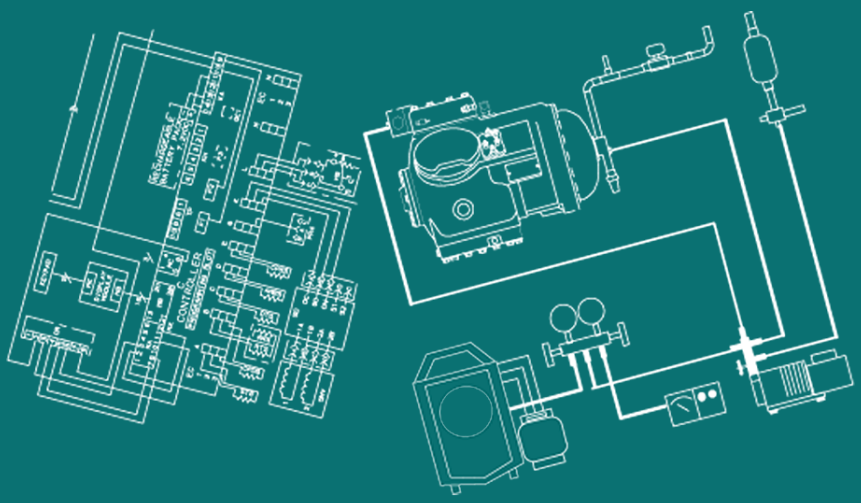
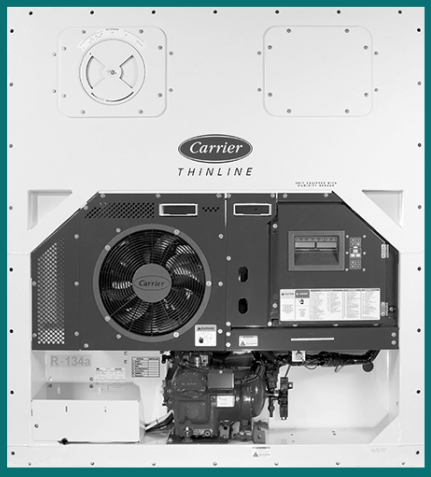
Container Refrigeration





OPERATIONS AND SERVICE MANUAL

For

69NT40-541-500 to 599

Container Refrigeration Units

T-363 Rev E

Carrier
TRANSICOLD

OPERATIONS AND SERVICE MANUAL

For

69NT40-541-500 to 599

 Printed in U. S. A. January 2021

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

FIGURE NUMBER **Page**

LIST OF TABLES

TABLE NUMBER **Page**

SECTION 1
SAFETY SUMMARY

1.1 General Safety Notices

Installation and servicing of refrigeration equipment can be hazardous due to system pressures and electrical components. Only trained and qualified service personnel should install, repair, or service refrigeration equipment.

The following general safety notices supplement 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.

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.

Keep hands, clothing and tools clear of the evaporator and condenser fans.

Wear appropriate personal protective equipment for the work being undertaken.

No work should be performed on the unit until all circuit breakers, start-stop switches are turned off, and power supply is disconnected.

In case of severe vibration or unusual noise, stop the unit and investigate.

1.4 Maintenance Precautions

Beware of unannounced starting of the evaporator and condenser fans. Do not open the condenser fan grille or evaporator access panels before turning power off, and disconnecting and securing the power plug.

Be sure power is turned off before working on motors, controllers, solenoid valves, and electrical control switches. Tag circuit breaker and power supply 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 modules in both control boxes. Do not remove wire harness from the modules unless you are grounded to the unit frame with a static safe wrist strap.

In case of electrical fire, open circuit switch and extinguish with CO2 (never use water).

1.5 Specific Hazard 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 − Indicates an immediate hazard that WILL result in severe personal injury or death.

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

CAUTION − Warns against potentially hazardous or unsafe practices that could result in minor personal injury, product or property damage.

The statements listed below are applicable to the 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

EXPLOSION HAZARD: Failure to follow this WARNING can result in death, serious personal injury and / or property damage. Never use air or gas mixtures containing oxygen (O2) for leak testing or operating the product. Charge Only With R−134a: Refrigerant must conform to AHRI Standard 700 specification.

⚠ WARNING

Beware of unannounced starting of the evaporator and condenser fans. The unit may cycle the fans and compressor unexpectedly as control requirements dictate.

⚠ WARNING

Do not attempt to remove power plug(s) before turning OFF start-stop switch (ST), unit circuit breaker(s), and external power source.

⚠ WARNING

Make sure the power plugs are clean and dry before connecting to power receptacle.

⚠ WARNING

Make sure that the unit circuit breaker(s) (CB-1 & CB-2) and the START-STOP switch (ST) are in the “O” (OFF) position before connecting to any electrical power source.

⚠ WARNING

Make sure power to the unit is OFF and power plug disconnected before replacing the compressor.

⚠ WARNING

Do not use a nitrogen cylinder without a pressure regulator.

⚠ WARNING

Do not remove the condenser fan grille before turning power OFF and disconnecting power plug.

⚠ WARNING

Always turn OFF the unit circuit breakers (CB-1 & CB-2) and disconnect main power supply before working on moving parts.

⚠ WARNING

The unit power plug must be disconnected to remove power from circuit breaker CB1.

⚠ WARNING

Before disassembly of any external compressor component make sure to relieve possible internal pressure by loosening the bolts and tapping the component with a soft hammer to break the seal.

⚠ CAUTION

Do not remove wire harnesses from circuit boards unless you are grounded to the unit frame with a static safe wrist strap or equivalent static drain device.

⚠ CAUTION

Remove the controller module and unplug all connectors before performing any arc welding on any part of the container.

⚠ CAUTION

Pre-trip inspection should not be performed with critical temperature cargoes in the container.

⚠ CAUTION

When Pre-Trip key is pressed, dehumidification and bulb mode will be deactivated. At the completion of Pre-Trip activity, dehumidification and bulb mode must be reactivated.

⚠ CAUTION

When a failure occurs during automatic testing, the unit will suspend operation awaiting operator intervention.

⚠ CAUTION

When Pre-Trip test Auto 2 runs to completion without being interrupted, the unit will terminate pre-trip and display “Auto 2” “end.” The unit will suspend operation until the user depresses the ENTER key!

⚠ CAUTION

The unit will remain in the full cooling mode as long as the emergency bypass switch is in the BYPASS position and the MODE SWITCH is in the FULL COOL position. If the cargo may be damaged by low temperatures, the operator must monitor container temperature and manually cycle operation as required to maintain temperature within required limits.

⚠ CAUTION

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

⚠ CAUTION

Removing the compressor motor press-fit stator in the field is not recommended. The rotor and stator are a matched pair and should not be separated.

⚠ CAUTION

The copper tube that connects to the oil suction strainer extends out the bottom with the bottom plate removed. Take precautions to avoid bending or breaking it while changing crankcase positions.

⚠ CAUTION

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

⚠ CAUTION

The set screw on the crankshaft must be removed for this type of oil pump (see Figure 7.8).

⚠ CAUTION

Use only Carrier Transicold approved Polyol Ester Oil (POE) − Castrol-Icematic SW20 compressor oil with R-134a. Buy in quantities of one quart or smaller. When using this hygroscopic oil, immediately reseal. Do not leave container of oil open or contamination will occur.

⚠ CAUTION

Take necessary steps (place plywood over coil or use sling on motor) to prevent motor from falling into condenser coil.

⚠ CAUTION

DO NOT disassemble piston from NEW suction modulating valve powerhead assembly. Doing so may result in damage to piston.

⚠ CAUTION

Unplug all controller connectors before performing arc welding on any part of the container.

⚠ CAUTION

The unit must be OFF whenever a programming card is inserted or removed from the controller programming port.

⚠ CAUTION

Do not allow moisture to enter wire splice area as this may affect sensor resistance.

SECTION 2
INTRODUCTION

2.1 Introduction

The Carrier Transicold ThinLINE model 69NT40-541-500 to 599 series units are of lightweight aluminum frame construction designed to fit in the front of a container and serve as the container's front wall.

They are one piece, self-contained, all-electric units, which include cooling and heating systems to provide precise temperature control.

The units are suppled with a complete charge of refrigerant R-134a and compressor lubricating oil, and are ready for operation upon installation. Forklift pockets are provided for unit installation and removal.

The base unit operates on nominal 380/460 volt, 3-phase, 50/60 hertz power. An optional autotransformer may be fitted to allow operation on nominal 190/230, 3 phase, 50/60 hertz power. Power for the control system is provided by a transformer, which steps the supply power down to 18 and 24 volts, single phase.

The controller is a Carrier Transicold Micro-Link 3 microprocessor. The controller operates automatically to select cooling, holding or heating as required to maintain the desired set point temperature within very close limits. The unit may also be equipped with an electronic temperature recorder.

The controller has a keypad and display for viewing or changing operating parameters. The display is also equipped with lights to indicate various modes of operation.

2.2 Configuration Identification

Unit identification information is provided on a plate located near the compressor. The plate provides the unit model number, the unit serial number and the unit parts identification number (PID). The model number identifies the overall unit configuration while the PID provides information on specific optional equipment, factory provisions to allow for field installation of optional equipment and differences in detailed parts.

2.3 Feature Descriptions

2.3.1 Control Box

Units are equipped with an aluminum control box, and may be fitted with a lockable door.

2.3.2 Controller

The unit is equipped with a Micro-Link 3 microprocessor system.

2.3.3 Temperature Readout

The unit is fitted with suction and discharge refrigerant temperature sensors. The sensor readings may be viewed on the controller display.

2.3.4 Pressure Readout

The is fitted with suction and discharge pressure transducers. The transducer readings may be viewed on the controller display.

2.3.5 Compressor

The unit is fitted with a single speed reciprocating compressor.

2.3.6 Condenser Coil

The unit is fitted with a two-row square formed condenser coil using 7mm tubing.

2.3.7 Condenser Grille

Condenser grilles are direct bolted.

2.3.8 Evaporator

The evaporator section is equipped with a hermetic thermal expansion valve (TXV) and a heat exchanger. The unit has six heaters.

2.3.9 Evaporator Fan Operation

Units are equipped with three-phase evaporator fan motors. Opening of an evaporator fan internal protector will shut down the unit.

2.3.10 Plate Set

Each unit is equipped with a tethered set of wiring schematic and wiring diagram plates. The plate sets are ordered using a seven-digit base part number and a two-digit dash number.

2.4 Option Descriptions

Various options may be factory or field equipped to the base unit. These options are described in the following subparagraphs.

2.4.1 Battery

The refrigeration controller may be fitted with standard replaceable batteries or a rechargeable battery pack. Rechargeable battery packs may be fitted in the standard location or in a secure location.

2.4.2 Dehumidification

The unit may be fitted with a humidity sensor. This sensor allows setting of a humidity set point in the controller. In dehumidification mode the controller will operate to reduce internal container moisture level.

2.4.3 USDA

The unit may be supplied with fittings for additional temperature probes, which allow recording of USDA Cold Treatment data by the integral DataCORDER function of the Micro-Link refrigeration controller.

2.4.4 Interrogator

Units that use the DataCORDER function are fitted with interrogator receptacles for connection of equipment to download the recorded data. Two receptacles may be fitted; one is accessible from the front of the container and the other mounted inside the container (with the USDA receptacles).

2.4.5 Remote Monitoring

The unit may be fitted with a remote monitoring receptacle. This item allows connection of remote indicators for COOL, DEFROST and IN RANGE. Unless otherwise indicated, the receptacle is mounted at the control box location.

2.4.6 Quest - CCPC

Compressor-Cycle Perishable Cooling (CCPC) is a method of temperature control used during steady-state perishable cooling that cycles the compressor on and off according to supply / return air temperature conditions.

2.4.7 Communications Interface Module

The unit may be fitted with a communications interface module. The communications interface module is a slave module which allows communication with a master central monitoring station. The module will respond to communication and return information over the main power line. Refer to the ship master system technical manual for further information.

2.4.8 460 Volt Cable

Various power cable and plug designs are available for the main 460 volt supply. The plug options tailor the cables to each customer’s requirements.

2.4.9 Autotransformer

An autotransformer may be provided to allow operation on 190/230, 3-phase, 50/60 hertz power. The autotransformer raises the supply voltage to the nominal 380/460 volt power required by the base unit. The autotransformer may also be fitted with an individual circuit breaker for the 230 volt power. If the unit is equipped with an autotransformer and communications module, the autotransformer will be fitted with a transformer bridge unit (TBU) to assist in communications.

2.4.10 230 Volt Cable

Units equipped with an autotransformer require an additional power cable for connection to the 230 volt source. Various power cable and plug designs are available. The plug options tailor the cables to customer requirements.

2.4.11 Gutters

Rain gutters may be fitted over the control box to divert rain away from the controls.

2.4.12 Handles

The unit may be equipped with handles to facilitate access to stacked containers.

2.4.13 Thermometer Port

The unit may be fitted with ports in the front of the frame for insertion of a thermometer to measure supply and/or return air temperature. If fitted, the port(s) will require a cap and chain.

2.4.14 Back Panels

Aluminum back panels may have access doors and/or hinge mounting.

2.4.15 Cable Restraint

Various designs are available for storage of the power cables. These options are variations of the compressor section front cover.

2.4.16 Upper Air (Fresh Air Make Up)

The unit may be fitted with an upper fresh air makeup assembly. The fresh air makeup assembly is available with a vent positioning sensor (VPS) and may also be fitted with screens.

2.4.17 Lower Air (Fresh Air Make Up)

The unit may be fitted with a lower fresh air makeup assembly. The fresh air makeup assembly is available with a vent positioning sensor (VPS) and may also be fitted with screens.

2.4.18 Labels

Safety Instruction and Function Code listing labels differ depending on the options installed. Labels available with additional languages are listed in the parts list.

2.4.19 Display Module

The unit may be fitted with a backlit Liquid Crystal Display (LCD) or a Light Emitting Diode (LED) Display.

2.4.20 Emergency Bypass

The optional Emergency Bypass switch (EB) functions to bypass the controller in the event of controller failure.

2.4.21 eAutoFresh

The optional eAutoFresh™ venting system moderates the atmospheric level inside the container unit in response to cargo respiration.

Procedures and technical information related to the eAutoFresh™ venting system can be found in the **T-342 eAutoFresh Manual**, located in the Literature section of the Container Refrigeration website. To find the manual from the Literature section, click on Options > eAutoFresh.

2.4.22 XtendFRESH

XtendFRESH™ is an OEM option that helps slow the ripening process by removing ethylene and simultaneously controlling CO_2 and O_2 levels in multiple combinations.

Procedures and technical information related to the XtendFRESH™ controlled atmosphere system can be found in the **T-366 XtendFRESH Manual**, located in the Literature section of the Container Refrigeration website. To find the manual from the Literature section, click on Options > XtendFRESH.

SECTION 3
DESCRIPTION

3.1 General Description

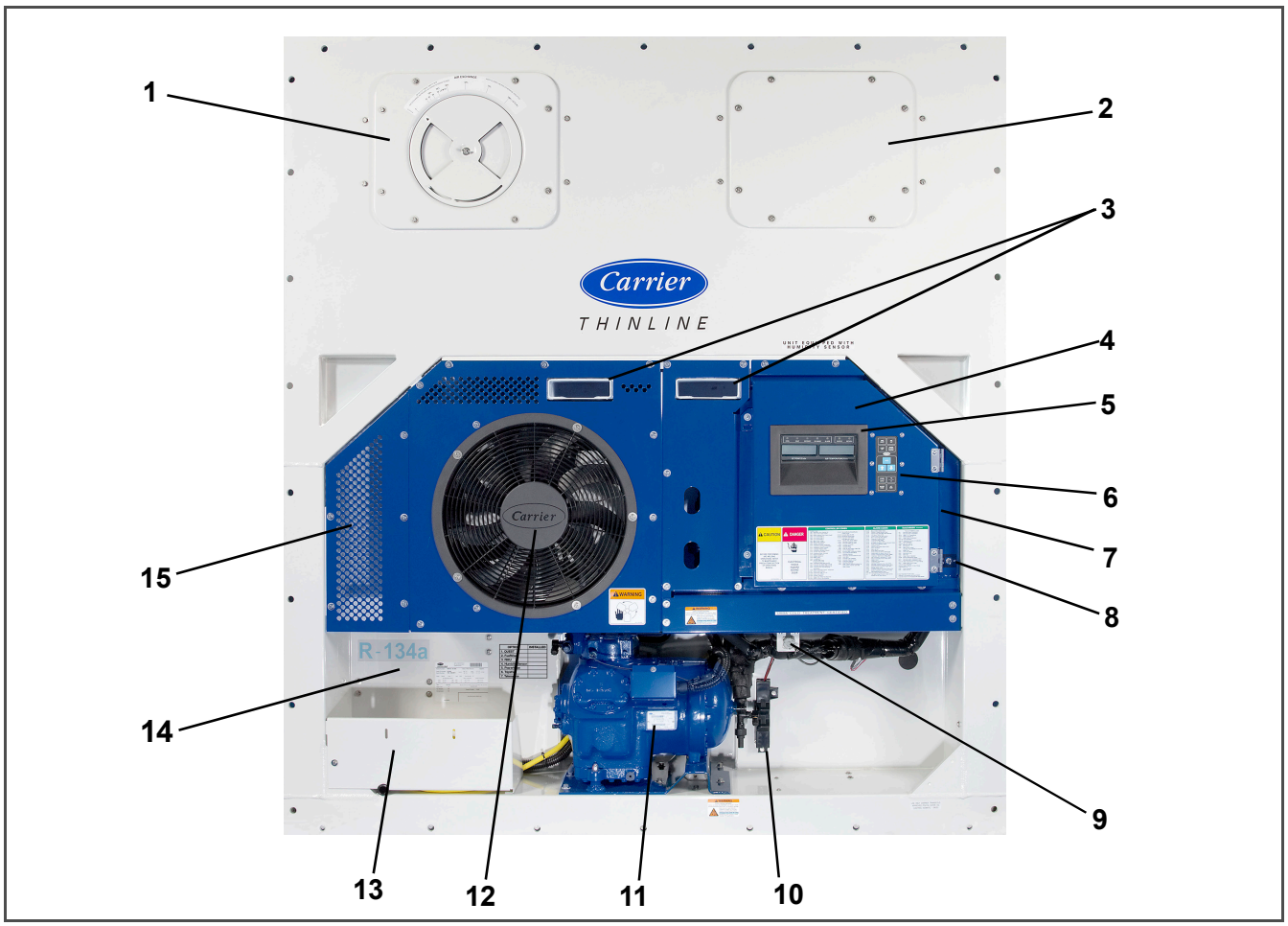
3.1.1 Refrigeration Unit - Front Section

The unit is designed so the majority of the components are accessible from the front (see **Figure 3.1**). The unit model number, serial number, and parts identification number can be found on the serial plate to the left of the compressor.

3.1.2 Fresh Air Makeup Vent

The function of the upper or lower makeup air vent is to provide ventilation for commodities that require fresh air circulation. A manually operated venting system is located in the upper left access panel. The optional eAutoFresh vent system is to moderate the atmospheric level in the container in response to cargo respiration. When transporting frozen cargo loads the vent will be closed. The upper left access panel contains the vent slide and motor assembly. It may be removed to allow entry into the evaporator section where the CO_2 sensor and drive pack are located.

Figure 3.1 Refrigeration Unit - Front Section



1. Upper Fresh Air Makeup Vent Panel / Evap Fan #2 (Inside panel includes DTS, HS and RTS. Refer to **Figure 3.2**)
2. Access Panel for Evap Fan #1 (Inside panel includes TXV, TXV Bulb, and HTT. Refer to **Figure 3.2**)
3. Fork Lift Pockets
4. Control Box
5. Unit Display
6. Keypad
7. Remote Monitoring Receptacle (option)
8. Start-Stop Switch (ST)
9. Interrogator Connector
10. Supply Temperature Sensor / Supply Recorder Sensor (STS / SRS)
11. Compressor
12. Condenser Fan
13. Power Cables and Plug location
14. Autotransformer location (option)
15. Lower Fresh Air Makeup Vent location

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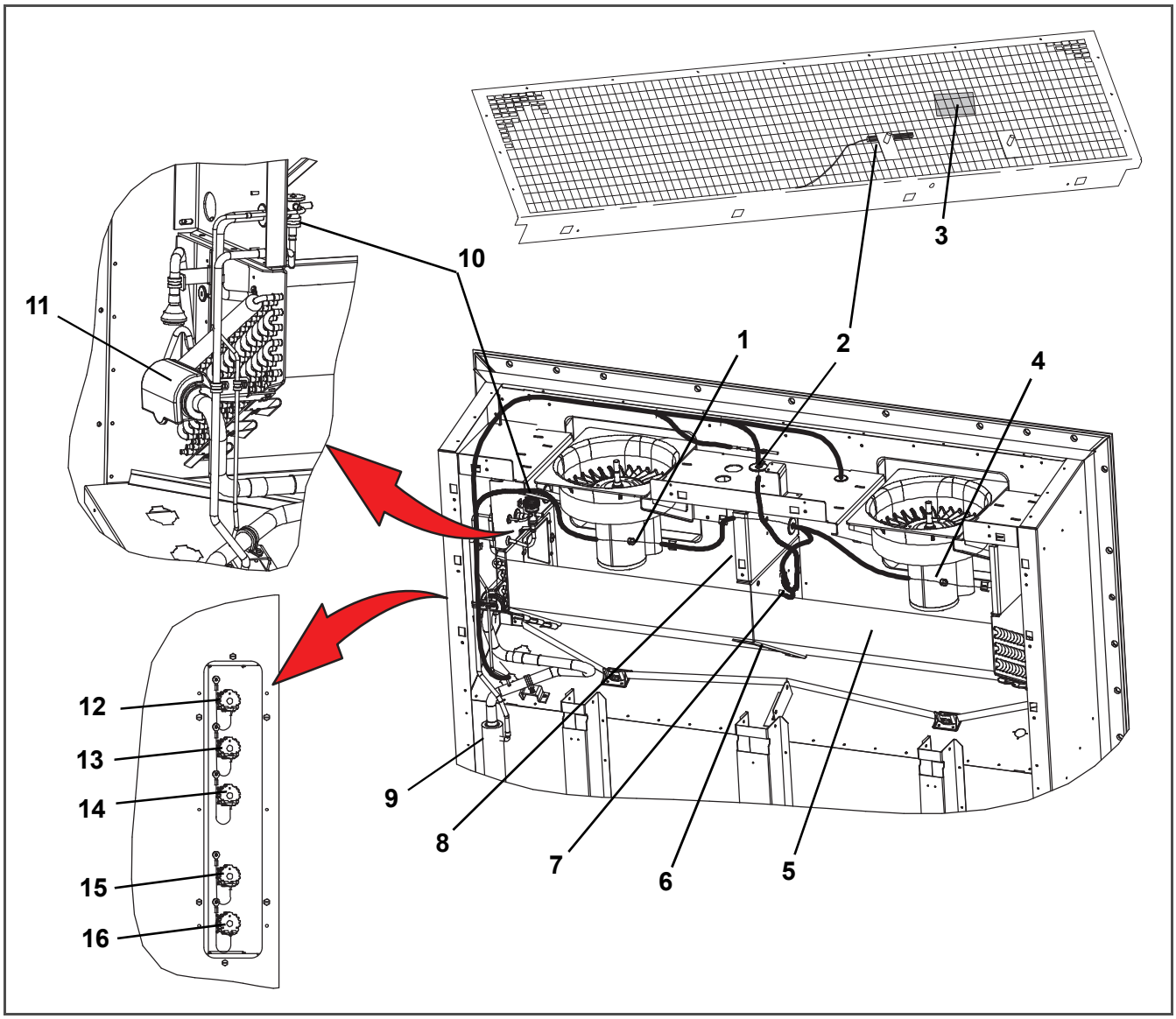
3.1.3 Evaporator Section

The evaporator section is shown below. The evaporator fans circulate air through the container by pulling it in the top of the unit, directing it through the evaporator coil where it is heated or cooled, and discharging it at the bottom.

If the unit is equipped with eAutoFresh, system components are mounted in addition to the standard refrigeration unit components. The stepper motor component is installed in the vent; the air filter, CO_2 sensor, stepper motor drive and CO_2 sensing lines are installed on the rib of the upper grill.

Most evaporator components are accessible by removing the upper rear panel (as shown in the illustration) or by removing the evaporator fan access panels (see **Figure 3.1**).

Figure 3.2 Evaporator Section - Units with Center Access Panel



1. Evaporator Fan Motor #1
2. Return Recorder Sensor (RRS) / Return Temperature Sensor (RTS)
3. Humidity Sensor (HS)
4. Evaporator Fan Motor #2
5. Evaporator Coil
6. Evaporator Coil Heaters
7. Defrost Temperature Sensor (DTS)
8. Heater Termination Thermostat (HTT)
9. Heat Exchanger
10. Thermostatic Expansion Valve (TXV)
11. TXV Bulb
12. Interrogator Connector Rear (ICR)
13. USDA Probe Receptacle PR2
14. USDA Probe Receptacle PR1
15. USDA Probe Receptacle PR3
16. Cargo Probe Receptacle PR4

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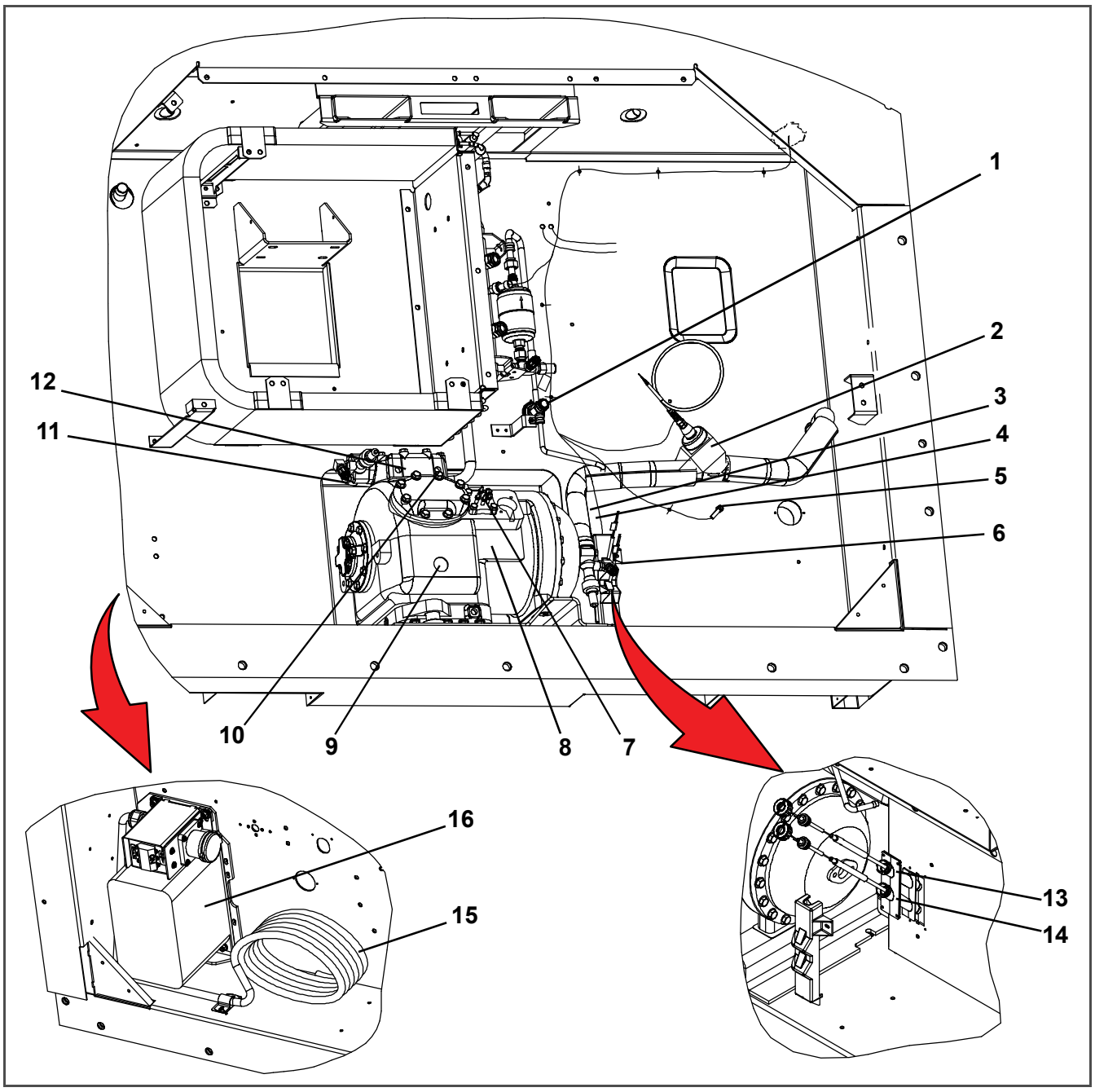
3.1.4 Compressor Section

The compressor section includes the compressor (with high pressure switch), power cable storage compartment, and autotransformer. This section also contains the quench valve, suction modulating valve, discharge pressure regulating valve, discharge temperature sensor, and discharge/suction pressure transducers. The supply temperature sensor, supply recorder sensor, and ambient sensor are located at the right side of the compressor.

Figure 3.3 Compressor Section



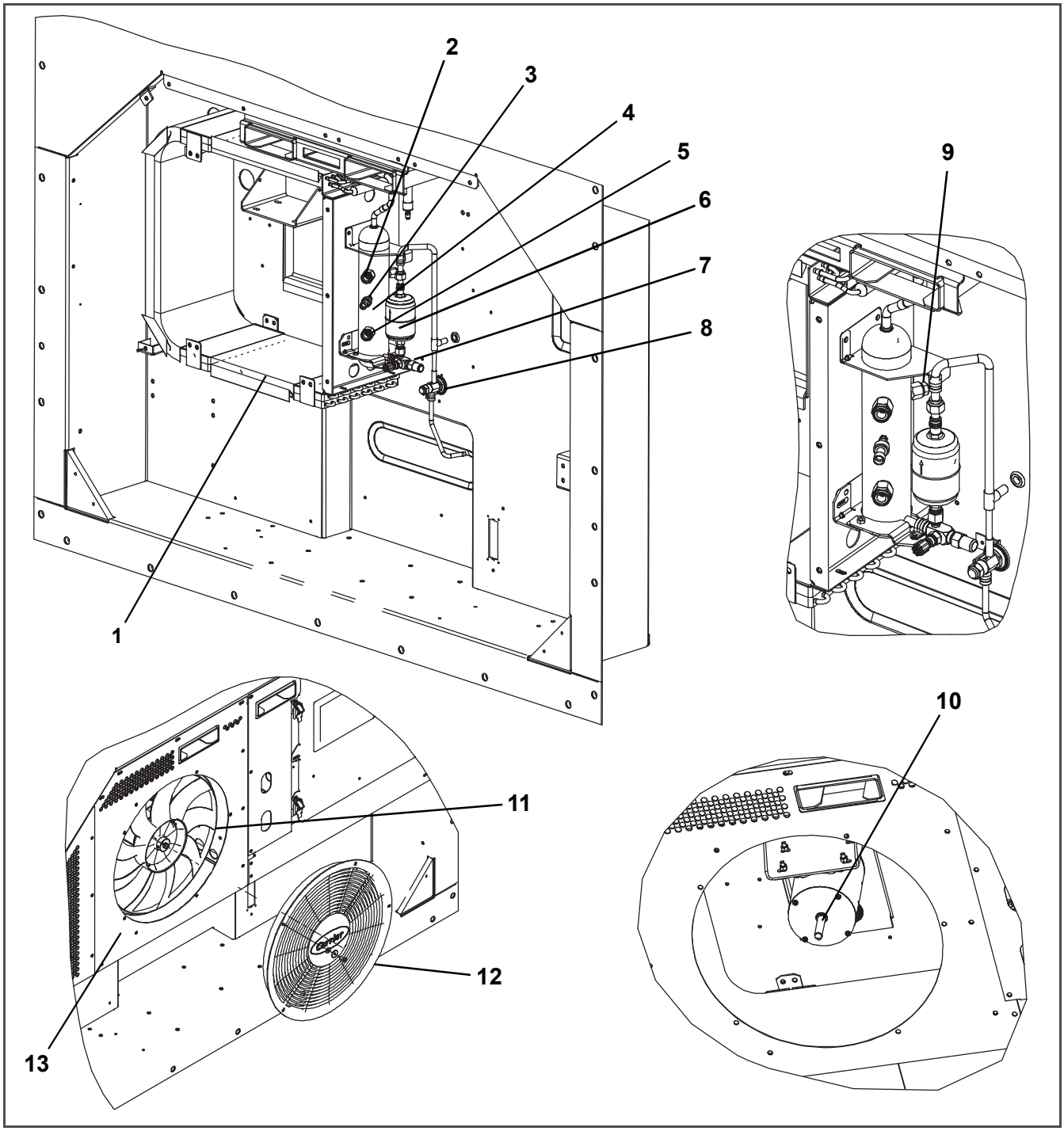
1. Quench Valve
2. Suction Modulating Valve
3. Suction Temperature Sensor
4. Quench Valve Temperature Bulb
5. Ambient Sensor
6. Suction Service Valve
7. Suction Pressure Transducer
8. Compressor
9. Compressor Sight Glass View Port
10. Discharge Pressure Transducer
11. Discharge Service Valve
12. High Pressure Switch
13. Supply Temperature Sensor (STS)
14. Supply Recorder Sensor (SRS)
15. Power Cables and Plug
16. Autotransformer

- - - - -

3.1.5 Air-Cooled Condenser Section

The air-cooled condenser section (**Figure 3.4**) consists of the condenser fan, condenser coil, receiver with sight glass/ moisture indicator, quench valve, liquid line service valve, filter-drier, condenser pressure transducer, and fusible plug. The condenser fan pulls air from around the coil and discharges it horizontally through the condenser fan grille.

Figure 3.4 Condenser Section



1. Condenser Coil
2. Sight Glass
3. Condenser Pressure Transducer
4. Receiver
5. Sight Glass/Moisture Indicator
6. Filter-Drier
7. Liquid Line Service Valve
8. Quench Valve
9. Fusible Plug
10. Condenser Fan Motor
11. Condenser Fan
12. Condenser Grille
13. Condenser Coil Cover

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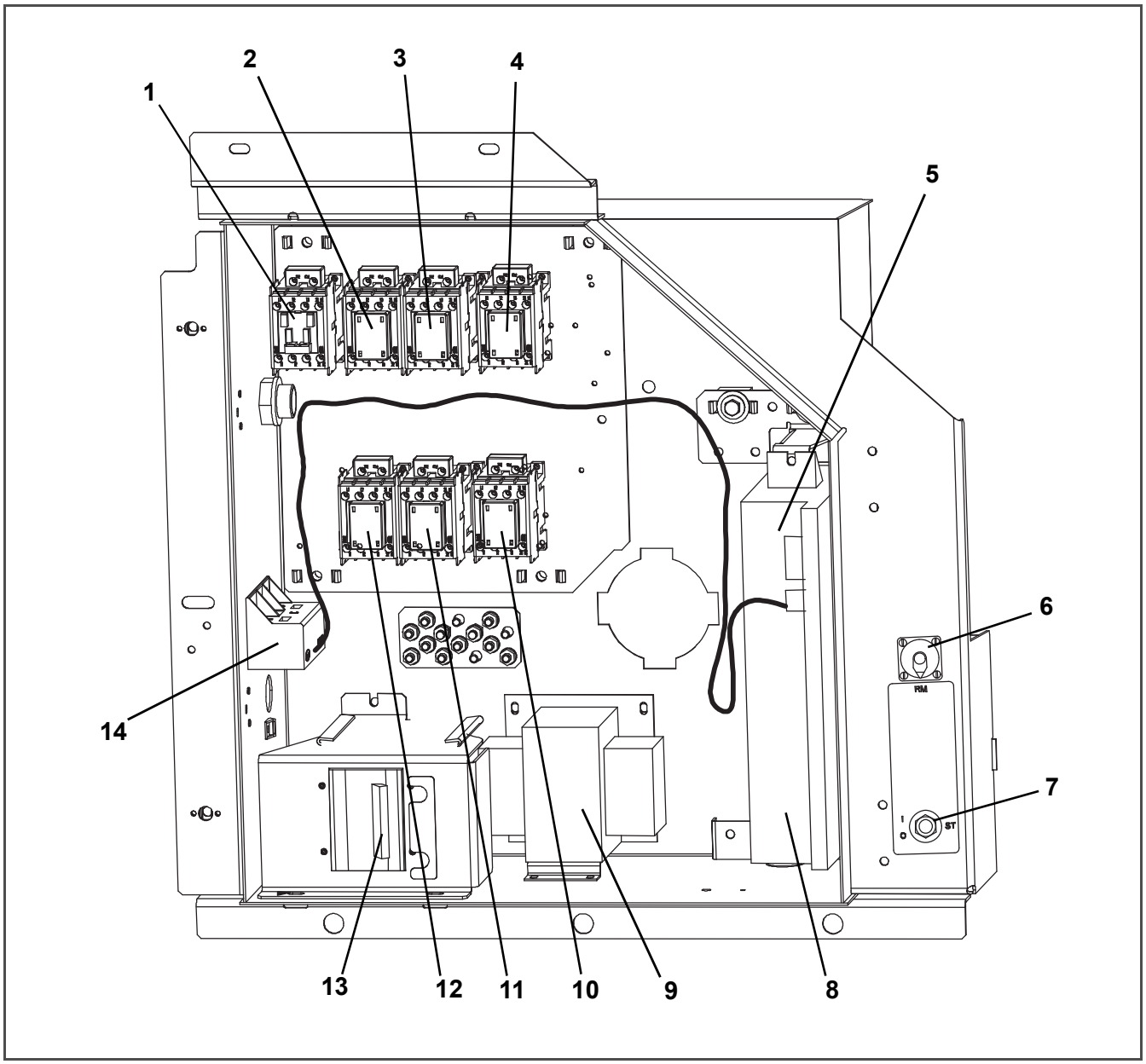
3.1.6 Control Box Section

The control box (**Figure 3.5**) includes the manual operation switches, circuit breaker (CB-1), compressor, fan and heater contactors, control power transformer, current sensor module, controller module and the communications interface module.

3.1.7 Communications Interface Module (option)

The communications interface module is a slave module which allows communication between the refrigeration unit and a ship system master central monitoring station. The module will respond to communication, and return information over the ships main power line. Refer to the master system technical manual for further information.

Figure 3.5 Control Box Section



1. Compressor Contactor - CH
2. Compressor Phase A Contactor - PA
3. Compressor Phase B Contactor - PB
4. Heater Contactor - HR
5. Controller / DataCORDER Module (Controller)
6. Remote Monitoring Receptacle
7. Start-Stop Switch, ST
8. Controller Battery Pack (Standard Location)
9. Control Transformer
10. High Speed Evaporator Fan Contactor - EF
11. Low Speed Evaporator Fan Contactor - ES
12. Condenser Fan Contactor - CF
13. Circuit Breaker (CB1) - 460V
14. Current Sensor Module

- - - - -

3.2 Refrigeration System Data

Table 3–1 Refrigeration System Data

a. Compressor/Motor Assembly	Number of Cylinders	6
	Model	06DR
	CFM	41
	Weight (Dry)	118kg (260 lb)
	Approved Oil	Castrol Icematic
	Oil Charge degrees	3.6 liters (7.6 U.S. pints)
	Oil Sight Glass	The oil level range, with the compressor off, should be between the bottom and one-eighth level of the sight glass.
b. Expansion Valve Superheat	Verify at -18°C (0°F) container box temperature	4.4 to 6.7°C (8 to 12°F)
c. Heater Termination Thermostat	Opens	54° (+/- 3) C = 130° (+/- 5) F
	Closes	38° (+/- 4) C = 100° (+/- 7) F
d. High Pressure Switch	Cutout	25 (+/- 1.0) kg/cm^2 = 350 (+/- 10) psig
	Cut-In	18 (+/- 0.7) kg/cm^2 = 250 (+/- 10) psig
WARNING **EXPLOSION HAZARD: Failure to follow this WARNING can result in death, serious personal injury and / or property damage.** **Never use air or gas mixtures containing oxygen (O_2) for leak testing or operating the product.** **Charge Only With R-134a: Refrigerant must conform to AHRI Standard 700 specification.**		
e. Refrigerant	R-134a	Conforming to AHRI standard 700 specifications.
f. Refrigerant Charge	Unit Configuration	Charge Requirements - R-134a
	Receiver	3.3 kg (7.3 lbs)
NOTE When replacing components (g.) and (h.), refer to installation instructions included with replacement part.		
g. Fusible Plug, Receiver*	Melting point	99°C = (210°F)
	Torque*	6.2 to 6.9 mkg (45 to 50 ft-lbs)
h. Sight Glass / Moisture Indicator	Torque	8.9 to 9.7 mkg (65 to 70 ft-lbs)
i. Condenser Pressure Transducer	Condenser Fan Starts	Condenser fan will start if condenser pressure is greater than 14.06 kg/cm2 (200 psig) OR the condenser fan is OFF for more than 60 seconds.
	Condenser Fan Stops	Condenser fan will stop if condenser pressure is less than 9.14 kg/cm2 (130 psig) AND the condenser fan remains ON for at least 30 seconds.
j. Unit Weight	Refer to unit model number plate.	

* Rupture Disc, part number 14-00215-04 may be installed as an alternate for the receiver mounted fusible plug.

3.3 Electrical Data

Table 3–2 Electrical Data

a. Circuit Breaker	CB-1	Trips at 29 amps	
	CB-2 (50 amps)	Trips at 62.5 amps	
	CB-2 (70 amps)	Trips at 87.5 amps	
b. Compressor Motor	Full Load Amps (FLA)	17.6 amps @ 460 VAC (with current limiting set at 21 amps)	
c. Condenser Fan Motor	Nominal Supply	**380 VAC, Three Phase, 50 Hz**	**460 VAC, Three Phase, 60 Hz**
	Full Load Amps	0.71 amps	0.72 amps
	Horsepower	0.21 hp	0.36 hp
	Rotations Per Minute	1450 rpm	1750 rpm
	Voltage and Frequency	360 - 460 VAC +/- 2.5 Hz	400 - 500 VAC +/- 2.5 Hz
	Bearing Lubrication	Factory lubricated, additional grease not required.	
	Rotation	Counter-clockwise when viewed from shaft end.	
d. Evaporator Coil Heaters	Number of Heaters	6	
	Rating	750 watts +5/-10% each @ 230 VAC	
	Resistance (cold)	66.8 to 77.2 ohms @ 20°C (68°F)	
	Type	Sheath	
e. Evaporator Fan Motor(s)		**380 VAC/3 PH/50 Hz**	**460 VAC/3 PH/60 Hz**
	Full Load Amps High Speed	1.07	0.9
	Full Load Amps Low Speed	0.47	0.47
	Nominal Horsepower High Speed	0.36	0.63
	Nominal Horsepower Low Speed	0.05	0.8
	Rotations Per Minute High Speed	2850 rpm	3450 rpm
	Rotations Per Minute Low Speed	1425 rpm	1725 rpm
	Voltage and Frequency	360 - 460 VAC +/- 1.25 Hz	400 - 500 VAC +/- 1.5 Hz
	Bearing Lubrication	Factory lubricated, additional grease not required	
	Rotation	CW when viewed from shaft end	
f. Fuses	Control Circuit	7.5 amps (F3A, F3B)	
	Controller / DataCORDER	5 amps (F1 & F2)	
g. Vent Positioning Sensor	Electrical Output	0.5 VDC to 4.5 VDC over 90 degree range	
	Supply Voltage	5 VDC +/- 10%	
	Supply Current	5 mA (typical)	

Table 3–2 Electrical Data (Continued)

h. Humidity Sensor	Orange wire	Power
	Red wire	Output
	Brown wire	Ground
	Input voltage	5 vdc
	Output voltage	0 to 3.3 vdc
	Output voltage readings verses relative humidity (RH) percentage:	
	30%	0.99V
	50%	1.65V
	70%	2.31V
	90%	2.97V
i. Controller	Setpoint Range	-30 to +30°C (-22 to +86°F)

3.4 Safety and Protective Devices

Unit components are protected from damage by safety and protective devices listed in the following table. These devices monitor the unit operating conditions and open a set of electrical contacts when an unsafe condition occurs.

Table 3–3 Safety and Protective Devices

Unsafe Condition	Safety Device	Device Setting
Excessive current draw	Circuit Breaker (CB-1) - Manual Reset	Trips at 29 amps (460VAC)
	Circuit Breaker (CB-2, 50 amp) - Manual Reset	Trips at 62.5 amps (230VAC)
	Circuit Breaker (CB-2, 70 amp) - Manual Reset	Trips at 87.5 amps (230VAC)
Excessive current draw in control circuit	Fuse (F3A & F3B)	7.5 amp rating
Excessive current draw by controller	Fuse (F1 & F2)	5 amp rating
Excessive condenser fan motor winding temperature	Internal Protector (IP-CM) - Automatic Reset	N/A
Excessive compressor motor winding temperature	Internal Protector (IP-CP) - Automatic Reset	N/A
Excessive evaporator fan motor(s) winding temperature	Internal Protector(s) (IP-EM) - Automatic Reset	N/A
Abnormal pressures / temperatures in the high refrigerant side	Fusible Plug - Receiver	99°C = (210°F)
Abnormally high discharge pressure	High Pressure Switch (HPS) - Automatic Reset	Open at 25kg/cm^2 (350 psig) Close at 18kg/cm^2 (250 psig)

3.5 Refrigeration Circuit

Starting at the compressor (see **Figure 3.6**), the suction gas is compressed to a higher pressure and temperature.

The gas flows out the compressor through the discharge service valve. Refrigerant gas then moves into the air-cooled condenser, where air flowing across the coil fins and tubes cools the gas to saturation temperature. By removing latent heat, the gas condenses to a high pressure/high temperature liquid and flows to the receiver, which stores the additional charge necessary for low temperature operation.

The liquid refrigerant continues through the liquid line service valve, the filter-drier (which keeps refrigerant clean and dry), and a heat exchanger (that increases sub-cooling of the liquid) to the thermostatic expansion valve (TXV).

As the liquid refrigerant passes through the variable orifice of the TXV, the pressure drops to suction pressure. In this process some of the liquid vaporizes to a gas (flash gas), removing heat from the remaining liquid. The liquid exits as a low pressure, low temperature, saturated mix. Heat is then absorbed from the return air by the balance of the liquid, causing it to vaporize in the evaporator coil. The vapor then flows through the suction tube back to the compressor.

The TXV is activated by the bulb strapped to the suction line near the evaporator outlet. The valve maintains a constant superheat at the coil outlet regardless of load conditions.

The TXV is a mechanical device that regulates the flow of liquid to the evaporator coil in order to maintain a relatively constant degree of superheat in the gas leaving the evaporator regardless of suction pressure.

The flow of liquid to the evaporator is regulated by a variable orifice which opens to increase refrigerant flow (decrease superheat), or closes to decrease refrigerant flow (increase superheat). The variable orifice is controlled by the temperature sensing bulb which is strapped to the suction line near the evaporator outlet.

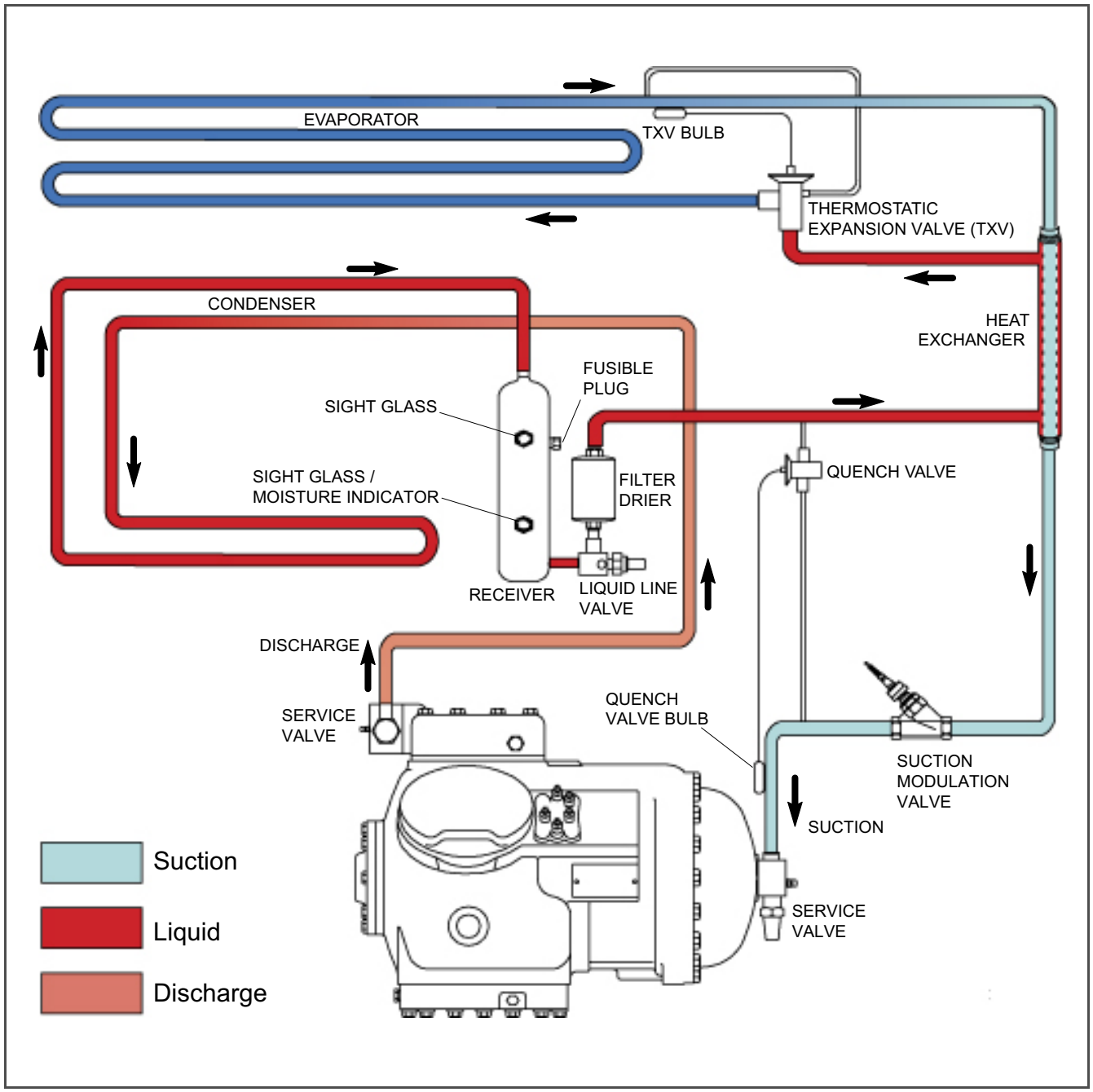
During periods of low load, the suction modulating valve (SMV) decreases flow of refrigerant to the compressor. This action balances the compressor capacity with the load and prevents operation with low coil temperatures. In this mode of operation, the quench valve will open as required to provide sufficient liquid refrigerant flow into the suction line for cooling of the compressor motor. The quench valve senses refrigerant condition entering the compressor and modulates the flow to prevent entrance of liquid into the compressor.

The refrigeration system is also fitted with a condenser pressure transducer, which feeds information to the controller. The controller programming will operate the condenser fan so as to attempt to maintain discharge pressures above 130psig in low ambients. At ambients below 27°C (80°F), the condenser fan will cycle on and off depending on condenser pressure and operating times.

1. The condenser fan will start if the condenser pressure is greater than 200 psig OR the condenser fan has been OFF for more than 60 seconds.
2. The condenser fan will stop if the condenser pressure is less than 130 psig AND the condenser fan has been running for at least 30 seconds.

At ambients above 27°C (80°F), condenser pressure control is disabled and the condenser fan runs continuously.

