is acceptable.

3. Ensure that the operator message panel displays “RECOVER/LEAK CHK/EVAC MODE” during the pressurizing and leak checking procedures. Refer to **Section 5.2.5**. If the control system switches to Charge Mode during the process, switch it back to the “RECOVER/LEAK CHK/EVAC MODE”.
4. Pressurize the low side of the system 5 to 10 psig (0.3 to 0.7 bar) with refrigerant from the high side by turning the liquid line service valve off frontseat for a few seconds and then returning to frontseat.

WARNING

Do not use a nitrogen cylinder without a pressure regulator. Cylinder pressure is approximately 2350 psig (159.9 bar). Do not use oxygen in or near a refrigerant system as an explosion may occur. Refer to Figure 8.43.

5. Connect a cylinder of dry nitrogen. Use the nitrogen to increase the low side pressure 20 to 150 psig (1.4 to 10.2 bar) to detect the leak. The larger the leak the less pressure is required. The smaller the leak, the greater the pressure required.
6. The recommended procedure for finding leaks from a system is with an electronic leak detector. Checking joints with soapsuds is satisfactory only for locating large leaks, or pinpointing small leaks once a general area has been located.
7. Once leak checking is complete, remove the refrigerant/nitrogen vapor from the low side of the system.
8. If no leaks are found the low side of the system is ready for evacuation. (Skip to Step 11)
9. If any leaks are found they must be repaired before proceeding.
10. Repeat steps 4 - 9 as necessary.
11. Disconnect the nitrogen cylinder. Evacuate the low side of the system after all leaks are repaired. Refer to **Section 8.7.4**.

8.7.3.4 Leak Checking Compressor

The compressor and its associated switches, transducers, etc. must be leak checked once the compressor is closed and all repairs complete.

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter.
2. Connect refrigerant system service equipment to the suction and discharge service valves, if not already connected. Refer to **Figure 8.22** or **Figure 8.23**.

WARNING

Only a refrigerant cylinder containing R404A or R452A should be connected to this refrigeration unit in order to pressurize the system. However, dry nitrogen may be used to increase pressure. Any other gas or vapor will contaminate the system and require additional removal and evacuation.

NOTICE

Do not vapor charge R-404Aor R-452A. Only liquid charging through the liquid line service valve is acceptable.

3. Pressurize the compressor 5 to 10 psig (0.3 to 0.7 bar) by opening the suction service valve for a few seconds, then closing (frontseating) it again.

WARNING

Do not use a nitrogen cylinder without a pressure regulator. Cylinder pressure is approximately 2350 psig (159.9 bar). Do not use oxygen in or near a refrigerant system as an explosion may occur. Refer to Figure 8.43.

4. Connect a cylinder of dry nitrogen. Use the nitrogen to increase the compressor pressure 20 to 150 psig (1.4 to 10.2 bar) to detect the leak. The larger the leak the less pressure is required. The smaller the leak, the greater pressure required
5. The recommended procedure for finding leaks from a compressor is with an electronic leak detector. Checking joints with soapsuds is satisfactory only for locating large leaks, or pinpointing small leaks once a general area has been located.
6. Once leak checking is complete, remove the refrigerant/nitrogen vapor from the compressor.
7. If no leaks are found the compressor is ready for evacuation. (Skip to Step 10)
8. If any leaks are found they must be repaired before proceeding.
9. Repeat steps 4 through 9 as necessary.
10. Disconnect the nitrogen cylinder. Evacuate the compressor after all leaks are repaired. Refer to **Section 8.7.4**.

8.7.4 Evacuation and Dehydration

Moisture is detrimental to refrigerant systems. The presence of moisture in a refrigeration system can have many undesirable effects such as copper plating, acid sludge formation, "freeze-up" of the expansion valve, and formation of acids, resulting in metal corrosion. Proper evacuation of the system will remove any moisture from inside the system.

NOTES

- Essential tools to properly evacuate any system include a good vacuum pump (5 cfm/8mH) volume displacement (Carrier Transicold part number 07-00176-11) and a good vacuum indicator such as a thermocouple vacuum gauge (micrometer). (Carrier Transicold part number 07-00414-00)
- The use of a compound gauge is not recommended for use in determining when the evacuation process is completed because of its inherent inaccuracy.
- Standard service hoses are not recommended for evacuation purposes. Evacuation hoses are recommended for this procedure.

8.7.4.1 Evacuation of the Complete System

1. Evacuate only after leak check. Refer to **Section 8.7.3**.
2. If possible keep the temperature of the major components (condenser, evaporator, compressor and receiver) above 60°F (15.6°C) to speed evaporation of moisture. If the temperature is lower than 60°F (15.6°C), ice might form before moisture removal is complete. Heat lamps, heat guns or alternate sources of heat may be used to raise system temperature.
3. The recommended method to evacuate the system is to connect three evacuation hoses with vacuum pump and vacuum indicator. Refer to**Figure 8.22** or **Figure 8.23**.
4. Ensure that the operator message panel displays "RECOVER/LEAK CHK/EVAC MODE" during the evacuation and dehydration procedures. Refer to **Section 5.2.5**. If the control system switches to Charge Mode during the process, switch it back to the "RECOVER/LEAK CHK/EVAC MODE".
5. Backseat (turn counter-clockwise) the liquid line service valve, suction service and discharge service valve.
6. With the unit service valves closed (back seated) and the vacuum pump and vacuum indicator 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.
7. Midseat the refrigerant system service valves. Ensure that the operator message panel displays "RECOVER/LEAK CHK/EVAC MODE".

   NOTE

   The service valve caps help minimize leakage through valve stems during midseat operation.

8. Start the vacuum pump. Evacuate unit until the vacuum indicator indicates 2000 microns. Close the vacuum pump valve and shut off the pump. Wait a few minutes to ensure the vacuum holds.
9. Break the vacuum with dry nitrogen through the discharge service valve. Raise system pressure to approximately 2 psig (0.1 bar). Ensure that the control system does not switch to the Charge Mode. If this occurs, switch it back to the "RECOVER/LEAK CHK/ EVAC MODE" Refer to **Section 5.2.5**.
10. Purge nitrogen from system at the suction service valve.
11. Open the vacuum pump valve and start the pump. Evacuate unit to 500 microns. Close the vacuum pump valve and shut off the pump. Wait a few minutes to be sure the vacuum holds below 2000 microns.
12. If vacuum holds below 2000 microns continue to step 14. If vacuum rises above 2000 microns continue to step 13.
13. Repeat steps 8 through 11 until the vacuum stays below 2000 microns.
14. Once the system holds a good vacuum, it is ready to be charged with refrigerant. Refer to **Section 8.7.2**.

8.7.4.2 Evacuation of the Low Side

1. Evacuate only after a low side leak check. Refer to **Section 8.7.3**
2. If possible, keep the temperature of the major components (condenser, evaporator, compressor and receiver) above 60°F (15.6°C) to speed evaporation of moisture. If the temperature is lower than 60°F (15.6°C), ice might form before moisture removal is complete. Heat lamps, heat guns or alternate sources of heat may be used to raise system temperature.
3. The recommended method to evacuate the system is to connect three evacuation hoses with vacuum pump and vacuum indicator. Refer to **Figure 8.22** or **Figure 8.23**.
4. Ensure that the operator message panel displays "RECOVER/LEAK CHK/EVAC MODE" during the evacuation and dehydration procedures. Refer to **Section 5.2.5**. If the control system switches to Charge Mode during the process, switch it back to the "RECOVER/LEAK CHK/EVAC MODE".
5. Leave the liquid line service valve and the discharge service valve frontseated and then midseat the suction service valve.
6. Start the vacuum pump. Evacuate unit until the electronic vacuum gauge indicates 2000 microns. Close the vacuum pump valve and shut off the pump. Wait a few minutes to be sure the vacuum holds.
7. Break the vacuum with dry nitrogen through the liquid line service valve. Raise system pressure to approximately 2 psig (0.1 bar). Ensure that the control system does not switch to the Charge Mode. If this occurs, switch it back to the "RECOVER/LEAK CHK/EVAC MODE." Refer to **Section 5.2.5**.
8. Purge nitrogen from the low side of the system at the suction service valve.
9. Open the vacuum pump valve and start the pump. Evacuate unit to 500 microns. Close the vacuum pump valve and shut off the pump. Wait a few minutes to be sure the vacuum holds below 2000 microns.
10. If vacuum holds below 2000 microns continue to step 12. If vacuum rises above 2000 microns continue to step 11.
11. Repeat steps 6 through 9 until the vacuum stays below 2000 microns.
12. Once the system holds a good vacuum, open the compressor discharge service valve and the liquid line service valve.
13. Re-enable the starter, start unit and check the refrigerant charge. Refer to **Section 8.7.2**.

8.7.4.3 Evacuation of the Compressor

1. Evacuate only after a compressor leak check. Refer to **Section 8.7.3**.
2. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter.
3. If possible keep the temperature of the compressor above 60°F (15.6°C) to speed evaporation of moisture. If the temperature is lower than 60°F (15.6°C), ice might form before moisture removal is complete. Heat lamps, heat guns or alternate sources of heat may be used to raise compressor temperature.
4. Connect evacuation equipment to the compressor suction and discharge service valves. Refer to **Figure 8.22** or **Figure 8.23**.
5. Start the vacuum pump. Evacuate compressor to 500 microns. Close the vacuum pump valve and shut off the pump. Wait a few minutes to be sure the vacuum holds. This checks for residual moisture and/or leaks.
6. Once the compressor holds a good vacuum, open the compressor suction and discharge service valve to allow refrigerant to enter the compressor.
7. Re-enable the starter, start unit and check the refrigerant charge. Refer to **Section 8.7.2**.

8.8 compressor and Unloader Service

8.8.1 Repair or Replacement Determination

Certain operating conditions or refrigeration system components may be misdiagnosed and subsequently lead to the determination that the compressor requires replacement. These conditions or components should be checked prior to replacing a compressor and after a replacement compressor is installed to prevent replacement compressor damage. To determine if compressor replacement or repair is required, do the following:

1. If the compressor is operational, check the refrigerant charge. Refer to **Section 8.7.2**.
2. If the compressor is operational, check operation of the unloaders. Refer to **Section 8.8.5.5**.
3. If the compressor is operational, check the system components as follows:
   a. Install gauges to allow reading of receiver, suction and discharge pressure. Refer to **Figure 8.22** or **Figure 8.23**.
   b. Start the unit in cooling so that compressor operates.
   c. Frontseat liquid line service valve, shutdown unit when suction pressure drops to 2 psig (0.2 bar).
   d. Monitor the gauges. If receiver pressure drops rapidly and the suction and discharge pressures rise rapidly the liquid line service valve or bypass check valve require replacement before the compressor can be further tested.
   e. Backseat the liquid line service valve and restart the unit. Slowly frontseat the suction service valve. Shutdown the unit when suction pressure drops to 2 psig (0.2 bar).
   f. Monitor the gauges. If suction and discharge pressures do not equalize rapidly, the compressor is not at fault.
4. Check condition of and repair cylinder heads and valve plates. Refer to **Section 8.8.3**.

8.8.2 Removal and Replacement of Compressor

1. Pumpdown the compressor or remove charge. Refer to **Section 8.7.2**.
2. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and removing the negative battery cable.
3. Remove any interfering equipment attached to the end flange. Refer to **Figure 8.27**.

WARNING

Do not unscrew service valve mounting cap screws all the way before breaking seal. Entrapped pressure could result in injury.

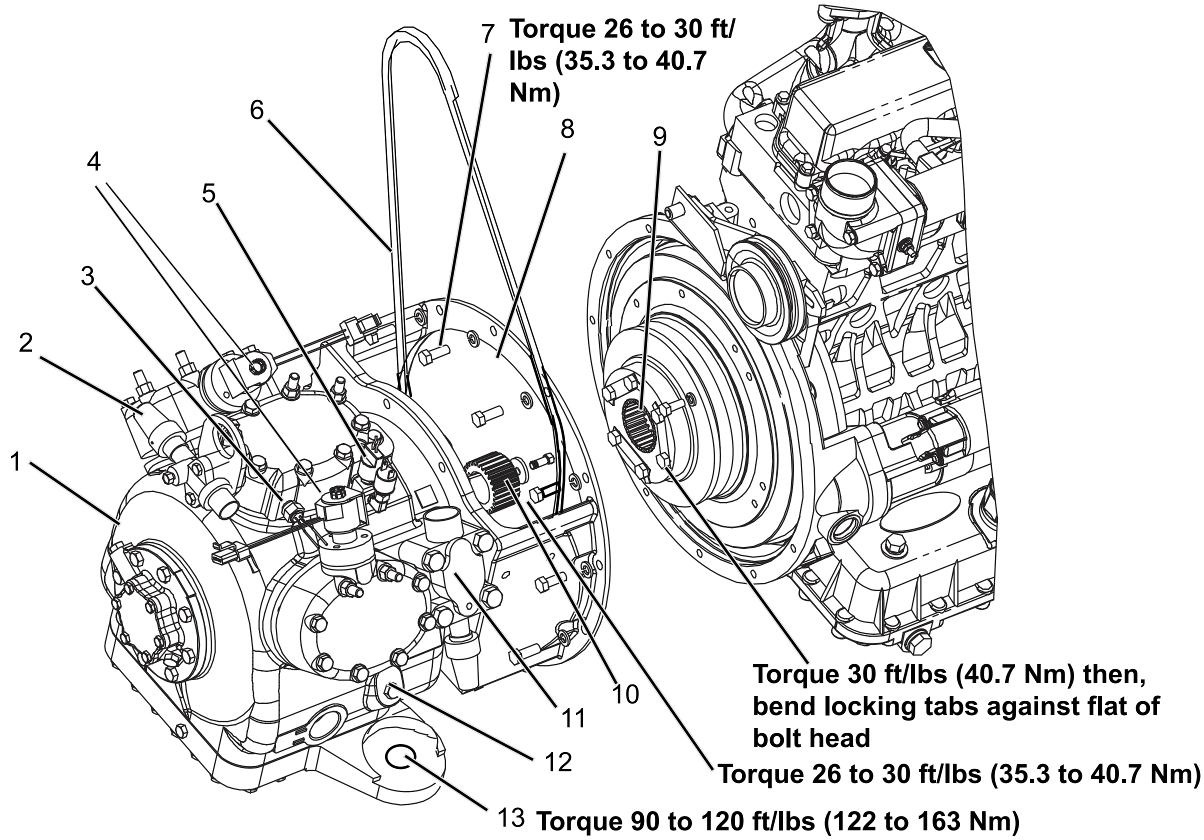
4. Loosen the suction and discharge service valve mounting bolts. Tap the valve bodies to break the seal and then remove bolts.
5. Disconnect all low voltage connectors (UL1, UL2, CDT, CDP and HPS).
6. Loosen lower belt idler and remove belt from gearbox. Belt may be removed and reinstalled with the compressor.
7. Block up the engine and remove compressor shockmount bolts.
8. Remove the 12 end flange bolts and lock washers. Attach a sling or other device to compressor (refer to **Section 2.9** for weight of compressor). Slide compressor sufficient to disengage compressor drive gear from nylon drive gear. Remove compressor.
9. Inspect nylon drive gear for wear or sharp edges. Replace if required.
10. Remove oil from compressor for shipping. Test for acidity. If acid is present a system cleanup may be necessary.

WARNING

Do not unscrew replacement compressor lifting eyelet/blankoff plate mounting cap screws all the way before breaking seal. Entrapped pressure could result in injury.

11. Loosen the suction and discharge lifting eyelet/ blankoff plate mounting bolts. Tap the center of the blankoff plates to break the seal and then remove bolts, plates and gaskets.
12. If required add oil to the replacement compressor. Add only 5.0 pints (2.4 liters) of oil when first adding oil to the compressor. This procedure is designed to compensate for excess oil that may have migrated with refrigerant to other parts of the system during unit operation.
13. Exchange all external compressor components including the unloader coils, discharge and suction strainers, switches, transducers, temperature sensors, fittings and compressor drive gear.
14. Install blankoff plates and plugs in original compressor for shipment.
15. Remove any remaining old gasket material from the discharge and suction service valve sealing surfaces.
16. Ensure belt is in end plate opening and around drive gear. Ensure correct alignment of compressor drive gear and nylon gear as compressor is installed in unit. Use new lock nuts when replacing compressor shockmounts. Refer to **Figure 8.27** for mounting bolt torque information.
17. Reconnect all wiring per wiring schematic.
18. Clean or replace strainers as required and, using new gaskets, install service valves. Torque discharge service valve mounting bolts 20 to 30 ft lbs (27 to 40.7 Nm). Torque suction service valve mounting bolts 55 to 80 ft lbs (74 to 108 Nm).

