Carrier TRANSICOLD
United Technologies

Truck Refrigeration

OPERATION & SERVICE MANUAL

For The

Supra 950MT
with Cab Command Controller

Truck Refrigeration Units

62-11863 Rev C

OPERATION & SERVICE MANUAL

For The

Supra 950MT with Cab Command Controller

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SECTION 1
SAFETY PRECAUTIONS

1.1 SAFETY PRECAUTIONS

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

Your Carrier Transicold refrigeration unit has been designed with the safety of the operator in mind. During normal operation, all moving parts are fully enclosed to help prevent injury. During all pre-trip inspections, daily inspections, and problem troubleshooting, you may be exposed to moving parts. Stay clear of all moving parts when the unit is in operation and when the unit RUN/STOP Switch (RSS) is in the START/RUN position.

⚠ CAUTION

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

⚠ CAUTION

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

⚠ CAUTION

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

1.2 FIRST AID

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

1.3 OPERATING PRECAUTIONS

- Always wear safety glasses
- Wear hearing protection as required
- Keep hands, clothing and tools clear of all moving parts
- No work should be performed on the unit until all circuit breakers and the RUN/STOP Switch are turned off, and the power supply is disconnected
- Always work in pairs; never work on the equipment alone
- In case of severe vibration or unusual noise, stop the unit and investigate

1.4 MAINTENANCE PRECAUTIONS

Beware of unannounced starting of the unit. This unit is equipped with Auto-Start in both the road and standby modes. The unit may start at any time. When performing any check of the system make certain the RUN/STOP Switch is in the OFF position.

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

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

When performing any arc welding on the unit or container, disconnect all wire harness connectors from the microprocessor. Do not remove wire harnesses from the modules unless you are grounded to the unit frame with a static safe wrist strap.

In case of electrical fire, place RUN/STOP switch in the OFF position and extinguish with CO2 (never use water).

1.5 AUTO-START

Your refrigeration unit is equipped with Auto-Start in both Start/Stop and Continuous Run modes. The unit may start at any time. A buzzer will sound for five seconds before the unit is started. When performing any check of the refrigeration unit (e.g., checking the belts, checking the oil), make certain that the RUN/STOP Switch is in the OFF (0) position.

1.6 ENGINE COOLANT

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

1.7 REFRIGERANTS

The refrigerant contained in 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 during system service, we recommend that you contact your nearest Carrier Transicold authorized repair facility whenever your unit requires refrigeration system service.

1.8 BATTERY

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

1.9 SPECIFIC WARNING, CAUTION, AND NOTICE STATEMENTS

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

DANGER

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

WARNING

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

CAUTION

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

NOTICE

NOTICE - warns against potential product or property damage.

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

WARNING

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

WARNING

Refrigerant is an acid base liquid and harmful for human contact. Wear gloves and eye protection when working with refrigerant. Allow time for coolant to cool and for pressure to release before the cap is removed from the radiator.

WARNING

Protect your eyes carefully from solvent by wearing chemical-safe goggles.

WARNING

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

WARNING

Beware of unannounced starting of the fans and V-belts caused by the thermostat and the start/stop cycling of the unit that may start automatically.

⚠ WARNING

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

⚠ WARNING

Always place the RUN/STOP switch in the STOP position and turn off the power supply before disconnecting the power plug from the unit.

⚠ WARNING

Make sure the power plug is clean and dry before connecting to any power source. Do not attempt to connect or remove power plug or perform service and/or maintenance before ensuring the unit RUN/STOP Switch is in the STOP position, the I/O switch is in the "O" position and the external power circuit breaker is OFF.

⚠ 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 clamps are secure and cables are not pinched or chafing against any components.

⚠ WARNING

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

⚠ WARNING

Do not use high pressure water spray to avoid damaging condenser fins.

⚠ WARNING

Do not allow insulated jumper wire to touch any ground.

⚠ 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.

⚠ CAUTION

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

⚠ CAUTION

In units with R404A and POE oil, the use of inert gas brazing procedures is mandatory, otherwise compressor failure will occur. See Technical Procedure 98-50553-00 Inert Gas Brazing for more information.

⚠ CAUTION

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

⚠ CAUTION

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

⚠ CAUTION

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

⚠ CAUTION

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

⚠ CAUTION

Check for correct power connection with connectors located in Main Control Relay Box.

⚠ CAUTION

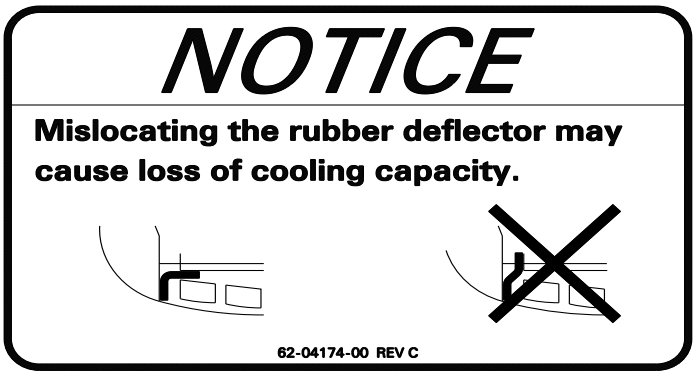
Be certain that the unit is connected to an appropriate power source.

⚠ CAUTION

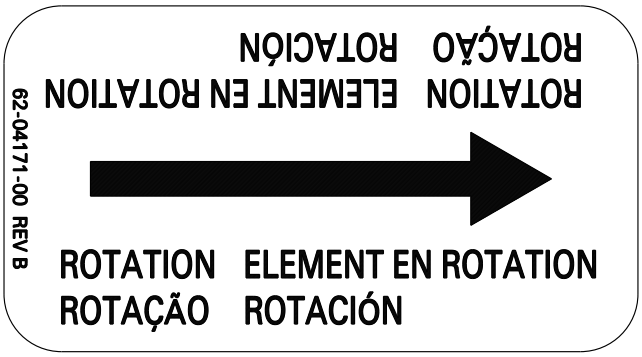
Do not allow the insulated jumper wire used to change unit Configurations to touch any ground.

NOTICE

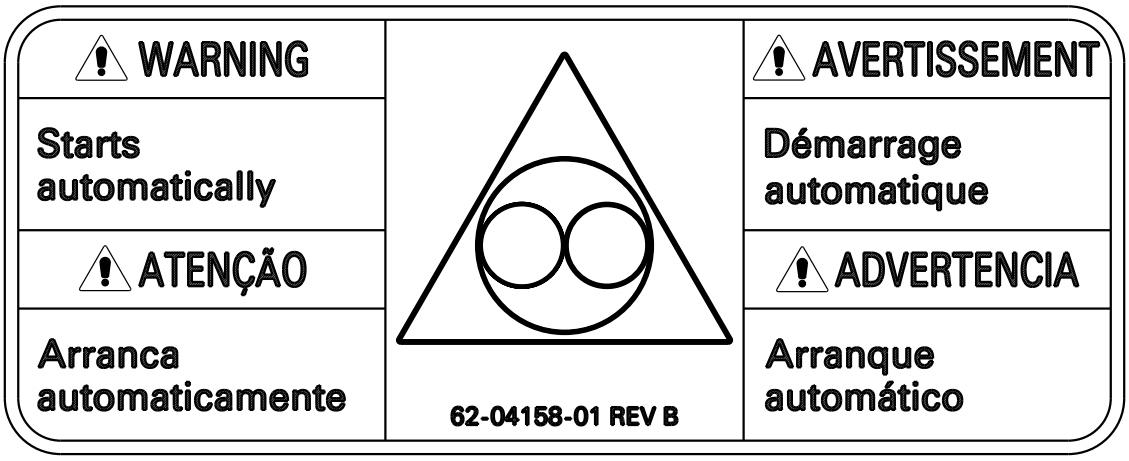
NEVER POUR COLD WATER INTO A HOT ENGINE. However, hot water can always be added to a cold engine.


NOTICE
Mislocating the rubber deflector may cause loss of cooling capacity.
62-04174-00 REV C


62-04157-00 REV A


ROTATION ELEMENT EN ROTATION
ROTAÇÃO ROTACIÓN
62-04171-00 REV B
ROTATION ELEMENT EN ROTATION
ROTAÇÃO ROTACIÓN


62-04156-00 REV B


WARNING
Starts automatically
ATENÇÃO
Arranca automaticamente
AVERTISSEMENT
Démarrage automatique
ADVERTENCIA
Arranque automático
62-04158-01 REV B

⚠ WARNING	⚠ AVERTISSEMENT
Charge only with R-404A	Charger uniquement avec du R-404A
⚠ ATENÇÃO	⚠ ADVERTENCIA
Carregue somente com R-404A	Carge unicamente R-404A
Use POE oil only: CTD P/N 07-00317-00	

62-04160-00 REV D

NOTICE

Over-tensioning belts may cause bearing damage. Tension belts according to instructions in the operation and service manual.

62-04172-00 REV C

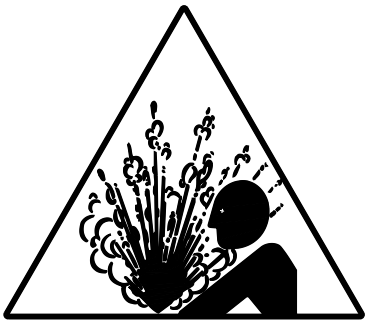
NOTICE

Do not overfill with oil or engine failure may occur.

62-04173-00
REV C

62-04159-00 REV C

⚠ AVERTISSEMENT	⚠ WARNING
Utiliser le couvercle de protection pour éviter un court circuit batterie	Use terminal covers to avoid battery short circuit
⚠ ATENÇÃO	⚠ ADVERTENCIA
Use capa dos terminais da bateria para evitar curto-circuito	Use las protecciones de las terminales para evitar corto circuito de la batería



62-04155-00 REV C

⚠ WARNING	⚠ ADVERTENCIA
Remove cap slowly when cool	Quite la tapa lentamente en frio
⚠ AVERTISSEMENT	⚠ ATENÇÃO
Enlever doucement le bouchon radiateur uniquement quand ce dernier est froid	Remova a tampa vagarosamente quando frio

NOTICE

Radiator Coolant Instructions

1) Fill empty radiator through filler neck slowly to avoid air entrapment.
2) Top coolant into recovery bottle only.

62-04154-00 REV C

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.

SECTION 2
UNIT DESCRIPTION

2.1 INTRODUCTION

⚠ WARNING

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

Table 2–1 Additional Support Manuals

Manual Number	Equipment Covered	Type of Manual
-- -- --	Supra 950MT	Parts included in T-T PLUS Rev. D
62-11861	Supra 950MT	Operator's Manual
62-10299	Compressor (05G)	Parts List
62-11167	Engine	Workshop Manual

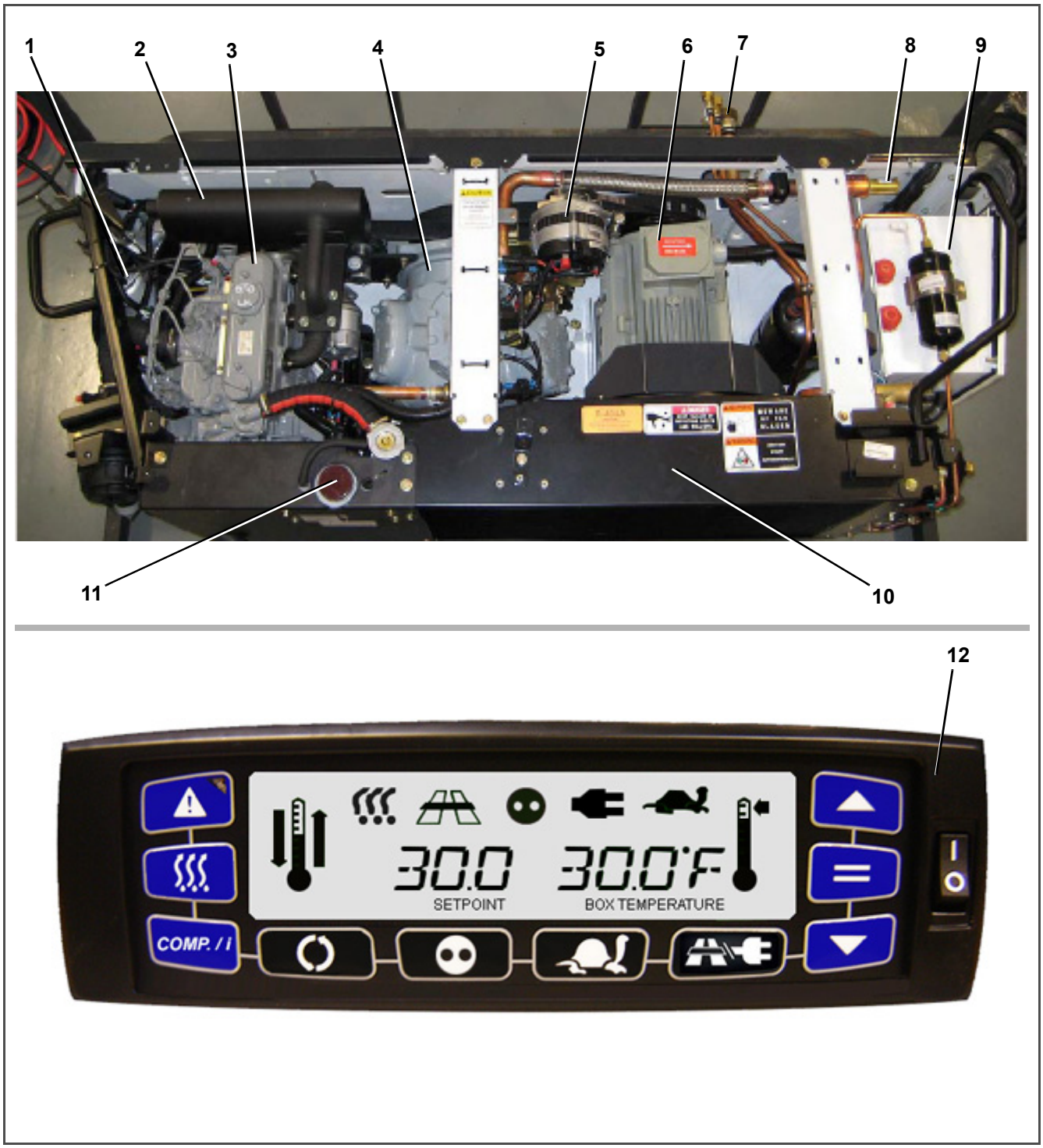
Table 2–2 Model Chart

Model Number	R404A	Engine	Compressor	Standby Motor
TDD-36FN4-3M	12.0 LB / 5.44 KG	D1105 Tri-Vortex	37 CFM O5G	Rotation speed: 1760 rpm @ 60 hz

Table 2–3 Evaporator Model Chart

Model	Discharge	Length	Power (Watts)	Number of fans
MTS 1100 H24	Single	43.3 inches (1100 mm)	2400	2
MTD 1100 H24	Double	43.3 inches (1100 mm)	2400	2

Figure 2.1 Supra 950MT Model - Top View/Cab Command



1. Dip Stick
2. Muffler
3. Engine (Refer to **Section 2.7.1**)
4. Compressor (Refer to **Section 2.7.4**)
5. Alternator (12 V)
6. Electric standby motor
7. Fittings for MT evaporators
8. Compressor pressure regulating valve (CPR)
9. Filter drier
10. Condenser
11. Coolant bottle
12. Cab Command

- - - - -

Figure 2.2 Supra 950MT Model - Curbside View

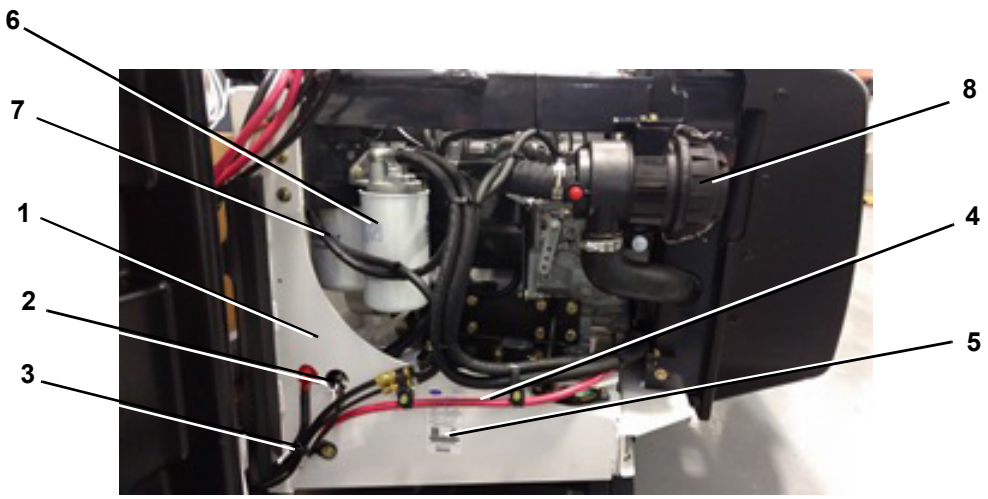
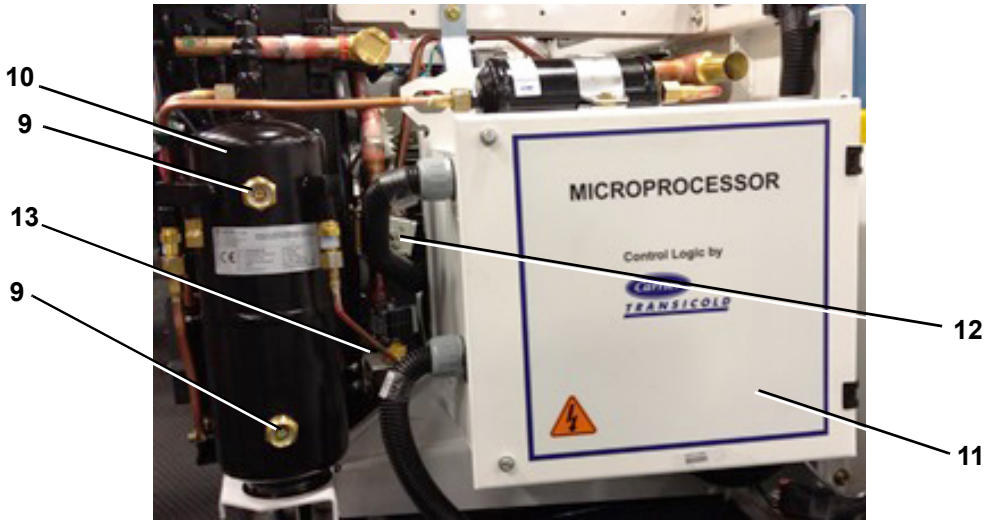


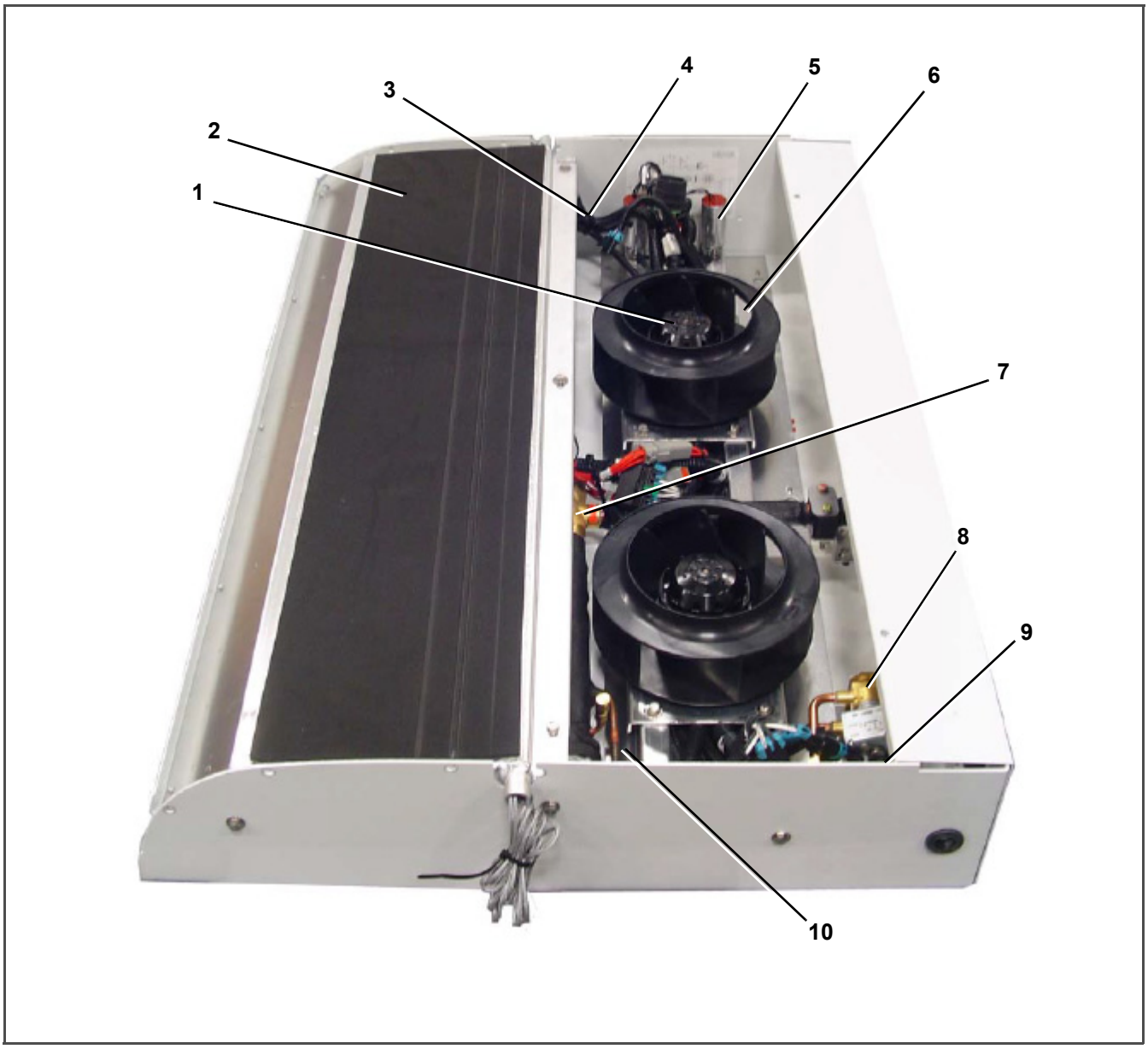
Figure 2.3 Supra 950MT Model - Roadside View



1. Negative Battery Cable
2. MP + Wire
3. Fuel Lines
4. Positive Battery Cable
5. Serial/Model Plate
6. Oil Filter
7. Fuel Filter
8. Air Cleaner
9. Receiver Sight Glass
10. Receiver
11. Electrical Box
12. Main Heat Valve
13. Receiver Pressure Valve

- - - - -

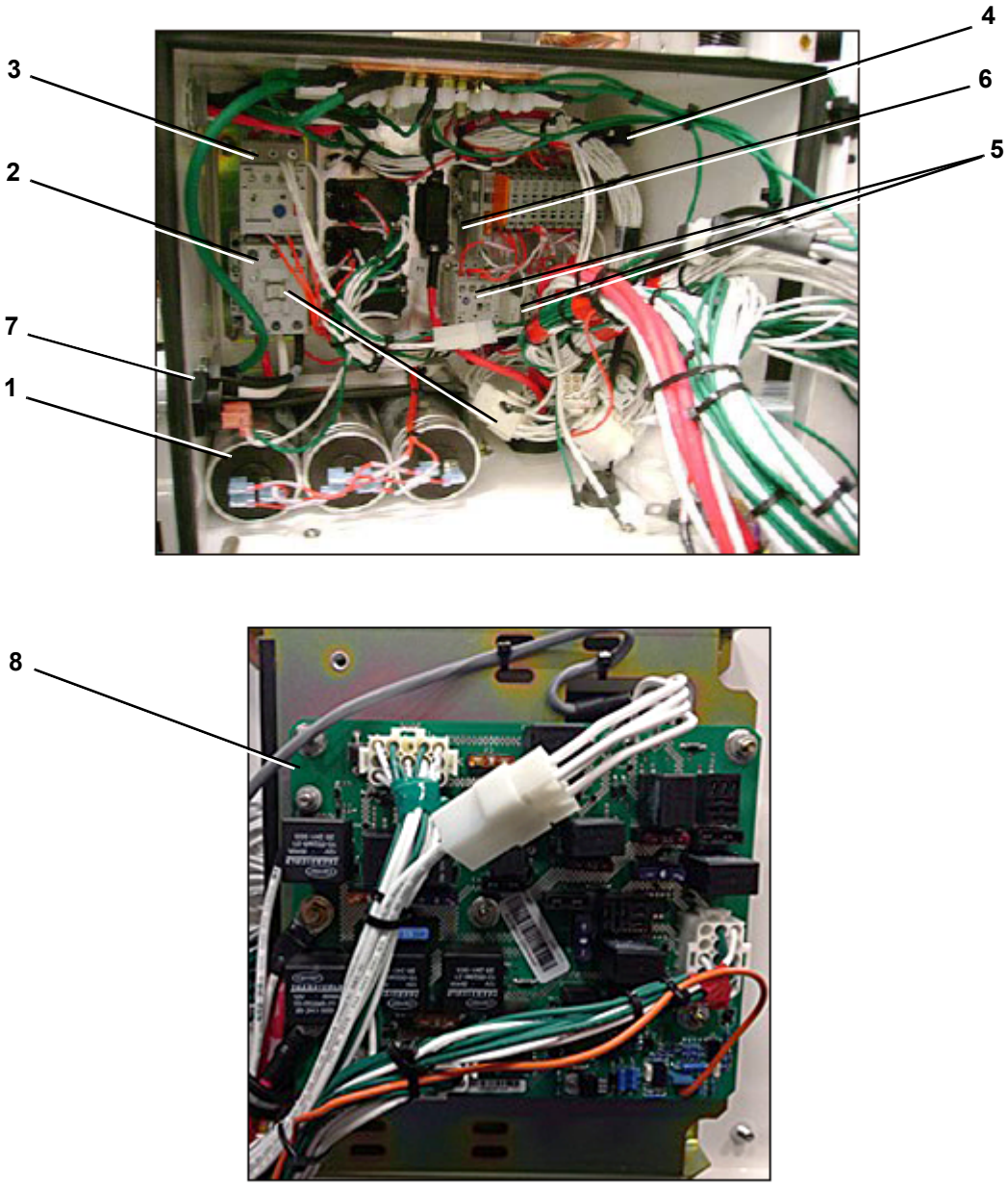
Figure 2.4 Evaporator (MTS 1100 Illustrated)



1. Return Air Sensor
2. Evaporator Coil
3. Defrost Termination Temperature Sensor
4. Evaporator High Temperature Switch
5. Capacitor
6. Fan and Motor Assembly
7. Check Valve Assembly
8. Liquid Line Valve Assembly
9. Hot Gas Valve
10. Electric Heater

- - - - -

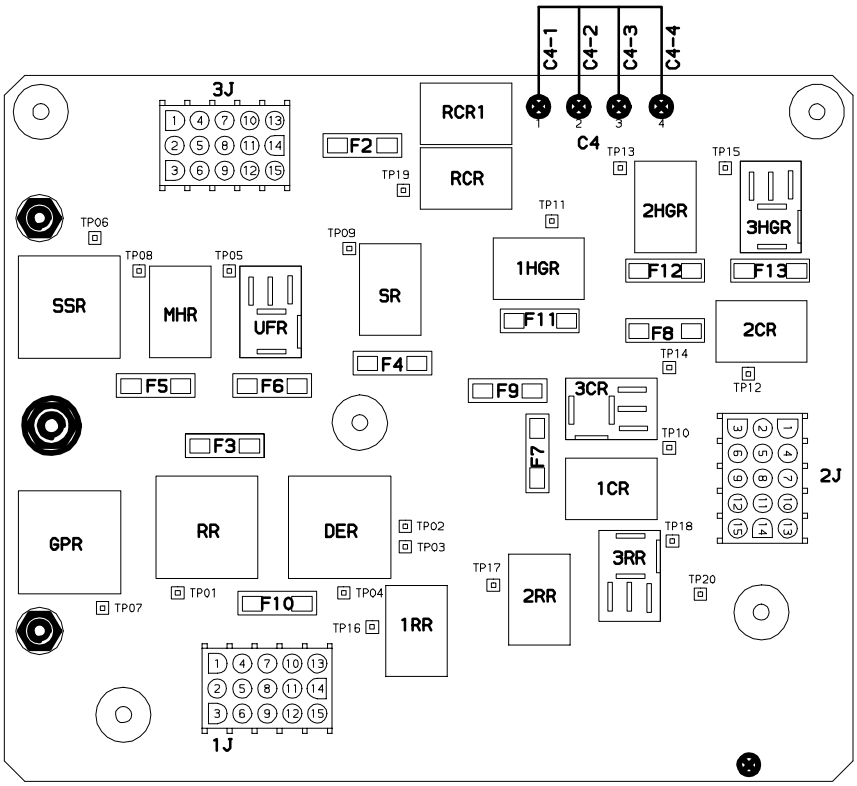
Figure 2.5 Electrical Box



1. Capacitors
2. Standby Motor Contactor (MC)
3. Motor Overload Relay (MOL)
4. Manual Run/Stop Switch
5. EHR Contactors
6. Main Fuse (80 amps)
7. Buzzer
8. Relay and Fuse Board

- - - - -

Figure 2.6 Control Relay Board View



The Supra 950MT control relay board allows better maintenance using pin connections (TP01 to TP 17). Output voltage can be measured pin-by-pin to check the relay's power supply.

Figure 2.7 Multi-Temp Sub Panel

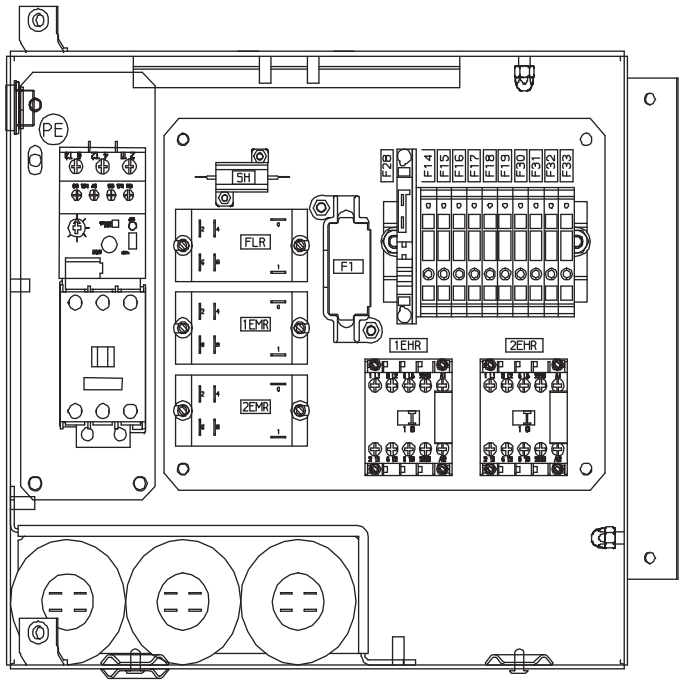


Table 2–4 Fuse Identification

Designation	Item	Amps
F1	Main fuse	80 A
F2	RCR fuse	5 A
F3	Run Relay fuse	15 A
F5	Main Heater Relay fuse	5 A
F6	Unloader fuse	3 A
F7	1 Liquid Solenoid Valve fuse	3 A
F8	2 Liquid Solenoid Valve fuse	3 A
F10	Fuel pump fuse	5 A
F11	1 Hot Gas Valve Fuse	7.5 A
F12	2 Hot Gas Valve Fuse	7.5 A
F14	Heater Strip Fuse	8 A
F15	Heater Strip Fuse	8 A
F16	Heater Strip Fuse	8 A
F17	Heater Strip Fuse	8 A
F18	Heater Strip Fuse	8 A
F19	Heater Strip Fuse	8 A
F27	Fuel Heater Fuse (Option)	25 A
F28	Flashing Relay	5 A
F30	2EMR	8 A
F31	1 and 2 EMR	8 A
F32	1EMR	8 A
F33	Flashing Relay	5 A
F35	Microprocessor fuse	5 A

Table 2–5 Relay Identification

Designation	Item
SSR	Starter Solenoid Relay
1CR, 2CR	Cool Relay (1st and 2nd compartments)
1EHR, 2EHR	Electrical Heat Relay (1st and 2nd compartments)
FLR	Flashing Relay
UFR	Unloader Front Relay
FHR	Fuel Heater Relay (option)
1HGR, 2HGR	Hot Gas Relay (1st and 2nd compartments)
DER	Diesel Electric Relay
RR, 1RR, 2RR	Run Relay (1st and 2nd compartments)
GPR	Glow Plug Relay
RCR	Run Control Relay
MHR	Main Heat Relay
1EMR, 2EMR	Electric Motor Relay (1st and 2nd compartments)

Table 2–6 Test Point Identification

Test Point #	Circuit
TP1	RR NO Output
TP2	DER NC Output
TP3	F10 Output
TP4	DER NO Output
TP5	UFR NO Output
TP6	SSR NO Output
TP7	GPR NO Output
TP8	MHR NO Output
TP9	SR NO Output
TP10	1CR NO Output
TP11	1HGR NO Output
TP12	2CR NO Output
TP13	2HGR NO Output
TP14	3CR NO Output
TP15	3HGR NO Output
TP16	1RR NO Output
TP17	2RR NO Output
TP18	3RR NO Output
TP19	RCR NO Output
TP20	DPS 12 Volt Input

2.2 GENERAL DESCRIPTION

2.2.1 System

The Supra 950MT offers the versatility of two-compartment temperature control for truck refrigeration, allowing the shipper to ship frozen and perishable commodities in the same load under separate refrigeration control.

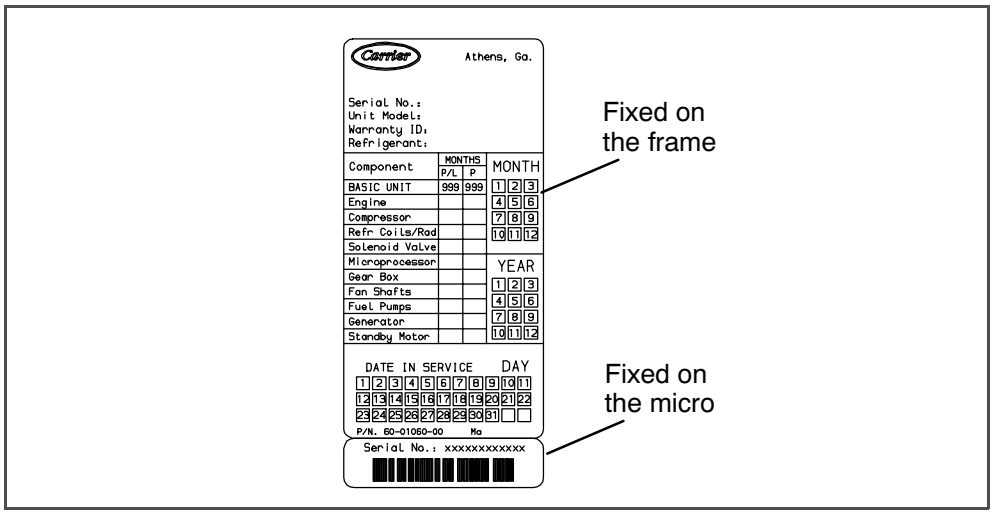
Units are equipped with an internal combustion diesel engine and an electric standby motor. In Standby Operation, the compressor and alternator are driven by the electric standby motor.

2.2.2 Truck Condensing Units

The Supra 950MT is a one-piece condensing unit designed for truck applications available for R404A refrigerant. It is equipped with an electric standby motor.

The model/serial number plate is located on the frame on the inside of the unit.

Figure 2.8 Supra 950MT Serial Number Plate



The Supra 950MT is furnished with a microprocessor control system. (Refer to **Section 3.1**) Once the desired set point is entered at the Cab Command in the truck, the unit will operate automatically to maintain the desired temperature within very close limits. The control system automatically selects Loaded and Unloaded Cooling or Loaded and Unloaded Heating as necessary to maintain the desired temperature.

The microprocessor has an Auto Start/Stop feature. The Auto Start/Stop operation provides automatic cycling of the diesel engine, which in turn offers an energy efficient alternative to continuous operation of the engine. Temperatures are maintained by alternate cooling and heating of the supply air (evaporator outlet air).

A remote standby receptacle is standard with all units.

2.2.3 Multi-Temperature Evaporators

The compartments of the Supra 950MT system are equipped with separate evaporators. For multi-temp applications, single discharge and double discharge evaporators are available. The evaporators are different in size, capacity and number of fans (See **Table 2–3**), but all work on the same principle and use the same single-phase 50Hz/60Hz fan assembly. The electrical heaters vary according to the type of condensing unit used and number of compartments.

One or more of the following components are located inside the evaporator housing:

- 230V single-phase backward curved impeller supplying high air volumes at low noise levels and both expansion and check valves
- 12V hot gas solenoid
- 12V liquid line solenoid
- 12V water drain heater
- Electrical heater element
- Sensor (Defrost Termination sensor)
- Safety heating thermostat

2.3 CONDENSING SECTION

The condensing section (See **Figure 2.1**, **Figure 2.2** and **Figure 2.3**) contains the drive equipment, alternator, and the high side refrigeration system equipment. The engine radiator and refrigerant condenser are incorporated into a single condenser/radiator assembly.

2.3.1 Drive Equipment

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

a. Engine

The Supra 950MT is equipped with a Kubota D1105 TriVortex 3-cylinder diesel engine. (See **Figure 2.1** and **Section 2.7.1**). Engine operation is controlled by a run solenoid. The engine is cooled by a radiator, which is integral with the refrigerant condenser. The cooling system is fitted with a coolant overflow reservoir. Engine air cleaners are dry type.

b. Clutch Assembly

The clutch assembly is mounted on the engine crankshaft. All units have centrifugal type clutches.

c. Standby Motor/Generator

The Supra 950MT is equipped with a heavy-duty electric standby motor operating on nominal 208V/230V-3ph-60Hz. Overload and short cycle protection is provided along with automatic reset. Units are also equipped with a remote mounted power receptacle.

Standby Mode: Motor drives the compressor from the power supplied from building power (230V/35A).

Diesel Mode: The motor acts as a generator, which supplies power for the remote evaporator fans, and heaters.

2.3.2 Switches and Controls

Components required for monitoring and controlling the diesel engine refrigeration system are located in the unit control box.

Run/Stop Switch (RSS)

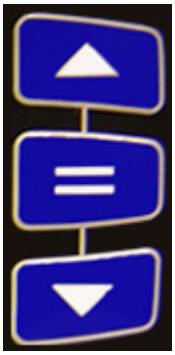
When placed in RUN position, the Run/Stop switch provides power to the microprocessor. To stop the unit or power down the microprocessor, place the Run/Stop switch in the STOP position.