Figure 3.6 Refrigeration Circuit with Receiver



SECTION 4
MICROPROCESSOR

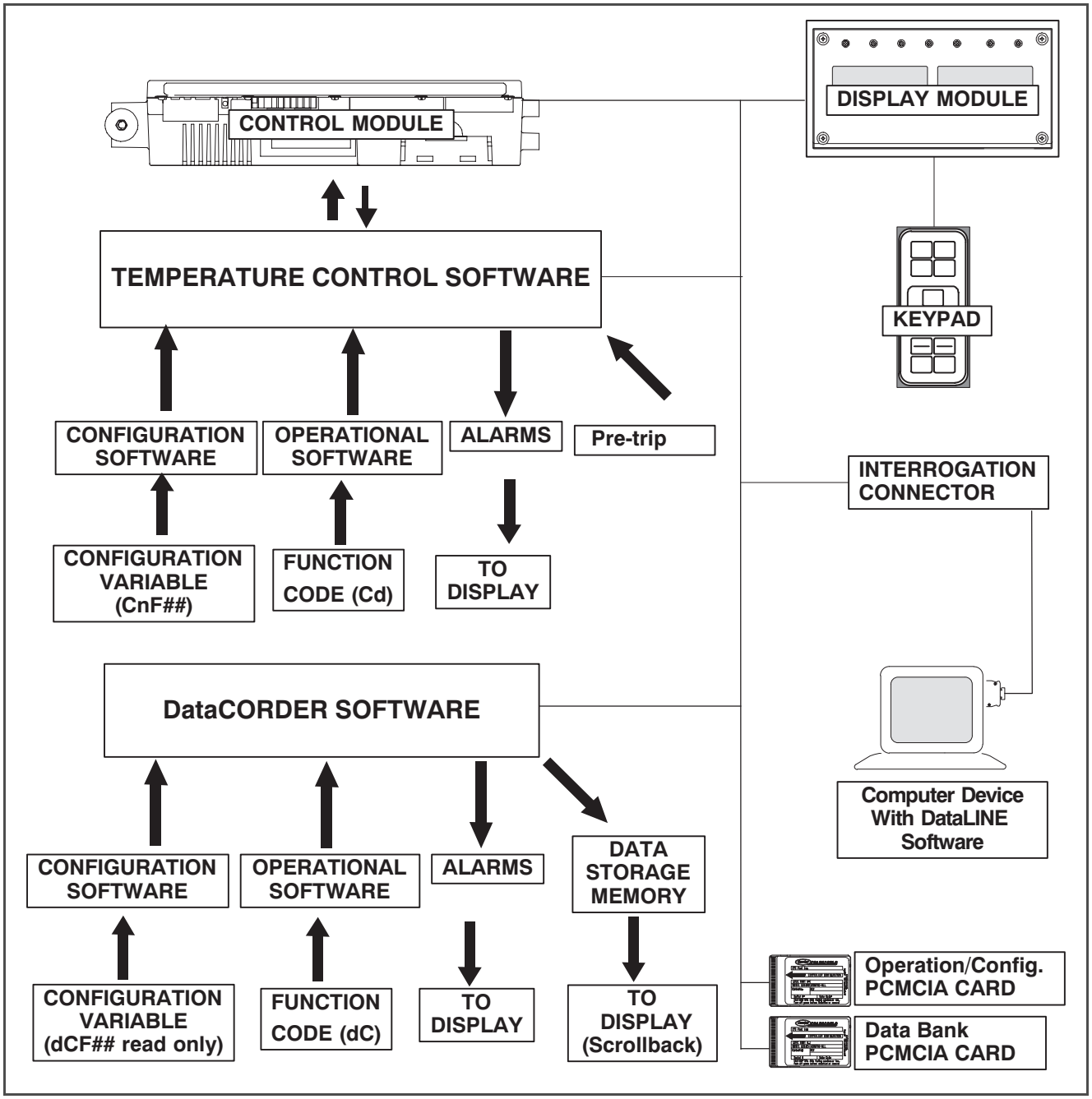
4.1 Temperature Control Microprocessor System

The temperature control Micro-Link 3 microprocessor system (see **Figure 4.1**) consists of a keypad, display module, control module (controller), and interconnecting wiring. The controller houses the temperature control software and the DataCORDER Software. The temperature control software functions to operate the unit components as required to provide the desired cargo temperature and humidity.

The DataCORDER software functions to record unit operating parameters and cargo temperature parameters for future retrieval. Coverage of the temperature control software begins with **Section 4.2**. Coverage of the DataCORDER software is provided in **Section 4.8**.

The keypad and display module serve to provide user access and readouts for both of the controller functions, temperature control, and DataCORDER. The functions are accessed by keypad selections and viewed on the display module. The components are designed to permit ease of installation and removal.

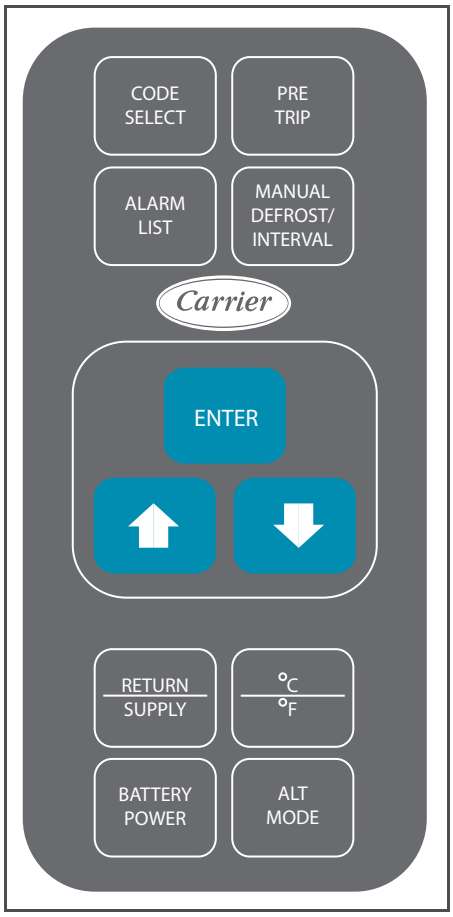
Figure 4.1 Temperature Control System



4.1.1 Keypad

The keypad (**Figure 4.2**) is mounted on the control box door. The keypad consists of 11 push button switches that act as the user's interface with the controller. Descriptions of the switch functions are provided in **Table 4–1**.

Figure 4.2 Keypad



4.1.2 Display Module

The display module (**Figure 4.3**) consists of five digital displays and seven indicator lights. Indicator lights include:

1. COOL - White or Blue LED: Energized when the refrigerant compressor is energized.
2. HEAT - Orange LED: Energized to indicate heater operation in heat mode, defrost mode, or dehumidification.
3. DEFROST - Orange LED: Energized when the unit is in the defrost mode.
4. IN RANGE - Green LED: Energized when the controlled temperature probe is within specified tolerance of set point.

NOTE

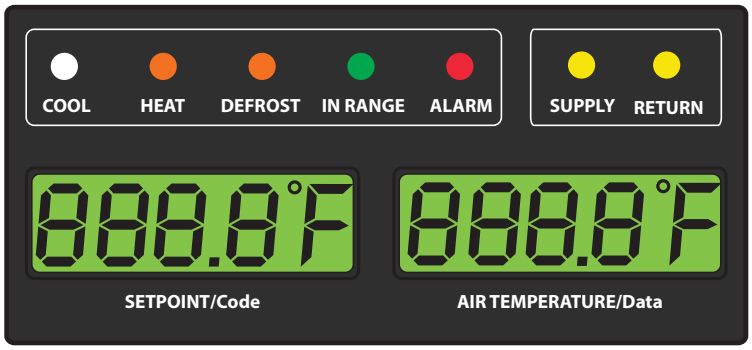
The controlling probe in perishable range is the SUPPLY air probe and the controlling probe in frozen range is the RETURN air probe.

5. SUPPLY - Yellow LED: Energized when the supply air probe is used for control. When this LED is illuminated, the temperature displayed in the AIR TEMPERATURE display is the reading at the supply air probe. This LED will flash if dehumidification or humidification is enabled.
6. RETURN - Yellow LED: Energized when the return air probe is used for control. When this LED is illuminated, the temperature displayed in the AIR TEMPERATURE display is the reading at the return air probe. This LED will flash if dehumidification or humidification is enabled.
7. ALARM - Red LED: Energized when an active or an inactive shutdown alarm is in the alarm queue

Table 4–1 Keypad Function

Key	Function
CODE SELECT	Accesses function codes.
PRE TRIP	Displays the pre-trip selection menu. Discontinues pre-trip in progress.
ALARM LIST	Displays alarm list and clears the alarm queue.
MANUAL DEFROST / INTERVAL	Displays selected defrost mode. Depressing and holding the Defrost interval key for five seconds will initiate defrost using the same logic as if the optional manual defrost switch was toggled on.
ENTER	Confirms a selection or saves a selection to the controller.
Arrow Up	Change or scroll a selection upward. Pre-trip advance or test interruption.
Arrow Down	Change or scroll a selection downward. Pre-trip repeat backward
RETURN / SUPPLY	Displays non-controlling probe temperature (momentary display).
Celsius / Fahrenheit	Displays alternate English/Metric scale (momentary display). When set to degrees Fahrenheit, pressure is displayed in psig and vacuum in "/ hg. "P" appears after the value to indicate psig and "i" appears for inches of mercury. When set to degrees Celsius, pressure readings are in bars. "b" appears after the value to indicate bars.
BATTERY POWER	Initiate battery backup mode to allow set point and function code selection if AC power is not connected.
ALT MODE	This key is pressed to switch the functions from the temperature software to the DataCORDER Software. The remaining keys function the same as described above except the readings or changes are made to the DataCORDER programming.

Figure 4.3 Display Module



4.1.3 Controller

⚠ CAUTION

Do not remove wire harnesses from controller unless you are grounded to the unit frame with a static safe wrist strap.

⚠ CAUTION

Unplug all controller wire harness connectors before performing arc welding on any part of the container.

⚠ CAUTION

Do not attempt to use an ML2i PC card in an ML3 equipped unit. The PC cards are physically different and will result in damage to the controller.

NOTE

Do not attempt to service the controller. Breaking the seal will void the warranty.

The Micro-Link 3 controller is a single module microprocessor as shown in **Figure 4.4**. It is fitted with test points, harness connectors and a software card programming port.

4.2 Controller Software

The controller software is a custom designed program that is subdivided into the configuration software and the operational software. The controller software performs the following functions:

a. Control supply or return air temperature to required limits, provide modulated refrigeration operation, economized operation, unloaded operation, electric heat control, and defrost. Defrost is performed to clear buildup of frost and ice to ensure proper air flow across the evaporator coil.

b. Provide default independent readouts of set point and supply or return air temperatures.

c. Provide ability to read, and if applicable, modify the configuration software variables, operating software function codes, and alarm code indications.

d. Provide a Pre-trip step-by-step checkout of refrigeration unit performance, including proper component operation, electronic and refrigeration control operation, heater operation, probe calibration, pressure limiting, and current limiting settings.

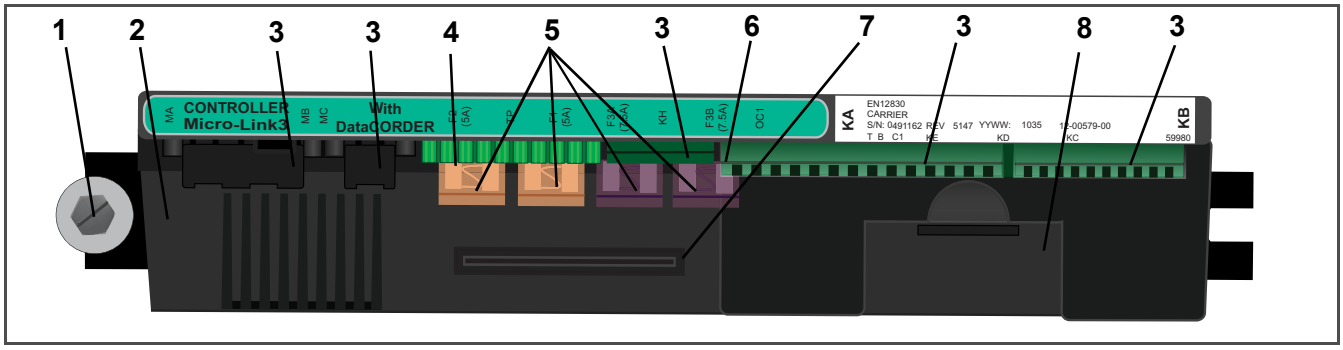
e. Provide battery-powered ability to access or change selected codes and set points without AC power connected.

f. Provide the ability to reprogram the software through the use of a memory card.

4.2.1 Configuration Software (CnF Variables)

The configuration software is a variable listing of the components available for use by the operational software. This software is factory-installed in accordance with the equipment fitted and options listed on the original purchase order. Changes to the configuration software are required only when a new controller has been installed or a physical change has been made to the unit such as the addition or removal of an option. A configuration variable list is provided in **Table 4–4**. Change to the factory-installed configuration software is achieved via a configuration card or by communications.

Figure 4.4 Control Module



1. Mounting Screw
2. Micro-Link 3 Controller
3. Connectors
4. Test Points
5. Fuses
6. Control Circuit Power Connection (located on back of controller)
7. Software Programming Port
8. Battery Pack

- - - - -

4.2.2 Operational Software (Cd Function Codes)

The operational software is the actual operation programming of the controller which activates or deactivates components in accordance with current unit operation conditions and selected modes of operation.

The programming is divided into function codes. Some of the codes are read only, while the remaining codes may be user configured. The value of the user configurable codes can be assigned in accordance with user desired mode of operation. A list of the function codes is provided in **Table 4–5**.

To access the function codes:

a. Press CODE SELECT, then press an arrow key until the left window displays the desired function code.

b. The right window will display the selected function code value for five seconds before returning to the default display mode.

c. If additional time is required, pressing the ENTER key will extend the display time to 30 seconds.

4.3 Modes of Operation

General operation sequences for cooling, heating, and defrost are provided in the following sub-paragraphs. Schematic representation of controller actions are provided in **Figure 4.5** & **Figure 4.8**.

Operational software responds to various inputs. These inputs come from the temperature sensors and pressure transducers, the temperature set point, the settings of the configuration variables and the function code assignments. The action taken by the operational software changes as the input values change. Overall interaction of the inputs is described as a “mode” of operation. The modes of operation include perishable (chill) mode and frozen mode. Descriptions of the controller interaction and modes of operation are provided in the following sub paragraphs.

4.3.1 Perishable Mode Temperature Control

The unit is capable of maintaining supply air temperature to within +/- 0.25°C (+/- 0.5°F) of set point. Supply air temperature is controlled by positioning of the suction modulation valve (SMV), cycling of the compressor, and cycling of the heaters.

In Perishable Mode, the controller maintains the supply air temperature at set point, the SUPPLY indicator light is illuminated and the default reading on the display window is the supply temperature sensor reading.

When the supply air temperature enters the in-range temperature tolerance (Cd30), the green IN-RANGE light will energize.

When CnF26 (Heat Lockout Temperature) is set to -10°C, perishable mode is active with set points above -10°C (+14°F). When CnF26 is set to -5°C, perishable mode is active with set points above -5°C (+23°F).

4.3.2 Perishable Pulldown

When the system is in Perishable Pulldown Mode, the highest priority is given to bringing the container down to set point. When cooling from a temperature that is more than 5°C (9°F) above set point, the system will be in Perishable Pulldown Mode, and the SMV will open to reduce the pulldown time.

However, pressure and current limit functions may restrict the valve if either exceeds the preset limits.

4.3.3 Perishable Steady State

Perishable Steady State is used to maintain the control temperature near a setpoint that is above the heat lockout temperature.

The operational software is designed so the SMV will begin to close as the set point is reached. The SMV will continue to close and restrict refrigerant flow until the capacity of the unit and the load are balanced.

If the temperature drops below the set point, the compressor will remain running for a few minutes. This is to accommodate any initial undershoot which might occur. After this time has expired and the temperature is 0.2°C (0.36°F) or greater below the set point, the compressor will be turned OFF.

If the temperature drops to 0.5°C (0.9°F) below set point, the heaters will be energized. The heaters will de-energize when the temperature rises to 0.2°C (0.36°F) below the set point. The compressor will not restart until the temperature rises to 0.2°C (0.36°F) above the set point and three minutes have elapsed since the last compressor turn off.

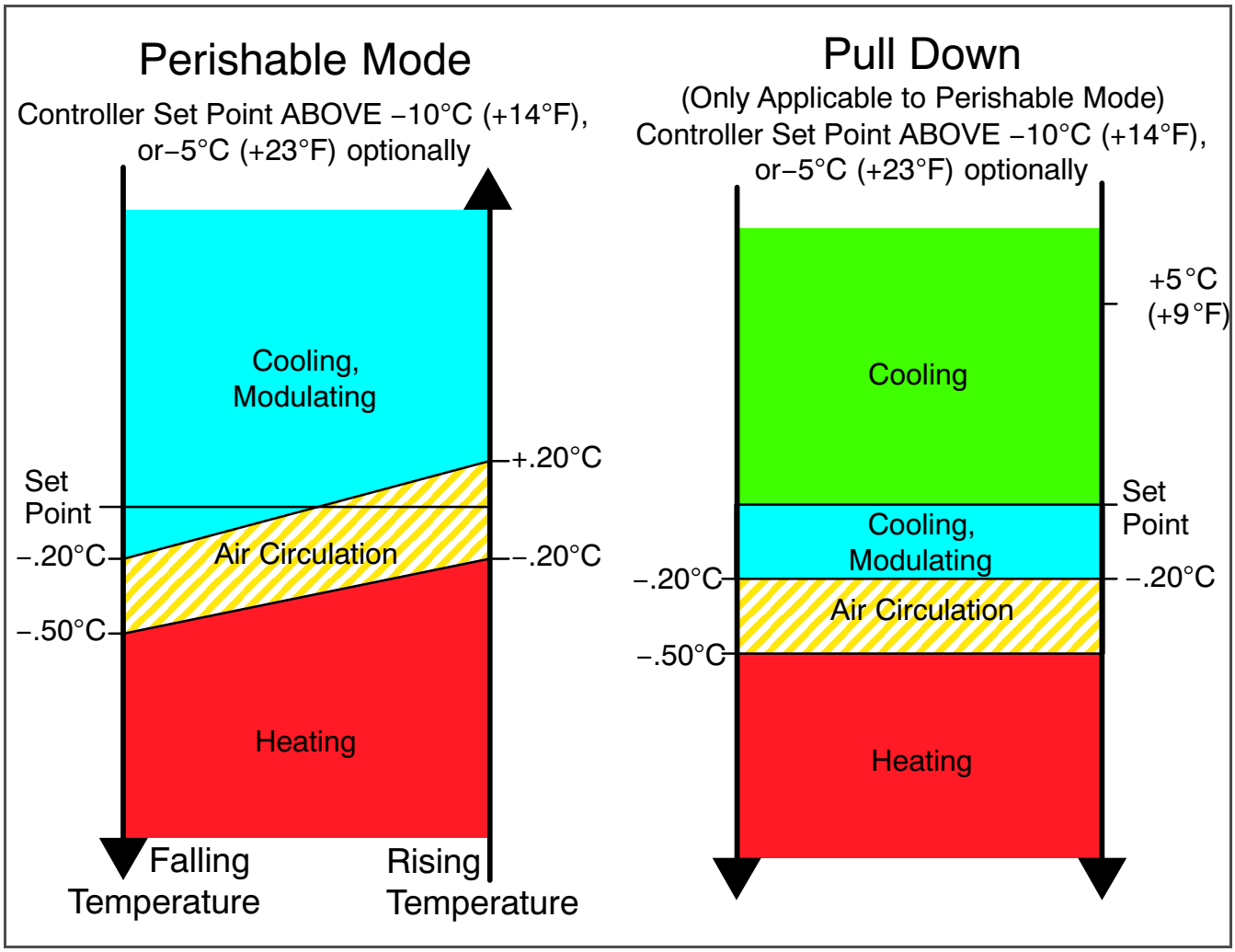
4.3.4 Perishable Idle, Air Circulation

Perishable Idle Mode is used when it is unnecessary to run the compressor to maintain control temperature. If the controller has determined that cooling is not required or the controller logic determines suction pressure is at the low pressure limit, the unit will transition to Perishable Idle Mode. During Perishable Idle Mode, the compressor is turned off, but the evaporator fans continue to run to circulate air throughout the container. If temperature rises +0.2°C above set point, the unit will transition back to perishable steady state.

4.3.5 Perishable Heating

When it is necessary to raise the control temperature, the system will enter Perishable Heating Mode. If the temperature drops to 0.5°C (0.9°F) below set point, the unit will transition to Perishable Heating Mode, and the heaters will be energized. The unit will transition back to Perishable Idle Mode when the temperature rises to 0.2°C (0.36°F) below the set point, and the heaters will de-energize.

Figure 4.5 Controller Operation - Perishable Mode



4.3.6 Perishable Mode Dehumidification

Dehumidification is provided to reduce the humidity levels inside the container. Dehumidification is activated when a humidity value is set at Cd33. The yellow SUPPLY LED will flash ON and OFF every second to indicate that dehumidification is active. Once dehumidification is active and the following conditions are satisfied, the controller will activate the heat relay to begin dehumidification.

1. The humidity sensor reading is above the humidity set point (Cd33).
2. The unit is in the perishable steady state mode, and the supply air temperature is less than 0.25°C (0.45°F) above set point.
3. The heater debounce timer (three minutes) has timed out.
4. Heater termination thermostat (HTT) is closed.

If the above conditions remain true for at least one hour, the evaporator fans will switch from high speed to low speed. Evaporator fan speed will then switch every hour, as long as the 4 conditions are met (see Bulb Mode, **Section 4.3.7** for different evaporator fan speed options).

If any condition except for item (1) becomes false OR if the relative humidity sensed is 2% below the dehumidification set point, the high speed evaporator fans will be energized.

During dehumidification, power is applied to the defrost heaters. This added heat load causes the controller to open the SMV to match the increased heat load while still holding the supply air temperature very close to the set point.

Opening the SMV reduces the temperature of the evaporator coil surface, which increases the rate at which water is condensed from the passing air. Removing water from the air reduces the relative humidity. When the relative humidity sensed is 2% below set point, the controller de-energizes the heat relay. The controller will continue to cycle heating to maintain relative humidity below the selected set point. If the dehumidification mode is terminated by a condition other than the humidity sensor, e.g., an out-of-range or compressor shutdown condition, the heat relay is de-energized immediately.

Two timers are activated during dehumidification to prevent rapid cycling and consequent contactor wear:

1. Heater debounce timer (three minutes) - The heater debounce timer is started whenever the heater contactor status is changed. The heat contactor remains energized (or de-energized) for at least three minutes even if the set point criteria is satisfied.
2. Out-of-range timer (five minutes) - The out-of-range timer is started to maintain heater operation during a temporary out-of-range condition. If supply air temperature remains outside of the user selected in-range setting for more than five minutes, the heaters will be de-energized to allow the system to recover. The out-of-range timer starts as soon as the temperature exceeds the in-range tolerance value set by Cd30.

4.3.7 Perishable, Dehumidification - Bulb Mode

Bulb mode is an extension of dehumidification which allows changes to the evaporator fan speed and/or defrost termination set points.

Bulb mode is active when Cd35 is set to “Bulb.” Once bulb mode is activated, the user may then change the dehumidification mode evaporator fan operation from the default (speed alternates from low to high each hour) to constant low or constant high speed. This is done by toggling Cd36 from its default of “alt” to “Lo” or “Hi” as desired. If low speed evaporator fan operation is selected, the user has the additional capability of selecting dehumidification set points from 60 to 95% (instead of the normal 65 to 95%).

In addition, if bulb mode is active, Cd37 may be set to override the previous defrost termination thermostat (DTT) settings. The temperature at which the DTT will be considered “open” may be changed [in 0.1°C (0.2°F) increments] to any value between 25.6°C (78°F) and 4°C (39.2°F). The temperature at which the DTT is considered closed for interval timer start or demand defrost is 10°C (50°F) for “open” values from 25.6°C (78°F) down to a 10°C (50°F) setting. For “open” values lower than 10°C, the “closed” values will decrease to the same value as the “open” setting. Bulb mode is terminated when:

1. Bulb mode code Cd35 is set to “Nor.”
2. Dehumidification code Cd33 is set to “Off.”
3. The user changes the set point to one that is in the frozen range.

When bulb mode is disabled by any of the above, the evaporator fan operation for dehumidification reverts to “alt” and the DTS termination setting resets to the value determined by CnF41.

4.3.8 Perishable Economy

Economy fan mode is an extension of the Perishable Mode, and is provided for power saving purposes. Economy fan mode is activated when Cd34 (also used for Frozen Economy Mode) is set to “ON.” Economy fan mode is used in the transportation of temperature-tolerant cargo or non-respiration items which do not require high airflow for removing respiration heat.

There is no active display that indicates that economy fan mode has been initiated. To check for economy fan mode, perform a manual display of Cd34.

In order to achieve economy mode, a perishable set point must be selected prior to activation. When economy mode is active, the evaporator fans will be controlled as follows:

At the start of each cooling or heating cycle, the evaporator fans will run in high speed for three minutes.

After the initial three minutes, they will then be switched to low speed any time supply air temperature is within +/- 0.25°C (0.45°F) of set point and return air temperature is less than or equal to supply air temperature +3°C (5.4°F).

The fans will continue to run in low speed for one hour. At the end of the hour, the evaporator fans will switch back to high speed and the cycle will be repeated.

4.3.9 Perishable Mode Cooling - Sequence of Operation

NOTE

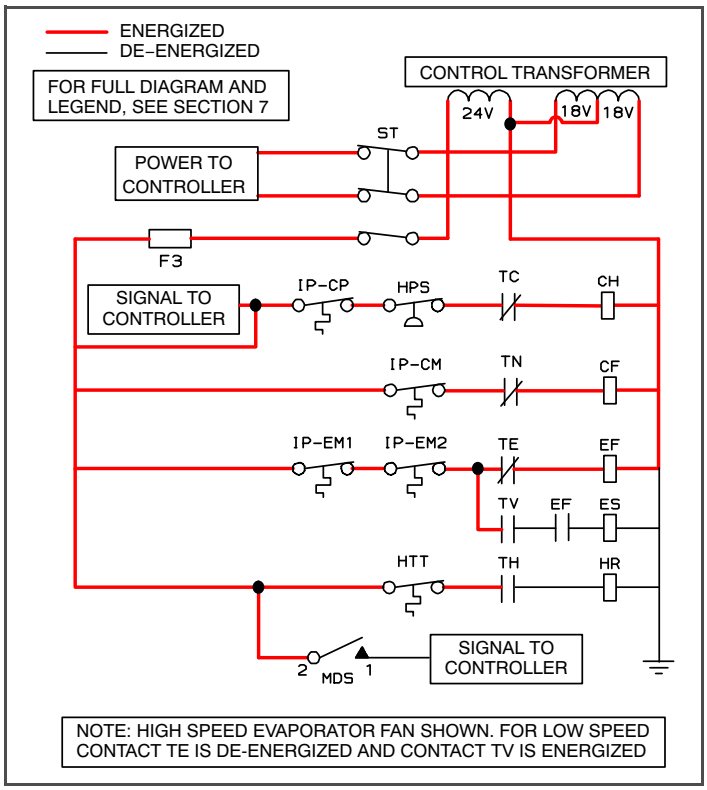
In Standard Perishable Mode, the evaporator motors run in high speed. In Economy Fan Mode, fan speed is varied.

NOTE

In low temperature ambients, the condenser fan will be cycled by the controller to maintain proper condensing pressure.

a. With supply air temperature above set point and decreasing, the unit will cooling with the condenser fan motor (CF), compressor motor (CH), evaporator fan motors (EF) energized, and the white COOL light illuminated (see **Figure 4.6**).

Figure 4.6 Perishable Mode Cooling



b. When supply air temperature decreases to a predetermined tolerance above set point (Cd30), the green IN RANGE light is illuminated.

c. As the air temperature continues to fall, modulating cooling starts as the supply air temperature approaches set point.

d. The controller continuously monitors supply air temperature. Once the supply air temperature falls below set point and 0% SMV position is reached, the controller periodically records the supply air temperature, set point, and time. A calculation is then performed to determine temperature drift from set point over time. If the calculation determines that cooling is no longer required, contacts TC and TN are opened to de-energize the compressor motor and the condenser fan motor.

e. The evaporator fan motors continue to run to circulate air throughout the container. The green IN-RANGE light remains illuminated as long as the supply air is within tolerance of set point.

f. When the supply air temperature increases to 0.2°C (0.36°F) above set point and the three minute off time has elapsed, relays TC and TN are energized to restart the compressor and condenser fan motor. The white COOL light is also illuminated.

4.3.10 Perishable Mode Heating - Sequence of Operation

NOTE

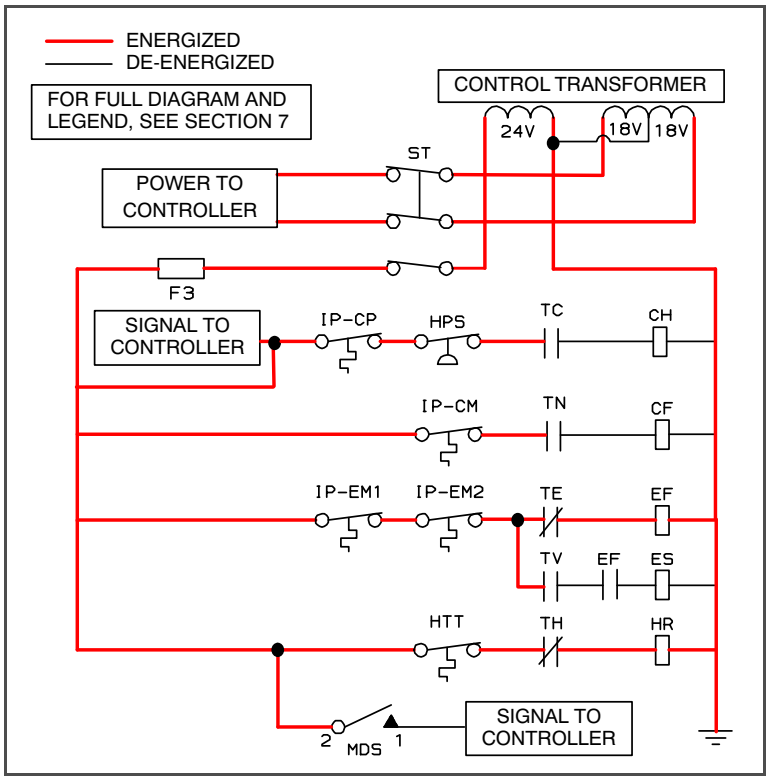
The unit will heat only when in the Perishable Mode, relay TH is electronically locked out when in the Frozen Mode.

a. If the supply air temperature decreases 0.5°C (0.9°F) below set point, the system enters the heating mode (see **Figure 4.5**). The controller closes contacts TH (see **Figure 4.7**) to allow power flow through the heat termination thermostat (HTT) to energize the heaters (HR). The orange HEAT light is also illuminated. The evaporator fans continue to run to circulate air throughout the container.

b. When the supply temperature rises to 0.2°C (0.36°F) below set point, contact TH opens to de-energize the heaters. The HEAT light is also de-energized. The evaporator fans continue to run to circulate air throughout the container.

c. The safety heater termination thermostat (HTT) is attached to an evaporator coil circuit and will open the heating circuit if overheating occurs.

Figure 4.7 Perishable Mode Heating



4.3.11 Frozen Mode - Temperature Control

In Frozen Mode, the controller maintains the return air temperature at set point, the yellow RETURN indicator light is illuminated, and the default reading on the display window is the return temperature sensor (RTS) reading.

When the return air temperature enters the in-range temperature tolerance (Cd30), the green IN-RANGE light will energize.

With CnF26 (Heat Lockout Temperature) is set to -10°C, frozen mode is active with set points at or below -10°C (+14°F). With CnF26 set to -5°C, frozen mode is active at or below -5°C (+23°F).

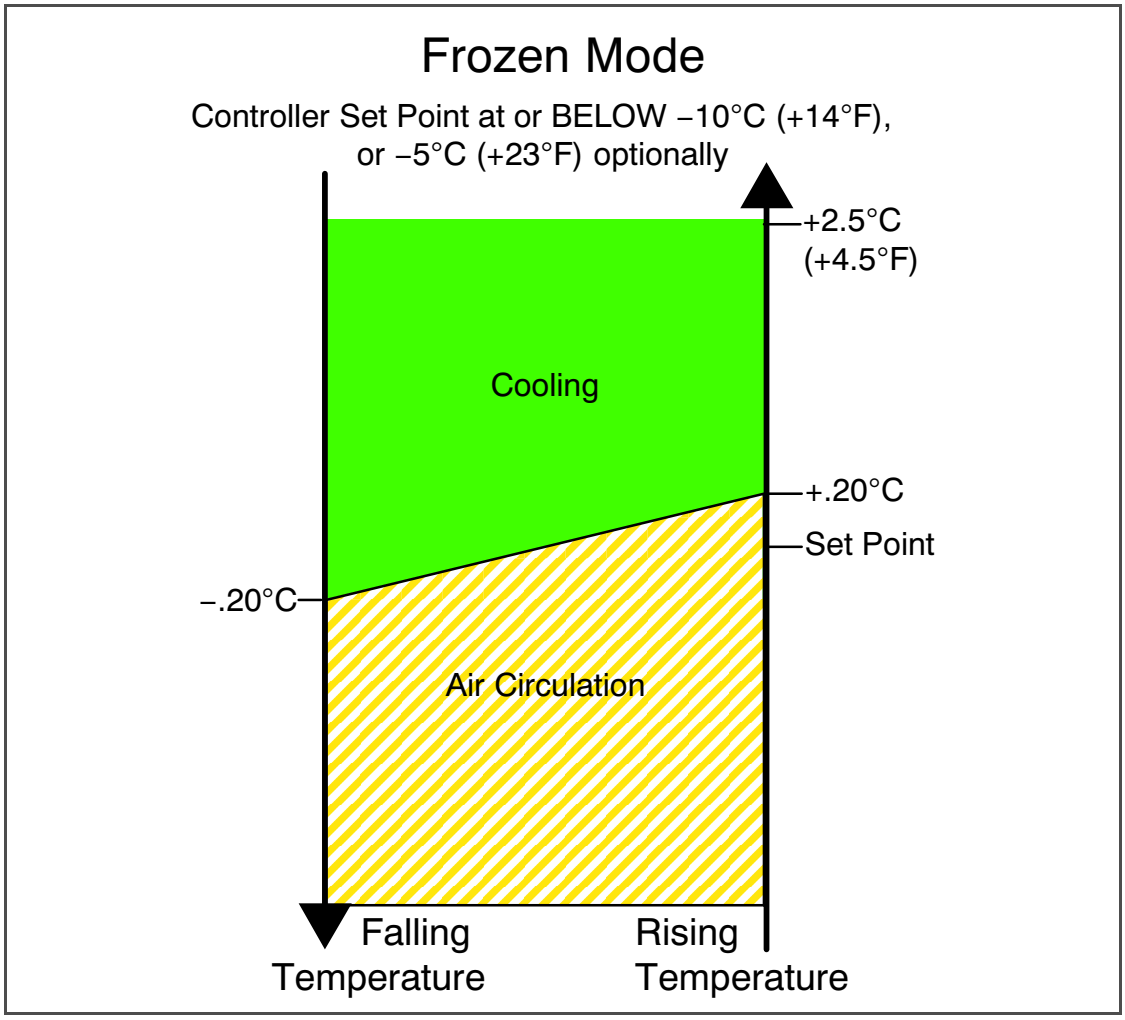
When the system is in Frozen Mode, the highest priority is given to bringing the container down to set point.

When return air temperature is greater than 0.2°C (0.36°F) above the frozen set point and the three minute time delay has been met, the unit will always operate at full capacity with the suction modulation valve open as allowed by current and pressure limiting.

4.3.12 Frozen Steady State

Frozen range cargoes are not sensitive to minor temperature changes. The method of temperature control employed in frozen range takes advantage of this fact to greatly improve the energy efficiency of the unit. Temperature control in frozen range is accomplished by cycling the compressor on and off as the load demand requires. The unit will operate in the conventional frozen mode when the controller set point is at or below the frozen range and Economy Mode (Cd34) is set to “OFF.”

Figure 4.8 Controller Operation - Frozen Mode



4.3.13 Frozen Idle Mode

When temperature drops to set point minus 0.2°C (0.36°F) and the compressor has run for at least five minutes, the unit will transition to the frozen idle mode. The compressor is turned off and the evaporator fans continue to run to circulate air throughout the container. If temperature rises above set point +0.2°C, (0.36°F) the unit will transition back to the frozen steady state mode.

NOTE

On start up of the unit, SMV will reset to a known open position. This is accomplished by assuming the valve was fully open, driving it fully closed, resetting the percentage open to zero, then opening to a known 21% staging position.

To prevent rapid cycling of the compressor, a three minute compressor off time must be satisfied before the compressor will restart. Under a condition of rapidly changing return air temperature, the time delay may allow the return air temperature to rise slightly above set point temperature before the compressor can restart.

4.3.14 Frozen “Heat” Mode

If the temperature drops 10°C (18°F) below set point, the unit will transition to the frozen “heating” mode. The evaporator fans are brought to high speed, and the heat from the fans is circulated through the container. The unit will transition back to frozen steady state when the temperature rises back to the transition point.

4.3.15 Frozen Economy Mode

In order to activate economy frozen mode operation, a frozen set point temperature must be selected, and Cd34 (Economy Mode) set to “ON.” When economy mode is active, the system will perform normal frozen mode operations except that the entire refrigeration system, excluding the controller, will be turned off when the control temperature is less than or equal to the set point -2°C (3.6°F).

After an off-cycle period of 60 minutes, the unit will turn on high speed evaporator fans for three minutes and then check the control temperature. If the control temperature is greater than or equal to the frozen set point +0.2°C (0.36°F), the unit will restart the refrigeration system and continue to cool until the previously mentioned off-cycle temperature criteria are met. If the control temperature is less than the frozen set point +0.2°C (0.36°F), the unit will turn off the evaporator fans and restart another 60 minute off-cycle.

4.3.16 Frozen Mode Cooling - Sequence of Operation

NOTES

1. In the Frozen Mode the evaporator motors run in low speed.
2. In low temperature ambients, the condenser fan will be cycled by the controller to maintain proper condensing pressure, refer to **Section 4.4.4**.

a. When the return air temperature is above set point and decreasing, the unit will be cooling with the condenser fan motor (CF), compressor motor (CH), evaporator fan motors (ES) energized and the white COOL light illuminated (see **Figure 4.9**).

b. When the return air temperature decreases to a predetermined tolerance above set point, the green INRANGE light is illuminated.

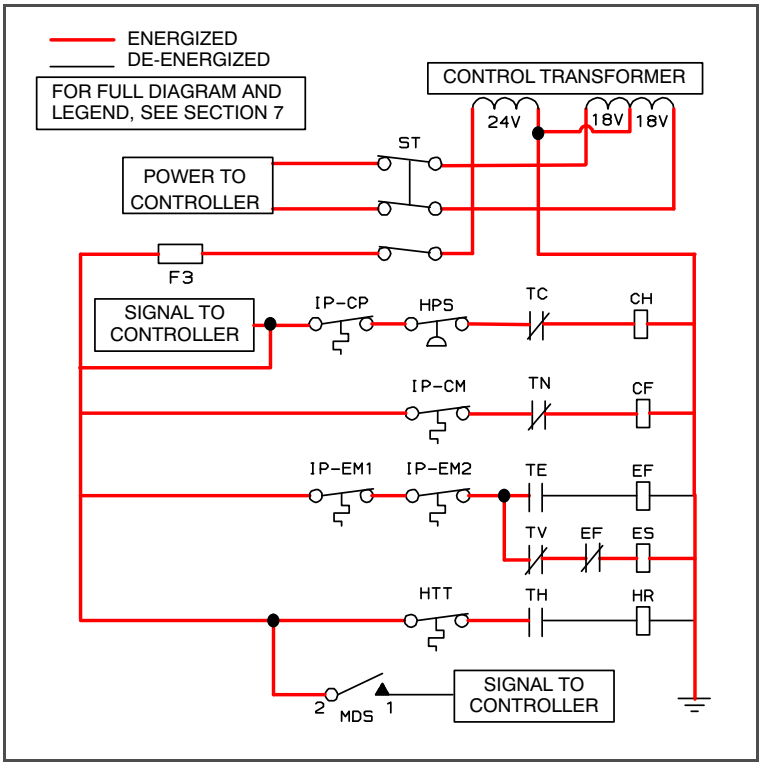
c. When the return air temperature decreases to 0.2°C (0.36°F) below set point, contacts TC and TN are opened to de-energize the compressor and condenser fan motors. The white COOL light is also de-energized.

d. The evaporator fan motors continue to run in low speed to circulate air throughout the container.

e. The green IN-RANGE light remains illuminated as long as the return air is within tolerance of set point.

f. When the return air temperature increases to 0.2°C (0.36°F) above set point and the three minute off time has elapsed, relays TC and TN are energized to restart the compressor and condenser fan motors. The white COOL light is also illuminated.

Figure 4.9 Frozen Mode



4.3.17 Defrost

Defrost is initiated to remove ice buildup from the evaporator coil which can obstruct air flow and reduce the cooling capacity of the unit. The defrost cycle may consist of up to three distinct operations depending upon the reason for the defrost or model number configuration. The first is de-icing of the coil, the second is defrost due to a probe check cycle and the third is a snap freeze process based on the unit model configuration.

Defrosting the coil consists of removing power to the cooling components (compressor, evaporator fans, and condenser fan), closing the SMV, and turning on the heaters, which are located below the evaporator coil. During normal operation, de-icing will continue until temperatures indicate that the ice on the coil has been removed, proper air flow has been restored, and the unit is ready to control temperature efficiently.

If defrost was initiated by the probe check logic, then a Probe Check is carried out after the completion of the defrost cycle. A Probe Check is initiated only when there is an inaccuracy between the controller temperature sensors. For more information on Probe Check refer to **Section 5.10**.

Snap Freeze allows the system to cool for a period of time after de-icing, with the evaporator fans turned off, and is only carried out if configured by model number. Snap Freeze allows for the removal of latent de-icing heat from the evaporator coils, and freezes any remaining moisture that might otherwise be blown into the container.

4.3.18 Defrost Operation

Initiation of defrost is dependent on the state of the Defrost Temperature Sensor (DTS). When the (DTS) senses a temperature less than 10°C (50°F), the defrost options become active and the timer is engaged for the initiation of the defrost cycle. The defrost time accumulates when the compressor is running. In the perishable mode this is the same as real time as the compressor in general runs continuously. In frozen mode the actual time necessary to count down to the next defrost will exceed the defrost interval depending on the compressor duty-cycle.

When the defrost mode is in the active state, defrost can be initiated when any one of the following additional conditions become true:

1. Manually: A manual defrost is initiated by pressing the MANUAL DEFROST / INTERVAL key for greater than 5 seconds.
2. Timer: The Defrost Interval Timer reaches the user selectable Interval. The user-selected intervals are (OFF), 3, 6, 9, 12, 24 hours, AUTO, or PuLS; factory default is 3 hours. Refer to code select CD27 (see **Table 4–5**).
    a. Automatic defrost starts with an initial defrost at three hours and then adjusts the interval to the next defrost based on the accumulation of ice on the evaporator coil. Following a start-up or after termination of defrost, the time will not begin counting down until the DTS reading falls below 10°C (50°F). If the reading of DTS rises above termination setting any time during the timer count down, the interval is reset and the countdown starts over. The Auto defrost time is reset to three hours start time after every PTI initiation or trip start interval.
    b. Fan Pulsing Logic is used to help prevent ice formation in the drain gutter and drain cup and ice buildup in supply air channel by using the evaporator fans to blow the warm air onto these areas during unit defrost. When cooling at lower setpoints, evaporator fan pulsing can be used during Defrost/De-ice when the “PuLS” option is selected in the Defrost Interval function select code. When enabled, evaporator fan pulsing will occur based on the unit temperature setpoint and the Evaporator Fan Pulsing Temperature Setting (Cd60). QUEST II also pulses the evaporator fans during Defrost/De-ice within a narrow perishable setpoint range. The logic for each evaporator fan pulsing feature is described below.
    c. After a new Defrost Interval is selected, the previously selected Interval is used until the next defrost termination, the next time the DTS contacts are OPEN, or the next time power to the control is interrupted. If the previous value or the new value is “OFF”, the newly selected value will be used immediately.
3. If defrost is initiated due to Probe Check immediately following the defrost cycle the evaporation fans are started and run for eight minutes to stabilize the temperature throughout the container. A probe check comparison is carried out at the end of the eight minute period if any sensor is found out of calibration. At this time it is no longer used for control/reorder purposes.
4. Probe Check Logic: The logic determines that a Probe Check is necessary based on temperature values currently reported by the supply and return probes.
5. Remote: An Initiate Defrost command is sent via communications.

6. Delta T Logic: If the difference between return and supply air temperature (Delta T) becomes too great indicating possible reduced airflow over the evaporator coil caused by ice buildup requiring a defrost.

   a. In Perishable Pull Down - Delta T increases to greater than 12°C, and 90 minutes of compressor run time have been recorded.

   b. In Perishable Steady State - A baseline Delta T is recorded following the first defrost cycle after steady state conditions are reached, (the unit is cooling, and the evaporator fans and heaters must remain in a stable state for a period of five minutes). Defrost will be initiated if Delta T increases to greater than 4°C above the baseline, and 90 minutes of compressor run time have been recorded.

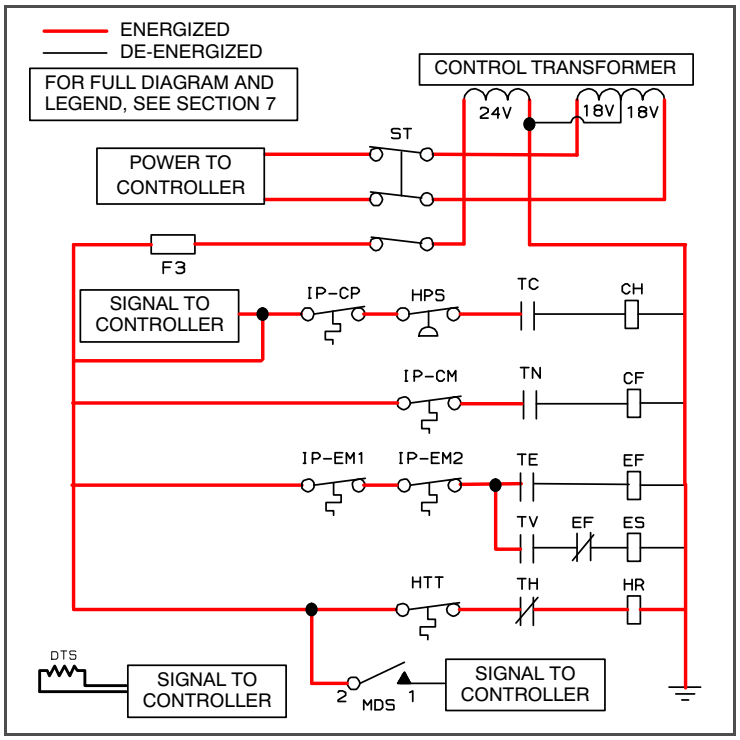
   c. In Frozen Mode - Defrost will be initiated if Delta T increases to greater than 16°C and 90 minutes of compressor run time have been recorded.

NOTICE

When defrost is initiated, the controller closes the SMV, opens contacts TC, TN and TE (or TV) to de-energize the compressor, condenser fan and evaporator fans.

The controller then closes contacts TH to supply power to the heaters. The orange DEFROST light and heat light are illuminated and the COOL light is also de-energized.

Figure 4.10 Defrost



NOTE

The SMV is independently operated by the microprocessor. Complete schematics and legends are located in **Section 8.1**.

Defrost will terminate when the DTS reading rises above one of two model number configurable options selection, either an upper setting of 25.6°C (78°F) which is default or lower setting of 18°C (64°F).

When the DTS reading rises to the configured setting, the de-icing operation is terminated.

4.3.19 Defrost Related Settings

IDTS Failure

When the return air temperature falls to 7°C (45°F), the controller ensures that the defrost temperature sensor (DTS) reading has dropped to 10°C or below. If it has not it indicates a failed DTS, a DTS failure alarm is triggered and the defrost mode is operated by the return temperature sensor (RTS). Defrost will terminate after 1 hour.

If the DTS fails to reach is termination setting, the defrost terminate after 2 hours of operation.

Defrost Timer

If CnF23 is configured to “SAv” (save), then the value of the defrost interval timer will be saved at power down and restored at power up. This option prevents short power interruptions from resetting an almost expired defrost interval, and possibly delaying a needed defrost cycle. If the save option is not selected the defrost timer will re-initiate and begin recounting.

If CnF11 is model number configured to OFF the operator will be allowed to choose “OFF” as a defrost interval option.

If CnF64 is configured in the operator will be allowed to choose “PuLS” as a defrost interval option. For units operating with “PuLS” selected, defrost interval is determined by the unit temperature setpoint and the Evaporator Fan Pulsing Temperature Setting (Cd60). When the unit temperature setpoint is equal to or less than the Evaporator Fan Pulsing Temperature Setting, the defrost interval is set to 6 hours. Otherwise, the defrost interval is determined using the Automatic Defrost Interval Determination logic. In either case, “PuLS” remains displayed in this function select code.

If any Auto Pretrip sequence is initiated, Cd27 will be set to ’AUTO’ unless CnF49 (OEM Reset) is set to “Custom” AND CnF64 (Evaporator Fan Pulsing Logic) configuration variable is set to IN, in which case Cd27 will be set to “PuLS”.

If defrost does not terminate correctly and temperature reaches the set point of the Heat Termination Thermostat (HTT) 54°C (130°F), the HTT will open to de-energize the heaters (AL59 & AL60). If the HTT does not open and termination does not occur within two hours, the controller will terminate defrost. AL60 will be activated to inform of a possible DTS failure.

4.4 Protection Modes of Operation

4.4.1 Evaporator Fan Operation

Opening of an evaporator fan internal protector will shut down a unit. (CnF32 set to 2EFO).

4.4.2 Failure Action

Function code Cd29, Failure Action Mode, may be operator set to allow continued operation in the event the control sensors are reading out of range. The factory default is full system shutdown (refer to **Table 4–5**).

4.4.3 Generator Protection

Function codes Cd31, Stagger Start Offset Time, and Cd32, System Current Limit, may be operator set to control start-up sequence of multiple units and operating current draw. The factory default allows on demand starting of units and full current draw (refer to **Table 4–5**).

4.4.4 Condenser Pressure Control

When configuration variable CnF14 is set to “In,” the condenser pressure control logic is activated to maintain discharge pressures above 130psig in low temperature ambients. The logic turns the condenser fan on or off in accordance with the condenser pressure transducer reading (refer to **Table 4–4**) The function is enabled when the following conditions are met:

1. The ambient sensor reading is less than or equal to 27°C (80°F), and
2. Voltage/Frequency ratio is less than or equal to 8.38.

When the above conditions are met, either pressures or timers may dictate a change of state from OFF to ON or ON to OFF. If the condenser fan is OFF, it will be energized if saturated condensing pressure is greater than 200psig OR if the condenser fan has been OFF for a variable time period of up to 60 seconds depending on the ambient temperature. As the ambient temperature increases, the amount of time that the condenser fan is energized will correspondingly increase towards the maximum.

If the condenser fan is ON, it will de-energize only if the saturated condensing pressure is less than 130psig and the condenser fan has been running for a minimum of thirty seconds depending on the ambient temperature.

4.5 Quest - CCPC

Compressor-Cycle Perishable Cooling (CCPC) is a method of temperature control during steady-state perishable cooling that cycles the compressor on and off according to return air temperature.

To be eligible for steady-state control the unit must first complete a “setpoint pulldown” phase and a “CCPC pulldown” phase:

During setpoint pulldown supply air temperature is controlled according to the unit’s nominal supply air setpoint.

During CCPC pulldown the supply air temperature is lowered somewhat relative to the nominal setpoint. Evaporator fans are forced to operate at high speed.

Steady-state CCPC control maintains the same lowered supply air temperature as was used during CCPC pulldown. The compressor cycles on and off according to return air high and low limits. Depending on the fan mode of operation selected, the evaporator fans may be programmed to run at low speed some or all of the time according to the control logic.

4.6 Controller Alarms

Alarm display is an independent controller software function. If an operating parameter is outside of expected range or a component does not return the correct signals back to the controller, an alarm is generated. A listing of the alarms is provided in **Table 4–6**.

The alarm philosophy balances the protection of the refrigeration unit and that of the refrigerated cargo. The action taken when an error is detected always considers the survival of the cargo. Rechecks are made to confirm that an error actually exists.

Some alarms requiring compressor shutdown have time delays before and after to try to keep the compressor on line. An example is alarm code “LO,” (low main voltage), when a voltage drop of over 25% occurs, an indication is given on the display, but the unit will continue to run.

An alarm is indicated by flashing an alarm code on the display panel, and for some alarms, by the alarm light illuminating.

When an Alarm Occurs:

1. The red alarm light will illuminate for “20 series” alarms.
2. If a detectable problem is found to exist, its alarm code will be alternately displayed with the set point on the left display.
3. The user should scroll through the alarm list to determine what alarms exist or have existed. Alarms must be diagnosed and corrected before the Alarm List can be cleared.

To Display Alarm Codes:

1. While in the Default Display mode, press the ALARM LIST key. This accesses the Alarm List Display Mode, which displays any alarms archived in the Alarm Queue.
2. The alarm queue stores up to 16 alarms in the sequence in which they occurred. The user may scroll through the list by depressing an ARROW key.
3. The left display will show “AL##,” where ## is the alarm number sequentially in the queue.
4. The right display will show the actual alarm code. “AA##” will display for an active alarm, where “##” is the alarm code. Or “IA##” will display for an inactive alarm.
5. “END” is displayed to indicate the end of the alarm list if any alarms are active.
6. “CLEAr” is displayed if all alarms are inactive. The alarm queue may than be cleared by pressing the ENTER key. The alarm list will clear and “-----” will be displayed.