Figure 8.27 Compressor



1. Compressor
2. Discharge Service Valve and Strainer/Flange
3. Compressor Discharge Temperature Sensor (CDT)
4. Unloader Coils (UL1 and UL2)
5. Compressor Discharge Pressure Transducer (CDP) and High Pressure Switch (HPS)
6. Lower Belt
7. End Flange Bolt and Lock Washer
8. End Flange
9. Nylon Drive Gear
10. Compressor Drive Gear, Key, Special Washer and Bolt.
11. Suction Service Valve and Strainer/Flange
12. Oil Fill Port
13. Shockmount (Location)

19. Reinstall and tension lower belt. Refer to **Section 8.6.1**.

20. Reinstall all components and clamps removed from end plate, battery and battery connection(s).

21. Leak check, evacuate and dehydrate, and charge system as required. Refer to **Section 8.7.2**, **8.7.3** and **8.7.4**.

8.8.3 Cylinder Head and Valve Plate Service

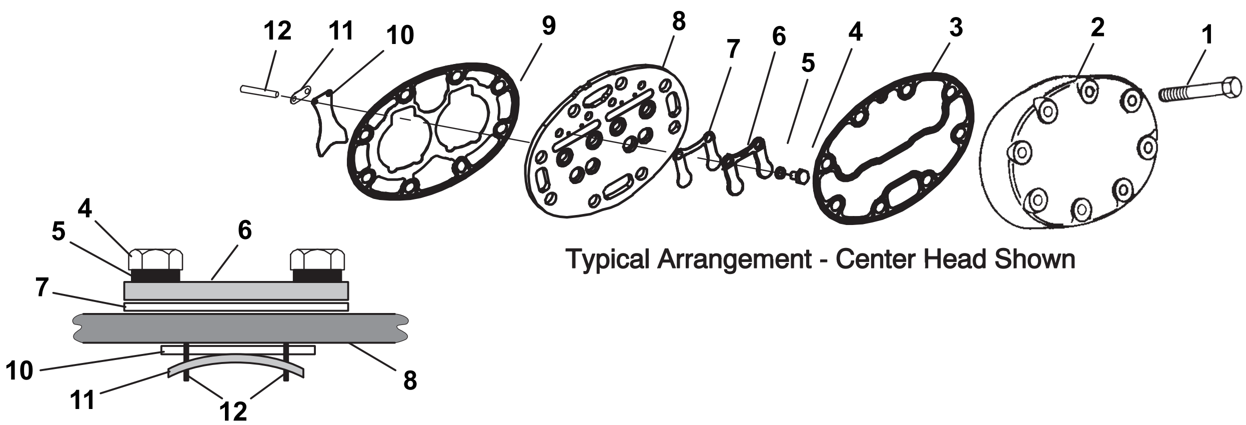
1. Pumpdown the compressor. Refer to **Section 8.7.2**.
2. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and removing the negative battery cable.

WARNING

Do not unscrew cylinder head mounting cap screws all the way before breaking seal. Entrapped pressure could result in injury.

3. Loosen cylinder head cap screws. Tap the head lightly with a wooden or lead mallet to break the seal and relieve any remaining pressure. Be careful not to drop the head or damage the gasket sealing surface. Remove cylinder head cap screws and gasket. Refer to **Figure 8.28**

Figure 8.28 Cylinder Head and Valve Plate



1. Cap screw
2. Cylinder Head
3. Cylinder Head Gasket
4. Capscrew
5. Lockwasher
6. Discharge Valve Backer
7. Discharge Valve
8. Valve Plate
9. Valve Plate Gasket
10. Suction Valve
11. Suction Valve Spring
12. Dowel Pin

4. If removing the center head, remove the discharge valve mounting hardware.
5. If required, free the valve plates from the cylinder deck by using the discharge valve cap screws, without washers, as jack screws through the outermost tapped holes in the valve plate after the valve stops and valves have been removed. Remove the valve plate gasket.
6. Inspect the parts of the cylinder head and/or the valve plate:

   a. Inspect cylinder head gaskets for proper alignment and center web blow-out.

   b. Inspect the discharge valves for loose or damaged valve stops, or any debris that may affect the proper operation of the valves.

   c. Inspect for broken, cracked, or chipped discharge valves.

   d. Inspect the side valve plate discharge check valves to ensure the pistons move and contact the plates.

   e. Inspect for broken, cracked, or chipped suction valves.

   f. Inspect the valve plate and the cylinder head for cracks.

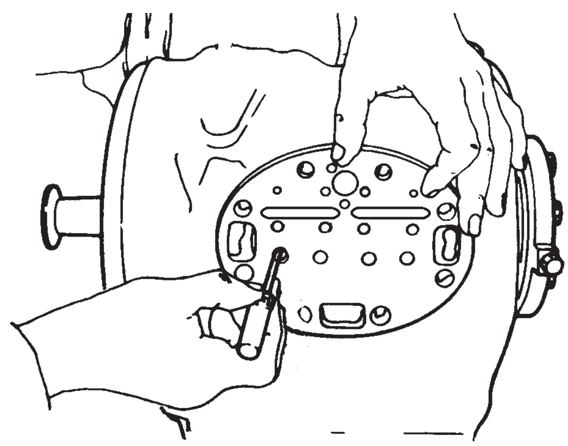
   g. Inspect valve plate gaskets for damage and wear.

   h. Remove any oil on top of the pistons. Inspect the top of the pistons for damage. Check for debris, burned and carbonized oil sludge, or mechanical failure.

i. Inspect cylinder bores for excessive wear. Excessive wear for cylinder bores is defined as heavy and uneven scratches, gouges, or chipping of the internal wall of the cylinder, with a depth greater than 0.025 inch, which are caused by foreign objects, other than a normal reciprocating movement of the pistons and piston rings. If cylinder(s) are damaged, compressor replacement is required.

7. Discard valves and gaskets. Use only new valves and gaskets when assembling cylinder head and valve plate assemblies.
8. If required, install the discharge valves and discharge valve stops with cap screws and lock washers onto the valve plates. Torque cap screws to 12 to 16 ft/ lbs (16.3 to 21.7 Nm).
9. Turn the valve plate over.
10. Install the suction valve spring on the dowel pins with the spring ends bearing away from the cylinder head. Refer to **Figure 8.28**.
11. Place suction valve on dowel pins.
12. Place the valve plate and new valve plate gasket (with flat side toward cylinder deck) on cylinder deck, ensuring that the valve plate is properly positioned on the four dowel pins.
13. Using a small screwdriver, operate the suction valves to ensure that the valve tips are not being held by the valve plate gasket. Refer to **Figure 8.29**.

Figure 8.29 Check Suction Valve

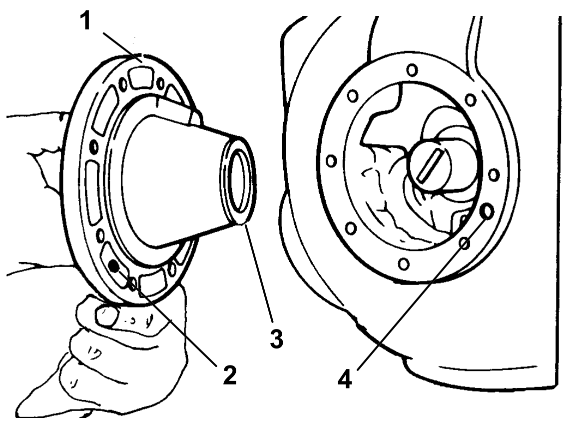


14. Install cap screws, cylinder head and new cylinder head gasket (with flat side toward valve plate), ensuring that the gasket and cylinder head are properly positioned on the valve plate. Torque the cap screws, in a diagonal pattern, 42 to 55 ft/lbs (57 to 74 Nm).
15. Leak check, evacuate and dehydrate, and charge system as required. Refer to **Section 8.7.2**, **8.7.3** and **8.7.4**.

8.8.4 Oil Pump and Bearing Head

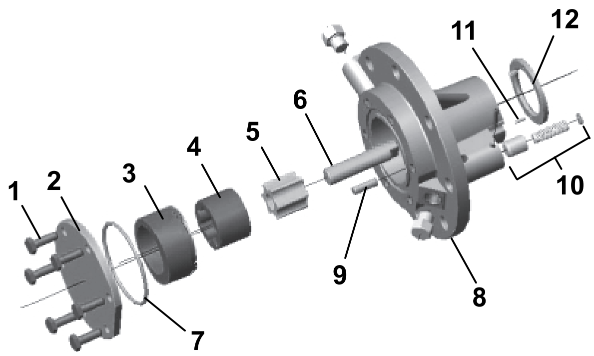
1. Pumpdown the compressor. Refer to **Section 8.7.2**.
2. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter.
3. Loosen the eight cap screws, tap the pump to relieve any remaining pressure and then remove the oil pump bearing head assembly, gasket and thrust washer. Refer to **Figure 8.30**.
4. If it is determined that the oil pump is not operating properly, the entire oil pump and bearing head assembly must be replaced. Replacement parts for the pump are not available except for the cover plate O-ring. However, in the event the pump requires inspection or cleaning, refer to **Figure 8.31** for disassembly and reassembly. Clean all parts; coat all moving parts with compressor oil before proceeding with reassembly.

Figure 8.30 Oil Pump and Bearing Head Assembly



1. Oil Pump and Bearing Head
2. Thrust Washer
3. Oil Pickup Tube
4. Oil Inlet Port

Figure 8.31 Oil Pump



1. Cap screws
2. Cover
3. Eccentric Ring
4. Rotor
5. Idler
6. Shaft (Drive)
7. O-Ring
8. Oil Pump and Bearing
9. Dowel Pin
10. Relief Valve Assembly
11. Pins (2)
12. Thrust Washer

NOTICE

Ensure that thrust washer does not fall off dowel pins while installing oil pump.

5. Install the pump end thrust washer on the two dowel pins located on the bearing head. Refer to **Figure 8.30**.
6. Install the bearing head assembly with a new gasket on the compressor crankshaft. Carefully push oil pump on by hand ensuring that the thrust washer remains on the dowel pins, the tang on the end of the drive engages the slot in the crankshaft, and the oil inlet port on the pump is aligned with the oil pickup tube in the crankcase. The oil pump should mount flush with the crankcase with the word “TOP” stamp on the pump oriented straight up.
7. Align the gasket and the eight cap screws in the mounting flange. Torque cap screws, in a diagonal pattern, 30 to 50 ft/lbs (40.7 to 67.8 Nm).
8. Leak check, evacuate and dehydrate, and charge system as required. Refer to **Section 8.7.2**, **8.7.3** and **8.7.4**.

8.8.5 Compressor Oil Level

8.8.5.1 Checking Compressor Oil Level

NOTICE

An overcharge of oil will reduce system capacity and possibly cause internal compressor damage.

For this reason, Carrier Transicold re-manufactured compressors now contain a reduced oil charge to compensate for oil remaining in the system. A level slightly below the minimum mark is acceptable until the oil level can be checked using the following procedure:

1. Operate the unit in high speed, fully loaded cool for at least 15 minutes. Unplug wires to the unloaders if necessary to ensure six cylinder operation.

   NOTE

   Check the oil sight glass on the compressor to ensure that no foaming of the oil is present after 15 minutes of operation. If the oil is foaming check the refrigerant system for flood-back of liquid refrigerant. Correct this situation before performing step 2.

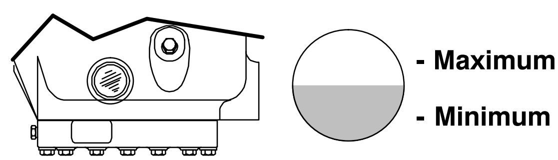
2. After 15 minutes, initiate a defrost cycle. This will allow any residual oil to be returned to the compressor.

   NOTE

   Operate the unit in defrost for only 3-5 minutes. **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 sight glass (Figure 8.32). Oil level should be between the Minimum and Maximum marks.

Figure 8.32 Oil Level in Sight Glass



Adding Oil with Compressor in System

⚠ CAUTION

Use only Carrier Transicold approved Polyol Ester Oil (POE). Buy quantities of one gallon or less. When using this hygroscopic oil, immediately reseal. Do not leave container of oil open or contamination will occur.

Two methods for adding oil are the Oil Pump Method and Closed System Method.

8.8.5.2 Oil Pump Method

One compressor oil pump that may be purchased is a Robinair, part number 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 (**Figure 8.27**). There is no need to remove pump from can after each use.

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

Backseat suction service valve and connect oil charging hose to oil fill. Purge the oil hose at oil pump. Add oil as necessary.

8.8.5.3 Closed System Method

NOTICE

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.

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

1. Pump down the compressor. Refer to **Section 8.7.2**.With both manifold gauge set valves frontseated, leave the suction connection connected to the compressor suction service valve port and connect the common connection to a vacuum pump. Remove the discharge hose from the manifold gauge set; connect to the compressor oil fill port (**Figure 8.27**) and immerse the other end in a container of refrigeration oil. Start the vacuum pump throttle the manifold gauge set suction valve and pull a vacuum on the compressor while watching the oil level in the glass. Fill to minimum mark on crankcase. Shutdown pump and remove oil fill line from the oil fill port.

2. Break any remaining vacuum (raise to 0 psig/bar) with refrigerant remaining in the system (crack open the suction service valve), or from a fresh cylinder of refrigerant. Evacuate the compressor crankcase to 500 microns. Remove service equipment, backseat suction and discharge service valves and recheck oil level.

8.8.5.4 Removing Oil From The Compressor

1. Check compressor oil level, refer to preceding step a. If the oil level is above the maximum mark on the crankcase, oil must be removed from the compressor.

2. Pump down the compressor. Refer to **Section 8.7.2**.

3. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter.

4. Loosen the oil drain plug (**Figure 8.27**, item 10) and allow oil to seep out and bring the level to 1/8 glass. Tighten the plug securely back into the compressor.

5. Leak check the oil drain plug. Refer to **Section 8.7.3**. Start compressor and recheck oil level.

8.8.5.5 Unloaders

Unloader Checkout Procedure

1. Install a manifold gauge set on the compressor suction and discharge service valves and start unit in cooling with compartment temperature at least 5°F (2.8°C) above setpoint. The compressor will be fully loaded (both unloader coils de-energized). Note suction pressure.
2. Unplug both unloader coils.
3. Using a 12 VDC source, energize the front unloader (UL1). Note discharge and suction pressures. A rise of approximately 3 psig (0.2 bar) will be noted on the suction pressure gauge. Discharge pressure should drop approximately 5 to 15 psig (0.4 to 1.0 bar).
4. De-energize UL1 and note pressures. Suction pressure should drop and discharge pressure should rise by same amount as in step 3 above.
5. Repeat steps 3 and 4 for the rear unloader (UL2). At the end of the test, reconnect both unloaders.

NOTE

If pressures do not change as indicated, check the unloader coil resistance (refer to **Section 2.11**). Replace if coil is open or shorted. If either unloader coil energizes and the suction and discharge pressures do not change, the unloader assembly must be checked.

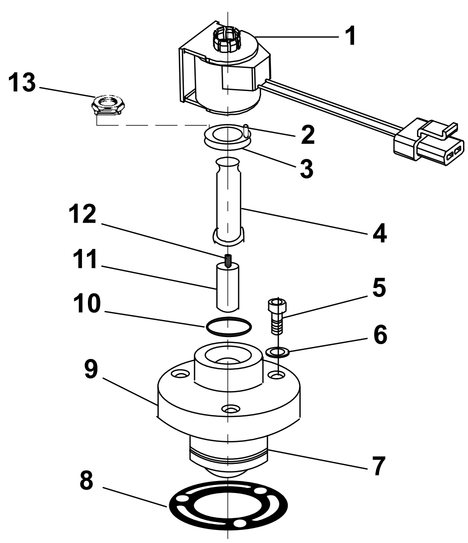
8.8.5.6 Unloader Coil Replacement

NOTE

The coil may be removed while the compressor is under pressure.

1. Disconnect leads and lift coil (see **Figure 8.33**) off enclosing tube.
2. Verify replacement coil is the correct type, voltage and frequency.
3. Place new coil over enclosing tube. With wiring facing in the desired direction, ensure roll pin is fitted in one of the detents in the bottom of the coil mounting. Coil is to snap into place with bottom in contact with the enclosing tube nut. Connect wiring.
4. Check operation, refer to preceding step a.

Figure 8.33 Unloader Coil



1. Coil Assembly
2. Pin, Roll
3. Enclosing Tube Nut
4. Enclosing Tube
5. Bolts, Valve Body (3)
6. Washers (3)
7. Piston
8. Gasket
9. Valve Body
10. “O” Ring
11. Plunger
12. Plunger Spring
13. Installation/Removal Tool

8.8.5.7 Replacing Unloader Valve Internal Parts

1. Pump down the compressor. Refer to **Section 8.7.2**.
2. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter.
3. Disconnect and remove coil.

⚠ WARNING

Do not unscrew enclosing tube nut all the way before breaking seal. Entrapped pressure could result in injury.