2.4 DESCRIPTION OF CAB COMMAND COMPONENTS

2.4.1 Keypad

The keypad (**Figure 2.1**) has 10 keys that allow the operator to initiate various functions, display operating data, and change operating parameters.

Arrow Keys and Enter Key



The UP and DOWN ARROW keys are used to modify (in increments or decrements) the displayed data. If the unit is in the default display, these keys are pressed to change the setpoint selection.

The ENTER key is used to accept a change in function codes or a change in setpoint.

Manual Defrost Key

The MANUAL DEFROST key is used to initiate a defrost cycle. If the predetermined conditions for defrost are not met, the unit will not enter defrost and the display will return to the default screen. Refer to **Section 3.9**.

Auto Start/Stop - Continuous Run Key

The AUTO START/STOP key is used to change the operating mode from CONTINUOUS RUN to AUTO START-STOP. Each push of the key will alternate the operating modes. The microprocessor retains the last entered setpoint in memory even if the unit is shut down or a power failure occurs. The Auto Start/Stop indicator on the display will illuminate when Auto Stop/Start is enabled. If the indicator is not illuminated, the unit is in the CONTINUOUS RUN Mode.

To start the unit in MANUAL START mode, the Auto Start-Stop-Continuous selection must be in CONTINUOUS RUN mode and the Auto/Manual Start Operation function parameter set to AUTO OP (FN10 ON).

Function Change Key

The FUNCTION CHANGE key is used to display the function codes. Each time this key is pressed, the display will advance to the next code. This key, in conjunction with the ARROW and ENTER keys, will allow the user to change the Function Parameters. See **Section 3.10** for more detailed information.

NOTE

If configuration CNF11 is ON, functional parameters are locked. The ability to change functional parameters from keypad are disabled.

Pretrip Function will be enabled by pressing and holding the FUNCTION CHANGE key for more than 3 seconds. The **Pretrip Function** is disabled on the Supra 950MT.

Unit Data / Comp Key

The UNIT DATA / COMP. key supports three different functions:

1. Display the status of compartments. This is available from the Compartment Status Menu, which is brought up by a single press of the UNIT DATA / COMP. key from the default screen.
2. Control the On/Off status of compartments. This is available from the Compartment Selection Menu, which is brought up by a double press of the UNIT DATA / COMP. key from the default screen. Or, from a single press of the key from the Compartment Status Menu. Select the desired compartment using the UP and DOWN ARROW Keys and press the ENTER key to make the compartment On/Off.
3. Display the unit operating data parameters. Pressing the UNIT DATA / COMP. key for more than 3 seconds will display the unit operating data parameters. This key, in conjunction with the ARROW keys, will allow the user to display the unit's operating data values (i.e, coolant temperature, battery voltage, etc.) See **Section 3.11** for more detailed information.

City Speed Key

The CITY SPEED key is disabled on the Supra 950MT as it is a single-speed only machine.

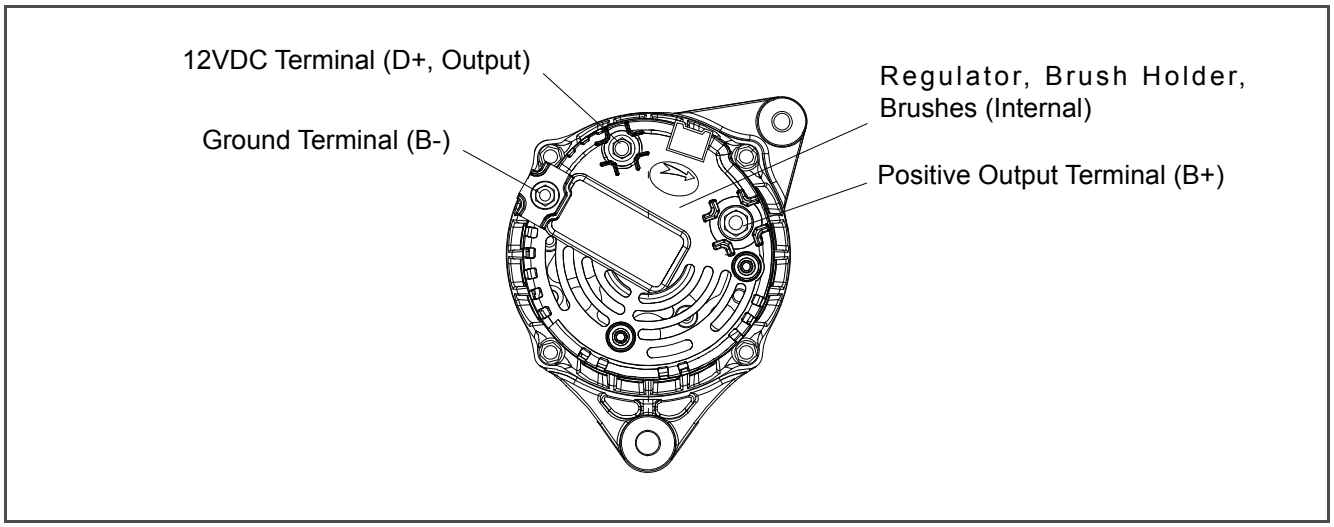
Alarm Key

Press and hold the ALARM key for 3 seconds to disable the Cab Command buzzer. When not disabled by use of this key, the buzzer is activated whenever the alarm/fault indicator is illuminated.

Road / Standby Key

The ROAD / STANDBY key selects road or electric motor operating mode. The microprocessor retains the last entered setpoint in memory even if the unit is shut down or a power failure occurs. NO POWER will be displayed, if unit is switched to standby and power is not available.

Figure 2.9 70 Amp Alternator



Alternator/Regulator

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

The alternator supplies power for operation of the system controls and charging the unit battery, if equipped.

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

The regulator is an all-electronic, transistorized device. No mechanical contacts or relays are used to perform the voltage regulation of the alternator system.

The regulator is an electronic switching device. It senses the voltage appearing at the auxiliary terminal of the alternator and supplies the necessary field current for maintaining the system voltage at the output terminal. The output current is determined by the load.

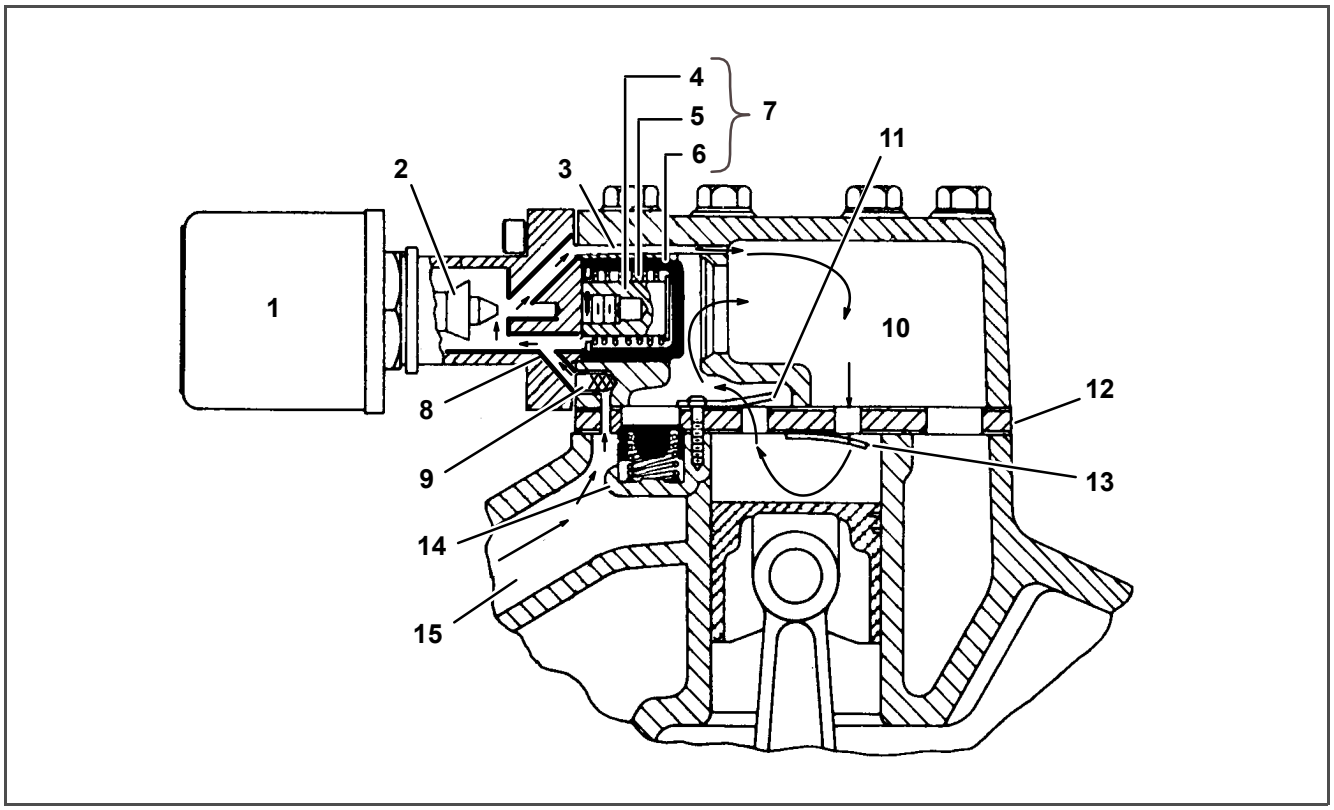
2.4.2 Condensing Section Refrigeration System

The condensing section mounted refrigeration system equipment includes the compressor, condenser/subcooler, accumulator, filter drier, receiver, compressor pressure regulating valve, main heat valve (MHV), and the receiver pressure valve (RPV).

a. Compressor

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

Figure 2.10 Cylinder Head - Unloaded



1. Solenoid valve
2. Valve stem
3. Gas bypass port
4. Spring guide
5. Spring
6. Piston
7. Piston bypass valve
8. Bleed orifice
9. Strainer
10. Suction manifold
11. Cylinder discharge valve
12. Valve plate
13. Cylinder suction plate
14. Discharge piston check valve assembly
15. Discharge manifold

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b. Compressor Manifold

The Supra 950MT unit compressor is fitted with one electric unloader valve. The capacity-controlled cylinder is easily identified by the solenoid, which extends from the side of the cylinder head. When the solenoid is energized, two cylinders are unloaded. The unloaded cylinders operate with little or no pressure differential and consume very little power. A description of unloader operation is provided in the following steps.

Unloaded Operation

Refer to **Figure 2.10**. Pressure from the discharge manifold (Item 15) passes through the strainer (9) and bleed orifice (8) to the back of the piston bypass valve (7). Unless bled away, this pressure tends to close the piston (6) against the piston spring (5) pressure.

With the solenoid valve (1) energized the solenoid valve stem (2) opens the gas bypass port (3).

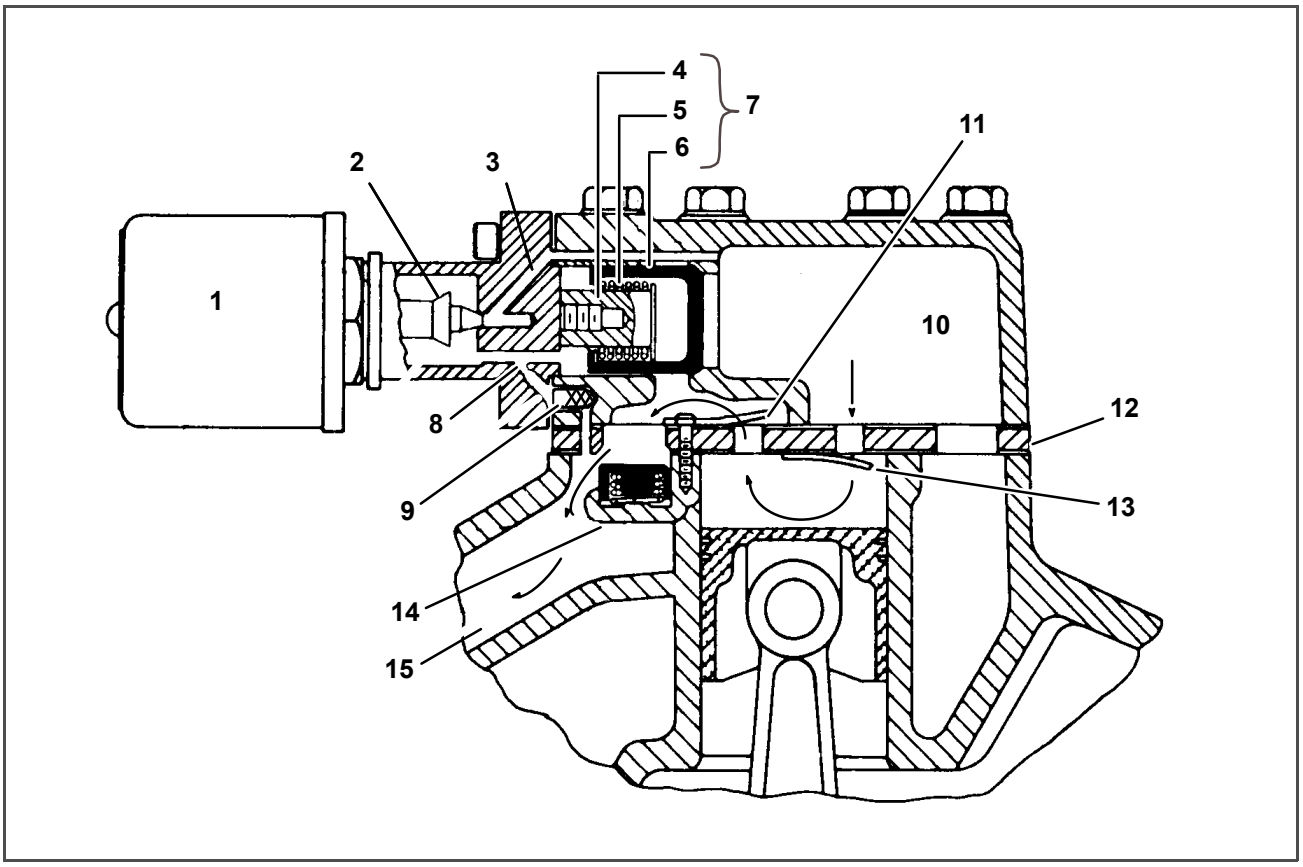
Refrigerant pressure is bled to the suction manifold (10) through the opened gas bypass port. A reduction in pressure on the piston bypass valve takes place because the rate of bleed through the gas bypass port is greater than the rate of bleed through the bleed orifice (8).

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

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

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

Figure 2.11 Cylinder Head - Loaded



1. Solenoid valve
2. Valve stem
3. Gas bypass port
4. Spring guide
5. Spring
6. Piston
7. Piston bypass valve
8. Bleed orifice
9. Strainer
10. Suction manifold
11. Cylinder discharge valve
12. Valve plate
13. Cylinder suction plate
14. Discharge piston check valve assembly
15. Discharge manifold

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Loaded Operation

Refer to **Figure 2.11**. Discharge pressure bleeds from the discharge manifold (Item 15) through the strainer (9) and (8) bleed orifice to the solenoid valve stem (2) chamber and the back of the piston bypass valve (7).

With the solenoid valve (1) de-energized the solenoid valve stem closes the gas bypass port (3).

Refrigerant pressure overcomes the bypass valve spring (5) tension and forces the piston (6) forward closing the gas bypass from the discharge manifold to the suction manifold (10).

Cylinder discharge pressure forces open the discharge piston check valve assembly (14). Refrigerant gas passes into the compressor discharge manifold.

The loaded cylinder bank continues to operate fully loaded until the solenoid valve control device is energized and the gas bypass port is opened.

c. Condenser/Subcooler

The condenser is of the tube and fin type, and acts as a heat exchanger in which the compressed refrigerant gas is condensed into a liquid and lowered in temperature. Air movement over the condenser is provided by a fan mounted on the standby motor.

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

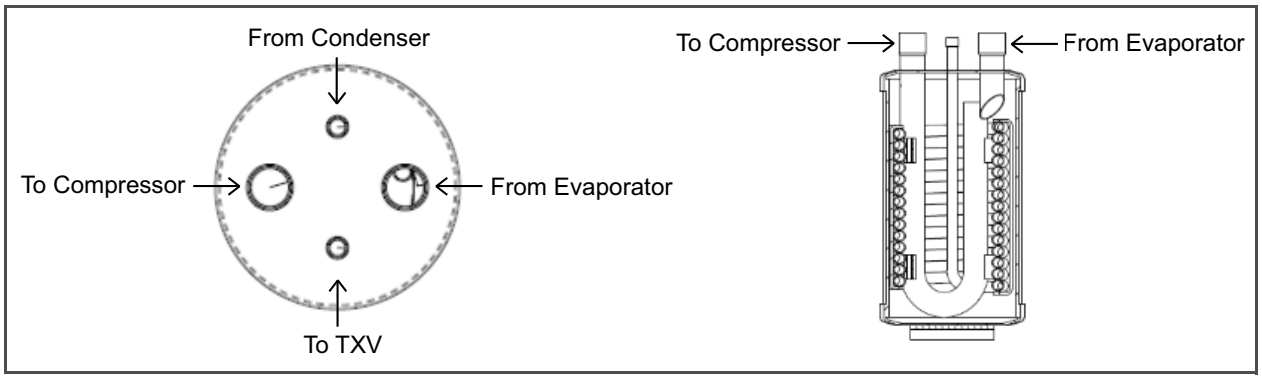
d. Accumulator/Subcooler/Heat Exchanger

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

The tube-in-tank type heat exchanger is internal to the accumulator. Within the heat exchanger, the cold suction gas is used to cool the warm liquid refrigerant. This results in greater system capacity and efficiency

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

Figure 2.12 Accumulator/Subcooler/Heat Exchanger



e. Compressor Pressure Regulating Valve (CPR)

The CPR is an adjustable regulating valve that regulates the suction pressure entering the compressor. The suction pressure is controlled to avoid overloading the electric motor or engine during high refrigerated compartment temperature operation.

f. Filter Drier

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

g. Receiver

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

The receiver is equipped with two sight glasses for the observation of liquid level and a pressure relief valve.

2.5 REMOTE EVAPORATOR SECTIONS

The evaporator sections contain the evaporator coil, thermal expansion valve, heat exchanger, defrost termination thermostat(s), electric heaters, hot gas solenoid valve, liquid solenoid valve, and electric evaporator fan motors.

2.5.1 Evaporator Coil

The evaporator coil is a tube-and-fin type. The operation of the compressor maintains a reduced pressure with the coil. At this reduced pressure, the liquid refrigerant evaporates at a temperature low enough to absorb heat from the air. Air movement over the evaporator coil is provided by two or three electric fans.

2.5.2 Thermal Expansion Valve (TXV)

The thermal expansion valve is an automatic device that controls the flow of liquid to the evaporator according to changes in superheat to the refrigerant leaving the evaporator. The thermal expansion valve maintains a relatively constant degree of superheat in the gas leaving the evaporator regardless of suction pressure. Thus, the valve has a dual function − automatic expansion control and prevention of liquid return to the compressor.

2.5.3 Defrost Termination Temperature Sensor (DTS)

The DTS senses the temperature of the evaporator and allows defrost initiation once the temperature falls below 40°F (4.4°C)

2.5.4 Electric and Electric Hot/Gas Heat

The unit can be equipped with electric heat and electric/hot gas heat. When the microprocessor calls for heat, the heater contactor will close or valve will open and engage the heat system.

2.5.5 Receiver Pressure Valve (RPV)

The Receiver Pressure Valve is a normally closed valve. In cool mode, this valve is always de−energized or CLOSED. If the one of the compartments is calling for heat and the other is not calling for cool, the MHV is energized (CLOSED) and RPV valve will be energized (OPEN). This will allow high pressure refrigerant into the receiver to pressurize the liquid allowing it to flow through the drier and pass through any liquid solenoid valve which would be energized.

2.5.6 Main Heat Valve (MHV)

The Main Heat Valve directs flow of the high pressure, high temperature refrigerant leaving the compressor through the system. The MHV is a normally OPEN valve. During COOL mode, the MHV coil is de−energized, and the valve is open. The high pressure, high temperature gas leaving the compressor is directed to the condenser. During HEAT mode when neither remote evaporator is calling for cool, the MHV coil is energized and the valve is CLOSED. The high temperature, high pressure gas leaving the compressor is now directed towards the hot gas valves in the remote evaporators.

2.5.7 Remote Evaporator Hot Gas Valve (1HGV and 2HGV)

The Hot Gas Valves are located in the remote evaporators. When the remote evaporator is in COOL mode, the normally closed valves are de−energized. If one or both compartments are calling for heat and the other is not calling for cool, the corresponding 1HGV or 2HGV is energized and OPEN and the MHV is energized, CLOSED. The high pressure, high temperature refrigerant leaving the compressor is diverted through the remote evaporator coils.

2.5.8 Liquid Solenoid Valve

The liquid solenoid valve opens or closes depending on the thermostat.

2.5.9 Electric Evaporator Fan Motor

The electric evaporator fan motor moves air over the evaporator coil. See **Section 2.7.6** for unit specifications.

Compartment 1:

Cool/Heat - Fans On:

With voltage at the closed N/O contacts of the 1CR pins (30-87) and voltage at the 1J14 connector, there should be ground at the 1RR coil pin 85 and voltage at 1RR coil pin 86. The N/O contacts of the 1RR (30-87) should close sending power to the 1EMR coil pin 1 and ground should be at 1EMR coil pin 0. The N/O contacts on the 1EMR (6-8) and (2-4) should close, sending 230/1/60 A/C voltage to the evaporator fan motors. The fans should be running.

Defrost - Fans Off:

With voltage at the closed N/O contacts of the 1CR pins (30-87) and voltage at the 1J14 connector along with ground at the 1J11 connector. The ground should be removed from the 1RR coil pin 85. The N/O contacts of the 1RR should be open and the N/O contacts on the 1EMR (6-8) and (2-4) should be open. The fans should be off.

Compartment 2:

Cool/Heat - Fans On:

With voltage at the closed N/O contacts of the 2CR pins (30-87) and voltage at the 1J12 connector, there should be ground at the 2RR coil pin 85 and voltage at 2RR coil pin 86. The N/O contacts of the 2RR (30-87) should close sending power to the 2EMR coil pin 1 and ground should be at 2EMR coil pin 0. The N/O contacts on the 2EMR (6-8) and (2-4) should close, sending 230/1/60 A/C voltage to the evaporator fan motors. The fans should be running.

Defrost - Fans Off:

With voltage at the closed N/O contacts of the 2CR pins (30-87) and voltage at the 1J12 connector along with ground at the 1J11 connector. The ground should be removed from the 2RR coil pin 85. The N/O contacts of the 2RR should be open and the N/O contacts on the 2EMR (6-8) and (2-4) should be open. The fans should be off.

2.6 SYSTEM OPERATING CONTROLS AND COMPONENTS

The unit is furnished with a microprocessor control system (Refer to **Section 3.1**). Once the desired set point is entered at the Cab Command in the truck, the unit will operate automatically to maintain the desired temperature within very close limits. The control system automatically selects Loaded and Unloaded Cooling or Loaded and Unloaded Heating as necessary to maintain the desired temperature.

The microprocessor has an Auto Start/Stop feature. The Auto Start/Stop operation provides automatic cycling of the diesel engine, which in turn offers an energy efficient alternative to continuous operation of the engine. Temperatures are maintained by alternate cooling and heating of the supply air (evaporator outlet air).

A remote standby receptacle is standard with all units.

2.6.1 Switches And Controls

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

Run/Stop Switch (RSS)

The RSS controls the supply of power to the microprocessor and cab command. The switch is placed in the ON position to allow manual or automatic unit operation. With the switch in the OFF position, the unit will be shut down, and neither manual or automatic starting is allowed.

Oil Pressure Safety Switch (OP)

The Oil Pressure Safety switch automatically stops the engine upon loss of oil pressure. The switch is preset to open when the pressure drops below 15 ± °3 psig (1.0 ± 0.2 bar).

Water Temperature Sensor (WTS)

Located on top of the engine, the WTS senses engine water temperature. The microprocessor stops the unit when the temperature exceeds 230°F ± 5F (110°F ± 3C). The sensor is located near the thermostat housing in the cylinder head.

High Pressure Cutout Switch (HP1)

This switch will automatically stop the engine when compressor discharge pressure exceeds cut out The switch is located on the compressor cylinder head.

Compressor Discharge Temperature Sensor (CDT)

The microprocessor will stop the unit when this sensor signals a high discharge temperature condition. The sensor is located on the compressor center head.

Compressor Suction Pressure Transducer (SPT)

The Compressor Suction Pressure Transducer signal is used by the microprocessor in the compressor protection logic to protect the compressor under excessive suction pressure conditions and under excessively low suction pressure conditions. The sensor is located on the compressor body.

Ambient Temperature Sensor (ATS)

The Ambient Temperature Sensor signal is used by the microprocessor in the compressor protection logic to determine expected conditions. It is located between the condenser and the front grille.

Temperature Control Sensors

Compartment temperature is monitored and controlled by the Return Air Sensor (RAS), which measures return air temperature to the remote evaporators.

2.7 UNIT SPECIFICATIONS

2.7.1 Engine Data

Engine Model	D1105
Used on	Supra 950MT
Displacement	68.5 in^3 (1105 cc)
Do. Cylinders	3
Horsepower	14.9 kw (20 hp) @2400rpm
Weight	214 lbs (97 kg)
Coolant Capacity	5 quarts (4.7 liters)
Oil Capacity without oil bypass kit	10 quarts (9.5 liters)
Operating Speed	2300 - 2350 rpm
Injection Setting	1991 to 2133 psig (140 to 150 kg/cm^2)

2.7.2 Water Temperature Sensor (WTS)

The WTS is a thermistor type sensor located on the engine cylinder head which measures the temperature of the coolant.

The unit shuts down if any of the following conditions occur:

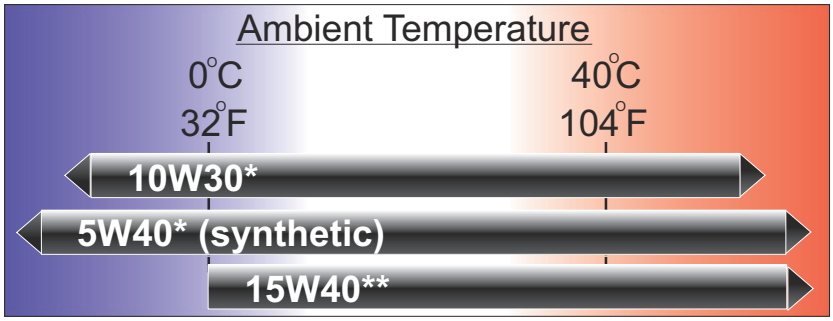
- Ambient is less than 120°F (5°C) and coolant temperature exceeds 230°F (110°C)
- Ambient is greater than 120°F (50°C) and coolant temperature exceeds 240°F (110°C)
- Coolant temperature stays between 240°F (110°C) and 230°F (110°C) for five minutes

2.7.3 Lubrication System

- Oil pressure switch (OP)
- Closes above 15 psig (1.05 bar) ± 3 psig (0.2 bar)
- Lube Oil Viscosity: (API classification CD minimum)

Table 2–7 Lube Oil Viscosity

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



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

2.7.4 Compressor Reference Data

Model	05G 37CFM
No. Cylinders	6
No. Unloaders	1
Weight	137 lbs (62 kg)
Oil Charge	5.5 pints (2.6 liters)
Approved Oil	Mobil Arctic EAL 68

2.7.5 Refrigeration System Data

Defrost Timer	1.5h, 3h, 6h, or 12 hours
Defrost Thermostat	Opens at: 50°F ± 5°F (10° ± 3°C) Closes at: 45°F ± 5°F (7° ± 3°C)
High Pressure Cutout Switch (HP1)	Opens at: 465 ± 10 psig (32.1 ± 0.7 bar) Closes at: 350 ± 10 psig (24.1 ± 0.7 bar)
High Pressure Cutout Switch (HP2)	Opens at: 348 ± 10 psig (24.0 ± 0.7 bar) Closes at: 312 ± 10 psig (21.5 ± 0.7 bar)
Refrigerant Charge	Refer to **Section 2.7.1**
Compressor Pressure Regulating Valve (CPR) in heat mode	CPR Setting − 28 ± 1 psig (1.9 bar)
Thermostatic Expansion Valve Superheat	Setting at 0°F (-20°C) compartment temperature Setting: 8 to 10°F (4 to 6°C)
Compressor Discharge Temperature Sensor (CDT)	Unit shuts down at 310°F (154°C) for three minutes or 350°F (177°C)

2.7.6 Electrical Data

a. Evaporator Fan Motors

Voltage	230 V
Frequency	60 HZ
Speed	2950 rpm
Power	200 W
Current	.88 A

No maintenance: Lubricated for life.

b. Standby Motor: Rotation speed: 1760 rpm @ 60 hz

c. Alternator: 70 amps

d. Standby Motor Overload

The function of the motor overload is to protect the standby motor against high amperage draw. The overload provides an adjustable knob to set the maximum amperage draw. The motor overload is also equipped with a reset button. This overload has three positions - automatic reset, manual, and test. In the application the button should remain in the automatic reset position.

Operating Voltage	FLA Rating	Circuit Breaker Capacity	Cable Requirement
230 V 60 Hz 3 phase	35 A	50 A	8/3 with ground (up to 50 ft)

2.7.7 Torque Values

Assembly	ft-lb	Nm
Power Tray to Frame	40	54
Standby Motor to Power Tray	40	54
Engine to Power Tray	50	67.8
Compressor to Power Tray	40	54
Standby Motor Pulley	36.8	49.7
Engine Pulley	22	30
Compressor Pulley	22	30
Evaporator Fan Motor	13	17.6
Evaporator Fan Grille	7	9.4
Condenser Coil to Chassis	7	9.4
Tensioner to Power Tray	22	3.0
Engine Support	40	5.5
Condenser Fan Blade	18	24.4
Engine Clutch	22	29

2.8 SAFETY DEVICES

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

Table 2–8 Safety Devices

Unsafe Conditions	Safety Device
Low engine lubricating oil pressure	Oil pressure safety switch OP automatic reset (Refer to **Section 2.7.3**)
High engine cooling water temperature	Water temperature sensor (WTS) (Refer to **Section 2.7.2**)
Excessive current draw by glow plug circuit, control circuit or starter solenoid (SS)	Fuse (F1)
Excessive current draw by microprocessor	Fuse (F2)
Excessive current draw by control circuit	Fuse (F3)
Excessive current draw by speed control solenoid	Fuse (F4)
Excessive compressor discharge pressure	High pressure cutout switch HP automatic reset (Refer to **Section 2.7.5**)
Excessive compressor discharge temperature	Compressor discharge temperature sensor (CDT) (Refer to **Section 2.7.5**)

2.9 REFRIGERANT CIRCUIT DURING COOLING

Overview

When cooling, the unit operates as a vapor compression refrigeration system. The main components of the system are the reciprocating compressor, air-cooled condenser, thermostatic expansion valve, direct expansion evaporator, and liquid line solenoid valve. The compressor raises the temperature and pressure of the refrigerant and it passes through a normally open Main Heat Valve (MHV), through a check valve into the condenser (See **Figure 2.13** for detailed information).

Condenser

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

Receiver Charge

The receiver stores the additional charge necessary for low ambient operation, and for heating and defrost modes. The refrigerant leaves the receiver and flows through a manual receiver shutoff valve (king valve).

Refrigerant Flow

The refrigerant then flows through the subcooler. The subcooler occupies a portion of the main condensing coil surface and gives off further heat to the passing air.

The refrigerant then flows through a filter-drier where an absorbent keeps the refrigerant clean and dry.

The refrigerant then flows through the accumulator / heat exchanger and then to the liquid solenoid valves (LSV). These solenoids are electrically energized when in cooling mode and allow the liquid refrigerant to flow through the externally equalized thermostatic expansion valve (TXV), which reduces the pressure of the liquid and meters the flow of liquid refrigerant to the evaporator to obtain maximum use of the evaporator heat transfer surface.

Heat Transfer

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

The transfer of heat from the air to the low-temperature, low-pressure saturated mixture causes the refrigerant to vaporize. This low-temperature, low-pressure vapor passes into the accumulator tank. The compressor draws the vapor out of the accumulator through a pick-up tube, which is equipped with a metering orifice. This orifice prevents the accumulation of oil in the accumulator tank. The metering orifice is calibrated to control the rate of oil flowing back to the compressor.

Vapor

The vapor refrigerant then enters the compressor pressure regulating valve (CPR), which regulates refrigerant pressure entering the compressor, where the cycle starts over.

2.10 REFRIGERANT CIRCUIT DURING HEAT AND DEFROST

In heat mode, two technologies can be used; hot gas heating through the hot gas solenoid valves (1HGV and 2HGV) or heating by electric heaters in the evaporator. (See **Figure 2.14** for detailed information.)

Heating by hot gas is allowed only if neither evaporator is in cooling mode. If both evaporators are in heat mode, only one will be in hot gas heating. The other evaporator will be given inductive heating using the electric heaters in the evaporator. Both hot gas and electric heat are used for defrost.

2.10.1 Hot Gas Heating

Overview

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

Heat Mode

When in the heat mode, with neither evaporator calling for cooling, the hot gas solenoid valves 1HGV and 2HGV could be energized. The main heat valve (MHV) will close, diverting the refrigerant to 1HGV and 2HGV. The normally closed liquid solenoid valves 1LSV and 2LSV will energize and open.

Flow

The normally closed receiver pressure valve (RPV), situated in the hot gas line to the receiver will open. This allows the receiver to be pressurized and liquid refrigerant to flow through the drier and sight glass, and pass through any liquid line solenoid valves, which would be energized. The refrigerant passes through the expansion valve into the evaporator. At the same time, high-temperature, high-pressure gas enters the evaporator via the solenoid valves 1HGV and 2HGV to provide required heating. The extra liquid purged from the receiver ensures maximum heating capacity in low-ambient conditions.

Evaporator

The evaporator fan passes the air over the hot refrigerant pipes and distributes heated air into the cargo space.

Accumulator

The hot gas travels through the suction line check valve into the accumulator where it is drawn back through the compressor pressure regulating valve (CPR) to begin the process again.

Null Mode

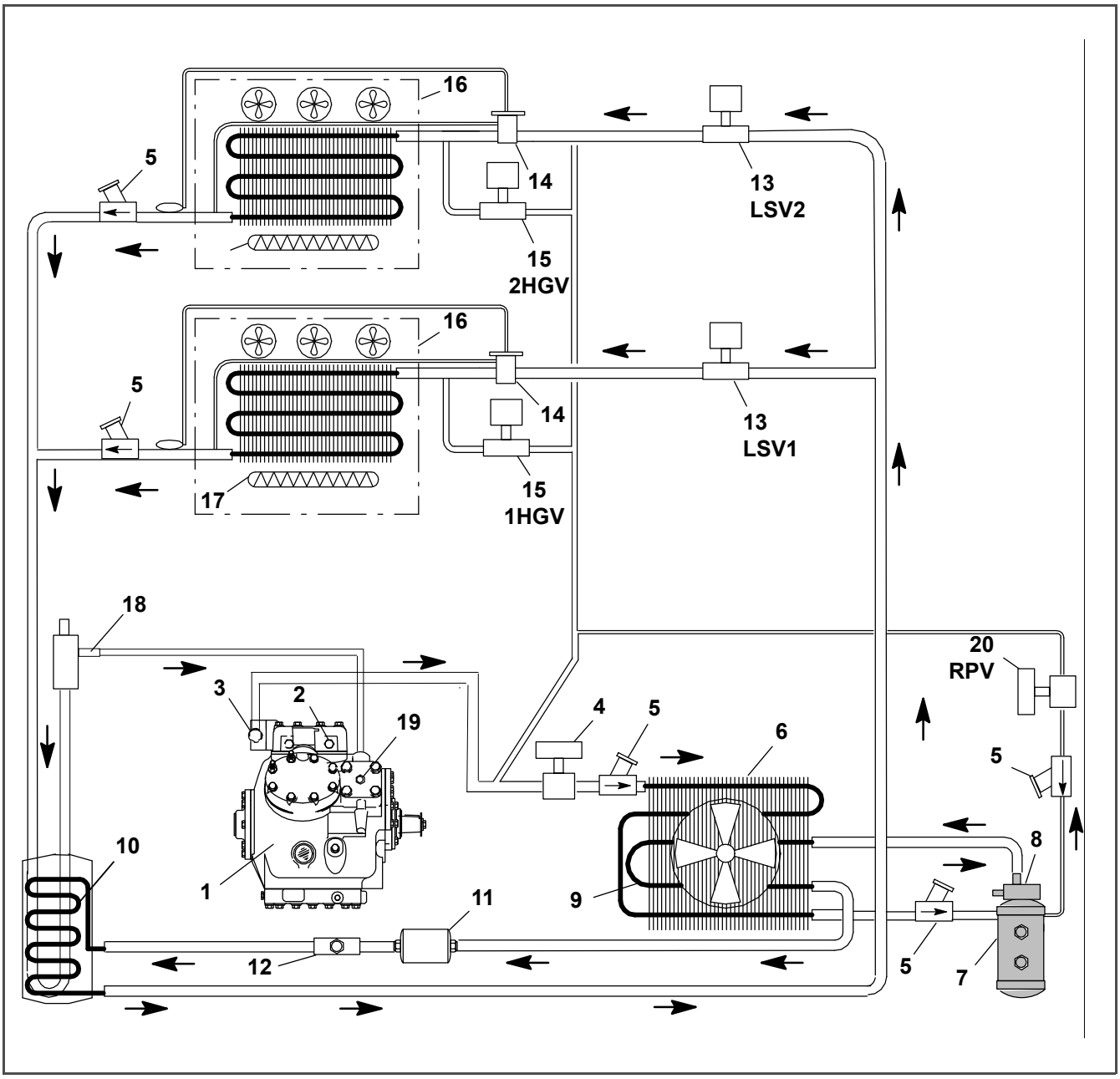
When temperature is achieved in both evaporators, they will go into null mode. The compartment with the highest set point will then take the lead and revert back to cool/heat cycles.

2.10.2 Principle of Induction Heating (Electric Heat)

The remote evaporators are equipped with 3-phase resistive heaters. In diesel operation, the standby motor is used as a 230 VAC 3-phase induction generator. This generator supplies power to the resistive heaters. This induction generation is made possible by a bank of three capacitors connected across the three legs of the standby motor. The capacitors are located in the control box.

In Standby operation, the heaters are supplied with standby AC power.

