Container Refrigeration

OPERATIONS AND SERVICE MANUAL

For

PrimeLINE

69NT40-571-001 to 199

PrimeLINE ONE™

69NT40-575-001 to 199

Container Refrigeration Units

T-372 Rev C

Carrier
TRANSICOLD

OPERATIONS AND SERVICE MANUAL

For

PrimeLINE

69NT40-571-000 to 199

PrimeLINE ONE

69NT40-575-000 to 199

Container Refrigeration Units

 ● Printed in USA May 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. When working on refrigeration equipment, observe all potential Danger, Warning and Caution hazards, including those shown below and on hazard labels attached to the unit.

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 and 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, 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 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 CO_2 (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 - means an immediate hazard that WILL result in severe personal injury or death.

WARNING - means to warn against hazards or unsafe conditions that COULD result in severe personal injury or death.

CAUTION - means to warn against potential hazard or unsafe practice that could result in 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 (O_2) for leak testing or operating the product. Charge only with refrigerants R-134a or R-513A as specified for the unit model number: 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 the 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

Before disassembly of the compressor, be sure to relieve the internal pressure very carefully by slightly loosening the couplings to break the seal.

⚠ WARNING

Do not use a nitrogen cylinder without a pressure regulator.

⚠ WARNING

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

⚠ WARNING

Oakite No. 32 is an acid. Be sure that the acid is slowly added to the water. DO NOT PUT WATER INTO THE ACID - this will cause spattering and excessive heat.

⚠ WARNING

Wear rubber gloves and wash the solution from the skin immediately if accidental contact occurs. Do not allow the solution to splash onto concrete.

⚠ WARNING

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

⚠ WARNING

Installation requires wiring to the main unit circuit breaker, CB-1. Make sure the power to the unit is off and power plug disconnected before beginning installation.

⚠ CAUTION

When charging the unit with R-513A refrigerant, charge as a liquid only. R-513A is an azeotrope blend containing R-1234yf and R-134a. Charging or topping off as a vapor will result in an incorrect mixture of blend in the system.

⚠ CAUTION

Charge water-cooled condenser or receiver according to nameplate specifications to ensure optimal unit performance.

⚠ CAUTION

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

⚠ CAUTION

Unplug all controller module wire harness connectors before performing 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, economy, dehumidification and bulb mode will be deactivated. At the completion of pre-trip activity, economy, 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

Allowing the scroll compressor to operate in reverse for more than two minutes will result in internal compressor damage. Turn the Start-Stop switch OFF immediately.

⚠ CAUTION

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

⚠ CAUTION

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

⚠ CAUTION

The PrimeLINE unit has a hermetically sealed compressor that should not be opened and/or repaired. Doing so can cause a loss in performance and premature system failure due to the precision machinery and assembly required within the compressor. To repair the unit, remove the faulty compressor and replace with an approved Carrier compressor. If the return of the compressor is not required, follow local waste collection & recycling regulations in discarding the compressor.

⚠ CAUTION

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

⚠ CAUTION

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

⚠ CAUTION

Unplug all module 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

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

⚠ 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 PrimeLINE models 69NT40-571-000 to 199 are of lightweight aluminum frame construction, designed to be bolted onto the front of a container and serve as the container's front wall. Forklift pockets are provided for unit installation and removal.

The Carrier Transicold PrimeLINE ONE™ models 69NT40-575-000 to 199 are units of lightweight aluminum frame construction, designed to be directly installed on-site onto a welded front wall of a container.

Primeline units are self-contained, all electric units, which include cooling and heating systems to provide precise temperature control. The units are supplied with a complete charge of refrigerant and compressor lubricating oil, and are ready for operation upon installation.

The base unit operates on nominal 380/460 volt, 3-phase, 50/60 hertz (Hz) power. An optional autotransformer may be fitted to allow operation on nominal 190/230, 3-phase, 50/60 Hz power. Control system power 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 5 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 Refrigerant

PrimeLINE models 69NT40-571-000 to 099 and PrimeLINE ONE™ models 69NT40-575-000 to 099 are units designed to only be charged with R-134a refrigerant.

PrimeLINE models 69NT40-571-100 to 199 and PrimeLINE ONE™ models 69NT40-575-100 to 199 are R-513A-ready units. They are supplied with a complete charge of R-134a refrigerant. But, they are capable of being field converted to R-513A refrigerant at a later date as requested by the unit owner. R-513A is an azeotrope blend containing R-1234yf and R-134a. All information in this manual pertaining to R-513A is only applicable to 571-100 to 199 units or 575-100 to 199 units that have either been converted or are being converted to R-513A.