4. Loosen the enclosing tube nut (see **Figure 8.33**) using installation/removal tool supplied with repair kit. Ensure tube is loose and seal is broken then remove tool, enclosing tube nut, enclosing tube, plunger with plunger spring and o-ring.
5. Check plunger for restriction due to: (a) corroded or worn parts; (b) foreign material lodged in valve; (c) bent or dented enclosing tube.
6. Install new parts. Do not over tighten enclosing tube assembly. Torque to 100 inch/lbs (11.3 Nm).
7. Remove tool and install coil, refer to preceding step b.
8. Leak check, evacuate and dehydrate, and charge system as required. Refer to **Section 8.7.2**, **8.7.3** and **8.7.4**.
9. Check operation, refer to preceding step a.

8.8.5.8 Unloader Valve Replacement

1. Pump down the compressor. Refer to **Section 8.7.2**.
2. Disconnect and remove coil.

⚠ WARNING

Do not unscrew unloader valve body mounting bolts all the way before breaking seal. Entrapped pressure could result in injury.

3. Loosen the valve body mounting bolts. Tap the valve body to break the seal and then remove bolts and gasket.
4. Remove small screen from inside the compressor head and ensure it is not obstructed. Clean or replace as required.
5. Place a new gasket onto the replacement unloader valve body (with flat side toward the head) and, using unloader ring pliers, (Carrier Transicold part number 07-00223-00) compress the unloader ring while inserting the unloader into the compressor head.
6. One valve body mounting hole is offset to assist in correctly aligning the valve body and gasket. Insert mounting bolts, align with gasket holes and mounting holes in head. Start bolts by hand and then toque mounting bolts 12 to16 ft-lbs (1.3 to 1.8 Nm).
7. Leak check, evacuate and dehydrate, and charge system as required. Refer to **Section 8.7.2**, **8.7.3** and **8.7.4**.
8. Check operation, refer to preceding step a.

8.9 Refrigerant System Service

8.9.1 Evaporator Coil

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 coil 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.
- After being wetted and dried several times, cardboard fiber particles can be very hard to remove. Therefore, several washings may be necessary.
- 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.

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and disabling the starter.
2. Remove rubber check valves (Kazoo) from drain lines of the evaporator to be cleaned.
3. Spray coil with a mild detergent solution such as Oakite 164 or 202) 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.
4. Re-install check valves.
5. Re-enable the starter and run unit until Defrost Mode can be initiated to check for proper draining from drain pan.

8.9.2 Condenser Coil

8.9.2.1 Cleaning

NOTE

Only clean water should be used to wash the condenser. Do not use detergents to clean.

Remove all foreign material from the 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. Take care so that the fins aren’t bent during this procedure.

8.9.2.2 Condenser Replacement

NOTE

If the condenser coil (**Figure 8.34**) requires replacement, the entire condenser/radiator assembly must be removed from the unit and disassembled/reassembled on the bench.

1. Remove the refrigerant charge. Refer to **Section 8.7.2**.
2. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and removing the negative battery cable.
3. Drain coolant into a suitable container by removing coolant bottle cap and then the engine drain plug. Refer to **Figure 8.15**.
4. Remove the surround with the grille attached. Refer to **Section 8.4.3**.
5. Remove remaining hoses from radiator connections.

⚠ CAUTION

Unit uses R404A and POE oil. The use of inert gas brazing procedures is mandatory for all Carrier Transicold refrigeration units; otherwise compressor failure will occur. For more information Refer to Technical Procedure 98-50553-00 Inert Gas Brazing.

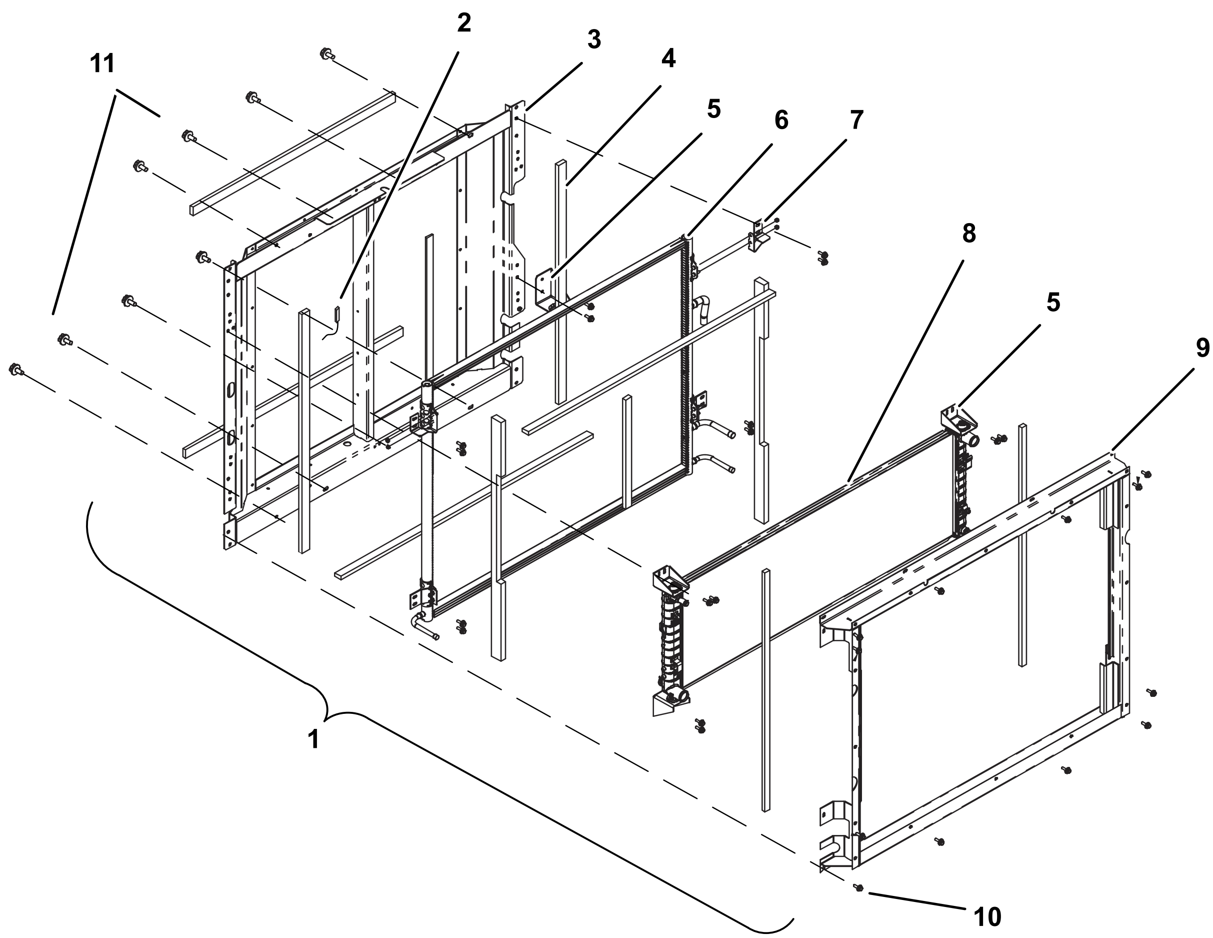
6. Unbraze refrigerant lines from condenser coil.
7. Disconnect the hail and bug screen sufficient to reach the ambient air temperature sensor (**Figure 8.34**) and wiring. Remove sensor and wiring from front condenser frame.
8. Remove the condenser/radiator assembly mounting bolts securing the condenser/radiator assembly to the unit.
9. Remove the condenser/radiator assembly from the unit.
10. Remove eight rear condenser frame mounting bolts securing the rear condenser frame to the front condenser frame and set rear frame aside.
11. Separate the radiator from the condenser/radiator assembly by removing the top radiator mounting brackets and removing grommets in the bottom brackets. Set radiator aside.
12. Remove condenser coil by removing the condenser coil mounting brackets.
13. Reassemble condenser/radiator assembly in reverse order using new coil and new gaskets as required. Torque all condenser/radiator bracket and frame mounting bolts 36 to 60 inch/lbs (4.1 to 6.8 Nm).

NOTICE

Do not bend the tubing on the condenser coil when installing the new condenser. Bend the unit tubing if tubes do not align correctly.

14. Reassemble condenser/radiator assembly into unit using new gaskets as required. Note the three upper and lower curb side mounting holes are slotted for ease of alignment. Torque condenser/radiator assembly mounting bolts 95 to 119 inch/lbs (10.7 to 13.4 Nm). Braze condenser coil refrigerant connections.
15. Leak check, evacuate and dehydrate, and charge system as required. Refer to **Section 8.7.2**, **8.7.3** and **8.7.4**.
16. Refill engine coolant. Refer to **Section 8.5.14**.
17. Reinstall the negative battery cable, start unit and run Pretrip to check operation.

Figure 8.34 Condenser/Radiator Assembly



1. Condenser/Radiator Assembly
2. Ambient Air Temperature Sensor (ATT)
3. Front Condenser Frame
4. Gasket (Typical)
5. Radiator Mounting Brackets
6. Condenser Coil
7. Condenser Coil Mounting Brackets
8. Radiator
9. Rear Condenser Frame
10. Rear Condenser Frame Mounting Bolts
11. Condenser/Radiator Assembly Mounting Bolts

8.9.3 Filter Drier

8.9.3.1 Check Filter Drier

The unit must be running in cool for this test. Check for a restricted or plugged filter drier by feeling the liquid line inlet and outlet connections of the drier cartridge. if the outlet side feels cooler than the inlet side, then the filter drier should be replaced.

8.9.3.2 Replace Filter Drier

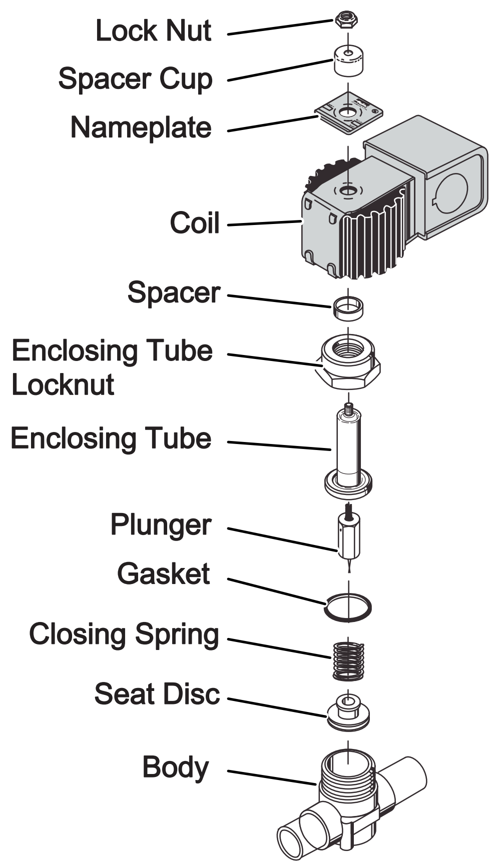
1. Pump down the low side. Refer to **Section 8.7.2**.
2. Remove bracket, loosen the inlet connection to relieve any remaining pressure then remove drier.
3. Procure new O-rings. Lubricate the O-rings, back side of sleeves and coupling nuts. Using a backup wrench at each connection torque 30 to 38 ft/lbs (40.7 to 51.5 Nm).
4. Leak check, evacuate and dehydrate, and charge system as required. Refer to **Section 8.7.2**, **8.7.3** and **8.7.4**.

8.9.4 Replacing Receiver Sight Glass Or Fusible Plug

1. Remove the refrigerant charge. Refer to **Section 8.7.2**.
2. Loosen the sight glass or fusible plug to relieve any remaining pressure. Remove and discard glass or plug.
3. Using new o-ring, install component. Torque the sight glass to 15 to 25 ft/lbs (20.3 to 33.9 Nm). Torque the fusible plug to 48 to 96 inch/lbs (5.4 to 10.8 Nm).
4. Leak check, evacuate and dehydrate, and charge system as required. Refer to **Section 8.7.2**, **8.7.3** and **8.7.4**.

8.9.5 Condenser Pressure Control Solenoid Valve (SV1)

Figure 8.35 Condenser Pressure Control Solenoid Valve (SV1)



8.9.5.1 Checkout Procedure

To obtain proper heating and defrost, the normally open SV1 must energize and close tightly during the heat and defrost cycles. If the valve does not close tightly due to physical damage, foreign material or wear, refrigerant leakage through the valve can reduce heating capacity.

- **During normal heat or defrost cycles the following conditions will be observed when the valve is operating properly:**

1. Receiver refrigerant level will drop quickly at the initiation of heating or defrost.
2. Suction pressure will rise slowly to 90-100 PSIG (6.12 to 6.80 Bar).
3. Discharge pressure will drop quickly, but will begin to rise to a minimum of 250 PSIG (17.0 Bars) within 15 to 20 minutes.

- **If suction and discharge pressures remain low and the receiver level does not drop, the valve may be inoperative and can be checked by the following method.**

1. Verify the solenoid coil has proper voltage and is energized in heating and defrosting.
2. Connect a discharge pressure gauge at the discharge service valve and connect a gauge to the liquid line service valve.
3. With the refrigerated compartment temperature at 35°F (1.7°C) or lower, operate the unit in high speed cool and disconnect the coil.
4. With a separate 12 VDC source, energize the coil with the unit in high speed cooling and observe the discharge and receiver pressures. If the valve is closing properly, compressor discharge pressure will begin to rise and the receiver pressure will remain the same or begin to drop slowly. If the valve is not seating properly, both discharge and receiver pressure will rise slowly or remain the same.
5. Operate the unit until discharge pressure reaches 200 PSIG (13.61 Bars) and disconnect the coil. Discharge and receiver pressure should be within 5 to 15PSIG (0.34 to 1.02 Bars) of each other.

8.9.5.2 Replacing The Coil

NOTE

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

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and removing the negative battery cable.
2. Remove top lock nut, spacer cup and nameplate (**Figure 8.35**).
3. Disconnect wiring and remove coil. Ensure spacer is in place.
4. Replace coil by reversing the preceding steps. Torque coil lock nut 46 to 50 inch/lbs (5.2 to 5.7 Nm).
5. Reinstall the negative battery cable, start unit and run Pretrip to check operation.

8.9.5.3 Replacing Internal Components

⚠ CAUTION

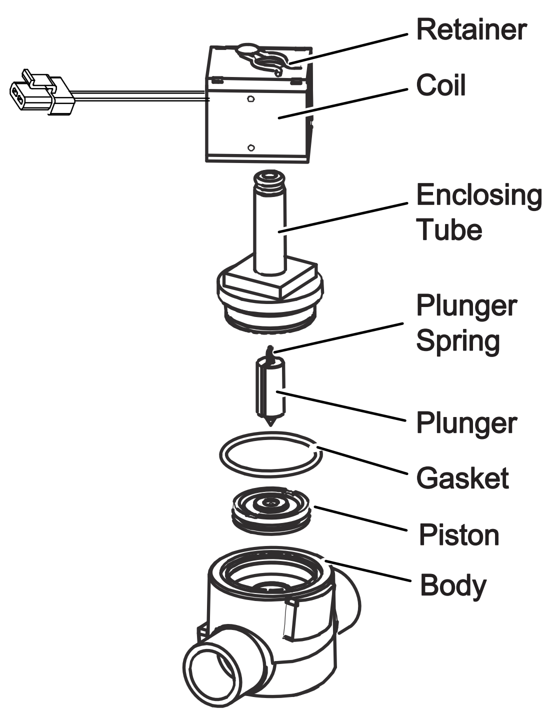
Service Mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating.

1. Remove the refrigerant charge. Refer to **Section 8.7.2**.
2. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and removing the negative battery cable.
3. Remove top lock nut, spacer cup, nameplate, coil and spacer (see **Figure 8.35**).
4. Using a 12 point, 1-3/8 inch box wrench, loosen the enclosing tube locknut and bleed off any remaining pressure.
5. Remove enclosing tube lock nut, enclosing tube with plunger, gasket, and closing spring.

6. Remove seat disc from inside of body and check for obstructions and foreign material.
7. Procure kits (rebuild kit or metal gasket kit) for reassembly as required.
8. Place the seat disc into the valve body with the smaller diameter end facing up.
9. Install the closing spring, gasket, enclosing tube with plunger and the enclosing tube lock nut. Torque enclosing tube locknut 30 to 40 ft-lb (40.7 to 54.2 Nm). If valve body has been replaced, torque mounting screws 30 to 34 inch/lbs (3.4 to 3.9 Nm).
10. Install coil, refer to preceding step b.
11. Leak check, evacuate and dehydrate, and charge system as required. Refer to **Section 8.7.2**, **8.7.3** and **8.7.4**.
12. Reinstall the negative battery cable, start unit and run Pretrip to check operation.

8.9.6 Liquid Line (SV2) / Hot Gas (SV4) Solenoid Valves

Figure 8.36 SV-2 and SV-4



8.9.6.1 Replacing the Coil

NOTE

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

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and removing the negative battery cable.
2. Remove the retainer (see **Figure 8.36**).
3. Disconnect wiring and remove coil.
4. Replace coil by reversing the preceding steps.
5. Reinstall the negative battery cable, start unit and run Pretrip to check operation.