Figure 2.13 Refrigeration Circuit - Cooling



1. Compressor
2. High Pressure Switch (HP)
3. Discharge Service Valve
4. Main Heat Valve (MHV)
5. Check Valve
6. Condenser
7. Receiver
8. Receiver Service Valve
9. Subcooler
10. Accumulator
11. Filter-Drier
12. Sight Glass
13. Liquid Solenoid Valve (LSV)
14. Expansion Valve
15. Hot Gas Valve (1HGV AND 2HGV)
16. Evaporator
17. Electric Heater
18. Compressor Pressure Regulating Valve (CPR)
19. Suction Service Valve
20. Receiver Pressure Valve (RPV)

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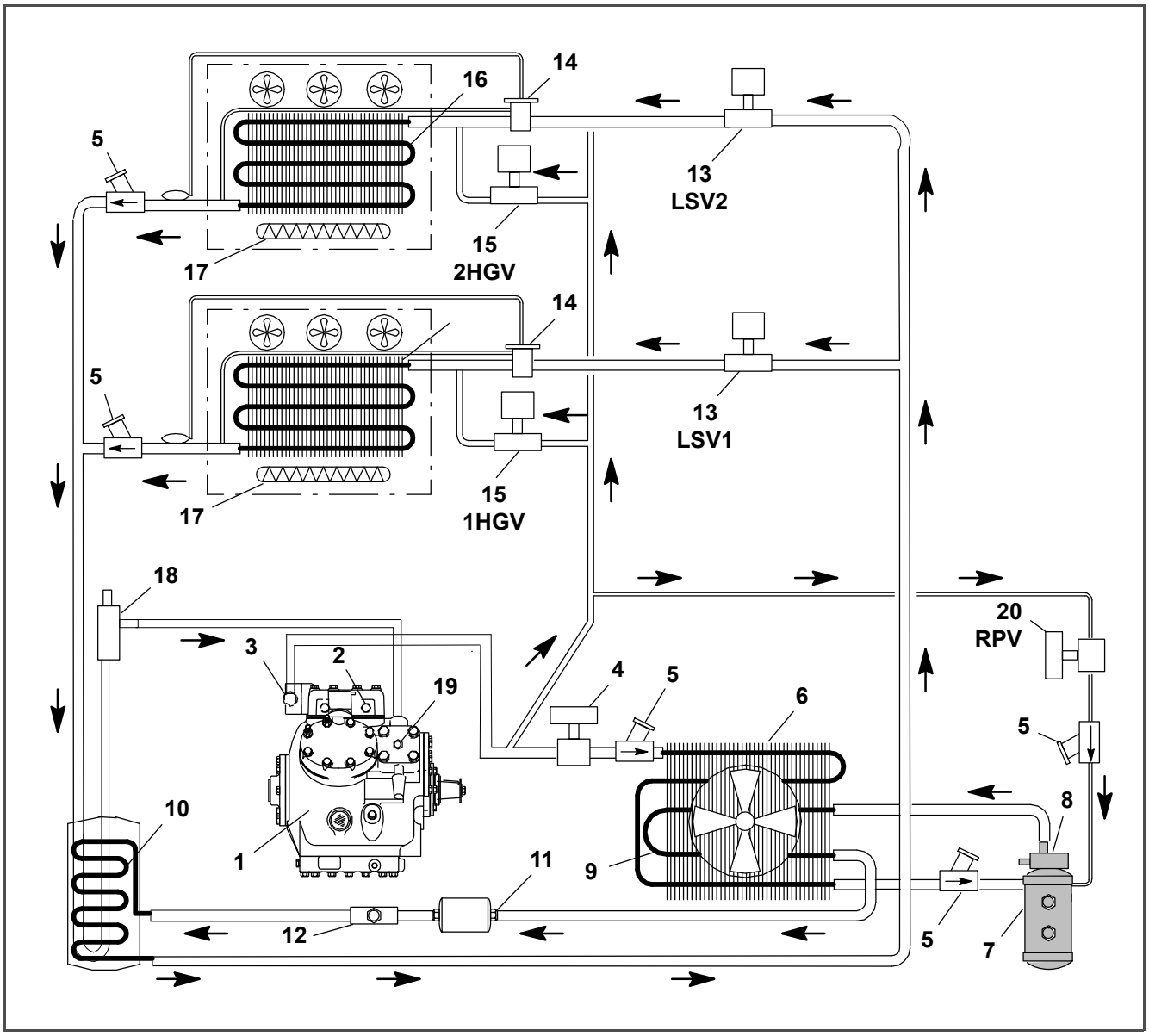
Figure 2.14 Refrigeration Circuit - Heating



1. Compressor
2. High Pressure Switch (HP)
3. Discharge Service Valve
4. Main Heat Valve (MHV)
5. Check Valve
6. Condenser
7. Receiver
8. Receiver Service Valve
9. Subcooler
10. Accumulator
11. Filter-Drier
12. Sight Glass
13. Liquid Solenoid Valve (LSV)
14. Expansion Valve
15. Hot Gas Valve (1HGV AND 2HGV)
16. Evaporator
17. Electric Heater
18. Compressor Pressure Regulating Valve (CPR)
19. Suction Service Valve
20. Receiver Pressure Valve (RPV)

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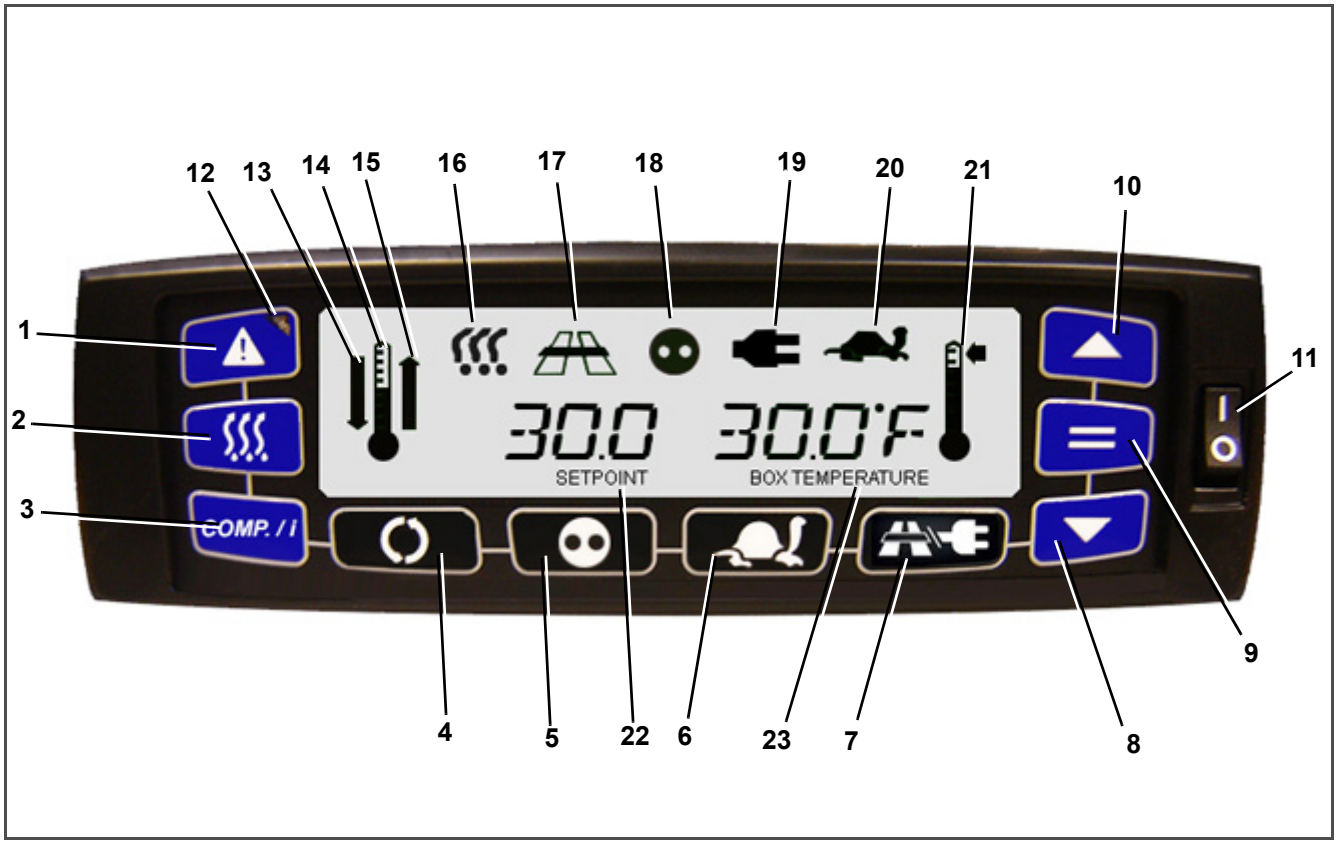
SECTION 3
OPERATION

3.1 MICROPROCESSOR

⚠ 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.

Figure 3.1 Cab Command



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

- - - - -

3.1.1 Introduction

The microprocessor and relay module is housed in the control box:

- The processor board includes the microprocessor, program memory, and necessary input/output circuitry to interface with the unit.
- The relay module contains replaceable relays and fuses along with the wiring harness.

The cab command is mounted remotely in the truck, and includes the LCD display, keypad, and keypad interface (See **Figure 3.1**).

The microprocessor provides the following features:

- Controls return air temperature by providing refrigeration control, heat, and defrost to ensure conditioned air delivery to the load.
- Independent readouts of set point and return air temperatures.
- Digital readout and ability to select unit operational data. Refer to **Table 3–1** for function codes, **Table 3–6** for unit data codes, and **Table 3–7** for alarm digital display identification.
- A self-test check on program memory and data memory. The self-test is executed each time the system is switched from OFF to ON. Errors, if any, are indicated on the display as a ERR.X, where X is a number corresponding to the number of the test. The unit displays this error for five seconds and then resets the microprocessor.

Error	Cause
ERR.1, ERR.2, ERR.3	Processor failure Check chip installation or replace microprocessor
ERR.4	Display board to logic board communication failure. This can be caused by a defective ribbon cable or ribbon cable not
ERR.5	Processor RAM test failure at micro start up. Replace microprocessor.
ERR.6	Processor ROM test failure at micro start up. Replace microprocessor.

3.2 MICROPROCESSOR CONFIGURATION

The microprocessor is configured in accordance with the equipment supplied on an individual unit and the requirements of the original purchase order. The configurations do not require change unless the unit has an equipment change or a change is required by the owner.

Although the configurations may not be modified using the keypad, operational differences are noted throughout the following descriptions and operating procedures.

Some microprocessor settings such as set point and functional parameters can be changed at the keypad, and are described in the following sections.

3.3 BEFORE STARTING THE UNIT

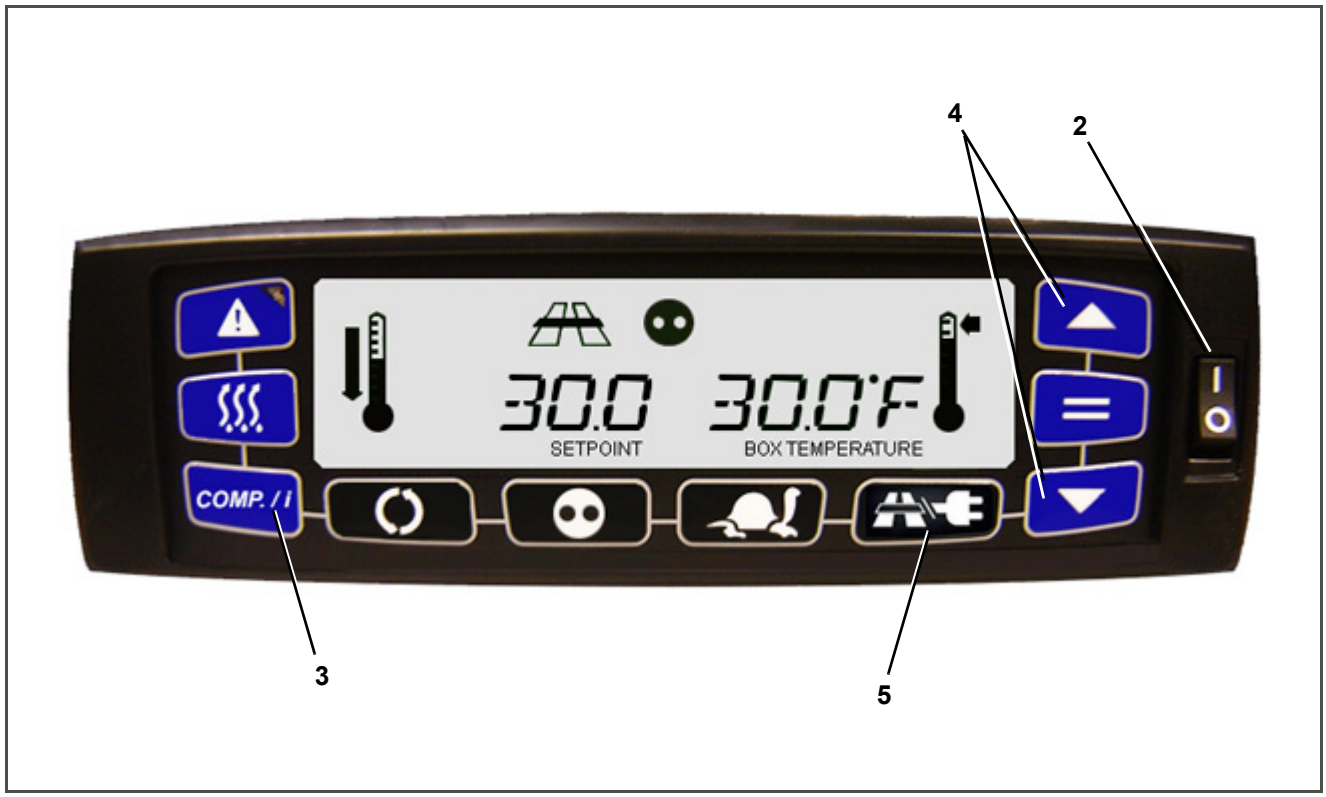
Prior to starting the unit, the I/O switch should be in the RUN (I) position and the RUN/STOP switch, which is located on the side of the electrical box, should be in the RUN position.

The microprocessor will power up and go through a self test. It will then show OFF in the display.

3.4 STARTING UNIT - ENGINE / ROAD OPERATION

⚠ WARNING

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



1. Place the unit RUN/STOP switch, which is located on the side of the electrical box, in the RUN position.
2. Place the I/O switch in the RUN (I) position.
3. Press and hold the UNIT DATA / COMP. key to go to compartment selection mode.
4. Select the desired compartment using the UP and DOWN arrow key.
5. If the unit was previously used in the Standby Mode, press the ROAD/STANDBY key.

   The microprocessor performs a self-test (all display messages appear in display window), after which time the setpoint and refrigeration compartment temperature is displayed.

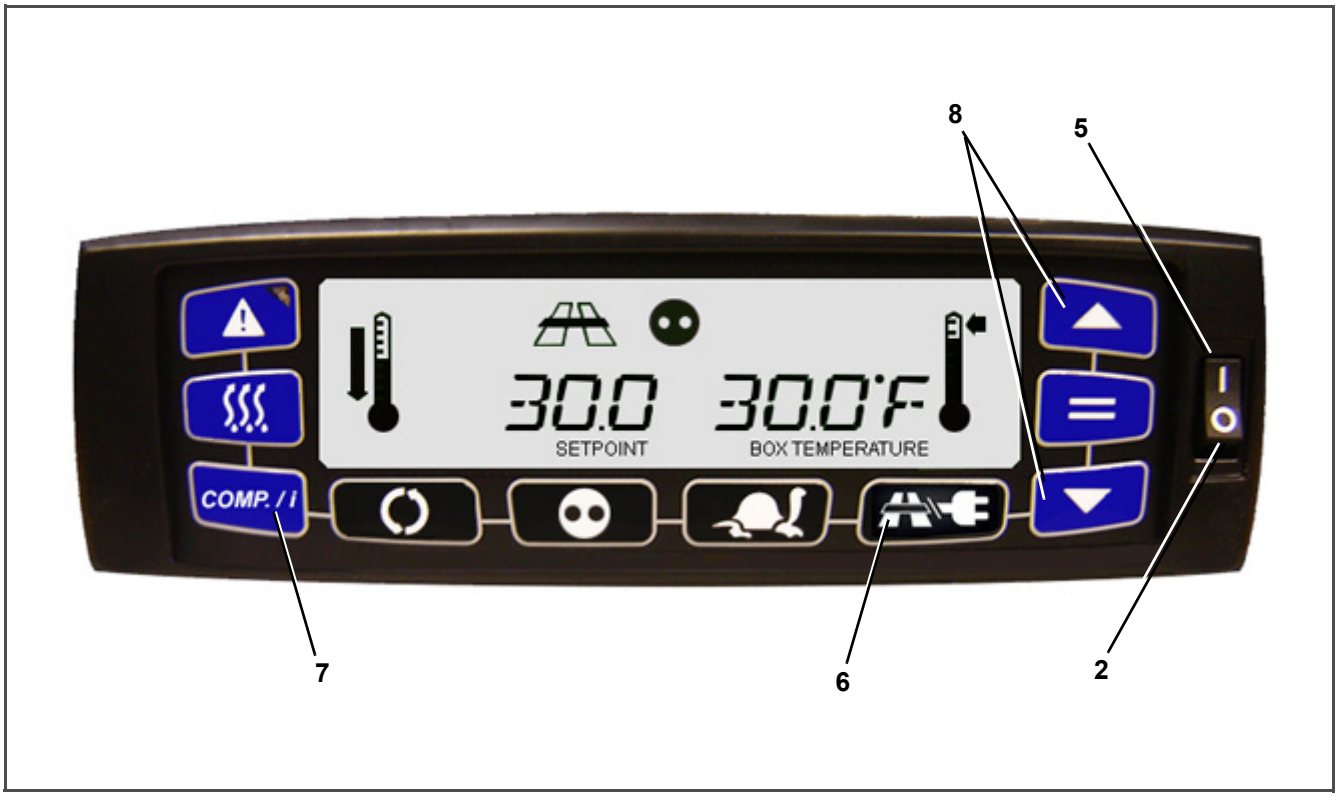
3.5 STARTING UNIT - ELECTRIC / STANDBY OPERATION

⚠ WARNING

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

Make sure the power plug is clean and dry before connecting to any electrical outlet / receptacle.

Do not attempt to connect or remove power plug or perform service and/or maintenance before ensuring the unit RUN/STOP switch is in the STOP position, the I/O switch is in the OFF (O) position and the external power circuit breaker is OFF.



1. Place the unit RUN/STOP switch, which is located on the side of the electrical box, in the STOP position.
2. Place the I/O switch in the OFF (O) position.
3. Connect the standby cable to the unit and then turn the external power circuit on.
4. Place the unit RUN/STOP switch in the RUN position.
5. Place the I/O switch in the RUN (I) position.
6. Press the ROAD/STANDBY key until the STANDBY icon is displayed.
7. Press and hold the UNIT DATA/COMP. key to go to compartment selection mode.
8. Select the desired compartment using the UP and DOWN arrow key.

   The microprocessor performs a self-test (all display messages appear in display window), after which time the setpoint and refrigeration compartment temperature is displayed.

Standby Guidelines

NOTE

Check for proper motor rotation. Condenser air must be drawn into the unit (see indicating flag on front grille). To reverse rotation, stop the unit, disconnect power cord, and change polarity of plug.

For safe, reliable operation in standby mode, it is important to consider the following guidelines:

- **NEVER** connect the unit to a power source with the RUN/STOP switch in the RUN position.
- The power supply cable and circuit breaker must comply with the following:

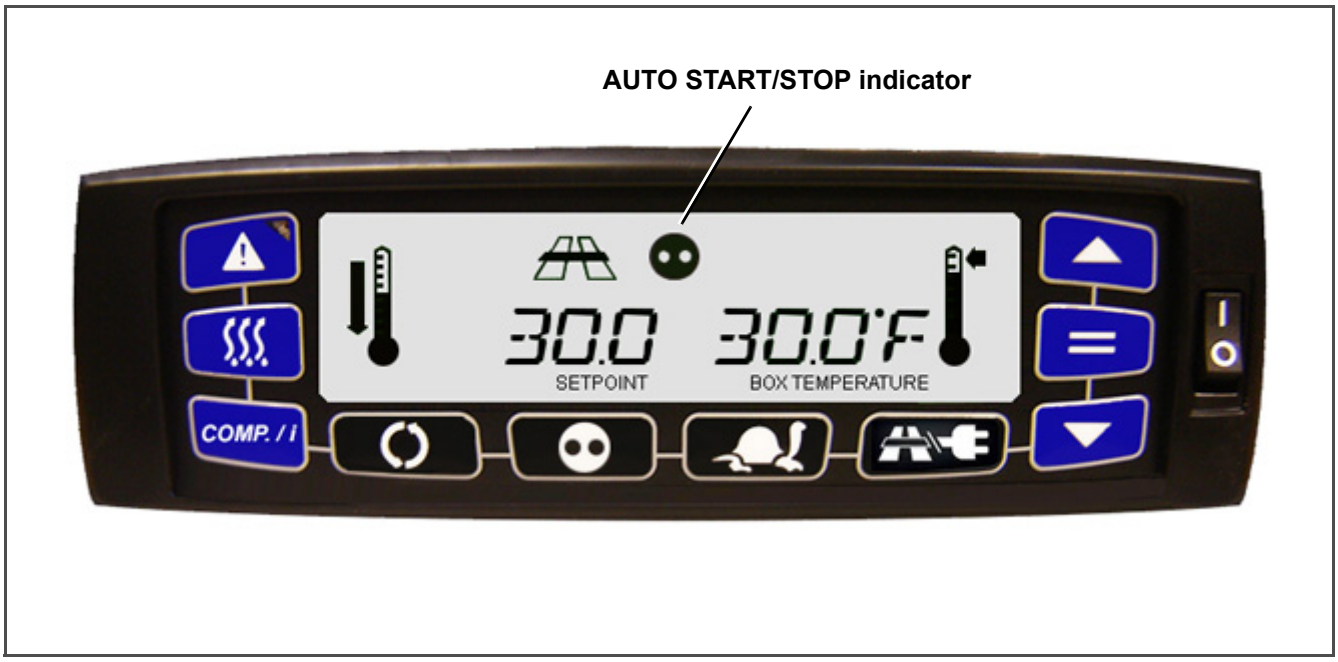
Operating Voltage	FLA Rating	Circuit Breaker Capacity	Cable Requirement
230 V 60 Hz 3 phase	35 A	50 A	8/3 with ground (up to 50 ft)

- When multiple units are in use, each unit must be operated on its own electrical circuit. You should never operate more than one unit on a circuit breaker.
- When preparing a circuit for operation of the refrigeration unit, a licensed electrician should be contracted. A licensed electrician is familiar with all local ordinances and special requirements for your area and can ensure that the circuits are properly designed and installed, and that connections are correct.

TIP

If unit is switched to Standby and the power plug is not plugged in, NO POWER is displayed.

3.6 START / STOP OPERATION



1. Check if AUTO START/STOP indicator is illuminated. If not, press the AUTO START/ STOP toggle key to place the unit in Start/Stop mode. The AUTO START/STOP indicator will then be illuminated.

The AUTO START/STOP key is used to change the operating mode from Continuous Run to Auto Start/Stop. Each push of the key will alternate the operating modes. The Auto Start/Stop indicator on the display will illuminate when Auto Stop/Start is enabled. If the indicator is not illuminated, the unit is in the Continuous Run Mode.

Auto Start/Stop is provided to permit starting/restarting of the diesel-driven compressor as required. This gives the microprocessor automatic control of starting and stopping the diesel engine. The main function of auto start-stop is to turn off the refrigeration system near set point to provide a fuel efficient temperature control system and then restart the engine when needed.

Once the unit starts in Auto Start/Stop, it will run until:

- It runs for the predetermined minimum run time
- Engine coolant temperature is above 122°F (50°C)
- Box temperature is at set point

The microprocessor will not shut off the engine if the battery voltage is not sufficient to restart it. Battery voltage above approximately 13.4 volts is required for shutdown. This varies depending on ambient. Look at battery voltage in data list (refer **Section 3.15.3**, **Table 3–9**) to find out whether shutdown voltage has been reached. If there is a + in front of the number, the voltage is enough to shutdown and restart. If only the number appears, the voltage is still too low for shutdown.

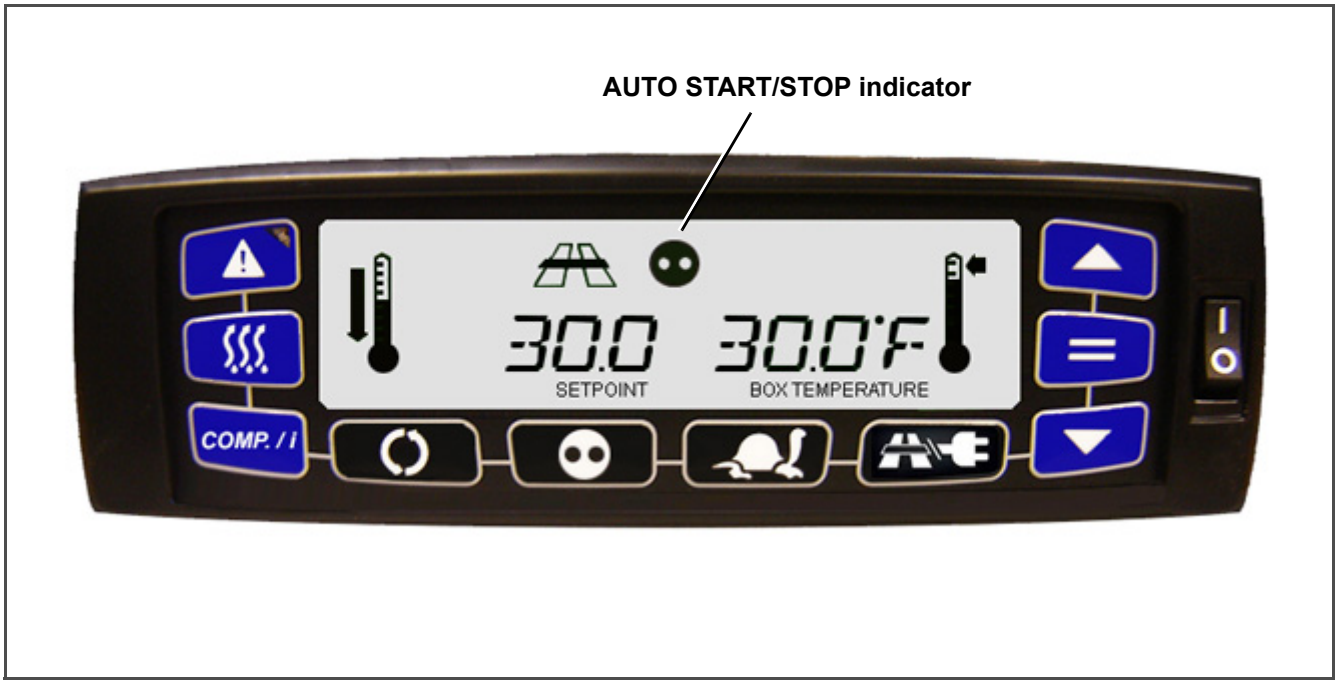
The microprocessor will restart the engine if any of the following criteria have been met:

- Refrigerated compartment temperature has changed by ±11°F (±6.1°C) or set points in the perishable range and +11°F (+6.1°C) for set points in the frozen range DURING Minimum Off Time.
- Refrigerated compartment temperature has moved away from set point by ±3.6°F (2.0°C) AFTER Minimum Off Time for set points in the perishable range or +0.5°F (0.3°C) for set points in the frozen range.
- The battery voltage drops below 12.2 VDC. (See **Section 3.11** for Unit Data).
- The engine coolant temperature drops below 34°F (1°C).

NOTE

Auto Start/Stop operation may be tied to the set point ranges for frozen and perishable loads and the AUTO START/STOP key may be locked out.

3.7 CONTINUOUS RUN OPERATION



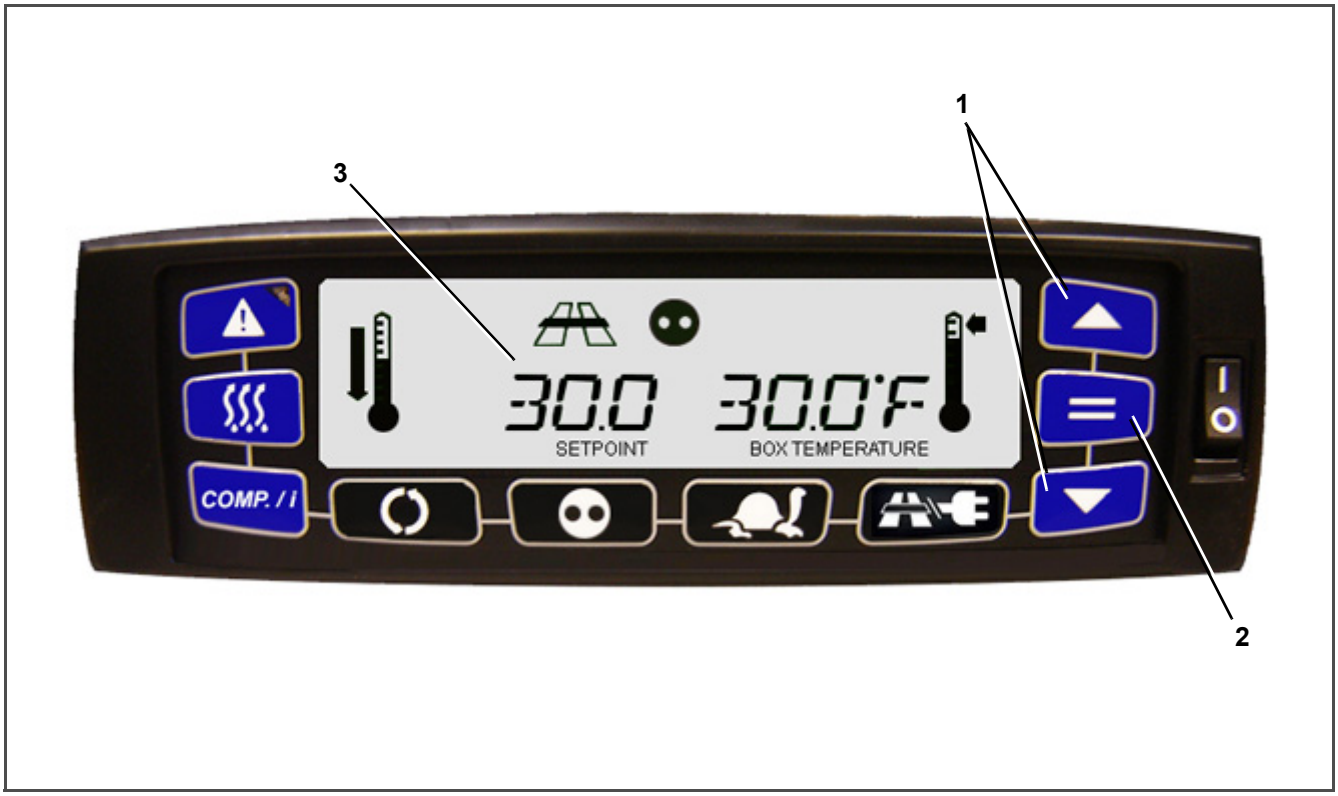
1. If the AUTO START/STOP indicator is illuminated, press the AUTO START/ STOP toggle key to place the unit in Continuous Run operation. The indicator will not be illuminated.

In the Continuous Run mode, the diesel engine (and the electric motor in Standby operation) will run continuously providing constant air flow and temperature control to the product. Continuous operation may be tied to the setpoint ranges for frozen and perishable loads and the AUTO START/STOP key may be locked out.

Continuous Run mode is adequate when load type requires constant airflow for better product protection. Control of temperature is accomplished by alternating cooling or heating to maintain set point. In the Continuous Run mode, the diesel engine will not shut down except for safety or if the engine stalls. This function also applies to the operation of the electric motor.

3.8 CHANGING SET POINT

Set points for each compartment can be set independently. Settings for C1 and C2 will alternate every five seconds. Wait until the desired compartment is displayed and then:

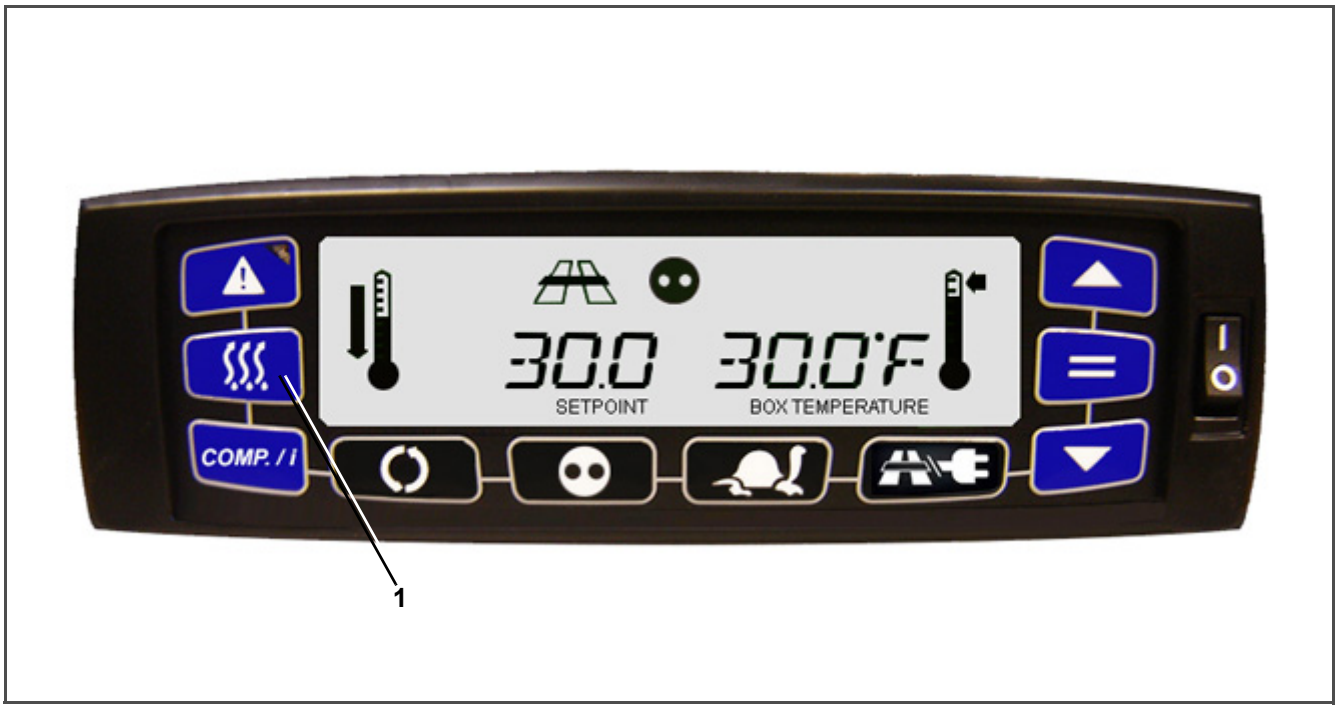


1. Press the UP or DOWN arrow key to increase or decrease displayed set point.
2. Press the ENTER key when desired set point is displayed to lock in new set point.
3. New set point will flash and then return to original set point if ENTER key is not pressed within five seconds.

Set points of -22°F to +89°F (-30°C to +32°C) may be entered via the keypad. The microprocessor always retains the last entered set point in memory. If no set point is in memory (i.e. on initial startup), the microprocessor will lock out the run relay and flash SP on the left hand display until a valid set point is entered. The set point may be changed up or down in 1° increments by pressing and releasing either the UP arrow or DOWN arrow key.

You cannot change set point when the unit is in Pretrip or when viewing Unit Data or Functional Parameters.

3.9 MANUAL DEFROST



1. Press the MANUAL DEFROST key to initiate defrost.

Defrost mode may be initiated in two different ways if the evaporator coil is below 45°F (7.2°C):

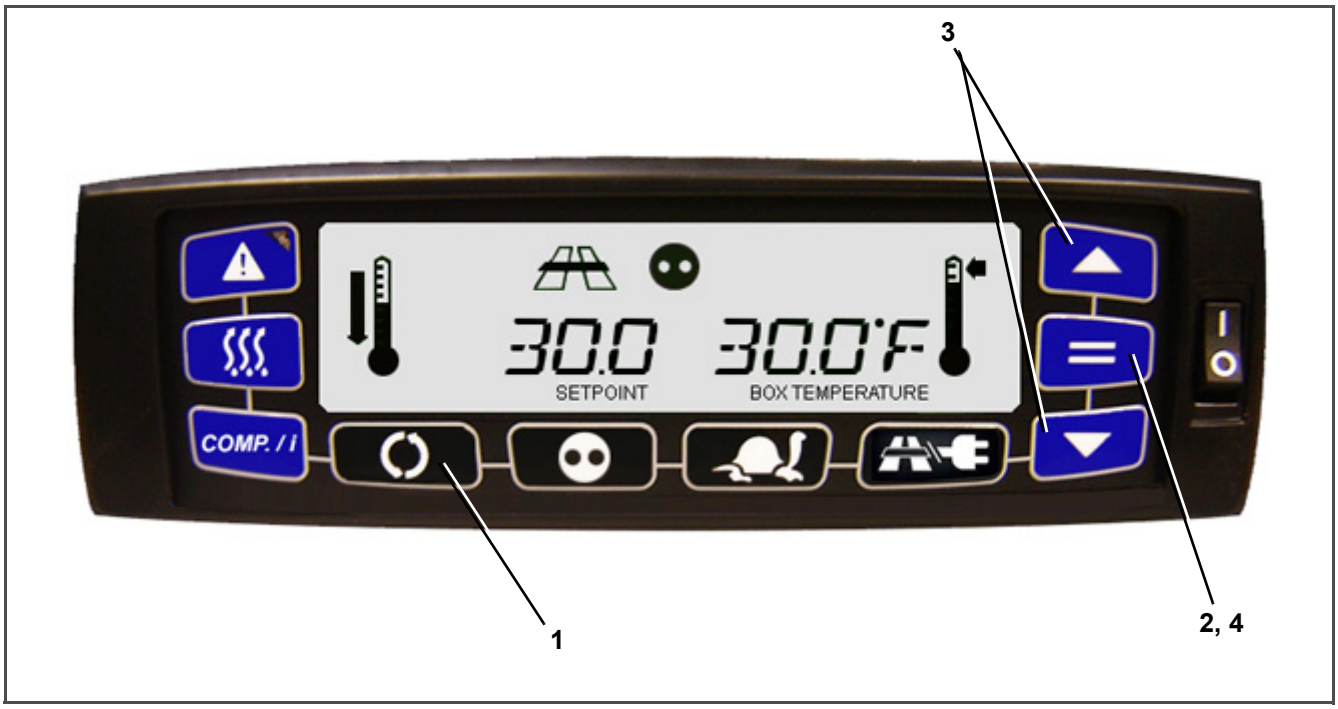
- Defrost is initiated automatically at preset intervals by the defrost timer in the microprocessor.
- The defrost mode may be manually initiated by pressing the MANUAL DEFROST key.

The defrost mode terminates when the evaporator temperature is higher than 55°F (12.8°C). Should the defrost cycle not complete within 45 minutes, the defrost cycle is terminated automatically by the microprocessor.