NOTE

AL26 is active when all of the sensors are not responding. Check the connector at the back of the controller, if it is loose or unplugged, reconnect it. Then run a pretrip test (P5) to clear AL26.

4.7 Pre-Trip Diagnostics

Pre-trip diagnostics is an independent controller function that will suspend normal refrigeration controller activities and provide preprogrammed test routines. The test routines include Auto Mode testing, which automatically performs a pre-programmed sequence of tests or Manual Mode testing, which allows the operator to select and run any of the individual tests.

⚠ CAUTION

Pre-trip inspection should not be performed with critical temperature cargoes in the container.

⚠ CAUTION

When Pre-Trip key is pressed, dehumidification and bulb mode will be deactivated. At the completion of Pre-Trip activity, dehumidification and bulb mode must be reactivated.

A Pre-trip test may be initiated by use of the keypad or via communication, but when initiated by communication the controller will execute the entire battery of tests (auto mode).

At the end of a pre-trip test, the message “P,” “rSLts” (pretest results) will be displayed. Pressing ENTER will allow the user to see the results for all subtests. The results will be displayed as “PASS” or “FAIL” for all the tests run to completion.

A detailed description of the pre-trip tests and test codes is provided in **Table 4–7**. Detailed operating instructions are provided in **Section 5.9**.

4.8 DataCORDER

The Carrier Transicold “DataCORDER” software is integrated into the controller and serves to eliminate the temperature recorder and paper chart. DataCORDER functions may be accessed by keypad selections and viewed on the display module. The unit is also fitted with interrogation connections (see **Figure 4.1**). A personal computer with Carrier Transicold DataLINE software may also be used to download data and configure settings.

The resulting file uses a proprietary file format that protects it from potential tampering or altering of data. Therefore, once downloaded, all dcx files shall be considered secured. The DataCORDER consists of:

The DataCORDER consists of:

- Configuration Software
- Operational Software
- Data Storage Memory
- Real Time Clock (with internal battery backup)
- Six Thermistor Inputs
- Interrogation Connections
- Power Supply (battery pack)

The DataCORDER performs the following functions:

a. Logs data at 15, 30, 60 or 120 minute intervals and stores two years’ of data (based on one hour interval).

b. Records and displays alarms on the display module.

c. Records results of Pre-trip testing.

d. Records DataCORDER and temperature control software generated data and events as follows:

- Container ID Change
- Software Upgrades
- Alarm Activity
- Battery Low (Battery Pack)
- Data Retrieval
- Defrost Start and End
- Dehumidification Start and End
- Power Loss (with and without battery pack)

- Power Up (with and without battery pack)
- Remote Probe Temperatures in the Container USDA cold treatment and cargo probe recording)
- Return Air Temperature
- Set Point Change
- Supply Air Temperature
- Real Time Clock Battery (Internal) Replacement
- Real-Time Clock Modification
- Trip Start
- ISO Trip Header (When entered via Interrogation program)
- Economy Mode Start and End
- “Auto 1/Auto 2/Auto 3” Pre-trip Start and End
- Bulb Mode Start
- Bulb Mode changes
- Bulb Mode End
- USDA Trip Comment
- Humidification Start and End
- USDA Probe Calibration
- Fresh Air Vent Position

4.8.1 DataCORDER Software

The DataCORDER Software is subdivided into Operational Software, Configuration Software, and the Data Memory.

a. Operational Software (dC Function Codes)

The Operational Software reads and interprets inputs for use by the Configuration Software. The inputs are labeled Function Codes. Controller function codes (see **Table 4–8**), allow the operator to examine the current input data or stored data. To access these codes, do the following:

1. Press the ALT. MODE and CODE SELECT keys.
2. Press an arrow key until the left window displays the desired code number. The right window will display the value of this item for five seconds before returning to the normal display mode.
3. If a longer time is desired, press the ENTER key to extend the time to 30 seconds.

b. Configuration Software

The configuration software controls the recording and alarm functions of the DataCORDER. Reprogramming to the factory-installed configuration is achieved via a configuration card. Changes to the software may be made using the DataLINE integration software.

A list of the configuration variables is provided in **Table 4–2**. Descriptions of DataCORDER operation for each variable setting are provided in the following paragraphs.

4.8.2 Sensor Configuration (dCF02)

Two modes of operation may be configured, the Standard Mode and the Generic Mode.

a. Standard Mode

In the standard mode, the user may configure the DataCORDER to record data using one of seven standard configurations. The seven standard configuration variables, with their descriptions, are listed in **Table 4–3**.

The six thermistor inputs (supply, return, USDA #1, #2, #3, and cargo probe) and the humidity sensor input will be generated by the DataCORDER. An example of a report using a standard configuration is shown in **Figure 4.11**.

NOTE

The DataCORDER software uses the supply and return recorder sensors. The temperature control software uses the supply and return temperature sensors.

b. Generic Mode

The generic recording mode allows user selection of the network data points to be recorded. The user may select up to a total of eight data points for recording. A list of the data points available for recording follows. Changing the configuration to generic and selecting which data points to record may be done using the Carrier Transicold Data Retrieval Program.

- Control mode
- Control temperature
- Frequency
- Humidity
- Phase A current
- Phase B current
- Phase C current
- Main voltage
- Suction modulation valve percentage
- Discrete outputs
- Discrete inputs
- Ambient sensor
- Compressor suction sensor
- Compressor discharge sensor
- Return temperature sensor
- Supply temperature sensor
- Defrost temperature sensor
- Discharge pressure transducer
- Suction pressure transducer
- Condenser pressure transducer

4.8.3 Logging Interval (dCF03)

The user may configure four time intervals between data recordings. Data is logged at exact intervals in accordance with the real-time clock. The clock is factory set at Greenwich Mean Time.

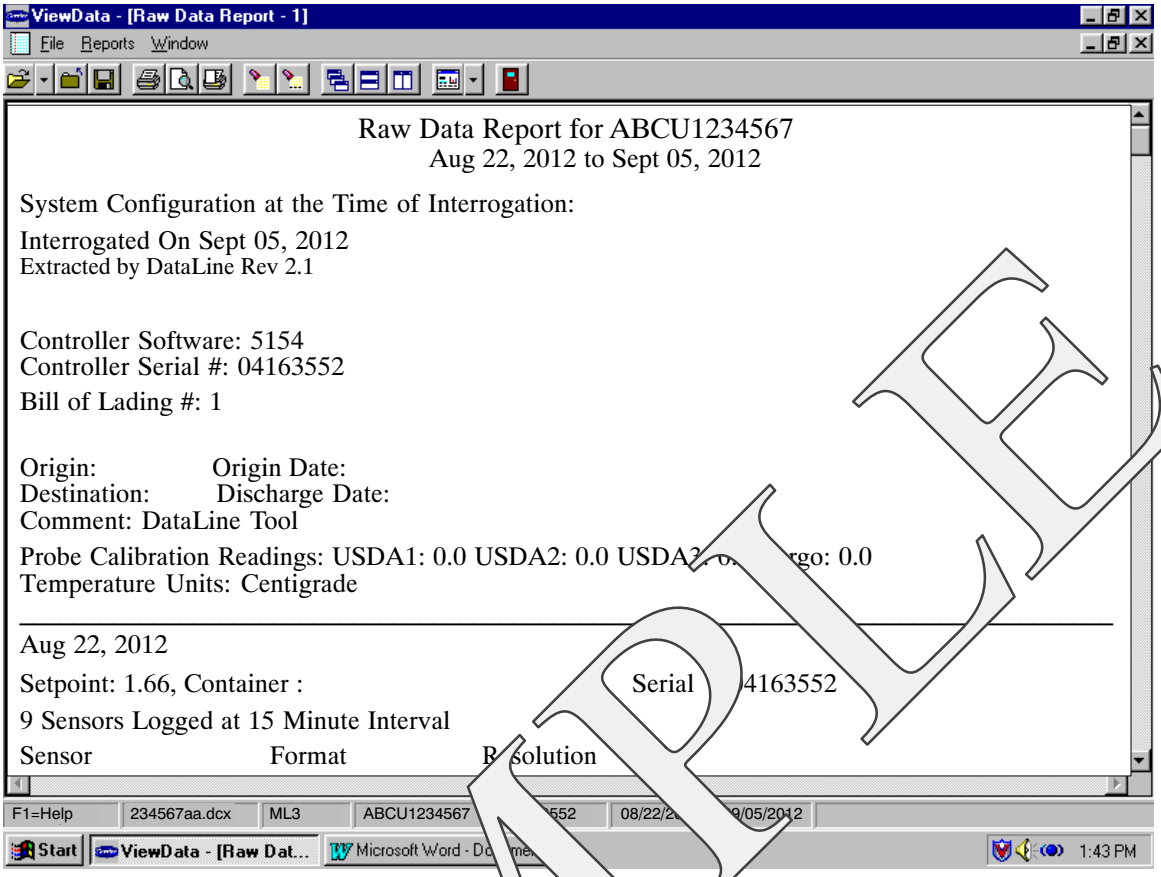
4.8.4 Thermistor Format (dCF04)

The user may configure the format in which the thermistor readings are recorded. The low resolution is a 1 byte format and the normal resolution is a 2 byte format. The low resolution requires less memory and records temperature in 0.25°C (0.45°F) increments when in perishable mode or 0.5°C (0.9°F) increments when in the frozen mode. The normal resolution records temperature in 0.01°C (0.02°F) increments for the entire range.

Table 4–2 Data CORDER Configuration Variables

Config	Title	Default	Option
dCF01	(Future Use)	--	--
dCF02	Sensor Configuration	2	2, 5, 6, 9, 54, 64, 94
dCF03	Logging Interval (Minutes)	60	15, 30, 60, 120
dCF04	Thermistor Format	Short	Low, Normal
dCF05	Thermistor Sampling Type	A	A, b, C
dCF06	Controlled Atmosphere / Humidity Sampling Type	A	A, b
dCF07	Alarm Configuration USDA Sensor 1	A	Auto, On, Off
dCF08	Alarm Configuration USDA Sensor 2	A	Auto, On, Off
dCF09	Alarm Configuration USDA Sensor 3	A	Auto, On, Off
dCF10	Alarm Configuration Cargo Sensor	A	Auto, On, Off

Figure 4.11 Standard Configuration Report



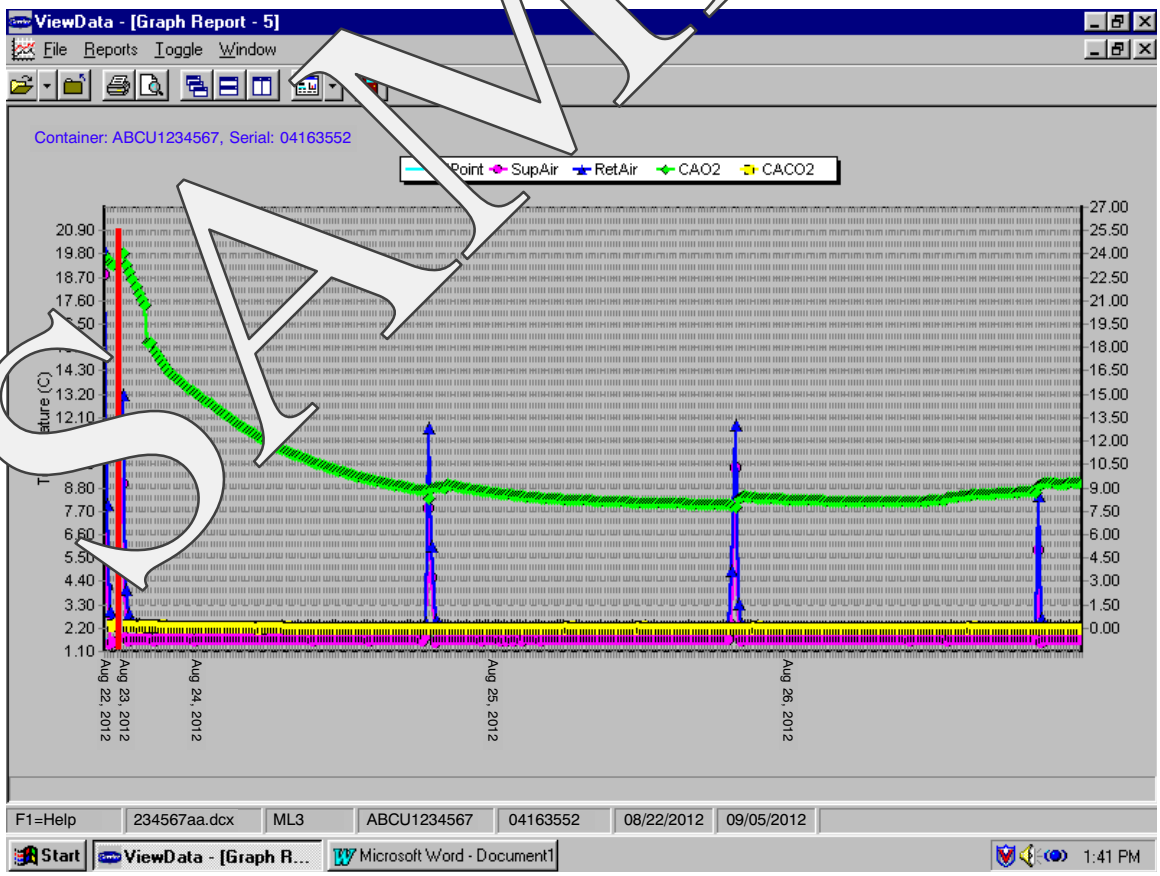


Table 4–3 Data CORDER Standard Configurations

Standard Config	Description
2 sensors (dCF02=2)	2 thermistor inputs (supply & return)
5 sensors (dCF02=5)	2 thermistor inputs (supply & return) 3 USDA thermistor inputs
6 sensors (dCF02=6)	2 thermistor inputs (supply & return) 3 USDA thermistor inputs 1 humidity input
9 sensors (dCF02=9)	Not Applicable
6 sensors (dCF02=54)	2 thermistor inputs (supply & return) 3 USDA thermistor inputs 1 cargo probe (thermistor input)
7 sensors (dCF02=64)	2 thermistor inputs (supply & return) 3 USDA thermistor inputs 1 humidity input 1 cargo probe (thermistor input)

4.8.5 Sampling Type (dCF05 & dCF06)

Three types of data sampling are available -average, snapshot, and USDA. When configured to average, the average of readings taken every minute over the recording period is recorded. When configured to snapshot, the sensor reading at the log interval time is recorded. When USDA is configured, the supply and return temperature readings are averaged and the three USDA probe readings are snapshot.

4.8.6 Alarm Configuration (dCF07 - dCF10)

The USDA and cargo probe alarms may be configured to OFF, ON or AUTO.

If a probe alarm is configured to OFF, then the alarm for this probe is always disabled.

If a probe alarm is configured to ON, then the associated alarm is always enabled.

If the probes are configured to AUTO, they act as a group. This function is designed to assist users who keep their DataCORDER configured for USDA recording, but do not install the probes for every trip. If all the probes are disconnected, no alarms are activated. As soon as one of the probes is installed, then all of the alarms are enabled and the remaining probes that are not installed will give active alarm indications.

The DataCORDER will record the initiation of a pre-trip test (refer to **Section 4.7**) and the results of each of the tests included in pre-trip. The data is time-stamped and may be extracted via the Data Retrieval program. Refer to **Table 4–9** for a description of the data stored in the DataCORDER for each corresponding pre-trip test.

4.8.7 DataCORDER Power-Up

The DataCORDER may be powered up in any one of four ways:

1. *Normal AC power*: The DataCORDER is powered up when the unit is turned on via the stop-start switch.
2. *Controller DC battery pack power*: If a battery pack is installed, the DataCORDER will power up for communication when an interrogation cable is plugged into an interrogation receptacle.
3. *External DC battery pack power*: A 12-volt battery pack may also be plugged into the back of the interrogation cable, which is then plugged into an interrogation port. No controller battery pack is required with this method.
4. *Real-time Clock demand*: If the DataCORDER is equipped with a charged battery pack and AC power is not present, the DataCORDER will power up when the real-time clock indicates that a data recording should take place. When the DataCORDER is finished recording, it will power down.

During DataCORDER power-up, while using battery-pack power, the controller will perform a hardware voltage check on the battery. If the hardware check passes, the Controller will energize and perform a software battery voltage check before DataCORDER logging. If either test fails, the real-time clock battery power-up will be disabled until the next AC power cycle. Further DataCORDER temperature logging will be prohibited until that time.

An alarm will be generated when the battery voltage transitions from good to bad indicating that the battery pack needs recharging. If the alarm condition persists for more than 24 hours on continuous AC power, the battery pack needs replacement.

4.8.8 Pre-trip Data Recording

The DataCORDER will record the initiation of a Pre-trip test (refer to **Section 4.7**) and the results of each of the tests included in pre-trip. The data is time-stamped and may be extracted via the Data Retrieval program. Refer to **Table 4–9** for a description of the data stored in the DataCORDER for each corresponding pre-trip test.

4.8.9 DataCORDER Communications

Data retrieval from the DataCORDER can be accomplished by using the DataLINE, DataBANK Card, or a communications interface module.

NOTE

A DataLINE or a communications interface module display of Communication Failed is caused by faulty data transfer between the datacorder and the data retrieval device. Common causes include:

1. Bad cable or connection between DataCORDER and data retrieval device.
2. PC communication port(s) unavailable or mis-assigned.

Communication identification for the models covered herein may be obtained on the Container Products Group Information Center by authorized Carrier Transicold Service Centers.

a DataLine

The DataLINE software for a personal computer is supplied on both floppy disks and CD. This software allows interrogation, configuration variable assignment, screen view of the data, hard copy report generation, cold treatment probe calibration, and file management. Refer to Data Retrieval manual 62-10629 for a more detailed explanation of the DataLINE interrogation software. The DataLine manual may be found on the Internet at www.container.carrier.com.

c. DataBANK Card

The DataBANK™card is a PCMCIA card that interfaces with the controller through the programming slot and can download data at a fast rate. Files downloaded to DataBANK card files are accessible through an Omni PC Card Drive. The files can then be viewed using the DataLINE software.

b. Communications Interface Module

The communications interface module is a slave module which allows communication with a master central monitoring station. The module will respond to communication and return information over the main power line. With a remote monitoring unit installed, all functions and selectable features that are accessible at the unit may be performed at the master station. Retrieval of all DataCORDER reports may also be performed. Refer to the master system technical manual for further information.

4.8.10 USDA Cold Treatment

Sustained cold temperature has been employed as an effective post harvest method for the control of Mediterranean and certain other tropical fruit flies. Exposing infested fruit to temperatures of 2.2°C (36°F) or below for specific periods results in the mortality of the various stages of this group of insects.

In response to the demand to replace fumigation with this environmentally sound process, Carrier has integrated Cold Treatment capability into its microprocessor system. These units have the ability to maintain supply air temperature within one-quarter degree Celsius of setpoint and record minute changes in product temperature within the DataCORDER memory, thus meeting USDA criteria. Information on USDA is provided in the following subparagraphs

a. USDA Recording

A special type of recording is used for USDA cold treatment purposes. Cold treatment recording requires three remote temperature probes be placed at prescribed locations in the cargo. Provision is made to connect these probes to the DataCORDER via receptacles located at the rear left-hand side of the unit. Four or five receptacles are provided. The four three-pin receptacles are for the probes and fifth, five-pin, receptacle is the rear connection for the Interrogator. The probe receptacles are sized to accept plugs with tricam coupling locking devices. A label on the back panel of the unit shows which receptacle is used for each probe.

The standard DataCORDER report displays the supply and return air temperatures. The cold treatment report displays USDA #1, #2, #3, and the supply and return air temperatures. Cold treatment recording is backed up by a battery so recording can continue if AC power is lost.

b. USDA/ Message Trip Comment

A special feature is incorporated which allows the user to enter a USDA (or other) message at the head of a data report. The maximum message length is 78 characters. Only one message will be recorded per day.

4.8.11 USDA Cold Treatment Procedure

The following is a summary of the steps required to initiate a USDA Cold Treatment:

1. Calibrate the three USDA probes by ice bathing the probes and performing the calibration function with the DataLINE. This calibration procedure determines the probe offsets and stores them in the controller for use in generating the cold treatment report. Refer to the Data Retrieval manual 62-10629 for more details.
2. Pre-cool the container to the treatment temperature or below.
3. Install the DataCORDER module battery pack (if not already installed).
4. Place the three probes. The probes are placed into the pulp of the fruit (at the locations defined in the following table) as the product is loaded.

Sensor 1	Place in pulp of the product located next to the return air intake.
Sensor 2	Place in pulp of the product five feet from the end of the load for 40-foot containers, or three feet from the end of the load for 20-foot containers. This probe should be placed in a center carton at one-half the height of the load.
Sensor 3	Place in pulp of product five feet from the end of the load for 40-foot containers or three feet from the end of the load for 20-foot containers. This probe should be placed in a carton at a side wall at one-half the height of the load.

5. To initiate USDA recording, connect the personal computer and perform the configuration as follows, using the DataLINE software:
   a. Enter ISO header information.
   b. Enter a trip comment if desired.
   c. Configure the DataCORDER for five probes (s, r, P1, P2, P3) (dcf02=5).
   d. Configure the logging interval for one hour.
   e. Set the sensor configuration to “USDA”.
   f. Configure for two byte memory storage format (dcf04=LONG).
   g. Perform a “trip start.”

4.8.12 DataCORDER Alarms

Alarm display is an independent DataCORDER function. If an operating parameter is outside of the expected range or a component does not return the correct signals back to the DataCORDER an alarm is generated. The DataCORDER contains a buffer of up to eight alarms. A listing of the DataCORDER alarms is provided in **Table 4–10**. Refer to **Section 4.8.6** for configuration information.

To display alarm codes:

1. While in the Default Display mode, press the ALT. MODE & ALARM LIST keys. This accesses the DataCORDER Alarm List Display Mode, which displays any alarms stored in the Alarm Queue.
2. To scroll to the end of the alarm list, press the UP ARROW. Depressing the DOWN ARROW key will scroll the list backward.
3. The left display will show “AL#” where # is the alarms number in the queue. The right display will show “AA##,” if the alarm is active, where ## is the alarm number. “IA##,” will show if the alarm is inactive
4. “END” is displayed to indicate the end of the alarm list if any alarms are active. “CLEAr” is displayed if all the alarms in the list are inactive.
5. If no alarms are active, the Alarm Queue may be cleared. The exception to this rule is the DataCORDER Alarm Queue Full alarm (AL91), which does not have to be inactive in order to clear the alarm list. To clear the alarm list:

a. Press the ALT. MODE & ALARM LIST keys.

b. Press the UP/DOWN ARROW key until “CLEAr” is displayed.

c. Press the ENTER key. The alarm list will clear and “-----” will be displayed.

d. Press the ALARM LIST key. “AL” will show on the left display and “-----” on the right display when there are no alarms in the list.

e. Upon clearing of the Alarm Queue, the Alarm light will be turned off.

4.8.13 ISO Trip Header

DataLINE provides the user with an interface to view/ modify current settings of the ISO trip header through the ISO Trip Header screen. The ISO Trip Header screen is displayed when the user clicks on the “ISO Trip Header” button in the “Trip Functions” Group Box on the System Tools screen.

F9 function - Provides the user with a shortcut for manually triggering the refresh operation. Before sending modified parameter values, the user must ensure that a successful connection is established with the controller.

If the connection is established with the DataCORDER, the current contents of the ISO Trip Header from the DataCORDER will be displayed in each field. If the connection is not established with the DataCORDER, all fields on the screen will be displayed as “Xs.” If at any time during the display of the ISO Trip Header screen the connection is not established or is lost, the user is alerted to the status of the connection.

After modifying the values and ensuring a successful connection has been made with the DataCORDER, click on the “Send” button to send the modified parameter values.

The maximum allowed length of the ISO Trip Header is 128 characters. If the user tries to refresh the screen or close the utility without sending the changes made on the screen to the DataCORDER, the user is alerted with a message.

4.9 Controller Configuration Variables

Table 4–4 Controller Configuration Variables

Config	Title	Default	Option
CnF01	Bypass Valve Enable	In	0-in, 1-out
CnF02	Evaporator Fan Speed	dS (Dual)	0-single, 1-dual
CnF03	Control Sensors	FOUr (quad)	0-duAL, 1-quad
CnF04	Dehumidification Mode	On	0-on, 1-off
CnF07	Unit Selection, 20FT / 40FT / 45FT	40ft	0-40ft, 1-20ft, 2- 45ft
CnF08	Single Phase / Three Phase Motor	1Ph	0-1phe, 1-3phe
CnF10	Two Speed Compressor Logic	Out (Single)	0-single, 1-dual
CnF11	Defrost Off Selection	noOFF	0-noOFF, 1-OFF
CnF12	TXV / Solenoid Quench Valve	Out (TXV)	0-quench, 1-TXV
CnF13	Unloader	Out	0-in, 1-out
CnF14	Condenser Pressure Control (CPC)	In	0-in, 1-out
CnF15	Discharge Temperature Sensor	Out	0-in, 1-out
CnF16	DataCORDER Present	On (Yes)	0-off, 1-on
CnF17	Discharge Pressure Sensor	Out (No)	0-out (No), 1-in (Yes)
CnF18	Heater	Old (Low Watt)	0-old, 1-new (High Watt)
CnF19	Controlled Atmosphere	Out (No)	0-out, 1-in (Yes)
CnF20	Suction Pressure Sensor	Out (No)	0-out, 1-in (Yes)
CnF21	Autotransformer	Out	0-out, 1-in
CnF22	Economy Mode Option	OFF	0-off, 1-full, 2-std, 3-cust
CnF23	Defrost Interval Timer Save Option	noSAv	0-no_sav, 1-sav
CnF24	Enable Long PreTrip Test Series	Auto1	0-auto1, 1-auto2, 3-aAuto3

Table 4–4 Controller Configuration Variables (Continued)

Config	Title	Default	Option
CnF25	Enable PreTrip Data Recording	rSLtS	0-rSLts, 1-dAtA
CnF26	Heat Lockout Change Option	Set to -10C	Set to -5C
CnF27	Suction Temperature Display Option	Out	0-out, 1-in
CnF28	Enable Bulb Mode Option	NOr	0-normal, 1-bulb
CnF29	Enable Arctic Mode	Out	0-out, 1-in
CnF30	Compressor Size	41cfm	0-41cfm, 1-37cfm
CnF31	Probe Check Option	SPEC	0-Std, 1-Special
CnF32	Enable Single Evaporator Fan Option	2EF0 (dual)	0-dual, 1-single_enable
CnF33	Enable Snap Freeze Option	OFF	0-off, 1-snap
CnF34	Temperature Unit Display	bOth (C&F)	0-enable both, 1-F, 2-C
CnF35	Enable Humidification Mode	0-OFF	1-on
CnF36	SMV Type	PWM	0-PWM, 1-Spor, 2-Alco
CnF37	Electronic Temperature Recorder	rEtUR	0-return, 1-supp, 2-both
CnF38	Quench Bypass Valve	0-Out	1-in
CnF39	Expanded Current Limit Range	0-Out	1-in
CnF40	Demand Defrost	0-Out	1-in
CnF41	Lower DTT Setting	0-Out	1-in
CnF42	Enable Auto Pretrip Start	0-Out	1-in
CnF43	Pulldown Defrost	0-Out	1-in
CnF44	Autoslide Enabled	0-Out	1-Lo, 2-Up
CnF45	Low Humidity Enabled	0-Out	1-in
CnF47	Fresh Air Vent Position Sensor	0-Out	1-up, 2-low, 3-cust
CnF48	CFS / WPS Override	0-Out	1-in
CnF49	OEM Reset Option	0-Off	1-std, 2-spec, 3-cust
CnF50	Enhanced Bulb Mode Selection	0-Out	1-in
CnF51	Timed Defrost Disable	0-Out	1-in
CnF54	Remote Evaporator	0-Out	1-in
CnF60	Compressor-Cycle Perishable Cooling	0-Out	1-in
CnF61	ACT ASC Control Enable	0-Out	1-in
CnF62	Extended Temperature Control Enable	0-Out	1-in
CnF63	CCPC Pre-trip / Tripstart Default State	0-On	1-off
CnF64	Evaporator Fan Pulsing Logic Enable	0-In	1-out
CnF66	High Speed Evaporator Fan Option	0-off	1-on
CnF67	Air Heaters	0-out	1-in
CnF68	Enable Default Pulsing Temperature	0-out	1-in

Note: Configuration numbers not listed are not used in this application. These items may appear when loading configuration software to the controller but changes will not be recognized by the controller programming.

4.10 Controller Function Codes

Table 4–5 Controller Function Codes

Code	Title	Description
Note: If the function is not applicable, the display will read "-----"		
Display Only Functions - Cd01 through Cd26 are display only functions.		
Cd01	Capacity Modulation (%)	Displays the SMV percent open. The right display reads 100% when the valve is fully open and 0% when the valve is fully closed. The valve will usually be at 21% on start up of the unit except in very high ambient temperatures.
Cd02	Quench Valve State	Displays the state of the solenoid quench valve, open or closed.
Cd03	Suction Solenoid Valve State	Displays the state of the suction solenoid valve, open or closed.
Cd04 Cd05 Cd06	Line Current, Phase A Line Current, Phase B Line Current, Phase C	The current sensor measures current on two legs. The third unmeasured leg is calculated based on a current algorithm. The current measured is used for control and diagnostic purposes. For control processing, the highest of the Phase A and B current values is used for current limiting purposes. For diagnostic processing, the current draws are used to monitor component energy. Whenever a heater or a motor is turned ON or OFF, the current draw increase/ reduction for that activity is measured. The current draw is then tested to determine if it falls within the expected range of values for the component. Failure of this test will result in a pretrip failure or a control alarm indication.
Cd07	Main Power Voltage	The main supply voltage is displayed.
Cd08	Main Power Frequency	The value of the main power frequency is displayed in Hertz. The frequency dis played will be halved if either fuse F1 or F2 is bad (see alarm code AL21).
Cd09	Ambient Air Temperature	The Ambient Temperature Sensor reading is displayed.
Cd10	Compressor Suction Temperature	The Compressor Suction Temperature Sensor reading is displayed.
Cd11	Compressor Discharge Temperature	The Compressor Discharge Temperature Sensor reading is displayed.
Cd12	Compressor Suction Port Pressure	The Compressor Suction Pressure Transducer reading is displayed.
Cd13	Condenser Pressure Control (CPC) Sensor	The Condenser Pressure Control Sensor reading is displayed.
Cd14	Compressor Discharge Pressure	The Compressor Discharge Pressure Transducer reading is displayed.
Cd15	Digital Unloader Valve	Not used in this application
Cd16	Compressor Motor Hour Meter / Unit Run Time Hour Meter	This code displays the compressor motor hours. User can view unit run time by pressing the ENTER key while in Cd16. Total hours are recorded in increments of 10 hours (i.e., 3000 hours is displayed as 300). The Compressor Motor Hour Meter display can be reset to 0 by pressing and holding the ENTER key for 5 seconds. The Unit Run Time Hour Meter cannot be reset
Cd17	Relative Humidity (%)	Humidity sensor reading is displayed. This code displays the relative humidity, as a percent value.
Cd18	Software Revision Number	The software revision number is displayed.

Table 4–5 Controller Function Codes (Continued)

Code	Title	Description
Cd19	Battery Check	This code checks the Controller / DataCORDER battery pack. While the test is running, “btest” will flash on the right display, followed by the result. PASS will be displayed for battery voltages greater than 7.0 volts. FAIL will be displayed for battery voltages between 4.5 and 7.0 volts, and ----- will be displayed for battery voltages less than 4.5 volts. After the result is displayed for four seconds, “btest” will again be displayed, and the user may continue to scroll through the various codes.
Cd20	Config/Model #	This code indicates the dash number of the model for which the Controller is con figured (i.e., if the unit is a 69NT40541100, the display will show 41100). To display controller configuration database information, press ENTER. Values in CFYYMMDD format are displayed if the controller was configured with a configuration card or with a valid OEM serial port configuration update; YYMMDD rep resents the publication date of the model configuration database.
Cd21	ML3 - Humidity Water Pump/Air Pump Status	This code displays the status of the humidity water pump (-----, On, or OFF). If not configured, the mode is permanently deactivated and will display -----.
Cd22	Compressor State	The status of the compressor is displayed (high, low or off).
Cd23	Evaporator Fan State	Displays the current evaporator fan state (high, low or off).
Cd24	Controlled Atmosphere State	Displays the controlled atmosphere state (-----, On or Off).
Cd25	Compressor Run Time Remaining Until Defrost	This code displays the time remaining until the unit goes into defrost (in tenths of an hour). This value is based on the actual accumulated compressor running time.
Cd26	Defrost Temperature Sensor Reading	Defrost Temperature Sensor (DTS) reading is displayed.

Table 4–5 Controller Function Codes (Continued)

Code	Title	Description
		Configurable Functions
Configurable Functions - Cd27 through Cd37 are user-selectable functions. The operator can change the value of these functions to meet the operational needs of the container.		
Cd27	Defrost Interval (Hours or Automatic)	There are two modes for defrost initiation, either user-selected timed intervals or automatic control. The user-selected values are (OFF), 3, 6, 9, 12, 24 hours, AUTO, or PuLS. Factory default is “AUTO”. Automatic defrost starts with an initial defrost at three hours and then adjusts the interval to the next defrost based on the accumulation of ice on the evaporator coil. Following a startup or after termination of a defrost, the time will not begin counting down until the defrost temperature sensor (DTS) reading falls below set point. If the reading of DTS rises above set point any time during the timer count down, the interval is reset and the countdown begins over. If the DTS fails, alarm code AL60 is activated and control switches over to the return temperature sensor. The controller will act in the same manner as with the DTS except the return temperature sensor reading will be used. If CnF23 is configured to SAv (save), then the value of the defrost interval timer will be saved at power down and restored at power up. This option prevents short power interruptions from resetting an almost expired defrost interval, and possibly delaying a needed defrost cycle. **NOTE** The defrost interval timer counts only during compressor run time. Configuration variable (CnF11) determines whether the operator will be allowed to chose OFF as a defrost interval option. Configuration variable (CnF64) determines whether the operator will be allowed to choose PuLS as a defrost interval option. For units operating with PuLS selected, defrost interval is determined by the unit temperature setpoint and the Evaporator Fan Pulsing Temperature Setting (Cd60). When the unit temperature setpoint is equal to or less than the Evaporator Fan Pulsing Temperature Setting, the defrost interval is set to 6 hours. Otherwise, the defrost interval is determined using the Automatic Defrost Interval Determination logic. In either case, PuLS remains displayed in this function select code. After a new Defrost Interval is selected, the previously selected Interval is used until the next defrost termination, the next time the DTT contacts are OPEN, or the next time power to the control is interrupted. If the previous value or the new value is OFF, the newly selected value will be used immediately. If any Auto Pretrip sequence is initiated, Cd27 will be set to 'AUTO' unless CnF49 (OEM Reset) is set to Custom AND CnF64 (Evaporator Fan Pulsing Logic) con figuration variable is set to IN, in which case Cd27 will be set to PuLS.
Cd28	Temperature Units (Degrees C or Degrees F)	This code determines the temperature units (°C or °F) which will be used for all temperature displays. The user selects °C or °F by selecting function code Cd28 and pushing the ENTER key. The factory default value is Celsius units. This function code will display ----- if CnF34 is set to °F.
Cd29	Failure Action Mode	This is the desired action to be taken if an alarm occurs that severely limits the capability of the control system. Depending upon what alarm has occurred, the actual action taken may not be the same as the desired failure action. The user selects one of four possible actions as follows: A - Full Cooling (stepper motor SMV at maximum allowed opening) B - Partial Cooling (stepper motor SMV 11% open) C - Evaporator Fan Only D - Full System Shutdown - Factory Default

Table 4–5 Controller Function Codes (Continued)

Code	Title	Description
Cd30	In-Range Tolerance	The in-range tolerance will determine the band of temperatures around the set point which will be designated as in-range. For normal temperature control, control temperature is considered in range if it is within setpoint In-Range Tolerance. There are four possible values: 1 = +/ 0.5°C (+/0.9°F) 2 = +/ 1.0°C (+/1.8°F) 3 = +/ 1.5°C (+/2.7°F) 4 = +/ 2.0°C (+/3.6°F) - Factory Default If the control temperature is in-range, the INRANGE light will be illuminated. In-Range tolerance shall be set to +/ 2.0°C upon activation of dehumidification or bulb mode (Cd33, Cd35, Cd48). When CCPC is actively controlling, IN-RANGE TOLERANCE is not considered. ----- will be displayed whenever Dehumidification or Bulb mode is enabled or when CCPC with six hour re-activation is actively controlling. ----- will be displayed whenever Frozen Economy Mode is operating.
Cd31	Stagger Start Offset Time (Seconds)	The stagger start offset time is the amount of time that the unit will delay at startup, thus allowing multiple units to stagger their control initiation when all units are powered up together. The eight possible offset values are: 0 (Factory Default), 3, 6, 9, 12, 15, 18 or 21 seconds
Cd32	System Current Limit (Amperes)	The current limit is the maximum current draw allowed on any phase at any time. Limiting the unit's current reduces the load on the main power supply. This is accomplished by reducing the SMV position until current draw is reduced to the set point. When desirable, the limit can be lowered; however, capacity is also reduced. The five values for 460VAC operation are 15, 17, 19, 21 (Factory Default), 23.
Cd33	Humidity Setpoint	This is the value in percent to which the system will dehumidify or humidify. There are configuration variables that determine whether dehumidification/ humidification capabilities are installed. In the test mode, the setpoint will be temporarily set to 1%, allowing the test of dehumidification. After 5 minutes, the normal setpoint is restored. If unit is configured for HUMIDIFICATION MODE then selection of a setpoint greater than 75% will activate humidification, and a setpoint less than or equal to 75% will activate dehumidification. If the unit is configured for dehumidification only, then the entire setpoint range will apply to dehumidification. If Pretrip is initiated, this value will be set to OFF automatically. (Replaced by Cd48 if CnF50, Enhanced Bulb Mode, is active.)
Cd34	Economy Mode (On-Off)	The current state of the economy mode option, -----, On, or Off. CnF22 determines whether economy mode offered. Economy mode is a user selectable mode of operation provided for power saving purposes.
Cd35	Bulb Mode	The current state of the bulb mode option, -----, nOr, or bULb. (Replaced by Cd48 if CnF50, Enhanced Bulb Mode, is active.) Bulb mode is an extension of dehumidification control (Cd33). If dehumidification (CnF04) is set to Off, Cd35 will display Nor and the user will be unable to change it. CnF28 determines whether the bulb mode selection is offered. After a dehumidification set point has been selected and entered for code Cd33, the user may then change Cd35 to bulb. After Bulb Mode has been selected and entered, the user may then utilize function codes Cd36 and Cd37 to make the desired changes.

Table 4–5 Controller Function Codes (Continued)

Code	Title	Description
Cd36	Evaporator Fan Speed Select	This is the desired evaporator fan speed for use during the bulb Dehumidification and Humidification mode option. (Replaced by Cd48 if CnF50, Enhanced Bulb Mode, is active.) This code is enabled only if in the dehumidification mode (Cd33) and bulb mode (Cd35) has been set to bulb. If these conditions are not met, alt will be dis played (indicating that the evaporator fans will alternate their speed) and the dis play cannot be changed. If a dehumidification set point has been selected along with bulb mode then alt may be selected for alternating speed, Lo for low speed evaporator fan only, or Hi for high speed evaporator fan only. If a setting other than alt has been selected and bulb mode is deactivated in any manner, then selection reverts back to alt.
Cd37	Variable DTT Setting (Bulb Mode)	This is the Variable Defrost Termination Thermostat (DTT) setting to be used with the optional bulb mode functionality. This item is only displayed if the bulb mode option is configured on. (Replaced by Cd48 if CnF50, Enhanced Bulb Mode, is active.)
Display Only Functions - Cd38 through Cd40 are display only functions.		
Cd38	Secondary Supply Temperature Sensor	Code Cd38 will display the current supply recorder sensor (SRS) reading for units configured for four probes. If the unit is configured with a DataCORDER, Cd38 will display -----. If the DataCORDER suffers a failure (AL55), Cd38 will display the supply recorder sensor reading.
Cd39	Secondary Return Temperature Sensor	Code Cd39 will display the current return recorder sensor (RRS) reading for units configured for four probes. If the unit is configured with a DataCORDER, Cd39 will display -----. If the DataCORDER suffers a failure (AL55), Cd39 will display the return recorder sensor reading.
Cd40	Container Identification Number	If a valid container id exists, the default display for cd40 will be cd40_XXXXX where XXXXX is the 5th character through the 9th character of the container id. Pressing the Enter key on cd40 will display id_YYYYYYY where YYYYYYY is the 5th character to the 11th character of the container id. If no valid container id exists or the container id is blank, the default display will have cd40 on the left display and the right display will alternate between _nEEd and ___id. Pressing the enter key while on cd40 in the state will prompt the Set Id Interface. On start up if the container id is not valid, cd40 be brought up on the display for the first minute of power up. This can be left by either entering a container id or leaving the code select normally. Code Cd40 is configured at commissioning to read a valid container identification number. The reading will not display alpha characters; only the numeric portion of the number will display.
Service Function - Cd41 is used for troubleshooting.		
Cd41	Valve Override	This code allows manual positioning of the SMV. Refer to paragraph 6.18 for operating instructions.

Table 4–5 Controller Function Codes (Continued)

Code	Title	Description
Configurable Functions - Cd43 is a user-selectable function. The operator can change the value of this function to meet the operational needs of the container.		
Cd43	eAutoFresh Mode	Cd43 is a user selectable mode of operation that allows opening and closing of a mechanical air vent door via a stepper motor. Selection modes are as follows: OFF - Air makeup vent will remain closed. USER - Allows for manual selection of the setting. DELAY -The opening of the door is based on selected time, return temperature and flow rate (percent opened). gASLM - The opening is based percent open and CO_2 and O_2 selectable limits (LM). This selection is only active if the unit has a CO_2 sensor. TEST / CAL (CO_2 sensor option units only) - The door will fully open and close to allow the user to inspect its operation. If CAL is selected, the controller will zero calibrate the CO_2 sensor input. If the unit is not configured with AutoFresh, the CD43 will display ----
Cd43	XtendFRESH Mode	Cd43 has three selectable modes of operation: FRESH - All XtendFRESH operations are enabled and setpoints for CO_2 and O_2 can be edited. OFF - All XtendFRESH operations are disabled. TEST - the operator has the ability to test operation of mechanical components, test and calibrate the CO_2 sensors and verify the validity of the O_2 sensor.
Display Only Function - Cd44 is a display only function.		
Cd44	eAutoFresh Values / CO_2 Sensor Status	Code Cd44 displays the eAutoFresh CO_2 and O_2 values (CO_2 and O_2) and CO_2 and O_2 limits (CO_2 LIM and O_2 LIM), respectively. This function code will be dashed out if not configured for eAutofresh. This function code will be dashed if CO_2 sensor is not detected, and a sensor is not expected (didn't have one previously). This function code will display ChECK if a CO_2 sensor has not been auto-detected at the most recent power-up and was detected at a previous power-up. If ChECK is displayed and the ENTER key is pressed, SEnSr is displayed with the choices of YES and no: “YES” sensor should be remembered as detected (present) “no” sensor should not be remembered as being detected (not present)
Cd44	XtendFRESH Values	Cd44 allows the user to view the following XtendFRESH values: CO_2 setpoint, CO_2 percentage, O_2 setpoint, O_2 percentage, and O_2 voltage. For the CO_2 setpoint, the range is from 0 to 19% in 1% increments with a default setting of 5%. For the O_2 setpoint, the range is from 3% to 21% in 1% increments with a default setting of 10%.
Configurable Functions - Cd45 through Cd48 are user-selectable functions. The operator can change the value of these functions to meet the operational needs of the container.		
Cd45	Vent Position Sensor (VPS) Position	Values: 0 to 240 for UPPER / 0 to 225 for LOWER This function code will be dashed out if not configured for VPS. When configured for VPS, Cd45 displays the current vent position in units of 5 CMH (units displayed as CM) or CFM (units displayed as CF) depending on the selection of Cd46 (Airflow display units), Cd28 (Metric/Imperial) or the pressing of the deg C/F key. Cd45 will display whenever the control detects movement via the sensor unless AL50 is active. Cd45 will display for 30 seconds, then time out and return to the normal display mode.

Table 4–5 Controller Function Codes (Continued)

Code	Title	Description
Cd46	Airflow Display Units	Selects the airflow units to be displayed by Cd45 if configured for Vent Position Sensor or displayed by USER/FLO under Cd43 if configured for Autoslide. CF = Cubic Feet per Minute CM = Cubic Meters per Hour bOth = Displays CF or CM depending on the setting of Cd28 (Metric/Imperial) or the pressing of the degree C/F key.
Cd47	Variable Economy Temperature Setting	Used when Economy Mode (CnF22) is set to 3-cust. Display will show when the unit is not configured for Economy Mode. When the unit has a perishable setpoint and Economy Mode is active, at the start of each cooling or heating cycle, high speed evaporator fans will run for 3 minutes. After three minutes, the evaporator fans will be switched to low speed any time that the supply temperature is within +/- 0.25°C of the setpoint and the return temperature is less than or equal to the supply temperature + the user selected Cd47 (values are 0.5 °C - 4.0° C, default is 3.0 °C).

Table 4–5 Controller Function Codes (Continued)

Code	Title	Description
Cd48	Dehumidification / Bulb Cargo Mode Parameter Selection	Initially Cd48 will display current dehumidification-mode; bUlb - bulb cargo mode, dEhUM - normal dehumidification, or OFF - off. This display is steady. Pressing ENTER key will take the interface down into a hierarchy of parameter selection menus (mode, setpoint, evaporator speed, DTT setting). Pressing ENTER key in any parameter selection menu commits to selection of the currently displayed parameter and causes the interface to descend into the next parameter selection menu. All parameter selection menus alternate between a blank display and the current selection in the right hand display. Pressing CODE SELECT key in a selection menu cancels the current selection activity and ascends back up to the next higher selection menu (or to Cd48 display mode if that is the next higher). If the operator does not press any key for five seconds the interface reverts to normal system display and the current selection menu is cancelled, but any previously committed changes are retained. Available parameters and parameter ranges are a function of configuration options and previously selected parameters as indicated above. Whenever any pretrip test is initiated, dehumidification-mode goes to OFF. Whenever dehumidification-mode goes to OFF: Dehumidification control setpoint goes to 0% RH internally but will then initialize to 95% RH when dehumidification-mode leaves OFF. Evaporator speed select goes to Alt for units without PWM Compressor Control (Cnf57 = Out), Evaporator speed select goes to Hi for units with PWM Compressor Control (Cnf57 = In). DTT setting goes to 25.6°C or 18.0°C, depending on Cnf41. Whenever dehumidification-mode is set to bUlb, DTT setting goes to 18.0°C if it had been set higher. Whenever dehumidification-mode is set to dEhUM, DTT setting goes to 25.6°C or 18.0°C, depending on Cnf41. For units without PWM Compressor Control (Cnf57 = Out): Whenever dehumidification control setpoint is set below 65% RH evaporator speed select goes to LO if it had been set to Hi. Whenever dehumidification control setpoint is set above 64% RH evaporator speed select goes to Alt if it had been set to LO. For units with PWM Compressor Control (Cnf57 = In): Whenever dehumidification control set point is set below 60% RH, the evaporator fan speed is set to LO, the user has the ability to set the evaporator fan speed to Hi via the keypad. Whenever dehumidification control set point is set equal to or above 60% RH, the evaporator fan speed is set to Hi, the user has the ability to set the evaporator fan speed to LO via the keypad.
Display Only Function - Cd49 is a display only function.		
Cd49	Days Since Last Successful Pretrip	Displays the number of days since last successful pretrip sequence. Press ENTER to view the number of days since the last successful pretrip for Auto1, Auto2, and Auto2 in sequence. Press CODE SELECT to step back through the list and ultimately to exit the Cd49 display.

Table 4–5 Controller Function Codes (Continued)

Code	Title	Description
Configurable Functions - Cd50 through Cd53 are user-selectable functions. The operator can change the value of these functions to meet the operational needs of the container.		
Cd50	Quest Enable/Disable	"OFF" = disabled. "On" = enabled. "SEtPt" = suspended by setpoint too low. "CAHUM" = suspended by CA or humidity control. "ACt" = suspended by ACT active. "FAIL" = all return temperature probe failure for CCPC. "PrtrP" = pretrip active. "C LIM" = suspended by cool limit logic. "PULL" = pulldown active. ALArM = suspended by shutdown alarm Press enter, arrow keys, and then enter to select "OFF" or "On". If "On" is selected, CCPC operation may be suspended as indicated by one of the suspension codes listed above. If CCPC is not "OFF" and is not suspended, "On" will be displayed.
Cd51	Automatic Cold Treatment (ACT) Mode Parameter Selection	ACT-mode: Cd51 increments of (1 day)_(1hr), Display: default 0_0 done mm-dd this will be display is ACT has completed ACt value On OFF or ----Display /Select: default OFF trEAt value °C / °F on 0.1 degree increments Display/Select: default 0.0°C DAyS value “0-99” increments of 1 Display/Select: default “0” ProbE value Probe positions ex '1 2 _ 4' '1 _ 3 _' Display: default ---- SPnEW value °C / °F on 0.1_ increments Display/Select: default 10.0°C Initially Cd51 will display current countdown timer increments of (1 day)_(1hr), de fault 0_0 Pressing ENTER key will take the interface down into a hierarchy of parameter selection menus in the order listed above. Pressing ENTER key in any of the parameter selection menus commits to selection of the currently displayed parameter and causes the interface to descend into the next parameter selection menu. All parameter selection menus alternate between a blank display and the current selection in the right hand display. Pressing CODE SELECT key in a selection menu cancels the current selection activity and ascends back up to the next higher selection menu (or to Cd51 dis play mode if that is the next higher). If the operator does not press any key for five seconds the interface reverts to normal system display and the current selection menu is cancelled, but any previously committed changes are retained. Available parameters and parameter ranges are a function of configuration options and previously selected parameters as indicated above. Parameter with the exception of Act may not be altered if Cd51 is re-entered if Act is On. When ACT has completed including reaching the new setpoint done on the left display and the MONTH DAY of completion on the right display will be displayed as the second entry in the menu. Turning ACT off clears this entry. This action also resets Cd51 to initial time remaining. ACT must then be turned on to view or modify the additional parameters. Whenever any auto pretrip test or Trip Start is initiated, act-mode goes to OFF.

Table 4–5 Controller Function Codes (Continued)

Code	Title	Description
Cd53	Automatic Setpoint Change (ASC) Mode Parameter Selection	ASC-mode: Cd53 increments of (1 day)_(1hr), Display: default 0_0 done mm-dd this will be display is ASC has completed ASC value “On” “OFF” Display /Select: default OFF nSC value “1 - 6” (This is the value n for the subsequent entries). SP (n-1) value °C/°F on 0.1 degree increments Display/Select: default 10.0°C DAY (n-1) value “1-99” increments of 1 Display/Select: default 1 SP (n) value °C/°F on 0.1 degree increments Display/Select: default 10.0°C Initially displays current count down timer increments of (1 day)(1hr), default “0_0” Pressing ENTER key will take the interface down into a hierarchy of parameter selection menus in the order listed above. Pressing ENTER key in any of the parameter selection menus selects the currently displayed parameter and causes the interface to descend into the next parameter selection menu. All parameter selection menus alternate between a blank display and the current selection in the right hand display. Pressing CODE SELECT key in a selection menu cancels the current selection activity and ascends back up to the next higher selection menu (or to Cd53 dis play mode if that is the next higher). If the operator does not press any key for five seconds the interface reverts to normal system display and the current selection menu is cancelled, but any previously committed changes are retained. Available parameters and parameter ranges are a function of configuration options and previously selected parameters as indicated above. Parameter with the exception of ASC may not be altered if Cd53 is re-entered if ASC is On. When ASC has completed including reaching the last setpoint done on the left display and the MONTH DAY of completion on the right display will be displayed as the second entry in the menu. Turning ASC off clears this entry. This action also resets Cd53 to initial time remaining. ASC must then be turned on to view or modify the additional parameters. Whenever any auto Pretrip test or Trip Start is initiated, ASC mode goes to OFF.
Display Only Functions - Cd55 through Cd58 are display only functions.		
Cd55	Discharge Superheat	Cd55 will display the discharge superheat values in °C / °F as calculated by the discharge temperature minus the discharge saturation temperature as calculated from discharge pressure. ----- will be displayed if selection is not valid.