8.9.6.2 Replacing Internal Components

⚠ CAUTION

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

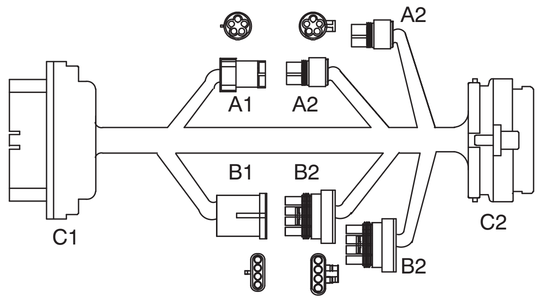
1. To service the liquid line solenoid valve SV2, pump the unit down. (Refer to **Section 8.7.2**). To service the hot gas solenoid valve SV4, remove the refrigerant charge. (Refer to **Section 8.7.2**.)
2. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and removing the negative battery cable.
3. Remove the retainer (**Figure 8.36**) disconnect wiring and remove coil.
4. Loosen the enclosing tube and bleed off any remaining pressure.
5. Remove enclosing tube, plunger spring, plunger and gasket.
6. Remove piston from inside of body and check for obstructions and foreign material.
7. Procure kits (rebuild kit or gasket kit) for reassembly as required. Gasket kit may contain more than one type gasket, replace with same color gasket as originally installed in valve.
8. Place the piston into the valve body.
9. Install piston, gasket, plunger, plunger spring and enclosing tube. Torque enclosing tube 19 to 23 ft-lb (25.4 to 31.1 Nm).
10. Install coil and retainer.
11. Leak check, evacuate and dehydrate, and charge system as required. Refer to **Section 8.7.2**, **8.7.3** and **8.7.4**.
12. Reinstall the negative battery cable, start unit and run Pretrip to check operation.

8.9.7 Stepper Test Harness

A stepper test harness (Carrier Transicold part number 07-00515) is available for testing the compressor suction modulation valve (CSMV) and evaporator expansion valve (EVXV).

The test harness is installed by disconnecting the 2SVM connector at the SVM module and plugging the C1 connector (**Figure 8.37**) into the module and C2 connector into the unit harness. With the test harness in place, the A1/A2 test harness connectors may be used to perform EVXV testing while the B1/B2 connectors may be used to perform CSMV testing.

Figure 8.37 Stepper Test Harness



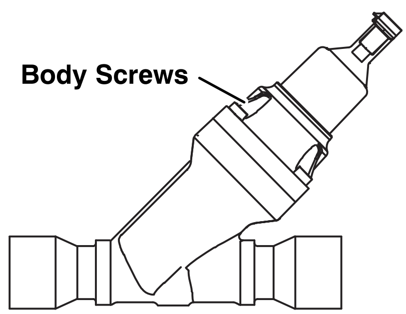
8.9.8 Compressor Suction Modulation Valve (CSMV)

The purpose of the CSMV (**Figure 8.38**) is to maintain the compressor within its operating envelope and maximize unit capacity and fuel economy.

If it is suspected that the CSMV is malfunctioning, the most efficient method of diagnosing the valve is to run a Pretrip (refer to **Section 3.6**). The Pretrip steps will check the remainder of the system and the CSMV specific test will check the valve. During the CSMV specific test the valve will be brought to a preset position, the unit started and then the valve will be opened while the APX Control System monitors suction pressure.

If there is a problem with the valve internal motor/piston assembly or wiring to the valve, the test will fail.

Figure 8.38 Suction Modulation Valve (CSMV)



[

8.9.8.1 Diagnostics - Control System or Wiring - Voltage

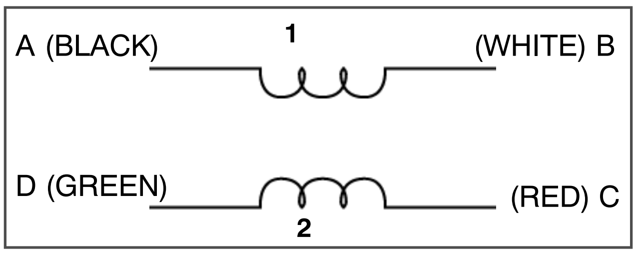
1. Place the START/RUN-OFF switch in the OFF position and disconnect the starter motor wire at the weather tight connector.
2. Disconnect the CSMV connector. The Stepper Test Harness can also be used, refer to **Section 8.9.7**
3. Place unit in Component Test mode and select CSMV. This will open and close the CSMV for 10 minutes. Measure the AC voltage on the harness side of the connector between pins A and B and then between C and D. A consistent voltage (10 to 16 VAC) should be read by the digital voltmeter for each pair of wires. If the reading is present on all pairs there is a good signal coming from the SVM.
4. If the reading is not present on one or more of the wire pairs, check the wiring between the SVM and the CSMV connector, or check the APX Control System for proper model number configuration.

8.9.8.2 Diagnostics - Stepper Motor (CSMV) - Voltage

The valve stepper motor may be tested using a stepper motor drive tester or ohmmeter.

1. To test with a stepper motor drive tester (Carrier Transicold part number 07-00375-00), connect the 4-pin test cable supplied with the tester to the valve connector, refer to **Figure 8.39**, and the cable wires to the tester in accordance with wire and terminal color.
2. Set the step rate to 150 steps per second and either open or close the valve. Each red LED should light sequentially until all four are illuminated. Any LED failing to illuminate indicates an open on that leg and a need to replace the piston and drive motor assembly.
3. To test with an ohmmeter, check the winding resistance between connector pin A and B and then between C and D (**Figure 8.39**). In normal ambient, the resistance between the pins should be 72 to 84 ohms. If an out of tolerance or zero reading is observed, the piston and drive motor assembly is to be replaced.
4. With component installed on the unit, check each pin to chassis ground, If any of the pins on the valve give an ohm reading other than OL (over limit), the valve is grounded and should be replaced.

Figure 8.39 CSMV Coil



8.9.8.3 Diagnostics Valve

NOTE

If the valve failed pretest and passed the preceding diagnostic testing, this is an indication that the valve mechanism is damaged and the internal motor/piston assembly is to be replaced.

1. To test the valve internal mechanism, install a manifold gauge set on the suction service valve and a stepper motor drive tester.
2. Start the unit, set the step rate to 150 steps per second and close the valve while watching the suction pressure. Within one minute the suction pressure should begin to fall. Place the START/RUN-OFF switch in the OFF position before the reading enters a vacuum.
3. If the suction pressure does not change, this is an indication the valve is stuck and the internal motor/piston assembly is to be replaced.

8.9.8.4 Replacing Internal Motor/Piston Assembly

1. Pump down the low side. Refer to **Section 8.7.2**.
2. Remove internal motor/piston assembly and replace with a new assembly and gasket. The motor/piston assembly is set to 100% open when received from the warehouse. This is to ensure the Teflon valve seal is not damaged when it is installed. Ensure the valve is fully open by using the stepper motor tester to manually open the valve to 100% before installation. Torque the body screws 80 to 97 inch/lbs (9 to 11 Nm).
3. Leak check, evacuate and dehydrate, and charge system as required. Refer to **Section 8.7.2**, **8.7.3** and **8.7.4**.

8.9.8.5 Emergency Repair Procedures

In the event that the CSMV system has a failure, and replacement components are not readily available in an emergency, a **LIMP-HOME** procedure can be done as follows:

1. Install a manifold gauge set.
2. Pump down the low side. Refer to **Section 8.7.2**.
3. Remove the internal motor/piston assembly.
4. Loosen the Allen screw and remove the piston and screw.

5. Install the motor/piston assembly (without the piston). Torque the nut 35 to 40 ft/lb (47.5 to 54.2 Nm) or body screws 80 to 97 inch/lbs (9 to 11 Nm) as applicable.
6. Leak check, evacuate and dehydrate, and charge system as required. Refer to **Section 8.7.2**, **8.7.3** and **8.7.4**.
7. Start the unit.
8. Adjust the suction service valve so that the approximate temperature is maintained. For perishable loads, it is recommended that the adjustment be made so that the available capacity is slightly larger than the load, the unit will cycle OFF and ON.
9. Once repair parts become available, repair as required.

8.9.9 Evaporator Expansion Valve

The evaporator expansion valve (EVXV) (**Figure 8.40**) is a SVM driven device which meters the flow of refrigerant into the coil. Unless the valve is defective, it seldom requires any maintenance.

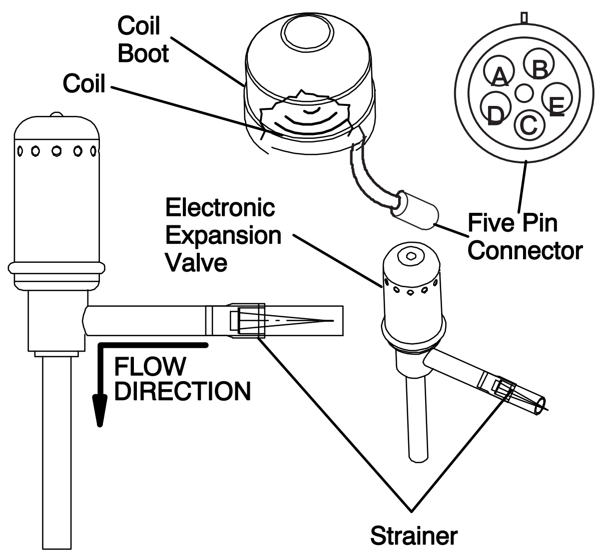
The flow control provides:

- Response to match the evaporator load
- Prevention of liquid refrigerant return to the compressor.

NOTE

As a preliminary check, ensure the EVXV coil is snapped down fully, and the internal coil retention tab is properly seated in one of the valve body dimples.

Figure 8.40 Evaporator Expansion Valve



8.9.9.1 Diagnostics - MSM or Wiring - Voltage

Place the unit in component test mode and select EVXV. The EVXV will open and close for 10 minutes. During this time the voltage being sent to the EVXV can be measured.

The stepper test harness (**Section 8.9.7**) should be used to test the EVXV. If a test harness is not available, voltages can be measured directly at the harness connector, however, voltage readings at the harness will be lower (about half) as compared to using the test harness.

1. Disconnect the 2SVM connector and locate the wires on the engine harness side labeled EXVA, EXVB, EXVC, EXVD and EXVE. These will correlate to the connector pins labeled A, B, C, D and E. Refer to **Table 8–2**.
2. Set the voltmeter to the ACV scale. Place the START/RUN-OFF switch in the OFF position and disconnect the starter motor wire at the weather tight connector. Place the START/RUN-OFF switch back in the START/RUN position.

Table 8–2 EVXV Connections

Connector Pin	Wire Color	Winding
A	ORANGE	A
B	RED	B
C	YELLOW	$\overline{A}$
D	BLACK	$\overline{B}$
E	GREY	COM (+12V)

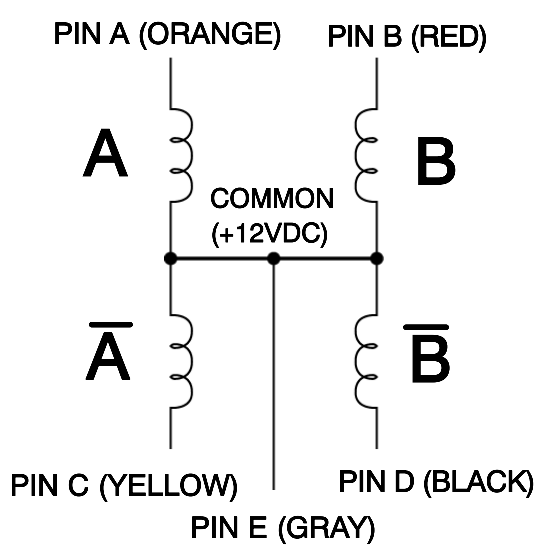
3. Perform the following test on the wiring coming from the SVM: Place the positive (+) voltmeter lead on pin E, the negative (-) voltmeter lead on pin A and observe the meter for several seconds. The voltage reading will be approximately 5 to 9 VAC depending on valve position.
4. Leave the positive (+) voltmeter lead on pin E and repeat for pins B, C and D. This procedure may have to be repeated several times to ensure consistent readings due to the 6 second "home" time.
5. If there is no voltage reading, or if the voltage never rises to the 5 to 9 VAC level, it indicates a problem in the wiring or the SVM. Place the START/RUN-OFF switch in the OFF position and reconnect the starter wire. Test all wiring from the EVXV connector to the SVM and verify good continuity before replacing the SVM.

8.9.9.2 Diagnostics - Stepper Motor (EVXV) - Resistance

The valve stepper motor may be tested using a stepper motor drive tester or ohmmeter.

1. To test with a stepper motor drive tester (Carrier Transicold part number 07-00375-00SV), connect the 5-pin test cable to the valve connector (**Figure 8.41**) and the cable wires to the tester in accordance with wire and terminal color. (if a 5-pin tester cable is required, order Carrier Transicold part number 07-00375-11.)
2. Set the step rate to 50 steps per second and either open or close the valve. Each red LED should light sequentially until all four are illuminated. Any LED failing to illuminate indicates an open on that leg and a need to replace the drive.
3. To test with an ohmmeter, check the winding resistance between connector pin A and E, B and E, C and E and then between D and E. In normal ambient, the resistance between the pins should be 46 ohms. If an infinite or zero reading is observed, the piston and drive motor assembly is to be replaced.
4. With component installed on unit, check each pin to chassis ground. If any of the pins on valve give and ohm reading other than OL (over limit), the valve is grounded and should be replaced.

Figure 8.41 EVXV Connector



8.9.9.3 Diagnostics - Valve

If the valve failed Pretrip and passed the preceding diagnostic testing, this is an indication that the valve internal mechanism is damaged and the piston and motor assembly is to be replaced.

1. To test the valve internal mechanism, install a manifold gauge set on the suction service valve and a stepper motor drive tester. Refer to **Section 8.7.1**.
2. Start the unit, set the step rate to 150 steps per second (refer to the preceding step b.) and close the valve while watching the suction pressure. Within one minute the suction pressure should begin to fall.
3. If the suction pressure does not change, this is an indication the valve is stuck and the piston and drive motor assembly is to be replaced.

8.9.9.4 Replacing Expansion Valve and Screen

1. Pump down the low side. (Refer to **Section 8.7.2**).
2. Remove coil and unbraze valve. Clean all tube stubs so new valve fits on easily.
3. Use a wet rag to keep the replacement valve cool and braze in place.
4. Leak check and evacuate the low side. Refer to **Section 8.7.3** and **8.7.4**.

8.9.10 Replacing Check Valve

A check valve allows flow in one direction only. Refer to **Figure 8.42**.

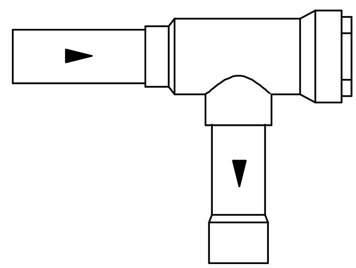
The function of the discharge check valve is to prevent liquid refrigerant from migrating back the compressor during the unit off cycle. Refer to **Figure 2.10**

NOTE

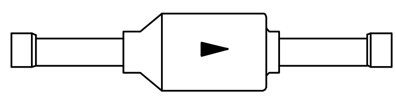
The function of the hot gas bypass check valve is to raise the receiver pressure (when the ambient temperature is low) so that refrigerant can flow from the receiver to the evaporator when the unit is in heating or defrost. Refer to **Figure 2.11**.These check valves are not serviceable, and must be removed and replaced as an assembly.

Figure 8.42 Check Valves

Discharge Check Valve



Hot Gas Check Valve



1. Remove the refrigerant charge. Refer to Section 8.7.2.

NOTICE

Unit uses R404A and POE oil. The use of inert gas brazing procedures is mandatory for all Carrier Transicold refrigeration units; otherwise compressor failure will occur. For more information Refer to Technical Procedure 98-50553-00 Inert Gas Brazing.

2. Using a pipe cutter, cut the valve stub-outs and unbraze the remaining stub-out from the connecting copper.
3. Clean tube stubs so new valve fits easily. Position new valve.
4. Wrap valve with wet rags to keep cool when brazing.
5. Braze valve in place and cool connections with wet rag.
6. Leak check, evacuate and dehydrate, and charge system as required. Refer to Section 8.7.2, 8.7.3 and 8.7.4.

8.9.11 High Pressure Switch

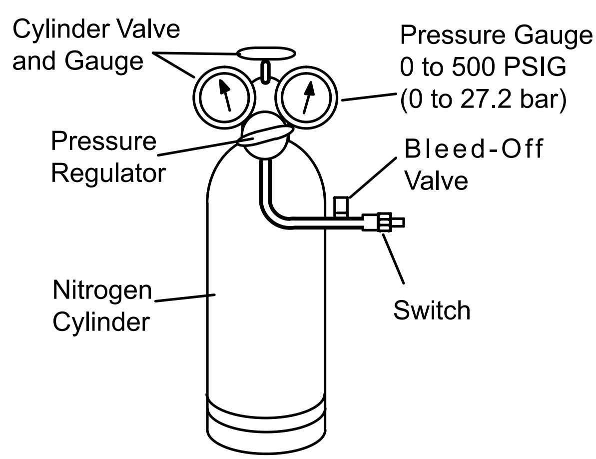
8.9.11.1 Checking High Pressure Switch

WARNING

Do not use a nitrogen cylinder without a pressure regulator. Cylinder pressure is approximately 2350 PSIG (160 bar). Do not use oxygen in or near a refrigerant system as an explosion may occur. Refer to Figure 8.43.