After the 45 minute termination, the microprocessor will wait 1.5 hours before attempting another defrost cycle. Pressing the MANUAL DEFROST key will override this mode and start a defrost cycle.

If a shutdown alarm occurs, defrost will be terminated. Refer to **Section 3.15.2** for more information on Defrost Mode.

3.10 FUNCTION CHANGE



1. Press the FUNCTION key.
2. Press the ENTER key to select the desired function to change.
3. Press either the UP or DOWN ARROW key until the desired function setting is displayed.
4. Press the ENTER key to select.

NOTE

Function changes will change the operation of the unit. The ability to change functional parameters from the keypad may be disabled depending on fleet requirements.

NOTE

Pressing and holding the FUNCTION key for more than 3 seconds will initiate the Pretrip Function.

The Function Parameters control selected operating features of the unit. When multiple choices are available, the display will show the function description on the left side with the corresponding function choice on the right side.

With a function parameter displayed, the data choice can be changed by pressing ENTER then pressing either the UP or DOWN arrow keys. The displayed choice will then flash to indicate that the choice has not been entered. Depress the ENTER key to activate the new choice. The display will stop flashing to indicate that the choice has been entered.

All functional parameters are retained in memory. A description of the function is displayed on the left side with the corresponding data on the right side. Press the FUNCTION CHANGE key or use the UP/DOWN arrow keys to display the functional parameter list.

With each press of the FUNCTION CHANGE key, the list advances one. If the FUNCTION CHANGE key is pressed and held for one second, the list advances one item at a time. The function list loops, which means that once the end of the list is reached it goes back to the first entry.

While the functional parameter is displayed, the data can be changed by pressing ENTER and then pressing the UP or DOWN arrow keys. If the value is changed, the displayed data flashes to indicate that the value has not been entered.

If the new value is not entered in five seconds, the display reverts to the last entered value. If the ENTER key is pressed, the display stops flashing to indicate that the value has been entered. The new value will continue to be displayed for five seconds before reverting to the default display. Each time a key is pressed, the five second delay is reset. To select a different functional parameter the FUNCTION CHANGE key must be pressed first.

The following sections describe the list of functions which can be modified via the keypad.

Table 3–1 Function Parameters

Code	English	Data
FN0	DEFR	Defrost Interval
FN1 ON	CITY SPD	Feature disabled
FN1 OFF	HIGH SPD	Feature disabled
FN2	OFF T	Minimum off-time
FN3	ON T	On-time
FN4	DEGREES F or C	Temperature Unit °C or °F
FN5 ON	TIME STRT	Maximum off-time 30 minutes
FN5 OFF	TEMP STRT	Temperature Based Restarting
FN6	MOP	
FN7 ON	AUTO OP	Auto Start Operation
FN7 OFF	MAN OP	Not operational
FN8	T RANGE	Out-of-Range Tolerance
Code / English = Code or English display format		
Alarm RST = Alarm Reset Required		
Alarm CLR = No Alarm Active		

FN0: Defrost Interval

The Defrost Interval is displayed with the description DEFR or FN0. The data for the interval is displayed with one decimal place and then the capital letter H for hours (i.e., DEFR 12.0H). The defrost intervals are 1.5, 3, 6, or 12 hours.

FN1: Speed Control Selection

This feature is disabled on the Supra 950MT as it is a single-speed only machine.

FN2: Minimum Off-Time

The Off-Time selection for the AUTO START mode is displayed with the description OFF T or FN2. The off-times are 10, 20, 30, 45 or 90 minutes. The data for the off-time is displayed with two digits and then the capital letter M for minutes (i.e. OFF T 20M).

FN3: On-Time

The On-Time selection for the AUTO START mode is displayed with the description ON T or FN3. The on-times are four or seven minutes. The data for the on-time is displayed with two digits and then the capital letter M for minutes (i.e. ON T4 M).

FN4: Standard Units Select

Standard Unit Select controls how all parameters are displayed. The two choices are DEGREES F and DEGREES C. This parameter also controls units that data is displayed in psig or bars (i.e, Degrees F or Degrees C). The code display is FN4. The selections are F or C.

FN5: Maximum Off-Time

The setting for the Maximum Off-Time is within the parameters TEMP STRT (FN6 OFF) or TIME STRT (FN6 ON). With the unit in TIME STRT, the control forces the engine to restart 30 minutes after shutoff.

FN7: Auto/Manual Start Operation

The selection for starting the unit is displayed AUTO OP (FN7 ON) for Auto Start operation or MAN OP (FN7 OFF) for Manual Start operation. AUTO OP must be used to start the Supra 950MT; Manual Start is no longer in use.

FN8: Out-of-Range Tolerance

The Out-of-Range Temperature tolerance selection is displayed with the description T RANGE or code FN11. The selection are A, B, and C.

A = 3.6°F (2°C), B = 5.4°F (3°C), and C = 7.2°F (4C°).

When the Out-of-Range Temperature is configured ON, the microprocessor indicates out-of-range when the temperature has been within the tolerance band at least once, and then goes outside the tolerance band for 45 minutes. If this condition occurs, the unit will shut down or shown an alarm depending on the setting of CNF9.

For set points at or below +10°F (-12.2°C) frozen range, the unit is only considered out-of-range for temperatures above set point.

Code/English Messages

The description messages of the functional parameters, unit status, and alarms can be displayed in English or Codes through this function selection. The two choices are displayed as ENGLISH or CODES. With this parameter set to CODES, all display descriptions are set to their code display. This parameter does not change due to this selection. Refer to each section for the alternate display description.

Manual Glow Override

The auto start glow time can be manually overridden through this function. The message is displayed as NORM GLOW or ADD GLOW. If the ADD GLOW selection is entered, the control adds 30 second of glow to the glow times listed in **Table 3–8**. This feature must be selected before the three start attempts have been completed. At higher ambients, this override only affects the second or third start attempt. The add glow time is deselected when the engine starts or fails to start. This parameter does not change due to the Code vs English selection.

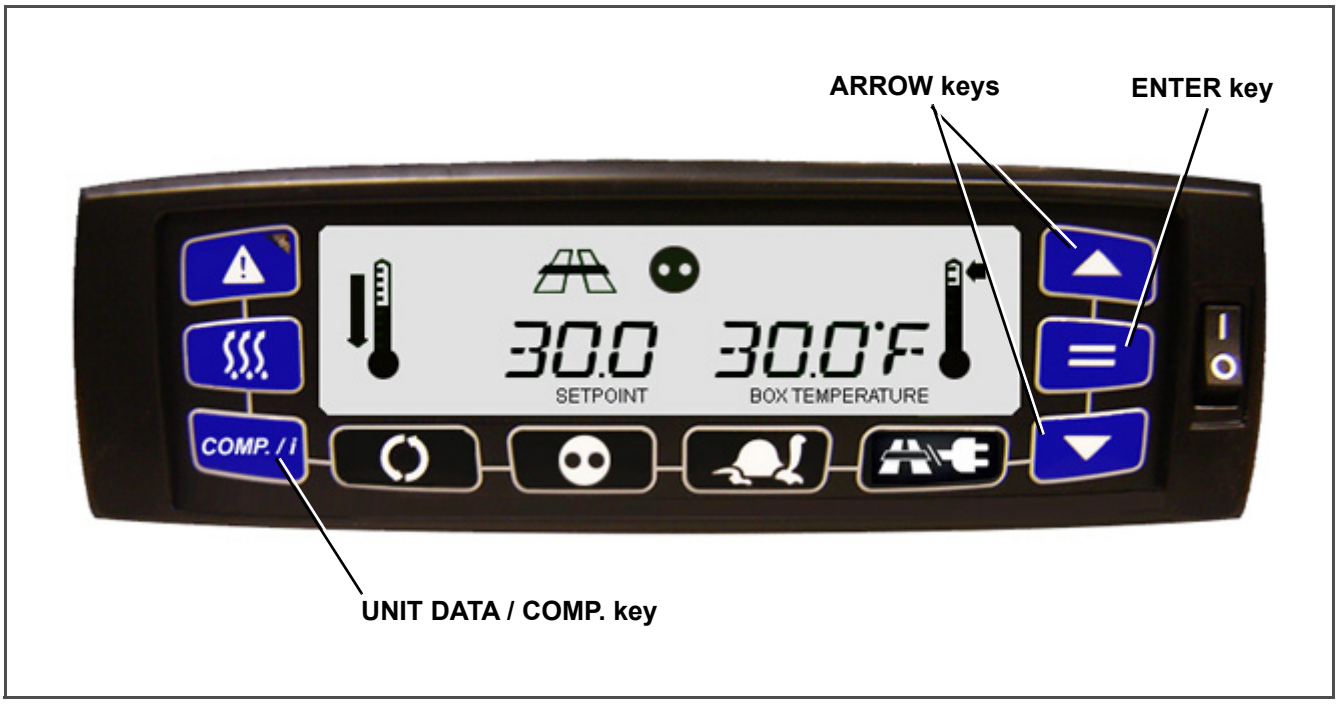
Alarm Reset

Alarms can be reset through this function. The messages are displayed as ALARM RST or ALARM CLR. If the ALARM RST is displayed there is at least one alarm present. Pressing the ENTER key clears all the alarms present. If the ALARM CLR is displayed, there are no alarms present. This parameter does not change due to the code/English selection. See **Section 3.12** for more detailed information.

3.11 UNIT DATA / COMPARTMENT MENUS

The UNIT DATA / COMP. key supports three different functions:

1. Display the On/Off status of compartments. This is available from the Compartment Status Menu, which is brought up by a single press of the UNIT DATA / COMP. key from the default screen.
2. Control the On/Off status of compartments. This is available from the Compartment Selection Menu, which is brought up by a double press of the UNIT DATA / COMP. key from the default screen. Or, from a single key press from the Compartment Status Menu.
3. Display the unit operating data parameters. Pressing the UNIT DATA / COMP. key for more than 3 seconds will display the unit operating data parameters. This key, in conjunction with the ARROW keys, will allow the user to display the unit's operating data values (i.e, coolant temperature, battery voltage, etc.).



3.11.1 Compartment Status Menu

The Compartment Status Menu, brought up by a single press of the UNIT DATA / COMP. key from the default screen, displays the status of compartments that are turned ON.

The timeout period for the Compartment Status Menu is 5 seconds after which the user is directed back to the default screen. If a high priority alarm occurs, the default screen is brought up sooner than the timeout period.

To show that compartment 1 is turned ON, the LCD digit 1 and digit 2 will display string C1, and digit 3 and digit 6 will display "/". This is shown in **Table 3–2**.

Table 3–2 Display for Compartment 1 Turned On

Digit 1	Digit 2	Digit 3	Digit 4	Digit 5	Digit 6	Digit 7	Digit 8	Digit 9
C	1	/			/			

To show that compartment 2 is turned On, the LCD digit 4 and digit 5 will display string C2, and digit 3 and digit 6 will display "/". This is shown in **Table 3–3**.

Table 3–3 Display for Compartment 2 Turned On

Digit 1	Digit 2	Digit 3	Digit 4	Digit 5	Digit 6	Digit 7	Digit 8	Digit 9
		/	C	2	/			

To show that all compartments are On, the LCD digit 1 and digit 2 will display string C1, digit 4 and digit 5 will display string C2, digit 7 and digit 8 will display string C3 and digit 3 and digit 6 will display "/". This is shown in **Table 3–5**.

Table 3–4 Display for All Compartments On

Digit 1	Digit 2	Digit 3	Digit 4	Digit 5	Digit 6	Digit 7	Digit 8	Digit 9
C	1	/	C	2	/			

To show that all compartments are Off, the digit 3 and digit 6 will display "/". This is shown in **Table 3–5**.

Table 3–5 Display for All Compartments Off

Digit 1	Digit 2	Digit 3	Digit 4	Digit 5	Digit 6	Digit 7	Digit 8	Digit 9
		/			/			

3.11.2 Compartment Selection Menu

The Compartment Selection Menu is brought up by a double press of the UNIT DATA / COMP. key from the default screen. Or, from a single key press from the Compartment Status Menu. This Menu allows a user to control the ON/OFF status of compartments along with the language (English/Chinese). Use the UP and DOWN arrow keys and press the ENTER key to change the compartment status or change the language.

The timeout period for the Compartment Selection Menu is 7 seconds after which the user is directed back to the default screen. If a high priority alarm occurs, the default screen is brought up sooner than the timeout period.

3.11.3 Unit Operating Data Parameters

Pressing the UNIT DATA / COMP. key for more than 3 seconds will display the unit operating data parameters. This key, in conjunction with the arrow keys, will allow the user to display the unit's operating data values (i.e, coolant temperature, battery voltage, etc.).

1. Press the UNIT DATA/COMP. key to scroll through the data list one item at a time.
2. To scroll through the list faster, use the UP or DOWN arrow keys.
3. Data will display for five seconds.
4. Press the ENTER key to display data for 30 seconds.
5. The display will revert back to the default display if no keys are pressed for five seconds.

The description of the data is displayed on the left side with the actual data on the right side. The unit data list can be scrolled through by pressing the UNIT DATA/COMP. key.

With each successive key push, the list advances one. If the Unit Data UP or DOWN arrow key is held for one second, the list changes at a rate of one item every 0.5 seconds. Once the end of the list is reached it returns to the first entry.

The following sections describe the list of data which can be displayed via the keypad.

Table 3–6 Unit Data Codes

Code	English	Data
CD1	SUCT	Suction Pressure
CD2	ENG	Engine Hours
CD3	WT	Engine Temperature
CD4	1RA	Return Air Temperature C1
CD6	2DT	C2 Defrost Thermistor Sensor
CD7	3DT	Not used in Supra 950MT
CD8	1DT	C1 Defrost Thermistor Sensor
CD9	CDT	Discharge Temperature
CD10	BATT	Battery Voltage
CD11	SBY	Standby Hours
CD12	MOD V	Future Expansion
CD13	REV	Software Revision
CD14	SERL	Serial Number Low
CD15	SERU	Serial Number Upper
CD16	2RA	C2 Air Temperature
CD17	3RA	Not used in Supra 950MT
CD18	MHR1	Maintenance Hour Meter 1
CD19	MHR2	Maintenance Hour Meter 2
CD20	SON	Switch On Hour Meter

CD1: Suction Pressure

The Suction Pressure is displayed with the description SUCT or CD1. The data is displayed with the proper unit designator P (psig) or B (bars) (i.e. SUCT 25P). The display is in inches of mercury for readings below 0 psig. The display range is -0.7 Bars to 6.9 Bars (-20 HG to 100 psig).

CD2: Engine Hours

The number of diesel engine hours are displayed with the description ENG or CD2. The data is displayed with units designator H (i.e. ENG 5040H OR CD2 5040H). The display range is 0 to 99999.

CD3: Engine Temperature

The coolant temperature is displayed with the description WT or CD3. The data is displayed with the proper unit designator: Degrees Fahrenheit or Celsius (i.e, WT 185F or CD3 185F). The display range is -58°F to 266°F (-50°C to 130°C).

CD4: Compartment 1 Return Air Temperature

Compartment 1 Return Air Temperature is displayed with the description 1RA or CD4. The data is displayed with one decimal place and the proper unit designator, Degrees Fahrenheit or Celsius (i.e. RAS 85.0F). The display range is -36°F to 158°F (-38°C to 70°C).

CD6: Compartment 2 Defrost Thermistor Sensor

Compartment 2 Defrost Thermistor Sensor is displayed with the description 2DT or CD6. The data is displayed with one decimal place and the proper unit designator, Degrees Fahrenheit or Celsius (i.e. 2DT 85.0F). The display range is -36°F to 158°F (-38°C to 70°C).

CD8: Compartment 1 Defrost Thermistor Sensor

Compartment 1 Defrost Thermistor Sensor is displayed with the description 1DT or CD8. The data is displayed with one decimal place and the proper unit designator, Degrees Fahrenheit or Celsius (i.e. 1DT 85.0F). The display range is -36°F to 158°F (-38°C to 70°C).

CD9: Compressor Discharge Temperature

Compressor Discharge Temperature is displayed with the description CDT or CD9. The data is displayed with the proper unit designator, Degrees Fahrenheit or Celsius, i.e. CDT 85F (-40°C to 200°C). The display range is -40°F to 392°F. If the sensor is open, the display will read −−− for the data.

CD10: Battery Voltage

The Battery Voltage is displayed with the description BATT or CD10. The data is displayed with one decimal place and then the letter V for volts (i.e. BATT 12.2V or CD10 12.2V). The voltage reading is displayed with a plus (+) sign if the battery status is good.

CD11: Standby Hours

The number of electric motor hours is displayed with the description SBY or CD11. The data is displayed in hours and units designator H (i.e. SBY 5040H or CD11 5040H). The display range is 0 to 99999.

CD12: Mod V - Future Expansion

This unit data is not used at this time. The Code display is CD12.

CD13: Software Revision

The Eprom software revision number is displayed with the description REV or CD13 on the left and Eprom software revision number on the right. Pressing the Enter key for three seconds will display CD13 U2 on the left and the board mounted software revision number on the right.

CD14: Serial Number Low

The low serial number of the microprocessor is displayed with the description SERL or CD14. The data is the lower three digits of the serial number burned in to the Eprom (i.e. SERL 504 or CD14 504).

CD15: Serial Number Upper

The upper serial number of the microprocessor is displayed with the description SERU or CD15. The data is the upper three digits of the serial number burned in to the Eprom (i.e. SERH 001 or CD15 001).

CD16: Compartment 2 Return Air Temperature

The Return Air Temperature for Compartment 2 is displayed with the abbreviated description 2RA on the left side of display. The code display is CD16. The data is displayed with one decimal place and the proper unit designator, Degrees Fahrenheit or Celsius (i.e. 2RA 85.0F).

CD17: Compartment 3 Return Air Temperature

Not used in Supra 950MT

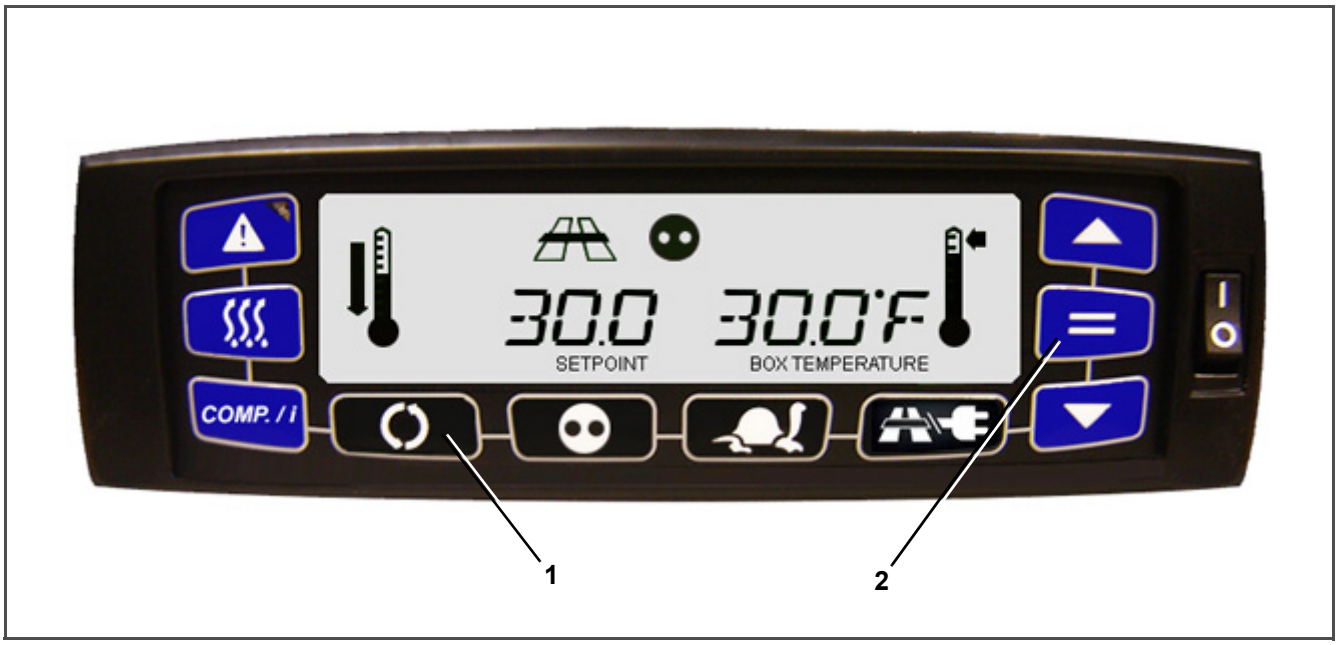
CD19: Maintenance Hour Meter 2

The Maintenance Hour Meter 2 setting is displayed with the description MHR2 on the left side or CD19. The maintenance hour meter is compared to one of the hour meters (diesel, standby, or switch on) determined by its mode. If the hour meter is greater than the maintenance hour meter an alarm is generated.

CD20: Switch On Hour Meter

The number of Switch On Hours is displayed with the description SON or CD20 (i.e. SON 2347H or CD20 2347H). The display range is 0 to 99999.

3.12 ALARM DISPLAY AND RESET



1. To reset the display, Press the FUNCTION key and then the UP or DOWN arrow key until ALARM RST is displayed.
2. Press ENTER to clear the alarm. ALARM CLR will be displayed. (Unit will restart if alarm condition has been corrected and unit is in Start/Stop or Auto OP).

The fault light (FL) illuminates only for alarms that specify it. If an alarm is generated, the default display is overridden. When an alarm is generated, the display will alternate the default display (set point/compartment temperature) and the active alarm(s). Each item is displayed for 3 to 10 seconds and will continue to scroll through the list. See **Table 3–7** for list of alarms.

Alternate Alarm Reset

Place the I/O switch in the OFF (O) position. (Unit can now be restarted after alarm condition has been corrected).

Table 3–7 Alarm Display

Code	English	Description
AL0	ENG OIL	✓ Low Engine Oil Pressure
AL1	ENG HOT	✓ High Engine Coolant Temperature
AL2	HI PRESS	✓ High Compressor Discharge Pressure
AL3	START-FAIL	✓ Start Failure After Three Attempts
AL4	LOW BATT	✓ Low Battery Voltage
AL5	HI BATT	✓ High Battery Voltage
AL6	DEFRFAIL	Defrost Override
AL7	ALT AUX	✓ Alternator Auxiliary
AL8	STARTER	✓ Starter Motor - Engagement Not Sensed
AL9	1RA SENSOR	✓ Return Air Sensor Comp 1 Failure
AL10	2RA SENSOR	Return Air Sensor Comp 2 Failure
AL11	WT SENSOR	Coolant Temperature Sensor Failure
AL12	HIGH CDT	✓ High Compressor Discharge Temperature
AL13	CD SENSOR	Discharge Temperature Sensor Failure

Table 3–7 Alarm Display (Continued)

AL14	SBY MOTOR	✓ Standby Motor Overload Open
AL15	FUSE BAD	✓ Fuse Open
AL16	3RA SENSOR	Not used in Supra 950MT
AL17	DISPLAY	Display Communication Failure
AL18	SERVICE 1	Maintenance Hour Meter 1
AL19	SERVICE 2	Maintenance Hour Meter 2
AL20	1RA OUT	✓ Main Compartment Out-of-range
AL21	2RA OUT	✓ Remote Compartment 2 Out-of-range
AL22	3RA OUT	Not used in Supra 950MT
AL23	NO POWER	No Power for Standby
AL26	SYSTEM CK	✓ Low suction pressure
✓ = FAULT LIGHT ON		

AL0: Low Oil Pressure Alarm

The Low Oil Pressure alarm is displayed with the description ENG OIL or AL0. This alarm is generated if the control senses low oil pressure under the proper conditions. The fault light (FL) is on and the engine shuts down.

AL1: High Coolant Temperature Alarm

The High Coolant Temperature alarm is displayed with the description ENG HOT or AL1. This alarm is generated if the control senses a high coolant temperature. The fault light (FL) is on and the engine shuts down. See **Section 2.7.2** for more detailed information, and see **Section 5.2.1** for coolant system and replacement.

AL2: High Pressure Alarm

The High Pressure alarm is displayed with the description HI PRESS or AL2. This alarm is generated if the High Pressure switch opens. The fault light (FL) is on and the engine shuts down. For more information, see **Section 2.7.5**. Also, see **Section 5.12.2** for high pressure switch checks.

AL3: Start Failure Alarm

The Start Failure alarm is displayed with the description STARTFAIL or AL3. This alarm is generated if the engine fails to start. The fault light (FL) is turned on.

AL4: Low Battery Voltage Alarm

The Low Battery Voltage alarm is displayed with the description LOW BATT or AL4 and the fault light (FL) is on. This alarm is activated whenever battery voltage falls below 10V except for the period of time when the starter is cranking the engine (Auto startup or Start/Stop restart) and the five seconds immediately after the starter stops cranking. See **Section 3.15.3** and **Table 3–9** for more detailed information.

AL5: High Battery Voltage Alarm

The High Battery Voltage alarm is displayed with the description HI BATT or AL5. This alarm is generated if the battery voltage is above 17 VDC. The fault light (FL) is on and the engine shuts down.

AL6: Defrost Override Alarm

The Defrost Override alarm is displayed with the description DEFR FAIL or AL6. If after 45 minutes of defrost, the unit is still in DEFROST mode, the unit displays AL6 and switches to DEFROST OVERRIDE mode. The fault light (FL) is on.

AL7: Alternator Auxiliary Alarm

The Alternator Auxiliary alarm is displayed with the description ALT AUX or AL7. This alarm is generated if the alternator auxiliary signal is not present with the engine running. The fault light (FL) is on. See **Section 5.2.9** for more detailed information on servicing the alternator.

AL8: Starter Motor Alarm

The Starter Motor alarm is displayed with the description STARTER or AL8. This alarm is generated if the starter motor input signal is not present with starter solenoid energized. The fault light (FL) is on.

AL9: Compartment 1 Return Air Sensor Alarm

The Compartment 1 Return Air Sensor alarm is displayed with the description 1RA SENSOR or AL9. This alarm is generated if the return air sensor is open or shorted. The fault light (FL) is on because there is no controlling probe.

AL10: Compartment 2 Return Air Sensor Alarm

The Compartment 2 Return Air Sensor alarm is displayed with the description 2RA SENSOR or AL10. This alarm is generated if the return air sensor is open or shorted. The fault light (FL) is on because there is no controlling probe.

AL11: Coolant Temperature Sensor Alarm

The Coolant Temperature Sensor alarm is displayed with the description WT SENSOR or AL11. This alarm is generated if the coolant temperature sensor is open or shorted.

AL12: Compressor Discharge Temperature Alarm

The Compressor Discharge Temperature alarm is displayed with the description HIGH CDT or AL12. This alarm is generated if the temperature is sensed above 310°F (154°C) for three minutes. If the discharge temperature exceeds 350°F (177°C), the three minute timer is overridden and the unit shuts down immediately. The fault light (FL) is on.

AL13: Compressor Discharge Temperature

Sensor Alarm The Compressor Discharge Temperature sensor alarm is displayed with the description CD SENSOR or AL13. This alarm is generated if the sensor is open or shorted.

AL14: Standby Motor Overload Alarm

The Standby Motor Overload alarm is displayed with the description SBY MOTOR or AL14. This alarm is generated when the MOL input is sensed open with the Run Relay energized in electric mode (Diesel/Electric Relay energized).

AL15: Fuse Alarm

The Fuse alarm is displayed with the description FUSE BAD or AL15. This alarm is generated when the FUSE input is sensed low. The fault light (FL) is on.

AL16: Compartment 3 Return Air Sensor Alarm

Not used in Supra 950MT

AL17: Display Alarm

When no communications exist between the main board and the display board for eight seconds, the Display alarm description is DISPLAY or AL17

AL18: Maintenance Hour Meter 1 Alarm

The Maintenance Hour Meter Alarm 1 is displayed with the description SERVICE 1 or AL18. This alarm is generated when the designated hour meter is greater than maintenance hour meter 1.

AL19: Maintenance Hour Meter 2 Alarm

The Maintenance Hour Meter Alarm 2 is displayed with the description SERVICE 2 or AL19. This alarm is generated when the designated hour meter is greater than maintenance hour meter 2.

AL20: Compartment 1 Out-of-Range Alarm

The Out-of-Range alarm is displayed with the description 1RA OUT or AL20. This alarm is generated when compartment 1 is out-of-range. The fault light (FL) is on. See **Table 3–1** for more information.

AL21: Compartment 2 Out-of-range Alarm

The Out-of-Range alarm is displayed with the description 2RA OUT or AL21. This alarm is generated when Compartment 2 is out-of-range. The fault light (FL) is on. See **Table 3–1** for more information.

AL22: Compartment 3 Out-of-Range Alarm

Not used in Supra 950MT

AL23: No Power for Standby Alarm (Truck Unit)

NO POWER is displayed if the truck unit is switched to standby and the power plug is not plugged in.

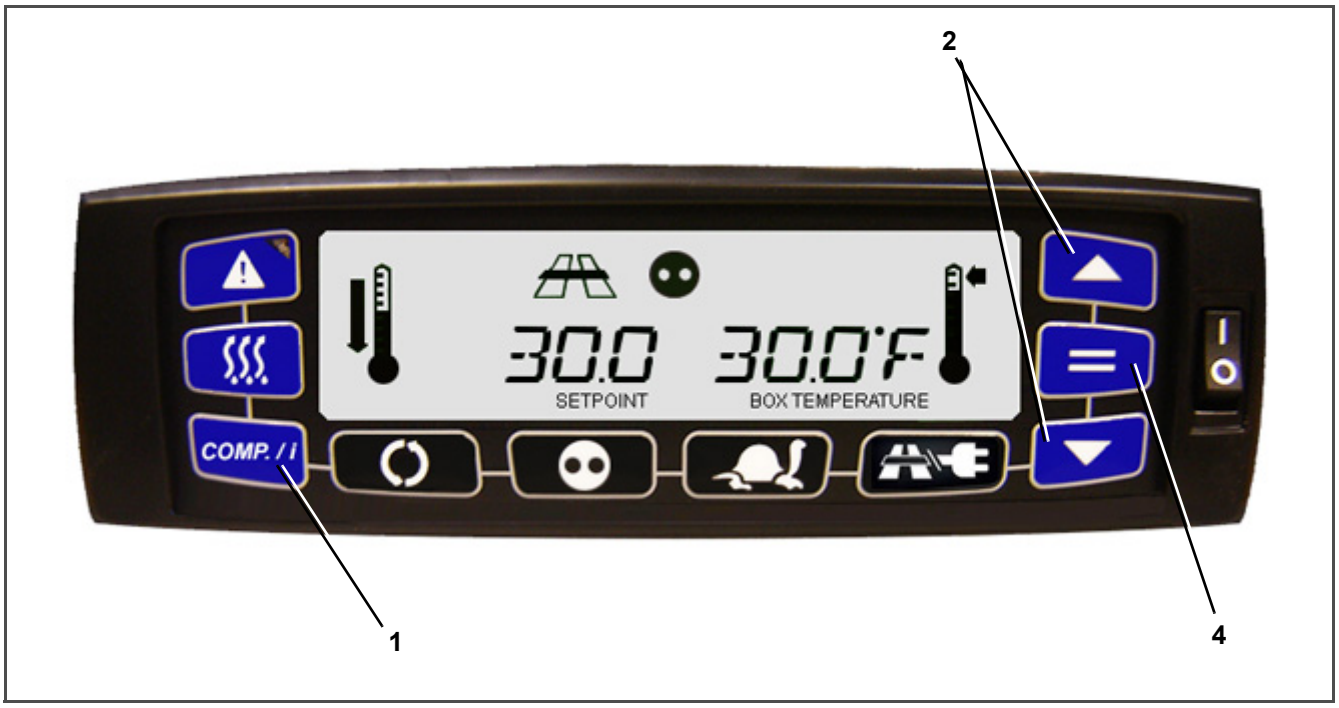
AL26: System Check Alarm

Truck refrigeration system suction pressure is monitored and the alarm is activated if the pressure is <−5 PSI for 120 seconds while in the perishable range.

3.13 STOPPING UNIT

⚠ WARNING

Always place the RUN/STOP switch in the STOP position and turn off the power supply before disconnecting the power plug from the unit.



1. Press and hold the UNIT DATA / COMP. key to go to Compartment Selection mode.
2. Select the desired compartment using the UP and DOWN arrow key.
3. Place C1 and C2 in the OFF position using the ENTER key.
4. Place the I/O switch in the OFF (O) position.

   The diesel engine/electric motor will stop and the microprocessor display will turn off.

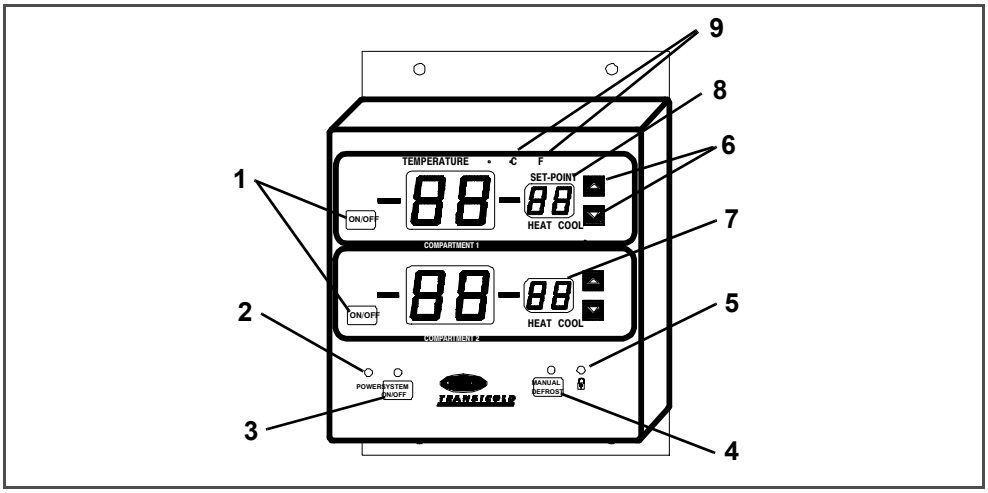
NOTE

If both compartments are stopped and the unit RUN/STOP switch is still in the RUN position, the unit will stop but the microprocessor will stay energized.

3.14 REMOTE PANEL

The optional remote panel is a user-friendly indicator and control that enables the operator to view compartment temperatures. The panel can be mounted to suit the individual operator's preference.

From this control panel (option) the operator can turn the unit on and off, check temperature in either compartment, change set points, or initiate a manual defrost (refer to **Section 3.9**).

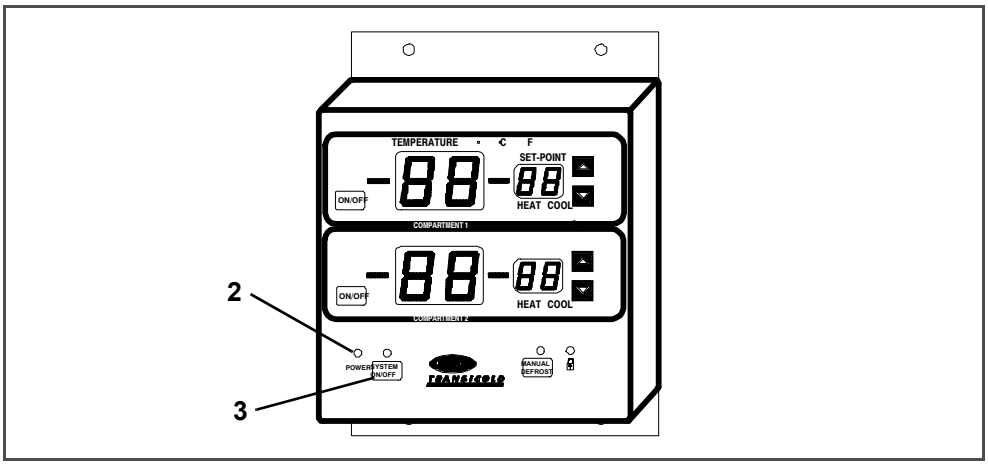


1. Compartment ON/OFF key
2. Control panel power on light
3. System ON/OFF key
4. Manual defrost key
5. Control panel locking light
6. Up and Down Arrow keys
7. Heating operating mode light of a compartment
8. Cooling operating mode light of a compartment
9. Temperature indicated in °C or °F

- - - - -

a. Operating the remote control panel

1. Start the unit.
2. Press the System On/Off key. Power light goes ON.
3. Press the On/Off key to energize the selected compartment.



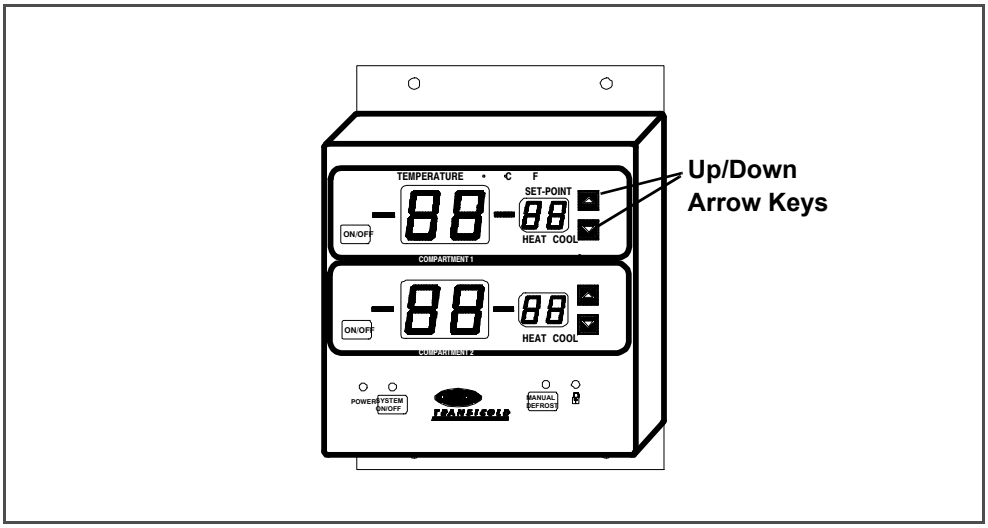
4. The Display unit is explained below:

--	Waiting for communication with unit
-20	Compartment temperature display
-20	Set point temperature display
	Evaporator status (heat or cool or null)
OF	Compartment shut-down via remote control
dF -20	Defrost compartment
-- -20	Temperature sensor malfunction

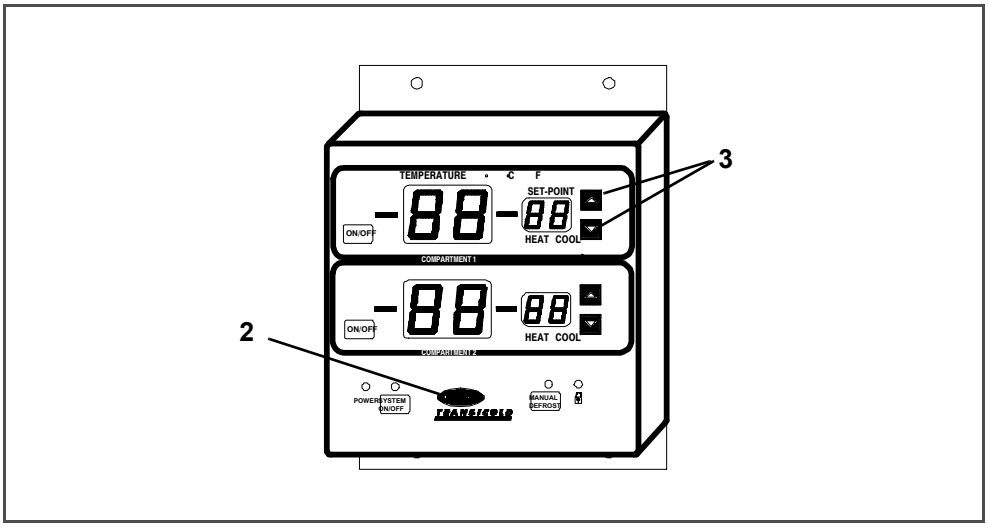
b. Changing Set Point

Changes to the set point can be made from either the remote control panel or the cab control.