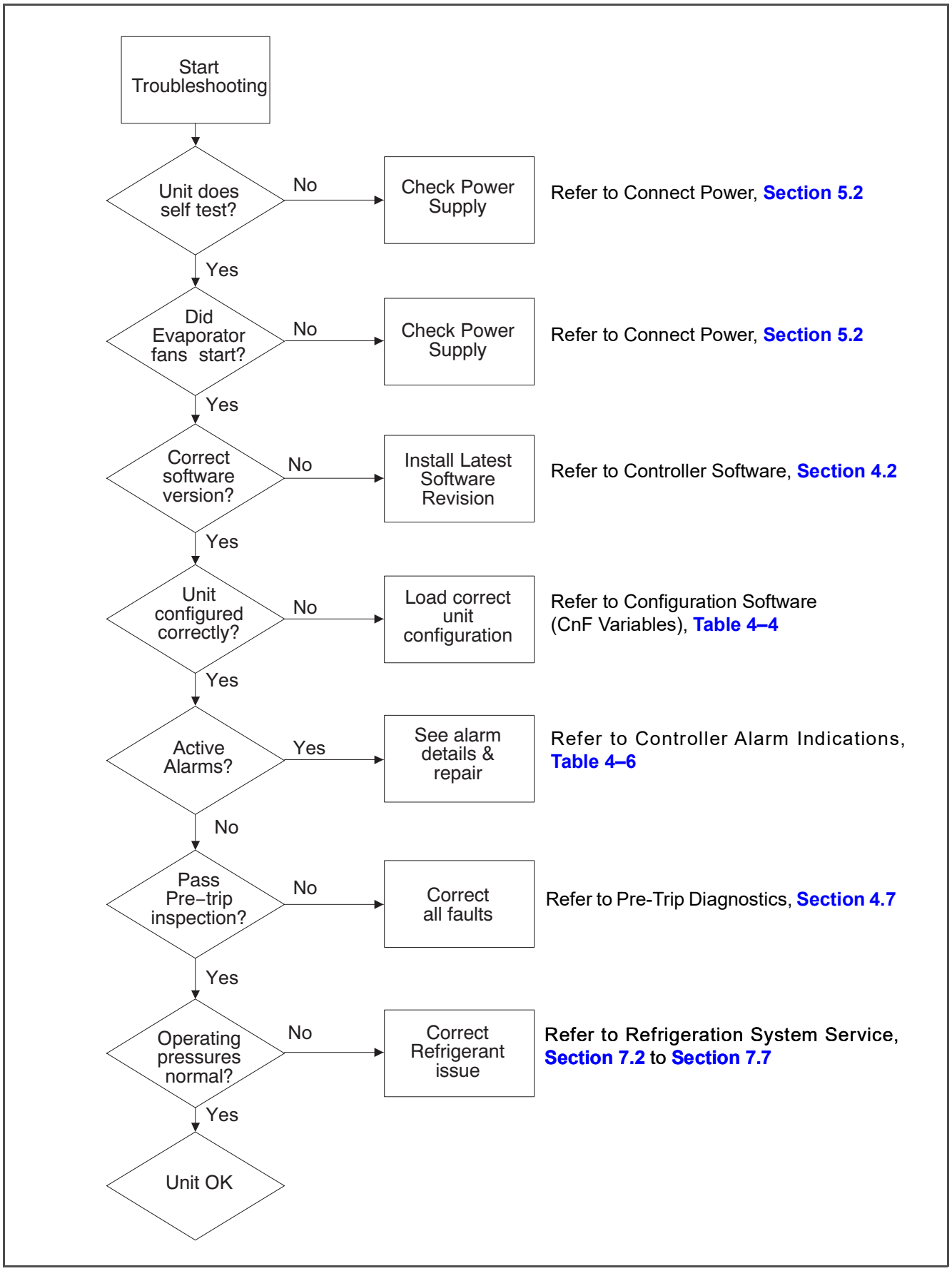
Table 4–5 Controller Function Codes (Continued)

Code	Title	Description
Cd58	Water Pressure Switch / Condenser Fan Switch State or Override Logic State	Cd58 will display “CLOSE” if the WPS or CFS switch contacts are closed or if these options are not installed. “OPEn” is displayed when the WPS or CFS switch contacts are open. When the WPS/CFS Override Logic is “TRUE”, the right display will flash on all units. NOTE: 1. This CLOSE/OPEn state displayed in this Code Select function only applies to units that have the ability to detect the state of a WPS/CFS. This function should not be relied upon to display the condition of the switch on units that don’t have a WPS/CFS switch connected to ECG2 exclusively. 2. The right display will flash if the WPS/CFS Override Logic is TRUE on all units. This is always the case, whether the unit has a WPS or CFS installed or not. 3. The ability of the WPS/CFS Override Logic to control the condenser fan is limited. It is not possible for this logic to control the fan on units that have the WPS or CFS wired in series with the fan contactor. Units wired in this configuration can indicate that the WPS/CFS Override Logic is active by flashing the right display, however, the wiring will not allow for control of the condenser fan
Configurable Functions - Cd60 is a user-selectable function. The operator can change the value of this function to meet the operational needs of the container.		
Cd60	Evaporator Fan Pulsing Temperature Setting	Cd60 contains a selectable temperature range used to determine the engagement point of the Evaporator Fan Pulsing logic. Default setting is -18.1°C. The user may change the temperature by pressing enter, then scrolling to the desired temperature using either arrow key. Press Enter to accept the change. The temperature setting will be retained until either a Pretrip or Trip Start is initiated at which time the temperature will set to the default setting. “-----” will be displayed if CnF68 is configured OUT.
Cd62	High Speed Evaporator Fan Setting	Dashed-out if setpoint is in frozen range OR if Cnf66 is configured OFF. This function code is used to force evaporator fan speed to high while temperature control is being performed in the perishable setpoint range. When set to On, evaporator fans operate in high speed regardless of any other active option that can control evaporator fan speed. Following a power cycle, the state of the function select code is retained at its state prior to the power cycle. If On, this function select code will be set to OFF when any trip-start occurs or any pretrip test is initiated. Default is OFF.
Cd65	TripWise	If the function is off, display "OFF". If the function is on, display "ON". “-----” will be displayed if the TripWise option is not active for the current configuration. Press the ENTER key. The existing entry will flash. Use the Arrow keys to alternate between OFF and ON. Press ENTER again to set the Expiration Interval. Left display: “dAyS” Right display: Expiration Interval 2 through 365 in one day increments. Default value is 30.
Cd66	Instantaneous Power (kW)	Real power in kW currently being used by the system. Value is “-----“,“ nnn.n Display “-----“ if not configured else nnn.n

Table 4–5 Controller Function Codes (Continued)

Code	Title	Description
Cd67	Total Power (kW-hr)	Energy used by the system, in kW-hrs, since last Trip Start. Value is "-----"," nnnnn Display "-----" if not configured else nnnnn
Cd70	Temp Setpoint Lock	Cd70 locks out setpoint selection, requiring the user to manually turn the lock off, prior to making a setpoint change. If the setpoint lock is "ON", and the user attempts to enter a new setpoint, a message "SPLK" (Setpoint Lock) is in the left display and "ON" in the right display for five seconds. Press the ENTER key. "SPLK" will display along with the current setting of "ON" or "OFF". Use the Arrow keys to change the selection - the new selection will then flash for five seconds. Press the ENTER key to confirm the new selection. An event will be recorded in the DataCorder each time the action of turning it "ON" or "OFF" is taken. Default setting is "OFF". Unit will default to "OFF" with the selection of PTI or a TripWise on the unit.

Figure 4.12 Alarm Troubleshooting Sequence



4.11 Controller Alarm Indications

AL05	Manual Defrost Switch Failure	
Cause:	Controller has detected continuous Manual Defrost Switch activity for five minutes or more.	
	Component	Keypad
	Troubleshooting	Power cycle the unit.
	Corrective Action	Resetting the unit may correct problem, monitor the unit. If the alarm reappears after 5 minutes replace the keypad.

AL06	Keypad or Keypad Harness Fail	
Cause:	Controller has detected one of the keypad keys is continuously activity.	
	Component	Keypad or Harness
	Troubleshooting	Power cycle the unit.
	Corrective Action	Resetting the unit may correct problem, monitor the unit. If the alarm reappears replace the keypad and harness.

AL07	Fresh Air Vent Open	
Cause:	The VPS is reading greater than 0 CMH while unit is in frozen mode or XtendFRESH active.	
	Component	Vent Position Sensor (VPS)
	Troubleshooting	Manually reposition vent and confirm using Cd45. Refer to Vent Position Sensor Service, **Section 7.23**.
	Corrective Action	If unable to obtain zero reading, replace defective VPS.

AL09	O2 Sensor Failure	
Cause:	Triggered anytime the O_2 sensor reading is outside of the normal operation range, after an initial signal was detected.	
	Component	O_2 Sensor, O_2 Amplifier, Sensor Switch Module (if equipped)
	Troubleshooting	Check Cd44 and scroll down to 02V. The O_2 sensor output will be displayed in millivolts (130mV to 4100mV). Switch equipped: If voltage is not present at Cd44 and a sensor switch module is installed, check for O_2 voltage on the black wire connected to the sensor switch module, connecting ground of meter to TP9. If the voltage is in the 130mV to 4.1V range, directly wire the black wire to KD04. This may cause an AL07 depending on O_2 reading but XtendFRESH will operate normally. If no voltage on the black wire, proceed to next step. Check wiring (see schematic), and correct if found mis-wired. If O_2 sensor is available, remove the upper fresh air panel and evaporator motor and replace the sensor. If after replacing sensor AL09 continues, replace amplifier. If parts are not available, turn XtendFRESH option off (Cd43) and open the Manual Fresh Air Vent.

AL10	CO_2 Sensor Failure	
Cause:	Alarm 10 is triggered when the CO_2 sensor voltage is operating outside of the normal operating range, after an initial signal was detected.	
	Component	This is a display alarm and has no associated failure action.
	Troubleshooting	Refer to eAutoFresh manual.
	Corrective Action	The alarm is triggered off when voltage is within operating range.

AL11	Evaporator Fan 1 IP	
Cause:	Alarm 11 is triggered when configured for single evap operation and MC6 sensed high.	
	Component	Evaporator Fan 1
	Troubleshooting	The unit will suspend probe check diagnostic logic and disable the probe check portion of defrost cycle.
	Corrective Action	AL11 is triggered off when MC6 sensed low.

AL12	Evaporator Fan 2 IP	
Cause:	Alarm 12 is triggered when configured for single evap operation and KB10 sensed high.	
	Component	Evaporator Fan 2
	Troubleshooting	The unit will suspend probe check diagnostic logic and disable the probe check portion of defrost cycle.
	Corrective Action	AL12 is triggered off when KB10 sensed low.

AL15	Loss of Cooling	
Cause:	AL15 is triggered 30 minutes after the completion of a controller initiated probe check defrost if Supply Temperature is more than 0.25°C (0.45°F) above set point. Refer to Defrost, **Section 4.3.17**.	
	Component	Refrigerant Level
	Troubleshooting	Power cycle the unit.
	Corrective Action	Refer to Refrigerant Charge, **Section 7.7**. Power cycle the unit.

AL20	Control Contactor Fuse (F3)	
Cause:	Control power fuse (F3A or F3B) is open.	
	Component	Check F3A, if the fuse is open:
	Troubleshooting	Check PA, PB, CH coils for short to ground, if short is found:
	Corrective Action	Replace the defective coil. Replace the fuse.
	Component	Check F3B, if the fuse is open:
	Troubleshooting	Check CF, ES, EF, HR coils for short to ground, if short is found, coil is defective.
	Corrective Action	Replace the defective coil. Replace the fuse.
	Component	Check voltage at QC1:
	Troubleshooting	If voltage is present, it indicates a defective microprocessor.
	Corrective Action	Refer to Controller Service, **Section 7.21**.

AL21	Control Circuit Fuse (F1/F2)	
Cause:	One of the 18 VAC controller fuses (F1/F2) is open. Refer to Cd08.	
	Component	System Sensors
	Troubleshooting	Check system sensors for short to ground.
	Corrective Action	Replace defective sensor(s).
	Component	Wiring
	Troubleshooting	Check wiring for short to ground.
	Corrective Action	Repair as needed.
	Component	Controller
	Troubleshooting	Controller may have an internal short.
	Corrective Action	Replace controller. Refer to Controller Service, **Section 7.21**.

AL22	Evaporator IP	
Cause:	Evaporator motor internal protector (IP) is open.	
	Component	Evaporator Motor
	Troubleshooting	Shut down unit, disconnect power, & check Evaporator Motor IP at plug connection pins 4 & 6.
	Corrective Action	Replace defective evaporator fan motor. Refer to Evaporator Fan Motor Service, **Section 7.15**.

AL23	Loss of Phase B	
Cause:	Controller fails to detect current draw.	
	Component	Incoming Power
	Troubleshooting	Check incoming power source.
	Corrective Action	Correct power source as required.

AL24	Compressor IP	
Cause:	Compressor internal protector (IP) is open.	
	Component	Compressor
	Troubleshooting	Shut down unit disconnect power, & check resistance of compressor windings at contactor T1-T2, T2-T3.
	Corrective Action	Monitor unit. If alarm remains active or is repetitive, replace the compressor at the next available opportunity. Refer to **Section 7.8**.

AL25	Condenser IP	
Cause:	Condenser fan motor internal protector (IP) is open.	
	Component	Insufficient Air Flow
	Troubleshooting	Shut down unit and check condenser fan for obstructions.
	Corrective Action	Remove obstructions.
	Component	Condenser Fan Motor
	Troubleshooting	Shut down unit, disconnect power, & check Condenser Fan Motor IP at plug connection pins 4 & 6.
	Corrective Action	Replace defective condenser fan motor. Refer to **Section 7.11**.

AL26	All Sensors Failure: Supply / Return Probes	
Cause:	Sensors out of range.	
	Component	All sensors detected as out of range.
	Troubleshooting	Perform Pre-trip P5:
	Corrective Action	If P5 passes, no further action is required. If P5 fails, replace the defective sensor as determined by P5. Refer to Temperature Sensor Service, **Section 7.22**.

AL27	Analog to Digital Accuracy Failure	
Cause:	Controller AD converter faulty.	
	Component	Controller
	Troubleshooting	Power cycle the unit. If the alarm persists, it indicates a defective microprocessor.
	Corrective Action	Replace defective microprocessor. Refer to Controller Service, **Section 7.21**.

AL29	AutoFresh Failure (eAutoFresh)	
Cause:	Alarm 29 is triggered if CO_2 or O_2 level is outside of the limit range and the vent position is at 100% for longer than 90 minutes.	
	Component	Alarm LED will be activated and user intervention is required.
	Troubleshooting	Refer to eAutoFresh manual.
	Corrective Action	The alarm is triggered off when atmospheric conditions are within limit settings.

AL29	Loss of Atmospheric Control (XtendFRESH)	
Cause:	Triggered whenever the CO_2 level is above its upper limit by 1% for 60 minutes. Or, when the O_2 level is greater than 1% below its setpoint for longer than 30 minutes after the unit has been in range. The alarm is triggered off when the levels return to within the normal range.	
	Setup	Run Cd43 test mode for troubleshooting the below components. At the end of test mode, a sensor calibration will be attempted. Under loaded box conditions, the sensor values may post “No Cal” or “CAL FAIL”. Results from original calibration will be retained. If test mode times out, then hold the code select key for 3 seconds to exit test mode.
	Troubleshooting	If components do not energize, check FX1 and FX2 for power (460 VAC). If fuse is open, check heater continuity (XHT1 to ground). Must be greater than 1 mega ohm. If less than 1, disconnect the heater at XHT1 and XHT2. Replace fuse. Unit will control on fresh air solenoids.
	Component	Solenoid Air Vents.
	Troubleshooting	Visually inspect to see if the Solenoid Valves are opening air vents. If vents open, troubleshoot the next component. If vents do not open, continue with troubleshooting below. Check FX4 fuse for power (~20 volts dc). If fuse is open, check wiring and or replace solenoid if part is available. If no part is available, open manual fresh air vent.
	Component	XtendFRESH Fan(s) / XtendFRESH Scrubber Motor
	Troubleshooting	Visually inspect to see if the XtendFRESH Fan(s) are running (air blowing on left, intake on right), check current draw of motor at the XST1 (~40 to 200 milliamps / contactor load side). Troubleshoot the non-operating component. If both are running, proceed to next component. Verify XS contactor is pulling in. If not, check FX6 fuse for power (24 VAC). If not, check power at controller KB4. Check FX3 fuse for power (~20 vdc). If no power, replace fuse. If fuse opens a second time, take no further action. O_2 level will be controlled with the opening and closing of the fresh air vents. If part is available, replace either fan or scrubber motor. Fan is replaceable from the front on a loaded unit; Scrubber motor is not. If no part is available or accessible, take no action and service at next PTI. O_2 level will be controlled with the opening and closing of the fresh air vents.
	Component	Heater
	Troubleshooting	Verify XH contactor is pulling in. If not, check FX6 for power (24 VAC). If open ohm contactors XHA1 and XSA1 to ground. Replace (12 Amp) contactor. If contactor is pulling, power unit off and check heater resistance from XH1 to XH2 (450 to 500 ohms). If heater is outside of the range, disconnect heater at XHT1 and XHT2 and replace at next PTI. Unit will control on fresh air solenoids.

AL50	Air Vent Position Sensor (VPS)	
Cause:	VPS Sensor out of range.	
	Component	Vent Position Sensor (VPS)
	Troubleshooting	Make sure VPS is secure.
	Corrective Action	Manually tighten panel.
	Component	Vent Position Sensor (VPS)
	Troubleshooting	If the alarm persists, replace the sensor or the assembly.
	Corrective Action	Replace VPS.

AL51	EEPROM Failure	
Cause:	Controller Memory Failure	
	Component	Controller
	Troubleshooting	Pressing the ENTER key when CLEAr is displayed will result in an attempt to clear the alarm.
	Corrective Action	If action is successful (all alarms are inactive), AL51 will be reset.
	Component	Controller
	Troubleshooting	Power cycle the unit. If the alarm persists, it indicates defective controller memory.
	Corrective Action	Replace defective controller. Refer to Controller Service, **Section 7.21**.

AL52	EEPROM Alarm List Full	
Cause:	Alarm list queue is full.	
	Component	Active Alarms
	Troubleshooting	Repair any alarms in the queue that are active. Indicated by AA.
	Corrective Action	Clear alarms. Refer to Controller Alarms, **Table 4–6**.

AL53	Battery Pack Failure	
Cause:	Battery voltage low	
	Component	Battery
	Troubleshooting	If this alarm occurs on start up, allow a unit fitted with rechargeable batteries to operate for up to 24 hours to charge rechargeable batteries sufficiently. Once fully charged, the alarm will deactivate.
	Corrective Action	To clear the alarm, press ENTER and ALT simultaneously at the startup of Cd19 (Battery Check). If alarm persists, replace the battery pack. Refer to Battery Replacement, **Section 7.21.5**.

AL54	Primary Supply Sensor (STS)	
Cause:	Invalid Supply Temperature Sensor (STS) reading.	
	Component	Supply Temperature Sensor (STS)
	Troubleshooting	Perform Pre-trip P5:
	Corrective Action	If P5 passes, no further action is required. If P5 fails, replace the defective sensor as determined by P5. Refer to Temperature Sensor Service, **Section 7.22**.

AL56	Primary Return Sensor (RTS)	
Cause:	Invalid Return Temperature Sensor (RTS) reading.	
	Component	Return Temperature Sensor (RTS)
	Troubleshooting	Perform Pre-trip P5:
	Corrective Action	If P5 passes, no further action is required. If P5 fails, replace the defective sensor as determined by P5. Refer to Temperature Sensor Service, **Section 7.22**.

AL57	Ambient Sensor (AMBS)	
Cause:	Invalid Ambient Temperature Sensor (AMBS) reading.	
	Component	Ambient Temperature Sensor (AMBS)
	Troubleshooting	Test the AMBS. Refer to Temperature Sensor Service, **Section 7.22**.
	Corrective Action	Replace AMBS if defective. Refer to Temperature Sensor Service, **Section 7.22**.

AL58	Compressor High Pressure Safety (HPS)	
Cause:	High pressure safety switch remains open for at least one minute.	
	Component	High Pressure Switch (HPS)
	Troubleshooting	Test the HPS. Refer to High Pressure Switch, **Section 7.9**.
	Corrective Action	Replace HPS if defective. Refer to High Pressure Switch, **Section 7.9**.
	Component	Refrigeration System
	Troubleshooting	Check unit for air flow restrictions.
	Corrective Action	Clean or remove any debris from coils.

AL59	Heater Termination Thermostat (HTT)	
Cause:	Heat Termination Thermostat (HTT) is open.	
	Component	Alarm 59 is triggered by the opening of the Heat Termination Thermostat (HTT) and will result in the disabling of the heater.
	Troubleshooting	Check for 24 volts at test point TP10. If no voltage at TP10 after unit has reached set point, HTT is open.
	Corrective Action	Replace HTT if defective.

AL60	Defrost Temperature Sensor (DTS)	
Cause:	Failure of the Defrost Temperature Sensor (DTS) to open.	
	Component	Defrost Temperature Sensor (DTS)
	Troubleshooting	Test the DTS. Refer to Sensor Checkout Procedure, **Section 7.22.2**.
	Corrective Action	Replace the DTS if defective. Refer to Sensor Replacement, **Section 7.22.4**.

AL61	Heater Current Draw Fault	
Cause:	Improper current draw during heat or defrost mode.	
	Component	Heater(s)
	Troubleshooting	While in heat or defrost mode, check for proper current draw at heater contactors. Refer to Electrical Data, **Section 3.3**.
	Corrective Action	Replace heater(s) if defective. Refer to Evaporator Heater Removal and Replacement, **Section 7.13**.
	Component	Contactor
	Troubleshooting	Check voltage at heater contactor on the heater side.
	Corrective Action	If no voltage present, replace heater contact or if defective.

AL62	O2 Out of Range	
Cause:	This is a notification alarm and does not pose a risk to fresh produce. It is triggered when there is an indication that O_2 level is rising after reaching its setpoint (+ 1%). If O_2 level exceeds 4% above setpoint, the alarm is activated. The alarm does not activate if the unit was pre-tripped or trip started between last reaching its O_2 setpoint and exceeding the plus 4%, or if power has been turned off for eight hours. The alarm is deactivated if O_2 drops below setpoint (+ 1%) or if a pre-trip or trip start is performed.	
	Component	Scrubber Failure
	Troubleshooting	See the troubleshooting of the Scrubber Motor in the AL29 alarm.
	Component	XtendFRESH Solenoid Valves
	Troubleshooting	See the troubleshooting of the Solenoid Air Vent in the AL29 alarm.
	Component	Container Air Tightness
	Troubleshooting	Seal container where possible (access panels, rear doors, mounting hardware, etc).

AL63	Current Limit	
Cause:	Unit operating above current limit.	
	Component	Refrigeration System
	Troubleshooting	Check unit for air flow restrictions.
	Corrective Action	Clean or remove any debris from coils.
	Component	Refrigeration System
	Troubleshooting	Check unit for proper operation.
	Corrective Action	Repair as needed.
	Component	Power supply
	Troubleshooting	Confirm supply voltage/frequency is within specification and balanced according to Electrical Data, **Section 3.3**.
	Corrective Action	Correct power supply.
	Component	Current limit set too low
	Troubleshooting	Check current limit setting Code Cd32.
	Corrective Action	The current limit can be raised (maximum of 23 amps) using Cd32.

AL64	Discharge Temperature Sensor (CPDS)	
Cause:	Discharge Temperature sensor out of range.	
	Component	Discharge temperature sensor (CPDS)
	Troubleshooting	Test the CPDS. Refer to Temperature Sensor Service, **Section 7.22**.
	Corrective Action	Replace the CPDS if defective. Refer to Temperature Sensor Service, **Section 7.22**.

AL65	Discharge Pressure Transducer (DPT)	
Cause:	Compressor Discharge Transducer is out of range.	
	Component	Compressor Discharge Transducer (DPT)
	Troubleshooting	Confirm accurate DPT pressure readings. Refer to Manifold Gauge Set, **Section 7.2**.
	Corrective Action	Replace DPT if defective.

AL66	(SPT) Suction Pressure Transducer, (EPT) Evaporator Pressure Transducer	
Cause:	Suction Pressure Transducer (SPT) out of range.	
	Component	Suction Pressure Transducer (SPT)
	Troubleshooting	Confirm accurate EPT and SPT pressure readings. Refer to Manifold Gauge Set, **Section 7.2**. Performing a Pre-trip 5-9 test will also check the transducers.
	Corrective Action	Replace EPT/SPT if defective.
	Component	Suction Pressure Transducer (SPT)
	Troubleshooting	Monitor
	Corrective Action	If the alarm persists, it may indicate a failing compressor. Refer to Compressor Service, **Section 7.8**.

AL67	Humidity Sensor	
Cause:	Humidity Sensor (HS) reading out of range.	
	Component	Humidity Sensor (HS)
	Troubleshooting	Make sure the humidity sensor is properly connected in the socket and the wires have not been dam aged.
	Corrective Action	Monitor, replace HS if alarm persists.

AL68	CPC Pressure Transducer	
Cause:	Condenser Pressure Transducer (CPC) out of range.	
	Component	Condenser Pressure Transducer (CPC)
	Troubleshooting	NA
	Corrective Action	Unit will disable Condenser Pressure Control if configured.

AL69	Suction Temp Sensor (CPSS)	
Cause:	Suction Temperature Sensor (CPSS) out of range.	
	Component	Suction Temperature Sensor (CPSS)
	Troubleshooting	Test the CPSS. Refer to Temperature Sensor Service, **Section 7.22**.
	Corrective Action	Replace CPSS if defective. Refer to Temperature Sensor Service, **Section 7.22**.

AL70	Secondary Supply Sensor (SRS)	
Cause:	Secondary Supply Sensor (SRS) is out of range.	
	Component	Secondary Supply Sensor (SRS)
	Troubleshooting	Perform Pre-trip P5.
	Corrective Action	If P5 passes, no further action is required. If P5 fails, replace the defective sensor as determined by P5. Refer to Temperature Sensor Service, **Section 7.22**.

AL71	Secondary Return Sensor (RRS)	
Cause:	Secondary Return Sensor (RRS) is out of range.	
	Component	Secondary Return Sensor (RRS)
	Troubleshooting	Perform Pre-trip P5.
	Corrective Action	If P5 passes, no further action is required. If P5 fails, replace the defective sensor as determined by P5. Refer to Temperature Sensor Service, **Section 7.22**.

AL72	Control Temp Out of Range	
Cause:	After the unit goes in-range for 30 minutes then out of range for a continuous 120 minutes.	
	Component	Refrigeration System
	Troubleshooting	Ensure unit is operating correctly.
	Corrective Action	Power cycle unit. Control Temperature is in In-range. Any Pre-trip mode, resets the timers

AL96	Scrubber Rotational Feature - optional feature	
Cause:	Feedback from the Scrubber Motor to the controller is not sensed when the motor is turning.	
	Component	Scrubber Fuse
	Troubleshooting	Check to see if Scrubber Fuse is blown. Replace Fuse if necessary.
	Component	Scrubber Motor
	Troubleshooting	Run Test Mode and verify scrubber bed is turning. If back panel cannot be removed to check, verify the scrubber amperage consumption, read at XS contactor wire XSL1. If between 40 and 200mA, motor is rotating properly. If no current detected, check and replace FX3. If current spiking to 350mA for 2 seconds then dropping to 90mA, the scrubber motor is located. If scrubber motor is locked, further inspection of the scrubber bed is required. Unit will control CO_2 with the fresh air solenoid when this alarm occurs if scrubber inaccessible. If Scrubber Motor not operating, follow the troubleshooting flowchart in XtendFresh manual and take appropriate action.
	Component	Ground Interface Module (GIM)
	Troubleshooting	Once it has been verified that the scrubber motor is rotating, check the wiring connections to the GIM module. If all wires secured properly, replace the GIM module if one is available. If not, the unit will control CO_2 using the fresh air solenoids.

Table 4–6 Controller Alarm Indications

<table>
<tr><td colspan="3">NOTE
If the controller is configured for four probes without a DataCORDER, the DataCORDER alarms AL70 and AL71 will be processed as Controller alarms AL70 and AL71. Refer to Table 4–10.</td></tr>
<tr><td rowspan="13">ERR #</td><td rowspan="13">Internal Microprocessor Failure</td><td>The controller performs self-check routines. If an internal failure occurs, an ERR alarm will appear on the display. This is an indication the controller needs to be re placed.</td></tr>
<tr><td><table>
<tr><td>ERROR</td><td>DESCRIPTION</td></tr>
<tr><td>ERR 0-RAM failure</td><td>Indicates that the controller working memory has failed.</td></tr>
<tr><td>ERR 1-Program Memory failure</td><td>Indicates a problem with the controller program.</td></tr>
<tr><td>ERR 2-Watchdog time-out</td><td>The controller program has entered a mode whereby the controller program has stopped executing.</td></tr>
<tr><td>ERR 3-N/A</td><td>N/A</td></tr>
<tr><td>ERR 4-N/A</td><td>N/A</td></tr>
<tr><td>ERR 5-A-D failure</td><td>The controller's Analog to Digital (A-D) converter has failed.</td></tr>
<tr><td>ERR 6-IO Board failure</td><td>Internal program / update failure.</td></tr>
<tr><td>ERR 7-Controller failure</td><td>Internal version / firmware incompatible.</td></tr>
<tr><td>ERR 8-DataCORDER failure</td><td>Internal DataCORDER memory failure.</td></tr>
<tr><td>ERR 9-Controller failure</td><td>Internal controller memory failure.</td></tr>
</table></td></tr>
<tr><td>In the event that a failure occurs and the display cannot be updated, the status LED will indicate the appropriate ERR code using Morse code as shown below.
E R R 0 to 9
ERR0 = . .-. .-. -----
ERR1 = . .-. .-. . ----
ERR2 = . .-. .-. . . ---
ERR3 = . .-. .-. . . . --
ERR4 = . .-. .-. . . . . -
ERR5 = . .-. .-. . . . . .
ERR6 = . .-. .-. -. . . .
ERR7 = . .-. .-. --. . .
ERR8 = . .-. .-. ---. .
ERR9 = . .-. .-. ---- .</td></tr>
<tr><td>Entr StPt</td><td>Enter Set point (Press Arrow & Enter)</td><td>The controller is prompting the operator to enter a set point.</td></tr>
<tr><td>LO</td><td>Low Main Voltage (Function Codes Cd27-38 disabled and NO alarm stored.)</td><td>This message will be alternately displayed with the set point whenever the supply voltage is less than 75% of its proper value.</td></tr>
</table>

4.12 Controller Pre-Trip Test Codes

Table 4–7 Controller Pre-Trip Test Codes

NOTE Auto or Auto1 menu includes the: P, P1, P2, P3, P4, P5, P6 and rSLts. Auto2 menu includes P, P1, P2, P3, P4, P5, P6, P7, P8, P9, P10 and rSLts.Auto3 menu includes P, P1, P2, P3, P4, P5, P6, P7, P8 and rSLts		
P0-0	PreTrip Initiated: Configuration Display, Indicator Lamps, LEDs, and Displays	Container identifier code, Cd18 Software Revision Number, Cd20 Container Unit Model Number, & configuration database identifier CFMMYYDD are displayed in sequence. Next the unit will indicate the presence or non-presence of an RMU according to whether any RMU inquiry messages have been received since the unit was booted. Units equipped with Autoslide Enabled (Cnf44) will cause the vent to seek to its closed position, followed by two sequences of opening to 100% and returning to the closed position. No other Autoslide mode of operation will be available until the two cycles of opening and closing have completed. Since the system cannot recognize lights and display failures, there are no test codes or results associated with this phase of Pretrip. To know if the test passes the operator must observe that the LCD display elements and the indicator lights behave as described below.
P1 Tests - Heaters Current Draw: Heater is turned on, then off. Current draw must fall within specified range. No other system components will change state during this test.		
P1-0	Heaters On Test	Heater starts in the off condition, current draw is measured, and then the heater is turned on. After 15 seconds, the current draw is measured again. The change in current draw is then recorded. Test passes if the change in current draw test is in the range specified.
P1-1	Heaters Off Test	Heater is then turned off. After 10 seconds the current draw is measured. The change in current draw is then recorded. Test passes if change in current draw is in the range specified.
P2 Tests - Condenser Fan Current Draw: Condenser fan is turned on, then off. Current draw must fall within specified range. No other system components will change state during this test.		
P2-0	Condenser Fan On Test	Condenser fan starts in the off condition, current draw is measured, and con denser fan is then turned on. After 15 seconds the current draw is measured again. The change in current draw is then recorded. Test passes if change in current draw test is in the specified range.
P2-1	Condenser Fan Off Test	Condenser fan is then turned off. After 10 seconds the current draw is measured. The change in current draw is then recorded. Test passes if change in current draw test is in the specified range.
P3 Tests - Low Speed Evaporator Fan Current Draw: The system must be equipped with a low speed evaporator fan, as determined by CnF02, the Evaporator Fan Speed Select configuration variable. Low speed evaporator fan is turned on, then off. Current draw must fall within specified range. No other system components will change state during this test. **NOTE** If unit configured for single evaporator fan operation and either AL11 or AL12 is active at the start of either test, then the test will fail immediately. If AL11 or AL12 become active during the test, then the test will fail upon conclusion of the test.		
P3-0	Low Speed Evaporator Fans On Test	High speed evaporator fans will be turned on for 20 seconds, the fans will be turned off for 4 seconds, current draw is measured, and then the low speed evaporator fans are turned on. After 60 seconds the current draw is measured again. The change in current draw is then recorded. Test passes if change in current draw test is in the specified range.

Table 4–7 Controller Pre-Trip Test Codes (Continued)

P3-1	Low Speed Evaporator Fan Off Test	Low speed evaporator fans are then turned off. After 10 seconds the current draw is measured. The change in current draw is then recorded. Test passes if change in current draw test is in the specified range.
P4 Tests - High Speed Evaporator Fans Current Draw: High speed evaporator fans are turned on, then off. Current draw must fall within specified range and measured current changes must exceed specified ratios. No other system components will change state during this test. **NOTE** If unit configured for single evaporator fan operation and either AL11 or AL12 is active at the start of either test, the test will fail immediately. If AL11 or AL12 become active during the test, the test will fail upon conclusion of the test.		
P4-0	High Speed Evaporator Fan Motors On	Evaporator fans start in the off condition, current draw is measured, then high speed evaporator fans will be turned on. After 60 seconds the current draw is measured again. The change in current draw is then recorded. Test passes if change in current draw in the specified range AND measured cur rent changes exceed specified ratios. If the three phase motors are configured IN, the change ratio test is skipped.
P4-1	High Speed Evaporator Fan Motors Off	High speed evaporator fans are then turned off. After 10 seconds the current draw is measured. The change in current draw is then recorded. Test passes if change in current draw test is in the specified range.
P5 Tests - Air Stream Temperature Sensor Tests: Tests the validity of the Air Stream Temperature Sensors.		
P5-0	Supply / Return Probe Test	The High Speed Evaporator Fan is turned on and run for eight minutes, with all other outputs de-energized. A temperature comparison is made between the return and supply probes. Test passes if temperature comparison falls within the specified range. **NOTE** If this test fails, P50 and FAIL will be displayed. If both Probe tests (this test and the PRIMARY / SECONDARY) pass, the display will read P5 PASS.
P5-1	Supply Probe Test	This test if for units equipped with secondary supply probe only. The temperature difference between primary supply probe and secondary supply probe is compared. Test passes if temperature comparison falls within the specified range. **NOTE** If this test fails, P51 and FAIL will be displayed. If both Probe tests (this and the SUPPLY/ RETURN TEST) pass, because of the multiple tests, the display will read 'P 5' 'PASS'.
P5-2	Return Probe Test	For units equipped with secondary return probe only. The temperature difference between primary return probe and secondary return probe is compared. Test passes if temperature comparison falls within the specified range. **NOTES** 1. If this test fails, P52 and FAIL will be displayed. If both Probe tests (this test and the SUPPLY/ RETURN) pass, because of the multiple tests, the display will read P 5, PASS. 2. The results of PreTrip tests 50, 51 and 52 will be used to activate or clear control probe alarms.

Table 4–7 Controller Pre-Trip Test Codes (Continued)

P5-3	Evaporator Fan Direction Test	With evaporator fan running on high speed, measure the temperature difference between the primary supply and primary return probes. Turn the heaters on for 60 seconds then measure the temperature difference between the primary sup ply and primary return probes. After 60 seconds this test is forced to PASS irrespective of differential change in primary supply temperature and primary return temperature. Test P5-0 must pass before this test is run.
P5-4 - P5-9		Not Applicable
P5-10	Humidity Sensor Controller Configuration Verification Test	This is a Pass/Fail/Skip test of the humidity sensor configuration. Test passes if the controller configuration has humidity sensor in. Test fails if the controller configuration has humidity sensor out and Vout is greater than 0.20 Volts for the humidity sensor. Test is skipped if the controller configuration has the humidity sensor out and Vout is less than 0.20 Volts. Unit must be configured with a Humidity Sensor for this test is run.
P5-11	Humidity Sensor Installation Verification Test	This is a Pass/Fail test of humidity sensor installation (sensor is present). Test passes if Vout is greater than 0.20 Volts for the humidity sensor. Test fails if Vout is less than 0.20 Volts for the humidity sensor. Test P5-10 must pass before this test is run.
P5-12	Humidity Sensor Range Check Test	This is a Pass/Fail test of the Humidity Sensor Range. Test passes if Vout for the humidity sensor is between 0.33 Volts and 4 Volts. Test fails if Vout is outside of this range. Test P5-11 must pass before this test is run.
P6 Tests - Compressor and Refrigerant Valves: This section of testing deals with the Compressor and the two Compressor valves: Suction Modulation Valve and Quench Valve.		
P6-0	Compressor On	A current draw test is performed before the compressor is started. The compressor is started, the SMV is opened, and another current draw test is performed. Test Passes if the change in compressor current draw is within the specified range.
P6-1, P6-H, P6-L	Not Applicable	These tests are not run for Single Speed Compressors.
P6-2	Suction Modulation Valve (Open and Closed)	The compressor and fans continue to run from the previous test. The quench valve (if configured) will operate as in normal control mode. The SMV is closed to 0% open, current and condenser pressure readings are taken. The SMV is opened to 50% with continuous current and condenser pressure readings taken to establish maximum values. The SMV is returned to 0% open and final readings are taken. Test passes if the calculated difference in current at the 50% open position are above a specified value before and after opening of the SMV, OR the calculated difference in condenser pressure at the 50% open position are above a specified value before and after opening of the SMV.
P6-3	Quench Valve Test	To run this test, the system must be equipped with a solenoid quench valve as determined by CnF12, (TXV/Solenoid Quench Valve), and ambient temperature must be greater than -12°C. Compressor suction temperature is measured with the Quench valve closed, the Quench valve is energized and the suction temperature drop is checked. Test passes if suction temperature is within the valid range.
P6-4	Not Applicable	This test is not run for units configured with a stepper type SMV.
P6-5	Not Applicable	This test is not run, units with stepper type SMVs are not configured with a by pass valve.

Table 4–7 Controller Pre-Trip Test Codes (Continued)

P6-6	Not Applicable	This test is only run on systems that have an Unloader as indicated by CnF13 (Unloader).
NOTE P70 & P8 are included with the Auto2 & Auto 3 only. P90 through P10 are included with Auto2 only.		
P7 Tests - High Pressure Tests: Unit is run at full capacity without condenser fan running to make sure that the HPS opens and closes properly.		
P7-0	High Pressure Switch Closed	With the unit running, the condenser fan is de-energized, and a 15 minute timer is started. The right display shows discharge pressure if the unit is equipped with a discharge pressure transducer (DPT). If no DPT is installed, the condenser pressure transducer (CPT) reading will be displayed. Test is skipped if: Sensed ambient temperature is less than 7°C (45°F) Return air temperature is less than 17.8°C (0°F) The water pressure switch (WP) is open, indicating that the unit is operating with a water-cooled condenser Test is skipped if the unit does NOT have: A compressor discharge sensor (CPDS) A discharge pressure transducer (DPT) A condenser pressure transducer (CPT) Test passes if the HPS opens within 15 minutes. Test immediately fails if the following inputs are sensed to be invalid: Compressor discharge sensor (CPDS) Discharge pressure transducer (DPT) Condenser pressure transducer (CPT) Return temperature sensor (RTS) Ambient sensor (AMBS) Test will also fail if: HPS fails to open within 15 minutes Discharge temperature exceeds 138°C (280°F) Discharge temperature is less than or equal to ambient temperature plus 5°C (9°F) CPT or DPT pressure exceeds 27.42kg/cm^2 (390psig)
P7-1	High Pressure Switch Open	Test P70 must pass for P71 to execute. The condenser fan is started and a 60 second timer is started. Test passes if the high pressure switch (HPS) closes within the 60-second time limit, otherwise, it fails.
P8 Tests Perishable Mode Tests: Pretrip tests P70 and P71 must have passed or have been skipped for these tests to execute.		
P8-0	Perishable Mode Heat Test	If the container temperature is below 15.6°C (60°F), the set point is changed to 15.6°C, and a 60-minute timer is started. The left display will read P80. The control will then heat the container until 15.6°C is reached. If the container temperature is above 15.6°C at the start of the test, then the test proceeds immediately to test P81 and the left display will change to P81. The test fails if the 180-minute timer expires before the control temperature reaches set point. The display will read P80, FAIL.

Table 4–7 Controller Pre-Trip Test Codes (Continued)

P8-1	Perishable Mode Pull Down Test / eAutofresh CO_2 Sensor Calibration	Control temperature must be at least 15.6°C (60°F). The set point is changed to 0°C (32°F), and a 180-minute timer is started. The left display will read P81, the right display will show the supply air temperature. The unit will then start to pull down the temperature to the 0°C set point. The test passes if the container temperature reaches set point before the 180-minute timer expires. On units where the CO_2 Sensor Status indicates that a CO_2 sensor is present, calibration of the CO_2 sensor will be attempted during P8-1. Once P8-1 begins, calibration will be attempted when the supply temperature goes below 5°C. If the CO_2 sensor voltage reads within the 0.95 <>1.15Vdc range before the end of P8-1, the sensor will be calibrated by holding the CO_2 zero line low for 4 seconds. Once calibration is performed, the sensor voltage will be verified to make sure it is in the 0.95 to 1.05 Vdc range. If the voltage is not within this range, CO_2 sensor calibration fails.
P8-2	Perishable Mode Maintain Temperature Test	Test P81 must pass for P82 to execute. A fifteen minute timer is started, and the system will attempt to minimize control temperature error (supply temperature minus setpoint) until the timer expires. The control temperature will be sampled each minute starting at the beginning of P82. During P82, the left display will read P82, and the right display will show the supply air temperature. When the test is completed, the average control temperature error will be compared to the pass/fail criteria. Test passes if the average temperature error is within +/- 1.0°C. Test fails if the average temperature error is greater than +/- 1.0°C, or if the DataCorder supply temperature probe is invalid. If the test fails, the control probe temperature will be recorded as -50.0°C.
P9 Test - DTT Close and Open Test: The DTT in this control is not a physical device, with actual metallic con tacts, it is a software function that acts similar to a thermostat. Using various temperature inputs, the DTT function determines whether a thermostat mounted on the Evaporator Coil would have OPEN or CLOSED contacts. Primarily, the DTT function operates based on the temperature reading from the Defrost Termination Sensor		
P9-0	DTT Closed and Open Test	During P90 the defrost temperature sensor (DTS) reading will be displayed on the left display. The right display will show the supply air temperature. The unit will run FULL COOL for 30 minutes maximum until the DTT is considered closed. Once the DTT is considered closed, the unit simulates defrost by running the heaters for up to two hours, or until the DTT is considered open. Test fails if: The DTT is not considered closed after the 30 minutes of full cooling HTT opens when DTT is considered closed or if return air temperature rises above 248°C (120°F). Test passes if the DTT is considered open within the 2 hour heat cycle time limit.

Table 4–7 Controller Pre-Trip Test Codes (Continued)

P10 Tests - Frozen Mode Tests:		
P10-0	Frozen Mode Setup Test	After completion of the Defrost Test, if the container temperature is below 7.2°C, the setpoint is changed to 7.2°C, and a 180 minute timer is started. The control will then be placed in the equivalent of normal heating. If the container temperature is above 7.2°C at the start of the test, then the test proceeds immediately to test P101. During P10, the control temperature will be shown on the right display. Test fails if the 180 minute timer expires before the control temperature reaches setpoint - 0.3°C. If the test fails, it will not auto-repeat. There is no pass display for this test. Once the control temperature reaches set point, the test proceeds to test 10-1.
P10-1	Frozen Mode Pulldown Test	When the container temperature is greater than or equal to the 7.2°C (45°F) set point which was set in the frozen mode heat test, the left display will read P101 and the right display will show the return air temperature. The set point will then be changed to 17.7°C (0°F). The unit will then have a maximum of three hours to pull the container temperature down to the 17.7°C set point. If this occurs within the three hour time limit, the test passes. If pulldown is not completed within the three hour time, the test fails. Upon failure and when initiated by an automatic Pretrip sequence, P101 will auto-repeat by starting P100 over again.
P10-2	Frozen Mode Maintain Temperature Test	Test P101 must pass for P102 to execute. A fifteen minute timer is started, and the system will attempt to minimize control temperature error (return temperature minus setpoint) until the timer expires. The control temperature will be sampled each minute starting at the beginning of P102. During P101, the left display will read P102 and the right display will show return air temperature. When the test is completed, the average control temperature error will be com pared to the pass/fail criteria. Test passes if the average temperature error is within +/-1.6°C. Test fails if the average temperature error is greater than +/-1.6°C, or if the DataCORDER supply temperature probe is invalid. If the test fails, the control probe temperature will be recorded as -50.0°C. Upon failure and when initiated by an automatic Pretrip sequence, P102 will auto-repeat by starting P100 over again.

Table 4–8 DataCORDER Function Code Assignments

NOTE Inapplicable Functions Display "-----"		
To Access: Press ALT. MODE key then CODE SELECT key		
Code	**Title**	**Description**
dC1	Recorder Supply Temperature	Current reading of the supply recorder sensor.
dC2	Recorder Return Temperature	Current reading of the return recorder sensor.
dC3-5	USDA 1,2,3 Temperatures	Current readings of the three USDA probes.
dC6-13	Network Data Points 18	Current values of the network data points (as configured). Data point 1 (Code 6) is generally the humidity sensor and its value is obtained from the Controller once every minute.
dC14	Cargo Probe 4 Temperature	Current reading of the cargo probe #4.
dC15-19	Future Expansion	These codes are for future expansion, and are not in use at this time.
dC20-24	Temperature Sensors 15 Calibration	Current calibration offset values for each of the five probes: supply, return, USDA #1, #2, and #3. These values are entered via the interrogation program.
dC25	Future Expansion	This code is for future expansion, and is not in use at this time.
dC26,27	S/N, Left 4, Right 4	The DataCORDER serial number consists of eight characters. Function code dC26 contains the first four characters. Function code dC27 contains the last four characters. (This serial number is the same as the Controller serial number)
dC28	Minimum Days Left	An approximation of the number of logging days remaining until the Data CORDER starts to overwrite the existing data.
dC29	Days Stored	Number of days of data that are currently stored in the DataCORDER.
dC30	Date of last Trip start	The date when a Trip Start was initiated by the user. In addition, if the system goes without power for seven continuous days or longer, a trip start will automatically be generated on the next AC power up.
dC31	Battery Test	Shows the current status of the optional battery pack. **PASS**: Battery pack is fully charged. **FAIL**: Battery pack voltage is low.
dC32	Time: Hour, Minute	Current time on the real-time clock (RTC) in the DataCORDER.
dC33	Date: Month, Day	Current date (month and day) on the RTC in the DataCORDER.
dC34	Date: Year	Current year on the RTC in the DataCORDER.
dC35	Cargo Probe 4 Calibration	Current calibration value for the Cargo Probe. This value is an input via the interrogation program.

Table 4–9 DataCORDER Pre-Trip Result Records

Test	Title	Data
1-0	Heater On	Pass / Fail / Skip Result, Change in current for Phase A, B and C
1-1	Heater Off	Pass / Fail / Skip Result, Change in currents for Phase A, B and C
2-0	Condenser Fan On	Pass / Fail / Skip Result, Water pressure switch (WPS) - Open/ Closed, Change in currents for Phase A, B and C
2-1	Condenser Fan Off	Pass / Fail / Skip Result, Change in currents for Phase A, B and C
3-0	Low Speed Evaporator Fan On	Pass / Fail / Skip Result, Change in currents for Phase A, B and C
3-1	Low Speed Evaporator Fan Off	Pass / Fail / Skip Result, Change in currents for Phase A, B and C
4-0	High Speed Evaporator Fan On	Pass / Fail / Skip Result, Change in currents for Phase A, B and C
4-1	High Speed Evaporator Fan Off	Pass / Fail / Skip Result, Change in currents for Phase A, B and C
5-0	Supply/Return Probe Test	Pass / Fail / Skip Result, STS, RTS, SRS and RRS
5-1	Secondary Supply Probe Test	Pass / Fail / Skip Result
5-2	Secondary Return Probe Test	Pass / Fail / Skip Result
6-0	Compressor On	Pass / Fail / Skip Result, Change in currents for Phase A, B and C
6-1	Not Applicable	Not Used
6-2	Suction Modulation Valve Open and Closed	Pass / Fail / Skip Result, Is current or pressure limit in effect (Y,N)
6-4	Not Applicable	Not Used
6-5	Not Applicable	Not Used
7-0	High Pressure Switch Closed	Pass / Fail / Skip Result, AMBS, DPT or CPT (if equipped) Input values that component opens
7-1	High Pressure Switch Open	Pass / Fail / Skip Result, STS, DPT or CPT (if equipped) Input values that component closes
8-0	Perishable Heat	Pass / Fail / Skip Result, STS, time it takes to heat to 16°C (60°F)
8-1	Perishable Pull Down	Pass / Fail / Skip Result, STS, time it takes to pull down to 0°C (32°F)
8-2	Perishable Maintain	Pass / Fail / Skip Result, Averaged DataCORDER supply temperature (SRS) over last recording interval.
9-0	Defrost Test	Pass / Fail / Skip Result, DTS reading at end of test, line voltage, line frequency, time in defrost.
10-0	Frozen Mode Setup	Pass / Fail / Skip Result, STS, time unit is in heat.
10-1	Frozen Mode Pull Down	Pass / Fail / Skip Result, STS, time to pull down unit to 17.8°C (0°F).
10-2	Frozen Mode Maintain	Pass / Fail / Skip Result, Averaged DataCORDER return temperature (RRS) over last recording interval.

Table 4–10 DataCORDER Alarm Indications

To Access: Press ALT. MODE key then ALARM LIST key		
Code	**Title**	**Description**
dAL70	Recorder Supply Temperature Out of Range	The supply recorder sensor reading is outside of the range of 50 to 70°C (58°F to +158°F) or, the probe check logic has determined there is a fault with this sensor. **NOTE** The P5 PreTrip test must be run to inactivate the alarm.
dAL71	Recorder Return Temperature Out of Range	The return recorder sensor reading is outside of the range of 50 to 70°C (58°F to +158°F) or, the probe check logic has determined there is a fault with this sensor. **NOTE** The P5 PreTrip test must be run to inactivate the alarm.
dAL7274	USDA Temperatures 1, 2, 3 Out of Range	The USDA probe temperature reading is sensed outside of 50 to 70°C (58 to 158°F) range.
dAL75	Cargo Probe 4 Out of Range	The cargo probe temperature reading is outside of 50 to 70°C (58 to 158°F) range.
dAL76, 77	Future Expansion	These alarms are for future expansion, and are not in use at this time.
dAL7885	Network Data Point 1 - 8 Out of Range	The network data point is outside of its specified range. The DataCORDER is configured by default to record the supply and return recorder sensors. The DataCORDER may be configured to record up to 8 additional network data points. An alarm number (AL78 to AL85) is assigned to each configured point. When an alarm occurs, the DataCORDER must be interrogated to identify the data point assigned. When a humidity sensor is installed, it is usually assigned to AL78.
dAL86	RTC Battery Low	The real time clock (RTC) backup battery is too low to adequately maintain the RTC reading. A real time clock failure is critical to the operation of the unit. If this alarm occurs, replace the RTC battery at the next available opportunity. After replacing the battery the following actions are required: Update the RTC setting Update the unit's software configuration Update the operational software Update all user selectable function code settings (defrost, setpoint, etc)
dAL87	RTC Failure	An invalid time has been detected. Either the DataCORDER run time hour and minute have not changed at the start of the hour, or the real time clock (RTC) time has gained or lost more than 2 minutes in the hour. This situation may be corrected by cycling the power, setting the clock or meeting the above criteria for an hour.
dAL88	DataCORDER EEPROM Failure	A write of critical DataCORDER information to the EEPROM has failed.
dAL89	Flash Memory Error	An error has been detected in the process of writing daily data to the nonvolatile FLASH memory.
dAL90	Future Expansion	This alarm is for future expansion, and is not in use at this time.
dAL91	Alarm List Full	The DataCORDER alarm queue is determined to be full (eight alarms).