1. Remove switch as outlined in preceding section.
2. Connect ohmmeter or continuity light across switch terminals. Ohmmeter will indicate resistance and continuity light will be illuminated if switch closed after relieving pressure.

Figure 8.43 High Pressure Switch Testing



3. Connect switch to a cylinder of dry nitrogen. Refer to Figure 8.43.
4. Set nitrogen pressure regulator higher than open setting for switch being tested. For pressure switch settings, refer to Section 2.10.
5. Close valve on cylinder and open bleed-off valve.
6. Open cylinder valve. Slowly close bleed-off valve and increase pressure until the switch opens. If light is used, light will go out and if an ohmmeter is used, the meter will indicate open. Close cylinder valve. Slowly open bleed-off valve (to decrease pressure) until switch closes (light will illuminate or ohmmeter will indicate open).

8.9.11.2 Replacing High Pressure Switch

1. Pump down the compressor. Refer to Section 8.7.2.
2. Disconnect wiring from switch, and remove switch.
3. Install switch after verifying switch settings. (Refer to following step b.)
4. Leak check, evacuate and dehydrate, and charge system as required. Refer to Section 8.7.2, 8.7.3 and 8.7.4.

8.9.12 Pressure Transducers

The compressor discharge pressure transducer (CDP) has a range of 0 to 500 PSIG (0 to 34.0 bar) while the compressor suction pressure transducer (CSP) and evaporator outlet pressure transducer (EVOP) have a range of -14.7 to 100 PSIG (-1 to 6.8 bar). When comparing the transducer reading in Unit Data to the reading on a manifold gauge, keep in mind the following:

- The compressor discharge pressure reading in Unit Data will never read less than 0 bar/psig, even if it is exposed to a vacuum (such as when evacuating the system).
- If the compressor discharge pressure transducer has lost power or the signal is not returning to the module the reading in Unit Data will default to 305 to 315 psig (20.75 to 21.43 bar). Comparisons in this pressure range are not conclusive.
- The compressor suction pressure and evaporator pressure transducers will never read higher than 100 psig, even if actual pressure is higher.
- If the compressor suction pressure or evaporator pressure transducer has lost power or the signal is not returning to the module the reading in Unit Data will default to 55 to 60 psig (3.74 to 4.08 bar). Comparisons in this pressure range are not conclusive.

8.9.12.1 Test transducer wiring:

1. Verify that the wiring to the transducer is correct.

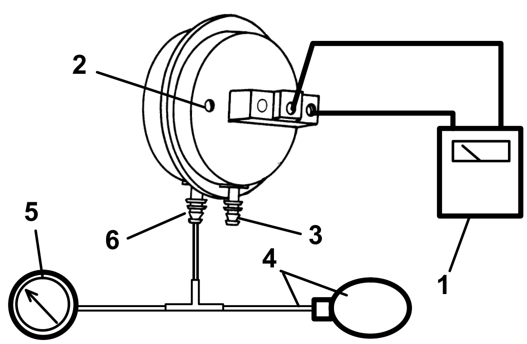
NOTE

CDP connector is identified with a red tape band. The CSP connector is identified with a blue band.

2. If required, power the transducer circuit by placing the unit in PC Mode, refer to **Section 5.3.2**. Check voltage to transducer connector. Voltage reading between connector position 2 (positive) and position 1 (negative) should be 5.0 VDC.
3. To check the signal wiring, check continuity between the transducer connector position 3 and the following connector: CDP = 2MM-10, CSP = 2MM-9, EVOP = 2MM-17
4. If voltage and signal wire are good, replace the transducer. The transducer may be removed by disconnecting the connector and quickly backing it off the Schrader valve fitting. Torque replacement transducer 13 to 15 ft/lb (17.6 to 20.3 Nm).

8.9.13 Defrost Air Switch

Figure 8.44 Defrost Air Switch Test Setup



1. Ohmmeter or Continuity Device
2. Adjustment Screw (0.050” socket head size)
3. Low Side Connection
4. Pressure Line or Aspirator Bulb (Carrier Transicold part number 07-00177-01)
5. Magnehelic Gauge (Carrier Transicold part number 07-00177-00)
6. High Side Connection

NOTE

If the DTT temperature is above 40°F (4.4°C) defrost cannot be initiated and the Message- Center will display “CANNOT START DEFROST CYCLE”.

1. Check air switch tubing. Red tube is to be connected to the high connection and routed below the coil. Clear tube is to be connected to the low connection and routed above coil. Check condition and mounting of air sensing fittings on coil end of both tubes. Refer to **Figure 2.3**
2. To check the defrost air switch, run unit in cooling and jumper across the air switch terminals. This will start the defrost cycle as it simulates the action of the defrost air switch. Bypassing the switch in this manner operates all components involved in defrost.
3. Unit should remain in defrost until the DTT and SAT both reach 55°F (12.8°C). At this point the defrost cycle will terminate and the unit will resume automatic operation.
4. If the above test indicates satisfactory operation, test DAS settings using a Magnehelic gauge (Carrier Transicold part number 07-00177) or similar instrument as follows.
5. Ensure magnehelic gauge is in proper calibration.

NOTE

The magnehelic gauge may be used in any position, but must be re-zeroed if position of gauge is changed from vertical to horizontal or vice versa. USE ONLY IN POSITION FOR WHICH IT IS ZEROED.

6. With air switch in vertical position, connect high pressure side of magnehelic gauge, a tee and aspirator to high side connection of air switch. Tee is to be placed approximately half-way between gauge and air switch or an improper reading may result. Refer to **Figure 8.44**.
7. Attach an ohmmeter to the air switch electrical contacts to check switch action.

NOTE

Use a hand aspirator (Carrier Transicold part number 07-00177-01), since blowing into tube by mouth may cause an incorrect reading.

8. 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.
9. Refer to **Section 2.10** for switch setting. If switch fails to actuate at correct gauge reading, adjust switch by turning adjusting screw clockwise to increase setting or counterclockwise to decrease setting.
10. Repeat checkout procedure until switch actuates at correct gauge reading.
11. 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.

8.9.14 Electrical System Components

Procedures for servicing or maintaining the electrical system components are provided in the following sub-paragraphs.

8.9.15 Main Microprocessor Module (MM)

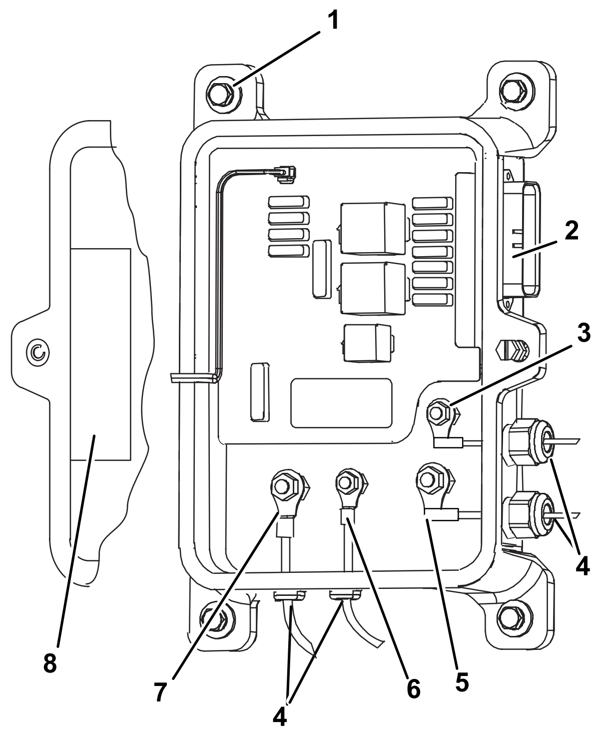
For complete Main Microprocessor Module replacement instructions refer to **Section 5.5.2**.

8.9.16 Power Control Module (PCM)

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and removing the negative battery cable.
2. Open PCM door. Loosen and remove stud-post terminal nuts (brass) at terminals BAT+. Refer to **Figure 8.45**, BAT–, ALT+ and EPH.
3. Remove nuts holding plastic bushings and leave hanging on wire.
4. Lift the 4 cable terminals up and off stud-posts. Remove loose nuts, slide plastic bushings and cables/terminals out of mounting hole in box.
5. Unlock tab on 35-pin connector and remove connector.
6. Remove the four mounting fasteners securing the PCM to unit frame; remove module from unit
7. Follow steps above in reverse order to install new PCM. Use the following torque values:

- Mounting fasteners 38 to 58 inch/lbs (4.3 to 6.6 Nm).
- M6 terminal nuts (EPH and BAT+) to 30 to 40 inch/lbs (3.4 to 4.5 Nm).
- M8 terminal nuts (ALT+ and BAT-) to 60 to 80 inch/lbs (6.8 to 9.0 Nm).

Figure 8.45 Power Control Module



1. Mounting Fasteners
2. 35-pin Connector
3. Engine Preheat Terminal (EPH)
4. Plastic Bushings
5. Alternator Positive Terminal (ALT +)
6. Battery Negative Terminal (BAT-)
7. Battery Positive Terminal (BAT +)
8. Door Mounted Legend Sticker

8. A component legend sticker is to be located inside the PCM door. Install the correct sticker (packaged with the replacement PCM) for this unit inside the replacement PCM. The replacement PCM is populated at the factory with the standard fuses and relays. Additional fuses and relays may be required for this application (see **Figure 2.7**) transfer the required fuses and relays from the original PCM to the replacement PCM as required.
9. Make sure the latest software has been loaded to ensure all modules are compatible. Refer to **Section 5.3.4**

NOTICE

When a module is replaced, software should be upgraded before switching the unit on. This will ensure software compatibility of all modules.

10. Reinstall the negative battery cable, start unit and run Pretrip to check operation.

8.9.17 Stepper Valve Module (SVM)

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and removing the negative battery cable.
2. Unlock the tabs and remove the 35-pin connector and 8-pin connector from the front of the module.
3. Replace module. Tighten mounting hardware to 96 inch/lbs (10.8 Nm).
4. Reinstall connectors ensuring tabs are fully locked in place.
5. Make sure the latest software has been loaded to ensure all modules are compatible, refer to **Section 5.3.4**

NOTICE

When a module is replaced, software should be upgraded before switching the unit on. This will ensure software compatibility of all modules.

6. Reinstall the negative battery cable, start unit and run Pretrip to check operation.

8.9.18 Display Module (DM)

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and removing the negative battery cable.
2. Unlock the tabs and then remove the 14-pin connector from the back of the module.
3. Remove hardware at rear of module. Replace module. Tighten mounting hardware to 84 to 120 inch/lbs (9.5 to 13.6 Nm).
4. Reinstall connector ensuring tabs are fully locked in place.
5. Make sure the latest software has been loaded to ensure all modules are compatible, refer to **Section 5.3.4**.

NOTICE

When a module is replaced, software should be upgraded before switching the unit on. This will ensure software compatibility of all modules.

6. Reinstall the negative battery cable, start unit and run Pretrip to check operation.

8.9.19 Alternator

⚠ 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 the negative and then the positive battery terminal when charging battery in unit.

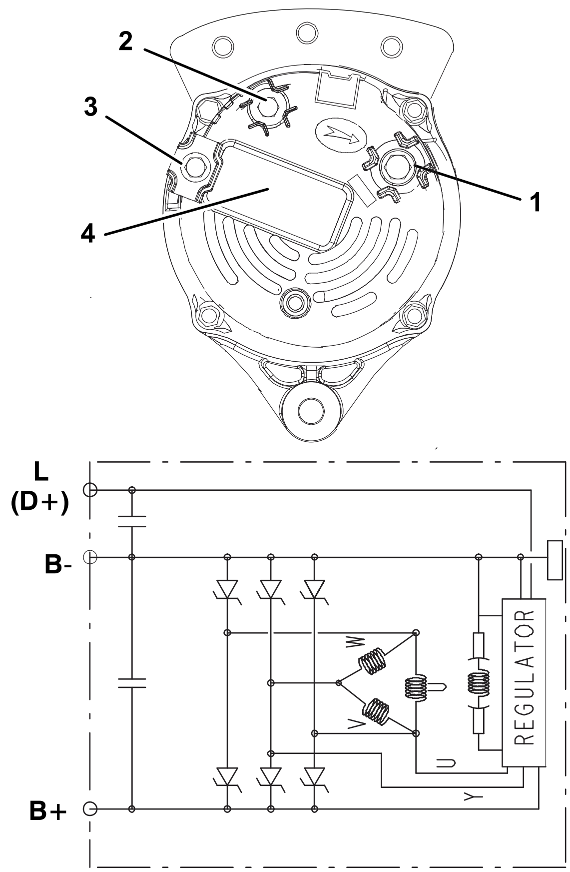
8.9.19.1 Inspection

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and removing the negative battery cable.
2. Verify condition and tightness of connections. Refer to **Figure 8.46**. Torque B+ terminal 62 to 80 inch/lbs (7 to 9 Nm) and B- terminal 38 to 52 inch/lbs (4.3 to 5.9 Nm). Check condition of belt,. Refer to **Figure 8.16**

8.9.19.2 Brush Replacement

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and removing the negative battery cable.
2. Remove screws holding the regulator/brush assembly.
3. Install new regulator/brush assembly. Torque mounting screws 35 to 40 inch/lbs (4 to 4.5 Nm).
4. Reinstall the negative battery cable, start unit and run Pretrip to check operation.

Figure 8.46 Alternator



1. Positive Output Terminal (B+)
2. L (D+) Terminal
3. Ground Terminal (B-)
4. Regulator/Brush Assembly

8.9.19.3 Alternator Replacement

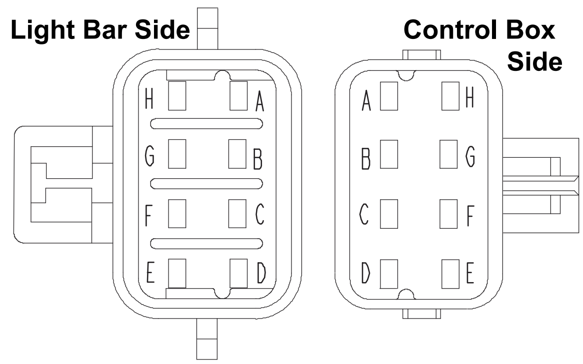
In the event the alternator is replaced, install the pulley on the alternator shaft with the “shoulder” side toward the alternator. Torque left hand thread pulley nut 50 to 60 ft/lbs (68 to 88 Nm) while holding shaft using a six point Torx T50 wrench. For instruction on tightening alternator mounting hardware and checking belt, refer to **Section 8.5.15**.

8.9.20 Light Bar

The light bar may be tested using a 12 VDC source. To test the light bar:

1. Ensure the unit will not start automatically by placing the START/RUN-OFF switch in the OFF position and removing the negative battery cable.
2. Connect the ground (-) from the power source to pin G on the light bar side of the connector.
3. The green LED's will illuminate when the 12 VDC side (+) of the power source is connected to pin B.
4. With the connection as in the preceding steps (+ on pin B, and - on pin G), the amber LED's will illuminate when the power (+) from the power source is also connected to pin H.
5. Reinstall the negative battery cable, start unit and run Pretrip to check operation.

Figure 8.47 Light Bar Connections



8.9.21 Sensor Checkout

An accurate ohmmeter must be used to check resistance values shown in **Table 8–3** or **Table 8–4**.

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 the tables.