To change set point from the remote control panel, press the UP or DOWN arrow keys to increase or decrease set-point. This is the same operation for each compartment.



c. Setting Preset Set Point



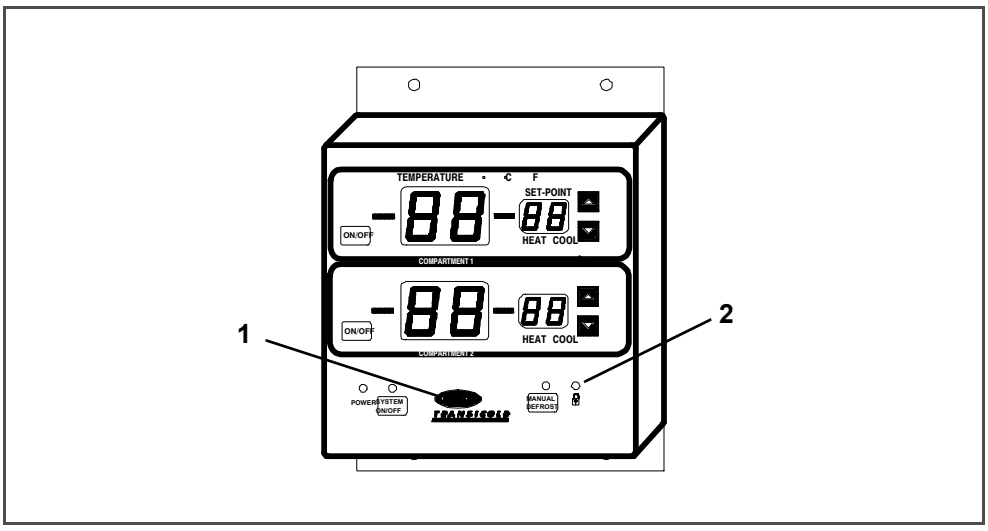
1. Switch the main RUN/STOP switch to RUN and the required remote compartment switches on cab command to I.
2. Press the Carrier logo and the lock light is displayed.
3. Press host compartment UP arrow key for 10 seconds. P1 is displayed in all compartments.
4. Set lowest set point temperature required.
5. Press Carrier logo and P2 is displayed. Set next lowest temperature required up to five preset set points are available.
6. Pressing the second compartment UP or DOWN arrow key allows the lowest temperature required to be preset in the second compartment. Pressing the Carrier logo then moves on to the next lowest (up to five).
7. Press the Carrier logo for 10 seconds. The lock light turns off and the preset set points are stored.

d. Removing Preset Set Point

1. Switch the main RUN/STOP switch to STOP and the required remote compartment switches on cab command to O.
2. Press Carrier logo and the lock light is displayed.
3. Press host compartment UP arrow key for 10 seconds. P1 is displayed in all compartments.
4. Set temperature to lowest possible and OFF is displayed.
5. Press the UP arrow key on remote compartments will display the presets, take the temperature to the lowest possible, and OFF is displayed.
6. Press the Carrier logo for 10 seconds and the new information is stored in memory.

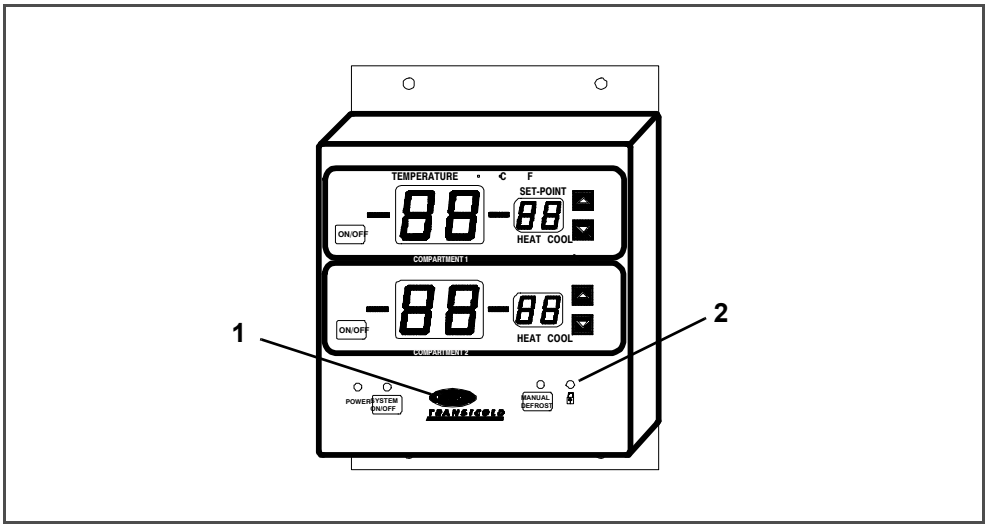
e. Locking the Control Panel

1. Press and hold the Carrier logo until it stops flashing.
2. The indicator light will illuminate, indicating the control panel is locked.



f. Unlocking the Control Panel

1. Press and hold the Carrier logo until the indicator light goes off.
2. Once the indicator light is off, the control panel is unlocked.



3.15 MODES OF OPERATION

3.15.1 Heat/Cool Mode

Once the engine is considered to be running, the unit microprocessor maintains the set point temperature by switching between heat and cool modes.

3.15.2 Defrost Cycle

Defrost is an independent cycle that overrides cooling and heating functions, and de-ices the evaporator(s) as required. During Defrost mode, the microprocessor displays DF on the right hand temperature display. The left hand display continues to display the set point.

There are two ways of initiating a defrost.

- Method one: Defrost may be initiated automatically at preset intervals by the defrost timer in the microprocessor.
- Method two: Press the MANUAL DEFROST key.

a. Initiating Automatic Defrost

When defrost time entered via Functions has elapsed (see **Table 3–1**), a defrost is initiated. Whenever a defrost cycle is initiated, the defrost timer is reset to zero. The microprocessor holds the last entered defrost interval in memory. The defrost timer runs only when a compartment defrost temperature sensor (DTS) is sensed at or below 45°F (7°C). The lowest number compartment will go into null mode, fans only. The highest number compartment will initiate defrost first by turning off the compartment fans and using both hot gas and electric heat to complete defrost. After compartment defrost terminates, there will be a one minute operation in cool without fans by the compartment that just completed defrost to allow excess moisture to freeze on the coil. A recovery time of 15 minutes will be utilized by both compartments. The highest number compartment will then go into null mode, fans only. The lowest compartment will initiate defrost by first turning off compartment fans and using both hot gas and electric heat to complete defrost. After compartment defrost terminates, there is a one minute operation in cool without fans by the compartment that just completed defrost to allow excess moisture to freeze on the coil.

b. Manual Defrost

Pressing the manual defrost on the cab command will put the lowest number compartment into null mode, fans only. The highest number compartment will initiate defrost first by turning off compartment fans and using both hot gas and electric heat to complete defrost. After compartment defrost terminates, there will be a one minute operation in cool without fans by the compartment that just completed defrost to allow excess moisture to freeze on the coil. The highest number compartment will then go into null mode, fans only. The lowest compartment will initiate defrost by first turning off compartment fans and using both hot gas and electric heat to complete defrost. There is a one minute operation in cool without fans by the compartment that just completed defrost to allow excess moisture to freeze on the coil.

c. Defrost Termination

After initiation, defrost mode terminates when the Defrost Temperature Sensor (DTS) is sensed at 50°F (10°C) indicating that the evaporator is de-iced and the defrost cycle is considered to be complete. Once a defrost has been initiated, the defrost interval timer resets to zero time. The compressor operates in four-cylinder operation during defrost and also uses electric heat. The length of defrost will depend on condition of evaporator coil(s). If a two compartment system is used and one of the compartments' Defrost Thermostat Sensor (DTS) is above 50°F (10°C), defrost will terminate and the system will continue to operate in temperature control mode.

c. Fail Safe Defrost Termination

If the defrost cycle does not complete within 45 minutes, the defrost cycle is terminated for that individual compartment by the microprocessor and the defrost cycle will continue within the next compartment. The Manual Defrost switch overrides this mode and starts a new 45-minute cycle.

When defrost override is active, the appropriate alarm is indicated. If the run relay is de-energized during defrost, defrost is terminated and/or if a shutdown alarm occurs, defrost will be terminated.

3.15.3 Continuous or Start-Stop Operation

a. Auto Start Failure

If the unit fails to start, shuts down on a safety, or fails to run for the minimum run time three consecutive times, the Start/Fail alarm is activated.

b. Auto Start Sequence (Engine Mode)

On initial power up, there is a five-second delay before the starting sequence begins. When starting conditions are met, the start sequence begins by energizing the run relay, defrost relay, main heat relay, all hot gas and cool relays, and the unloader.

If the required glow time is zero, the control will energize the starter after a five-second delay. After five seconds, the glow plug relay (GPR) is energized by a timed run control relay (RCR), supplying power to the glow plugs. The starter is energized after the variable glow time has elapsed, which is based on engine coolant temperature that is monitored by the microprocessor.

The flash circuit is used to ensure current is always available in the windings of the motor. This current is used to excite the magnetic field the motor produces when turned by the engine. The current is driven by three capacitors that are uniquely sized and balanced for the system. These capacitors work in conjunction with the motor to ensure three-phase AC voltage.

The engine will crank for 10 seconds or until engine operation is sensed by the alternator auxiliary signal. If the engine fails to start, a 15-second null cycle will elapse before subsequent start attempts.

The run relay remains energized until the next starting sequence. Before the next starting sequence, the oil pressure and alternator auxiliary output must be checked to ensure that the engine is not running.

For the second and third start attempts, the glow time is increased by five seconds over the glow time of the first attempt listed below. The control allows three consecutive start attempts before the starting is locked out and the start failure alarm is activated.

c. Variable Glow Time

The glow time for the first start attempt varies in duration based on engine coolant temperature and the type of engine selected.

Table 3–8 Engine Coolant Temperature Glow Time

Temperature	TV	DI
Less than 32°F (0°C)	15	55
33°F to 50°F (1°C to 10°C)	10	40
51°F to 77°F (11°C to 25°C)	5	25
Greater than 78°F (26°C)	0	10

The second and third start attempts have a glow time that is five seconds greater than the table amount. The glow time can be manually overridden through the function parameters. If the coolant temperature sensor is defective, the control assumes a temperature of less than 32°F (0°C) for the glow timing.

d. Minimum On-Time

If configured for Start-Stop operation, the unit must run for the minimum runtime (factory default is four minutes) before it can consider shutting off. This time is necessary to prevent short-cycling and ensure adequate air flow through the load to allow the micro to accurately sense load temperature and bring the battery up to minimum voltage level.

Minimum on-time value is selected via keypad.

e. Minimum Off-Time

Once the unit has cycled off, it will remain off for the minimum off-time (factory default is 20 minutes). This prevents rapid cycling due to changes in air temperature. Air temperature in the box can change rapidly, but it takes time for the product temperature to change.

Minimum off-time value is selected via keypad.

The minimum off-time is overridden if the temperature is more than ±11°F (±6°C) from set point.

f. Time Start / Temp Start

Selection between Time Start or Temp Start is provided via the keypad

- Temp Start: Unit remains OFF until box temperature deviates from set point.
- Time Start: Unit restarts automatically 30 minutes after it has stopped regardless of the box temperature.

g. Battery Voltage

Provisions are made to sense when the battery is good. A good battery is defined as having 13.4 volts at 75°F (24°C). This condition is used to allow shut-off of the diesel engine.

If the battery voltage falls below 10 volts during glow cycle, the starter will not engage and the start sequence will continue. This is considered a failed start. The start sequence is repeated until the unit starts or three consecutive start attempts have failed.

Table 3–9 Battery Voltages

Message Display	Voltage Level	Description
LOW BATT AL4	At 10	Unit shuts down except during cranking
	11 to 14.5	Considered normal voltage
HI BATT AL5	17 or more	Unit shuts down

h. Oil Pressure Signal

When the Oil Pressure switch is closed, it indicates the engine is running and prevents engagement of the starter motor when operating in Auto mode.

i. Maximum Off-Time

A keypad selectable feature is provided that will cause the engine to be started 30 minutes after the engine has stopped regardless of the box temperature.

j. Start-Stop Conditions

Unit will not cycle off if:

- Engine coolant temperature is less than 122°F (50°C)
- Battery is less than 13.4 volts

Unit will restart (overriding minimum off-time) if:

- Battery drops below 11 volts
- Coolant temperature drops below 34°F (1°C)

If the unit cannot cycle off, it will operate normally in Continuous mode. If all temperature probes fail and the set point is less than or equal to 10°F (-12°C), the unit will not shut down.

3.16 PRE TRIP INSPECTION

3.16.1 Before Starting Engine

1. Drain water and sediment from fuel tank sump and then fill tank with diesel fuel.
2. Check radiator coolant level. Add pre-mixed 50/50 permanent antifreeze-water as required.
3. Check evaporator and condenser coil for cleanliness.
4. Check engine lubrication and fuel filter, oil lines, and connections for leaks. Tighten connections and/or replace gaskets.
5. Check compressor and receiver service valve position (backseat position).
6. Check unit compartment and remove any foreign material.
7. Check engine oil level.
8. Check V-belts for proper tension, fraying or cracks. Adjust belt or replace.

⚠ 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.

9. Check battery terminals and electrical connections for cleanliness and tightness.

10. Check engine air cleaner for cleanliness and condition of air cleaner hose.
11. Check defrost drain pan hoses (should be clear of debris).

3.16.2 After Starting Refrigeration Unit

1. Check engine speed.
2. Listen for abnormal noises. If present, control compressor pressures with a manometer.
3. Check compressor oil level (refer to **Section 2.7.4** and **Section 5.9**).
4. Observe any signs of lube or fuel oil leaks.
5. Check radiator hoses for leaks.
6. Check refrigerant level (refer to 3.4.1).
7. Feel filter drier. Excessive temperature drop across drier indicates restriction.
8. Check water temperature (150 to 180°F = 65 to 82°C).

3.17 MICROPROCESSOR OPERATION

In order to reduce starter cranking and engine loads when the engine is started, the microprocessor always starts and operates in high speed, unloaded heat for the first 15 seconds. After the first 15 seconds, the microprocessor allows the unit to operate normally, providing the coolant temperature is above 79°F (26°C).

SECTION 4
CONTROL LOGIC AND TEMPERATURE CONTROL

4.1 MODES OF OPERATION

4.1.1 Introduction

The operational software responds to various inputs. These inputs come from the temperature and pressure sensors, the temperature set point, the settings of the configuration variables and the function code assignments. The action taken by the operational software will change if any one of the inputs changes. Overall interaction of the inputs is described as a “mode” of operation. Refer to **Section 2.7.4** for a description on the refrigerant circuit. Refer to **Section 5.18** for a description of the microprocessor logic circuit.

4.1.2 Temperature Control Logic

There are three modes of operation - Cool, Heat, and Defrost. The microprocessor automatically selects the necessary mode to maintain the refrigerated compartment temperature at set point.

There are two control ranges:

- Frozen: Set point less than 10.4°F (-12°C)
- Perishable: Set point greater than 10.4°F (-12°C)

In the frozen range, there are two control logics depending on whether or not heat is allowed.

There are also two operating modes:

- Continuous
- Start-Stop

a. Temperature Control/Continuous Mode

For DIESEL or STANDBY Modes: There are three possible states:

- Cool
- Heat
- Null

See **Figure 4.2** and **Figure 4.4**.

b. Temperature Control/Start-Stop

When START-STOP mode is activated, there is an additional off-state that corresponds to unit shut-off when box temperature is close to set point (see **Figure 4.1** and **Figure 4.3**).

c. Operation

COOL Mode: Default mode for the microprocessor

HEAT Mode: Microprocessor will energize MHR relay, which controls the Main Heat Valve and Receiver Tank heat Valve (RPV).

Either the HGR 1 or 2 (or any combination of the relays) is energized depending on which compartment requires heat. These control the hot gas valve in the evaporator.

Micro	Relay	Valve
N1 S2 Null	HGR1 HGR2 CR, HGR, EHR De-energized	1HGV 2HGV Not used

Table 4–1 Relay Operation

Mode	DER	GPR	RCR	SSR	FLR	CR 1,2	EHR 1,2	EMR 1,2	HGR 1,2	LSV 1,2	RR 1,2	MHR	UFR 950MT
ENGINE OPERATION													
Off	O	O	O	O	O	O	O	O	O	O	O	O	O
Glow	O	I	I	O	I or O	I	O	O	I	I	I	I	I
Start	O	O	I	I	O	I	O	O	I	I	I	I	I
Cooling	O	O	I	O	O	I or O	I or O	I or O	I	I or O	I or O	O	
Off Cycle	O	O	I	O	O	O	O	O	O	O	O	O	O
Heating	O	O	I	O	O	I or O	I or O	I or O	I or O	I or O	I or O	I or O	I or O
Defrost	O	O	I	O	O	I or O	I or O	O	I or O	I or O	I or O	I or O	I or O
STANDBY MOTOR OPERATION													
Cooling	I	O	I	O	O	I or O	O	I or O	O	I or O	I or O	O	I or O
Off cycle	I	O	I	O	O	O	O	O	O	O	O	O	O
Heating	I	O	I	O	O	I or O	I or O	I or O	I or O	I or O	I or O	I	I or O
Defrost	I	O	I	O	O	I or O	I or O	O	I or O	I or O	I or O	I or O	I
I = Output is ON; O = Output is OFF													

4.1.3 Logic

Supra 950MT units are equipped with an 05G compressor with one unloader for capacity control. The capacity-controlled cylinders are easily identified by the solenoid, which extends from the side of the cylinder head. When the solenoid is energized, two cylinders are unloaded (operating with no pressure differential) and absorbed power decreases. A de-energized solenoid reloads the cylinders. There are two modes of operation for the unloader − temperature control and suction pressure control.

a. Temperature Control

Operation is similar to the standard microprocessor units, except that additional states are present based on the number of loaded cylinders. Refer to **Figure 4.1** and **Figure 4.4**.

Unloader: The microprocessor will unload two cylinders by energizing unloader relay UFR, which controls the unloader solenoid. During truck diesel operation, the compressor is limited to four cylinders whenever a compartment is using electric heat.

b. Suction Pressure Operation

The microprocessor monitors the suction pressure of the refrigeration system and controls the unloader to maintain a maximum operating pressure based on this value (via a pressure transducer). The unloader is energized during engine or standby motor start.

4.1.4 Relay Operation

a. ENGINE Mode

Automatic Start:

Run relay is energized.

Diesel/Electric relay (DER) receives input from the motor contactor (N2) and the microprocessor:

- Run/Stop solenoid is activated in RUN position
- Fuel pump is energized
- Voltage supply to standby motor contactor and subsequent motor start is prevented

Glow plugs are energized via GPR relay and the starter solenoid is energized via SSR relay. The engine will crank for 10 seconds or until engine operation is sensed by the alternator signal (L3). The GPR is de-energized after the auxiliary input is sensed ON. If engine does not start, a 15 seconds null period will elapse before next start attempt. Run relay (RR) is kept energized.

b. STANDBY Mode

Automatic Start:

The DER is energized via N2 output.

- Prevents activation of engine run solenoid and fuel pump
- Standby motor contactor is energized

The RR is energized. Electrical power is supplied to the standby motor for starting.

c. Temperature Control

When a compartment enters COOL mode, the cool relay (CR) is energized, while the hot gas (HGR) and electric heat relays (EHR) are de-energized. This allows refrigerant to flow to the compartment's evaporator.

d. HEAT Mode

When a compartment enters the HEAT mode, it will either use hot gas, run an electric heater, or both. If the compartment is the lead compartment, it will heat with hot gas as long as no other compartment is cooling.

e. NULL Mode

When a compartment enters the NULL mode, the cool, hot gas, and electric heat relays are disabled.

4.1.5 Lead Compartment Decision

As long as the compressor is running, at least one compartment must accept refrigerant or hot gas. The unit may need to override the NULL mode in a compartment to force the compartment to either cool or hot gas heat, depending on the compartment's error offset. The compartment that is overridden is called the lead compartment.

The criteria used to decide which compartment should be lead at any given time is as follows:

If all active compartments are calling for the null mode, then some compartments must be forced to accept flow from the compressor. In this situation, the compartment with the highest set point will be chosen and will become the lead compartment.

4.1.6 Pulse Sequence

There is a sequence available for each compartment to use either pulse heating or cooling. A 30-second period is divided into three 10-second intervals, one for each compartment. Based on these 10-second intervals, each compartment uses a 50 percent duty cycle, or five seconds of refrigerant flow, followed by five seconds of no refrigerant flow. Following this, there is an additional 20-second period of no refrigerant flow for each compartment and the cycle repeats.

Figure 4.1 Temperature Controller Op Seq (Frozen Range) Controller Set Point Below +10°F (-12°C)

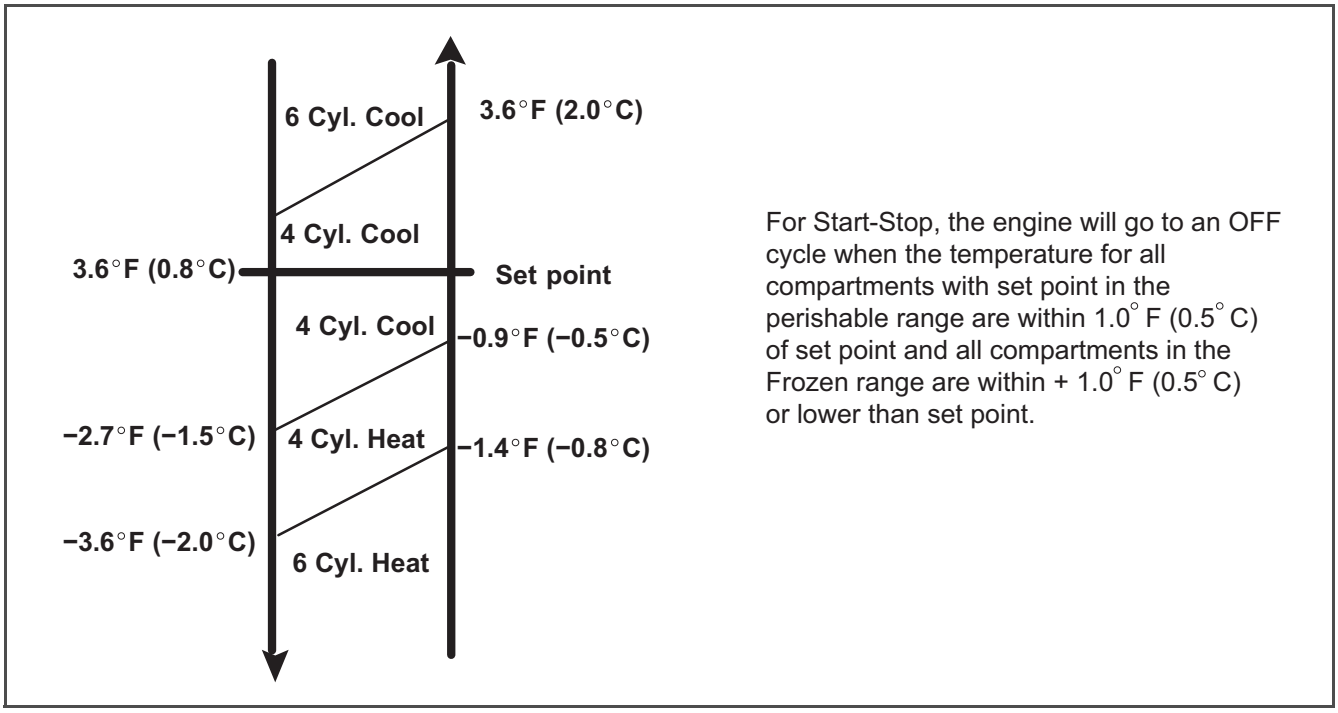


Figure 4.2 Perishable Continuous Mode - Normal (Non-Lead)

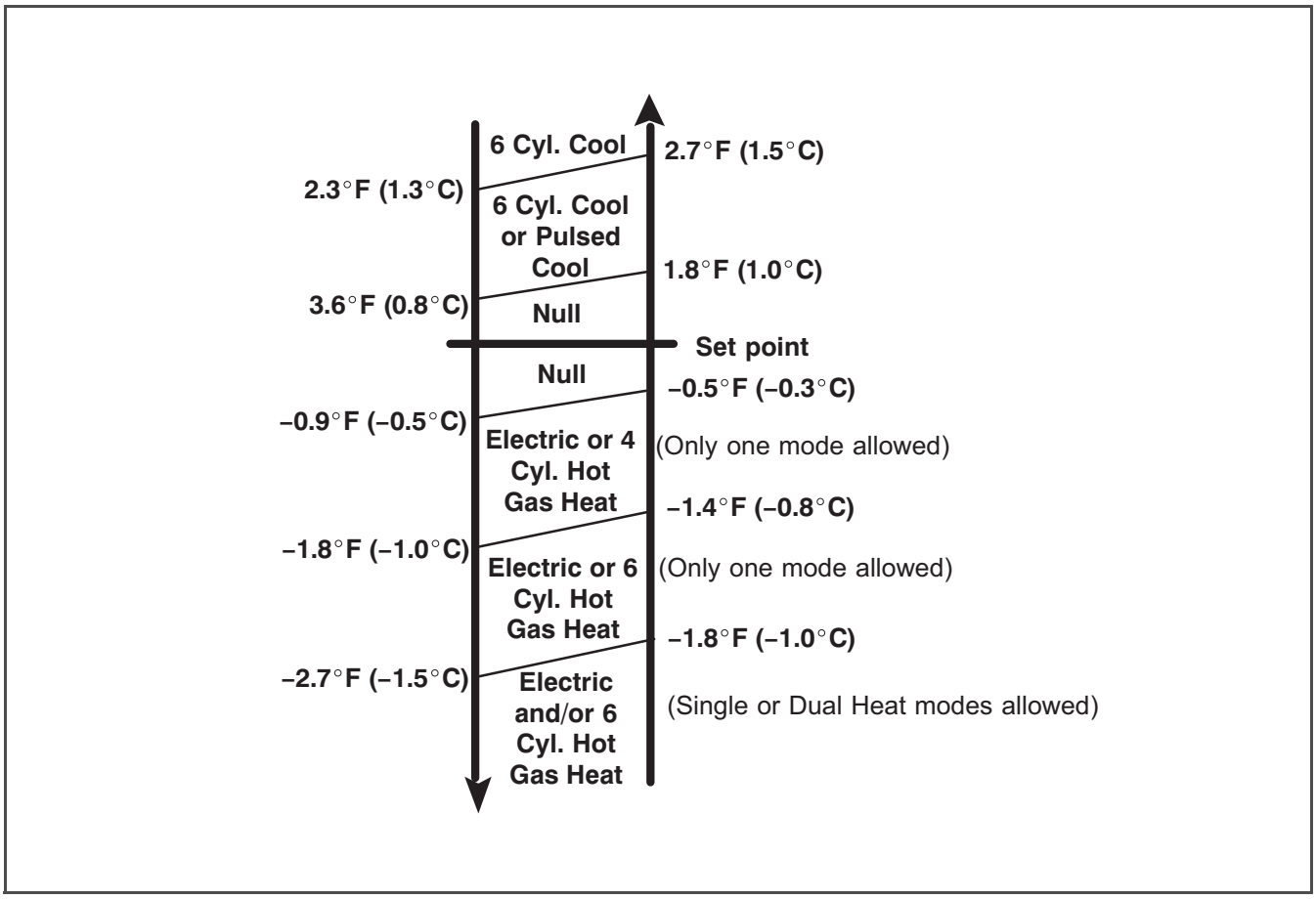


Figure 4.3 Perishable Continuous Mode - Normal (Lead)

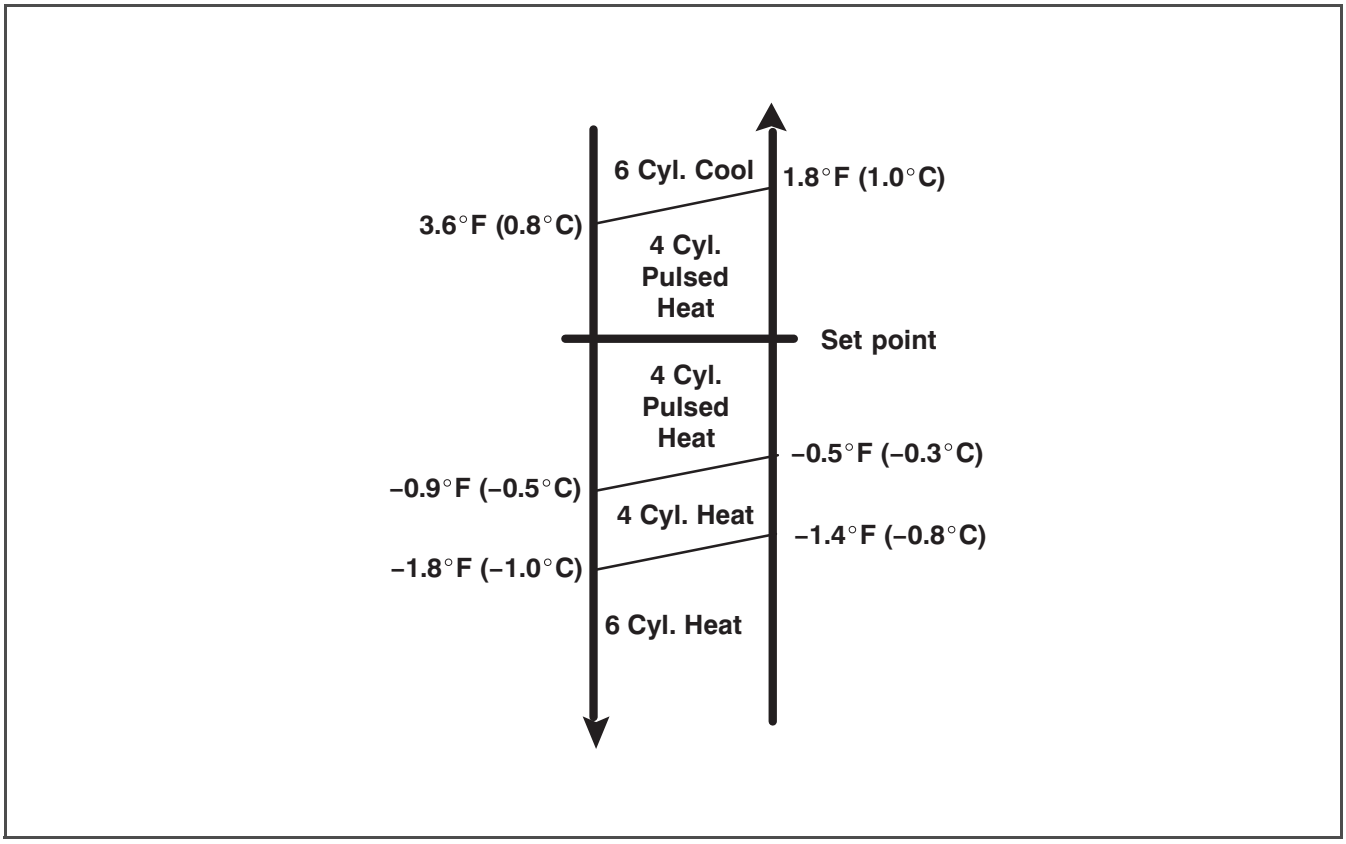
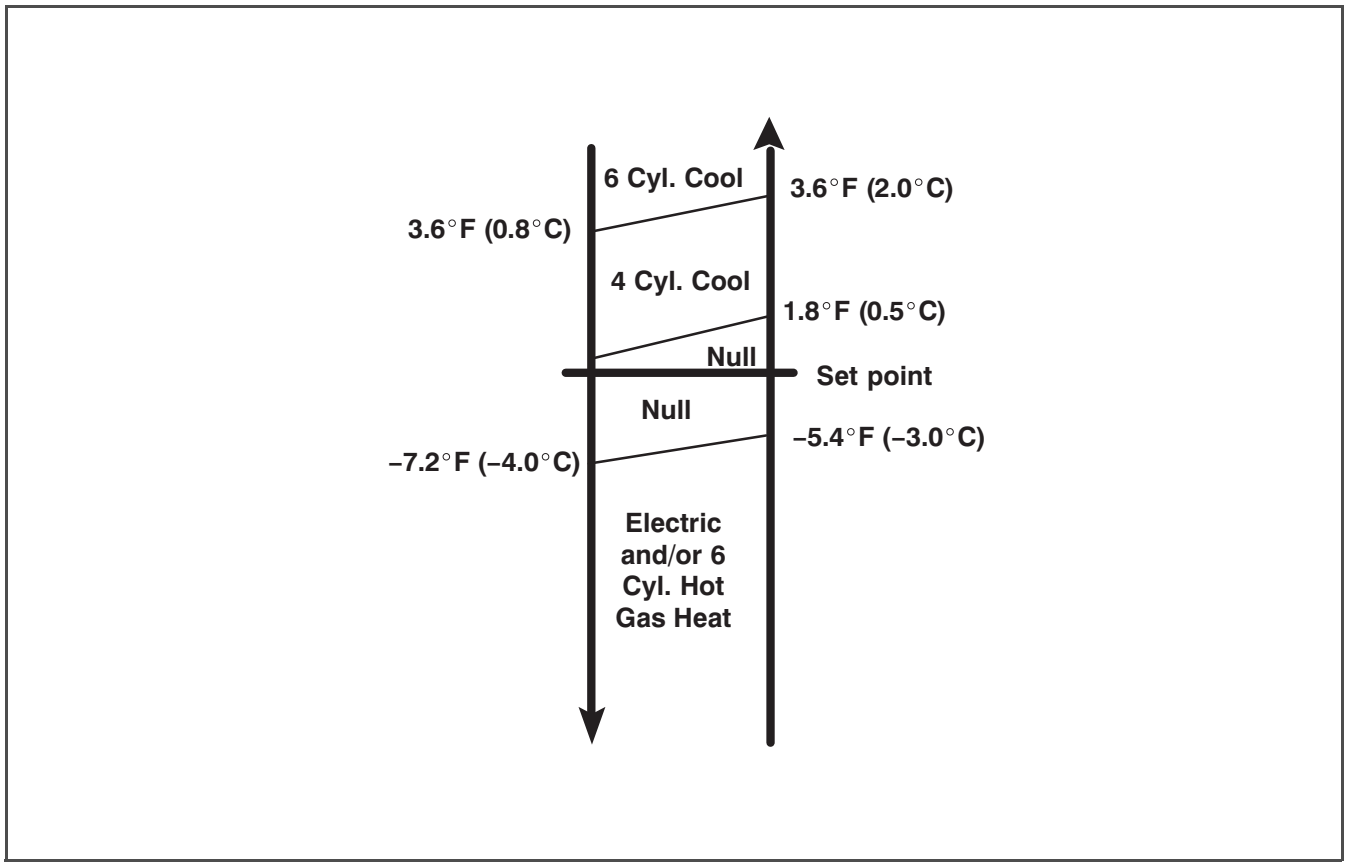


Figure 4.4 Frozen Continuous Mode



SECTION 5
SERVICE

⚠ WARNING

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

⚠ CAUTION

In units with R404A and POE oil, the use of inert gas brazing procedures is mandatory, otherwise compressor failure will occur. See Technical Procedure 98-50553-00 Inert Gas Brazing for more information.

NOTE

To avoid damage to the earth's ozone layer, always use a refrigerant recovery system when removing refrigerant. When working with refrigerants, you must comply with all local government environmental laws, U.S.A. EPA section 608.

5.1 MAINTENANCE SCHEDULE

Filter Type	Required Service					
Petroleum oil without bypass oil filter	A	B	C	BD	BE	F1/F2
Hours	250	1000	1500	2000	3000	6000/12000
Synthetic oil without bypass oil filter	A	C	BD	E	B	B/F1/F2
Hours	250	1500	2000	3000	4000	6000/12000

5.1.1 Oil Change Intervals

Oil Type	Intervals
Petroleum*	1000 Hours
Synthetic**	2000 Hours
* Maximum oil drain interval is one year (12 months). ** Mobil Delvac1 is the only approved synthetic oil. Maximum oil drain interval is two years. Oil filter change required once a year (every 12 months).	

Table 5–1 Service Category Descriptions

Service A	1. Check engine cooling system. 2. Check and clean air filter. 3. Check all belts. 4. Check all hardware and unit mounting bolts for tightness. Tighten as required.
Service B	1. Change lube oil and filter(s). 2. Check engine cooling system. 3. Check and clean air filter. 4. Check all belts.
Service C	1. Check fuel pump filter. 2. Replace air filter cartridge. 3. Check battery terminals and fluid level. 4. Check compressor oil level. 5. Check alternator brushes. Check in accordance with diesel hours PLUS stand-by hours. 6. Check engine thermostat for proper operation. 7. Check defrost: • Check timer setting and function • Check refrigerant control valves for proper operation • Check that fans stop • Check that defrost ends automatically • Check water drainage from evaporator 8. Check fan motor brushes. 9. Check and adjust rocker arms. 10. Replace belts as necessary.
Service D	1. Replace oil filter. 2. Clean radiator and condenser. 3. Check refrigerant level.
Service E	1. Change fan motor brushes. 2. Check and rebuild alternator. 3. Check engine speed: High: 2200-2250; Low: 1800-1850
Service F1 (Std. Coolant) F2 (Ext. Life Coolant)	1. Check all belt tension pulley bearings. 2. Change antifreeze and flush cooling system.* 3. Check bearings in clutch and electric motors. 4. Clean and adjust fuel injectors.**

NOTES:

* Do not mix standard coolant/antifreeze and extended life coolant/antifreeze. Verify coolant prior to adding any “make-up” coolant/antifreeze.

** Refer to the engine manual for correct procedure and settings.

5.2 SERVICING ENGINE-RELATED COMPONENTS

5.2.1 Cooling System

The condenser and radiator can be cleaned at the same time. The radiator must be cleaned internally as well as externally to maintain adequate cooling.