SECTION 5
OPERATION

5.1 Inspection (Before Loading)

⚠ WARNING

Beware of unannounced starting of the evaporator and condenser fans. The unit may cycle the fans and compressor unexpectedly as control requirements dictate.

1. If container is empty, check inside for the following:
   a. Check channels or “T” bar floor for cleanliness. Channels must be free of debris for proper air circulation.
   b. Check container panels, insulation, and door seals for damage. Make permanent or temporary repairs.
   c. Visually check evaporator fan motor mounting bolts for proper securement (refer to **Section 7.16**).
   d. Check for visible corrosion on the evaporator stator and fan deck (refer to **Section 7.16**).
   e. Check for dirt or grease on evaporator fan or fan deck and clean if necessary.
   f. Check evaporator coil for cleanliness or obstructions. Wash with fresh water (Refer to **Section 7.13**).
   g. Check defrost drain pans and drain lines for obstructions and clear if necessary. Wash with fresh water.
   h. Check panels on refrigeration unit for loose bolts and condition of panels. Make sure T.I.R. devices are in place on access panels.
2. Check condenser coil for cleanliness. Wash with fresh water (Refer to **Section 7.10**).
3. Open control box door. Check for loose electrical connections or hardware.
4. Check color of moisture-liquid indicator.
5. Check oil level in compressor sight glass (if applicable).

5.2 Connect Power

⚠ WARNING

Do not attempt to remove power plug(s) before turning OFF start-stop switch (ST), unit circuit breaker(s) and external power source.

⚠ WARNING

Make sure the power plugs are clean and dry before connecting to power receptacle.

5.2.1 Connection To 380/460 VAC Power

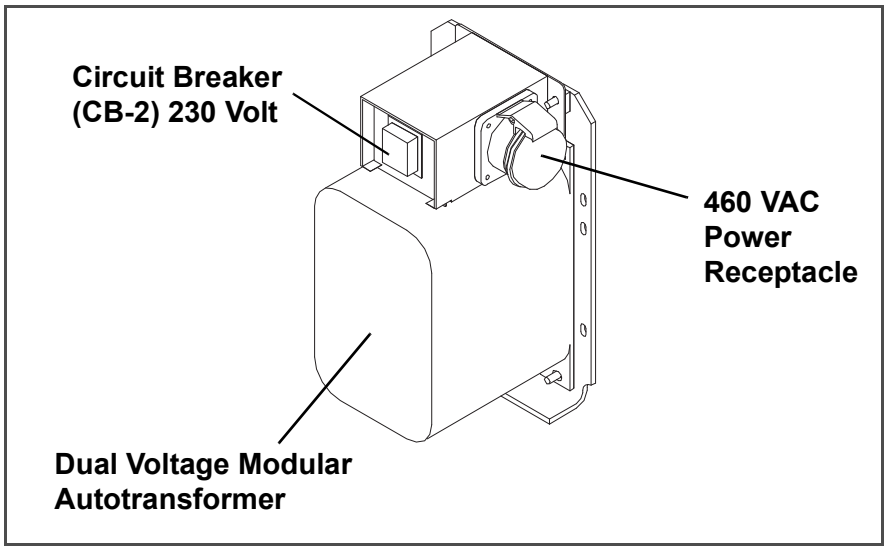
1. Make sure start-stop switch (ST on control panel) and circuit breaker (CB-1 in the control box) are in position “O” (OFF).
2. Plug the 460VAC (yellow) cable into a de-energized 380/460VAC, 3-phase power source. Energize the power source. Place circuit breaker (CB-1) in position “I” (ON). Close and secure control box door.

5.2.2 Connection to 190/230VAC Power (option)

An autotransformer (**Figure 5.1**) is required to allow operation on nominal 230 volt power. It is fitted with a 230VAC cable and a receptacle to accept the standard 460VAC power plug. The 230 volt cable is black in color while the 460 volt cable is yellow. The transformer may also be equipped with a circuit breaker (CB-2). The transformer is a step-up transformer that will provide 380/460VAC, 3-phase, 50/60 hertz power to the unit when the 230VAC power cable is connected to a 190/230VAC, 3-phase power source.

1. Make sure that the start-stop switch (ST, on control panel) and circuit breakers CB-1 (in the control box and CB-2 (on the transformer) are in position “O” (OFF). Plug in and lock the 460VAC power plug at the receptacle on the transformer.
2. Plug the 230VAC (black) cable into a de-energized 190/230VAC, 3-phase power source. Energize the power source. Set circuit breakers CB-1 and CB2 to position “I” (ON). Close and secure control box door.

Figure 5.1 Autotransformer



5.3 Adjust Fresh Air Makeup Vent

The purpose of the fresh air makeup vent is to provide ventilation for commodities that require fresh air circulation. The vent must be closed when transporting frozen foods.

Air exchange depends on static pressure differential, which will vary depending on the container and how the container is loaded.

Units may be equipped with a vent position sensor (VPS). The VPS determines the position of the fresh air vent (upper or lower, as equipped) and sends data to the controller display.

5.3.1 Upper Fresh Air Makeup Vent

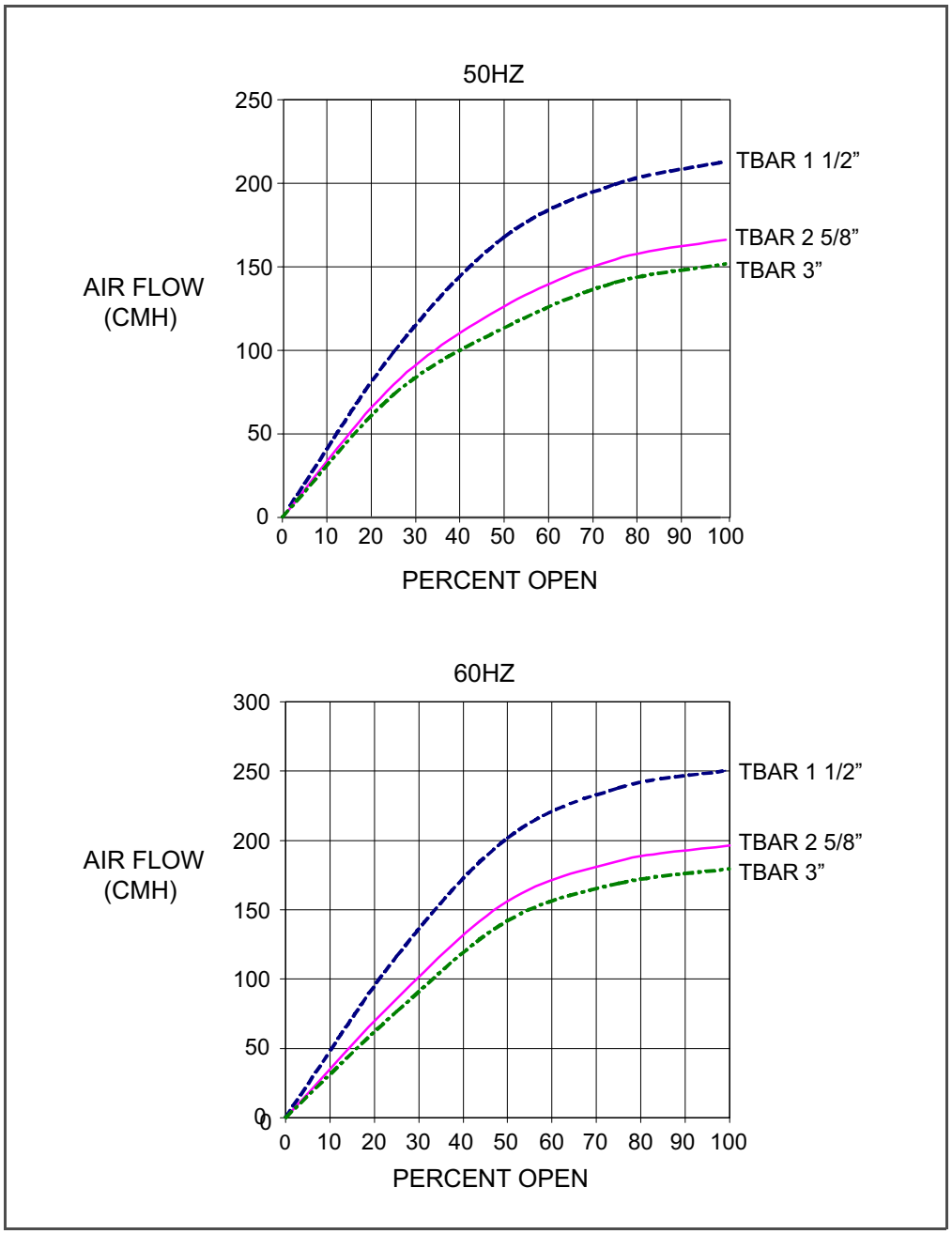
Two slots and a stop are designed into the Upper Fresh Air disc for air flow adjustments. The first slot allows for a 0 to 30% air flow; the second slot allows for a 30 to 100% air flow.

To adjust the percentage of air flow, loosen the wing nut and rotate the disc until the desired percentage of air flow matches with the arrow. Tighten the wing nut.

To clear the gap between the slots, loosen the wing nut until the disc clears the stop.

Figure 5.2 gives air exchange values for an empty container. Higher values can be expected for a fully loaded container.

Figure 5.2 Make Up Air Flow Chart



5.3.2 Vent Position Sensor

The VPS allows the user to determine position of the fresh air vent via Cd45. This function code is accessible via the code select key.

The vent position will display for 30 seconds whenever motion corresponding to 5CMH (3CFM) or greater is detected. It will scroll in intervals of 5CMH (3CFM). Scrolling to Cd45 will display the Fresh Air Vent Position.

The position of the vent will be recorded in the DataCORDER whenever the unit is running under AC power and any of the following:

- Trip start
- On every power cycle
- Midnight
- Manual change greater than 5 CMH (3 CFM) and remains in that position for at least four minutes

NOTE

The user has four minutes to make necessary adjustments to the vent setting. This time calculation begins on the initial movement of the sensor. The vent can be moved to any position within the four minutes. On completion of the first four minutes, the vent is required to remain stable for the next four minutes. If vent position changes are detected during the four minute stability period, an alarm will be generated. This provides the user with the ability to change the vent setting without generating multiple events in the DataCORDER.

5.4 eAutoFresh Operation

The optional eAutoFresh™ venting system is controlled through two function codes, Code 43 and Code 44. Code 43 contains specific parameters for operation and Code 44 provides a visible display of component conditions.

Procedures and technical information related to the eAutoFresh™ venting system can be found in the **T-342 eAutoFresh Manual**, located in the Literature section of the Container Refrigeration website. To find the manual from the Literature section, click on Options > eAutoFresh.

5.5 XtendFRESH Operation

The optional XtendFRESH™ controlled atmosphere system is controlled through two function codes, Code 43 and Code 44. Code 43 contains specific parameters for operation and Code 44 provides a visible display of component conditions.

Procedures and technical information related to the XtendFRESH™ controlled atmosphere system can be found in the **T-366 XtendFRESH Manual**, located in the Literature section of the Container Refrigeration website. To find the manual from the Literature section, click on Options > XtendFRESH.

5.6 Connect Remote Monitoring Receptacle

If remote monitoring is required, connect remote monitor plug at the unit receptacle, see **Figure 3.5**.

When the remote monitor plug is connected to the remote monitoring receptacle, the following remote circuits are energized:

Circuit	Function
Sockets B to A	Energizes remote cool light
Sockets C to A	Energizes remote defrost light
Sockets D to A	Energizes remote in-range light

5.7 Starting and Stopping Instructions

⚠ WARNING

Make sure that the unit circuit breaker(s) (CB-1 & CB-2) and the START-STOP switch (ST) are in the “O” (OFF) position before connecting to any electrical power source.

5.7.1 Starting the Unit

1. With power properly applied, the fresh air vent in proper position, place the START-STOP switch to “I” (ON), see **Figure 3.5**.
2. The Controller Function Codes for the container ID (Cd40), software version (Cd18) and unit model number (Cd20) will be displayed in sequence.
3. Continue with Start Up Inspection (refer to **Section 5.8**).

5.7.2 Stopping the Unit

To stop the unit, place the START-STOP switch in position “O” (OFF).

5.8 Start-Up Inspection

5.8.1 Physical Inspection

1. Check rotation of condenser and evaporator fans.
2. Check compressor oil level (refer to **Section 7.8.6**).

5.8.2 Check Controller Function Codes

Check and, if required, reset controller Function Codes (Cd27 through Cd39) in accordance with desired operating parameters (refer to **Section 4.2.2**).

5.8.3 Start Temperature Recorder

DataCORDER

1. Check and, if required, set the DataCORDER Configuration in accordance with desired recording parameter. Refer to **Section 4.8.2**.
2. Enter a “Trip Start.” To enter a “Trip Start,” do the following:
   a. Depress the ALT MODE key. When the left display shows, dC, depress the ENTER key.
   b. Scroll to Code dC30.
   c. Depress and hold the ENTER key for five seconds.
   d. The “Trip Start” event will be entered in the DataCORDER.

5.8.4 Complete Inspection

Allow unit to run for five minutes to stabilize conditions and perform a pre-trip diagnosis in accordance with **Section 5.9**.

5.9 Pre-Trip Diagnostics

⚠ CAUTION

Pre-trip inspection should not be performed with critical temperature cargoes in the container.

⚠ CAUTION

When Pre-Trip key is pressed, economy, dehumidification and bulb mode will be deactivated. At the completion of Pre-Trip activity, economy, dehumidification and bulb mode must be reactivated.

Pre-Trip diagnostics provides automatic testing of the unit components using internal measurements and comparison logic. The program will provide a “PASS” or “FAIL” display to indicate test results.

The testing begins with access to a Pre-trip selection menu. The user may have the option of selecting one of three automatic tests.

These tests will automatically perform a series of individual Pre-trip tests. The user may also scroll down to select any of the individual tests.

When only the short sequence is configured, it will appear as “AUtO” in the display. Otherwise “AUtO1” will indicate the short sequence and “AUtO2” will indicate the long sequence. The test short sequence will run tests P0 through P6. The long test sequence will run tests P0 through P10.

A detailed description of the Pre-trip test codes is listed in **Table 4–7**. If no selection is made, the Pre-trip menu selection process will terminate automatically. However, dehumidification and bulb mode must be reactivated manually if required.

Scrolling down to the “rSLts” code and pressing ENTER will allow the user to scroll through the results of the last pre-trip testing run. If no pre-testing has been run (or an individual test has not been run) since the unit was powered up, “----” will be displayed.

To start a Pre-trip test, do the following:

NOTES

Prior to starting a Pre-trip test, verify that unit voltage (Cd07) is within tolerance and unit amperage draw (Cd04, Cd05, Cd06) are within expected limits. Otherwise, tests may fail incorrectly.

All alarms must be rectified and cleared before starting tests.

Pre-trip may also be initiated via communications. The operation is the same as for the keypad initiation described below except that should a test fail, the Pre-trip mode will automatically terminate. When initiated via communications, a Pre-trip test may not be interrupted with an arrow key, but the Pre-trip test can be terminated with the PRE-TRIP key.

1. Press the PRE-TRIP key to accesses the Pre-trip test selection menu.
2. TO RUN AN AUTOMATIC TEST: Scroll through the selections by pressing the UP ARROW or DOWN ARROW keys to display AUTO, AUTO 2 or AUTO 3 as desired and then press the ENTER key.

   The unit will execute the series of tests without any need for direct user interface. These tests vary in length, depending on the component under test.

   While tests are running, “P#-#” will appear on the left display, where the #’s indicate the test number and sub-test. The right display will show a countdown time in minutes and seconds, indicating the amount of time remaining in the test.

⚠ CAUTION

When a failure occurs during automatic testing the unit will suspend operation awaiting operator intervention.

When an automatic test fails, it will be repeated once. A repeated test failure will cause “FAIL” to be shown on the right display, with the corresponding test number to the left.

The user may then press the DOWN ARROW to repeat the test, the UP ARROW to skip to the next test or the PRE-TRIP key to terminate testing. The unit will wait indefinitely until the user manually enters a command.

⚠ CAUTION

When Pre-Trip test Auto 2 runs to completion without being interrupted, the unit will terminate pre-trip and display “Auto 2” “end.” The unit will suspend operation until the user depresses the ENTER key!

When an Auto test runs to completion without a failure, the unit will exit the Pre-trip mode and return to normal control operation.

If configuration variable CnF42 is set to IN, a DataCORDER trip start will be entered. If CnF42 is set to OUT, the trip start will not be entered. However, dehumidification and bulb mode must be reactivated manually if required.

3. TO RUN AN INDIVIDUAL TEST: Scroll through the selections by pressing the UP ARROW or DOWN ARROW keys to display an individual test code. Pressing ENTER when the desired test code is displayed.

   Individually selected tests, other than the LED/ Display test, will perform the operations necessary to verify the operation of the component. At the conclusion, PASS or FAIL will be displayed.

   This message will remain displayed for up to three minutes, during which time a user may select another test. If the three minute time period expires, the unit will terminate pre-trip and return to control mode operation.

   While the tests are being executed, the user may terminate the pre-trip diagnostics by pressing and holding the PRE-TRIP key.

   The unit will then resume normal operation. If the user decides to terminate a test but remain at the test selection menu, the user may press the UP ARROW key. When this is done all test outputs will be de-energized and the test selection menu will be displayed.

   During Pre-trip testing, current limiting and pressure limiting are both active, except during P-7 (High Pressure Switch Testing) when pressure limiting is turned off.

4. At the end of the pre-trip test selection menu, the message “P,” “rSLts” (pre-trip results) will be displayed. Pressing the ENTER key will allow the user to see the results for all subtests (i.e., 1-0, 1-1, etc).

   The results will be displayed as “PASS” or “FAIL” for all the tests run to completion since power up. If a test has not been run since power up, “−−−−−” will be displayed.

   Once all pre-test activity is completed, dehumidification and bulb mode must be reactivated manually if required.

5.10 Probe Diagnostics

A complete temperature probe check is performed during the P5 Pre-trip test. A probe check is also run at the end of a defrost cycle; the defrost light will remain on during this period. If supply probes are within limits and return probes are within limits, the unit will return to normal operation. During normal operation, the controller continuously monitors and compares adjacent temperature probe readings.

The probe check procedure consists of running the evaporator fans for up to eight minutes in order to compare the readings from the adjacent temperature probes. If a significant difference in temperature readings is detected between probes, a defrost cycle, followed by another probe check may be initiated. Any continued disagreement between probes will prompt the controller to invalidate the failed temperature probe, and the backup probe will be used for temperature control.

In Perishable Mode, both pairs of supply and return probes are monitored for probe disagreement. Probe disagreement is considered a difference of 0.5°C (0.9°F) or greater between the supply air sensors and/ or a difference of 2.0°C (3.6°F) between the return air sensors. Probe disagreement found in either pair can trigger a defrost probe check.

In Frozen Mode, only the controlling probes are considered. Disagreement of the controlling probes can trigger a defrost probe check, which will occur when the difference between the sensors is greater than 2.0°C (3.6°F). Normally, the controlling probes are the return probes but if both return probes are invalidated, the supply probes are used for control purposes. Probe disagreement of the non-controlling probe pair will not trigger a defrost probe check.

If, after the defrost probe check, the supply probes agree and return probes agree, all supply and return sensors are considered valid and the unit returns to normal control.

In the Case of Probe Disagreement:

If the supply probes disagree and the return probes agree, the controller will invalidate the worst supply probe. If the probe check is run as part of Pre-trip P-5, an alarm will be triggered for the invalidated probe. If it is a run time defrost probe check, the invalidated probe will be passed over and no alarm will be triggered. However, if the best supply probe is greater than 1.2°C (2.2°F) difference with respect to its return probes, the best supply probe is also invalidated. If unit is in Perishable Mode, a probe alarm will be triggered for both supply probes.

If the supply probes agree and the return probes disagree, invalidate the worst return probe. If the probe check is being run as part of Pre-trip P-5, an alarm will be triggered for the invalidated probe. If it is a run time defrost probe check, the invalidated probe will be passed over and no alarm will be necessary. If the best return probe is greater than 1.2°C (2.2°F) difference with respect to its supply probes, then the best return probe is also invalidated. If the unit is in perishable mode, a probe alarm will be triggered for both return probes.

5.11 Emergency Bypass Operation (option)

Operation by the refrigeration controller may be overridden by use of the EMERGENCY BYPASS switch. The EMERGENCY BYPASS switch functions to bypass the controller in the event of controller failure.

To place the unit in the emergency bypass mode, cut the wire tie installed at the switch mounting and place the EMERGENCY BYPASS switch in the BYPASS position. This will in turn activate the Emergency Bypass System (EBS) control module.

To operate the fans only, the MODE switch must be in the FANS ONLY position and the EMERGENCY BYPASS Switch must be in the ON position.

The EBS module uses the system safety devices (high pressure switch, motor internal protectors, and heat termination thermostat) to protect the system while in Emergency Bypass Mode.

⚠ CAUTION

The unit will remain in the full cooling mode as long as the emergency bypass switch is in the BYPASS position and the MODE SWITCH is in the FULL COOL position.

If the cargo is at risk of being damaged by low temperatures, the operator must monitor container temperature and manually cycle operation as required to maintain temperature within required limits.

In the ON position the EBS will be enabled. With the MODE SWITCH in the FULL COOL MODE. The following will occur simultaneously:

1. The EBS switch will enable EBS input.
2. The phase detection circuit will detect the phase rotation and close to provide power to the compressor contactor.
3. The condenser fan contact will close to energize the condenser contactor and provide power to the condenser fan motor.
4. The evaporator fan contact will close to energize the high speed evaporator contactor and provide power to the evaporator fan motor.
5. The EBS electronic module will open the SMV to 100%.

To return the unit to normal operation, place the EBS switch in the NORMAL OPERATION position. When emergency operation is no longer required, re-install the wire tie at the switch mounting.

5.12 TripWise (Option)

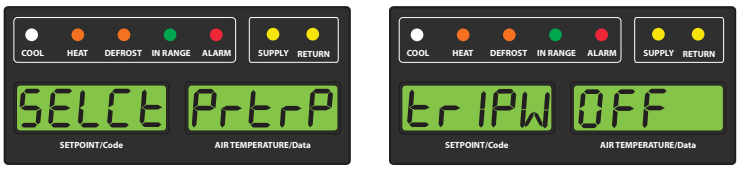
TripWise™ is a new premium option available for PrimeLINE and PrimeLINE with Edge units. TripWise is software logic that runs during every voyage as often as possible to indicate whether a standard Pre-trip Inspection (PTI) is needed and skip unless necessary. The tests run in the background and are similar to those completed as part of the standard PTI selection, which includes the following:

- Alarm Presence
- Evaporator Motor Current
- Heater Current
- Condenser Motor Current
- Compressor Current
- Humidity Sensor
- Supply / Return Sensors
- Evaporator Temperature and Pressure Sensors
- Defrost Temperature Sensor
- Electronic Expansion Valve
- RMU Presence
- Compressor Test
- Digital Loader / Unloader Valves
- Economizer Valve
- Temperature Control
- Suction / Discharge Temperature and Pressure

5.12.1 Checking TripWise Status

To check the status of the container, press the PRE-TRIP key on the keypad. The message “SELCt | PrtrP” will appear on the display module, alternating with one of the following TripWise status messages:

- trIPW | OFF. The TripWise option is turned off.
- trIPW | EX (Expired). It is recommended to pre-trip the unit prior to the unit's next trip following customer-specific guidelines.
- trIPW | PASS. The container should be ready for use after the operator has conducted a visual inspection. Standard PTI is not required.
- trIPW | CHECK. If any TripWise test(s) execute and do not meet the pass / fail requirements, It is recommended to pre-trip the unit following customer-specific guidelines prior to the unit's next trip.



Pressing the ENTER key while “SELCt | PrtrP” is displayed will enter into the Pre-trip test menu. Pressing the Arrow keys will navigate through the standard PTI test selections menu.

5.12.2 Enabling or Disabling TripWise Option

1. Press the CODE SELECT key on the keypad.

2. Use the Arrow keys to bring up code Cd65 in the display.
3. Press the ENTER key. The display will show either “-----”, “OFF” or “ON”.

NOTE

If “-----” is displayed, the TripWise function option is not active on the unit. To add this option to the unit, the equipment owner would need to contact their Regional Carrier Sales Manager.

4. Use the Arrow keys to toggle between “ON” and “OFF” and then press the ENTER key to select the desired option.
5. If “ON” is selected, the display will show “dAYS”. This is the expiration time (2 through 365 in 1 day increments). Use the Arrow keys to change the parameter and then press the ENTER key to confirm.

NOTE

The expiration interval is the total maximum days allowed between the running of each test. For example, if days are set to 30 and the low speed evaporator fan test has not run within those 30 days, the TripWise expired message will be displayed. If the TripWise expired message is displayed, it is recommended to Pre-trip the unit following customer specific guidelines prior to the next trip.

5.12.3 TripWise Status Event

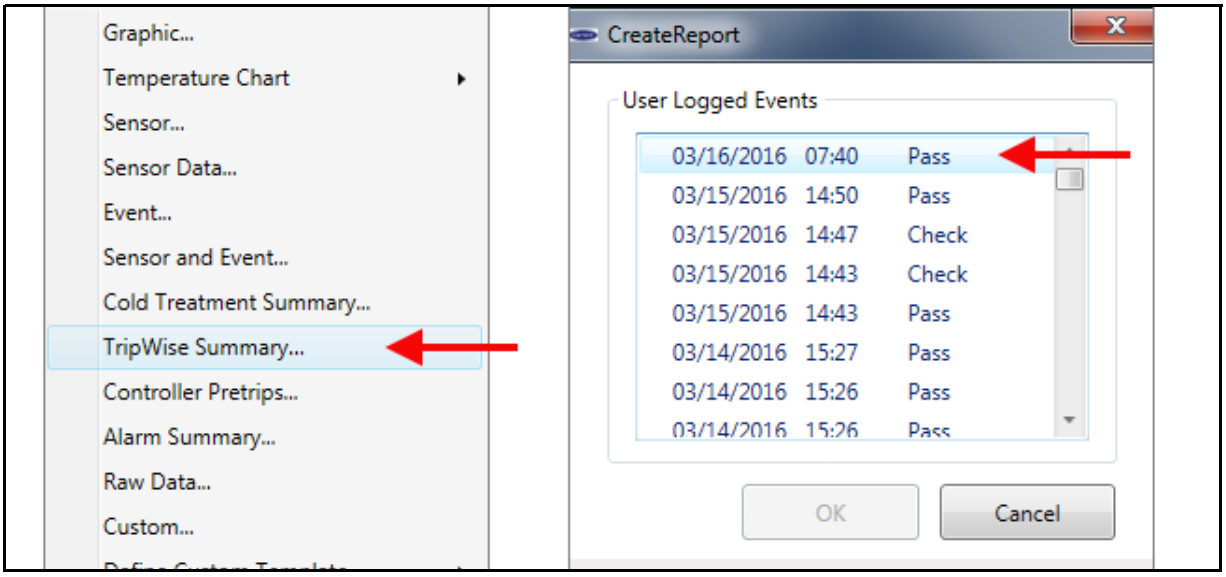
A TripWise status event will be recorded in the DataCorder recorder when the PTI is selected. In the current DataLINE software release, the event will show the status of the unit.

Figure 5.3 TripWise Status in DataCorder

```
Time  Event Data
12:48 Operating Mode Changed to Cool Max
12:54 Operating Mode Changed to Low Speed Evaps Only
13:49 Operating Mode Changed to Cool Max
13:50 TripWise Status Logged by User
      Status: Check
13:55 Operating Mode Changed to Low Speed Evaps Only
```

In DataLINE version 3.2, perform an all data download by selecting from the drop down menu “TripWise Summary” and then select a date in “User Logged Events” as shown in the Figure below.

Figure 5.4 Generating TripWise Summary Report



This will generate the status / results in a DataLINE TripWise Summary Report as shown in the Figure below.

Figure 5.5 TripWise Summary Report

TripWise Summary Report For TEST4934332

System Configuration at the Time of Interrogation:

Interrogated On Apr 13, 2016
Extracted By DataLine Rev 3.0.2

Controller Software :9533
Controller Serial #:04970257

Bill of Lading #:

Origin: Origin Date:

Destination: Discharge Date:

Comment:

Probe Calibration Readings:USDA1 0.0 USDA2 0.0 USDA3 0.0 Cargo 0.0

Temperature Units:Centigrade

TripWise Status Reviewed by User on: Mar 16,2016 07:40
TripWise Status:Pass — **Status**
Expiration Interval: 30 days

Results

Test Summary:

PTIRef.	TripWise Test	Test Performed	Results	Details
P0	Remote Monitoring Unit	Mar 15,2016 15:54	Pass	Present
P1	Heaters	Mar 15,2016 15:40	Pass	5.7A
P2	Low Speed Cond Fan	Mar 15,2016 15:40	Pass	0.4A
	High Speed Cond Fan	Mar 15,2016 23:50	Pass	0.8A
P3	Low Speed Evap Fans	Mar 16,2016 02:59	Pass	0.8A
P4	High Speed Evap Fans	Mar 15,2016 15:52	Pass	1.8A
P5	Sup/Rtn/Defrost Temp	Mar 16,2016 02:59	Pass	STS: -6.0C
				SRS: -5.9C
				RTS: -7.6C
				RRS: -7.6C
				DTS: -6.8C
	Supply Temp Probes	Mar 15,2016 08:24	Pass	STS: -25.0C
				SRS: -25.0C
	Return Temp Probes	Mar 15,2016 08:24	Pass	RTS: -21.0C
				RRS: -21.0C
	Evap Temp Sensors	Mar 15,2016 15:52	Pass	Pri: -14.8C
				Sec: -14.7C
	Evap/Suct Press Sensors	Mar 15,2016 15:52	Pass	SPT: 9.5psig
				EPT: 9.8psig
	Humidity Sensor	Mar 15,2016 15:52	Pass	Present
P6	Discharge Thermistor	Mar 15,2016 15:52	Pass	
	Suction Thermistor	Mar 15,2016 15:52	Pass	
	Discharge Press Sensor	Mar 15,2016 15:52	Pass	
	Suction Press Sensor	Mar 15,2016 15:52	Pass	
	Compressor Current	Mar 15,2016 23:55	Pass	4.8A
	Compressor Leak	Mar 16,2016 02:42	Pass	0.5Δpsi
	Economizer Valve	Mar 14,2016 09:29	Pass	9.6Δ
	Unloader/Loader Valves	Mar 16,2016 02:43	Pass	Ld: -10.2Δpsi
				ULd: 12.7Δpsi
	Evap Expansion Valve	Mar 16,2016 02:46	Pass	11.5ΔRatio
P8/P10	Temperature In-Range	Mar 15,2016 15:57	Pass	
TW	Alarm Activity Test	Mar 15,2016 15:02	Pass	

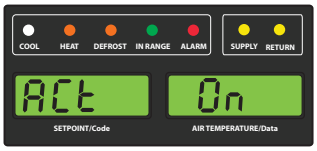
5.13 Automatic Cold Treatment (Option)

Cold Treatment has been employed as an effective post-harvest method for the control of Mediterranean and certain other tropical fruit flies. Exposing infested fruit to temperatures of 2.2°C (3.6°F) or below for specific time periods results in the mortality of various life stages for this group of insects.

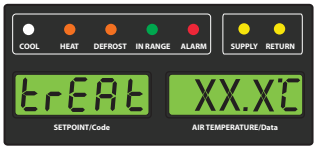
Automated Cold Treatment (ACT) in the Carrier Transicold unit is a method to simplify the task of completing cold treatment by automating the process of changing the setpoints. ACT is set up through Code Selection Cd51. Refer to Function Code table in this manual for Cd51 menu processing and displays.

Procedure to Set ACT:

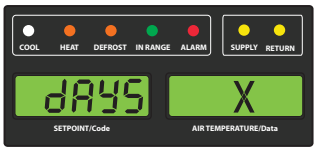
1. Enter the required cargo setpoint. It must be lower than the treatment temperature that will be discussed in step 4.
2. Press CODE SELECT, use the arrow keys to scroll to Cd51, and press ENTER.
3. "ACt" is now displayed in the left display and the right will display "Off". Use the arrow key to scroll to "On" in the right display and press ENTER.



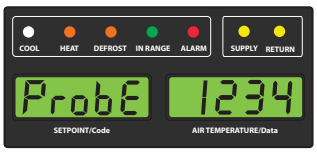
4. “trEAt" is now displayed in the left display and the right will be flashing the last setting (shown as XX.X°C). "trEAt" is the maximum value that the USDA probes need to remain below, to pass the Cold Treatment protocol. For instance, if the treat value is set at 35.0°F (1.7°C) then the USDA probe temperatures must remain below 35.0°F (1.7°C) to pass.



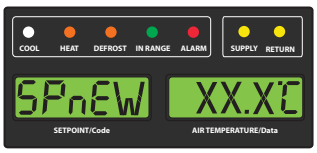
5. "dAyS" is now displayed in the left display and the right will be flashing. Use the arrow key to select the desired days for cold treatment and press ENTER.



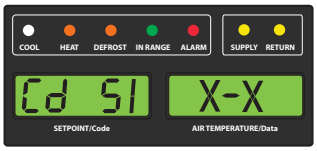
6. "ProbE" is now displayed in the left display and the right will display the probe numbers that are connected. Press ENTER. For instance, if "1234" is displayed, then all four of the probes are connected.



7. "SPnEW" is now displayed in the left display and the right will be flashing. Use the arrow key to select the desired setpoint after the cold treatment process has successfully completed and press ENTER. This would be the final temperature prior to the delivery of the cargo.



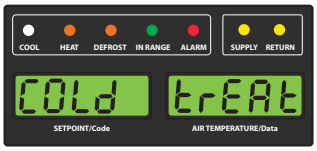
8. Cd51 is now displayed in the left display and the right will display days / hours.



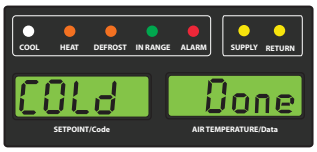
Once the cold treatment process has been initiated, setpoint change via the keypad is disabled.

The unit will start to countdown once all detected USDA probes have reached the cold treatment temperature in step 4 above. The cold treatment process will continue until the number of days specified in step 5 is reached. During operation, Cd51 will show the number of days and hours remaining in the cold treatment.

While the unit is operating in ACT mode, the left hand display will alternate between "COLd" and setpoint. The right hand display will alternate between "trEAt" and the cargo temperature. Once the treatment time has been completed, the setpoint temperature will increase to the "SPnEW" setting chosen in step 7.



When the cold treatment process is complete, the "SPnEW" setpoint will be displayed in the left hand display and cargo temperature in the right hand display, alternating with "COLd" "Done". "COLd" "Done" will continue to alternate with the setpoint and cargo temperature until ACT is turned off.



ACT can be manually turned off by selecting Cd51, scrolling to "Off" and pressing ENTER.

ACT will be automatically turned off with a TripStart, or if a Pretrip is initiated. Automatic Setpoint Change (ASC/Cd53) and ACT (Cd51) will not work simultaneously. Setting one will deactivate the other.

Procedure to Turn ACT OFF:

ACT will be automatically turned off with a TripStart, or if a Pretrip is initiated.

1. To manually turn ACT Off, press the CODE SELECT key.
2. Use the Arrow keys to scroll to Cd51, and then press the ENTER key.
3. Use the Arrow keys to bring up "Off" in the right display and press the ENTER key

5.14 Automatic Setpoint Change (ASC) Cd53

Automatic Setpoint Change (ASC) allows up to 6 setpoint changes to be pre-programmed over defined periods of time using Cd53.

1. Press the CODE SELECT key.
2. Use the Arrow keys to scroll to Cd53, then press the ENTER key.
3. Use the Arrow keys to scroll to ON, then press the ENTER key. If ASC is already ON, selecting OFF will terminate ASC.
4. Select the desired number of setpoint changes (nSC) by scrolling through the available “flashing” options (1 – 6) in the right display, then press the ENTER key.
5. Select the initial setpoint: With (SP 0) in the left display, select by scrolling to the desired “flashing” setpoint in the right display and press ENTER.
6. Select the days desired for initial setpoint (SP 0): With (DAY 0) in the left display, select by scrolling to the desired “flashing” days (1 to 99) in the right display and press ENTER.
7. Select the next setpoint (SP 1): With (SP 1) in the left display, select by scrolling to the desired “flashing” setpoint in the right display and press ENTER.
8. Continue to select each additional setpoint.
9. Select a final setpoint (SP x): With (SP x) in the left display, select by scrolling to the desired “flashing” setpoint in the right display and press ENTER.

While the unit is operating in ASC mode, the left hand display will alternate between current unit setpoint and “ASC”. The right hand display will alternate between current control temperature and “ACtvE”. The user can determine the amount of time left at the current setpoint by selecting Cd53. The amount of time left will be displayed in the right display (XX (days) / XX (hours). By sequentially pressing ENTER, set parameters can be viewed.

At completion of ASC mode, the left hand display will alternate between current unit setpoint “ASC”. The right hand display will alternate between current control temperature and “Done”.

The display will remain this way until ASC is turned off. The user can determine the date of completion by selecting Cd53. With (done) in the left display, the date of completion will be displayed in the right display (Month / Day).

ASC can be manually turned off by selecting Cd53, scrolling to “Off” and pressing the ENTER key.

ACS will be automatically turned off after three days without power, or if a Pre-trip is initiated.

ACS (Cd53) will work independently of Automatic Cold Treatment (ACT) (Cd51). Setting one deactivates the other

SECTION 6
TROUBLESHOOTING

6.1 Unit Will Not Start or Starts Then Stops

Condition	Possible Cause	Remedy / Reference
No power to unit	External power source OFF	Turn on
	Start-Stop switch OFF or defective	Check
	Circuit breaker tripped or OFF	Check
	Autotransformer not connected	5.2.2
Loss of control power	Circuit breaker OFF or defective	Check
	Control transformer defective	Replace
	Fuses (F3A, F3B) blown	Check
	Start-Stop switch OFF or defective	Check
Component(s) Not Operating	Evaporator fan motor internal protector open	7.15
	Condenser fan motor internal protector open	7.11
	Compressor internal protector open	7.8
	High pressure switch open	6.7
	Heat termination thermostat open	Replace
Compressor hums, but does not start	Low line voltage	Check
	Single phasing	Check
	Shorted or grounded motor windings	7.8
	Compressor seized	7.8

6.2 Unit Operates Long or Continuously Long in Cooling

Condition	Possible Cause	Remedy / Reference
Container	Hot load (Failure to Pre-cool)	Normal
	Defective box insulation or air leak	Repair
Refrigeration System	Shortage of refrigerant	7.7.1
	Evaporator coil covered with ice	6.6
	Evaporator coil plugged with debris	7.13
	Evaporator fan(s) rotating backwards	7.13/7.15
	Defective evaporator fan motor	7.15
	Air bypass around evaporator coil	Check
	Controller set too low	Reset
	Compressor service valves or liquid line shutoff valve par tially closed	Open valves completely
	Dirty condenser	7.10.1
	Compressor worn	7.8
	Current limit (function code Cd32) set to wrong value	4.4.3
	Suction modulation valve malfunction	7.18

6.3 Unit Runs But Has Insufficient Cooling

Condition	Possible Cause	Remedy / Reference
Compressor	Compressor valves defective	7.8
Refrigeration System	Abnormal pressures	6.7
	Controller malfunction	6.9
	Evaporator fan or motor defective	7.15
	Suction modulation valve malfunction	7.18
	Condenser Pressure Transducer defective	Check
	Shortage of refrigerant	7.7.1

6.4 Unit Will Not Heat or Has Insufficient Heating

Condition	Possible Cause	Remedy / Reference
No operation of any kind	Start-Stop switch OFF or defective	Check
	Circuit breaker OFF or defective	Check
	External power source OFF	Turn ON
No control power	Circuit breaker or fuse defective	Replace
	Control Transformer defective	Replace
	Evaporator fan internal motor protector open	7.15
	Heat relay defective	Check
	Heater termination switch open	7.13
Unit will not heat or has insufficient heat	Heater(s) defective	7.13
	Heater contactor or coil defective	Replace
	Evaporator fan motor(s) defective or rotating backwards	7.13/7.15
	Evaporator fan motor contactor defective	Replace
	Controller malfunction	6.9
	Defective wiring	Replace
	Loose terminal connections	Tighten
	Low line voltage	3.3

6.5 Unit Will Not Terminate Heating

Condition	Possible Cause	Remedy / Reference
Unit fails to stop heating	Controller improperly set	Reset
	Controller malfunction	6.9
	Heater termination thermostat remains closed along with the heat relay	7.13

6.6 Unit Will Not Defrost Properly

Condition	Possible Cause	Remedy / Reference
Will not initiate defrost automatically	Defrost timer malfunction (Cd27)	Table 4–5
	Loose terminal connections	Tighten
	Defective wiring	Replace
	Defrost temperature sensor defective or heat termination thermostat open	Replace
	Heater contactor or coil defective	Replace
Will not initiate defrost manually	Manual defrost switch defective	Replace
	Defrost temperature sensor open	7.22
Initiates but relay (DR) drops out	Low line voltage	3.3
Initiates but does not defrost	Heater contactor or coil defective	Replace
	Heater(s) burned out	
Frequent defrost	Wet load	Normal

6.7 Abnormal Pressures (Cooling)

Condition	Possible Cause	Remedy / Reference
High discharge pressure	Condenser coil dirty	7.10.1
	Condenser fan rotating backwards	7.11
	Condenser fan inoperative	7.11
	Refrigerant overcharge or noncondensibles	7.7.1
	Discharge service valve partially closed	Open
	Suction modulation valve malfunction	7.18
Low suction pressure	Suction service valve partially closed	Open
	Filter-drier partially plugged	7.12
	Low refrigerant charge	7.7.1
	Expansion valve defective	7.17
	No evaporator air flow or restricted air flow	7.13
	Excessive frost on evaporator coil	6.6
	Evaporator fan(s) rotating backwards	7.15.3
	Suction modulation valve malfunction	7.18
Suction and discharge pressures tend to equalize when unit is operating	Heat exchanger defective	Replace
	Compressor valves defective	7.8
	Compressor cycling/stopped	Check

6.8 Abnormal Noise or Vibrations

Condition	Possible Cause	Remedy / Reference
Compressor	Loose mounting bolts	Tighten
	Worn bearings	7.8
	Worn or broken valves	7.8
	Liquid slugging	7.17
	Insufficient oil	7.8.6
Condenser or Evaporator Fan	Bent, loose or striking venturi	Check
	Worn motor bearings	7.11/7.15
	Bent motor shaft	7.11/7.15

6.9 Microprocessor Malfunction

Condition	Possible Cause	Remedy / Reference
Will not control	Defective Sensor	7.22
	Defective wiring	Check
	Fuse (F1, F2) blown	Replace
	Stepper motor suction modulation valve circuit malfunction	7.18

6.10 No Evaporator Air Flow or Restricted Air Flow

Condition	Possible Cause	Remedy / Reference
Evaporator coil blocked	Frost on coil	6.6
	Dirty coil	7.13
No or partial evaporator air flow	Evaporator fan motor internal protector open	7.15
	Evaporator fan motor(s) defective	7.15
	Evaporator fan(s) loose or defective	7.15
	Evaporator fan contactor defective	Replace

6.11 EAutoFresh Not Operating

Condition	Possible Cause	Remedy / Reference
Vent not opening	Unit not Configured for eAutoFresh Operation	No action
	Cd43 in Off mode	4.10
	Wiring disconnected	Check wiring
	Stepper drive defective	7.24
	Stepper motor defective	7.24
	Unit operating in frozen mode	5.4
Gas Limit mode unavailable	Check CO_2 sensor	5.4
	Wiring disconnected	Check wiring
	Unit operating in frozen mode	5.4

6.11 EAutoFresh Not Operating

Condition	Possible Cause	Remedy / Reference
Unable to calibrate CO_2 sensor	Enter Key not held for sufficient length of time	5.4
	CO_2 outside of acceptable levels	Check
	Check CO_2 sensor	5.4
Cd44 displays -----	Unit not Configured for eAutoFresh Operation	No action
	Check CO_2 sensor	5.4

6.12 Thermostatic Expansion Valve Malfunction

Condition	Possible Cause	Remedy / Reference
Low suction pressure with high superheat	Low refrigerant charge	7.7.1
	External equalizer line plugged	Open
	Wax, oil or dirt plugging valve or orifice ice formation at valve seat	7.17
	Superheat too high	7.7.1
	Power assembly failure	7.17
	Loss of element/bulb charge	7.17
	Broken capillary	7.17
	Foreign material in valve	7.17
High suction pressure with low superheat	Superheat setting too low	7.17
	External equalizer line plugged ice holding valve open	Open
	Foreign material in valve	7.17
Liquid slugging in compressor	Pin and seat of expansion valve eroded or held open by foreign material	7.17
Fluctuating suction pressure	Improper bulb location or installation	7.17
	Low superheat setting	7.17

6.13 Autotransformer Malfunction

Condition	Possible Cause	Remedy / Reference
Unit will not start	Circuit breaker (CB1 or CB2) tripped	Check
	Autotransformer defective	7.20
	Power source not turned ON	Check
	460 VAC power plug is not inserted into the receptacle	5.2.2

SECTION 7
SERVICE

NOTE

Use a refrigerant recovery system whenever removing refrigerant. When working with refrigerants you must comply with all local government environmental laws. In the U.S.A., refer to EPA section 608.

⚠ WARNING

EXPLOSION HAZARD: Failure to follow this WARNING can result in death, serious personal injury and / or property damage. NEVER use air or gas mixtures containing oxygen (O_2) for leak testing or operating the product. Charge Only With R-134a: Refrigerant must conform to AHRI Standard 700 specification.

NOTE

Annual maintenance procedures for ThinLINE units 69NT40-541 can be found in the **62-10327 Annual Maintenance Manual**, located in the Literature section of the Container Refrigeration web site. To find the manual from the Literature section, click on Container Units > All Container Units > Operation.

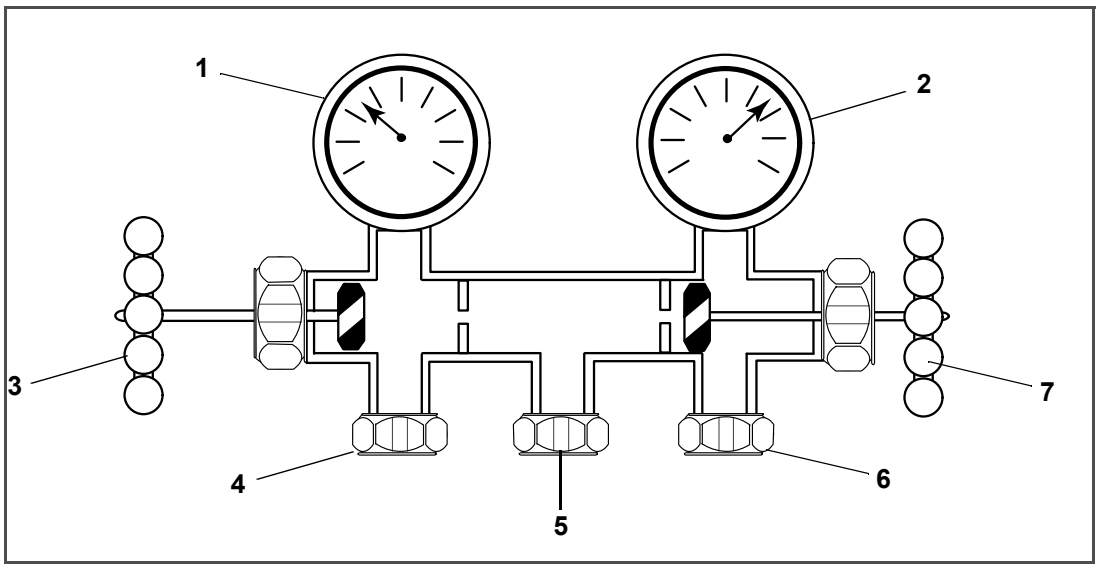
7.1 Section Layout

Service procedures are provided in this section beginning with refrigeration system service, then refrigeration system component service, electrical system service, temperature recorder service and general service. Refer to the Table of Contents to locate specific topics.

7.2 Manifold Gauge Set

The manifold gauge set (see **Figure 7.1**) is used to determine system operating pressure, add refrigerant charge, and to equalize or evacuate the system.

Figure 7.1 Manifold Gauge Set



1. Discharge Pressure Gauge
2. Suction Pressure Gauge
3. Discharge Pressure Valve (shown backseated)
4. High Side Connection
5. Utility Connection to: refrigerant cylinder, vacuum pump, oil container
6. Low Side Connection
7. Suction Pressure Valve (shown frontseated)

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When the Suction Pressure Valve is frontseated (turned all the way in), the suction (low) pressure can be checked at the Suction Pressure Gauge.

When the Discharge Pressure Valve is frontseated, the discharge (high) pressure can be checked at the Discharge Pressure Gauge.

When both valves are backseated (all the way out), high pressure vapor will flow into the low side.

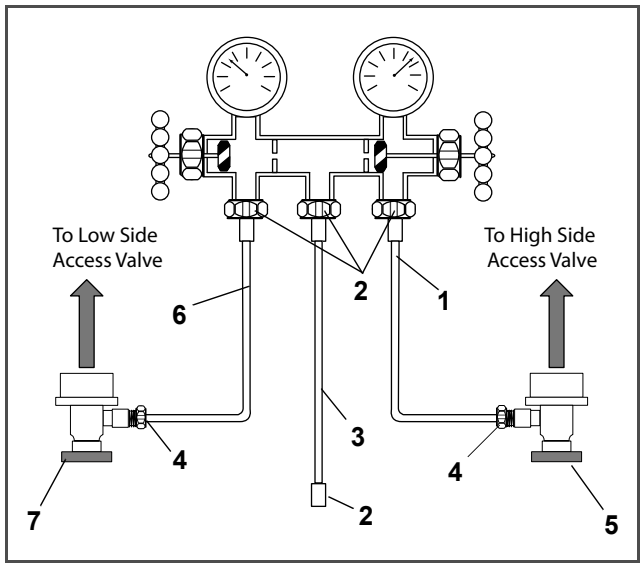
When the Suction Pressure Valve is open and the Discharge Pressure Valve is shut, the system can be charged through the Utility Connection. Oil can also be added to the system.

A R-134a manifold gauge/hose set with self-sealing hoses (see **Figure 7.2**) is required for service of the models covered within this manual. The manifold gauge/hose set is available from Carrier Transicold. (Carrier Transicold P/N 07-00294-00, which includes items 1 through 6, **Figure 7.2**).

If the manifold gauge/hose set is new or was exposed to the atmosphere, it will need to be evacuated to remove contaminants and air as follows:

1. Backseat (turn counterclockwise) both field service couplings (see **Figure 7.2**) and midseat both hand valves.
2. Connect the yellow hose to a vacuum pump and refrigerant 134a cylinder.
3. Evacuate to 10 inches of vacuum and then charge with R-134a to a slightly positive pressure of 0.1kg/cm^2 (1.0 psig).
4. Frontseat both manifold gauge set valves and disconnect from cylinder. The gauge set is now ready for use.

Figure 7.2 R-134a Manifold Gauge/Hose Set



1. RED Refrigeration and/or Evacuation Hose (SAE J2196/R-134a)
2. Hose Fitting (0.5-16 Acme)
3. YELLOW Refrigeration and/or Evacuation Hose (SAE J2196/R-134a)
4. Hose Fitting with O-ring (M14 x 1.5)
5. High Side Field Service Coupling (Red Knob)
6. BLUE Refrigeration and/or Evacuation Hose (SAE J2196/R-134a)
7. Low Side Field Service Coupling (Blue Knob)

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7.3 Service Valves

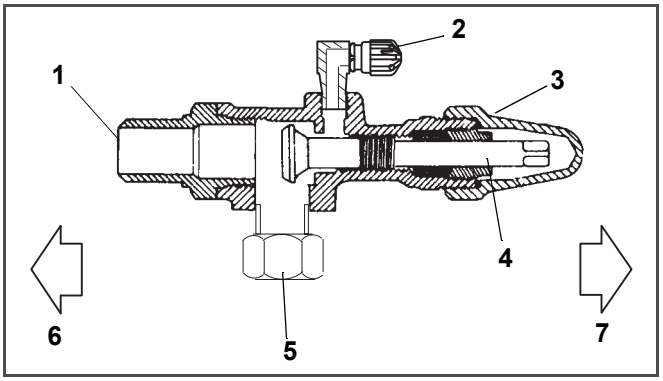
Compressor suction, compressor discharge, and liquid line service valves (see **Figure 7.3**) are provided with a double seat and a gauge connection, which enables servicing of the compressor and refrigerant lines.

Turning the valve stem clockwise (all the way forward) will frontseat the valve to close off the suction, discharge or liquid line and open the gauge port to the compressor or low side. Turning the stem counterclockwise (all the way out) will backseat the valve to open the connections and close off the port.

With the valve stem midway between frontseat and backseat, both of the service valve connections are open to the access valve path.