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 8–3 Sensor Resistance

Sensors AAT, RAT, SAT, ENCT, DTT, CST, EVOT, REMSN 1, 2											
°F	°C	Ohms	°F	°C	Ohms	°F	°C	Ohms	°F	°C	Ohms
-40	-40	336,500	18	-7.8	49,060	76	24.4	10,250	134	56.7	2,809
-38	-38.9	312,600	20	-6.7	46,230	78	25.6	9,760	136	57.8	2,697
-36	-37.8	290,600	22	-5.6	43,580	80	26.7	9,299	138	58.9	2,590
-34	-36.7	270,300	24	-4.4	41,100	82	27.8	8,862	140	60.0	2,488
-32	-35.6	251,500	26	-3.3	38,780	84	28.9	8,449	142	61.1	2,390
-30	-34.4	234,200	28	-2.2	36,600	86	30.0	8,057	144	62.2	2,297
-28	-33.3	218,200	30	-1.1	34,560	88	31.1	7,686	146	63.3	2,208
-26	-32.2	203,400	32	0	32,650	90	32.2	7,334	148	64.4	2,124
-24	-31.1	189,700	34	1.1	30,850	92	33.3	7,000	150	65.6	2,042
-22	-30	177,000	36	2.2	29,170	94	34.4	6,684	155	68.3	1,855
-20	-28.9	165,200	38	3.3	27,590	96	35.6	6,384	160	71.1	1,687
-18	-27.8	154,300	40	4.4	26,100	98	36.7	6,099	165	73.9	1,537
-16	-26.7	144,200	42	5.5	24,700	100	37.8	5,828	170	76.7	1,402
-14	-25.6	134,800	44	6.6	23,390	102	38.9	5,571	175	79.4	1,281
-12	-24.4	126,100	46	7.7	22,160	104	40.0	5,327	180	82.2	1,171
-10	-23.3	118,100	48	8.9	20,990	106	41.1	5,095	185	85.0	1,072
-8	-22.2	110,500	50	10	19,900	108	42.2	4,874	190	87.8	983
-6	-21.1	103,600	52	11.1	18,870	110	43.3	4,665	195	90.6	902
-4	-20	97,070	54	12.2	17,900	112	44.4	4,465	200	93.3	829
-2	-18.9	91,030	56	13.3	16,980	114	45.5	4,275	205	96.1	762
0	-17.8	85,400	58	14.4	16,120	116	46.7	4,095	210	98.9	702
2	-16.7	80,160	60	15.5	15,310	118	47.8	3,923	215	101.7	647
4	-15.6	75,270	62	16.6	14,540	120	48.9	3,759	220	104.4	598
6	-14.4	70,720	64	17.7	13,820	122	50.0	3,603	225	107.2	553
8	-13.3	66,460	66	18.9	13,130	124	51.1	3,454	230	110.0	511
10	-12.2	62,500	68	20.0	12,490	126	52.2	3,313	235	112.8	473
12	-11.1	58,790	70	21.1	11,880	128	53.3	3,177	240	115.6	438
14	-10.0	55,330	72	22.2	11,310	130	54.4	3,049	245	118.3	406
16	-8.9	52,090	74	23.3	10,760	132	55.6	2,926	250	121.1	378

Table 8–4 Sensor Resistance (CDT)

°C	°F	Ohms	°C	°F	Ohms	°C	°F	Ohms	°C	°F	Ohms
-40	-40	3,360,000	0	32	325,860	40	104	53,330	101.7	215	6,510
-38	-38	3,121,020	1.1	34	307,970	41.1	106	51,010	104.4	220	6,000
-37.8	-36	2,900,710	2.2	36	291,180	42.2	108	48,800	107.2	225	5,540
-36.7	-34	2,697,500	3.3	38	275,410	43.3	110	46,710	110.0	230	5,130
-35.6	-32	2,509.940	4.4	40	260,590	44.4	112	44,710	112.8	235	4,760
-34.4	-30	2,336,720	5.5	42	246,670	45.5	114	42,820	115.6	240	4,410
-33.3	-28	2,186,670	6.6	44	233,570	46.7	116	41,010	118.3	245	4,090
-32.2	-26	2,028,680	7.7	46	221,260	47.8	118	39,290	121.1	250	3,800
-31.1	-24	1,891,780	8.9	48	209,670	48.9	120	37,660	126.7	260	3,290
-30	-22	1,765,060	10	50	198,760	50.0	122	36,100	132.2	270	2,850
-28.9	-20	1,647,700	11.1	52	188,490	51.1	124	34,610	137.8	280	2,490
-27.8	-18	1,538,950	12.2	54	178,820	52.2	126	33,200	143.3	290	2,170
-26.7	-16	1,538,950	13.3	56	169,700	53.3	128	31,850	148.9	300	1,910
-25.6	-14	1,344,580	14.4	58	161,100	54.4	130	30,560	154.4	310	1,680
-24.4	-12	1,257,770	15.5	60	152,990	55.6	132	29,330	160.0	320	1,480
-23.3	-10	1,177,150	16.6	62	145,340	56.7	134	28,160	165.5	330	1,310
-22.2	-8	1,102,240	17.7	64	138,120	57.8	136	27,040	171.1	340	1,160
-21.1	-6	1,032,600	18.9	66	131,310	58.9	138	25,970	176.7	350	1,040
-20	-4	967,830	20.0	68	124,870	60.0	140	24,960	182.2	360	920
18.9	-2	907,560	21.1	70	118,790	61.1	142	23,980	187.8	370	830
-17.8	0	851,450	22.2	72	113,040	62.2	144	23,050	193.3	380	740
-16.7	2	799,180	23.3	74	107,600	63.3	146	22,160	198.9	390	670
-15.6	4	750,470	24.4	76	102,460	64.4	148	21,310	204.4	400	600
-14.4	6	705,060	25.6	78	97,600	65.6	150	20,5000	210.0	410	540
-13.1	-8	662,690	26.7	80	92,990	68.3	155	18,980	215.6	420	490
-12.2	10	623,150	27.8	82	88,630	71.1	160	16,940	231.1	430	450
-11.1	12	586,230	28.9	84	84,510	73.9	165	15,450	226.7	440	410
-10.0	14	551,740	30.0	86	80,6000	76.7	170	14,070	232.2	450	370
-8.9	16	519,5000	31.1	88	76,890	79.4	175	12,870	237.8	460	340
-7.8	18	489,690	32.2	90	73,380	82.2	180	11,750	243.3	470	310
-6.7	20	461,170	33.3	92	70,040	85.0	185	10,750	248.9	480	280
-5.6	22	434,790	34.4	94	66,880	87.8	190	9,870	254.4	490	260
-4.4	24	410,080	35.6	96	63,880	90.6	195	9,050	260.0	500	240
-3.3	26	386,940	36.7	98	61,040	93.3	200	8,320			
-2.2	28	365,260	37.8	100	58,330	96.1	205	7,650			
-1.1	30	344,930	38.9	102	55,770	98.9	210	7,050			

NOTICE

Refer to the following tables for Temperature Pressure Charts for R-452A and R-4A refrigerants. Note that the liquid state pressure values and the vapor state pressure values of the R-452A refrigerant are different from those of the R-404A refrigerant.0

Table 8–5 R-404A Temperature Pressure Chart

Temperature		Pressure		Temperature		Pressure	
°C	°F	BAR	PSIG	°C	°F	BAR	PSIG
-40	-40	0.3	4.5	0	32	5.0	72.5
-37	-35	0.5	7.1	1	34	5.2	75.6
-34	-30	0.7	9.9	2	36	5.4	78.8
-32	-25	0.9	12.9	3	38	5.7	82.1
-29	-20	1.1	16.3	4	40	5.9	85.5
-28	-18	1.2	17.7	6	42	6.1	89.0
-27	-16	1.3	19.2	7	44	6.4	92.5
-26	-14	1.4	20.7	8	46	6.6	96.2
-24	-12	1.5	22.3	9	48	6.9	99.9
-23	-10	1.7	23.9	10	50	7.2	103.7
-22	-8	1.8	25.6	13	55	8.0	115.4
-21	-6	1.88	27.3	16	60	8.7	126.1
-20	-4	2.0	29.1	18	65	9.5	137.4
-19	-2	2.1	30.9	21	70	10.3	149.4
-18	0	2.3	32.8	24	75	11.2	162.1
-17	2	2.4	34.8	27	80	12.1	175.5
-16	4	2.5	36.8	29	85	13.1	189.6
-14	6	2.7	38.9	32	90	14.1	204.5
-13	8	2.8	41.1	35	95	15.2	220.2
-12	10	3.0	43.3	38	100	16.3	236.8
-11	12	3.1	45.6	41	105	17.5	254.2
-10	14	3.3	48.0	43	110	18.8	272.4
-9	16	3.5	50.4	46	115	20.1	291.6
-8	18	3.7	52.9	49	120	21.5	311.8
-7	20	3.8	55.5	52	125	23.0	332.9
-6	22	4.0	58.1	54	130	24.5	355.0
-4	24	4.2	60.9	57	135	26.1	378.1
-3	26	4.4	63.7	60	140	27.7	402.3
-2	28	4.6	66.5	63	145	29.5	427.6
-1	30	4.8	69.5	66	150	31.3	454.0

Table 8–6 R-452A Temperature Pressure Chart

Temperature		Liquid		Vapor			Temperature		Liquid		Vapor	
°F	°C	psig	bar	psig	bar		°F	°C	psig	bar	psig	bar
-29.2	-34	10.4	0.72	6.5	0.45		68	20	144.6	9.97	128.6	8.87
-25.6	-32	12.7	0.87	8.5	0.58		71.6	22	153.5	10.59	136.9	9.44
-22	-30	15.1	1.04	10.6	0.73		75.2	24	162.8	11.23	145.6	10.04
-18.4	-28	17.6	1.21	12.8	0.88		78.8	26	172.4	11.89	154.7	10.67
-14.8	-26	20.3	1.40	15.2	1.05		82.4	28	182.4	12.58	164.1	11.32
-11.2	-24	23.2	1.60	17.7	1.22		86	30	192.8	13.29	174.0	12.00
-7.6	-22	26.2	1.81	20.4	1.41		89.6	32	203.6	14.04	184.2	12.71
-4	-20	29.5	2.03	23.3	1.61		93.2	34	214.8	14.81	194.9	13.44
-0.4	-18	32.9	2.27	26.3	1.82		96.8	36	226.4	15.61	206.0	14.21
3.2	-16	36.5	2.52	29.6	2.04		100.4	38	238.4	16.44	217.5	15.00
6.8	-14	40.4	2.78	33.0	2.28		104	40	250.9	17.30	229.5	15.83
10.4	-12	44.4	3.06	36.6	2.53		107.6	42	263.8	18.19	242.0	16.69
14	-10	48.7	3.36	40.5	2.79		111.2	44	277.1	19.11	255.0	17.59
17.6	-8	53.2	3.67	44.5	3.07		114.8	46	291.0	20.07	268.5	18.51
21.2	-6	57.9	3.99	48.8	3.36		118.4	48	305.3	21.06	282.5	19.48
24.8	-4	62.9	4.34	53.3	3.68		122	50	320.1	22.08	297.0	20.48
28.4	-2	68.1	4.70	58.0	4.00		125.6	52	335.4	23.13	312.1	21.52
32	0	73.6	5.08	63.0	4.35		129.2	54	351.2	24.22	327.7	22.60
35.6	2	79.4	5.48	68.3	4.71		132.8	56	367.6	25.35	344.0	23.72
39.2	4	85.4	5.89	73.8	5.09		136.4	58	384.4	26.51	360.9	24.89
42.8	6	91.7	6.33	79.6	5.49		140	60	401.8	27.71	378.4	26.10
46.4	8	98.4	6.78	85.7	5.91		143.6	62	419.8	28.95	396.7	27.36
50	10	105.3	7.26	92.1	6.35		147.2	64	438.4	30.23	415.7	28.67
53.6	12	112.5	7.76	98.7	6.81		150.8	66	457.5	31.55	435.4	30.03
57.2	14	120.0	8.28	105.7	7.29		154.4	68	477.2	32.91	456.1	31.45
60.8	16	127.9	8.82	113.0	7.79		158	70	487.4	34.30	477.6	32.94
64.4	18	136.1	9.39	120.6	8.32							

Table 8–7 Compressor Discharge Pressure Transducer Pressure/Voltage

PSIG	Bar	Voltage
0	0	0.5
10	0.7	0.6
20	1.4	0.7
30	2.0	0.7
40	2.7	0.8
50	3.4	0.9
60	4.1	1.0
70	4.8	1.1
80	5.4	1.1
90	6.1	1.2
100	6.8	1.3
125	8.5	1.5
150	10.2	1.7
175	11.9	1.9
200	13.6	2.1
225	15.3	2.3
250	17.0	2.5
275	18.7	2.7
300	20.4	2.9
325	22.1	3.1
350	23.8	3.3
375	25.5	3.5
400	27.2	3.7
450	30.6	4.1

Table 8–8 Compressor Suction Pressure Transducer Pressure/Voltage

PSIG	Bar	Voltage
-10	-0.7	0.7
-5.0	-0.3	0.8
0.0	0.0	1.0
5.0	0.3	1.2
10.0	0.7	1.4
15.0	1.0	1.5
20.0	1.4	1.7
25.0	1.7	1.9
30	2.0	2.1
35	2.4	2.2
40	2.7	2.4
45	3.1	2.6
50	3.4	2.8
55	3.7	3.7
60	4.1	3.1
65	4.4	3.3
70	4.8	3.5
75	5.1	3.6
80	5.4	3.8
85	5.8	5.8
90	6.1	4.1
95	6.5	4.3
100	6.8	4.5

SECTION 9
Unit Troubleshooting

NOTICE

Under no circumstances should anyone attempt to repair sealed module internal components. Should a problem develop with these components, contact your nearest Carrier Transicold dealer for replacement.

NOTE

Run a Pretrip (**Section 3.6**) and check all active alarms before continuing with troubleshooting.

9.1 Engine

Indication/Trouble	Possible Causes	Action / Reference
9.1.1 Engine Will Not Start		
Starter motor will not crank or low cranking speed	Battery insufficiently charged	9.2
	Battery cable connections loose or corroded	Check
	Damaged or corroded electrical connections at starter	Check/Repair
	Starter motor malfunction	9.1.4
	Starter motor solenoid defective	Engine Manual
	Open starting circuit	9.1.5
	Incorrect grade of lubricating oil	2.8
	Compressor not unloaded	8.8.5.5
	High suction pressure	8.9.8
Starter motor cranks but engine fails to start	No fuel in tank	Check
	Air in fuel system	8.5.2
	Water in fuel system	Drain Sump and 8.5.5
	Plugged fuel filter	8.5.5
	Plugged inlet screen to mechanical pump.	8.5.3
	Plugged inlet screen to electric pump.	8.5.4
	Plugged fuel lines to injector(s)	Check
	ENCU defective	Replace
	Engine preheat defective	8.5.11
Starter cranks, engages, but dies after a few seconds	Incorrect grade of lubricating oil	2.8
	Voltage drop in battery cable(s)	Check
	ENCU defective	Replace

Indication/Trouble	Possible Causes	Action / Reference
9.1.2 Engine Starts Then Stops		
Engine stops after several rotations	Fuel supply restricted	Check
	No fuel in tank	Check
	Leak in fuel system	Check
	Faulty fuel control operation	Engine Manual
	Plugged fuel filter	8.5.5
	Plugged inlet screen to mechanical pump	8.5.3
	Plugged inlet screen to electric pump	8.5.4
	Injector nozzle(s) defective	Engine Manual
	Injection pump defective	Engine Manual
	Air cleaner or hose restricted	8.5.10
	ENCU defective	Replace
	Electric fuel pump malfunction	8.5.4
	Mechanical fuel pump malfunction	Engine Manual
	Oil pressure switch defective	Replace
9.1.3 Engine Will Not Shut Off		
Engine will not shut off	ENCU operation defective	Replace
9.1.4 Starter Motor Malfunction		
Starter motor will not crank or turns slowly	Battery insufficiently charged	9.2
	Battery cable connections loose or corroded	Check
	Battery cables defective	Replace
	Excessively worn, open or defective starter brushes	Engine Manual
	Starter motor solenoid defective	Engine Manual
	Incorrect grade of lubricating oil	2.8
Starter motor turns but pinion does not engage	Pinion or ring gear obstructed or worn	Clean both, remove burrs, or replace
Starter motor does not disengage after engine starts	Starter motor solenoid defective	Engine Manual
	Defective starter	Engine Manual
9.1.5 Malfunction in the Engine Starting Circuit		
No power to starter solenoid (SS)	Battery condition	Load Test
	Damaged or corroded electrical connections at starter	Check/Repair
	ENCU defective	Replace
	No power from 3MM-12 to Starter Solenoid connector	Check/Repair

Indication/Trouble	Possible Causes	Action / Reference
9.1.6 Miscellaneous Engine Troubleshooting		
Loss of power	Air cleaner or hose restricted	8.5.10
	Air in fuel system	8.5.2
	Air vent restricted in fuel tank cap	Clean
	Restricted fuel lines	Engine Manual
	Defective fuel injection pump	Engine Manual
	Defective injector(s) or incorrect type	Engine Manual
	Incorrect fuel injection pump timing	Engine Manual
	Incorrect valve timing	Engine Manual
	Poor compression	Engine Manual
Vibration	Engine shockmounts defective	Replace
	Poor compression	Engine Manual
Overheating	Air cleaner or hose restricted	8.5.10
	Exhaust pipe restriction	Remove
	Restriction in water jacket	Engine Manual
	Restriction in radiator	8.5.14
	Coolant level too low	8.5.14
	Loose water pump	Engine Manual
	Defective thermostat	Engine Manual
	Alternator/Water pump belt loose/broken	8.5.16
Excessive crankcase pressure	Plugged crankcase breather	8.5.16