The condenser and radiator are incorporated into a single assembly. The condenser fans draw the air through the condenser and radiator coil. To provide maximum air flow, the condenser fan belt should be checked periodically and adjusted if necessary to prevent slippage.

⚠ CAUTION

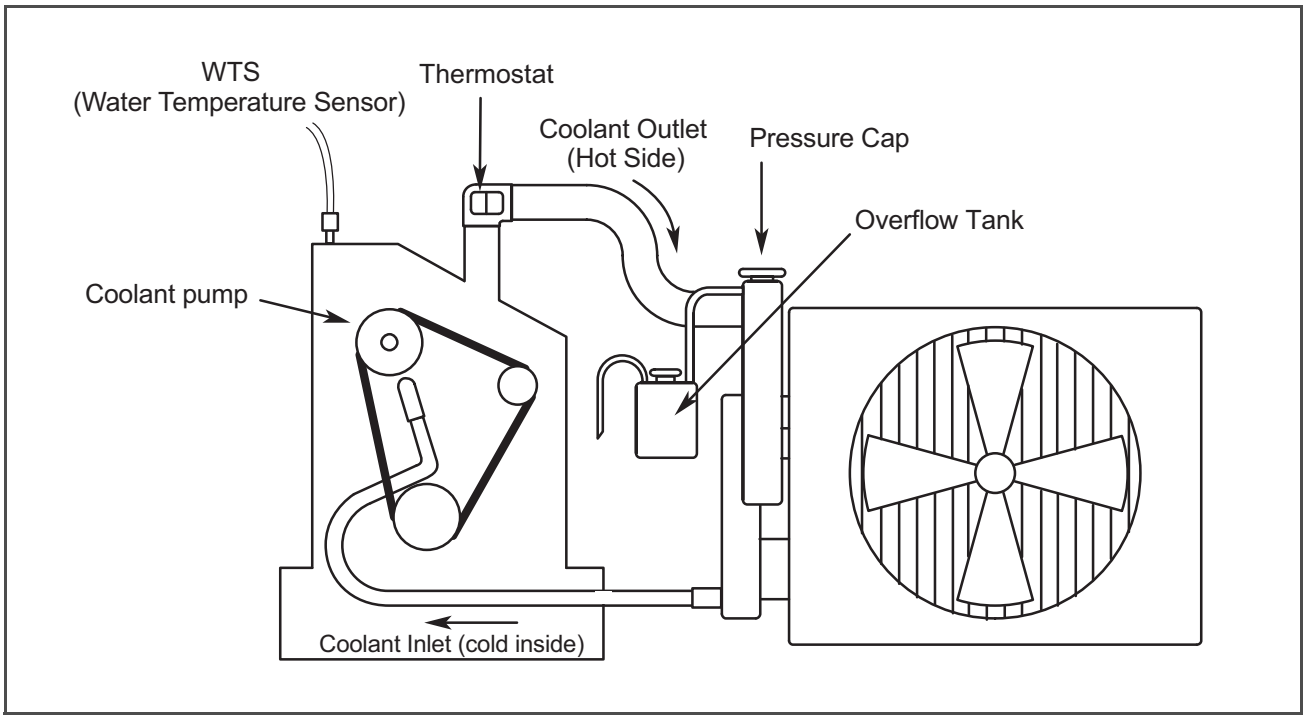
Use only ethylene glycol antifreeze (with inhibitors) in system as glycol by itself will damage the cooling system. Always add pre-mixed 50/50 antifreeze and water to radiator/ engine. Never exceed more than a 50 percent concentration of antifreeze. Use a low silicate antifreeze.

1. Remove all foreign material from the radiator/condenser coil by reversing the normal air flow (Air is pulled in through the front and discharges over the standby motor). Compressed air or water may be used as a cleaning agent. It may be necessary to use warm water mixed with any good commercial dish washer detergent. Rinse coil with fresh water if a detergent is used.
2. Drain coolant by removing the lower radiator hose and radiator cap.
3. Install the hose and fill system with clean, untreated water to which three to five percent of an alkaline based radiator cleaner should be added (six ounces - dry 151 grams to one gallon = 3.78 liters) of water.
4. Run the engine 6 to 12 hours and drain the system while warm. Rinse system three times after it has cooled down. Refill system with water.
5. Run the engine to operating temperature. Drain the system again and fill with treated water/antifreeze.

NOTICE

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

Figure 5.1 Cooling Circuit



b. Replacing Coolant

⚠ WARNING

Coolant is an acid base liquid and harmful for human contact. Wear proper protective gear: chemical-safe gloves and eye protection when working with refrigerant. Allow time for coolant to cool and for pressure to release before the cap is removed from the radiator.

1. Drain coolant by removing lower radiator hose and radiator cap.

NOTE

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

2. Install hose and fill system with clean, untreated water to which any proprietary radiator cleaner should be added (six ounces - dry 151 grams to one gallon = 3.78 liters) of water.
3. Run engine for the time recommended by the cleaner product used and drain system while warm.
4. Rinse system three times after it has cooled down. Refill system with water.
5. Run engine to operating temperature. Drain system again and fill with treated water/antifreeze.

c. Checking Radiator Operation

1. Visually check the cooling system, especially the hose between radiator and coolant bottle.
2. Verify coolant level inside the radiator and top off if necessary.
3. Power up the unit.
4. Run engine to operating temperature until coolant level in coolant bottle increases (flow from the radiator to the coolant bottle).
5. Stop the unit and verify that coolant decreases inside the coolant bottle (flow from the coolant bottle to the radiator).

5.2.2 Changing Lube Oil and Lube Oil Filters

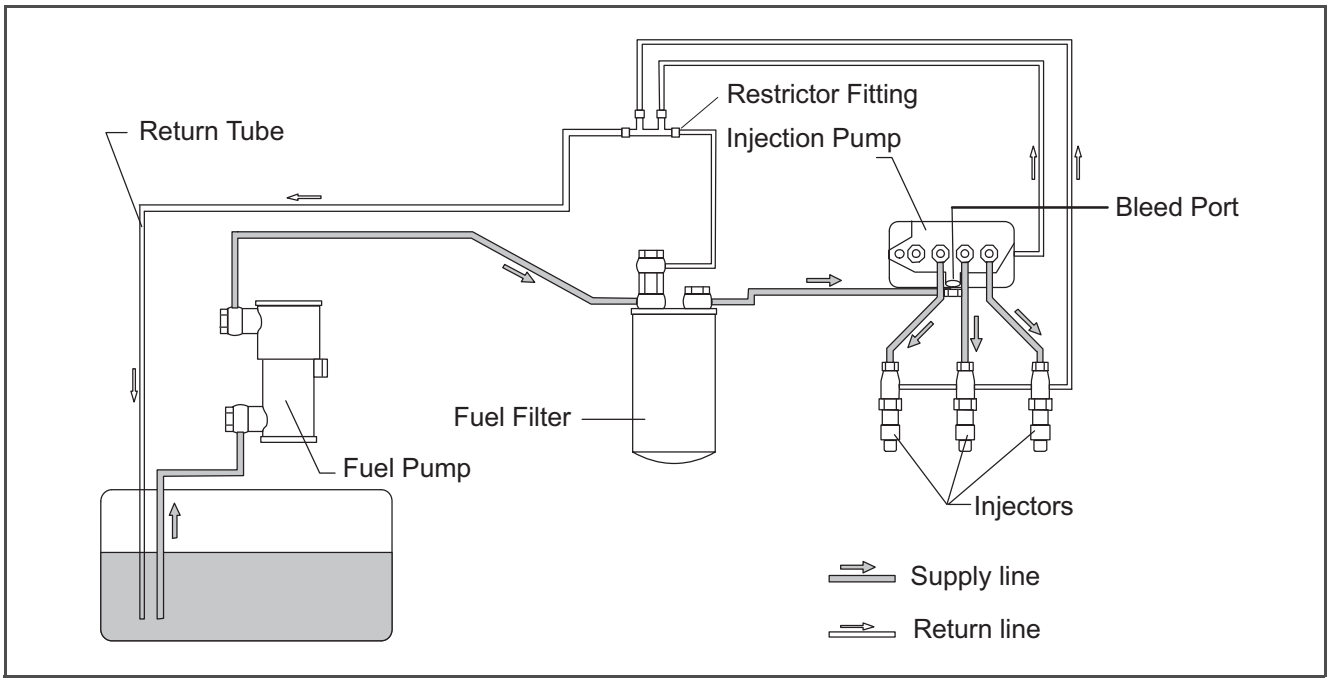
After warming up the engine, stop the engine, remove drain plug from oil reservoir, and drain engine lube oil.

⚠ CAUTION

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

Replace filter(s), lightly oil gasket on filter before installing, and add lube oil (refer to **Section 2.7.1** and **Section 5.5**). Warm up engine and check for leaks.

Figure 5.2 Fuel Filter and Fuel Circuit



a. Checking Fuel Circuit

1. The engine must run with the bleed port slightly unscrewed. This indicates that injection pump pressure is greater than 0.1 bars. If not, check for air leakages and clean fuel lines.
2. The electrical pump is designed to deliver 0.7 bar. The fuel circuit flow rate in the return line is about five liters per hour.

b. Changing Fuel Filter

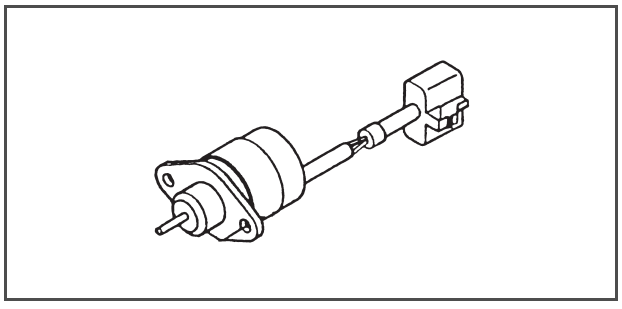
After changing fuel filter, operate the electrical pump to properly bleed the fuel circuit before engine start.

⚠ CAUTION

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

5.2.3 Replacing Solenoid

a. Dual Hold & Pull Coil Solenoid



During start sequence, hold coil is energized. When starter is engaged, pull coil is energized. After engine start (max 10s) - stater disengaged - pull coil is de-energized. Hold coil is kept energized

See **Section 5.10.2** for solenoid coil replacement procedure.

5.2.4 Engine Air Cleaner

a. Inspection

The air cleaner, hose, and connections should be inspected for leaks or fractures in the inlet and outlet hoses. A damaged air cleaner or hose can seriously affect the performance and life of the engine. If housing has been dented or damaged, check all connections immediately.

b. Air Filter Service Procedure

Stop engine, remove air filter, and install new air filter.

5.2.5 Servicing Fuel Pump

a. To check or to replace fuel pump:

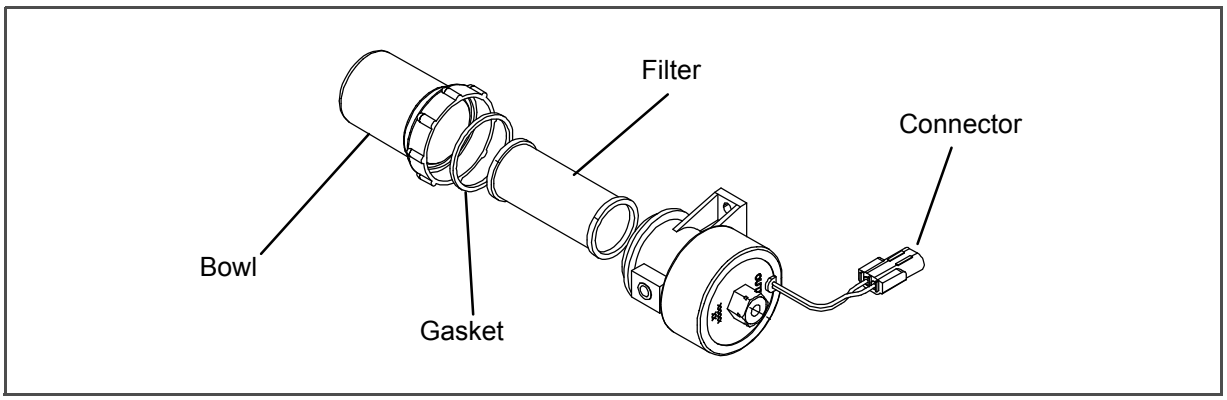
1. Remove three screws from cover (refer to **Figure 5.3**).
2. Remove cover, gasket, and filter.
3. Wash filter in cleaning solvent and blow out with air pressure. Clean cover.

⚠ WARNING

Protect your eyes carefully from solvent by wearing chemical-safe goggles.

4. Reverse above steps to install.

Figure 5.3 Electric Fuel Pump



b. To Verify Fuel Pump Capacity:

1. Remove fuel pump from the system. Connect the evacuation manifold to pump outlet. Energize fuel pump with a small quantity of fuel.
2. At zero flow, the fuel pump should provide about 0.7 bar of pressure at the pump outlet.
3. When running correctly, the fuel pump generates noise according to pulsation of the inner piston.

5.2.6 Servicing Glow Plugs

The CT3.69TV engine has fast glow plugs, which take 45 seconds to reach 1,472° F (800° C) under 11 VDC.

In the case of fast burn of glow plugs, verify that micro configuration is correct - TV for all engine types.

When servicing, the glow plug must be fitted carefully into the cylinder head to prevent damage to the glow plug. Torque value for the glow plug is 0.8 to 1.5 mkg (6 to 11 ft-lb).

Checking for a Defective Glow Plug

To check for a defective glow plug, place an ammeter (or clip-on ammeter) in series with each glow plug and energize the plugs. If good, each plug should show amperage draw. A good plug draws 8 to 10 amps.

5.2.7 Testing Flash Relay Circuit

⚠ WARNING

You must lockout/tagout the starter and standby receptacle prior to performing this procedure.

1. Disconnect the three capacitors that are connected to the three phases as these will change the readings for some of the tests. Do not reconnect the capacitors until testing is complete. Inspect and tighten all connections at the contactor, overload, standby motor, and fuse block before proceeding with this test procedure. The unit must be turned off at the end of each test and turned back on at the beginning of the next test.

NOTE

Prior to unit serial number MFY91192543, the buzzer and flash circuit will energize at the same time. For unit serial number MFY91192543 and later, the flash circuit will energize before the buzzer sounds and will drop out when the buzzer sounds.

2. The unit will energize the flash circuit for five seconds while the microprocessor performs a self-test or while the buzzer is sounding, depending on the serial number range of the unit.
3. Place a DC AMP clamp on the T2 wire between the motor overload and the standby motor. With the flash circuit energized there should be approximately 1.5 to 2.5 amps.
4. Check the VDC at the T2 wire between the motor overload and the standby motor. With the flash circuit energized there should be approximately 0.5 to 0.9 VDC.

   If the amp readings and voltage readings are within specs, the flash circuit is functioning. If not, continue with the rest of the test procedure.

NOTE

A meter with low resolution and/or slow reaction speed may affect the ability to read the amperage.

5. Remove fuse 28.
6. With the flash circuit energized, connect a VDC meter between ground and terminal (B) of fuse 28 (fuse removed). This tests the voltage going to the shunt. There should be battery voltage.
7. Install fuse 28.
8. With the flash circuit energized, connect a VDC meter between ground and terminal (B) of fuse 28 (fuse installed). This tests the voltage going to the shunt. There should be 0.5 to 0.9 VDC.
9. Remove fuse 33.
10. With the flash circuit energized, place the VDC meter between the ground and terminal (A) of fuse 33 (with fuse removed). This tests the voltage from the shunt through the standby motor. There should be battery voltage.
11. With the unit off, check for continuity between terminal (B) of fuse 33 and the ground stud. There should be very low resistance.
12. Reinstall fuse 33.
13. Reconnect the three capacitors connected to the three phases.
14. Remove Lockout/Tagout of the starter.
15. Verify that the unit operates correctly.

5.2.8 Clutch Control

a. Engagement Speed

The clutch is designed to engage around 900 rpm. This engagement speed will increase with shoe wear. It is crucial to replace shoes before engagement speed reaches around 1600 rpm to avoid clutch burnout.

b. Shoe Wear

1 Observe clutch housing to check for any discoloration of the metal surface, which is a sign that the clutch has overheated. If this is the case, check the condition of the shoes.

2 Remove clutch cover plate, and using a mirror, observe shoe condition and lining material thickness. If thickness is less than 1 mm, replace shoes.

5.2.9 Servicing Alternator

Inspection

Verify tightness of connections especially for the excitation wire. If disconnected, the unit will display ALT AUX and battery will not reload during unit operation. Check at 1500 hours or next service interval.

Brushes (every 5,000 hours)

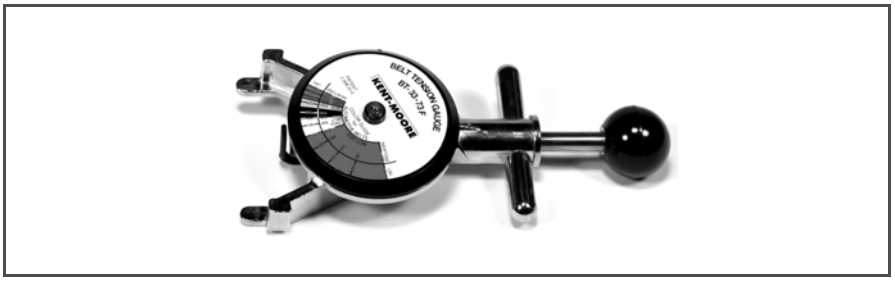
- Ensure battery terminals and alternator exciting cable are disconnected
- Remove the two screws holding the regulator
- Replace the brushes
- Reassemble the regulator

5.3 SERVICING AND ADJUSTING V-BELTS WARNING

Beware of unannounced starting of the fans and V-belts caused by the thermostat and the start/stop cycling of the unit that may start automatically.

5.3.1 Belt Tension Gauge

Figure 5.4 Belt Tension Gauge (Part Number 07-00203-00)



A belt tension gauge (P/N 07-00203-00), as shown in **Figure 5.4** is recommended for use whenever V-belts are adjusted or replaced. Check belt tension at midpoint of longest span between two pulleys.

NOTE

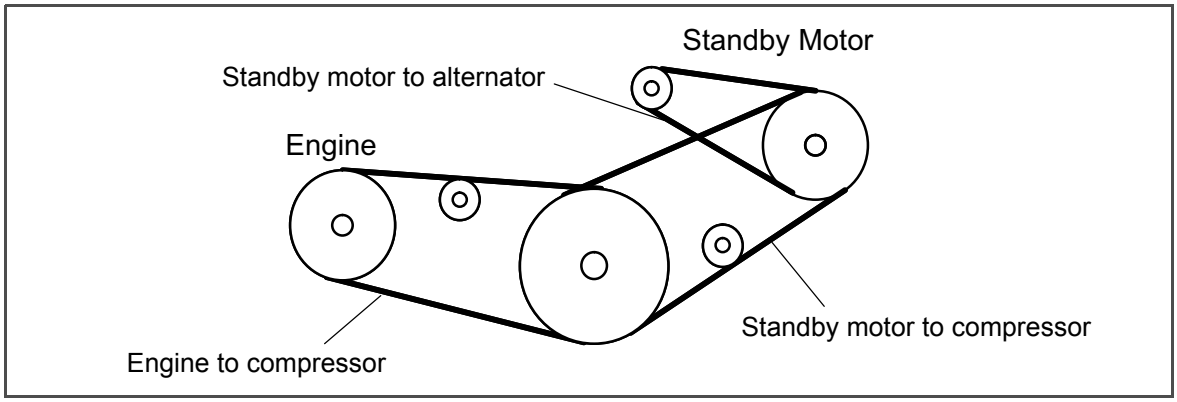
Make sure the belt drive is static (not in motion).

Table 5–2 Belt Tension

Belt	New ft. lbs. (Nm)	Running ft. lbs. (Nm)
Engine/Compressor	100-120	80-90
Motor/Compressor	(135-162)	(108-122)
Alternator	40-50 (54-68)	
Water Pump Belt	30-50 (41-68)	

5.3.2 Trapezoidal V-belt

Figure 5.5 V-belt Arrangement



5.3.3 Alternator Belt

a. Make sure the negative battery terminal is disconnected.

b. Tension is done by rotating the alternator around its pivot.

5.3.4 Water Pump V-Belt

⚠ WARNING

Beware of moving poly V-Belt.

⚠ WARNING

When working with belts, beware of pinch points.

The water pump v-belt is driven by a sheave on the engine crankshaft. Frayed, cracked or worn belts must be replaced. This belt requires no tension adjustment.

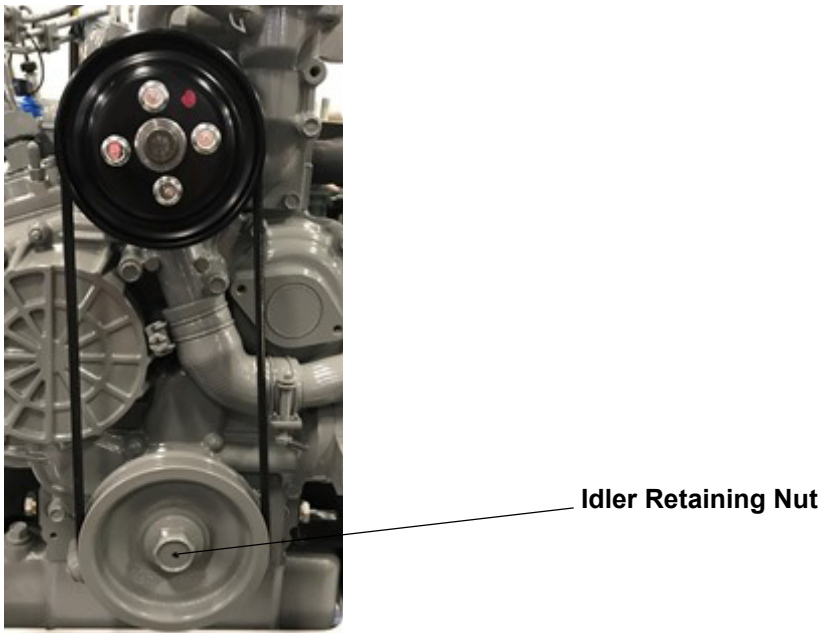
To Replace the Poly V-belt:

a. Ensure the unit will not start automatically by disabling any two way communication and placing the RUN/STOP switch in the OFF position. Disconnect the high voltage source and lockout/tagout the receptacle.

b. Using the proper size socket, slowly rotate the crank by turning the crank pulley nut. At the same time, use a flat, blunt object to guide the belt of the crank pulley. Be careful not to damage grooves on the pulley.

c. Replace the poly V-belt by positioning the belt on the water pump pulley, and while rotating the engine, use a flat, blunt object to guide the belt onto the crank pulley. Be careful not to damage grooves on the pulley or belt.

Figure 5.6 Water Pump Belt - Idler Retaining Nut



5.3.5 Standby Motor - Compressor V-belt Diesel Engine - Compressor V-belt

Tension is realized by moving idler pulley:

- UPWARDS (Engine/Compressor)
- DOWNWARDS (Standby/Compressor)

5.4 PUMPING DOWN THE UNIT OR REMOVING REFRIGERANT CHARGE

NOTE

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

5.4.1 Pumping Down the Unit

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

a. Close (backseat) suction and discharge service valve (turn counterclockwise) to close off gauge connection and attach manifold gauges to valves.

b. Open valves two turns (clockwise) and purge gauge line.

c. Close the receiver outlet (king) valve by turning clockwise. Start unit and run in high-speed cooling. Place the RUN/STOP switch in the STOP position when unit reaches 1 psig (0.1 kg/cm).

d. Frontseat suction service valve and the refrigerant is trapped between the compressor suction service valve and the manual shutoff (king) valve.

e. Before opening up any part of the system, a slight positive pressure should be indicated on the pressure gauge.

f. When opening up the refrigerant system, certain parts may frost. Allow the part to warm to ambient temperature before dismantling. This avoids internal condensation which puts moisture in the system.

g. Open (backseat) king valve and midseat suction service valve.

h. Leak check connections with a leak detector.

i. Start the unit in cooling and check for noncondensibles.

j. Check the refrigerant charge (refer to **Section 5.7.2**).

NOTE

If the system must be opened between the compressor discharge valve and receiver, store the refrigerant charge in an evacuated container. Whenever the system is opened, it must be evacuated and dehydrated (refer to **Section 5.6**)

5.4.2 Removing the Refrigerant Charge

Connect a refrigerant recovery system to the unit to remove refrigerant charge. Refer to instruction provided by the manufacturer of the refrigerant recovery system.

5.5 LEAK CHECKING THE UNIT

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

a. Use an electronic leak detector to find leaks in the system. Testing joints with soapsuds is satisfactory only for locating large leaks.

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

NOTE

It must be emphasized that only the correct refrigerant cylinder be connected to pressurize the system. Any other gas or vapor will contaminate the system, which will require additional purging and evacuation of the high side (discharge) of the system.

c. Remove refrigerant using a refrigerant recovery system and repair any leaks. Evacuate and dehydrate the unit (refer to **Section 5.6**). Charge unit with refrigerant (refer to **Section 5.7**).

5.6 EVACUATION AND DEHYDRATION

5.6.1 General

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

5.6.2 Preparation

a. Evacuate and dehydrate only after pressure leak test (refer to **Section 5.5**).

b. Essential tools to properly evacuate and dehydrate any system include a good vacuum pump (5 cfm = 8m-H volume displacement, P/N 07-00176-01) and a good vacuum indicator such as a thermocouple vacuum gauge (vacuum indicator).

NOTE

The use of a compound gauge is not recommended due to its inherent inaccuracy.

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

5.6.3 Procedure for Evacuating and Dehydrating System

a. Remove refrigerant using a refrigerant recovery system.

b. The recommended method to evacuate and dehydrate the system is to connect three evacuation hoses as shown in **Figure 5.7** to the vacuum pump and refrigeration unit (see note). Also, as shown, connect an evacuation manifold, with evacuation hoses only to the vacuum pump, electronic vacuum gauge, and refrigerant recovery system.

NOTE

Do not use standard service hoses, as they are not suited for evacuation purposes.

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

d. Midseat the refrigerant system service valves.

e. Open the vacuum pump and electronic vacuum gauge valves, if they are not already open. Start the vacuum pump. Evacuate unit until the electronic vacuum gauge indicates 2000 microns.

f. Close the electronic vacuum gauge and vacuum pump valves. Shut off the vacuum pump. Wait a few minutes to be sure the vacuum holds.

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

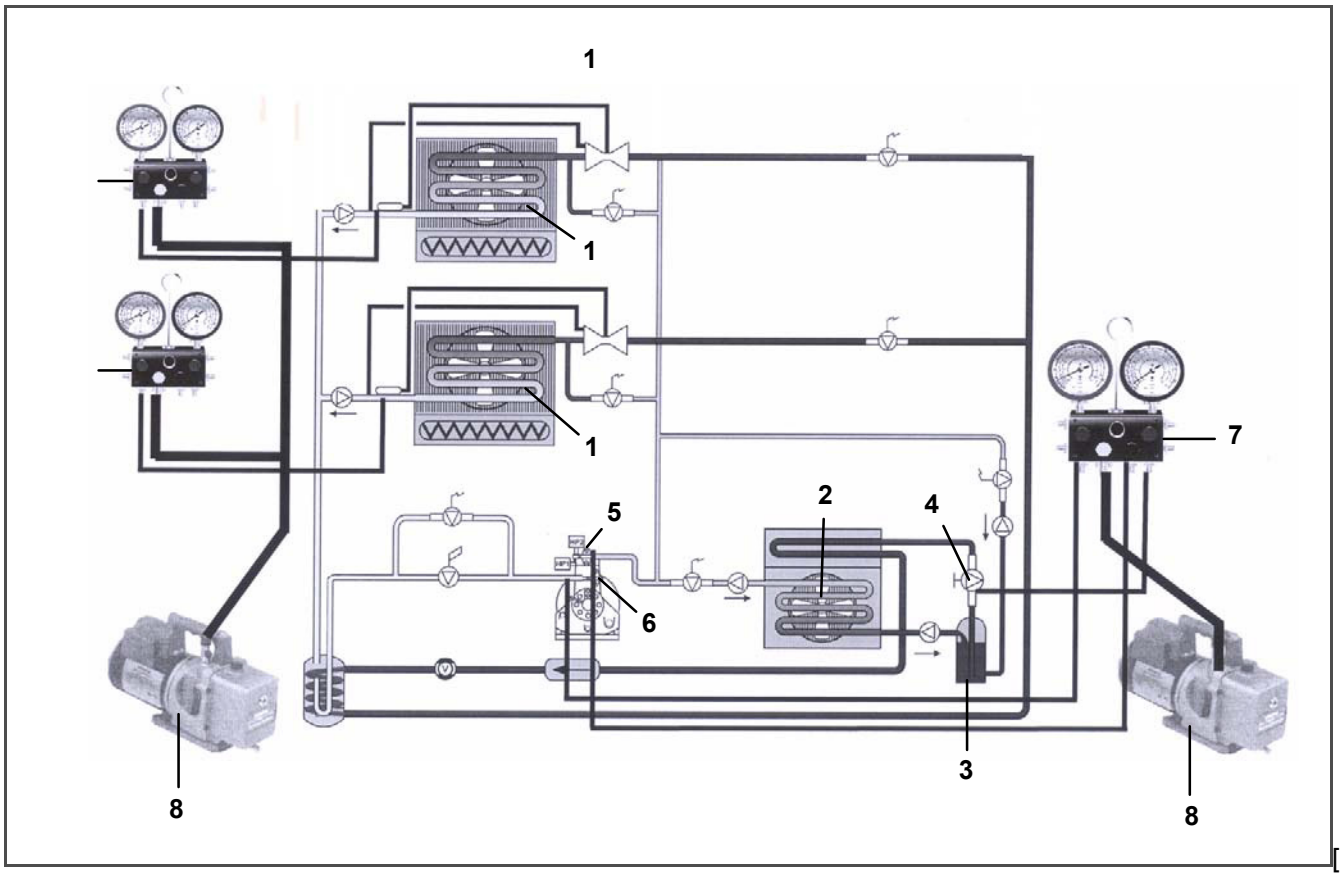
h. Remove refrigerant using a refrigerant recovery system.

i. Repeat steps e. through g. one time.

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

k. With a vacuum still in the unit, the refrigerant charge may be drawn into the system from a refrigerant container on weight scales. The correct amount of refrigerant may be added by observing the scales (refer to **Section 5.7**).

Figure 5.7 Dual Vacuum Pump Connections



1. Evaporator Coil
2. Condenser Coil
3. Receiver
4. King Valve
5. Discharge Service Valve
6. Suction Service Valve
7. Evacuation Manifold
8. Vacuum Pump
9. Vacuum Meter

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5.7 CHARGING THE REFRIGERANT SYSTEM

5.7.1 Installing a Complete Charge

a. Dehydrate unit and leave in deep vacuum (refer to **Section 5.6**).

b. Place refrigerant cylinder on scale and connect charging line from cylinder to receiver outlet (king) valve. Purge charging line at outlet valve.

c. Note weight of refrigerant cylinder.

d. Open liquid valve on refrigerant cylinder. Open king valve halfway and allow the liquid refrigerant to flow into the unit until the correct weight of refrigerant has been added as indicated by scales. See the following section for checking refrigerant charge. Correct charge data is found in **Table 2–2**.

NOTE

It is possible that all liquid may not be pulled into the receiver, as outlined in step d.

e. When refrigerant cylinder weight (scale) indicates that the correct charge has been added, close liquid line valve on cylinder and backseat the king valve.

5.7.2 Checking the Refrigerant Charge

Start unit in COOLING mode and run for approximately ten minutes. Partially block off air flow to condenser coil so discharge pressure rises to 210 psig (14.8 kg/cm). The unit is correctly charged when the lower receiver sight glass is full and no refrigerant is in the upper receiver sight glass.

5.8 REPLACING THE COMPRESSOR

a. Removing the Compressor

If compressor is inoperative and unit still has refrigerant pressure, frontseat suction and discharge service valves to trap most of the refrigerant in the unit. If compressor runs, pump down the unit (refer to **Section 5.4**).

1. Slowly release compressor pressure to a recovery system.
2. Remove bolts from suction and discharge service valve flanges.
3. Disconnect wiring to Compressor Discharge Temperature sensor (CDT), Suction Pressure Transducer (SPT), the wiring to the High Pressure switch (HP) as necessary.
4. Release idler pulleys and remove belts. Then remove the compressor from chassis.
5. Remove the pulley from the compressor.
6. Drain oil from defective compressor before shipping.

b. Installing the Compressor

1. To install the compressor, reverse the procedure outlined for removing the compressor.

NOTE

The service replacement compressor is sold without shutoff valves, but with blank off valve pads (cast iron plates with bolts). These bolted plate pads are used to cover the suction and discharge valve locations to keep the compressor sterile during shipment and until it is ready for replacement during the procedure.

The Customer should retain the original service valves for use on the new replacement compressor. The blank off valve pads coming in on the new replacement are retained and used on the failed compressor shipping for service. It is still important to keep the interior of the compressor going to service as clean as possible.

Check oil level in service replacement compressor (refer to **Section 5.9**).

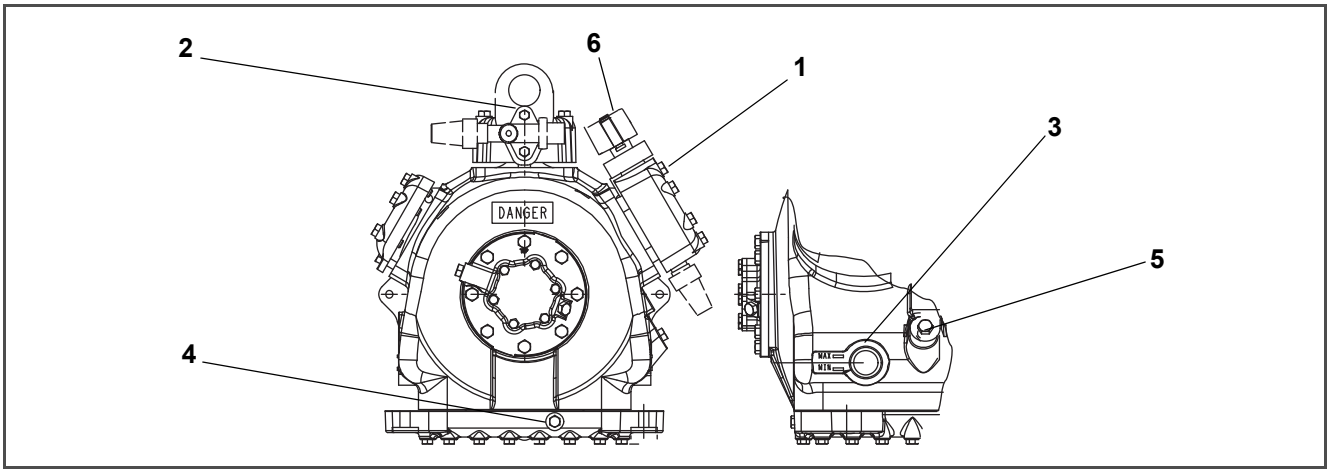
2. Attach two lines (with hand valves near vacuum pump) to the suction and discharge service valves. Dehydrate and evacuate compressor to 500 microns (29.90” Hg vacuum = 75.9 cm Hg vacuum). Turn off valves on both lines to pump.
3. Fully backseat (open) both suction and discharge service valves.
4. Remove vacuum pump lines and install manifold gauges.
5. Check refrigerant level (Refer to **Section 5.7.2**).

NOTE

It is important to check the compressor oil level of the new compressor and fill if necessary.

6. Check compressor oil level (refer to **Section 5.9**). Add oil if necessary and check refrigerant cycles.

Figure 5.8 Compressor (05G)



1. Suction Service Valve
2. Discharge Service Valve
3. Oil Level Sight Glass
4. Oil Drain Plug
5. Oil Fill Plug
6. Unloader Assembly

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5.9 COMPRESSOR OIL LEVEL

5.9.1 Checking Oil Level in 05G Compressor

a. Operate the unit in high-speed cooling or heating for a run time of at least 20 minutes.

b. Check the oil sight glass on the compressor to ensure that no foaming of the oil is present after 20 minutes of operation. If the oil is foaming excessively after 20 minutes of operation, check the refrigerant system for flood-back of liquid refrigerant. Correct this situation before performing step 3.

c. Check the level of the oil in the front sight glass with the compressor operating. The correct level should be between the bottom and one-quarter of the sight glass. If the level is above one-quarter, oil must be removed from the compressor. To remove oil from the compressor, follow step d. If the level is below sight glass, add oil to the compressor following **Section 5.9.2**.

5.9.2 Adding Oil with Compressor in System

There are two methods for adding oil − the oil pump method and the closed system method.

a. Oil Pump Method

While Carrier does not provide an oil pump with the 950MT, there are a number of commercially-available pumps, including a Robinair refrigerant oil pump (part number 14388), that can be used. This 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 suction service valve port. Also, there is no need to remove pump from the can after each use.

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

1. Backseat the suction service valve and connect oil charging hose to port.
2. Crack the service valve and purge the oil hose at oil pump.
3. Add oil as necessary.

b. Closed System Method

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

⚠ CAUTION

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

1. Connect the suction connection of the gauge manifold to the compressor suction service valve port, and immerse the common connection of the gauge manifold in an open container of refrigeration oil.
2. Crack the suction service valve and gauge valve to vent a small amount of refrigerant through the common connection and the oil to purge the lines of air.
3. Close the gauge manifold valve.
4. With the unit running, frontseat the suction service valve and pull a vacuum in the compressor crankcase.
5. Slowly crack the suction gauge manifold valve and oil will flow through the suction service valve into the compressor. Add oil as necessary.

5.9.3 Adding Oil to Service Replacement Compressor

Service replacement compressors may or may not be shipped with oil.

If compressor is without oil:

Add correct oil charge by removing the oil fill plug (Refer to **Section 2.7.4**, **Section 5.7.1** and **Section 5.7.2**; see **Figure 5.8**).

5.9.4 Removing Oil from the Compressor

a. Close suction service valve (frontseat) and pump unit down to 2 to 4 psig (0.1 to 0.3 kg/cm). Frontseat discharge service valve and slowly bleed remaining refrigerant.

b. Remove the oil drain plug from compressor and drain the proper amount of oil from the compressor. Replace the plug securely back into the compressor.

c. Open service valves and run unit to check oil level, repeat as required to ensure proper oil level.

5.10 COMPRESSOR UNLOADER VALVE

The compressor unloader (located on the compressor cylinder head) is controlled by relay UFR and the temperature controller.

5.10.1 Checkout Procedure

a. Connect manifold gauges to the compressor suction and discharge service valves and start unit in cooling with the set point at least 5°F (2.8°C) below box temperature. The compressor will be fully loaded (unloader coil de-energized). Note suction pressure.

b. Increase set point slowly until unloader valve is energized. Use a ferrous material, such as a screw driver to check for a magnetic field on the coil when it is energized. Verify suction pressure rise of approximately 3 psig (0.2 bars).