For example, the valve stem is first fully backseated when connecting a manifold gauge to measure pressure. Then, the valve is opened 1/4 to 1/2-turn to measure the pressure.

Figure 7.3 Service Valve



1. Line Connection
2. Access Valve
3. Stem Cap
4. Valve Stem
5. Compressor Filter Drier Inlet Connection
6. Valve (Frontseated)
7. Valve (Backseated)

- - - - -

Connection of the manifold gauge/hose set (see **Figure 7.4**) is dependent on the component being serviced. If only the compressor is being serviced, the high side coupling is connected to the discharge service valve.

For service of the low side (after pump down), the high side coupling is connected to the liquid line service valve. The center hose connection is brought to the tool being used (vacuum, tank, etc.).

Connecting the Manifold Gauge Set:

1. Remove service valve stem cap and make sure the valve is backseated.
2. Remove service port cap (See **Figure 7.3**).
3. Connect the high side field service coupling (see **Figure 7.2**) to the discharge or liquid line valve service valve port.
4. Turn the high side field service coupling knob (red) clockwise, which will open the high side of the system to the gauge set.
5. Connect the low side field service coupling to the suction service valve port.
6. Turn the low side field service coupling knob (blue) clockwise, which will open the low side of the system to the gauge set.
7. To read system pressures, slightly midseat the high side and suction service valves.

⚠ CAUTION

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

Removing the Manifold Gauge Set:

1. While the compressor is still ON, backseat the high side service valve.
2. Midseat both hand valves on the manifold gauge set and allow the pressure in the manifold gauge set to be drawn down to suction pressure. This returns any liquid that may be in the high side hose to the system.
3. Backseat the suction service valve. Backseat both field service couplings and frontseat both manifold set valves. Remove the couplings from the service ports.
4. Install both service valve stem caps and service port caps (finger-tight only).

7.4 Pump the Unit Down

To service the filter-drier, moisture-liquid indicator, expansion valve, suction modulation valve, quench valve, or evaporator coil, pump the refrigerant into the high side as follows:

1. Attach manifold gauge set to compressor service valves (refer to **Section 7.2**).
2. Start the unit and run in a cooling mode for 10 to 15 minutes. Frontseat the liquid line service valve. Place start-stop switch in the OFF position when the suction reaches a positive pressure of 0.1kg/cm^2 (1.0psig).

3. Frontseat the suction service valve. The refrigerant will be trapped between the compressor suction service valve and the liquid line valve.
4. Before opening up any part of the system, a slight positive pressure should be indicated on the pressure gauge. If a vacuum is indicated, emit refrigerant by cracking the liquid line valve momentarily to build up a slight positive pressure.
5. When opening up the refrigerant system, certain parts may frost. Allow the part to warm to ambient temperature before dismantling. This avoids internal condensation, which puts moisture in the system.
6. After repairs have been made, be sure to perform a refrigerant leak check (refer to **Section 7.5**), and evacuate and dehydrate the low side (refer to **Section 7.6**).
7. Check refrigerant charge (refer to **Section 7.7**).

7.5 Refrigerant Leak Checking

⚠ WARNING

EXPLOSION HAZARD: Failure to follow this WARNING can result in death, serious personal injury and / or property damage. Never use air or gas mixtures containing oxygen (O_2) for leak testing or operating the product. Charge Only With R-134a: Refrigerant must conform to AHRI Standard 700 specification.

1. The recommended procedure for finding leaks in a system is with a R-134a electronic leak detector. Testing joints with soapsuds is satisfactory only for locating large leaks.
2. If the system is without refrigerant, charge the system with refrigerant 134a to build up pressure between 2.1 to 3.5kg/cm^2 (30 to 50psig). Remove refrigerant cylinder and leak-check all connections.

NOTE

Only refrigerant 134a should be used to pressurize the system. Any other gas or vapor will contaminate the system, which will require additional purging and evacuation of the system.

3. If required, remove refrigerant using a refrigerant recovery system and repair any leaks.
4. Evacuate and dehydrate the unit (refer to **Section 7.6**).
5. Charge unit per **Section 7.7**.

7.6 Evacuation and Dehydration

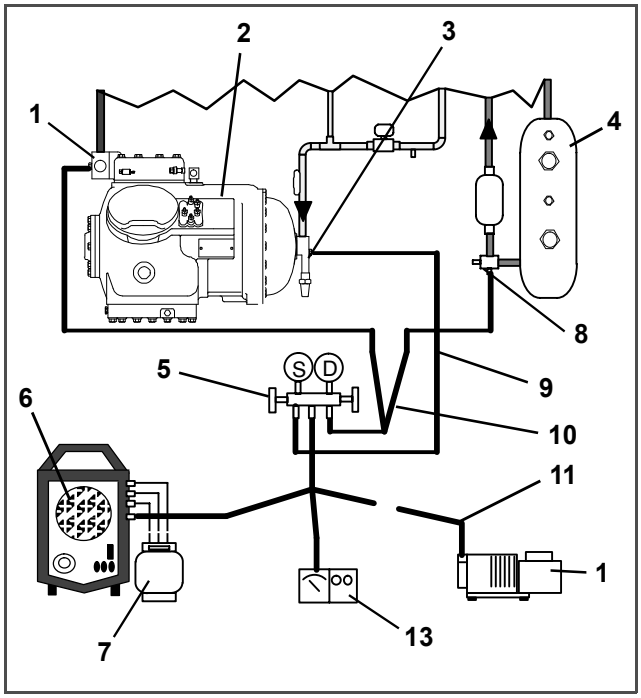
7.6.1 General

Moisture is the deadly enemy of refrigeration 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.

7.6.2 Preparation

1. Evacuate and dehydrate only after pressure leak test (refer to **Section 7.5**).
2. Essential tools to properly evacuate and dehydrate any system include a vacuum pump (8m-/hr = 5cfm volume displacement) and an electronic vacuum gauge. The pump is available from Carrier Transicold, P/N 07-00176-11. The micron gauge is P/N 07-00414-00.
3. If possible, keep the ambient temperature above 15.6°C (60°F) to speed evaporation of moisture. If the ambient temperature is lower than 15.6°C (60°F), ice might form before moisture removal is complete. Heat lamps or alternate sources of heat may be used to raise the system temperature.
4. Additional time may be saved during a complete system pump down by replacing the filter-drier with a section of copper tubing and the appropriate fittings. Installation of a new drier may be performed during the charging procedure.

Figure 7.4 Refrigeration System Service Connections



1. Discharge Service Valve
2. Compressor
3. Suction Service Valve
4. Receiver or Water Cooled Condenser
5. Manifold Gauge Set
6. Reclaimer
7. Refrigerant Cylinder
8. Liquid Service Valve
9. Low Side Hose
10. Center Hose
11. High Side Hose
12. Vacuum Pump
13. Electronic Vacuum Gauge

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7.6.3 Complete System

1. Remove all refrigerant using a refrigerant recovery system.
2. The recommended method to evacuate and dehydrate the system is to connect three evacuation hoses (see **Figure 7.4**) to the vacuum pump and refrigeration unit. Be sure the service hoses are suited for evacuation purposes.
3. Test the evacuation setup for leaks by backseating the unit service valves and drawing a deep vacuum with the vacuum pump and gauge valves open. Shut off the pump and check to see if the vacuum holds. Repair leaks if necessary.
4. Midseat the refrigerant system service valves.
5. Open the vacuum pump and electronic vacuum gauge valves, if they are not already open. Start the vacuum pump. Evacuate unit until the electronic vacuum gauge indicates 2000 microns. Close the electronic vacuum gauge and vacuum pump valves. Shut off the vacuum pump. Wait a few minutes to be sure the vacuum holds.
6. Break the vacuum with clean dry refrigerant 134a gas. Raise system pressure to approximately 0.2kg/cm^2 (2psig), monitoring it with the compound gauge.
7. Remove refrigerant using a refrigerant recovery system.
8. Repeat steps 5 and 6 one time.
9. Remove the copper tubing and change the filter-drier. Evacuate unit to 500 microns. Close the electronic vacuum gauge and vacuum pump valves. Shut off the vacuum pump. Wait five minutes to see if vacuum holds. This procedure checks for residual moisture and/or leaks.
10. With a vacuum still in the unit, the refrigerant charge may be drawn into the system from a refrigerant container on weight scales. Continue to **Section 7.7**.

7.6.4 Procedure - Partial System

1. If the refrigerant charge has been removed from the compressor for service, evacuate only the compressor by connecting the evacuation set-up at the compressor service valves. Follow evacuation procedures of the preceding paragraph except leave compressor service valves frontseated until evacuation is completed.

2. If refrigerant charge has been removed from the low side only, evacuate the low side by connecting the evacuation set-up at the compressor service valves and liquid service valve except leave the service valves frontseated until evacuation is completed.
3. Once evacuation has been completed and the pump has been isolated, fully backseat the service valves to isolate the service connections and then continue with checking and, if required, adding refrigerant in accordance with normal procedures.

7.7 Refrigerant Charge

⚠ WARNING

EXPLOSION HAZARD: Failure to follow this WARNING can result in death, serious personal injury and / or property damage. NEVER use air or gas mixtures containing oxygen (O_2) for leak testing or operating the product. Charge Only With R-134a: Refrigerant must conform to AHRI Standard 700 specification.

7.7.1 Checking the Refrigerant Charge

NOTE

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

1. Connect the gauge manifold to the compressor discharge and suction service valves.
2. Bring the container temperature to approximately 1.7°C (35°F) or -17.8°C (0°F). Set the controller set point to -25°C (-13°F) to ensure that the suction modulation valve is at maximum allowed open position.
3. Partially block the condenser coil inlet air. If covering the lower portion of the coil is not sufficient, remove the left hand infill panel and cover the left side of the coil. Increase the area blocked until the compressor discharge pressure is raised to approximately 12.8 bar (185 psig).
4. On the receiver, the level should be between the glasses. If the refrigerant level is not correct, continue with the following paragraphs to add or remove refrigerant as required.

7.7.2 Adding Refrigerant to System (Full Charge)

1. Evacuate unit and leave in deep vacuum (refer to **Section 7.6**).
2. Place cylinder of R-134a on scale and connect charging line from cylinder to liquid line valve. Purge charging line at liquid line valve and then note weight of cylinder and refrigerant.
3. Open liquid valve on cylinder. Open liquid line valve half-way and allow the liquid refrigerant to flow into the unit until the correct weight of refrigerant (refer to **Section 3.2**) has been added as indicated by scales.

NOTE

It may be necessary to finish charging unit through suction service valve in gas form, due to pressure rise in high side of the system (refer to **Section 7.7.3**).

4. Backseat manual liquid line valve (to close off gauge port). Close liquid valve on cylinder.
5. Start unit in cooling mode. Run approximately 10 minutes and check the refrigerant charge.

7.7.3 Adding Refrigerant to System (Partial Charge)

1. Examine the unit refrigerant system for any evidence of leaks. Repair as necessary (refer to **Section 7.5**).
2. Maintain the conditions outlined in **Section 7.7.1**.
3. Fully backseat the suction service valve and remove the service port cap.
4. Connect charging line between suction service valve port and cylinder of refrigerant R-134a. Open VAPOR valve.
5. Partially frontseat (turn clockwise) the suction service valve and slowly add charge until the refrigerant appears at the proper level.

7.8 Compressor

⚠ WARNING

Make sure power to the unit is OFF and power plug disconnected before replacing the compressor.

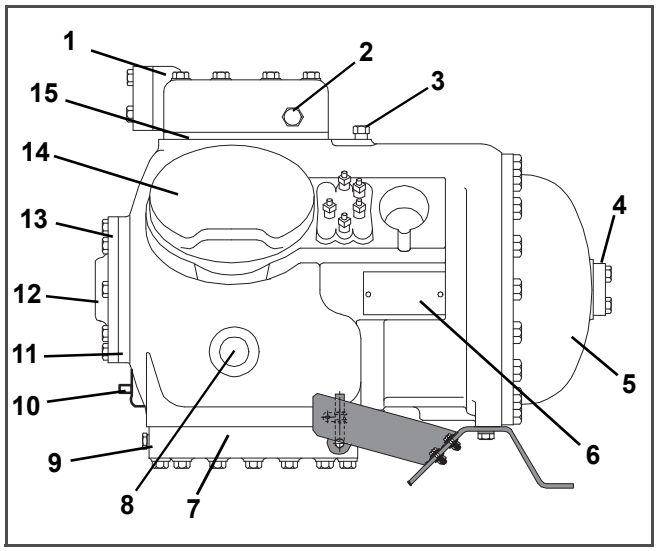
NOTES

- The compressor should not operate in a vacuum greater than 500mm/hg (20 inches/hg).
- The service replacement compressor is sold without shutoff valves (but with valve pads), and without terminal box and cover. Customer should retain the original terminal box, cover, and high pressure switch for use on replacement compressor.
- Check oil level in service replacement compressor (refer to **Section 7.8.6**).
- A compressor terminal wiring kit must be ordered as a separate item when ordering replacement compressor. Appropriate installation instructions are included with kit.
- Refer to **Table 7–5** and **Table 7–6** for applicable compressor wear limits and torque values.
- Refer to **Figure 7.41** for charts on compressor pressure, temperature and motor current curves.

7.8.1 Removal and Replacement of Compressor

1. Remove the protective guard from lower section of the unit.
2. Pump down low side (refer to **Section 7.4**) or frontseat compressor service valves and remove refrigerant from compressor using a refrigerant recovery system.
3. Locate the compressor junction box. Tag and disconnect wiring from compressor terminals and remove compressor junction box.
4. Loosen service valve mounting bolts, break seal, and then remove bolts.
5. Remove compressor plate mounting bolts.
6. Remove compressor and mounting plate. Refer to **Section 3.2** for weight of compressor.

Figure 7.5 Compressor



1. Discharge Valve Flange
2. High Side Pressure Connection
3. Low Side Pressure Connection
4. Suction Valve Flange
5. Motor End Cover
6. Serial / Model Number Plate
7. Bottom Plate
8. Sight Glass
9. Oil Drain Plug
10. Oil Charging Valve
11. Bearing Head
12. Oil Pump
13. Oil Fill Plug
14. Cylinder Head
15. Valve Plate

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1. Remove high pressure switch (HPS) from compressor and check operation of switch (refer to **Section 7.9.1**).
2. Remove compressor mounting bolts from mounting plate and install mounting plate on replacement compressor.
3. Install replacement compressor terminal wiring kit, following instructions included with kit.
4. Install high pressure switch on compressor.
5. Install compressor and mounting plate in unit.

6. Connect junction box(es) to compressor and connect all wiring per wiring diagram. Install junction box cover(s).
7. Install new gaskets on service valves.
8. Install mounting bolts in service valves and torque to 2.77 to 4.15mkg (20-30ft/lb).
9. Attach two hoses (with hand valves near vacuum pump) to the suction and discharge service valves. Dehydrate and evacuate compressor to 500 microns (75.9 cm Hg vacuum = 29.90 inches Hg vacuum). Turn off valves on both hoses to pump.
10. Fully backseat (open) both suction and discharge service valves.
11. Remove vacuum pump lines.
12. Start unit and check refrigerant charge (refer to **Section 7.7**).
13. Check moisture-liquid indicator for wetness. Change filter-drier if necessary (refer to **Section 7.12**).
14. Check compressor oil level per **Section 7.8.6**. Add oil if necessary.

7.8.2 Compressor Disassembly

⚠ WARNING

Before disassembly of any external compressor component make sure to relieve possible internal pressure by loosening the bolts and tapping the component with a soft hammer to break the seal.

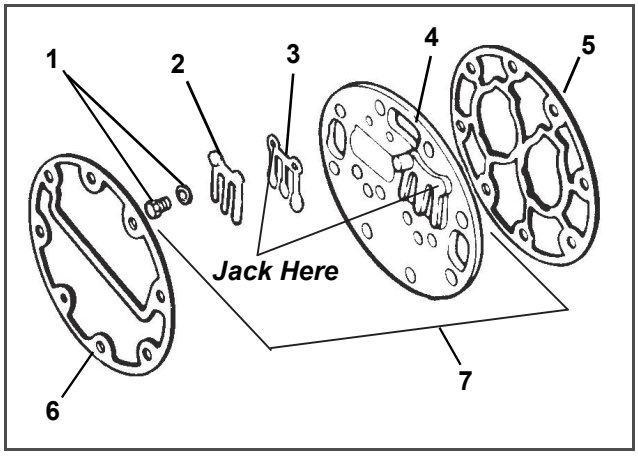
⚠ WARNING

Removing the compressor motor press-fit stator in the field is not recommended. The rotor and stator are a matched pair and should not be separated.

When disassembling compressor, matchmark parts so they may be replaced in their same relative positions (see **Figure 7.5**). Refer to **Table 7–5** and **Table 7–6** for compressor wear limits and bolt torque values.

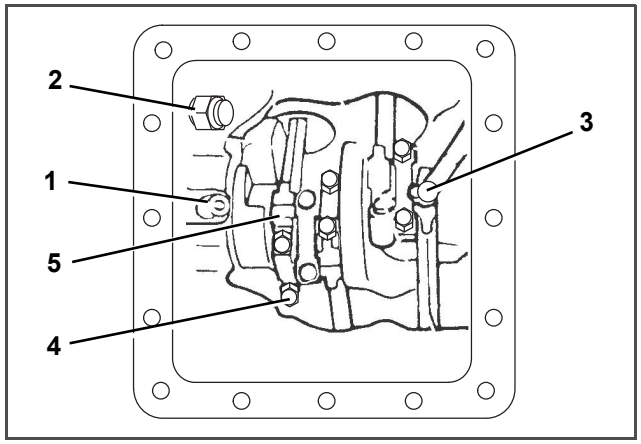
1. Place the compressor in a position where it will be convenient to drain the oil. Remove the oil fill plug (see **Figure 7.5**) to vent the crankcase. Loosen the drain plug in bottom plate and allow the oil to drain out slowly. Remove the plug slowly to relieve any crankcase pressure. Some units have a plug in the bottom center of the crankcase, which may be removed for draining the motor end more quickly.

Figure 7.6 Exploded View of Valve Plate



1. Discharge Valve Screw and Lockwasher
2. Discharge Valve Stop
3. Discharge Valve
4. Valve Plate
5. Valve Plate Gasket
6. Cylinder Head Gasket
7. Valve Plate Assembly

Figure 7.7 Bottom Plate Removed



1. Oil Pressure Relief Valve
2. Oil Return Check Valve
3. Oil Suction Tube
4. Cap Screw
5. Connecting Rod and Cap Assembly

- - - - -

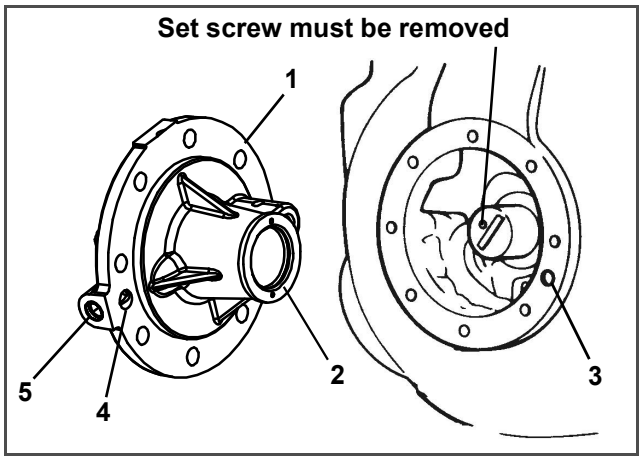
2. Loosen cylinder head cap screws. If the cylinder head is stuck, tap the center of the cylinder head with a wooden or lead mallet. Do not strike the side of the cylinder head. Be careful not to drop the head or damage the gasket sealing surface. Remove cylinder head bolts and gasket (see **Figure 7.6**).
3. Remove valve stops and valves. After they have been removed, free the valve plate from the cylinder deck by using the outside discharge valve hold-down cap screw as a jack screw through the tapped hole of the valve plate. Remove the valve plate gasket.
4. Turn the compressor on its side and remove the bottom plate oil suction screen and screen hold down plate. Inspect the screen for holes or an accumulation of dirt. The screen can be cleaned with a suitable solvent.
5. Match mark each connecting rod cap (see **Figure 7.7**) and connecting rod for correct reassembly. Remove the bolts and connecting rod caps. Push the piston rods up as far as they will go without having the piston rings extend above the cylinders.

⚠ CAUTION

The copper tube that connects to the oil suction strainer extends out the bottom with the bottom plate removed. Take precautions to avoid bending or breaking it while changing crankcase positions.

6. If necessary, remove the oil return check valve (see **Figure 7.7**). Inspect it for proper operation (flow in one direction only). Replace the assembly with a new unit if check valve operation is impaired.
7. To remove the oil pump (see **Figure 7.8**) remove eight cap screws, oil pump bearing head assembly, gasket, and thrust washer.

Figure 7.8 Oil Pump and Bearing Head



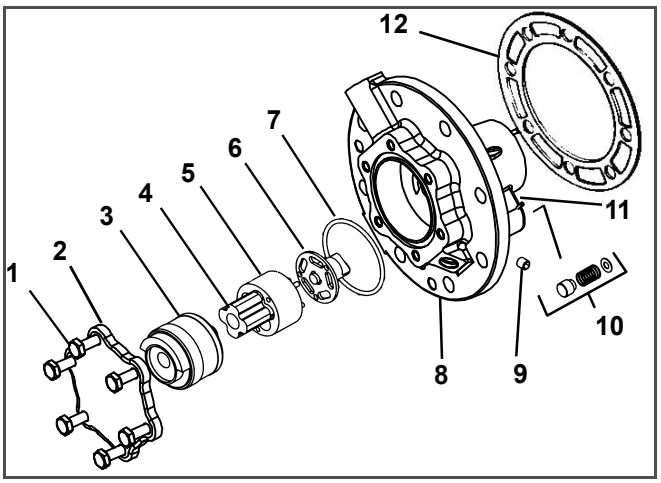
1. Oil Pump & Bearing Head
2. Thrust Washer
3. Oil Pickup Tube
4. Oil Inlet Port
5. Oil Pump Inlet

- - - - -

NOTE

If the oil pump was not operating properly, the entire oil pump & bearing head assembly must be replaced. Individual parts are not available. If the pump requires inspection or cleaning, disassemble and reassemble by referring to **Figure 7.9**. Clean all parts and coat all moving parts with compressor oil before proceeding with reassembly.

Figure 7.9 Low Profile Oil Pump

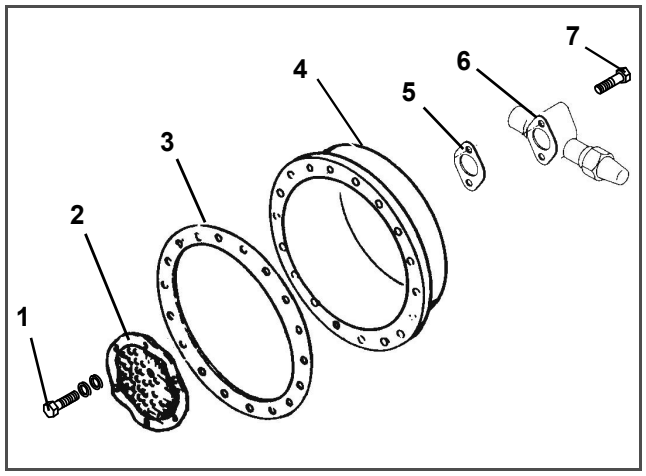


1. Cap screws
2. Cover
3. Reversing Assembly
4. Pinion
5. Gear
6. Drive
7. O-Ring
8. Oil Pump & Bearing
9. Set Screw
10. Relief Valve
11. Pin
12. Gasket

- - - - -

8. Be very careful not to damage the motor windings when removing the motor end cover (see **Figure 7.10**), as the cover fits over the winding coils. Loosen the cap screws, break the seal, and then remove all cap screws except one in the top of the cover. While holding the cover in place, remove the remaining cap screw. Do not allow the cover to drop from its own weight. To prevent striking the winding, remove the cover horizontally and in line with the motor axis.

Figure 7.10 Motor End Cover



1. Strainer Screws and Washers
2. Suction Strainer
3. Motor End Cover Gasket
4. Motor End Cover
5. Valve Gasket
6. Suction Service Valve
7. Valve Cap Screw

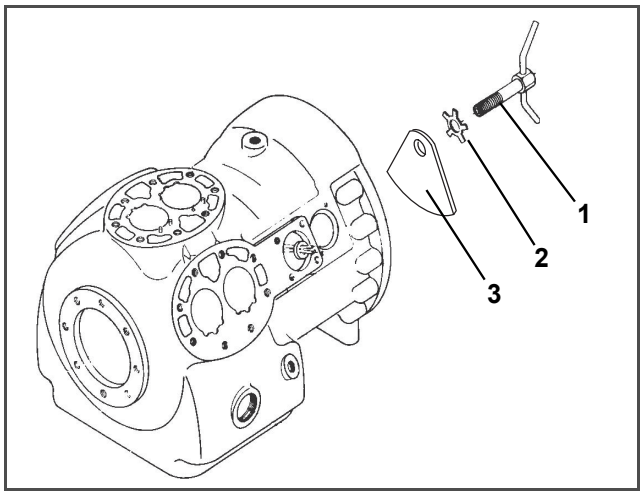
- - - - -

9. Remove the refrigerant suction strainer. If it is removed with ease, it may be cleaned with solvent and replaced. If the strainer is broken, corroded or clogged with dirt that is not easily removed, replace the strainer. Install new gaskets upon reassembly.
10. Block the compressor crankshaft so that it cannot turn. Use a screwdriver to bend back the tabs on the lock-washer, and remove the equalizer tube and lock screw assembly (see **Figure 7.11**). The slingers at the end of the tube draw vapor from the crankcase. Remove the rotor using a jack bolt. Insert a brass plug into the rotor hole to prevent damage to the end of the crankshaft.

11. If the piston rings extend beyond the cylinder tops, the pistons can be pulled through the bottom plate opening after the piston rings are compressed. A piston ring compressor will facilitate removal. Each piston pin is locked in place by lock rings, which are snapped into grooves in the piston wall (see **Figure 7.12**).

12. Since the stator cannot be replaced in the field, the terminal plate assembly need not be disturbed unless a leak exists and the plate assembly needs to be replaced. If no terminal plate repair is required, proceed with reassembly.

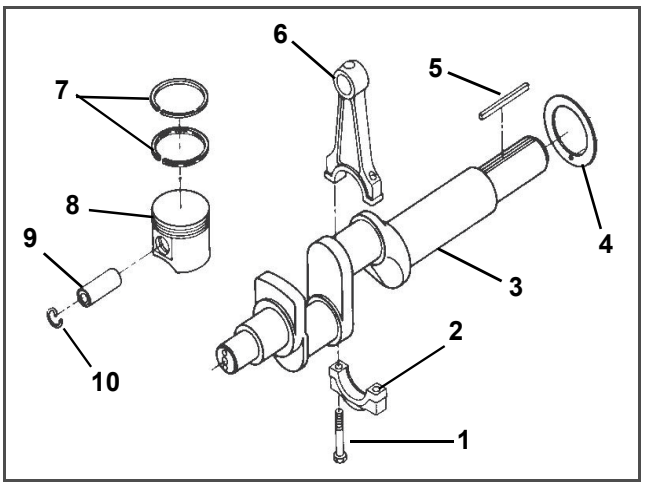
Figure 7.11 Equalizing Tube and Lock Screw Assembly



1. Equalizer Tube and Lock Screw Assembly
2. Lockwasher
3. Counterweight - Motor End

- - - - -

Figure 7.12 Crankshaft Assembly



1. Cap Screw
2. Cap
3. Crankshaft
4. Thrust Washer
5. Rotor Drive Key
6. Connecting Rod
7. Compression Ring
8. Piston
9. Pin
10. Retainer

- - - - -

7.8.3 Compressor Reassembly

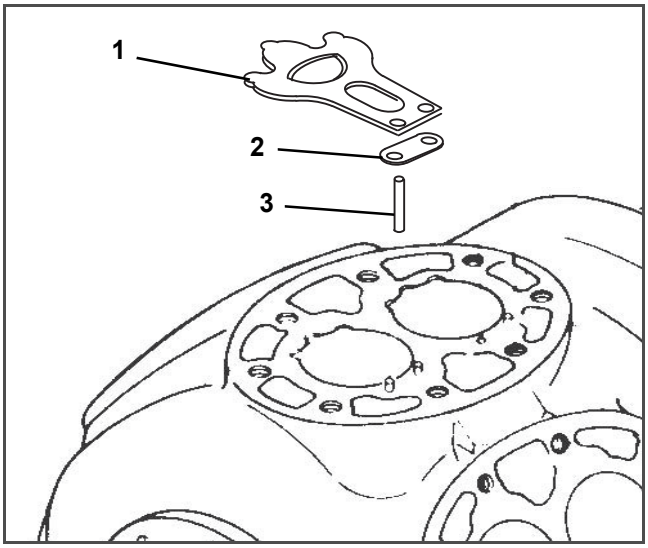
Clean all compressor parts, using a suitable solvent with proper precautions. Coat all moving parts with the proper compressor oil before assembly. Refer to **Table 7–6** for applicable compressor torque values.

7.8.4 Preparation

a. Suction and Discharge Valves

If the valve seats look damaged or worn, replace valve plate assembly. Always use new valves because it is difficult to reinstall used valves so that they will seat as before removal. Any valve wear will cause leakage.

Figure 7.13 Suction Valve and Positioning Rings



1. Suction Valve
2. Suction Valve Positioning Spring
3. Valve Plate Dowel Pin

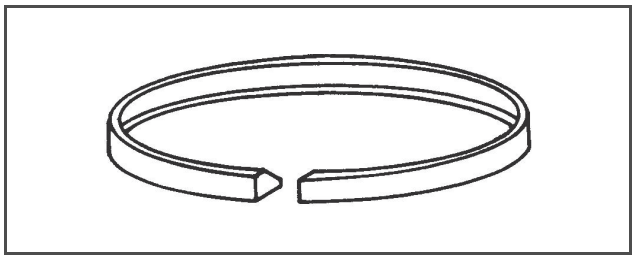
- - - - -

Suction valves are positioned by dowel pins (see **Figure 7.13**). Do not omit the suction valve positioning springs. Place the springs so that the ends bear against the cylinder deck (middle bowed away from cylinder deck). Use new gaskets when reinstalling valve plates and cylinder heads.

b. Compression Rings

The compression ring is chamfered on the inside circumference. This ring is installed with the chamfer toward the top. Stagger the ring end gaps so they are not aligned.

Figure 7.14 Piston Ring



The gap between the ends of the piston rings can be checked with a feeler gauge by inserting the ring into the piston bore approximately one inch below the top of the bore. Square the ring in the bore by pushing it slightly with a piston. The maximum and minimum allowable ring gaps are 0.33 and 0.127mm (0.013 and 0.005 inch) respectively.

7.8.5 Installing the Components

1. Push pistons from the inside of the crankcase through the cylinders, be careful not to break rings. Place rods so that the chamfered side is against radius of crankpins. Install the crankshaft and thrust washer through the pump end of the compressor. Ensure thrust washer is fitted on locating pin. Do not damage main bearings. Bring rods in position against crank bearings.
2. Install the pump end thrust washer on the two dowel pins located on the bearing head (see **Figure 7.8**).

⚠ CAUTION

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

⚠ CAUTION

The set screw on the crankshaft must be removed for this type of oil pump (see Figure 7.8).

3. Install bearing head assembly with a new gasket on the compressor crankshaft. Carefully push oil pump on by hand, ensuring the thrust washer remains on the dowel pins. The tang on the end of the drive engages the slot in the crankshaft, and the oil inlet port on the pump is aligned with the oil pickup tube in the crankcase. The pump should be mounted flush with the crankcase, and oriented with the oil pick up tube and oil inlet port, and aligned as shown in **Figure 7.8**.
4. Align gasket and install eight cap screws in mounting flange. Refer to **Table 7–6** for torque values.
5. Install matching connecting rod caps Be sure rod is not bound and crankshaft will turn correctly as each set of rod bolts is torqued.
6. Be sure key fits properly when installing rotor on shaft. Screw on equalizer tube and lock screw assembly with lock washer and bend over tabs of lock washer. Assemble suction strainer to motor and cover, and bolt cover to crankcase. Assemble valve plates and gaskets. Assemble cylinder heads & gaskets. Turn shaft by hand to see that it moves freely.
7. Install the oil suction screen, the oil suction screen hold down plate, and the bottom plate.

7.8.6 Compressor Oil Level

⚠ CAUTION

Use only Carrier Transicold approved Polyol Ester Oil (POE) - Castrol-Icematic SW20 compressor oil with R-134a. Buy in quantities of one quart or smaller. When using this hygroscopic oil, immediately reseal. Do not leave container of oil open or contamination will occur.

a. Checking the Oil Level in the Compressor

1. Turn unit on and operate in cooling mode for at least 20 minutes.
2. Check the front oil sight glass on the compressor to ensure that no foaming of the oil is present after 20 minutes of operation. If the oil is foaming excessively after 20 minutes of operation, check the refrigerant system for flood-back of liquid refrigerant. Correct this situation before performing step 3.
3. Turn unit off to check the oil level. The correct oil level range should be between the bottom to one-eighth level of the sight glass. If the level is above one-eighth, oil must be removed from the compressor. To remove oil from the compressor, follow step d in this section. If the level is below the bottom of the sight glass, add oil to the compressor following step b below.

b. Adding Oil with Compressor in System

1. The recommended method is to add oil using an oil pump at the oil fill valve (see item 10, **Figure 7.5**).
2. In an emergency where an oil pump is not available, oil may be drawn into the compressor through the suction service valve.

Connect the suction connection of the gauge manifold to compressor suction service valve port and immerse the common connection of the gauge manifold in a container of refrigeration oil. 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 compressor.

Crack the suction service valve and gauge valve to vent a small amount of refrigerant through the common connection and the oil to purge the lines of air. Close the gauge manifold valve.

With the unit running, frontseat the suction service valve and induce a vacuum in the compressor crankcase. SLOWLY crack the suction gauge manifold valve and oil will flow through the suction service valve into the compressor. Add oil as necessary.

c. Adding Oil to Service Replacement Compressor

Service replacement compressors are shipped without oil. If oil is present in crankcase, test the oil to ensure it is the correct oil and that moisture level is acceptable.

When adding oil to a service replacement compressor add three liters (6.3 pints) using an oil pump at the oil fill valve (see item 10, **Figure 7.5**). This quantity is recommended to allow for return of any oil that may be in the refrigerant system. Install compressor and check oil level after it is placed in operation (refer to **Section 7.8.6**).

d. Removing Oil from the Compressor

1. If the oil level is above one-eighth sight glass, excess oil must be removed from the compressor.
2. Close (frontseat) suction service valve and pump unit down to 0 to .1 bar (0 to 2 psig).
3. Turn the unit off.
4. Frontseat discharge service valve and remove the remaining refrigerant.
5. Loosen the oil drain plug on the bottom plate of the compressor and drain the proper amount of oil from the compressor to obtain the correct level.
6. Tighten the oil drain plug.
7. Backseat the suction and discharge service valves.
8. Repeat step a to ensure proper oil level.

7.9 High Pressure Switch

7.9.1 Checking High Pressure Switch

⚠ WARNING

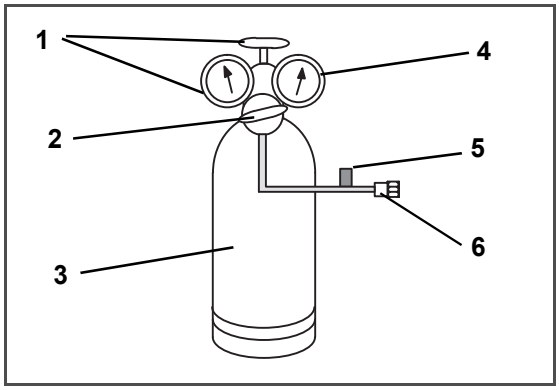
Do not use a nitrogen cylinder without a pressure regulator.

NOTE

The high pressure switch is non-adjustable.

1. Remove switch as outlined in **Section 7.9.2**.
2. Connect ohmmeter or continuity light across switch terminals. Ohm meter will indicate no resistance or continuity light will be illuminated if the switch closed after relieving compressor pressure.
3. Connect hose to a cylinder of dry nitrogen, see **Figure 7.15**.
4. Set nitrogen pressure regulator at 26.4kg/cm^2 (375psig) with bleed-off valve closed.
5. Close valve on cylinder and open bleed-off valve.
6. Open cylinder valve. Slowly close bleed-off valve to increase pressure on switch. The switch should open at a static pressure up to 25kg/cm^2 (350 psig). If a light is used, light will go out. If an ohmmeter is used, the meter will indicate open circuit.
7. Slowly open bleed-off valve to decrease the pressure. The switch should close at 18kg/cm^2 (250 psig).

Figure 7.15 High Pressure Switch Testing



1. Cylinder Valve and Gauge
2. Pressure Regulator
3. Nitrogen Cylinder
4. Pressure Gauge (0 to 36 kg/cm^2 = 0 to 400 psig)
5. Bleed-Off Valve
6. 1/4 Inch Connection

- - - - -

7.9.2 Replacing the High Pressure Switch

1. Turn unit start-stop switch OFF. Frontseat both suction and discharge service valves to isolate compressor. Remove the refrigerant from the compressor.
2. Disconnect wiring from defective switch. The high pressure switch is located on the center head and is removed by turning counterclockwise (see **Figure 3.3**).
3. Install a new high pressure switch after verifying switch settings (refer to **Section 7.9.1**).
4. Evacuate and dehydrate the compressor per **Section 7.6**.

7.10 Condenser Coil

The condenser coil consists of a series of parallel copper tubes expanded into copper fins and formed into a “C“ shape with the fourth side of the square formed by the side support bracket.

7.10.1 Condenser Coil Cleaning

To ensure optimal efficiency of the unit the condenser coil must be clean. The condenser coil should be cleaned at least once a year, but more frequent cleaning may be required depending on operating conditions. The coil is cleaned with fresh water sprayed in the reverse direction of the air flow to remove any debris from the coil. A high pressure washer is not required, mains water pressure is sufficient. To clean the condenser coil perform the following procedure:

⚠ WARNING

Do not remove the condenser fan grille before turning power OFF and disconnecting the power plug.

1. Make sure the unit is powered off and the plug is disconnected.
2. Remove the condenser fan grille.
3. Starting from the top of the coil, use a water hose with a nozzle to wash the coil from the inside out.
4. Systematically wash across the inside top face of the coil until the water runs clean.
5. Wash down the center section, and then through the bottom of the coil, continue washing until the water runs clear.
6. After the coil is clean, rinse the condenser fan to remove any dirt build up from the blades.
7. Replace the condenser fan grille ensuring that it is centered around the fan.

7.10.2 Condenser Coil Removal

1. Using a refrigerant reclaim system remove the refrigerant charge.

⚠ WARNING

Do not remove the condenser fan grille before turning power OFF and disconnecting the power plug.

2. Remove the condenser fan grille, retain all bolts and washers for reuse.
3. Remove the condenser fan.
4. Remove the infill panels to the left and right of the condenser fan shroud.
5. Remove the condenser fan shroud.
6. Unplug the condenser fan motor.
7. Remove and retain sufficient putty from around the motor wire harness to allow the harness to be slid back through the side support bracket.
8. Cut the top and bottom drain lines midway between the side support bracket and the first cable tie, approx 150mm (6”) from the side support bracket.
9. Remove and retain sufficient putty from around the drain lines to allow the tubes to be slid back through the side support bracket.
10. Remove filter drier.
11. Unbraze the inlet connection to coil.
12. Remove the cushion clamps securing the liquid line to the top and bottom receiver brackets, retain all clamps and securing hardware.
13. Place a support under the condenser coil before releasing the coil from the frame.
14. Remove the lower mounting bracket bolts from the inside of the coil.
15. Remove the top mounting bracket bolts and grille extension mount from inside the coil.
16. Remove the side support bracket mounting bolts.
17. Slide the condenser assembly with receiver out of the unit.

7.10.3 Condenser Coil Preparation

Before installing the new condenser coil, the receiver assembly and mounting hardware must be removed from the old coil assembly:

1. From the old coil, unbolt the receiver assembly from side support bracket.
2. Unbraze the receiver assembly from the coil outlet line and remove from the coil assembly.
3. Unbolt the side support bracket from the top and bottom coil supports and remove from old coil.
4. Refit the side support bracket to the new coil ensuring that the top and bottom are flush mounted with the coil support.

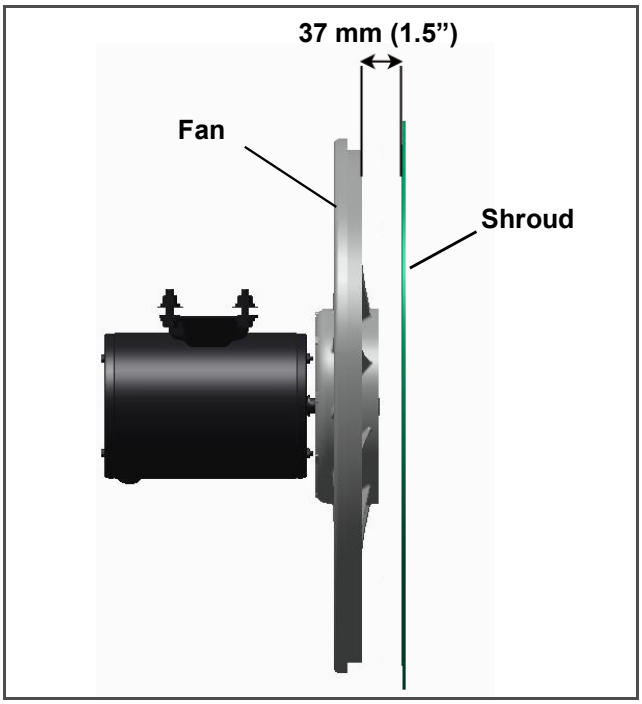
7.10.4 Condenser Coil Installation

Once the side support bracket has been secured to the new condenser coil, the entire assembly is ready to be installed into the unit:

1. Slide the new condenser coil into place ensuring the coil inlet connection is mated to the pipework and that the coil is fully supported.
2. Secure the condenser coil into the unit using the retained hardware; refit the mylar and fender washers:
   a. Refit the side support bracket bolts.
   b. Refit the top support bracket bolts as well as the top grille extension support.
   c. Refit the bottom support bracket bolts.

3. Braze the condenser coil inlet connection.
4. Insert the receiver pipe work onto the coil outlet and loosely secure the receiver assembly to the side support bracket with the retained hardware.
5. Braze the outlet connection to the receiver assembly.
6. Install a new filter drier.
7. Replace the liquid line cushion clamps.
8. Secure the receiver assembly to the side support bracket.
9. Pressure / leak test the coil and filter drier connections, refer to **Section 7.5**.
10. Evacuate the entire unit, refer to **Section 7.6**.
11. Slide the top and bottom drain lines back into place through the side support bracket.
12. Using the two supplied straight connectors and contact adhesive reconnect the drain lines.
13. Slide the condenser fan motor wiring harness back through the side support bracket and refit to condenser motor.
14. Replace all wire ties that were removed to properly secure the drain line and wiring.
15. Reseal the wire harness and drain line penetrations with the putty.
16. Slide the condenser fan onto the motor shaft reversed but do not secure.
17. Refit the condenser fan shroud to the unit. Use the condenser fan as a guide to ensure the shroud is properly centered around the fan.
18. Remove the condenser fan, and place it on the shaft facing the correct direction. Adjust the fan to the correct position, 37mm (1.5”) from the fan shroud, see **Figure 7.16**.

Figure 7.16 Condenser Fan Position



19. Use Loctite “H” on the fan set screws, and tighten.
20. Refit left and right infill panels.
21. Refit the condenser fan grille, ensuring the grille is properly centered around the condenser fan.
22. Evacuate the entire unit, refer to **Section 7.6**.
23. Recharge the unit with the charge shown on the unit serial plate, refer to **Section 7.7**. It is important for proper unit operation that the charge is weighed into the unit.

7.11 Condenser Fan and Fan Motor

The condenser fan rotates counter-clockwise (viewed from front of unit). The fan pulls air through the condenser coil, and discharges the air horizontally through the front of the unit.

7.11.1 Condenser Fan Motor Remove/Replace

⚠ WARNING

Do not remove the condenser fan grille before turning power OFF and disconnecting the power plug.

1. Remove the condenser fan grille, retain all bolts and washers for reuse.
2. Remove the condenser fan by loosening the two set screws.
3. Disconnect the condenser fan motor wiring.

⚠ CAUTION

Take necessary steps (place plywood over coil or use sling on motor) to prevent motor from falling into condenser coil.

4. Note the number of shims on each side of the motor as the same configuration will be required to refit the new motor.
5. Remove the fan motor mounting hardware and remove motor.
6. Loosely mount the new motor using new lock nuts.
7. Replace the shims in the same configuration as they were removed.
8. Tighten the fan motor mounting bolts to properly secure the motor.
9. To make sure that the motor is aligned properly, slide the condenser fan onto the motor shaft reversed but do not secure.
10. Rotate the fan to make sure the fan blades do not contact the shroud:
    a. If the fan motor is misaligned vertically, add or remove shims to align.
    b. If the fan motor is not properly centered, loosen the mounting bolts, and adjust the motor position on the bracket, and then secure the motor.
11. Remove the condenser fan, and connect the fan motor wiring to the fan motor.
12. Place the condenser fan on the shaft facing the correct direction. Adjust the fan to the correct position, 37mm (1.5”) from the fan shroud, see **Figure 7.16**.
13. Use Loctite “H” on the fan set screws, and tighten.
14. Refit the left and right infill panels.
15. Refit the condenser fan grille, ensuring the grille is properly centered around condenser fan.

7.12 Filter-Drier

a. To check filter drier:

1. Test for a restricted or plugged filter-drier by feeling the liquid line inlet and outlet connections of the drier cartridge. If the outlet feels cooler than the inlet, then the filter-drier should be changed.
2. Check the moisture-liquid indicator, if indicator shows a high level of moisture, the filter-drier should be replaced.

b. To replace filter drier:

1. Pump down the unit (refer to **Section 7.4**) and replace filter-drier.
2. Evacuate the low side in accordance with **Section 7.6**.
3. After unit is in operation, inspect for moisture in system and check charge.

7.13 Evaporator Coil

The evaporator section, including the evaporator coil, should be cleaned regularly. The preferred cleaning fluid is fresh water or steam. Another recommended cleaner is Oakite 202 or similar, following manufacturer's instructions.

The two drain pan hoses are routed behind the condenser fan motor and compressor. The drain pan line(s) must be open to ensure adequate drainage.

7.13.1 Evaporator Coil Replacement

1. Pump the unit down. Refer to **Section 7.4**.

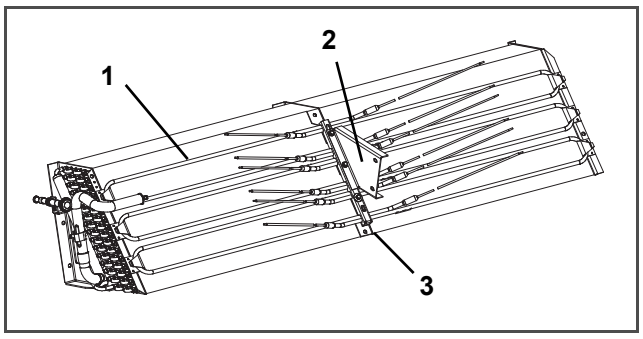
⚠ WARNING

Always turn OFF the unit circuit breakers (CB-1 & CB-2) and disconnect main power supply before working on moving parts.

2. With power OFF and power plug removed, remove the screws securing the panel covering the evaporator section (upper panel).
3. Disconnect the defrost heater wiring.
4. Remove the mounting hardware from the coil.
5. Unsolder the two coil connections, one at the distributor and the other at the coil header.
6. Disconnect the defrost temperature sensor from the coil. Refer to **Section 7.22**.
7. Remove middle coil support.
8. After defective coil is removed from unit, remove defrost heaters and install on replacement coil.
9. Install coil assembly by reversing above steps.
10. Leak check connections. Evacuate and add refrigerant charge.

7.14 Evaporator Heaters

Figure 7.17 Heater Arrangement



1. Heater Element
2. Bracket
3. Retainer

- - - - -

The heaters are wired directly back to the contactor and if a heater failure occurs during a trip, the heater set containing that heater may be disconnected at the contactor.

The next Pre-trip (P1) will detect that a heater set has been disconnected and indicate that the failed heater should be replaced.

7.14.1 Megger Testing the Heaters

⚠ WARNING

Always turn OFF the unit circuit breakers (CB-1 & CB-2) and disconnect main power supply before working on moving parts.

All of the checks performed during this procedure should be carried out using a 500v Meg-ohm tester.

1. Connect the ground wire from the insulation tester to a fixed ground point, preferably the ground plate in the control box.
2. At the load side of the heater contactor, check the insulation resistance to ground.

   If readings are > 2 Mohm, then the heaters are operating properly and no action is needed.

   If readings are < 1 Mohm, then the faulty heater needs to be identified. Proceed to step 3 for units *with* a heater access panel or step 4 for units *without* a heater access panel.

   If readings are between 1 and 2 Mohm, then the heaters need to be re-tested with the following steps:

   a. Reconnect the unit to power and power the unit on.

   b. Set the unit set point to a minimum of 10°C higher than the current temperature of the container. Allow the unit to go into heat mode, reach the temperature set point and maintain for 10-15 minutes.

   c. Power the unit off. Allow the unit to cool to ambient temperature.

   d. Connect the ground wire from the insulation tester to a fixed ground point, preferably the ground plate in the control box.

   e. At the load side of the heater contactor, check the insulation resistance to ground.

   If readings are > 1 Mohm, then the heaters are operating properly and no action is needed.

   If readings are < 1 Mohm, then the faulty heater needs to be identified. Proceed to step 3 for units with a heater access panel or step 4 for units without a heater access panel.
3. Identify the faulty heater(s) for units with a heater access panel:

   a. Open the access panel and cut out all wire splices to isolate all heaters inside of the unit.

   b. Repeat the Megger test on each individual heater. Connect the ground clip to the outer metal sheath of the heater and the test clip to one of the wires from the same heater.

   c. Replace any heater where the readings are < 1 Mohm.
4. Identify the faulty heater(s) for units without a heater access panel:

   a. Remove all six connections from the Heater (HR) contactor load side, which splits the six heaters into three separate pairs.

   b. Identify the following three wires: DHTL, DHML, DHBL. There is one from each load connection.

   c. Repeat the Megger test on each pair of heaters to identify the faulty heater pair. Connect the ground clip from the insulation tester to a fixed ground point on the unit, preferably the ground plate in the control box. Connect the test clip to one of the wires stated above.

   d. Test all three wires and replace any heater pair that has readings < 1 Mohm.
5. If the unit is loaded, and the heater can not be immediately replaced, perform the following steps:

   a. Identify the wire at the opposite end of the faulty heater pair: DHTL - DHTR, DHML - DHMR, DHBL - DHBR.

   b. Isolate the two wires.

   c. Reconnect the remaining good wiring pairs to their original connections.

   d. The unit will fail the PTI test P1-0 at the next pre-trip inspection. Repair action can be taken at that time.
6. If the unit is empty, replace the faulty heater:

⚠ WARNING

Before servicing the unit, make sure the circuit breakers (CB-1 & CB-2) and start-stop switch (ST) are in the OFF position and the power plug is disconnected.

   a. With the heater pair identified, remove the upper back panel inside the container.

   b. Identify the center point connection for the heater pair (black wiring from heaters) either against the unit back wall or in the wiring loom.

c. Cut the splice to separate the two heaters.

d. Carry out a Megger check on the two heaters in the same way as for units with heater panel. Replace any heater where the Megger readings are < 1 Mohms.

NOTE

If all heaters are above the acceptable limit with the wiring disconnected, then this indicates that the fault was in one or more of the wire splices that were removed.

e. Remove the hold-down clamp securing the heater(s) to the coil.

f. Verify that the heaters are not hot before handling them.

g. Lift the bent end of the heater (with the opposite end down and away from the coil). Move the heater to the side enough to clear the heater end support and remove.

h. To install heater, reverse steps.

i. Reconnect all wiring using new splices and heat shrink where needed. The heat shrink MUST have a 'melt-able' liner to ensure that the connections are properly sealed when shrunk. This can be seen as a 'Ring' of melt liner pushed from under the heat shrink at each end of the shrink tube.

NOTE

Failure to use melt liner heat shrink allows moisture to 'wick' up under the heat shrink and cause a leakage path.

7.15 Evaporator Fan and Motor Assembly

The evaporator fans circulate air throughout the container by pulling air in the top of the unit. The air is forced through the evaporator coil where it is either heated or cooled and then discharged out the bottom of the refrigeration unit into the container. The fan motor bearings are factory lubricated and do not require additional grease.

7.15.1 Replacing the Evaporator Fan Assembly

⚠ WARNING

Always turn OFF the unit circuit breakers (CB-1 & CB-2) and disconnect main power supply before working on moving parts.