9.2 Alternator

Indication/Trouble	Possible Causes	Action / Reference
Alternator fails to charge	Limited charging system operating time	Check
	Battery condition	Load Test
	Alternator belt loose/broken	Figure 8.15
	Damaged or corroded electrical connections	Check./Repair
	Excessively worn, open or defective brushes	8.9.19
	Regulator faulty	8.9.19
	Open rotor field coil	Check/Replace
Low or unsteady charging rate	Alternator belt loose/broken	Figure 8.15
	Damaged or corroded electrical connections	Check/Repair
	Excessively worn, sticky or defective brushes	8.9.19
	Regulator faulty	8.9.19
	Grounded or shorted turns in rotor	Check/Replace
	Open rotor field coil	Check/Replace

Excessive charging rate (evidenced by need for frequent filling or constant high charging amperage)	Regulator faulty	8.9.19
Alternator noisy	Alternator belt loose/broken/misaligned	Figure 8.15
	Loose pulley	8.9.19
	Worn bearings	8.9.19

9.3 Refrigeration / Temperature Control

Indication/Trouble	Possible Causes	Action / Reference
9.3.1 Unit Will Not Cool		
Compressor malfunction	Compressor drive defective	8.6.1
	Compressor defective	8.8.1
Refrigeration system	A defrost cycle did not terminate. Check DTT	8.9.21
	Abnormal pressure	9.3.9
	Solenoid valve malfunction	8.9.5 / 8.9.6
	Clutch failure	8.6.4
9.3.2 Unit Runs But Has Insufficient Cooling		
Compressor	Compressor internal damage	8.8.1
	Unloader malfunction	8.8.5.5
Refrigeration system	Abnormal pressure	9.3.9
	Unloader malfunction	8.8.5.5
	Expansion valve malfunction	9.3.13
	No or restricted evaporator airflow	9.3.12
	Suction Modulation Valve malfunction	8.9.8
	Check system for noncondensibles	8.7.2
	Clutch failure	8.6.4
9.3.3 System Will Not Pump Down		
Valve malfunction	SV2 or SV4 not closing	8.9.6
	Check valve not closing	8.9.10
	Liquid line service valve defective	Replace
Compressor	Compressor internal damage	8.8.1
9.3.4 Unit Operates Long Or Continuously In Cooling		
Refrigerated Compartment	Hot Load	Allow time to pull down
	Defective or insufficient refrigerated compartment insulation or air leak	Correct
Refrigeration system	Abnormal pressure	9.3.9
	Temperature sensor malfunction	8.9.21
	Check system for noncondensibles	8.7.2
Compressor	Compressor internal damage	8.8.1

Indication/Trouble	Possible Causes	Action / Reference
9.3.5 Unit Will Not Terminate Cooling		
Unit fails to stop cooling	Temperature sensor malfunction	8.9.21
	Incorrect temperature scale, check whether microprocessor is set for °C or °F	Check
9.3.6 Unit Will Not Heat Or Has Insufficient Heating		
Refrigeration system	Abnormal pressure	9.3.9
	Main microprocessor malfunction	5.5.2
	Solenoid valve malfunction	8.9.5 / 8.9.6
	Bypass check valve malfunction	8.9.10
	Clutch failure	8.6.4
Compressor	Compressor internal damage	8.8.1
9.3.7 Unit Will Not Terminate Heating		
Unit fails to stop heating	Temperature sensor malfunction	8.9.21
	Incorrect temperature scale, check whether microprocessor is set for °C or °F	Check
9.3.8 Defrost Cycle Malfunction		
Will not initiate defrost automatically	Defrost timer has not expired	Check/Reset
	Defrost air switch (DAS) malfunction	8.9.13
	DTT is above 40°F (4.4°C)	Cool Down
	Damaged or corroded electrical connections at DTT	Check/Repair
Will not initiate defrost manually	Display key defective	8.9.18
	DTT is above 40°F (4.4°C)	Cool Down
	Unit has been running less than 15 seconds	Try again
Initiates but does not defrost	Low refrigerant charge	8.7.2
	Solenoid valve malfunction	8.9.5 / 8.9.6
	Clutch failure	8.6.4
Frequent defrost	Defrost air switch (DAS) out of adjustment	8.9.13
	Wet load	Normal
Does not terminate or cycles on defrost	Defrost air switch (DAS) out of adjustment	8.9.13
	DTT malfunction	8.9.21
Refrigerated Compartment	Hot Load	Allow time to pull down
	Defective or insufficient refrigerated compartment insulation or air leak	Correct

Indication/Trouble	Possible Causes	Action / Reference
9.3.9 Abnormal Pressure Cooling		
High discharge pressure	Condenser coil dirty	8.9.2
	Condenser fan/upper belt defective	8.6.3
	Discharge check valve restricted	8.9.10
	Refrigerant overcharge or noncondensibles	8.7.2
	Discharge service valve partially closed	Open
Low discharge pressure	SV4 leaking	8.9.6
	Compressor valve(s) worn or broken	8.8.1
	Low refrigerant charge	8.7.2
	Suction modulation valve malfunction	8.9.8
Low suction pressure	Filter drier partially plugged	8.9.3
	Low refrigerant charge	8.7.2
	Expansion valve malfunction	9.3.13
	No evaporator air flow or restricted air flow	9.3.12
	Excessive frost on evaporator coil	9.3.8
	SV2 defective	8.9.6
	Suction modulation valve malfunction	8.9.8
	Liquid or suction line service valve partially closed	Open
	Clutch failure	8.6.4
High suction pressure	SV4 leaking	8.9.6
	Compressor valves(s) worn or broken	8.8.1
	Compressor gasket(s) defective	8.8.1
Suction and discharge pressures tend to equalize when unit is operating	Compressor valves defective	8.8.1
	Compressor gasket(s) defective	8.8.1
9.3.10 Abnormal Pressure Heating		
High discharge pressure	Solenoid valve malfunction	8.9.5 / 8.9.6
	Condenser fan/upper belt defective	8.6.3
	Check system for noncondensibles	8.7.2
Low discharge pressure	Compressor valves defective	8.8.1
	SV1 leaking	8.9.5
	Low refrigerant charge	8.7.2
Low suction pressure	Low refrigerant charge	8.7.2
	SV1 leaking	8.9.5

Indication/Trouble	Possible Causes	Action / Reference
9.3.11 Abnormal Noise		
Compressor	Loose mounting bolts	Tighten
	Worn bearings	8.8.1
	Worn or broken valves	8.8.1
	Liquid slugging	9.3.13
	Insufficient oil	8.8.5
Condenser or evaporator fan	Condenser fan	8.6.3
	Evaporator fan	8.6.5
	Fan shaft	8.6.6
Alternator/Water pump belt	Alternator belt loose/broken	Figure 8.15
9.3.12 No Evaporator Air Flow Or Restricted Air Flow		
Evaporator coil blocked	Frost on coil	8.9.13
	Dirty coil	8.9.1
No or partial evaporator air flow	Upper belt loose or broken	8.6.2
	Evaporator fan loose or defective	8.6.5
	Evaporator air flow blocked	Check
9.3.13 Expansion Valve (EVXV) Malfunction		
EVXV not controlling correctly	Low refrigerant charge	8.7.2
	EVOT defective	8.9.21
	Coil not seated properly on valve	8.9.12
	EVOP defective	Check
	EVXV inlet screen plugged	Check/Replace
	Damaged or corroded electrical connections at valve or SVM	Check/Repair
9.3.14 Compressor Suction Modulation Valve (CSMV) Malfunction		
CSMV not controlling correctly	Coil not seated properly	Check
	Coil defective	8.9.8
	CSP defective	8.9.12
	CST defective	8.10.7
	Damaged or corroded electrical connections at valve or SVM	Check/Repair
9.3.15 Solenoid Valve Malfunction		
Valve does not function properly	No power to valve	Check alarms
	Damaged or corroded electrical connections	Check/Repair
	Coil defective or improperly assembled	8.9.5 / 8.9.6
	Valve improperly assembled	8.9.5 / 8.9.6
	Foreign material in valve or valve worn	8.9.5 / 8.9.6
Valve closes but refrigerant continues to flow	Foreign material in valve or valve worn	8.9.5 / 8.9.6

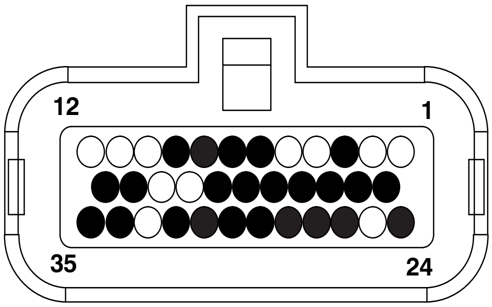
SECTION 10
Wiring

10.1 Harness Connector Wiring

All illustrations provided in this Section are looking at the connector connection end (with the wires in the back).

Table 10–1 PCM

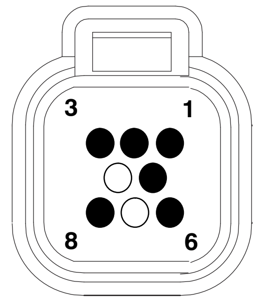
PCM – White



Component	Terminal
SP-8	3 (14)
SATPWR-A	6
LB-B	7
3MM-34	8
3MM-23	9
ES-E (EES power if equipped)	11
1RP-B	12
PCM-35	13 (35)
SP-8	14 (3)
SP-5	15
3MM-18	16
3MM-17 (FHR)	17
2SVM-11 / and 1RP-A (If equipped)	18
1MM-1	19
FLS-A	22
3MM-15	23
AFAS (F6-A)	24
3MM-13	26
3MM-14	27
3MM-28	28
2MM-12	29
2MM-23	30
2MM-29	31
1MM-6	32
SP-6	34
PCM-13	35 (13)
Unused Terminals: 1, 2, 4, 5, 10, 20, 21, 25	

Table 10–2 1MM

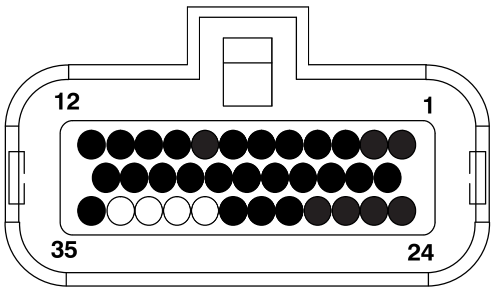
1MM – Black



Component	Terminal
PCM-19	1
SP-1	2
1SVM-1	3
SP-4	4
PCM-32	6
1SVM-6	8
Unused Terminals: 5, 7	

Table 10–3 2MM

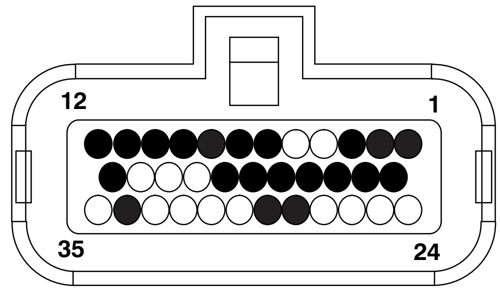
2MM – Black



Component	Terminal
AAT-A	1
AAT-B	2
RAT-A	3
RAT-B	4
SAT-A	5
SAT-B	6
EVOT-A	7
CDT-A	8
CSP-3	9
CDP-3	10
DTT-B	11
PCM-29	12
FLS-C	13
REM-E	14
IAT-A (If equipped)	15
REM-H (If not)	
CST-A	16
EVOP-3	17
EVOT-B	18
CDT-B	19
CSP-1	20
CDP-1	21
DTT-A	22
PCM-30	23
FLS-B	24
REM-F	25
IAT-B (If equipped)	26
REM-G (If not)	
CST-B	27
EVOP-1	28
PCM-31	29
SP-7	30
SP-9	35
Unused Terminals: 31-34	

Table 10–4 3MM

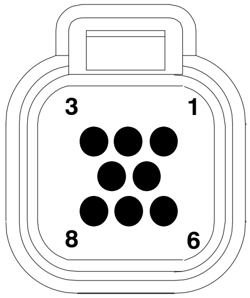
3MM – Gray



Component	Terminal
SV1-A (+)	1
SV2-A (+)	2
SV4-A (+)	3
UL1-A (+)	6
LB-H	7
UL2-A (+)	8
ENCU-44	9
FP (+)	10
CLH-A (+)	11
SS-A	12
PCM-26 (AFAR)	13
PCM-27	14
PCM-23	15
SP-5	16
PCM-17 (FHR)	17
PCM-16	18
DAS (+)	19
PCM-9	23
PCM-28	28
DAS (-)	29
PCM-8	34
Unused Terminals: 4, 5, 20-22, 24-27, 30-33, 35	

Table 10–5 1SVM

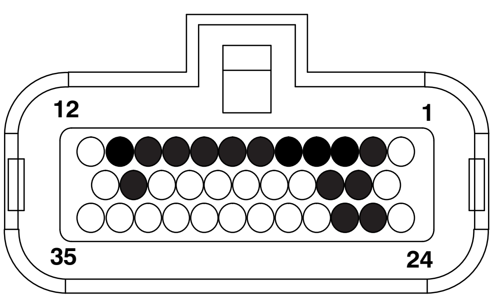
1SVM – Black



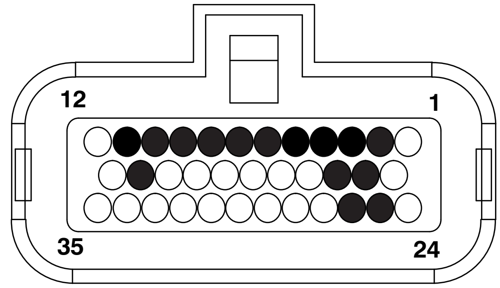
Component	Terminal
1MM-3	1
DM-2 (CAN-HI)	2
DM-1 (LOGIC GND)	3
DM-6 (CAN-LO)	4
SP-1	5
1MM-8	6
SP-4	7
DM-10 (LOGIC PWR)	8
Unused Terminals: None	

Table 10–6 2SVM

2SVM – Blue



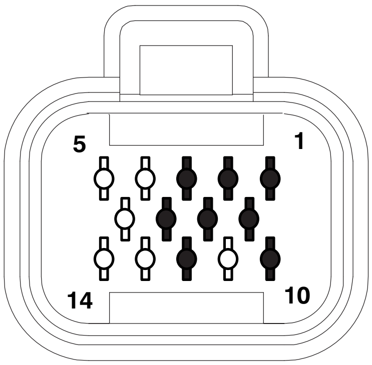
2SVM – Blue



Component	Terminal
CSMV-A	2
CSMV-B	3
CSMV-C	4
CSMV-D	5
EVXV-E	6
EVXV-A	7
EVXV-B	8
EVXV-C	9
EVXV-D	10
PCM-18	11
Units With DS Connector = DS-A	14
Without DS Connector = REM-A	
Units With DS Connector = REM-A	15
Without DS Connector = REM-C	
SP-6	22
Units With DS Connector = DS-B	25
Without DS Connector = REB-B	
Units With DS Connector = REM-B	26
Without DS Connector = REM-D	
Unused Terminals: 1, 12, 13, 16-21, 23, 24, 27-35. Units with DS Connector; 14, 25	

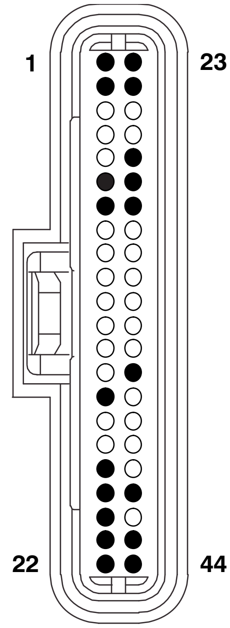
Table 10–7 DM

DM – Black



Component	Terminal
1SVM-3	1
1SVM-2	2
SATCOM-B	3
1SVM-4	6
J1-A	7
SATCOM-C	8
1SVM-8	10
SATCOM-A	12
Unused Terminals: 4, 5, 9, 11, 13, 14	

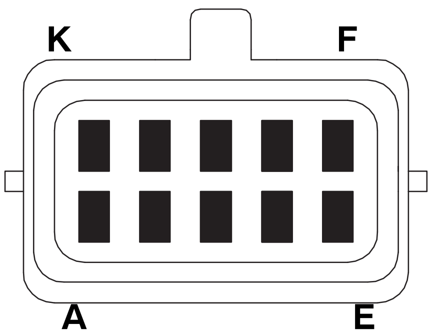
Table 10–8 ENCU



Component	Terminal
ENCT-B	1
ENSSN-2	2
ENCT-A	6
RPS-3	7
ENOPS-A	15
ENOPS-B	18
ENCU GND A	19
ENSSN-1	20
SM	21
SP-6	22
SP-1	23
SP-4	24
SP-27 (If equipped with MAP)	27
RPS-2 (If not)	
MAP-3 (If equipped with MAP)	28
SP-28 (If equipped with MAP)	29
RPS-1 (If not)	
FSA-1	36
FSA-2	41
ENSSN-3	43
3MM-9	44
Unused Terminals: 3-5, 8-14, 16, 17, 25, 26, 30-35, 37-40, 42	