NOTE

If either unloader coil energizes and the suction pressure does not change, the unloader assembly must be checked.

5.10.2 Solenoid Coil Replacement

NOTE

The coil may be removed without pumping the unit down.

a. Disconnect leads and lift off coil. (see **Figure 5.9**).

b. Verify coil type, voltage, and frequency of old and new coil. This information appears on the coil housing.

c. Place new coil over enclosing tube, retainer, and connect wiring.

5.10.3 Replacing Solenoid Valve Internal Parts

a. Pump down the unit (refer to **Section 5.4**). Frontseat both service valves to isolate the compressor.

b. Remove coil.

c. Remove enclosing tube collar (**Figure 5.9**). using installation/removal tool supplied with repair kit.

d. Check plunger for restriction due to: (a) Corroded or worn parts; (b) Foreign material lodged in valve; (c) Bent or dented enclosing tube.

e. Install new parts. Do not over-tighten enclosing tube assembly. Torque to a value of 100 inch pounds (1.15 mkg).

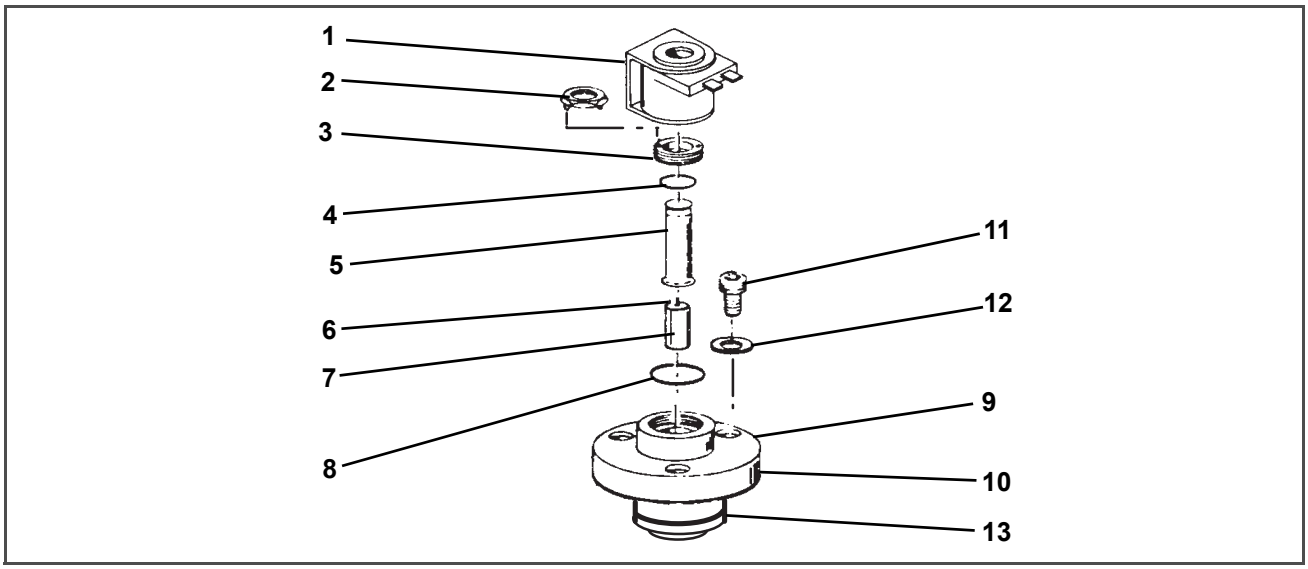
f. Remove supplied installation/removal tool. Install coil, voltage plate.

g. Evacuate and dehydrate the compressor (refer to **Section 5.6.3**).

h. Backseat both service valves and open slowly.

i. Start unit and check unloader operation (refer to **Section 5.10.1**).

Figure 5.9 Unloader Solenoid Valve



1. Coil Assembly
2. Installation/removal tool
3. Enclosing tube Collar
4. O-ring
5. Enclosing tube
6. Plunger spring
7. Plunger assembly
8. Gasket
9. Valve body
10. Gasket
11. Bolt
12. Gasket, bolt
13. Piston ring

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5.11 CHECKING AND REPLACING FILTER DRIER

Two Methods:

To Check Filter Drier

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

To Replace Filter Drier

a. Pump down the unit per **Section 5.4**.

b. Remove bracket, then replace drier.

c. Check refrigerant level (refer to **Section 5.7.2**).

5.12 CHECKING AND REPLACING HIGH PRESSURE CUTOUT SWITCHES (HP1 OR HP2)

5.12.1 Removing High Pressure Switch

The High Pressure switch is located near the top of the compressor.

a. Pump down the unit (refer to **Section 5.4**). Frontseat both suction and discharge service valves to isolate compressor (HP) or discharge and receiver valve.

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

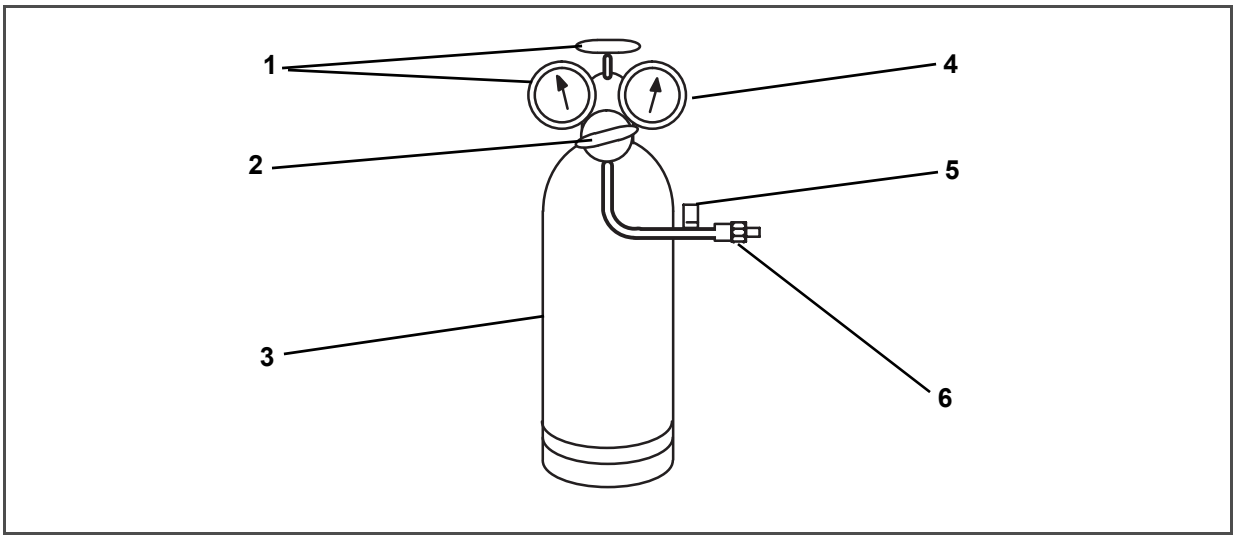
c. Disconnect wiring and remove.

5.12.2 Checking High Pressure Switch

⚠ WARNING

Do not use a nitrogen cylinder without a pressure regulator. Cylinder pressure is approximately 2350 psig (159.9 bar). Do not use oxygen in or near a refrigerant system as an explosion may occur. (See Figure 5.10)

Figure 5.10 Typical Setup for Testing High Pressure Switch



1. Cylinder valve and gauge
2. Pressure regulator
3. Nitrogen cylinder
4. Pressure gauge (0 to 500 psig = 0 to 227 kg/cm^2
5. Bleed-Off valve
6. 1/4 inch connection

- - - - -

a. Remove switch as outlined in **Section 5.12.1**.

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

c. Connect switch to a cylinder of dry nitrogen (see **Figure 5.10**).

d. Set nitrogen pressure regulator higher than cutout point on switch being tested. Pressure switch cutout and cut-in points are shown in **Section 2.7.5**.

e. Close valve on cylinder and open bleed-off valve.

f. Open cylinder valve. Slowly close bleed-off valve and increase pressure until the switch opens. If light is used, light will go out and if an ohmmeter is used, the meter will indicate open. Note the regulator pressure gauge reading, which should agree with the cutout pressure as specified in **Section 2.7.5**.

g. Open pressure on gauge. Slowly open bleed-off valve (to decrease pressure) until switch closes (light will light or ohmmeter will move). Note the regulator pressure gauge reading, which should agree with the cut-in pressure as specified in **Section 2.7.5**.

h. Install new cutout switch after verifying switch settings (refer to **Section 5.6.3**).

i. Evacuate and dehydrate the compressor (refer to **Section 5.6.3**).

5.13 REPLACING RECEIVER SIGHT GLASS ASSEMBLY

NOTE

There are two types of receiver sight glasses; the floating ball type and the prism type. They are interchangeable.

a. Store the refrigerant in an evacuated container (refer to **Section 5.6**).

b. Unscrew the sight glass assembly. Spread sealing compound on pipe threads of new sight glass assembly and install.

c. Leak-check receiver sight glass per **Section 5.5**.

d. After leak checking unit, evacuate and dehydrate as outlined in **Section 5.6**.

e. Add refrigerant charge (refer to **Section 5.7.2**).

f. Check for noncondensibles.

5.14 COIL CLEANING

5.14.1 Evaporator Coil

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

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

After being wet and dried several times, cardboard fiber particles can be very hard to remove. Therefore, several washings may be necessary.

a. Remove rubber check valves (kazoo) from drain lines.

b. Spray coil with a mild detergent solution such as Oakite 164 or any good commercial grade automatic dishwasher detergent. Let the solution stand for a few minutes and reverse flush (opposite normal air flow) with clean water at mild pressure. A garden hose with spray nozzle is usually sufficient. Make sure drain lines are clean.

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

5.14.2 Condenser Coil

Remove all foreign material from the condenser coil by reversing the normal air flow. Air is pulled in through the front and discharges over the engine. Compressed air or water may be used as a cleaning agent.

It may be necessary to use warm water mixed with any good commercial dishwasher detergent. If a detergent is used, rinse coil with fresh water.

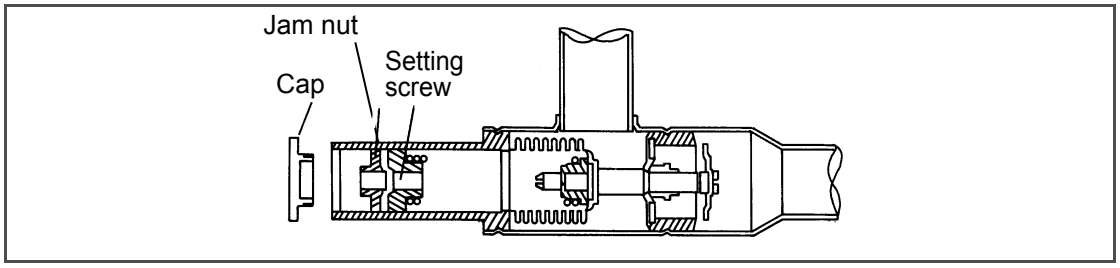
5.15 ADJUSTING THE COMPRESSOR PRESSURE REGULATING VALVE (CPR)

The CPR valve is factory preset and should not need adjustment. Use the following instructions if it becomes necessary to adjust the valve for any reason.

NOTE

When adjusting the CPR valve, the unit must be running in the high-speed heat or defrost. Turn Compartment 2 OFF, and set Compartment 1 into heat or defrost. This will ensure a full load is against the unit allowing suction pressure above the proper CPR setting for adjustment.

Figure 5.11 Compressor Pressure Regulating Valve



To adjust the CPR valve, proceed as follows (refer to **Figure 5.11**):

a. Install a manifold gauge set.

b. Remove cap from CPR valve.

c. With a 8 mm Allen wrench, loosen the jam nut.

d. Using the 8 mm Allen wrench, adjust the setting screw. To raise the suction pressure turn the setting screw clockwise; to lower the suction pressure, turn the setting screw counterclockwise. Refer to **Section 2.7.4** for CPR valve setting.

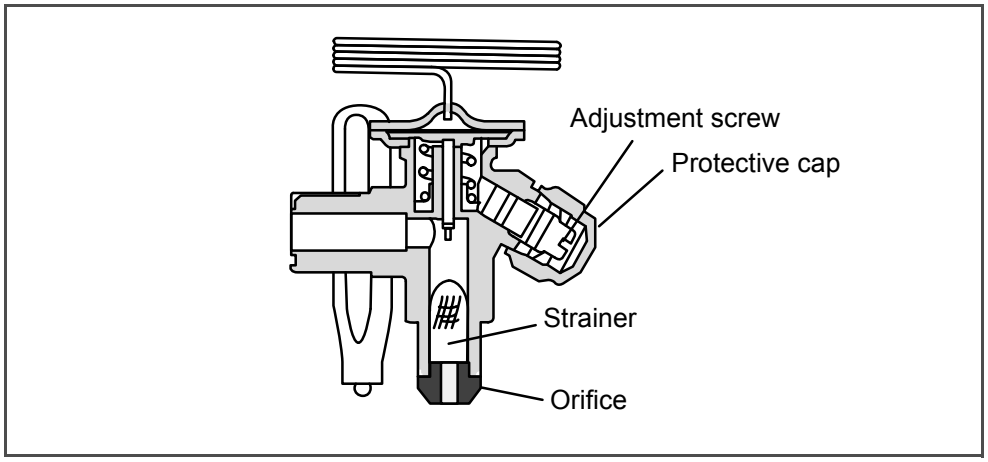
e. When the setting has been adjusted, tighten the jam nut securely against the setting screw. This will prevent any movement of the setting screw due to vibrations in the unit. Replace the cap.

5.16 THERMOSTATIC EXPANSION VALVE

The thermal expansion valve is an automatic device which maintains constant superheat of the refrigerant gas leaving the evaporator regardless of suction pressure. The valve functions are: (a) automatic response of refrigerant flow to match the evaporator load and (b) prevention of liquid refrigerant entering the compressor.

During normal operation, the valve should not require any maintenance. If service is required, it should be performed only by trained personnel.

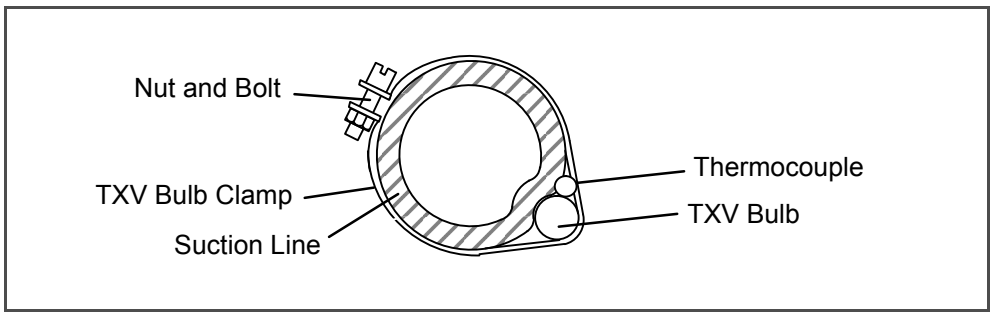
Figure 5.12 Thermostatic Expansion Valve



5.16.1 Setting and Adjusting Superheat

Remote evaporator superheat setting is critical to proper unit operation. In order to have optimum performance from both the remote evaporators, the superheat must be properly set. The Genesis-style remote evaporators supplied with the current Supra 950MT units have the expansion valve superheat set at a nominal setting for average installations.

Figure 5.13 Thermostatic Expansion Valve Bulb and Thermocouple



Follow these simple steps for proper remote evaporator superheat check and adjustment:

1. Prior to checking the superheat, verify that the TXV sensing bulb is properly located on the suction line. It should be located at 5 or 7 o'clock on the suction line, flat and tightly secured against the line, and insulated with Prestite tape.
2. To check superheat, install a thermocouple (Simpson lead or equal) next to the TXV sensing bulb under the strap clamp, as shown in **Figure 5.13**, and insulate with the existing Prestite tape.
3. Connect a suction pressure gauge to the flare fitting with Schrader valve located just before the remote evaporator check valve.
4. The return air grille must be re-installed prior to checking superheat so the evaporator coil is exposed to proper airflow.
5. Set the compartments to the values the customer will be utilizing in the field. When the compartments are near set point, crack open doors or bulkheads so that each compartment is in COOL mode and not NULL mode. Compressor operation should be fully loaded cool.
6. Read the bulb temperature and suction pressure. A series of readings should be taken once per minute over a 5 or 10 minute period and averaged to get the most accurate superheat reading.
7. Using a pressure-temperature (P/T) chart, convert the suction pressure to temperature. The bulb temperature minus the suction temperature equals the operating superheat (See **Table 5–5**).

Table 5–3 Optimum Operating Superheat Temperature Refrigerant Pressure and Type

Operating Superheat (°F)	R-22 (Psig)	R404A (Psig)
34°	60.2	76.5
35°	61.5	78.1
36°	62.9	79.7
37°	64.3	81.3
38°	65.7	83.0
39°	67.1	84.7
40°	68.6	86.4
41°	70.0	88.1
42°	71.5	89.9
43°	73.0	91.6
44°	74.5	93.4
45°	76.1	95.3
46°	77.6	97.1
47°	79.2	99.0

8. If adjustment is required, there is an external adjustment screw on the side of the TXV.
9. One complete turn of 360 degrees will equate to approximately 7°F of superheat. To decrease superheat, turn the screw counter-clockwise; to increase superheat, turn it clockwise. After adjustments are made, the unit should be allowed to operate for approximately 10 minutes for system stabilization before rechecking superheat.

NOTE

The optimum superheat setting is 10 to 34°F (-12.2 to 1.1°C). This is not always possible depending on the application and desired temperatures in each compartment. Since the type of evaporator, compartment size and location varies greatly with each application, it is recommended that the superheat be checked and adjusted, if necessary, at final unit pre-delivery inspection.

Superheat may be set higher in some conditions if the unit is unable to maintain the required temperature. Increasing superheat in the remote evaporator reduces the amount of refrigerant flow through the TXV, which consequently reduces the capacity of that evaporator.

In some applications, the superheat may be set slightly lower; this will increase capacity of the evaporator by allowing more refrigerant to flow through the TXV. This is needed in some cases where higher suction line pressure is required from the evaporator. The superheat should never be set low enough to allow frost on the compressor. This indicates liquid refrigerant returning to the compressor.

5.16.2 Replacing Expansion Valve

a. Check superheat and adjust valve (if adjustable) in accordance with the preceding steps. If valve requires replacement, pump down the unit. (Refer to **Section 5.4**, a)
b. Slowly loosen the nut at the base of the valve to relieve any remaining pressure. Pull the line away from the valve sufficient to remove the orifice and strainer. Check condition of orifice and strainer, clean as necessary. If no foreign material is found, then proceed with replacing the valve. Retain orifice for reassembly.
c. Remove insulation from expansion valve bulb and then remove bulb from suction line.
d. Using inert gas brazing procedures (refer to Technical Procedure 98-50553-00), unbraze the equalizer line, and if required, distributor.
e. Remove the strainer from the replacement valve and wrap in damp rags to prepare for brazing. Braze replacement valve in place. Install nut(s), orifice and strainer.
f. Strap thermal bulb to suction line and insulate both. It is recommended that the thermocouple required to check superheat be reinstalled at this time.
g. Leak check and evacuate low side by connecting at the suction and discharge service valve. Refer to **Section 5.4.1** and **Section 5.5** for general procedure.
h. Re-check superheat.

5.17 SUCTION PRESSURE TRANSDUCER

Before a new suction pressure transducer can be installed, it must be calibrated.

The calibration will not be performed if the run relay is energized. This prevents the operator from calibrating the unit with the sensor in the system. The reading of the sensor must be at atmospheric pressure (0 psig or 14.7 psi). If the sensor reading is greater than 20 psig (34.7 psi) or less than -6.7 psig (8 psi), it cannot be calibrated.

Once the micro is calibrated, the display will readout the actual value.

a. Turn power off, remove starter solenoid wire, and let unit fail to start. This will de-energize run relay.

b. Connect wiring to new suction pressure transducer. Before installing suction pressure transducer into unit, display the suction pressure via the unit status display.

c. While the suction pressure is being displayed press the Enter key for three seconds. The display should read 0. If display reads 0, install suction pressure transducer into unit.

Table 5–4 Sensor Resistance (ATS, CDT, RAS, SAS & WTS)

Temperature		RAS, SAS & WTS Resistance In Ohms	CDT Resistance In Ohms
°F	°C		
−20	-28.9	165,300	1,653,000
-10	-23.3	117,800	1,178,000
0	-17.8	85,500	855,000
10	-12.2	62,400	624,000
20	-6.7	46,300	463,000
30	-1.1	34,500	345,000
32	0	32,700	327,000
40	4.4	26,200	262,000
50	10.0	19,900	199,000
60	15.6	15,300	153,000
70	21.1	11,900	119,000
77	25	10,000	100,000
80	26.7	9,300	93,000
90	32.2	7,300	73,000
100	37.8	5,800	58,000
110	43.3	4,700	47,000
120	48.9	3,800	38,000
194	90	915	9,150
212	100	680	6,800
266	130	301	3,010
302	150	186	1,860
325	163	-	1,358
350	177	-	1,202

Table 5–5 R404A Temperature-Pressure Chart

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

5.18 MICROPROCESSOR

NOTE

The software revision level is noted on a label located on the EPROM chip (component U3 on the microprocessor logic board). Under NO circumstances should this label be removed.

⚠ CAUTION

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

Microprocessor Inputs

Some microprocessor inputs operate at voltage levels other than the conventional 12 VDC. Connector points and the associated approximate voltage levels are listed below for reference only. Under no circumstances should 12 VDC be applied at these connection points.

Grounded wrist cuffs are available from Carrier (P/N 07-00304-00). It is recommended that these be worn whenever handling a microprocessor.

Table 5–6 Connection Point Voltage Inputs

Connection Point	Approximate Voltage
ATS, CDT, RAS, SAS, WTS	2.5 vdc (Variable)
MP23	5.0 vdc

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

ESD Safety

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

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

a Replacing the Keyboard

Should damage to the keyboard of the microprocessor occur, it is possible to replace only the keyboard.

b Hour Meters

The hour meter can be set to any value via the serial port if the meter has less then five hours on it. This allows a replacement microprocessor to be set to the same hours as the microprocessor it is replacing.

The microprocessor has two programmable maintenance hour meters, which are set via the serial port. These maintenance hour meters are compared to one of the hour meters (diesel, standby, or switch on). If the hour meter is greater than the maintenance hour meter, the proper service alarm is triggered.

5.18.1 Microprocessor Replacement and Configuration Service Guidelines

a Removing and Replacing the Microprocessor Logic Board:

1. Before removing the microprocessor, disconnect the negative battery cable and attach a grounded wrist strap (07-00304-00) to your wrist and ground it to a good unit frame ground.
2. Open the roadside side door of the unit and loosen the four bolts holding the cover/microprocessor onto the front of the control box.
3. Unplug the ribbon cable from the logic board, but leave it connected to the cab command cable. For 950MT units, unplug the power cable (it does not have a ribbon type cable).
4. Take the new microprocessor from the anti-static bag and install in the control box, following steps 2 through 4 in reverse order.
5. Place the removed microprocessor back into the anti-static bag and part box for return.

NOTE

BEFORE STARTING THE UNIT: When replacing a microprocessor it is important to check that the configurations are compatible with the unit into which the microprocessor will be installed.

b To Reach Configuration Fields from Keypad:

1. Place the unit RUN/STOP switch in the STOP position and the I/O switch in the OFF (O) position.
2. With the unit off, locate the serial port plug behind the control panel. Remove the protective cap to gain access to the wire terminals. Place an insulated jumper wire between wires SPA and SPB at the serial port plug.

⚠ CAUTION

Do not allow insulated jumper wire to touch any ground.

3. Place the unit RUN/STOP switch in the RUN position and the I/O switch in the RUN (I) position. The FAULT light will come on, and the micro display will read CNF1 TV. Remove the jumper wire from the serial port and reinstall the protective cap. The configuration screen will now remain available for five minutes. Scroll through the configuration list using the Function key and compare the settings with those shown in the table on the following page. If any of the configurations need to be changed, continue with step 4 below.
4. To change the configuration selection: (Refer to **Table 5–7**):
   a. Bring the configuration to be changed onto the display. Press the Enter key to allow change access to the displayed configuration.
   b. Press either the UP or DOWN keys to display available selections for that configuration. Leave the correct selection on the screen. The selection display will flash, warning the operator that the displayed value has not been entered. Press the ENTER key to enter the new selection into memory. The display will revert to the original selection if no further action is taken for the next five seconds.
   c. Continue to scroll through the configuration list by pressing the FUNCTION key. Change any other configurations as required.
5. When finished, turn the RUN/STOP switch to the STOP position, then back to the RUN position to start the unit.

5.18.2 Controller Sensor Checkout

An accurate ohmmeter must be used to check resistance values shown in **Table 5–4**.

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 **Table 5–4**.

At least one lead from the sensor (RAS, terminals D1 and E1 or SAS, terminals D2 and E2) must be disconnected from the unit electrical system before any reading is taken. Not doing so will result in a false reading. Two preferred methods of determining the actual test temperature at the sensor, is an ice bath at 32°F (0°C) or a calibrated temperature tester.

Table 5–7 Microprocessor Configurations

Microprocessor		Description	Supra 950MT
CNF1: (DI/TV)	DI	DI engine long glow cycle	TV
	TV	TV engine short glow cycle	
CNF2: (ON/OFF)	OFF	CDT not used	ON
	ON	CDT used	
CNF3: (ON/OFF)	OFF	86°F (30°C) Maximum set point	OFF
	ON	90°F (32°C) Maximum set point	
CNF4: (ON/OFF)	OFF	Heat lockout on 10°F (-12°C)	OFF
	ON	Heat lockout off (trailer units)	
CNF5: (ON/OFF)	OFF	Frozen priority not active	OFF
	ON	Active	
CNF6: (ON/OFF)	OFF	Trailer unit	ON
	ON	Truck unit	
CNF7: (ON/OFF)	OFF	Low speed start	OFF
	ON	High speed start	
CNF8: (ON/OFF)	OFF	Belt driven fan	ON
	ON	Electrical fan motors	
CNF9: (ON/OFF)	OFF	Out of range alarm not shut down	OFF
	ON	Out of range alarm and unit shut down	
CNF10: (ON/OFF)	OFF	No auto restart	OFF
	ON	Auto restart active if FN5 = Time start	
CNF11: (ON/OFF)	OFF	Functions normal	OFF
	ON	Functions locked	
CNF12: (ON/OFF)	OFF	Low oil level alarm	OFF
	ON	Active	
CNF13: (ON/OFF)	OFF	Disable low refrigerant test	ON
	ON	Enable low refrigerant test	
CNF14: (ON/OFF)	OFF	Set points unlocked	OFF
	ON	Set points locked	
CNF15: (ON/OFF)	OFF	Disregard water temp sensor failure	ON
	ON	Water temp sensor failure shutdown	
CNF16: (ON/OFF)	OFF	Alt aux alarm only	ON
	ON	Alt aux alarm and unit shut down	
CNF17 to CNF32: (ON/OFF)	OFF	Future use	OFF
	ON	Future use	

SECTION 6
TROUBLESHOOTING

⚠ CAUTION

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

6.1 DIESEL ENGINE

INDICATION / TROUBLE	POSSIBLE CAUSES	REFERENCE
6.1.1 Engine Will Not Start		
Starter motor will not crank or low cranking speed	Battery insufficiently charged	Check
	Battery terminal post dirty or defective	Check
	Bad electrical connections at starter	Check
	Starter motor malfunctions	**6.1.3**
	Starter motor solenoid defective	Engine Manual
	Open starting circuit	**6.1.4**
	Incorrect grade of lubricating oil	**2.7.2**
Starter motor cranks but engine fails to start	No fuel in tank	Check
	Air in fuel system	Check
	Water in fuel system	Drain Sump
	Plugged fuel filters	Replace
	Plugged fuel lines to injector (s)	Check
	Fuel control operation erratic	Engine Manual
	Glow plug(s) defective	**5.2.6**
	Run solenoid defective	**5.2.3**
	Fuel pump (FP) malfunction	**5.2.5**
Starter cranks, engages, but dies after a few seconds	Engine lube oil too heavy	**2.7.2**
	Voltage drop in starter cable(s)	Check
6.1.2 Engine Starts Then Stops		
Engine stops after several rotations	Fuel supply restricted	Check
	No fuel in tank	Check
	Leak in fuel system	Check
	Faulty fuel control operation	Engine
	Fuel filter restricted	Replace
	Injector nozzle(s) defective	Engine Manual
	Injection pump defective	Engine Manual
	Air cleaner or hose restricted	**5.2.4**
	Safety device open	**2.8**
	Open wiring circuit to run solenoid	Check
	Fuel pump (FP) malfunction	**5.2.5**

6.1.3 Starter Motor Malfunction		
Starter motor will not crank or turns slowly	Battery insufficiently charged Battery cable connections loose or oxidized Battery cables defective Starter brushes shorted out Starter brushes hang up or have no contact Starter solenoid damaged Start/Run - Off switch defective Engine lube oil too heavy	Check Check Replace Engine Manual Engine Manual Engine Manual Replace 2.7.2
Starter motor turns but pinion does not engage	Pinion or ring gear obstructed or worn	Clean both, remove burrs, or replace; apply grease
Starter motor does not disengage after switch was depressed	Start/Run - Off switch defective Starter motor solenoid defective	Replace Engine Manual
Pinion does not disengage after engine is running	Defective starter	Engine Manual
6.1.4 Malfunction In the Engine Starting Circuit		
No power to starter motor solenoid (SS)	Battery defective Loose electrical connections	Check Tighten
Run solenoid does not energize or does not remain energized	Battery defective Loose electrical connections Oil pressure safety switch (OP) defective Run relay (RR) defective Water temperature safety switch open Water temperature sensor (WTS) defective Run solenoid defective Start/Run - Off switch defective	Check Tighten Replace Replace 2.8 Replace 5.2.3 Replace

6.2 ALTERNATOR

Alternator fails to charge	Unit has not run long enough to completely charge Limited charging system operating time Battery condition Alternator belt loose/broken Loose, dirty, corroded terminals, or broken leads Excessively worn, open or defective brushes Regulator faulty Alternator internal component failure	Check Check Check 5.3 Check/Repair Check Check Replace
Low or unsteady charging rates	Alternator belt loose Loose, dirty, corroded terminals, or broken leads Excessively worn, sticky or intermittent brushes Faulty regulator Alternator internal component failure	5.3 Check/Repair Check Check Replace

Excessive charging rate	Regulator leads loose, dirty/corroded terminals, or wires broken Defective regulator	Clean/Repair Check
Noisy alternator	Defective or badly worn V-belt Worn bearing(s) Misaligned belt or pulley Loose pulley	**5.3** Replace **5.3** Tighten

6.3 REFRIGERATION

6.3.1 Unit Will Not Cool		
Diesel engine	Malfunction(s)	**6.1**
Compressor malfunction	Compressor drive defective Compressor defective	**5.8** **5.8**
Refrigeration system	Defrost cycle did not terminate Abnormal pressure Hot Gas valve malfunction	**6.3.5** **6.3.6** **6.3.11**
6.3.2 Unit Runs But Has Insufficient Cooling		
Compressor	Compressor valves defective Unloader malfunction	**5.8** **5.10**
Refrigeration system	Abnormal pressure Expansion valve malfunction No or restricted evaporator airflow Unloader malfunction	**6.3.6** **6.3.10** **6.3.9** **5.10**
Engine does not develop full rpm	Engine malfunction Excessive engine load	**6.1** **2.7.1**
6.3.3 Unit Operates Long or Continuously in Cooling		
Container	Hot Load Defective box insulation or air leak	Allow time to pull down Correct
Refrigeration system	Abnormal pressure Temperature controller malfunction	**6.3.6** **6.3.8**
Compressor	Defective	**5.8**
6.3.4 Unit Will Not Heat or Has Insufficient Heating		
Refrigeration	Abnormal pressure Temperature controller malfunction Hot gas valve malfunction	**6.3.6** **6.3.8** **6.3.11**
Compressor	Compressor drive defective Compressor defective	**5.8** **5.8**
Engine does not develop full rpm	Engine malfunction Excessive engine load	**6.1** **2.7.1**

6.3.5 Defrost Cycle Malfunction		
Will not initiate defrost automatically	Defrost thermostat (DTT) open or defective Loose terminal connections Check the selected Defrost Interval	Replace Tighten Check
Will not initiate defrost manually	Microprocessor or Cab Command defective Loose terminal connections Defrost thermostat (DTT) open or defective	Replace Tighten Replace
Initiates but does not defrost	Hot gas valve malfunction Defrost relay (DR) defective Electric heater inoperative	**6.3.11** Replace Check
Frequent defrost	Defrost timer to be adjusted	**3.15.2**
Does not terminate within 45 minute maximum allowable time	Defrost thermostats (DTT) shorted closed Wet load	Replace Check
6.3.6 Abnormal Pressure, Cooling		
High discharge pressure	Condenser coil dirty or air flow restricted Condenser fan defective Loose or broken V-belt Discharge check valve restricted Non-condensibles or refrigerant overcharge Hot gas valve (1HGV or 2HGV) malfunction	**5.14.2** Check **5.3** Replace Replace **6.3.11**
Low discharge pressure	Compressor valve(s) worn or broken Low refrigerant charge Hot gas valve (1HGV or 2HGV) malfunction	**5.8** **5.4.1** **6.3.11**
High suction pressure	Compressor valve(s) worn or broken Compressor Pressure Regulator (CPR) valve not adjusted properly Compressor gasket(s) defective Hot gas valve (1HGV or 2HGV) malfunction	**5.8** **5.15** **5.8** **6.3.11**
Low suction pressure	Suction service valve partially closed King valve partially closed Compressor Pressure Regulator (CPR) valve not adjusted properly Filter-drier partially plugged Low refrigerant charge Expansion valve malfunction No evaporator air flow or restricted air flow Excessive frost on coil	Open Open **5.15** **5.11** **5.7** **6.3.10** **6.3.9** Check
Suction and discharge pressures tend to equalize when unit is operating	Compressor valves defective Hot gas valve (1HGV or 2HGV) malfunction	**5.8** **6.3.11**

6.3.7 Abnormal Pressure, Heating		
High discharge pressure	Overcharged system V-belts broken or loose Non-condensibles or refrigerant overcharge Main heat valve (MHV) malfunction Hot gas valve (1HGV or 2HGV) malfunction Compressor gaskets defective	**5.4.1** **5.3** Replace Check **6.3.11** Check
Low discharge pressure	Compressor valve(s) worn or broken Main heat valve (MHV) malfunction Low refrigerant charge	**5.8** Check **5.7**
Low suction pressure	Low refrigerant charge Compressor pressure regulating valve (CPR) malfunction Suction service valve partially closed	**5.7** **5.15** Open
High suction pressure	Compressor valve(s) worn or broken Compressor pressure regulating valve (CPR) not adjusted properly Compressor gaskets defective Hot gas valve (1HGV or 2HGV) malfunction	Replace Adjust Replace Check
6.3.8 Abnormal Noise		
Compressor	Loose mounting bolts Worn bearings Worn or broken valves Liquid slugging Insufficient oil	Tighten **5.8** **5.8** **6.3.10** **5.9**
Condenser or evaporator fan	Loose or striking shroud Bearings defective Bent shaft	Check Check Check
Compressor Drive System	V-belt cracked or worn Clutch malfunction	**5.3** Replace
6.3.9 Control System Malfunction		
Will not control	Sensor defective Relay(s) defective Microprocessor controller malfunction	**5.18.2** Check **5.18**
6.3.10 No Evaporator Air Flow or Restricted Air Flow		
Evaporator coil blocked	Frost on coil Dirty coil Fan motor(s) malfunction	Check **5.14.1** Replace
No or partial evaporator air flow	V-belt broken or loose Clutch defective Evaporator fan loose or defective Evaporator fan rotating backwards Evaporator air flow blocked in trailer (box) Fan motor(s) malfunction	**5.3** Replace Check **5.3** Check Replace

6.3.11 Expansion Valve Malfunction		
Low suction pressure with high superheat	Low refrigerant charge	**5.5** / **5.7**
	External equalizer line plugged	Clean
	Ice formation at valve seat	**5.6**
	Wax, oil or dirt plugging valve or orifice	**5.16**
	Broken capillary	**5.16**
	Power assembly failure or partial	Replace
	Loss of element/bulb charge	Replace
	Superheat setting too high	**5.16**
Low superheat and liquid slugging in compressor	Superheat setting too low	**5.16**
	External equalizer line plugged	Open
	Ice holding valve open	**5.6**
	Foreign material in valve	Clean
	Pin and seat of expansion valve eroded or held open by foreign material	**5.16**
Fluctuating suction pressure	Improper bulb location or installation	**5.16**
	Low superheat setting	**5.16**
High superheat	Broken capillary	**5.16**
6.3.12 Hot Gas Valve Malfunction		
Valve does not function properly	No power to valve	Check
	Improper wiring or loose connections	Check
	Coil defective	**5.10.2**
	Valve improperly assembled	**5.10.3**
	Coil or coil sleeve improperly assembled	**5.10.2**
	Temperature controller malfunction	Replace
	Movement of plunger restricted due to:	
	a) Corroded or worn parts	**5.10.2** / **5.10.3**
	b) Foreign material lodged in valve	**5.10.2** / **5.10.3**
	c) Bent or dented enclosing tube	**5.10.2**

6.4 STANDBY MOTOR MALFUNCTION

Standby motor fails to start	Motor contactor (MC) defective	Replace
	Motor Overload (OL) open	Replace motor
	Improper power supply	**2.7.6**
	Oil pressure switch (OPS) closed or grounded	Replace
	Cab Command defective	Replace
Standby motor starts, then stops	Motor Overload (OL) open	**2.7.6**
	High amperage draw	Check

SECTION 7
ELECTRICAL SCHEMATIC WIRING DIAGRAM

7.1 INTRODUCTION

This section contains the Supra 950MT electrical schematic wiring diagram.

The following general safety notices supplement the specific warnings and cautions appearing elsewhere in this manual. They are recommended precautions that must be understood and applied during operation and maintenance of the equipment covered herein.