1. Remove access panel by removing mounting bolts and TIR locking device. Reach inside of unit and remove the Ty-Rap securing the wire harness loop. Disconnect the connector by twisting to unlock and pulling to separate.
2. Loosen four 1/4-20 clamp bolts that are located on the underside of the fan deck at the sides of the fan assembly. Slide the loosened clamps back from the fan assembly.
3. Slide the fan assembly out from the unit and place on a sturdy work surface.

7.15.2 Disassemble the Evaporator Fan Assembly

1. Attach a spanner wrench to the two 1/4-20 holes located in the fan hub. Loosen the 5/8-18 shaft nut by holding the spanner wrench stationary and turning the 5/8-18 nut counter-clockwise (see **Figure 7.18**).
2. Remove the spanner wrench. Use a universal wheel puller and remove the fan from the shaft. Remove the washers and key.
3. Remove the four 1/4-20 x 3/4 long bolts that are located under the fan that support the motor and stator housing. Remove the motor and plastic spacer.

7.15.3 Assemble the Evaporator Fan Assembly

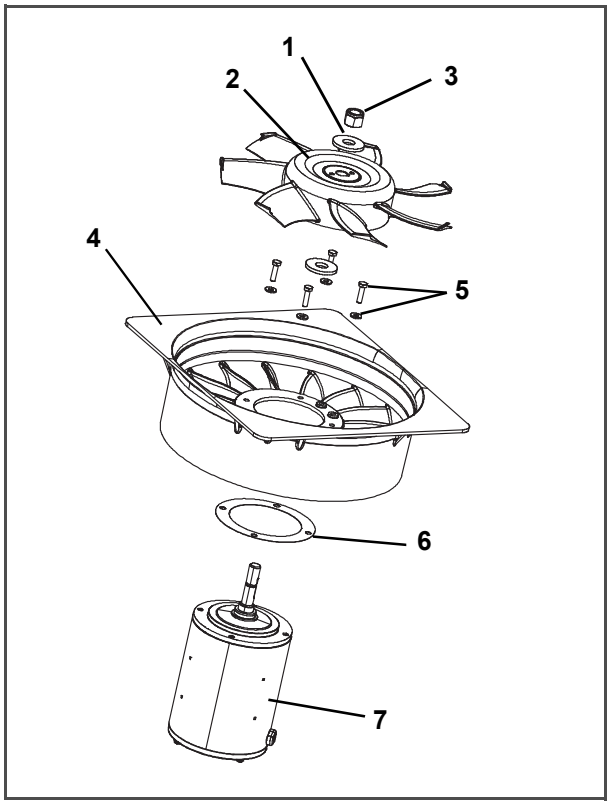
1. Assemble the motor and plastic spacer onto the stator.

NOTE

When removing the black nylon evaporator fan blade, care must be taken to assure that the blade is not damaged. In the past, it was a common practice to insert a screwdriver between the fan blades to keep it from turning. This practice can no longer be used, as the blade is made up of a material that will be damaged. It is recommended that an impact wrench be used when removing the blade. Do not use the impact wrench when reinstalling, as galling of the stainless steel shaft can occur.

2. Apply Loctite to the 1/4-20 x 3/4 long bolts and torque to 0.81 mkg (70 inch-pounds).
3. Place one 5/8 flat washer on the shoulder of the fan motor shaft. Insert the key in the keyway and lubricate the fan motor shaft and threads with a graphite-oil solution (such as Never-seez).
4. Install the fan onto the motor shaft. Place one 5/8 flat washer with a 5/8-18 locknut onto the motor shaft and torque to 40 foot-pounds.

Figure 7.18 Evaporator Fan Assembly



1. Washer
2. Fan
3. Nut
4. Stator
5. Screws, Washers
6. Protector
7. Motor

- - - - -

5. Install the evaporator fan assembly in reverse order of removal. Torque the four 1/4-20 clamp bolts to 0.81 mkg (70 inch-pounds). Connect the wiring connector.
6. Replace access the panel making sure that the panel does not leak. Make sure that the TIR locking device is lockwired.

7.16 Evaporator Section Cleaning

Containers and Container units that are exposed to certain fumigants may develop visible surface corrosion. This corrosion will show up as a white powder found on the inside of the container and on the reefer unit evaporator stator and fan deck.

Analyses by Carrier Transicold environmental specialists have identified the white powder as consisting predominantly of aluminum oxide. Aluminum oxide is a coarse crystalline deposit most likely the result of surface corrosion on the aluminum parts within the container. If left untreated over time, it may build up in thickness and eventually flake as a lightweight white powder.

The surface corrosion of aluminum is brought about by exposure to chemicals such as sulfur dioxide and possibly other fumigants that are commonly used for fumigation and protection of some perishable cargo such as grapes, for example. Fumigation is the process by which a chemical is released into an enclosed area to eliminate infestations of insects, termites, rodents, weeds and soil-born disease.

Typically any aluminum oxide that becomes detached from evaporator fan stators will be blown into the wet evaporator coil where it will be caught and then flushed out of the unit during routine defrost cycles. However, it is still highly recommended that after carrying cargo subject to fumigation procedures, that the inside of the unit be thoroughly cleansed prior to reuse.

Carrier Transicold has identified a fully biodegradable and environmentally safe alkaline cleaning agent (Tri-Pow'r® HD) for the unit. This will assist in helping to remove the corrosive fumigation chemicals and dislodging of the corrosive elements. This cleaner is available from the Carrier Transicold Performance Parts Group (PPG) and can be ordered through any of the PPG locations; Part Number NU4371-88. As a general safety precaution, before using this product, refer to and retain the Material Safety Data (MSDS) sheet.

Prior to Cleaning:

- Always wear goggles, gloves and work boots.
- Avoid contact with skin and clothing, and avoid breathing mists.
- When mixing, add water to the sprayer first, then the cleaner.
- ALWAYS provide for proper ventilation when cleaning indoor evaporator coils (rear doors must be open).
- Be aware of surroundings - food, plants, etc., and the potential for human exposure.
- Always read directions and follow recommended dilution ratios. More is not always better. Using non-diluted cleaner is not recommended.

Cleaning Procedure:

1. Remove the upper evaporator access panel inside of the unit.
2. Spray the surface with water before applying the cleaning solution. This helps the cleaner work better.
3. Liberally apply the prepared cleaner solution (5 parts water and 1 part cleaner).
4. Allow the cleaner to soak in for 5 to 7 minutes.
5. Assess area for rinsing. Follow all local regulations regarding disposal of waste water.
6. Thoroughly rinse the cleaner and surrounding area, floor, etc. When rinsing where heavy foaming solution is present, it is very important to take the time to thoroughly rinse the equipment and surroundings.
7. Always rinse the empty coil cleaner bottle, cap tightly and dispose of properly.

7.17 Thermostatic Expansion Valve

The thermostatic expansion valve (TXV) (see **Figure 3.2**) is an automatic device that maintains constant superheat of the refrigerant gas leaving the evaporator, regardless of suction pressure.

TXV functions are:

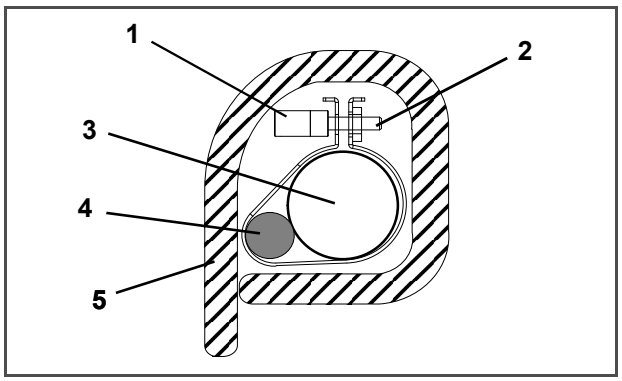
- Automatic control of the refrigerant flow to match the evaporator load.
- Prevention of liquid refrigerant entering compressor.

Unless the valve is defective, it seldom requires maintenance other than periodic inspection to ensure that the thermal bulb is tightly secured and properly insulated. See **Figure 7.19**.

NOTE

TXV Bulb Clamp is soldered to the suction line.

Figure 7.19 Thermostatic Expansion Valve Bulb



1. Thumbscrew
2. TXV Bulb Clamp
3. Suction Line
4. TXV Bulb
5. Foam Insulation

- - - - -

7.17.1 Checking Superheat

NOTE

Proper superheat measurement should be completed at -18°C (0°F) container box temperature where possible.

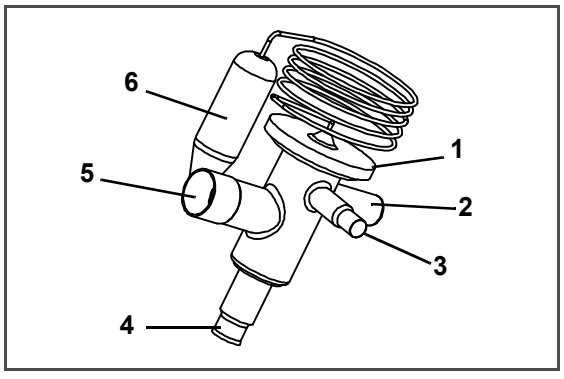
1. Open the upper right (EFM#1) access panel (see **Figure 3.1**) to expose the expansion valve.
2. Attach a temperature sensor near the expansion valve bulb and insulate. Make sure the suction line is clean and that firm contact is made with the sensor.
3. Connect an accurate gauge to the service port directly upstream of the suction modulating valve.
4. Set the temperature set point to -18°C (0°F) and run unit until conditions stabilize.
5. The readings may cycle from a high to a low reading. Take readings of temperature and pressure every three to five minutes for a total of 5 or 6 readings.
6. From the temperature/pressure chart (**Table**), determine the saturation temperature corresponding to the evaporator outlet test pressures at the suction modulation valve.
7. Subtract the saturation temperatures in step f from the temperatures measured in step e. The difference is the superheat of the suction gas. Determine the average superheat. It should be 4.5 to 6.7°C (8 to 12°F).

7.17.2 TXV Replacement

NOTES

1. The TXV is a hermetic valve, it does not have adjustable superheat (See **Figure 7.20**).
2. All connections on the hermetic TXV are bi-metallic, copper on the inside and stainless on the outside.
3. All joints on the hermetic TXV (inlet, outlet and equalizer lines) are brazed.
4. Bi-metallic connections heat up very quickly.

Figure 7.20 Thermostatic Expansion Valve



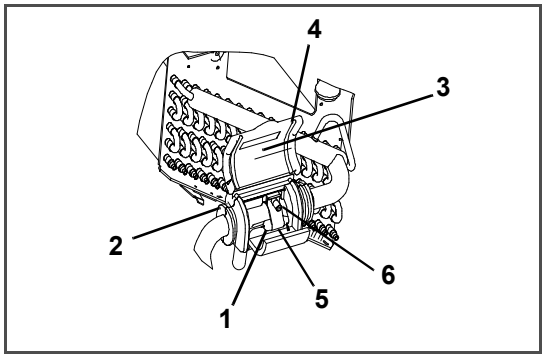
1. Hermetic Thermostatic Expansion Valve
2. Non-adjustable Superheat Stem
3. Equalizer Connection
4. Inlet Connection
5. Outlet Connection
6. Hermetic Expansion Valve Bulb

- - - - -

a. Removing the TXV:

1. Pump down the unit per **Section 7.4**.
2. If TXV replacement is to be performed from the front of the unit, open the upper right (EFM#1) access panel (see **Figure 3.1**) to remove evaporator fan motor.
3. Remove cushion clamp that secures the valve body to the bracket.
4. Unbraze the equalizer connection (1/4”), the outlet connection (5/8”), and then the inlet connection (3/8”). See **Figure 7.22**. Be careful to protect the insulation on the heaters and their wires.
5. Open the insulation flap. Flap is secured with Velcro (Item 3, **Figure 7.21**).
6. Loosen the thumb screw and slide the bulb, out by pulling it towards the front of the unit.

Figure 7.21 Hermetic Thermostatic Expansion Valve Bulb Location



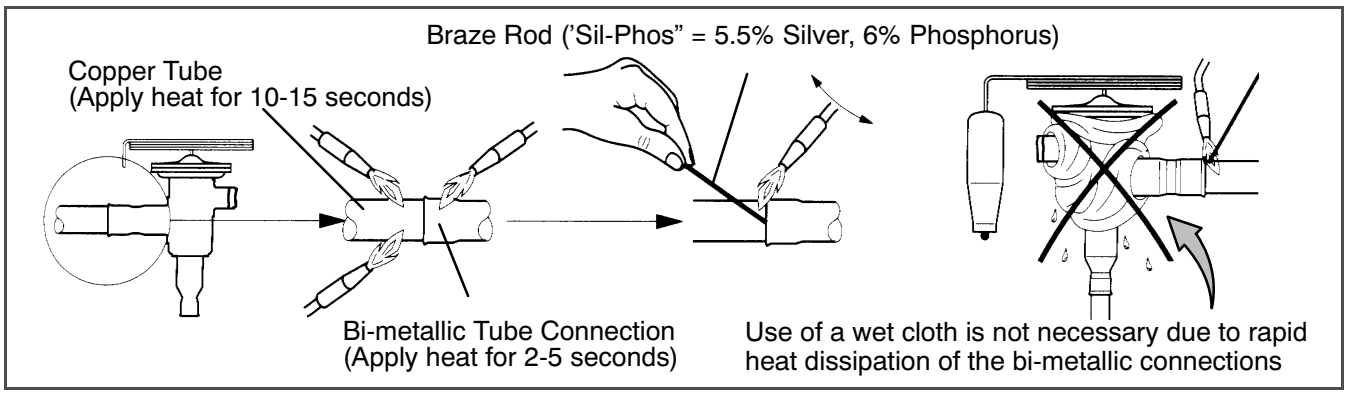
1. Hermetic Expansion Valve Bulb
2. Insulation
3. Insulation Flap
4. Velcro strip
5. Bulb Clamp
6. Thumb Screw

- - - - -

b. Installing the TXV

1. Braze inlet connection to inlet line (see **Figure 7.22**).
2. Braze outlet connection to outlet line.
3. Braze the equalizer connection to the equalizer line.
4. Reinstall the cushion clamp.
5. Thread the thermal bulb through the opening above the evaporator coil (see **Figure 3.2**), and slide it under the strap and secure the thumb screw. Close the insulation flap. Reinstall bulb access panel.
6. Check superheat (refer to step 7.16.1).

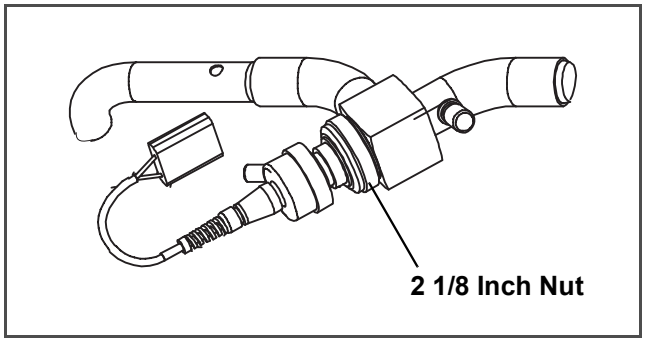
Figure 7.22 Hermetic Thermostatic Expansion Valve Brazing Procedure



7.18 Suction Modulation Valve

On start up of the unit, the SMV will reset to a known open position. This is accomplished by assuming the valve was fully open, driving it fully closed, resetting the percentage open to zero, then opening to a known 21% staging position.

Figure 7.23 Suction Modulation Valve (SMV)



7.18.1 Pre-Check Procedure

1. Check unit for abnormal operation.
2. Check charge. If refrigerant is low repair as required and again check operation.
3. If sufficient capacity cannot be maintained or unit is tripping excessively on high pressure switch (HPS) in high ambients, check coils and clean if required.
4. If capacity or control cannot be maintained, turn unit OFF, then back ON. This will reset the SMV in the event the controller lost communication with the valve, and may correct the problem.

NOTE

Carefully listen to the valve. During reset, the valve will make a ratcheting noise that may be heard or felt as it is attempting to close. If this can be heard or felt, it indicates that the controller and drive module are attempting to close the valve, and may serve as a quick indication that the drive module is in working order.

5. During the first few minutes of unit operation, compressor reliability enhancement logic (CREL) may be in effect. This places the valve at a 21% staging position and is sufficient to drive the temperature of the supply probe down several degrees during this interval.
6. After the CREL time-out has been met, the valve will start responding to the control logic and open or close relative to the demand. Scrutinize the unit operation for a few minutes. While in pulldown, the unit will open the SMV to a maximum discharge pressure of 325 psig in high ambient conditions, or as much as the current setting and control logic will allow. The current level should be high. A lower discharge pressure will be seen in lower ambient temperatures. Once the unit has reached set point, the SMV will go into control mode. Both the discharge/suction pressures, and current draw will go significantly lower. Once below set point, the suction pressure should go into a vacuum within several minutes. Should the operation differ as mentioned, the SMV, controller, or wiring, may be faulty.
7. Check for correct wire location at the stepper motor plug and the environmental connector (EC). Make sure that the wires terminate in accordance with the wire markings (addresses).
8. Attach a manifold gauge set (refer to **Section 7.2**). If the unit is operating in the perishable mode, proceed to step i. If the unit is operating in the frozen mode, proceed to step j.
9. Perishable operation: If the operation of the unit is in question, place the set point to approximately 6°C (11°F) less than the current box temperature, so the unit goes into pulldown. Run the unit for approximately one minute. Record readings on gauges and current draw. The current draw and pressures should go up. Place set point 0.5°C (0.9°F) above current box temperature to fully modulate valve, and run for approximately one minute.

NOTE

The unit may shut off for a short time. Wait until the unit self starts and sufficient time has elapsed to cause the valve to fully modulate. Record new gauge readings and current draw. The suction pressure should go into a vacuum and the current draw should have gone down. If little or no change to the suction pressure or current draw occurs, this is an indication of a malfunctioning SMV.

10. Frozen operation: In frozen mode the valve tends to stay open as much as possible. Again, this is dependent upon current limit setting and control logic. Turn the unit OFF and ON, as in the perishable mode, and watch the gauges. The valve will run at 21% open if CREL logic is active, and will open to maximum allowable after this. Depending on ambient conditions, there should be an increase in suction pressure and current draw as the valve opens. However, at times, this may be difficult to fully determine.
11. If the unit still does not operate properly, stop unit and proceed to the following step to check out the SMV system.

7.19 Valve Override Controls

Cd41 is a configurable function code that allows manual operation of the SMV valve for troubleshooting. Test sequences are provided in **Table 7–1**.

PCnt (% Setting - SMV Capacity Modulation) allows opening of the SMV to various percentages.

The Override Timer (tIM) selection is provided to enter a time period of up to five minutes, during which the override is active. If the timer is active, the valve override selection will take place immediately. If the timer is not active, changes will not take place for a few seconds after the timer is started. When the timer times out, override function is automatically terminated and the valve returns to normal machinery control. To operate the override, do the following:

1. Press the CODE SELECT key then press an ARROW key until Cd41 is displayed in the left window. The right window will display a controller communications code.
2. Press the ENTER key. The left display will show a test name alternating with the test setting or time remaining. Use an ARROW key to scroll to the desired test. Press the ENTER key and SELCt will appear in the left display.
3. Use an ARROW key to scroll to the desired setting, and then press the ENTER key. Selections are provided in the following table.
4. If the timer is not operating, follow the above procedure to display the timer. Use an ARROW key to scroll to the desired time interval and press ENTER to start the timer.
5. The above described sequence may be repeated during the timer cycle to change to another override.

Table 7–1 Valve Override Control Displays

Left Display	Controller Communication Codes (Right Display)	Setting Codes (Right Display)
Cd 41/SELCt	**tIM** (Override Timer)	**0 00** (0 minutes/0 Seconds) In 30 second increments to **5 00** (5 minutes/ 0 seconds)
	PCnt (% Setting - SMV Capacity Modulation)	**AUtO** (Normal Machinery Control) 0, 3, 6, 10, 25, 50, 100

7.19.1 Checking the Stepper Valve

a. Checking with ohmmeter

Stop the unit, disconnect the 4-pin connector to the stepper SMV. With a reliable digital ohmmeter, check the winding resistance. In normal ambient, the valve should have 72 to 84 ohms measured on the red/green (a-b terminals) and on the white/black (c-d terminals) leads. If an infinite or zero reading occurs, check connections and replace the motor. If near normal or normal reading occurs, proceed to step 7.18.2 to check out the controller.

b. Checking with SMA-12 portable stepper drive tester

The SMA-12 portable stepper drive tester (Carrier Transicold P/N 07-00375-00) is a battery-operated stepper drive that will open and close the SMV, allowing a more thorough check of the motor.

1. Stop the unit, disconnect the 4-pin connector from the stepper module to the valve (see **Figure 7.23**) and attach the SMA-12 stepper drive to the connector going to the valve.
2. Set the SMA-12 pulse per second (PPS) to one PPS and either open or close valve. Each LED should light sequentially until all four are lit. Any LED failing to light indicates an open on that leg, which indicates a poor connection or an open coil. Repair or replace as required to achieve proper operation.

3. Restart unit, set the step rate to 200PPS on SMA-12 for the valve, and close stepper valve while watching the suction gauge. Within one minute the suction pressure will go into a vacuum. This is an indication that the valve is moving.
4. If no change in suction pressure is detected, check for resistance, and check connections for proper continuity and retest. If the valve is functioning, and all connections and motor resistance are good, check the drive module.
5. If the valve is determined to be faulty after completing the above steps, perform a low side pump down. Remove valve powerhead assembly, and replace with a NEW valve powerhead assembly, torque nut to 35ft-lb, evacuate low side, and open all service valves.

⚠ CAUTION

DO NOT disassemble piston from NEW suction modulating valve powerhead assembly. Doing so may result in damage to piston.

7.19.2 Checking the Controller

1. Turn unit OFF.
2. With voltmeter set to read 20 volts DC, attach the positive lead to MC1 of the 4-pin connector and the negative lead to the TP9. Turn ON unit and watch the volt meter. After a short delay, the reading should remain unchanged at 0 volts. If 5VDC, make sure the jumper wire from MC1 to MC8 is in place; if not, install and retest.

7.19.3 SMV Emergency Repair Procedure

In the event of an SMV failure, and replacement components are not readily available, the system can be bypassed by removing the SMV valve piston. To remove the piston, do the following:

1. Perform a low side pump down (refer to **Section 7.4**).
2. Remove SMV powerhead by loosening the 2-1/8 inch diameter nut (see **Figure 7.23**) to relieve any pressure and then sliding the powerhead out.
3. Remove the piston by loosening the Allen screw and removing the piston and screw.
4. Install the powerhead assembly (without the piston) and torque to 35 to 40ft-lbs.
5. Open all valves.
6. Start the unit.
7. Adjust the suction service valve so that the approximate temperature OR current limit is maintained. For perishable loads, it is recommended that the adjustment be made so that the available capacity is slightly larger than the load. The unit will cycle OFF and ON.
8. Once repair parts become available, repair as required.

7.20 Autotransformer

If the unit does not start, check the following:

1. Make sure the 460VAC (yellow) power cable is plugged into the receptacle (item 3, **Figure 5.1**) and locked in place.
2. Make sure circuit breakers CB-1 and CB-2 are in the “ON” position. If the circuit breakers do not hold in, check voltage supply.
3. There is no internal protector for this transformer design; therefore, no checking of the internal protector is required.
4. Using a voltmeter and with the primary supply circuit ON, check the primary (input) voltage (460VAC). Next, check the secondary (output) voltage (230VAC). The transformer is defective if output voltage is not available.

7.21 Controller

7.21.1 Handling Controller

⚠ CAUTION

Do not remove wire harnesses from circuit boards unless you are grounded to the unit frame with a static safe wrist strap or equivalent static drain device.

⚠ CAUTION

Remove the controller module and unplug all connectors before performing any arc welding on any part of the container.

The guidelines and cautions provided herein should be followed when handling the Controller/DataCORDER module. These precautions and procedures should be implemented when replacing the module, when doing any arc welding on the unit, or when service to the refrigeration unit requires handling and removal of the controller.

1. Obtain a grounding wrist strap (Carrier Transicold P/N 07-00304-00) and a static dissipation mat (Carrier Transicold P/N 07-00304-00). The wrist strap, when properly grounded, will dissipate any potential electro-static buildup on the body. The dissipation mat will provide a static-free work surface on which to place and/or service the controller.
2. Disconnect and secure power to the unit.
3. Place strap on wrist and attach the ground end to any exposed unpainted metal area on the refrigeration unit frame (bolts, screws, etc.).
4. Carefully remove the controller, refer to **Section 7.21.4**. Do not touch any of the electrical connections if possible. Place the module on the static mat.
5. The strap should be worn during any service work on the controller, even when it is placed on the mat.

7.21.2 Controller Troubleshooting

A group of test points (TP) (see **Figure 7.24**) are provided on the controller for troubleshooting electrical circuits (see schematic diagram, **Section 8**). A description of the test points follows:

NOTE

Use a digital voltmeter to measure AC voltage between TPs and ground (TP9), except for TP8.

TP 1 - NA

TP 2 - This test point enables the user to check if the internal protector for the compressor motor (IP-CP) or high pressure switch is open.

TP 3 - This test point enables the user to check if the water pressure switch (WP) contact is open or closed.

TP 4 - This test point enables the user to check if the internal protector for the condenser fan motor (IP-CM) is open or closed.

TP 5 - This test point enables the user to check if the internal protectors for the evaporator fan motors (IP-EM1 or IP-EM2) are open or closed.

TP 6 - This test point enables the user to check if the controller water tank heater relay (TQ) is open or closed.

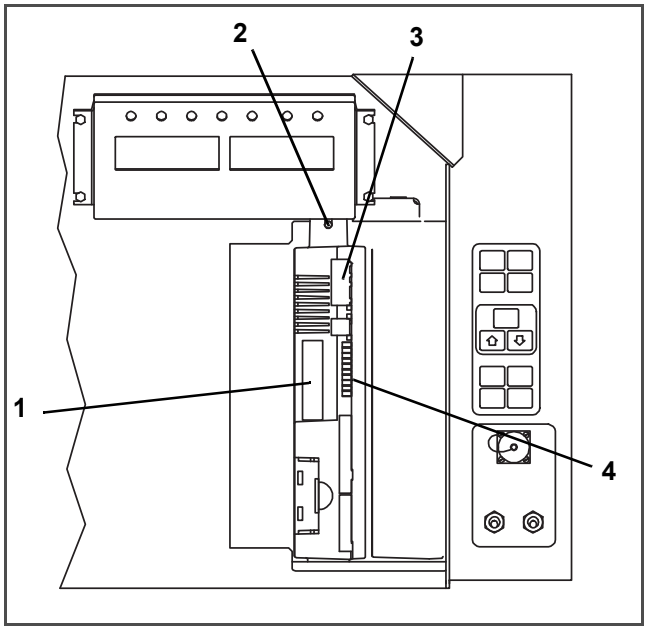
TP 7 - This test point is not used in this application.

TP 8 - This test point is not applicable to the units covered herein.

TP 9 - This test point is the chassis (unit frame) ground connection.

TP 10 - This test point enables the user to check if the heat termination thermostat (HTT) contact is open or closed.

Figure 7.24 Controller Section of the Control Box



1. Controller Software Programming Port
2. Mounting Screw
3. Controller
4. Test Points

- - - - -

7.21.3 Controller Programming Procedure

To load new software into the module, the programming card (PCMIA) is inserted into the programming/ software port.

⚠ CAUTION

The unit must be OFF whenever a programming card is inserted or removed from the controller programming port.

Loading Operational Software:

1. Turn unit OFF via start-stop switch (ST).
2. Insert software/programming card containing the following (example) files into the programming/software port (see **Figure 7.24**):

   menuDDMM.ml3 - This file allows the user to select a file/program to upload into the controller.

   cfYYMMDD.ml3 - Multi-configuration file.
3. Turn unit ON via start-stop switch (ST).
4. The display module will display the message ruN COnFG. If a defective card is being used, the display will blink the message “bAd CArd.” Turn start-stop switch OFF and remove the card.
5. Press the UP or DOWN arrow key until display reads, LOAd 51XX for Recip.
6. Press the ENTER key on the keypad. The display will alternate to between PrESS EntR and rEV XXXX.
7. Press the ENTER key on the keypad.
8. The display will show the message “Pro SoFt”. This message will last for up to one minute.
9. Press the ENTER key on the keypad.
10. The display module will go blank briefly, then read “Pro donE” when the software is loaded. If a problem occurs while loading the software, the display will blink the message “Pro FAIL” or “bad 12V.” Turn start-stop switch OFF and remove the card.
11. Turn unit OFF via start-stop switch (ST).
12. Remove the programming card from the programming/ software port and return the unit to normal operation by placing the start-stop switch in the ON position.

13. Turn power on and wait 15 seconds. The status LED will flash quickly and there will be no display. The controller is loading the new software into memory. This takes about 15 seconds.

    When complete the controller will reset and power up normally.

14. Wait for default display - setpoint on the left and control temperature on the right.
15. Confirm software is correct using keypad code select 18 to view Cd18 XXXX.
16. Turn power off. Operational software is loaded.

Loading Configuration Software:

1. Turn unit OFF using start-stop switch (ST).
2. Insert software/programming PCMCIA card containing the following (example) files into the programming/ software port (see **Figure 7.24**):

   menuDDMM.ml3 - This file allows the user to select the file/program to upload into the controller.

   cfYYMMDD.ml3 - Multi-configuration file.

   recp54XX.ml3 - Controller software program for recip units.

3. Turn unit ON using start-stop switch (ST).
4. The display module will display the message ruN COnFG. If a defective card is being used, the display will blink the message “bAd CArd.” Turn start-stop switch OFF and remove the card.
5. Press the ENTER key on the keypad.
6. The display module will go blank briefly and then display “541 00.” Based on the operational software installed.
7. Press the UP or DOWN ARROW key to scroll through the list to obtain the proper model dash number. (If a defective card is being used, the display will blink the message “bAd CArd.” Turn start-stop switch OFF and remove the card.)
8. Press the ENTER key on the keypad.
9. When the software loading has successfully completed, the display will show the message “EEPrM donE.” (If a problem occurs while loading the software, the display will blink the message “Pro FAIL” or “bad 12V.” Turn start-stop switch OFF and remove the card.)
10. Turn unit OFF using start-stop switch (ST).
11. Remove the programming card from the programming/ software port and return the unit to normal operation by placing the start-stop switch in the ON position.
12. Confirm correct model configuration using the keypad to choose code select 20 (CD20). The model displayed should match the unit serial number plate.

7.21.4 Removing and Installing the Controller

Two different replacement controllers are available:

1. Re-manufactured - Controller is the equivalent of a new OEM controller and is supplied with a 12 month warranty.
2. Repaired - Controller has had previous faults repaired and upgraded with the latest software.

NOTE

Repaired controllers are NOT to be used for warranty repairs. Only full OEM re-manufactured controllers are to be used.

Replacement controllers will be factory equipped with the latest version of operational software, but will NOT be configured for a specific model number and will need to be configured at the time of installation or sale.

a. Removal:

1. Disconnect all front wire harness connectors and move wiring out of way.
2. The lower controller mounting is slotted. Loosen the top mounting screw (see **Figure 7.24**) and lift up and out.

3. Disconnect the two back connectors (EC) and remove module.
4. When removing the replacement controller from its packaging, note how it is packaged. When returning the old controller for service, place it in the packaging in the same manner as the replacement. The packaging has been designed to protect the controller from both physical and electrostatic discharge damage during storage and transit.

b. Installation:

Install the module by reversing the removal steps.

Torque values for mounting screws (item 2, see **Figure 7.24**) are 0.23mkg (20 inch-pounds). Torque value for the connectors is 0.12mkg (10 inch-pounds).

7.21.5 Battery Replacement

Standard Battery Location (Standard Cells):

1. Turn unit power OFF and disconnect power supply.
2. Slide bracket out and remove old batteries. (See **Figure 4.4**, Item 8.)
3. Install new batteries and slide bracket into control box slot.

⚠ CAUTION

Use care when cutting wire ties to avoid nicking or cutting wires.

Standard Battery Location (Rechargeable Cells):

1. Turn unit power OFF and disconnect power supply.
2. Disconnect battery wire connector from control box.
3. Slide out and remove old battery and bracket. (See **Figure 4.4**, Item 8.)
4. Slide new battery pack and bracket into the control box slot.
5. Reconnect battery wire connector to control box and replace wire ties that were removed.

Secure Battery Option (Rechargeable Cells Only):

1. Turn unit power OFF and disconnect power supply.
2. Open control box door and remove both the high voltage shield and clear plastic rain shield (if installed).
3. Disconnect the battery wires from the “KA” plug positions 14, 13, 11.
4. Using Driver Bit, Carrier Transicold part number 07-00418-00, remove the 4 screws securing the display module to the control box. Disconnect the ribbon cable and set the display module aside.

NOTE

The battery wires must face toward the right.

5. Remove the old battery from the bracket and clean bracket surface. Remove the protective backing from the new battery and assemble to the bracket. Secure battery by inserting the wire tie from the back of the bracket around the battery, and back through the bracket.
6. Reconnect the ribbon cable to display and re-install the display.
7. Route the battery wires from the battery along the display harness and connect the red battery wire and one end of the red jumper to “KA14,” the other end of the red jumper wire to “KA11,” and the black wire to “KA13.”
8. Replace wire ties that were removed.

7.22 Temperature Sensor Service

Service procedures for service of the return recorder, return temperature, supply recorder, supply temperature, ambient, defrost temperature, compressor discharge and compressor suction temperature sensors are provided in the following sub paragraphs.

7.22.1 Ice Bath Preparation

The ice-water bath is a method for testing the accuracy of sensors by submerging the sensors in an insulated container with ice cubes or chipped ice, then filling voids between ice with water and agitating until mixture reaches 0°C (32°F) measured on a laboratory thermometer.

Notes:

- Wherever possible, use a thermometer that is regularly calibrated by an accredited test lab. Contact your instrument representative if the reference thermometer is not showing correct readings.
- Always use a temperature measurement reference instrument which is of higher accuracy than the device checked – for e.g., a thermometer with a rated accuracy of +/- 0.2 °C should be used to check a device with a rated accuracy +/- 0.3 °C.
- A thermally insulated container, tub open to atmosphere and large enough to contain crushed ice and water should be used. The tub should be large enough to contain the unit's sensor and the reference thermometer.
- Enough distilled water should be available to make ice cubes and to set up a proper and stable ice-water triple-point mixture. Prepare ice using distilled water.
- Pre-cool distilled water for testing.

Procedure:

1. Prepare a mixture of clean ice using distilled water in a clean insulated container. If possible, the person handling should be wearing latex gloves.
   a. Crush or chip the ice to completely fill the container. The finer the ice particles, the more accurate the mixture.
   b. Add enough pre-cooled distilled water to fill the container.
   c. Stir the mixture for a minimum of 2 minutes to ensure water is completely cooled and good mixing has occurred.
   d. The mixture should generally contain about 85% ice with the distilled water occupying the rest of the space.
   e. Add more ice as the ice melts.
2. Stir the ice water slurry mixture to maintain a temperature 0°C (32°F).
3. Constantly monitor the temperature of the ice water slurry with your reference thermometer. Ensure that the temperature of the bath has stabilized. The criterion for stability generally is to take two readings at 1 minute intervals, and the two readings should give you 0°C (32°F).

7.22.2 Sensor Checkout Procedure

To verify that accuracy of a temperature sensor:

1. Remove the sensor from the bracket and place in a 0°C (32°F) ice-water bath. The ice-water bath is prepared by filling an insulated container (of sufficient size to completely immerse bulb) with ice cubes or chipped ice, then filling voids between ice with water and agitating until mixture reaches 0°C (32°F) measured on a laboratory thermometer.
2. Start unit and check sensor reading on the control panel. The reading should be 0C (32F). If the reading is correct, reinstall sensor; if it is not, continue with the following:
3. Turn unit OFF and disconnect power supply.
4. Refer to **Section 7.21** and remove controller to gain access to the sensor plugs.
5. Using the plug connector marked "EC," that is connected to the back of the controller, locate the sensor wires (RRS, RTS, SRS, STS, AMBS, DTS, CPDS OR CPSS as required). Follow those wires to the connector and using the pins of the plug, measure the resistance. Values are provided in **Table 7–2** or **Table 7–3**.

   Due to the 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 defective, the resistance reading will usually be much higher or lower than the resistance values given.

Table 7–2 Sensor Resistance - AMBS, DTS, ETS, RRS, RTS, SRS, STS

°C	°F	OHMS		°C	°F	OHMS
-40	-40	336,500		6	42.8	24,173
-39	-38.2	314,773		7	44.6	23,017
-38	-36.4	294,600		8	46.4	21,922
-37	-34.6	275,836		9	48.2	20,886
-36	-32.8	258,336		10	50	19,900
-35	-31	242,850		11	51.8	18,975
-34	-29.2	228,382		12	53.6	18,093
-33	-27.4	214,164		13	55.4	17,258
-32	-25.6	200,909		14	57.2	16,466
-31	-23.8	188,545		15	59	15,715
-30	-22.0	177,000		16	60.8	15,002
-29	-20.2	166,360		17	62.6	14,325
-28	-18.4	156,426		18	64.4	13,683
-27	-16.6	147,148		19	66.2	13,073
-26	-14.8	138,478		20	68	12,494
-25	-13	130,374		21	69.8	11,944
-24	-11.2	122,794		22	71.6	11,420
-23	-9.4	115,702		23	73.4	10,923
-22	-7.6	109,063		24	75.2	10,450
-21	-5.8	102,846		**25**	**77**	**10,000**
-20	-4	97,022		26	78.8	9,572
-19	-2.2	91,563		27	80.6	9,164
-18	-0.4	86,445		28	82.4	8,777
-17	1.4	81,644		29	84.2	8,407
-16	3.2	77,139		30	86	8,055
-15	5	72,910		31	87.8	7,720
-14	6.8	68,938		32	89.6	7,401
-13	8.6	65,206		33	91.4	7,096
-12	10.4	61,699		34	93.2	6,806
-11	12.2	58,401		35	95	6,529
-10	14	55,330		36	96.8	6,265
-9	15.8	52,381		37	98.6	6,013
-8	17.6	49,634		38	100.4	5,772
-7	19.4	47,047		39	102.2	5,543
-6	21.2	44,610		40	104.0	5,323
-5	23	42,314		41	105.8	5,114
-4	24.8	40,149		42	107.6	4,914
-3	26.6	38,108		43	109.4	4,723
-2	28.4	36,182		44	111.2	4,540
-1	30.2	34,365		45	113	4,365
0	**32**	**32,650**		46	114.8	4,198
1	33.8	31,030		47	116.6	4,038
2	35.6	29,500		48	118.4	3,885
3	37.4	28,054		49	120.2	3,739
4	39.2	26,688		50	122	3,599
5	41	25,396				

Table 7–3 Sensor Resistance - PrimeLINE CPDS

°C	°F	OHMS		°C	°F	OHMS
-40	-40	849,822		18	64.4	136,705
-38	-36.4	834,450		20	68.0	124,876
-36	-32.8	819,079		22	71.6	114,101
-34	-29.2	803,707		24	75.2	104,352
-32	-25.6	788,336		**25**	**77**	**100,000**
-30	-22.0	772,964		26	78.8	95,585
-28	-18.4	757,593		28	82.4	87,619
-26	-14.8	742,221		30	83.0	80,447
-24	-11.2	726,849		32	89.6	73,931
-22	-7.6	711,478		34	93.2	68,000
-20	-4.0	696,106		36	96.8	62,599
-18	-0.4	680,735		38	100.4	57,657
-16	3.2	665,363		40	104.0	53,200
-14	6.8	649,992		42	107.6	49,117
-12	10.4	620,224		44	111.2	45,367
-10	14.0	563,722		46	114.8	41,965
-8	17.6	507,219		48	118.4	38,840
-6	21.2	450,717		50	122.0	35,991
-4	24.8	403,140		52	125.6	33,369
-2	28.4	365,427		54	129.2	30,967
0	**32.0**	**327,715**		56	132.8	28,753
2	35.6	295,834		58	136.4	26,733
4	39.2	267,922		60	140.0	24,867
6	42.8	241,618		62	143.6	23,152
8	46.4	219,659		64	147.2	21,570
10	50.0	198,927		66	150.8	20,827
12	53.6	180,987		68	154.4	20,112
14	57.2	164,687		70	158.0	18,768
16	60.8	149,680		72	161.6	16,375

7.22.3 GDP Supply and Return Sensor Calibration

European Commission GDP (Good Distribution Practices) guidelines, which are used worldwide, call for the equipment used to control or monitor environments where medicinal products are stored or transported be calibrated in accordance with pharmaceutical shipper specifications, typically every six months or annually.

This procedure explains how to perform a GDP calibration of the supply (STS/SRS) and return (RTS/RRS) sensors using DataLINE software version 3.1 or higher. The calibration procedure should be conducted in pairs (STS/SRS, or RTS/RRS) and it is recommended to calibrate before the full pre-trip inspection.

⚠ WARNING

Before removing the Supply or Return air sensors from the unit, turn the ON/OFF switch and circuit breaker to the OFF position. Disconnect the power plug from the unit. Follow proper lockout/tagout procedures to ensure the power cannot inadvertently be energized. It is important that all dismantling work is done and tools and personnel are away from the unit before powering on the unit for calibration.

⚠ WARNING

When performing the Return Air Sensor calibration, disconnect both evaporator motors.

Before proceeding with the calibration procedure, ensure that controller software version is 5368 or higher and DataLINE version 3.1 or higher is installed onto the download device. Only the latest DataLINE and controller software will allow users to carry out Good Distribution Practice (GDP) calibration. Do not downgrade the software after installing the latest software.

Before proceeding with the calibration procedure, it is recommended to check the sensors by running pre-trip P5-0. This test checks the sensor values. If the test fails, identify and correct the faulty sensor and rerun the test.

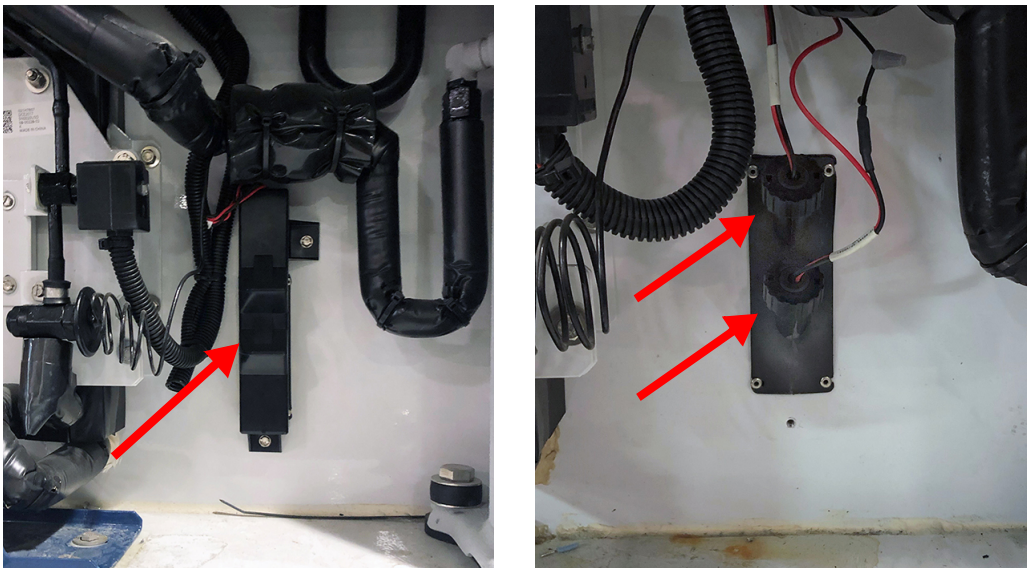
Tools Required:

- Socket screwdrivers set
- Phillips screwdriver
- Standard hand tools
- Interrogator cable
- Laptop with DataLINE 3.1 or above installed
- Clean insulated container for distilled water and ice
- A regularly calibrated reference thermometer, recommended to be of accuracy up to 2 decimal place.

GDP Calibration, Removing Supply Sensors (STS/SRS) from Unit:

1. Locate the supply sensors cover assembly on the suction side of the compressor. Remove the two fasteners securing the cover of the sensors (see **Figure 7.25**).
2. Remove the cover and rotate the supply air sensors, STS/SRS, in a clockwise direction and remove the sensors from the sensor housing (see **Figure 7.25**).

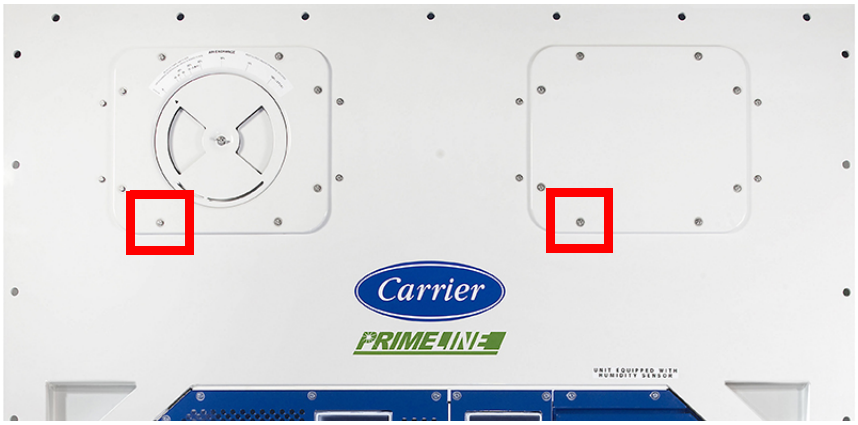
Figure 7.25 Supply Sensors - Cover Assembly and Sensors



GDP Calibration, Removing Return Sensors (RTS/RRS) from Unit:

1. Remove both front access panels from the unit by removing 8 fasteners from each panel (see **Figure 7.26**). Save all hardware for re-installation.

Figure 7.26 Removing Front Access Panels

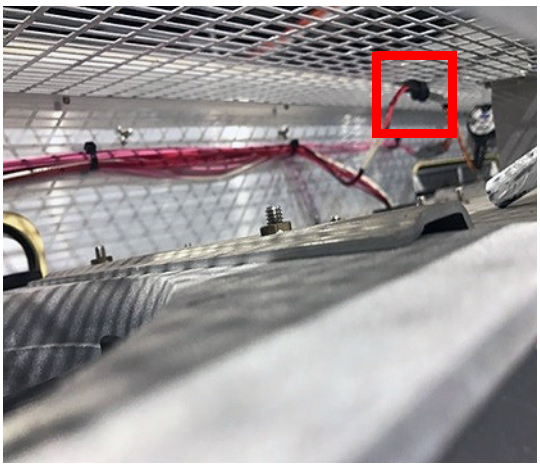


2. On the right side, disconnect the fan motor wiring, loosen the fastener and remove (slide) the evaporator motor from the unit (see **Figure 7.27**).

Figure 7.27 Removing Evaporator Motor

3. Loosen the fastener on the sensor bracket (see **Figure 7.28**).

Figure 7.28 Return Sensors - Bracket



4. Cut all the wire ties (see **Figure 7.29**) that are securing the sensors to the harness and remove sensor.

Figure 7.29 Return Sensors - Cutting Wire Ties

GDP Calibration, Perform Calibration:

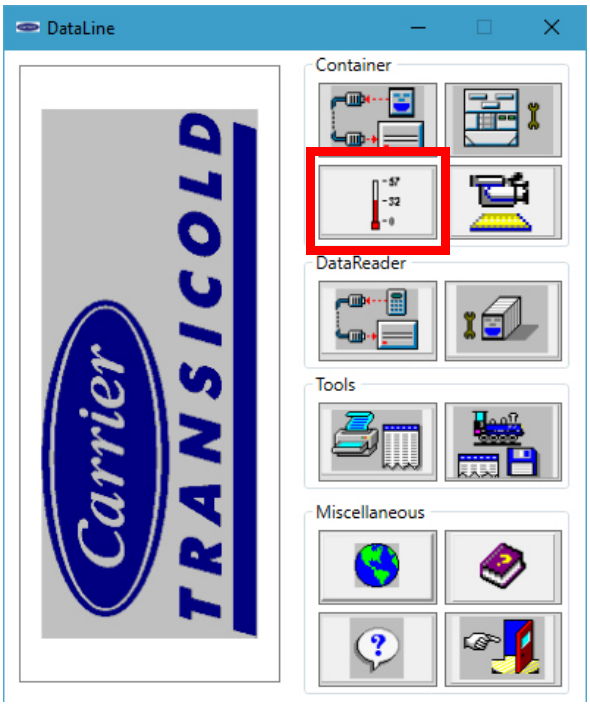
1. Connect the interrogator cable to the interrogator port. Then, power on the unit.

⚠ WARNING

Before powering on the unit, it is important to ensure that all dismantling work is done and tools are away and service personnel are not working on the unit at the time of power on.

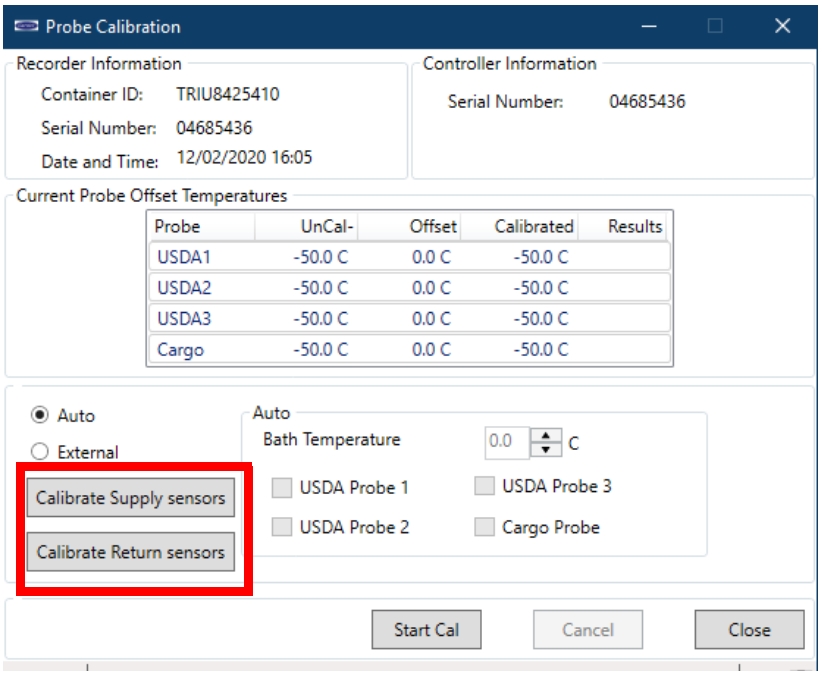
2. Open DataLINE version 3.1 or above. From the DataLINE launch pad, click on the Probe Calibration button (see **Figure 7.30**) to go to the Probe Calibration screen. A pop-up window will appear reminding the user to ensure proper ice bath temperature. Click OK to acknowledge.

Figure 7.30 DataLINE - Probe Calibration



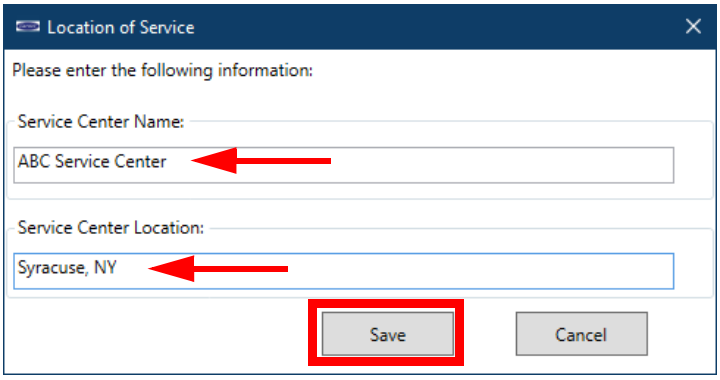
3. On the Probe Calibration screen, click on the Calibrate Supply sensors or Calibrate Return sensors button (see **Figure 7.31**).

Figure 7.31 DataLINE - Calibrate Sensors Button



4. A Location of Service pop-up window will appear (see **Figure 7.32**). In the appropriate fields, enter the Service Center Name and Service Center Location where the calibration is being performed. Then, click the Save button. A pop-up window will appear reminding the user to ensure proper ice bath temperature. Click OK to acknowledge and remember to maintain the Ice bath at 0°C (32°F).