Table 10–9 REM

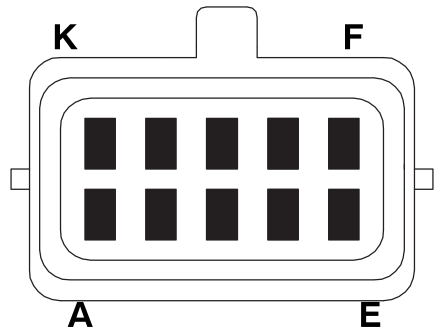
REM



Harness Connector Shown

UNITS WITH DS CONNECTOR		
From	**Terminal**	**To (Component)**
2SVM-15	A	REMS1
2SVM-26	B	REMS1
2MM-14	E	REMSN1
2MM-25	F	REMSN1
2MM-15	H	REMSN2
2MM-26	G	REMSN2
Unused Terminals: C, D, J, K		
UNITS WITHOUT DS CONNECTOR		
From	**Terminal**	**To (Component)**

REM



Harness Connector Shown

2SVM-14	A	DS
2SVM-25	B	DS
2SVM-15	C	REMS1
2SVM-26	D	REMS1
2MM-14	E	REMSN1
2MM-25	F	REMSN1
Unused Terminals: G, H, J, K		

10.2 Splice Points

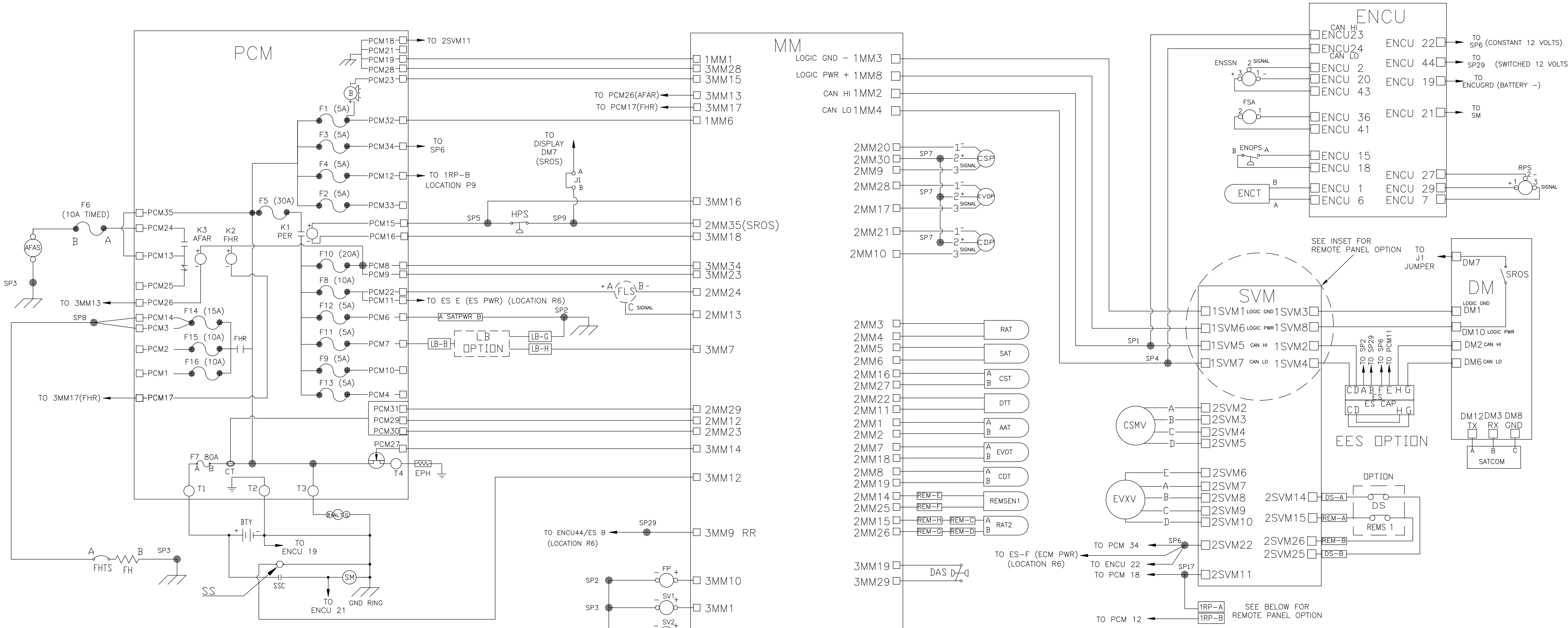
Table 10–10 Splice Points

Splice Pint #	Component
SP-1 (CAN High)	1MM-2
	1SVM-5
	ENCU-23
SP-2 (Ground)	SATPWR-A
	UL1-(negative)
	UL2-(negative)
	FP-(negative)
	GND1-RING1*
	LB-G
SP-3 (Ground)	AFAS-B (negative)
	CLH- B (negative)
	GND1-RING1*
	SV1-B (negative)
	SV2-B (negative)
	SV4-B (negative)
	FH1-B (FH to FHTS to FH1-A)
	FH2-B (FH to FHTS to FH2-A)
SP-4 (CAN low)	1MM-4
	1SVM-7
	ENCU-24
SP-5 (Power to K1)	3MM-16
	HPS-B
	PCM-15
SP-6 (Power from “RR”)	2SVM-22
	ENCU-22
	PCM-34
	ES-F (If EES equipped)
SP-7 (+ 5V power)	CDP-2
	EVOP-2
	CSP-2
	2MM-30
SP-8 (Power from FHR)	FH1-A (FHTS to FH to FH1-B)
	FH2-A (FHTS to FH to FH2-B)
	PCM-3
	PCM-14
SP-9 (Power from SROS)	2MM-35
	HPS-A
	J1-B
SP-27** (Sensor ground)	ENCU-27
	MAP-1
	RPS-2
SP-28** (Sensor power)	ENCU-29
	MAP-2
	RPS-1
SP-30 (If EES equipped)	ESEIT-1
	ESFIT-1
	ESFOT-1
	ECM-22
SP-31 (If EES equipped)	ESACV-5
	ESACV-3
	ECM-29
	ES-A (GRD)
	ESFP-1 (-)
	ESFI-1 (-)
	AP-5
SP-32 (If EES equipped)	ECM-16
	ES-C
	ES-G
SP-33 (If EES equipped)	ECM-30
	ES-H
	ES-D

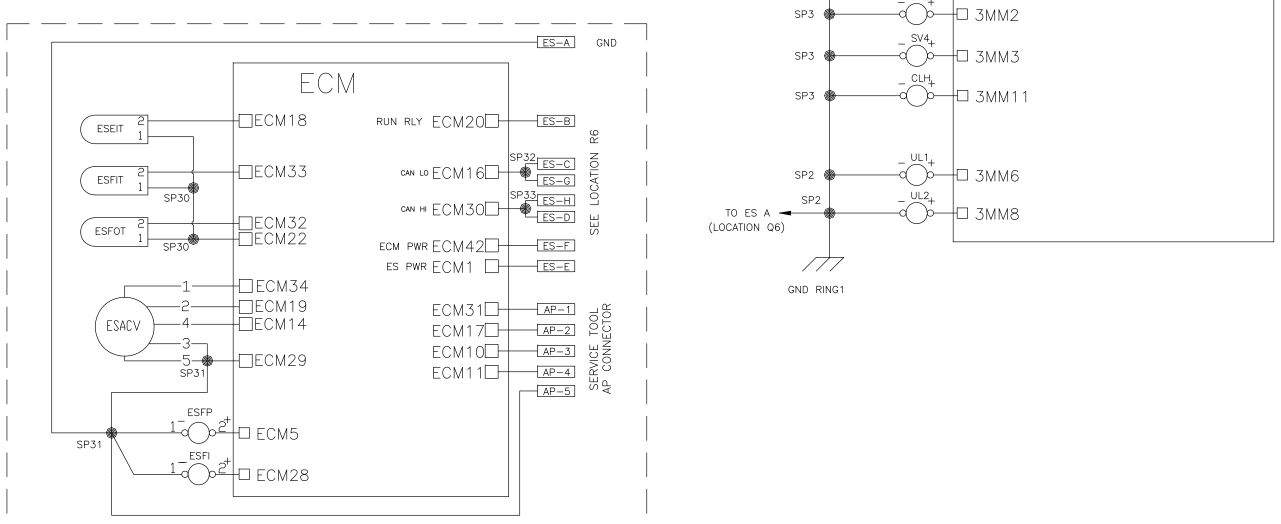
* Wire runs from splice point to battery ground wire.
** If equipped with MAP sensor only.

10.3 Wiring Schematic

The wiring schematic is provided on the following page.



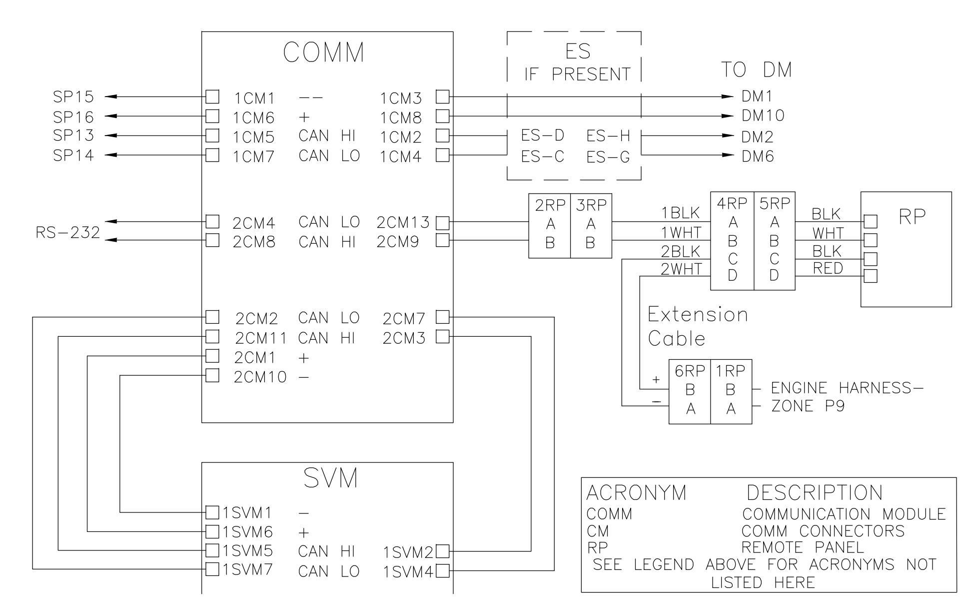
ZONE	ACRONYM	DESCRIPTION
E7	ALT	ALTERNATOR
M6	AAT	AMBIENT AIR TEMP SENSOR
C4	AFAR	AUTO FRESH AIR RELAY (OPTION)
A4	AFAS	AUTO FRESH AIR SOLENOID (OPTION)
E2	B	BUZZER
D8	BTY	BATTERY
I10	CLH	CLUTCH
M4	CDP	COMPRESSOR DISCHARGE PRESSURE SENSOR
M7	CDT	COMPRESSOR DISCHARGE TEMPERATURE SENSOR
O6	CSMV	COMPRESSOR SUCTION MODULATION VALVE
M3	CSP	COMPRESSOR SUCTION PRESSURE SENSOR
M6	CST	COMPRESSOR SUCTION TEMPERATURE SENSOR
C7	CT1	DC CURRENT SENSOR
M8	DAS	DEFROST AIR SWITCH
S4	DM	DISPLAY MODULE
R7	DS	DOOR SWITCH
M6	DTT	DEFROST TEMPERATURE SENSOR
D16,R6 Q11	EES	ENGINE EMISSIONS SYSTEM
R6	ES	ES CONNECTOR (EES OPTION)
R6	ES CAP	ES CONNECTOR JUMPER (EES OPTION)
P3	ENCT	ENGINE COOLANT TEMPERATURE
P3	ENOPS	ENGINE OIL PRESSURE SWITCH
R1	ENCU	ENGINE CONTROL UNIT
P2	ENSSN	ENGINE SPEED SENSOR
F7	EPH	ENGINE PRE HEATER
M3	EVOP	EVAPORATOR OUTLET PRESSURE SENSOR
M7	EVOT	EVAPORATOR OUTLET TEMPERATURE SENSOR
O7	EVXV	EVAPORATOR EXPANSION VALVE
E2	F1	FUSE -5 AMP
E3	F3	FUSE -5 AMP
D3	F5	FUSE - POWER ENABLE 30 AMP
B3	F6	FUSE - 10 AMP TIME DELAY AFAX (OPTION)
C7	F7	FUSE - 80 AMP MAIN
E4	F8	FUSE - 10 AMP FLS/EES (OPTION)
E4	F10	FUSE - 20 AMP
E5	F11	FUSE - 5 AMP LIGHT BAR (OPTION)
E5	F12	FUSE - 5 AMP SAT POWER
C5	F14	FUSE - 15 AMP FUEL HEAT (OPTION)
B8	FH	FUEL HEATER
D5,D8	FHR	FUEL HEATER RELAY
B8	FHTS	FUEL HEATER THERMOSTATIC SWITCH
I5	FLS	FUEL LEVEL SENSOR (OPTION)
I8	FP	FUEL PUMP (OPTION)
P2	FSA	FUEL SOLENOID ACTUATOR
G4	HPS	HIGH DISCHARGE PRESSURE SWITCH
H3	J1	OPTION CONNECTOR
H3	JUMPER (J1)	CONNECTOR JUMPER
G5	LB	LIGHT BAR (OPTION)
J2	MM	MICRO MODULE
D2	PCM	POWER CONTROL MODULE
D4	PER	POWER ENABLE RELAY(K1)
R7	REMS1	REMOTE SWITCH 1
M7	REMSEN1	REMOTE SENSOR 1
M5	RAT	RETURN AIR TEMPERATURE
M7	RAT2	RETURN AIR TEMPERATURE 2
S3	RPS	RACK POSITION SENSOR
M5	SAT	SUPPLY AIR TEMPERATURE
S7	SATCOM	SATELLITE COMMUNICATIONS CONNECTOR
F5	SATPWR	SATELLITE POWER (OPTION)
E8	SM	STARTER MOTOR
O5	SP1	SPLICE POINT 1
H8,H11,	SP2	SPLICE POINT 2(GROUND)
A4,C8,H9	SP3	SPLICE POINT 3
O5	SP4	SPLICE POINT 4
G4	SP5	SPLICE POINT 5
O8	SP6	SPLICE POINT 6
L3	SP7	SPLICE POINT 7(SENSOR 5V)
B5	SP8	SPLICE POINT 8
H3	SP9	SPLICE POINT 9
O8	SP17	SPLICE POINT 17
S1,H8,R6	SP29	SPLICE POINT 29
C10	SP30	SPLICE POINT 30
B12	SP31	SPLICE POINT 31
F10	SP32	SPLICE POINT 32
F10	SP33	SPLICE POINT 33
D8	SS	STARTER SOLENOID
D8	SSC	STARTER SOLENOID CONTACTOR
P5	SVM	STEPPER VALVE MODULE
I8	SV1	SOLENOID VALVE 1
I8	SV2	SOLENOID VALVE 2
I9	SV4	SOLENOID VALVE 4
I10	UL1	UNLOADER VALVE 1
I10	UL2	UNLOADER VALVE 2



EES (ENGINE EMISSIONS SYSTEM) OPTION

ACRONYM	DESCRIPTION
AP	ADVANCED PANEL (SERVICE CONNECTION, CAPPED)
ECM	EMISSIONS (SYSTEM) CONTROL MODULE
EES	ENGINE EMISSIONS SYSTEM
ES	EMISSIONS SYSTEM (ESS TO ENGINE)
ESACV	EMISSIONS SYSTEM AIR CONTROL VALVE
ESEIT	EMISSIONS SYSTEM EXHAUST INLET TEMPERATURE
ESFIT	EMISSIONS SYSTEM FILTER INLET TEMPERATURE
ESFOT	EMISSIONS SYSTEM FILTER OUTLET TEMPERATURE
ESFP	EMISSIONS SYSTEM FUEL PUMP
ESFI	EMISSIONS SYSTEM FUEL INJECTOR

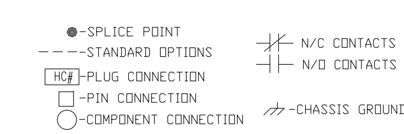
NOTE: THE 1CM CONNECTOR WAS ORIGINALLY INSTALLED AT THE 1SVM LOCATION ON STEPPER MODULE; SO WIRES ARE MARKED FOR THE 1SVM CONNECTOR. EXAMPLE: WIRE TO 1CM1 IS MARKED "1SVM1", ETC.



ACRONYM	DESCRIPTION
COMM	COMMUNICATION MODULE
CM	COMM CONNECTORS
RP	REMOTE PANEL

SEE LEGEND ABOVE FOR ACRONYMS NOT LISTED HERE

REMOTE PANEL OPTION



DECAL NO.	REV
62-11617-01	J
X-SERIES APX	

62-11617_ART2_S2_RJ

INDEX

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

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

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

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