⚠ WARNING

Beware of unannounced starting of the fans and V-belts caused by the thermostat and the start/stop cycling of the unit that may start automatically

⚠ WARNING

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

⚠ CAUTION

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

⚠ CAUTION

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

NOTICE

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

NOTICE

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

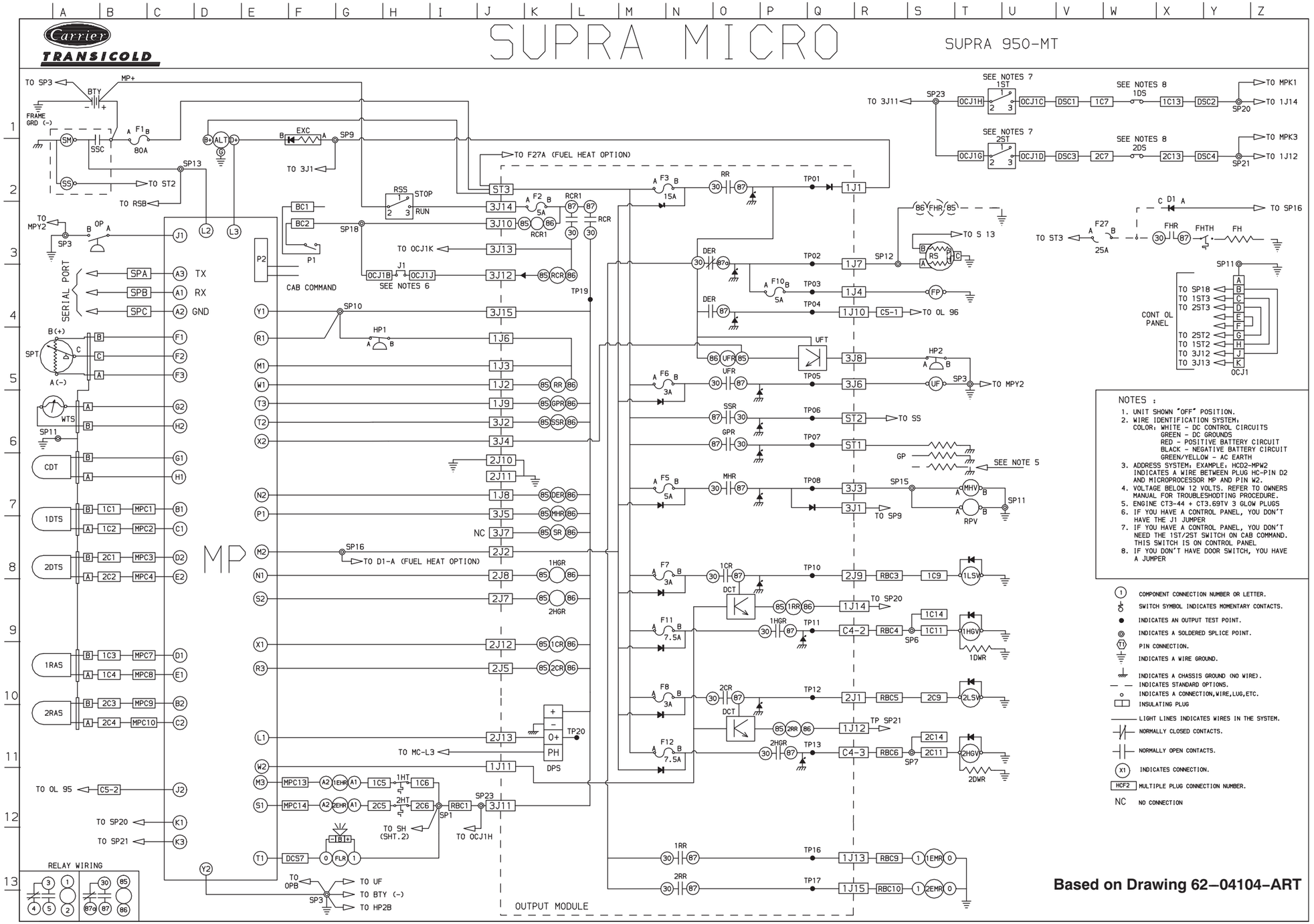
7.2 WIRING SCHEMATIC

The **wiring schematics** are provided on the following pages.

SUPRA MICRO

SUPRA 950-MT

Carrier TRANSICOLD



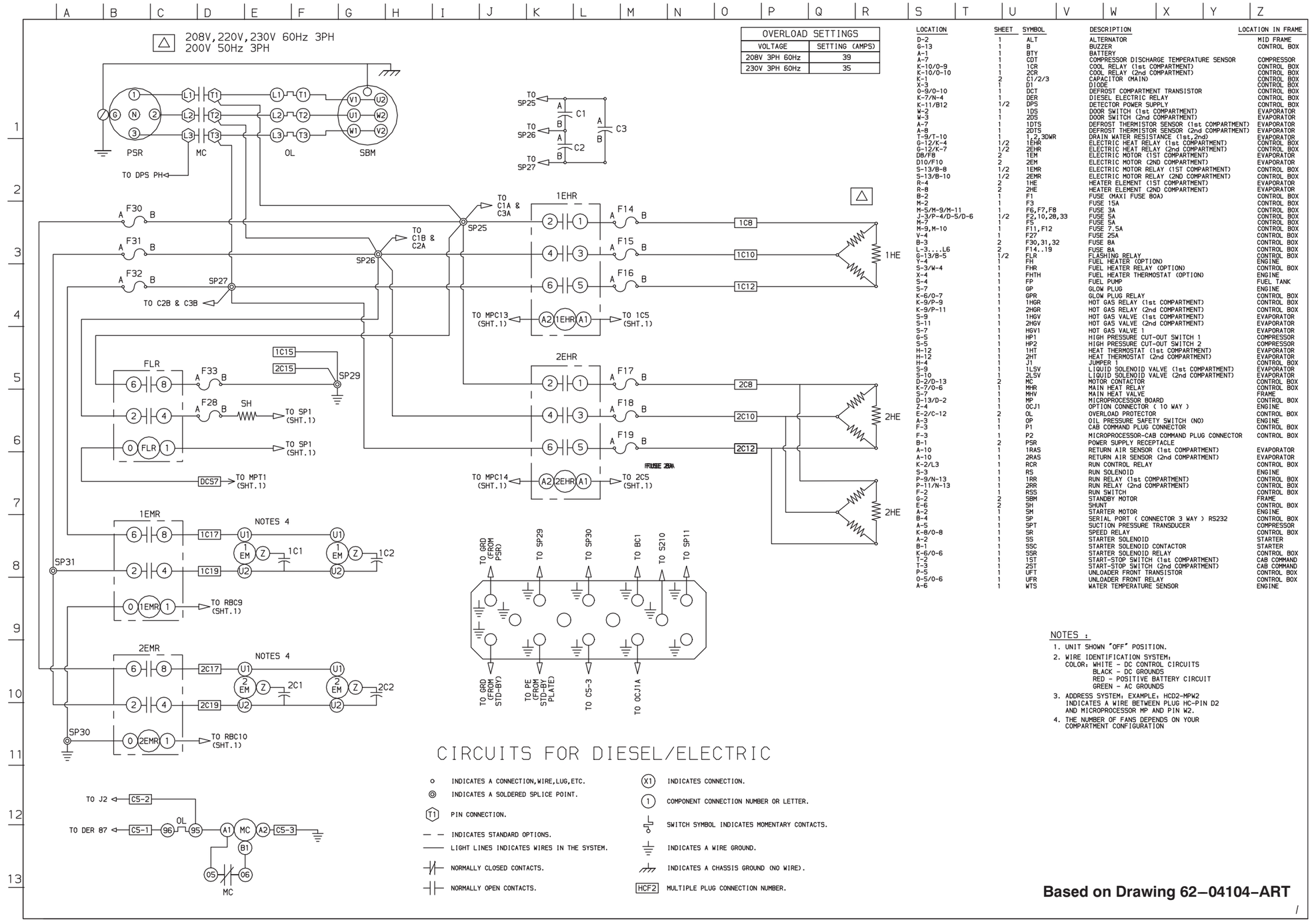
NOTES :

1. UNIT SHOWN "OFF" POSITION.
2. WIRE IDENTIFICATION SYSTEM:
   COLOR: WHITE - DC CONTROL CIRCUITS
   GREEN - DC GROUNDS
   RED - POSITIVE BATTERY CIRCUIT
   BLACK - NEGATIVE BATTERY CIRCUIT
   GREEN/YELLOW - AC EARTH
3. ADDRESS SYSTEM. EXAMPLE. HCD2-MPW2 INDICATES A WIRE BETWEEN PLUG HC-PIN D2 AND MICROPROCESSOR MP AND PIN W2.
4. VOLTAGE BELOW 12 VOLTS. REFER TO OWNERS MANUAL FOR TROUBLESHODTING PROCEDURE.
5. ENGINE CT3-44 + CT3.69TV 3 GLOW PLUGS
6. IF YOU HAVE A CONTROL PANEL, YOU DON'T HAVE THE J1 JUMPER
7. IF YOU HAVE A CONTROL PANEL, YOU DON'T NEED THE 1ST/2ST SWITCH ON CAB COMMAND. THIS SWITCH IS ON CONTROL PANEL
8. IF YOU DON'T HAVE DOOR SWITCH, YOU HAVE A JUMPER

(1) COMPONENT CONNECTION NUMBER OR LETTER.
SWITCH SYMBOL INDICATES MOMENTARY CONTACTS.
INDICATES AN OUTPUT TEST POINT.
INDICATES A SOLDERED SPLICE POINT.
(T) PIN CONNECTION.
INDICATES A WIRE GROUND.
INDICATES A CHASSIS GROUND (NO WIRE).
INDICATES STANDARD OPTIONS.
INDICATES A CONNECTION,WIRE,LUG,ETC.
INSULATING PLUG
LIGHT LINES INDICATES WIRES IN THE SYSTEM.
NORMALLY CLOSED CONTACTS.
NORMALLY OPEN CONTACTS.
(X1) INDICATES CONNECTION.
HCF2 MULTIPLE PLUG CONNECTION NUMBER.
NC NO CONNECTION

Based on Drawing 62-04104-ART

Figure 8-1. Electrical Schematic Wiring Diagram (Sheet 1 of 2)



OVERLOAD SETTINGS	
VOLTAGE	SETTING (AMPS)
208V 3PH 60Hz	39
230V 3PH 60Hz	35

LOCATION	SHEET	SYMBOL	DESCRIPTION	LOCATION IN FRAME
D-2	1	ALT	ALTERNATOR	MID FRAME
G-13	1	B	BUZZER	CONTROL BOX
A-1	1	BTY	BATTERY	
A-7	1	CDT	COMPRESSOR DISCHARGE TEMPERATURE SENSOR	COMPRESSOR
K-10/0-9	1	1CR	COOL RELAY (1st COMPARTMENT)	CONTROL BOX
K-10/0-10	1	2CR	COOL RELAY (2nd COMPARTMENT)	CONTROL BOX
K-1	2	C1/2/3	CAPACITOR (MAIN)	CONTROL BOX
X-3	1	D1	DIODE	CONTROL BOX
G-8/0-10	1	DCT	DEFROST COMPARTMENT TRANSISTOR	CONTROL BOX
K-7/N-4	1	DER	DIESEL ELECTRIC RELAY	CONTROL BOX
K-11/B12	1/2	DPS	DETECTOR POWER SUPPLY	CONTROL BOX
W-2	1	1DS	DOOR SWITCH (1st COMPARTMENT)	EVAPORATOR
W-3	1	2DS	DOOR SWITCH (2nd COMPARTMENT)	EVAPORATOR
A-7	1	1DTS	DEFROST THERMISTOR SENSOR (1st COMPARTMENT)	EVAPORATOR
A-8	1	2DTS	DEFROST THERMISTOR SENSOR (2nd COMPARTMENT)	EVAPORATOR
T-9/T-10	1	1,2,3DWR	DRAIN WATER RESISTANCE (1st,2nd)	EVAPORATOR
G-12/K-4	1/2	1EHR	ELECTRIC HEAT RELAY (1st COMPARTMENT)	CONTROL BOX
G-12/K-7	1/2	2EHR	ELECTRIC HEAT RELAY (2nd COMPARTMENT)	CONTROL BOX
D8/F8	2	1EM	ELECTRIC MOTOR (1ST COMPARTMENT)	EVAPORATOR
D10/F10	2	2EM	ELECTRIC MOTOR (2ND COMPARTMENT)	EVAPORATOR
S-13/B-8	1/2	1EMR	ELECTRIC MOTOR RELAY (1ST COMPARTMENT)	CONTROL BOX
S-13/B-10	1/2	2EMR	ELECTRIC MOTOR RELAY (2ND COMPARTMENT)	CONTROL BOX
R-4	2	1HE	HEATER ELEMENT (1ST COMPARTMENT)	EVAPORATOR
R-8	2	2HE	HEATER ELEMENT (2ND COMPARTMENT)	EVAPORATOR
B-2	1	F1	FUSE (MAXI FUSE 80A)	CONTROL BOX
M-2	1	F3	FUSE 15A	CONTROL BOX
M-5/M-9/M-11	1	F6,F7,F8	FUSE 3A	CONTROL BOX
J-3/P-4/D-5/D-6	1/2	F2,10,28,33	FUSE 5A	CONTROL BOX
M-7	1	F5	FUSE 5A	CONTROL BOX
M-9,M-10	1	F11,F12	FUSE 7.5A	CONTROL BOX
V-4	1	F27	FUSE 25A	CONTROL BOX
B-3	2	F30,31,32	FUSE 8A	CONTROL BOX
L-3,...L6	2	F14..19	FUSE 8A	CONTROL BOX
G-13/B-5	1/2	FLR	FLASHING RELAY	CONTROL BOX
Y-4	1	FH	FUEL HEATER (OPTION)	ENGINE
S-3/N-4	1	FHR	FUEL HEATER RELAY (OPTION)	CONTROL BOX
X-4	1	FHTH	FUEL HEATER THERMOSTAT (OPTION)	ENGINE
S-4	1	FP	FUEL PUMP	FUEL TANK
S-7	1	GP	GLOW PLUG	ENGINE
K-6/0-7	1	GPR	GLOW PLUG RELAY	CONTROL BOX
K-9/P-9	1	1HGR	HOT GAS RELAY (1st COMPARTMENT)	CONTROL BOX
K-9/P-11	1	2HGR	HOT GAS RELAY (2nd COMPARTMENT)	CONTROL BOX
S-9	1	1HGV	HOT GAS VALVE (1st COMPARTMENT)	EVAPORATOR
S-11	1	2HGV	HOT GAS VALVE (2nd COMPARTMENT)	EVAPORATOR
S-7	1	HGV1	HOT GAS VALVE 1	EVAPORATOR
G-5	1	HP1	HIGH PRESSURE CUT-OUT SWITCH 1	COMPRESSOR
S-5	1	HP2	HIGH PRESSURE CUT-OUT SWITCH 2	COMPRESSOR
H-12	1	1HT	HEAT THERMOSTAT (1st COMPARTMENT)	EVAPORATOR
H-12	1	2HT	HEAT THERMOSTAT (2nd COMPARTMENT)	EVAPORATOR
H-4	1	J1	JUMPER 1	CONTROL BOX
S-9	1	1LSV	LIQUID SOLENOID VALVE (1st COMPARTMENT)	EVAPORATOR
S-10	1	2LSV	LIQUID SOLENOID VALVE (2nd COMPARTMENT)	EVAPORATOR
D-2/D-13	2	MC	MOTOR CONTACTOR	CONTROL BOX
K-7/D-6	1	MHR	MAIN HEAT RELAY	CONTROL BOX
S-7	1	MHV	MAIN HEAT VALVE	FRAME
D-13/D-2	1	MP	MICROPROCESSOR BOARD	CONTROL BOX
Z-4	1	OCJ1	OPTION CONNECTOR (10 WAY)	ENGINE
E-2/C-12	2	OL	OVERLOAD PROTECTOR	CONTROL BOX
A-3	1	OP	OIL PRESSURE SAFETY SWITCH (NO)	ENGINE
F-3	1	P1	CAB COMMAND PLUG CONNECTOR	CONTROL BOX
F-3	1	P2	MICROPROCESSOR-CAB COMMAND PLUG CONNECTOR	CONTROL BOX
B-1	2	PSR	POWER SUPPLY RECEPTACLE	
A-10	1	1RAS	RETURN AIR SENSOR (1st COMPARTMENT)	EVAPORATOR
A-10	1	2RAS	RETURN AIR SENSOR (2nd COMPARTMENT)	EVAPORATOR
K-2/L3	1	RCR	RUN CONTROL RELAY	CONTROL BOX
S-3	1	RS	RUN SOLENOID	ENGINE
P-9/N-13	1	1RR	RUN RELAY (1st COMPARTMENT)	CONTROL BOX
P-11/N-13	1	2RR	RUN RELAY (2nd COMPARTMENT)	CONTROL BOX
F-2	1	RSS	RUN SWITCH	CONTROL BOX
G-2	2	SBM	STANDBY MOTOR	FRAME
E-6	2	SH	SHUNT	CONTROL BOX
A-2	1	SM	STARTER MOTOR	ENGINE
B-4	1	SP	SERIAL PORT (CONNECTOR 3 WAY) RS232	CONTROL BOX
A-5	1	SPT	SUCTION PRESSURE TRANSDUCER	COMPRESSOR
K-8/0-8	1	SR	SPEED RELAY	CONTROL BOX
A-2	1	SS	STARTER SOLENOID	STARTER
B-1	1	SSC	STARTER SOLENOID CONTACTOR	STARTER
K-6/0-6	1	SSR	STARTER SOLENOID RELAY	CONTROL BOX
T-2	1	1ST	START-STOP SWITCH (1st COMPARTMENT)	CAB COMMAND
T-3	1	2ST	START-STOP SWITCH (2nd COMPARTMENT)	CAB COMMAND
P-5	1	UFT	UNLOADER FRONT TRANSISTOR	CONTROL BOX
O-5/O-6	1	UFR	UNLOADER FRONT RELAY	CONTROL BOX
A-6	1	WTS	WATER TEMPERATURE SENSOR	ENGINE

NOTES :

1. UNIT SHOWN "OFF" POSITION.
2. WIRE IDENTIFICATION SYSTEM;
   COLOR: WHITE - DC CONTROL CIRCUITS
   BLACK - DC GROUNDS
   RED - POSITIVE BATTERY CIRCUIT
   GREEN - AC GROUNDS
3. ADDRESS SYSTEM: EXAMPLE: HCD2-MPW2
   INDICATES A WIRE BETWEEN PLUG HC-PIN D2
   AND MICROPROCESSOR MP AND PIN W2.
4. THE NUMBER OF FANS DEPENDS ON YOUR
   COMPARTMENT CONFIGURATION

CIRCUITS FOR DIESEL/ELECTRIC

- INDICATES A CONNECTION,WIRE,LUG,ETC.
- INDICATES A SOLDERED SPLICE POINT.
- (T1) PIN CONNECTION.
- — — INDICATES STANDARD OPTIONS.
- —— LIGHT LINES INDICATES WIRES IN THE SYSTEM.
- NORMALLY CLOSED CONTACTS.
- NORMALLY OPEN CONTACTS.
- (X1) INDICATES CONNECTION.
- (1) COMPONENT CONNECTION NUMBER OR LETTER.
- SWITCH SYMBOL INDICATES MOMENTARY CONTACTS.
- INDICATES A WIRE GROUND.
- INDICATES A CHASSIS GROUND (NO WIRE).
- HCF2 MULTIPLE PLUG CONNECTION NUMBER.

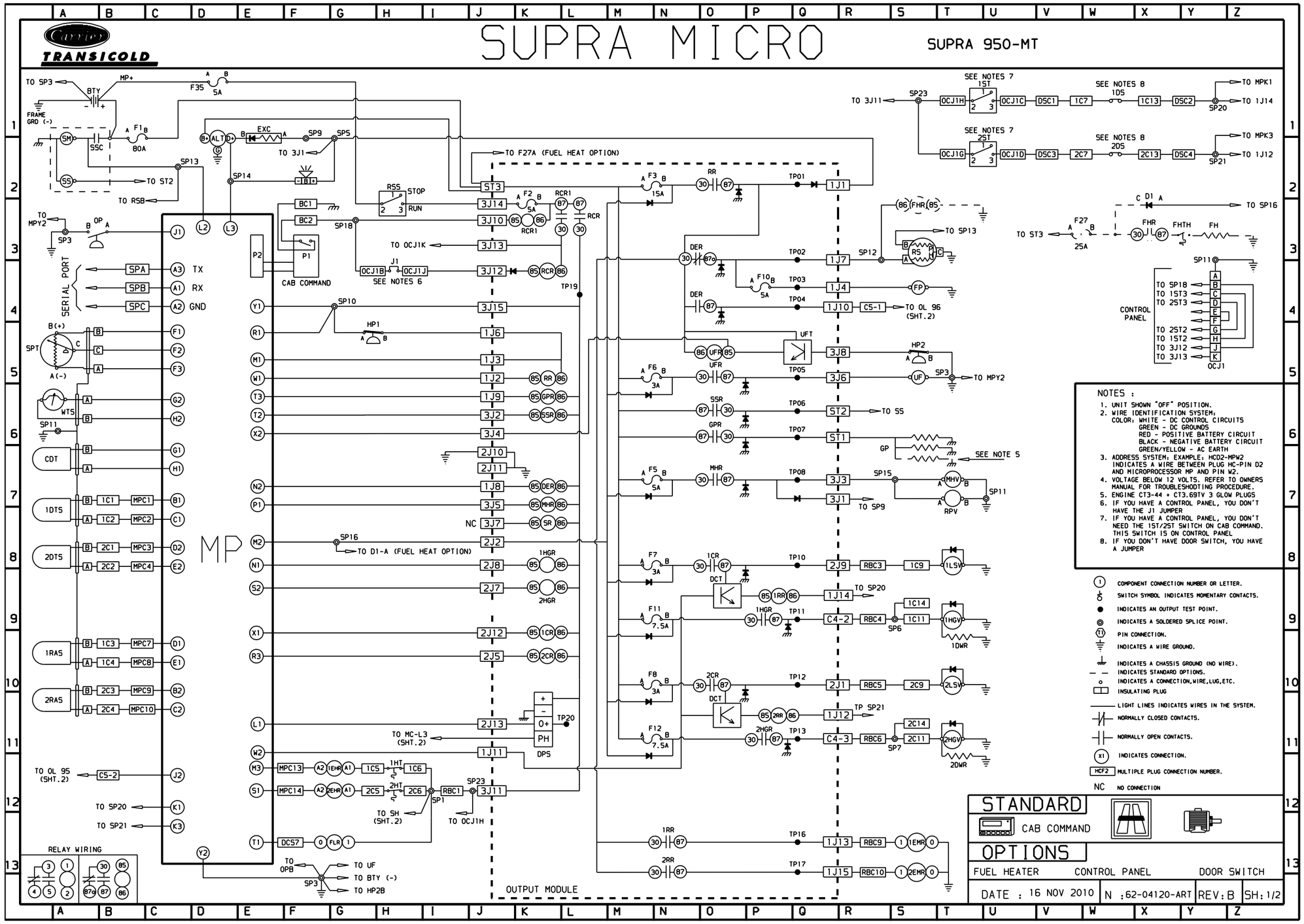
Based on Drawing 62-04104-ART

Figure 8-2. Electrical Schematic Wiring Diagram (Sheet 2 of 2)

SUPRA MICRO

SUPRA 950-MT

Carrier TRANSICOLD



NOTES :

1. UNIT SHOWN "OFF" POSITION.
2. WIRE IDENTIFICATION SYSTEM;
   COLOR: WHITE - DC CONTROL CIRCUITS
   GREEN - DC GROUNDS
   RED - POSITIVE BATTERY CIRCUIT
   BLACK - NEGATIVE BATTERY CIRCUIT
   GREEN/YELLOW - AC EARTH
3. ADDRESS SYSTEM; EXAMPLE: MCD2-MPW2 INDICATES A WIRE BETWEEN PLUG MC-PIN D2 AND MICROPROCESSOR MP AND PIN W2.
4. VOLTAGE BELOW 12 VOLTS. REFER TO OWNERS MANUAL FOR TROUBLESHOOTING PROCEDURE.
5. ENGINE CT3-44 + CT3.69TV 3 GLOW PLUGS
6. IF YOU HAVE A CONTROL PANEL, YOU DON'T HAVE THE J1 JUMPER
7. IF YOU HAVE A CONTROL PANEL, YOU DON'T NEED THE 1ST/2ST SWITCH ON CAB COMMAND. THIS SWITCH IS ON CONTROL PANEL
8. IF YOU DON'T HAVE DOOR SWITCH, YOU HAVE A JUMPER

(1) COMPONENT CONNECTION NUMBER OR LETTER.
SWITCH SYMBOL INDICATES MOMENTARY CONTACTS.
INDICATES AN OUTPUT TEST POINT.
INDICATES A SOLDERED SPLICE POINT.
(X1) PIN CONNECTION.
INDICATES A WIRE GROUND.
INDICATES A CHASSIS GROUND (NO WIRE).
INDICATES STANDARD OPTIONS.
INDICATES A CONNECTION,WIRE,LUG,ETC.
INSULATING PLUG
LIGHT LINES INDICATES WIRES IN THE SYSTEM.
NORMALLY CLOSED CONTACTS.
NORMALLY OPEN CONTACTS.
(X1) INDICATES CONNECTION.
HCF2 MULTIPLE PLUG CONNECTION NUMBER.
NC NO CONNECTION

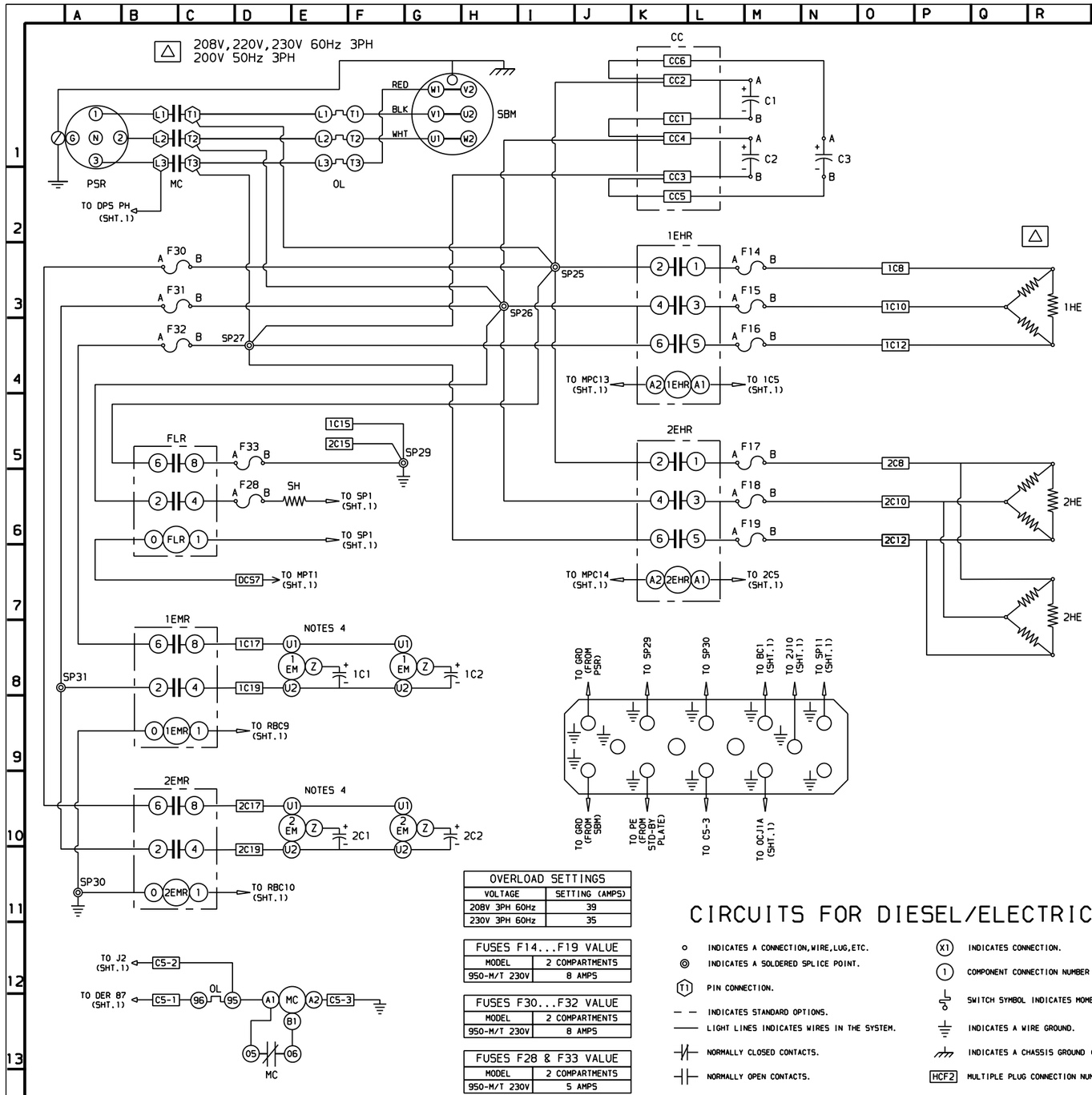
STANDARD

CAB COMMAND

OPTIONS

FUEL HEATER CONTROL PANEL DOOR SWITCH

DATE : 16 NOV 2010 | N :62-04120-ART | REV:B | SH:1/2



OVERLOAD SETTINGS	
VOLTAGE	SETTING (AMPS)
208V 3PH 60Hz	39
230V 3PH 60Hz	35

FUSES F14...F19 VALUE	
MODEL	2 COMPARTMENTS
950-M/T 230V	8 AMPS

FUSES F30...F32 VALUE	
MODEL	2 COMPARTMENTS
950-M/T 230V	8 AMPS

FUSES F28 & F33 VALUE	
MODEL	2 COMPARTMENTS
950-M/T 230V	5 AMPS

CIRCUITS FOR DIESEL/ELECTRIC

- ○ INDICATES A CONNECTION,WIRE,LUG,ETC.
- ◎ INDICATES A SOLDERED SPLICE POINT.
- (T1) PIN CONNECTION.
- – – INDICATES STANDARD OPTIONS.
- —— LIGHT LINES INDICATES WIRES IN THE SYSTEM.
- NORMALLY CLOSED CONTACTS.
- NORMALLY OPEN CONTACTS.
- (X1) INDICATES CONNECTION.
- (1) COMPONENT CONNECTION NUMBER OR LETTER.
- SWITCH SYMBOL INDICATES MOMENTARY CONTACTS.
- INDICATES A WIRE GROUND.
- INDICATES A CHASSIS GROUND (NO WIRE).
- [HCF2] MULTIPLE PLUG CONNECTION NUMBER.

LOCATION	SHEET	SYMBOL	DESCRIPTION	LOCATION IN FRAME
D-2	1	ALT	ALTERNATOR	MID FRAME
F-2	1	B	BUZZER	CONTROL BOX
A-1	1	BTY	BATTERY	
K-1/K-2	2	CC	CAPACITOR CONNECTOR (MAIN)	CONTROL BOX
A-7	1	CDT	COMPRESSOR DISCHARGE TEMPERATURE SENSOR	COMPRESSOR
E-8/G-8	2	1C1,1C2	ELEC. MOTOR CAP.(1st COMPARTMENT) 4 mfd,600V	EVAPORATOR
E-10/G-10	2	2C1,2C2	ELEC. MOTOR CAP.(2nd COMPARTMENT) 4 mfd,600V	EVAPORATOR
K-10/0-9	1	1CR	COOL RELAY (1st COMPARTMENT)	CONTROL BOX
K-10/0-10	1	2CR	COOL RELAY (2nd COMPARTMENT)	CONTROL BOX
M-1/N-1	2	C1/2/3	CAPACITOR (MAIN) 115 mfd, 280 V	CONTROL BOX
X-3	1	D1	DIODE	CONTROL BOX
D-9/0-10	1	DCT	DEFROST COMPARTMENT TRANSISTOR	CONTROL BOX
K-7/N-4	1	DER	DIESEL ELECTRIC RELAY	CONTROL BOX
K-11/B12	1/2	DPS	DETECTOR POWER SUPPLY	CONTROL BOX
W-2	1	1DS	DOOR SWITCH (1st COMPARTMENT)	EVAPORATOR
W-3	1	2DS	DOOR SWITCH (2nd COMPARTMENT)	EVAPORATOR
A-7	1	1DTS	DEFROST THERMISTOR SENSOR (1st COMPARTMENT)	EVAPORATOR
A-8	1	2DTS	DEFROST THERMISTOR SENSOR (2nd COMPARTMENT)	EVAPORATOR
T-9/T-10	1	1,2,3DWR	DRAIN WATER RESISTANCE (1st,2nd)	EVAPORATOR
G-12/K-4	1/2	1EHR	ELECTRIC HEAT RELAY (1st COMPARTMENT)	CONTROL BOX
G-12/K-7	1/2	2EHR	ELECTRIC HEAT RELAY (2nd COMPARTMENT)	CONTROL BOX
D8/F8	2	1EM	ELECTRIC MOTOR (1ST COMPARTMENT)	EVAPORATOR
D10/F10	2	2EM	ELECTRIC MOTOR (2ND COMPARTMENT)	EVAPORATOR
S-13/B-8	1/2	1EMR	ELECTRIC MOTOR RELAY (1ST COMPARTMENT)	CONTROL BOX
S-13/B-10	1/2	2EMR	ELECTRIC MOTOR RELAY (2ND COMPARTMENT)	CONTROL BOX
F-2	1	EXC	EXCITER (ALTERNATOR)	MID FRAME
R-4	2	1HE	HEATER ELEMENT (1ST COMPARTMENT)	EVAPORATOR
R-8	2	2HE	HEATER ELEMENT (2ND COMPARTMENT)	EVAPORATOR
B-2	1	F1	FUSE (MAXI FUSE 80A)	CONTROL BOX
M-2	1	F3	FUSE 15A	CONTROL BOX
M-5/M-9/M-11	1	F6,7,8	FUSE 3A	CONTROL BOX
J-3/P-4/D-5/D-6	1/2	F2,10,28,33	FUSE 5A	CONTROL BOX
M-7	1	F5	FUSE 5A	CONTROL BOX
M-9,M-10	1	F11,F12	FUSE 7.5A	CONTROL BOX
Y-4	1	F27	FUSE 25A	CONTROL BOX
D-1	1	F35	FUSE 5A	UNIT BATTERY
B-3	2	F30,31,32	FUSE 8A	CONTROL BOX
L-3....L6	2	F14..19	SEE CHART	CONTROL BOX
G-13/B-5	1/2	FLR	FLASHING RELAY	CONTROL BOX
Y-4	1	FH	FUEL HEATER (OPTION)	ENGINE
S-3/W-4	1	FHR	FUEL HEATER RELAY (OPTION)	CONTROL BOX
X-4	1	FHTH	FUEL HEATER THERMOSTAT (OPTION)	ENGINE
S-4	1	FP	FUEL PUMP	FUEL TANK
S-7	1	GP	GLOW PLUG	ENGINE
K-6/0-7	1	GPR	GLOW PLUG RELAY	CONTROL BOX
K-9/P-9	1	1HGR	HOT GAS RELAY (1st COMPARTMENT)	CONTROL BOX
K-9/P-11	1	2HGR	HOT GAS RELAY (2nd COMPARTMENT)	CONTROL BOX
S-9	1	1HGV	HOT GAS VALVE (1st COMPARTMENT)	EVAPORATOR
S-11	1	2HGV	HOT GAS VALVE (2nd COMPARTMENT)	EVAPORATOR
G-5	1	HP1	HIGH PRESSURE CUT-OUT SWITCH 1	COMPRESSOR
S-5	1	HP2	HIGH PRESSURE CUT-OUT SWITCH 2	COMPRESSOR
H-12	1	1HT	HEAT THERMOSTAT (1st COMPARTMENT)	EVAPORATOR
H-12	1	2HT	HEAT THERMOSTAT (2nd COMPARTMENT)	EVAPORATOR
H-4	1	J1	JUMPER 1	CONTROL BOX
S-9	1	1LSV	LIQUID SOLENOID VALVE (1st COMPARTMENT)	EVAPORATOR
S-10	1	2LSV	LIQUID SOLENOID VALVE (2nd COMPARTMENT)	EVAPORATOR
D-2/D-13	2	MC	MOTOR CONTACTOR	CONTROL BOX
K-7/0-6	1	MHR	MAIN HEAT RELAY	CONTROL BOX
S-7	1	MHV	MAIN HEAT VALVE	FRAME
D-13/D-2	1	MP	MICROPROCESSOR BOARD	CONTROL BOX
Z-4	1	OCJ1	OPTION CONNECTOR (10 WAY)	ENGINE
E-2/C-12	2	OL	OVERLOAD PROTECTOR	CONTROL BOX
A-3	1	OP	OIL PRESSURE SAFETY SWITCH (NO)	ENGINE
F-3	1	P1	CAB COMMAND PLUG CONNECTOR	CONTROL BOX
F-3	1	P2	MICROPROCESSOR-CAB COMMAND PLUG CONNECTOR	CONTROL BOX
A-1	2	PSR	POWER SUPPLY RECEPTACLE	
A-10	1	1RAS	RETURN AIR SENSOR (1st COMPARTMENT)	EVAPORATOR
A-10	1	2RAS	RETURN AIR SENSOR (2nd COMPARTMENT)	EVAPORATOR
K-2/L3	1	RCR	RUN CONTROL RELAY	CONTROL BOX
S-7	1	RPV	RECEIVER PRESSURE VALVE	CONDENSER
S-3	1	RS	RUN SOLENOID	ENGINE
P-9/N-13	1	1RR	RUN RELAY (1st COMPARTMENT)	CONTROL BOX
P-11/N-13	1	2RR	RUN RELAY (2nd COMPARTMENT)	CONTROL BOX
F-2	1	RSS	RUN SWITCH	CONTROL BOX
G-1	2	SBM	STANDBY MOTOR	FRAME
E-6	2	SH	SHUNT RESISTOR 5 OHM / 25 W	CONTROL BOX
A-2	1	SM	STARTER MOTOR	ENGINE
B-4	1	SP	SERIAL PORT (CONNECTOR 3 WAY) RS232	CONTROL BOX
A-5	1	SPT	SUCTION PRESSURE TRANSDUCER	COMPRESSOR
K-8/0-8	1	SR	SPEED RELAY	CONTROL BOX
A-2	1	SS	STARTER SOLENOID	STARTER
B-1	1	SSC	STARTER SOLENOID CONTACTOR	STARTER
K-6/0-6	1	SSR	STARTER SOLENOID RELAY	CONTROL BOX
T-2	1	1ST	START-STOP SWITCH (1st COMPARTMENT)	CAB COMMAND
T-3	1	2ST	START-STOP SWITCH (2nd COMPARTMENT)	CAB COMMAND
P-5	1	UFT	UNLOADER FRONT TRANSISTOR	CONTROL BOX
D-5/0-6	1	UFR	UNLOADER FRONT RELAY	CONTROL BOX
A-6	1	WTS	WATER TEMPERATURE SENSOR	ENGINE

NOTES :

1. UNIT SHOWN "OFF" POSITION.
2. WIRE IDENTIFICATION SYSTEM:
   COLOR: WHITE - DC CONTROL CIRCUITS
   BLACK - DC GROUNDS
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   AND MICROPROCESSOR MP AND PIN W2.
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STANDARD

CAB COMMAND

OPTIONS

FUEL HEATER CONTROL PANEL DOOR SWITCH

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INDEX

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CALIFORNIA

Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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