Figure 7.32 DataLINE - Enter Service Center Information

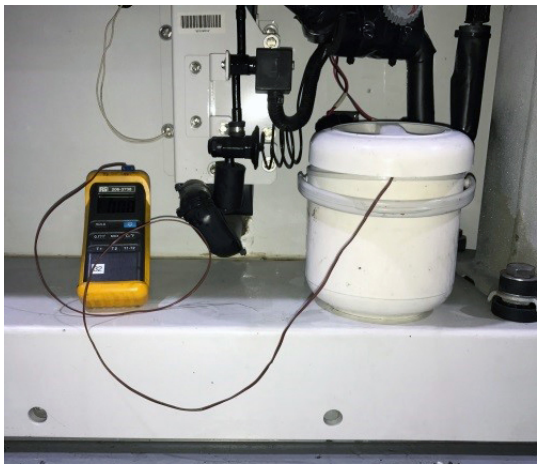


5. Prepare the ice bath. Refer to the **Ice Bath Preparation** procedure.

   Ensure that the set-up (i.e. ice bath, sensors, reference thermometer) has reached a stable state before beginning the calibration process. Ensure that the set-up is clean and the reference thermometer is regularly maintained and calibrated.

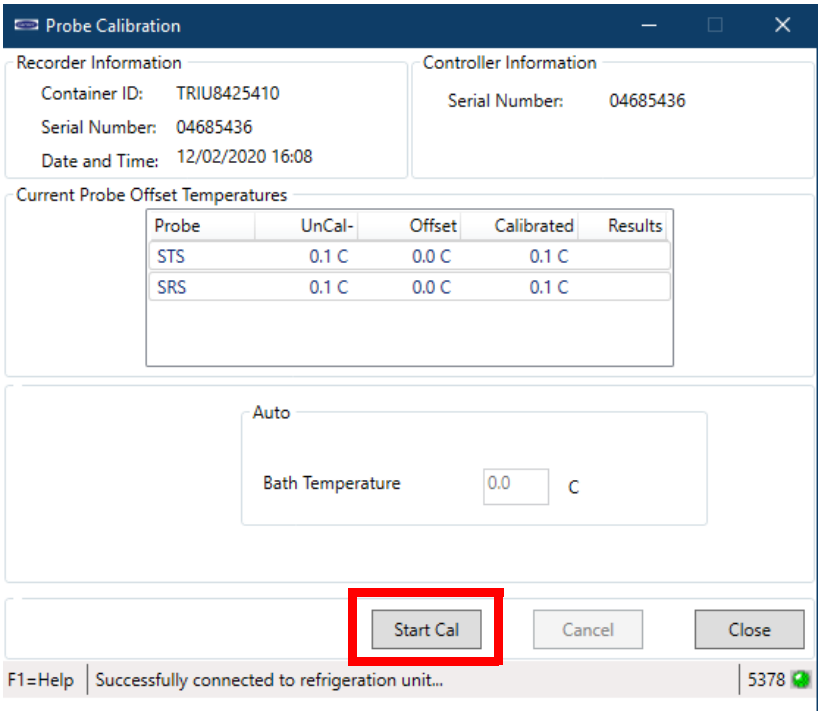
6. Place the ice bath in a location near sensors (see **Figure 7.33**). For Return Sensors, place the ice bath on an elevated platform (ladder) of appropriate height.

Figure 7.33 Ice Bath



7. Once temperature stability is ensured, submerge the sensors in the ice water slurry. Make certain that the sensors do not contact the container sides or bottom, or each other. Continuously stir the slurry mixture during calibration.
8. Ensure that the Ice bath is at 0°C (32°F) using the calibrated reference thermometer. Confirm that the sensor readings have stabilized and the sensors are within +/- 0.3°C (0.5°F). The readings can be taken from the Uncal column in the Current Probe Offset Temperatures table.
9. Then, after confirming the sensor readings have stabilized, click on the Start Cal button (see **Figure 7.34**). After clicking Start Cal, the process begins automatically and will complete in less than 5 minutes. Continue to stir the ice bath during testing. Calibration will fail if the stability cannot be achieved or the sensor offset is greater than 0.3°C (0.5°F).

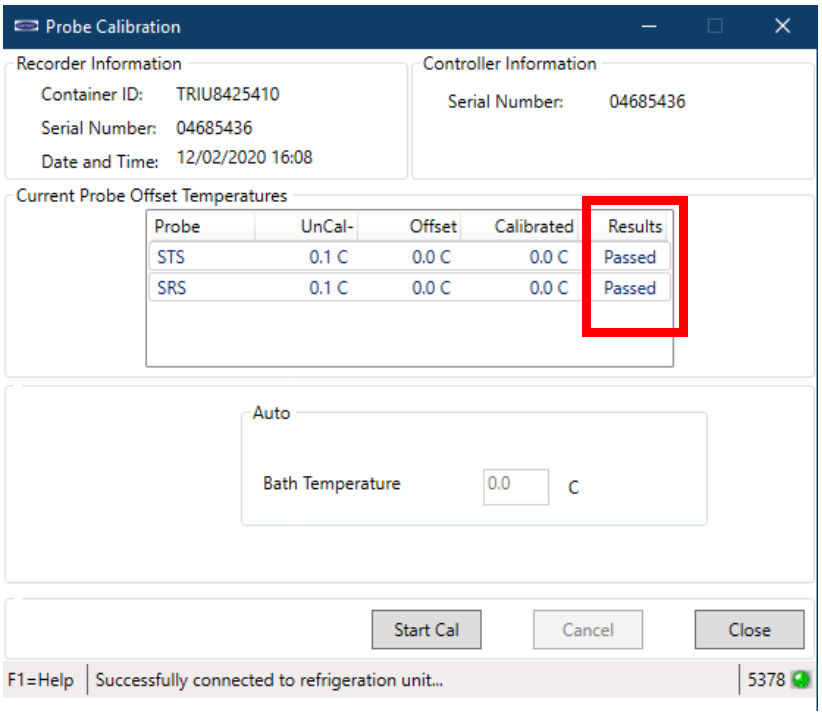
Figure 7.34 DataLINE - Start Cal Button



10. Once the calibration has completed, a pop-up will appear with the message Calibrate Complete. Click OK to acknowledge and the results will then be displayed on the screen in the Results column (see **Figure 7.35**).

    Calibration will fail if the stability cannot be achieved or the sensor offset is greater than 0.3°C (0.5°F). The validity of a sensor can be checked by hand warming the sensors to see if there are changes in the readings on the DataLINE screen. If calibration will not complete, replace and recalibrate the sensors. Refer to the **Sensor Replacement** procedure.

Figure 7.35 DataLINE - Calibration Results



11. After completing the calibration event, download a DCX file and check that all of the following information is captured: service center name, location, the results of the calibration and the offset applied. Ensure that all the information is captured and the event is considered a success when all the intended sensors in calibration have passed.

NOTE

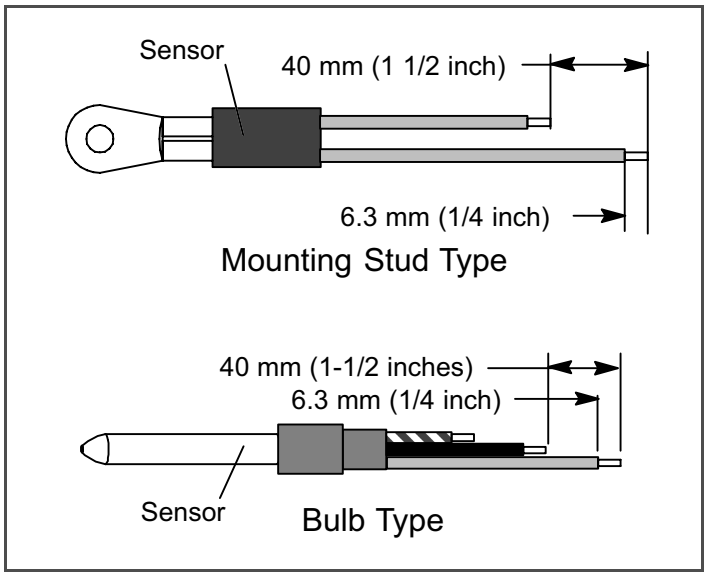
If there is “uncal” in the download, it means that the calibration process was not completed.

After the completion of the calibration, restore the unit to its original state.

7.22.4 Sensor Replacement

1. Turn unit power OFF and disconnect power supply.
2. For two wire sensors, cut cable 5cm (2 inches) from shoulder of defective sensor and discard the defective sensor only. For 3-wire sensors, cut at 23cm (9 inches). Slide the cap and grommet off well mounted sensor and save for possible reuse. Do not cut the grommet.
3. If required, prepare the replacement sensor by cutting sensor wire(s) back 40mm (1-1/2 inch). For 3-wire sensors, the black wire should be cut at the middle length and the red/white wire cut to the shorter length (See **Figure 7.36**).
4. Prepare the cables by cutting wires to the opposite of the sensor (See **Figure 7.37**).

Figure 7.36 Sensor Types



When installing a single wire color two wire sensor, cut one wire of existing two wire cable 40mm (1-1/2 inch) shorter than the other wire.

When replacing two single sensors with a combination (3-wire) sensor, the black wires of the cables should be cut to the same length and the red wire of one cable cut to the shorter length.

When replacing a original 3-wire sensor, cut the black wire to the middle length and the red wire to the shorter length.

5. Strip back insulation on all wiring 6.3mm (1/4 inch).
6. Slide a large piece of heat shrink tubing over the cable, and place small pieces of heat shrink tubing, one over each wire, before adding crimp fittings as shown in **Figure 7.37**.
7. If required, slide the cap and grommet assembly onto the replacement sensor. If the replacement sensor is of a larger diameter than the original, a different grommet may be required.
8. Slip crimp fittings over dressed wires (keeping wire colors together). Make sure wires are pushed into crimp fittings as far as possible and crimp with crimping tool.
9. Solder spliced wires with a 60% tin and 40% lead Rosincore solder.
10. Slide heat shrink tubing over splice so that ends of tubing cover both ends of crimp as shown in **Figure 7.37**.
11. Heat tubing to shrink over splice. Make sure all seams are sealed tightly against the wiring to prevent moisture seepage.
12. Slide large heat shrink tubing over both splices and shrink.

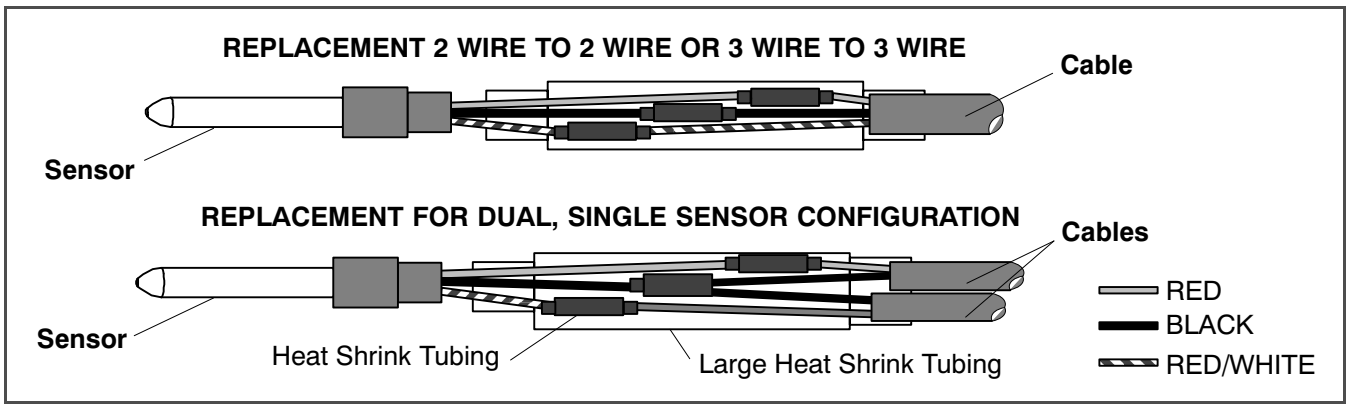
⚠ CAUTION

Do not allow moisture to enter wire splice area as this may affect sensor resistance. m.Reinstall sensor, refer to Section 7.22.5.

NOTE

The P5 Pre-Trip test must be run to inactivate probe alarms (refer to **Section 5.9**).

Figure 7.37 Sensor and Cable Splice



7.22.5 Sensor Re-Installation

a. Sensors STS/SRS

To properly position a supply sensor, the sensor must be fully inserted into the probe holder. This positioning will give the sensor the optimum amount of exposure to the supply air stream, and will allow the Controller to operate correctly. Insufficient probe insertion into the probe holder will result in poor temperature control due to the lack of air flow over the sensor.

It is also necessary to ensure that the probe tip does not contact the evaporator back panel. The design minimum clearance of 6mm (1/4 inch) should be maintained (see **Figure 7.38**).

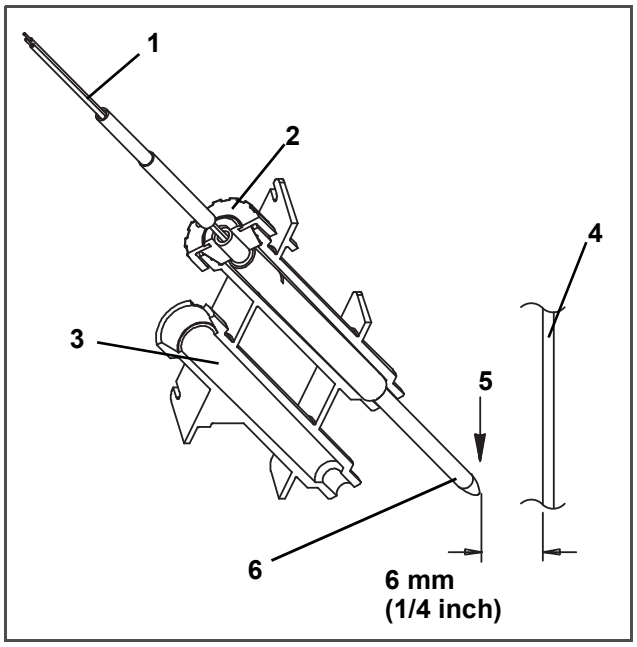
b. Sensor RTS/RRS

Reinstall the return sensor as shown in **Figure 7.39**. For proper placement of the return sensor, be sure to position the seal section of the sensor against the side of the mounting clamp.

c. Sensor DTS

The DTS sensor must have insulating material placed completely over the sensor to insure the coil metal temperature is sensed.

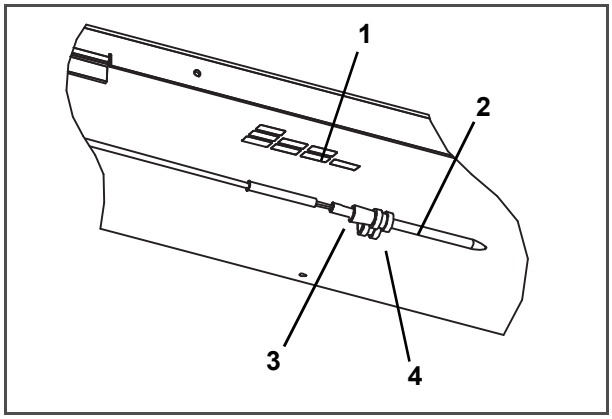
Figure 7.38 Supply Sensor Positioning



1. Sensor Wires
2. Cap and Grommet Assembly
3. Probe Holder
4. Evaporator Back Panel
5. Supply Air Stream
6. Supply Sensor

- - - - -

Figure 7.39 Return Sensor Positioning



1. Evaporator Grille
2. Combination Sensor (Mount in either Clamp)
3. Seal
4. Mounting Clamp

- - - - -

7.23 Vent Position Sensor (VPS)

The vent position sensor (VPS) determines the position of the fresh air vent in near real-time via the Cd45. The fresh air VPS alarm (AL50) will occur if the sensor reading is not stable for five minutes or if the sensor is outside of its valid range (shorted or open). This can occur if the vent is loose or the panel is defective. To confirm a defective panel, assure that the wing nut is secure and then power cycle the unit.

The alarm should immediately go inactive. Check the four-minute stability requirement. If the alarm reoccurs after the four minutes and the panel was known to have been stable, then the panel should be replaced. If the alarm immediately reappears as active, the panel should be replaced.

To replace the VPS, the panel must be removed and replaced with another upper fresh air panel equipped with VPS.

Upon installation, a new VPS assembly requires calibration as follows:

1. Rotate the vent to the 0CMH/CFM position.
2. Code select Cd45 will automatically be displayed. Press the Enter key and hold for five seconds.
3. After the enter key has been pressed, the display will read CAL (for calibration).
4. Press the ALT MODE key and hold for five seconds.
5. After the calibration has been completed, Cd45 will display 0 CMH / CFM.

7.24 eAutoFresh Service

Procedures and technical information related to the eAutoFresh™ venting system can be found in the **T-342 eAutoFresh Manual**, located in the Literature section of the Container Refrigeration website. To find the manual from the Literature section, click on Options > eAutoFresh

7.25 XtendFRESH Service

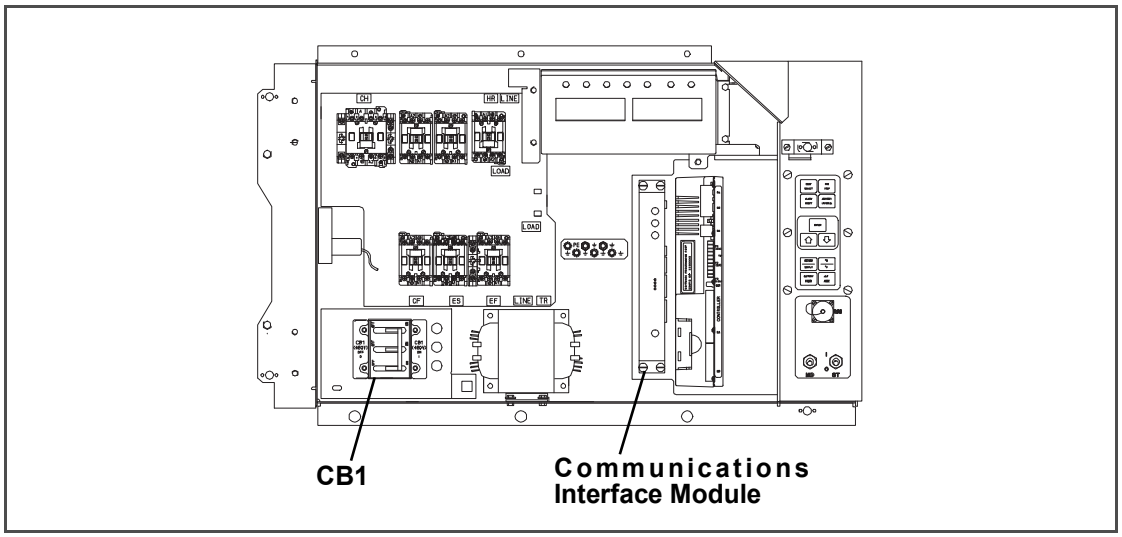
Procedures and technical information related to the XtendFRESH™ controlled atmosphere system can be found in the **T-366 XtendFRESH Manual**, located in the Literature section of the Container Refrigeration website. To find the manual from the Literature section, click on Options > XtendFRESH.

7.26 Maintenance of Painted Surfaces

The refrigeration unit is protected by a special paint system against the corrosive atmosphere in which it normally operates. However, should the paint system be damaged, the base metal can corrode. In order to protect the refrigeration unit from the highly corrosive sea atmosphere or if the protective paint system is scratched or damaged, clean area to bare metal using a wire brush, emery paper, or equivalent cleaning method. Immediately following cleaning, spray or brush on zinc-rich primer. After the primer has dried, spray or brush on finish coat of paint to match original unit color.

7.27 Communications Interface Module Installation

Figure 7.40 Communications Interface Installation



Units with communication interface module provision have the required wiring installed. The provision wiring kit (part number 76-00685-00), includes three pre-addressed wires installed between the circuit breaker and communication interface module locations. These wires are to be connected to the module and circuit breaker to allow the module to communicate over the power system.

7.27.1 Installing the Module

WARNING

The unit power plug must be disconnected to remove power from circuit breaker CB1

1. CB1 is connected to the power system, see wiring schematic. Ensure that the unit power is off AND that the unit power plug is disconnected.
2. Open control box, see **Figure 7.40** and remove low voltage shield. Open high voltage shield.
3. Remove the circuit breaker panel, with circuit breaker, from the control box.
4. Locate wires CB21/CIA3, CB22/CIA5 and CB23/CIA7 that have been tied back in the wire harness. Remove the protective heat shrink from the ends of the wires.
5. Attach the three wires as addressed to the LOAD side of the circuit breaker.
6. Refit the circuit breaker panel.
7. Fit the new RMU into the unit.
8. Remove plugs CIA, CIB and CID from the wiring harness and attach to the module.
9. Replace the low voltage shield.

Table 7–4 Recommended Bolt Torque Values (Dry, Non-Lubricated for 18-8 Stainless Steel)

Bolt Diameter	Threads	In-Lb	Ft-Lb	N-m
Free Spinning				
#4	40	5.2	0.4	0.6
#6	32	9.6	0.8	1.1
#8	32	20	1.7	2.3
#10	24	23	1.9	2.6
1/4	20	75	6.3	8.5
5/16	18	132	11	14.9
3/8	16	240	20	27.1
7/16	14	372	31	42
1/2	13	516	43	58.3
9/16	12	684	57	77.3
5/8	11	1104	92	124.7
3/4	10	1488	124	168.1
Non Free Spinning (Locknuts etc.)				
1/4	20	82.5	6.9	9.3
5/16	18	145.2	12.1	16.4
3/8	16	264	22.0	29.8
7/16	14	409.2	34.1	46.2
1/2	13	567.6	47.3	64.1
9/16	12	752.4	62.7	85
5/8	11	1214.4	101.2	137.2
3/4	10	1636.8	136.4	184.9

Table 7–5 Wear Limits For Compressors

Part Name	Factory Maximum		Factory Minimum		Maximum Wear Before Repair	
	inches	mm	inches	mm	inches	mm
MAIN BEARING						
Main Bearing Diameter	1.6268	41.3207			.0020	0.0508
Main Bearing Journal Diameter			1.6233	41.2318	.0020	0.0508
PUMP END						
Main Bearing Diameter	1.3760	34.9504			.0020	0.0508
Main Bearing Journal Diameter			1.3735	34.8869	.0020	0.0508
CONNECTING ROD	1.3768	34.9707			.0020	0.0508
Piston Pin Bearing			0.6878	17.4701	.0010	0.0254
CRANKPIN DIAMETER			1.3735	34.8869	.0025	0.0635
Throw	1.072	27.2288	1.070	27.1780		
THRUST WASHER (Thickness)	0.154	3.9116	0.1520	03.8608	.0250	0.6350

Table 7–5 Wear Limits For Compressors

Part Name	Factory Maximum		Factory Minimum		Maximum Wear Before Repair	
	inches	mm	inches	mm	inches	mm
CYLINDERS						
Bore	2.0010	50.8254			.0020	0.0508
Piston (Diameter)			1.9860	50.4444	.0020	0.0508
Piston Pin (Diameter)			0.6873	17.4574	.0010	0.0254
Piston Ring Gap	0.013	00.3302	0.0050	00.1270	.0250	0.6350
Piston Ring Side Clearance	0.002	00.0508	0.0010	00.0254	.0020	0.0508

Table 7–6 Compressor Torque Values

Size Diameter (inches)	Threads Per Inch	Torque Range		Usage
		ft-lb	N.m	
1/16	27 (pipe)	8 - 12	11 - 16	Pipe Plug - Crankshaft
1/8	20 (pipe)	6 - 10	8 - 13	Oil Return Check Valve - Crankcase
1/4	20 (pipe)	20 - 25	27 - 34	Pipe Plug - Gauge Connection
1/4	20	10 - 12	13 - 16	Connecting Rod cap screw
1/4	28	12 - 15	16 - 20	Baffle Plate - Crankcase
		12 - 16	16 - 22	Side Shield
		6 - 10	8 - 13	Oil Pump Drive Segment
		12 - 16	16 - 22	Unloader Valve
5/16	18	16 - 20	2 - 27	Cover Plate - Plate End
				Bearing Head
				Terminal Block Cap Screws
		20 - 30	27 - 41	Suction Valve
				Discharge Valve
3/8	16	40 - 50	55 - 70	Pump End Bearing Head
				Bottom Plate - Crankcase Compressor Foot
				Cylinder Head
7/16	14	55 - 60	76 - 83	Motor End Cover - Crankcase
5/8	11	25 - 30	34 - 41	Crankshaft
5/8	18	60 - 75	83 - 103	Oil Bypass Plug - Crankcase
#10	32	4 - 6	5 - 8	Oil Pump Drive Segment
1-1/2	18 NEF	35 - 45	48 - 62	Oil Level Sight Glass
NEF - National Extra Fine				

Table 7–7 R-134a Refrigerant Pressure Temperature Chart

Note: Underline figures are inches of mercury vacuum

°F	°C	PSIG		°C	°F	BAR
-40	-40.0	14.8		-40	-40.0	-0.49
-38	-38.9	13.9		-39	-38.2	-0.46
-36	-37.8	13.0		-38	-36.4	-0.43
-34	-36.7	12.0		-37	-34.6	-0.40
-32	-35.6	10.9		-36	-32.8	-0.37
-30	-34.4	9.8		-35	-31.0	-0.34
-28	-33.3	8.7		-34	-29.2	-0.30
-26	-32.2	7.5		-33	-27.4	-0.27
-24	-31.1	6.3		-32	-25.6	-0.23
-22	-30.0	5.0		-31	-23.8	-0.20
-20	-28.9	3.7		-30	-22.0	-0.16
-18	-27.8	2.3		-29	-20.2	-0.12
-16	-26.7	0.8		-28	-18.4	-0.07
-14	-25.6	0.3		-27	-16.6	-0.03
-12	-24.4	1.1		-26	-14.8	0.02
-10	-23.3	1.9		-25	-13.0	0.06
-8	-22.2	2.8		-24	-11.2	0.11
-6	-21.1	3.6		-23	-9.4	0.16
-4	-20.0	4.6		-22	-7.6	0.22
-2	-18.9	5.5		-21	-5.8	0.27
0	-17.8	6.5		-20	-4.0	0.33
2	-16.7	7.5		-19	-2.2	0.39
4	-15.6	8.5		-18	-0.4	0.45
6	-14.4	9.6		-17	1.4	0.51
8	-13.3	10.8		-16	3.2	0.57
10	-12.2	11.9		-15	5.0	0.64
12	-11.1	13.1		-14	6.8	0.71
14	-10.0	14.4		-13	8.6	0.78
16	-8.9	15.7		-12	10.4	0.85
18	-7.8	17.0		-11	12.2	0.93
20	-6.7	18.4		-10	14.0	1.01
22	-5.6	19.9		-9	15.8	1.09
24	-4.4	21.3		-8	17.6	1.17
26	-3.3	22.9		-7	19.4	1.25
28	-2.2	24.5		-6	21.2	1.34
30	-1.1	26.1		-5	23.0	1.43
32	0.0	27.8		-4	24.8	1.53
34	1.1	29.5		-3	26.6	1.62

Table 7–7 R-134a Refrigerant Pressure Temperature Chart

Note: Underline figures are inches of mercury vacuum

°F	°C	PSIG		°C	°F	BAR
36	2.2	31.3		-2	28.4	1.72
38	3.3	33.1		-1	30.2	1.82
40	4.4	35.0		0	32.0	1.93
42	5.6	37.0		1	33.8	2.04
44	6.7	39.0		2	35.6	2.15
46	7.8	41.1		3	37.4	2.26
48	8.9	43.2		4	39.2	2.38
50	10.0	45.4		5	41.0	2.50
52	11.1	47.7		6	42.8	2.62
54	12.2	50.0		7	44.6	2.75
56	13.3	52.4		8	46.4	2.88
58	14.4	54.9		9	48.2	3.01
60	15.6	57.4		10	50.0	3.15
62	16.7	60.0		11	51.8	3.29
64	17.8	62.7		12	53.6	3.43
66	18.9	65.4		13	55.4	3.58
68	20.0	68.2		14	57.2	3.73
70	21.1	71.1		15	59.0	3.88
72	22.2	74.1		16	60.8	4.04
74	23.3	77.1		17	62.6	4.21
76	24.4	80.2		18	64.4	4.37
78	25.6	83.4		19	66.2	4.54
80	26.7	86.7		20	68.0	4.72
82	27.8	90.0		21	69.8	4.90
84	28.9	93.5		22	71.6	5.08
86	30.0	97.0		23	73.4	5.27
88	31.1	100.6		24	75.2	5.46
90	32.2	104.3		25	77.0	5.65
92	33.3	108.1		26	78.8	5.85
94	34.4	112.0		27	80.6	6.06
96	35.6	115.9		28	82.4	6.27
98	36.7	120.0		29	84.2	6.48
100	37.8	124.2		30	86.0	6.70
102	38.9	128.4		31	87.8	6.93
104	40.0	132.7		32	89.6	7.15
106	41.1	137.2		33	91.4	7.39
108	42.2	141.7		34	93.2	7.63
110	43.3	146.4		35	95.0	7.87
112	44.4	151.1		36	96.8	8.12

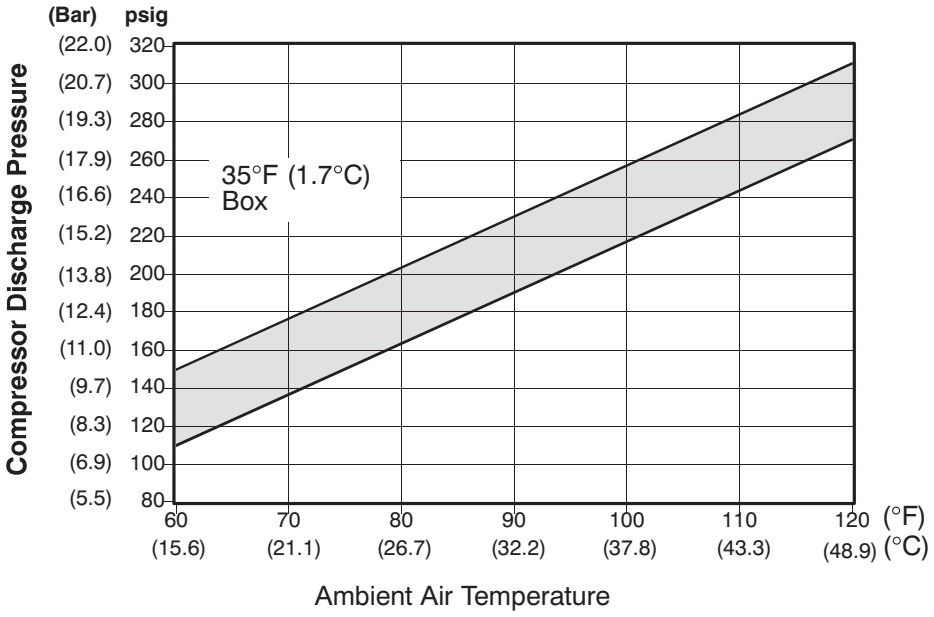
Table 7–7 R-134a Refrigerant Pressure Temperature Chart

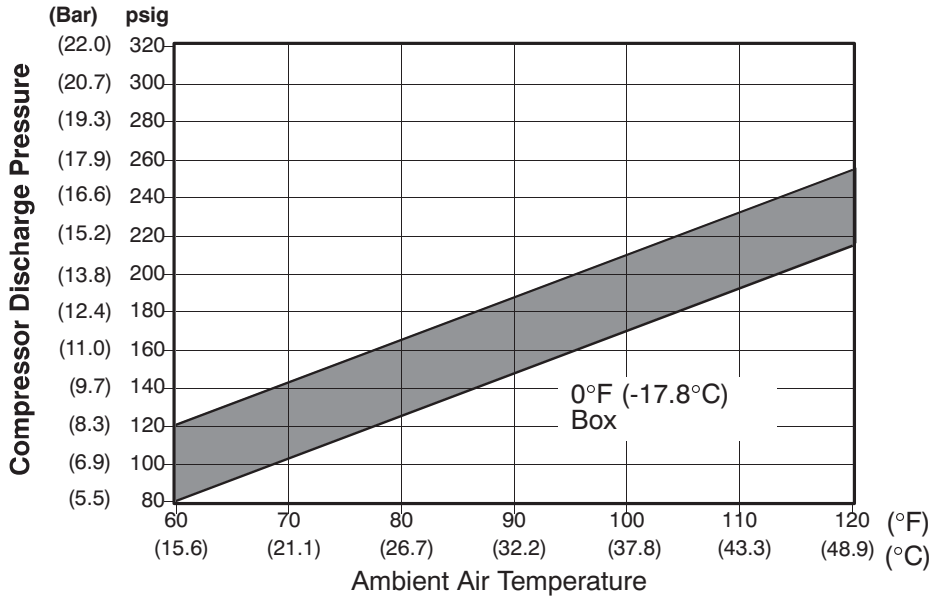
Note: Underline figures are inches of mercury vacuum

°F	°C	PSIG		°C	°F	BAR
114	45.6	156.0		37	98.6	8.37
116	46.7	160.9		38	100.4	8.63
118	47.8	166.0		39	102.2	8.90
120	48.9	171.2		40	104.0	9.17
122	50.0	176.5		41	105.8	9.44
124	51.1	181.8		42	107.6	9.72
126	52.2	187.4		43	109.4	10.01
128	53.3	193.0		44	111.2	10.30
130	54.4	198.7		45	113.0	10.60
132	55.6	204.6		46	114.8	10.90
134	56.7	210.6		47	116.6	11.21
136	57.8	216.7		48	118.4	11.53
138	58.9	222.9		49	120.2	11.85
140	60.0	229.2		50	122.0	12.18
142	61.1	235.7		51	123.8	12.51
144	62.2	242.3		52	125.6	12.85
146	63.3	249.0		53	127.4	13.20
148	64.4	255.9		54	129.2	13.56
150	65.6	262.9		55	131.0	13.92
				56	132.8	14.28
				57	134.6	14.66
				58	136.4	15.04
				59	138.2	15.42
				60	140.0	15.82
				61	141.8	16.22
				62	143.6	16.63
				63	145.4	17.04
				64	147.2	17.47
				65	149.0	17.90

Figure 7.41 R-134a Compressor Pressure and Motor Current Curves Vs. Ambient Temperature, Sheet 1

Note: Curves to be used as troubleshooting guide only for model series 69NT40 with fresh air makeup vent closed, unit powered on 460VAC/60Hz and SMV 100% open.





Compressor Discharge Pressure Versus Ambient Air Temperature at Stable Box Temperature

SECTION 8
ELECTRICAL WIRING SCHEMATIC AND DIAGRAMS

8.1 INTRODUCTION

This section contains the Electrical Schematics and Wiring Diagrams.

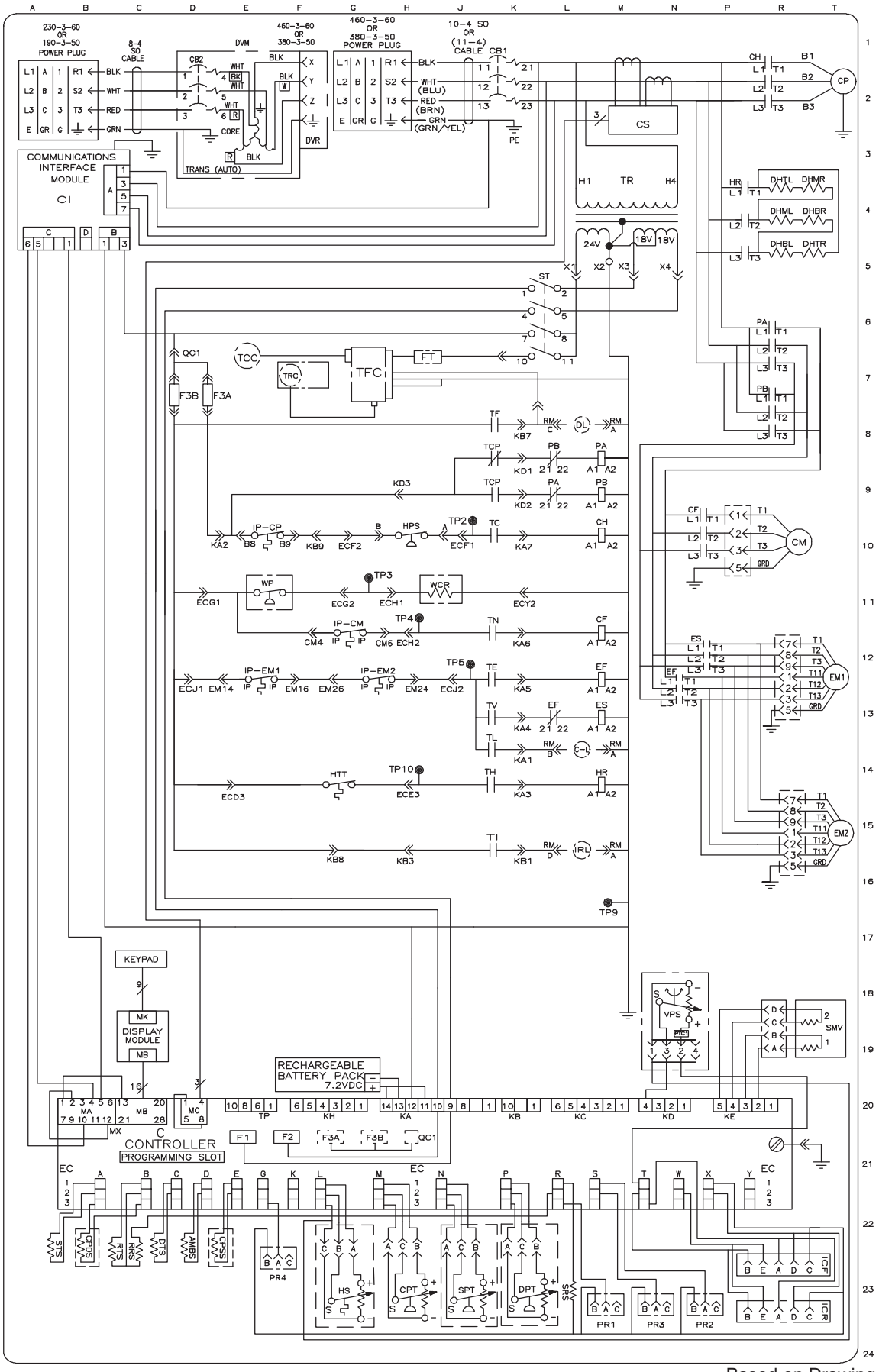
Figure 8.1 Legend

LEGEND

SYMBOL	DESCRIPTION
AMBS	AMBIENT SENSOR (D–22)
C	CONTROLLER (C–21)
CB1	CIRCUIT BREAKER – 460 VOLT (K–1)
CB2	OPTIONAL CIRCUIT BREAKER 230V (DVM OPTION) TERMINAL BLOCK WHEN CB2 NOT PRESENT (D–1)
CF	CONDENSER FAN CONTACTOR (L–11, N–9)
CI	COMMUNICATIONS INTERFACE MODULE (OPTION) (A–4)
CH	COMPRESSOR CONTACTOR (L–10, R–1)
C–L	COOL LIGHT (OPTION) (L–14)
CM	CONDENSER FAN MOTOR (G–11, R–10)
CP	COMPRESSOR MOTOR (E–10, T–2)
CPDS	COMPRESSOR DISCHARGE SENSOR (TEMP) (B–22)
CPSS	COMPRESSOR SUCTION SENSOR (TEMP) (OPTION), E–22
CPT	CONDENSER PRESSURE TRANSDUCER (H–23)
CS	CURRENT SENSOR (M–2)
DHBL	DEFROST HEATER – BOTTOM LEFT (R–5)
DHBR	DEFROST HEATER – BOTTOM RIGHT (T–4)
DHML	DEFROST HEATER – MIDDLE LEFT (R–4)
DHMR	DEFROST HEATER – MIDDLE RIGHT (T–3)
DHTL	DEFROST HEATER – TOP LEFT (R–3)
DHTR	DEFROST HEATER – TOP RIGHT (T–5)
DL	DEFROST LIGHT (OPTION) (L–8)
DPT	DISCHARGE PRESSURE TRANSDUCER (OPTION) (K–23)
DTS	DEFROST TEMPERATURE SENSOR (C–22)
DVM	DUAL VOLTAGE MODULE (OPTION) (E–1)
DVR	DUAL VOLTAGE RECEPTACLE (OPTION) (F–3)
EF	EVAPORATOR FAN CONTACTOR HIGH SPEED (M–12, N–12, L–13)
EM	EVAPORATOR FAN MOTOR (E–12, F–12, G–12, T–12, T–15)
ES	EVAPORATOR FAN CONTACTOR LOW SPEED (M–13, N–12)
F	FUSE (D–7, E–21, F–21, H–6)
FLA	FULL LOAD AMPS
HPS	HIGH PRESSURE SWITCH (H–10)
HR	HEATER CONTACTOR (L–14, P–3)
HS	HUMIDITY SENSOR (G–23)
HTT	HEAT TERMINATION THERMOSTAT (G–14)

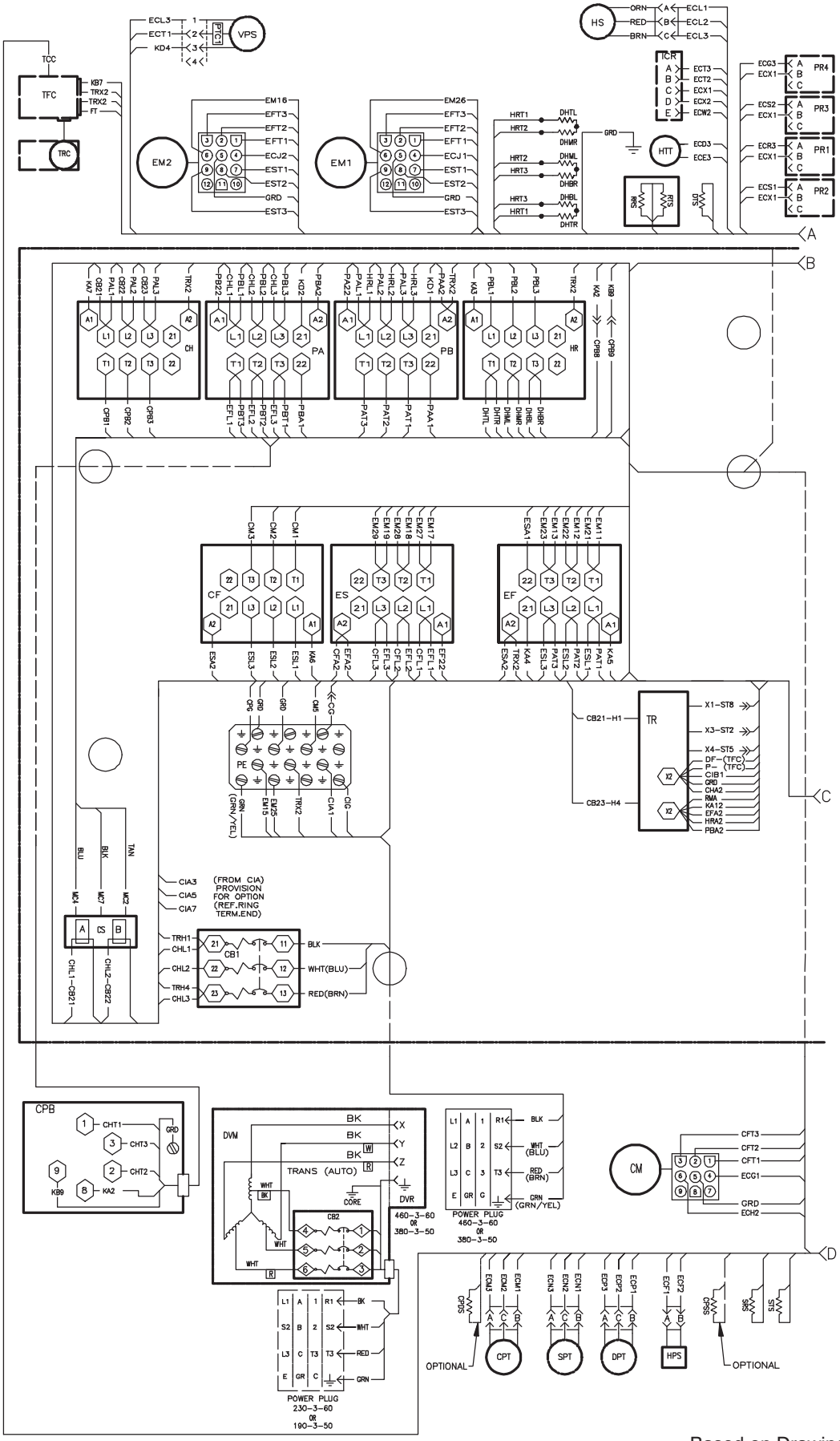
SYMBOL	DESCRIPTION
IC	INTERROGATOR CONNECTOR (OPTION) (T–23)
IP	INTERNAL PROTECTOR (E–10, E–13, G–13, G–12)
IRL	IN–RANGE LIGHT (OPTION) (M–16)
PA	CONTACTOR (K–9, L–8, R–6)
PB	CONTACTOR (K–8, L–9, R–7)
PR	PROBE RECEPTACLE (USDA OPTION) (F–22, M–23, N–23, P–23)
PTC1	PTC FOR VENT POSITION SENSOR (UPPER) (N–19)
RM	REMOTE MONITORING RECEPTACLE (OPTION) (L–13, K–13, K–16, L–16)
RRS	RETURN RECORDER SENSOR (OPTION) (C–22)
RTS	RETURN TEMPERATURE SENSOR (C–22)
SMV	STEPPER MOTOR SUCTION MODULATION VALVE (T–18)
SPT	SUCTION PRESSURE TRANSDUCER (OPTION) (J–23)
SRS	SUPPLY RECORDER SENSOR (L–23)
ST	START – STOP SWITCH (K–5)
STS	SUPPLY TEMPERATURE SENSOR (A–22)
TC	CONTROLLER RELAY–COOLING (K–10)
TCP	CONTROLLER RELAY – COMPRESSOR PHASE SEQUENCING (K–8, K–9)
TCC	TRANSFRESH COMMUNICATIONS CONNECTOR (OPTION) (E–7)
TE	CONTROLLER RELAY – HIGH SPEED EVAPORATOR FANS (K–12)
TH	CONTROLLER RELAY – HEATING (K–14)
TI	CONTROLLER RELAY – INRANGE RELAY (K–15)
TF	CONTROLLER RELAY – DEFROST (K–8)
TL	CONTROLLER RELAY – COOL LIGHT (K–13)
TN	CONTROLLER RELAY – CONDENSER FAN (K–11)
TP	TEST POINT (G–11, J–12, H–14, J–10, M–17, H–11)
TR	TRANSFORMER (M–3)
TRANS	TRANSFORMER AUTO 230/460 (OPTION) (D–3)
TRC	TRANSFRESH REAR CONNECTOR (OPTION) (F–7)
TV	CONTROLLER RELAY – LOW SPEED EVAPORATOR FANS (K–13)
VPS	VENT POSITION SENSOR (UPPER) (OPTION) (N–18)
WP	WATER PRESSURE SWITCH (OPTION) (E–11)
WCR	WETTING CURRENT RESISTOR (OPTION (J–11)

Figure 8.2 Schematic Diagram



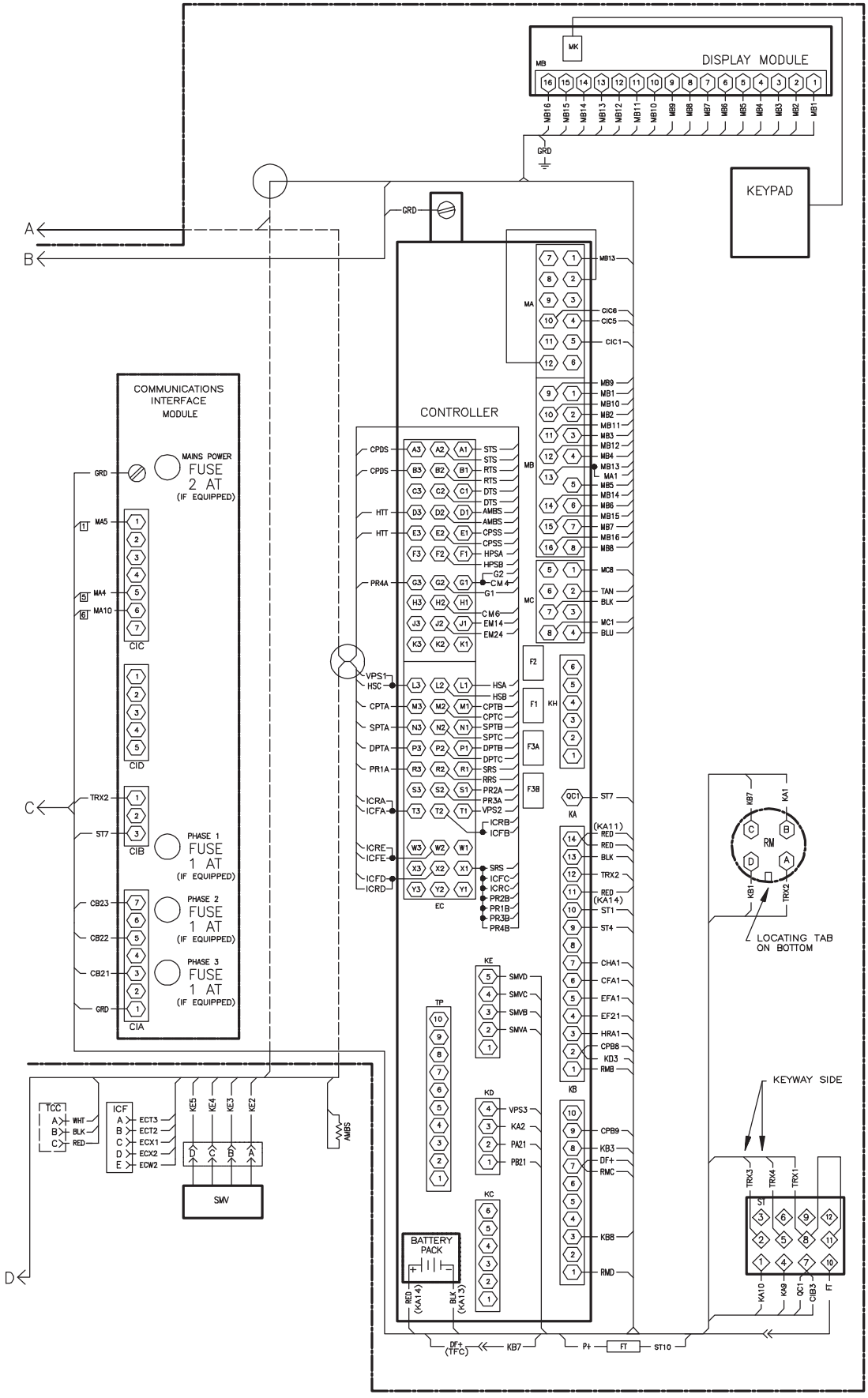
Based on Drawing 62–11730

Figure 8.3 Unit Wiring Diagram (Sheet 1 of 2)



Based on Drawing 62–11730

Figure 8.4 Unit Wiring Diagram (Sheet 2 of 2)



Based on Drawing 62–11730

SECTION 9

EU DECLARATION OF CONFORMITY

We, manufacturer: Carrier Transicold Pte Ltd
251 Jalan Ahmad Ibrahim
Singapore 629146

Declare, under our sole responsibility, that the ThinLINE Container Unit:

Model: 69NT40-541

is in conformity with the provisions of the following European Directives:

- "Machinery Directive 2006/42/EC following Annex VIII
- "Electromagnetic Compatibility Directive 2014/30/EU following Annex II

The assembly was assessed for applicability under the Pressure Equipment Directive, 2014/68/EU, but determined to be outside of the scope based on the exclusion indicated in PED Article 1, Paragraph 2.f. The assembly was determined to be no higher than PED Category I and is covered by the Machinery Directive 2006/42/EC.

The following Harmonized Standards were applied for this equipment:

Machinery Directive	EMC Directive
EN ISO 12100:2010	EN 61000-6-4:2007
EN 60204-1:2006	EN 61000-6-2:2005
EN 13857:2008	EN 55011:2009

The following Technical Standards were applied for this equipment:

- ISO 1496-2:2008

Person established in Europe authorized to compile a copy of the Technical File:

Shaun Bretherton
Service Engineering Manager of CTL Rotterdam
Pittsburgstraat 21 3047 BL Rotterdam
Netherlands

China RoHS per SJ/T 11364-2014

产品中有害物质的名称及含量

部件名称	有害物质					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr (VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
金属板部件	O	O	O	O	O	O
塑料部件	O	O	O	O	O	O
盘管组件	X	O	O	O	O	O
加热部件	O	O	O	O	O	O
马达，压缩机与风扇组件	X	O	O	O	O	O
温度控制微处理器系统	X	O	O	O	O	O
断路器与接触器	O	O	O	O	O	O
变压器	O	O	O	O	O	O
传感器	X	O	O	O	O	O
通讯组件	O	O	O	O	O	O
阀组件	X	O	O	O	O	O
电缆线/电源	O	O	O	O	O	O
电池	O	O	X	O	O	O
标签与绝缘材料	O	O	O	O	O	O
玻璃部件	X	O	O	O	O	O

本表格依据 SJ/T 11364 的规定编制。
O：表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。
X：表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。

INDEX

G

H

I

K

L

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