To convert a R-513A-ready unit to R-513A refrigerant, refer to procedure in Service **Section 7.8**.

2.3 Configuration Identification

Unit identification information is provided on a plate located on the back wall of the condenser section. 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 number provides information on specific optional equipment, factory provisioned to allow for field installation of optional equipment and differences in detailed parts.

2.4 Feature Descriptions

2.4.1 Control Box

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

2.4.2 Temperature Readout

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

2.4.3 Pressure Readout

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

2.4.4 Compressor

The unit is fitted with either an R-134a or an R-513A-ready scroll compressor equipped with suction and discharge service connections. To identify an R-513A-ready compressor in the field, a green dot is located on the top of the compressor on the DUV fitting.

2.4.5 Condenser Coil

The unit is fitted with a “C” shape condenser coil.

2.4.6 Evaporator

The evaporator section is equipped with an electronic expansion valve (EEV).

2.4.7 Evaporator Fan Operation

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

2.4.8 Plate Set

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

2.5 Option Descriptions

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

2.5.1 Battery

The refrigeration controller may be fitted with standard replaceable batteries or a rechargeable battery pack. Carrier-provided rechargeable batteries can be recharged via the ML5 controller and allow for wireless communication in battery mode. A non-carrier rechargeable 3-wire battery would charge but the controller will not monitor anything related to it. A standard 2-wire NiCAD battery would not charge.

NOTE

If ambient temperature is greater than 45 deg C, the carrier-provided rechargeable batteries will not charge.

2.5.2 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.

2.5.3 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.

2.5.4 Interrogator Receptacle

The unit has one external interrogator receptacle for connection of equipment for calibration. It is located inside the unit along side the USDA receptacles. It can also be used to download recorded data from the DataCORDER.

NOTE

The Micro-Link 5 controller has a USB micro port and wireless capability to allow viewing of DataCORDER data.

2.5.5 Quest

Quest (Quality and Energy Efficiency in Storage and Transport) power saving mode helps shipping lines lower their operating costs by decreasing the system’s run time, energy usage and emissions. Quest 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.

2.5.6 Autotransformer

An autotransformer may be provided to allow operation on 190/230, 3-phase, 50/60 Hz 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.

2.5.7 Handles

The unit may be equipped with handles to facilitate access to stacked containers. These fixed handles are located on either side of the unit.

2.5.8 Water Cooling

The refrigeration system may be provisioned for a water-cooled condenser. The condenser is constructed using copper nickel tube for sea water applications.

2.5.9 Back Panels

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

2.5.10 460 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.

2.5.11 230 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 each customer's requirements.

2.5.12 Cable Restraint

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

2.5.13 Upper Fresh Air Makeup

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.

2.5.14 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.

2.5.15 Controller

The controller is a Carrier Transicold Micro-Link 5 microprocessor. Refer to **Section 4.1** for more information. 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.

Two replacement controllers are available:

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

2.5.16 Condenser Grille

Condenser grilles are direct bolted.

2.5.17 EverFRESH

EverFRESH™ is a controlled atmosphere option that is able control container atmosphere by supplying nitrogen and oxygen into the container space and simultaneously controlling levels of oxygen and carbon dioxide. This extends the produce ripening process, which increases shelf life and enables longer cargo routes for certain perishable commodities.

Procedures and technical information related to the EverFRESH controlled atmosphere system can be found in the **T-374 EverFRESH Manual**, located in the Literature section of the Container Refrigeration website. To find the manual from the Literature section, click on Options > EverFRESH.

2.5.18 TripWise

TripWise™ is a new premium option available for PrimeLINE units. TripWise is software logic that runs in the background during every voyage and will let you know whenever a standard pre-trip inspection (PTI) is needed. See **Section 5.10** for more detail.

2.5.19 FuelWise

FuelWise™ is a power-saving option available for PrimeLINE units. FuelWise software works by dynamically cycling the refrigeration system on and off to save energy while still maintaining temperature within +/- 0.25 degrees Celsius of setpoint on an hourly average.

SECTION 3
DESCRIPTION

3.1 General Description

3.1.1 Refrigeration Unit - Front Section

The unit is designed so that 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 unit nameplate on the back wall of the condenser section.

Figure 3.1 Refrigeration Unit - Front Section

1) Upper Fresh Air Makeup Vent Panel. Located inside are: Evaporator Fan #2, Defrost Temperature Sensor (DTS)
2) Access Panel. Located inside are: Evaporator Fan #1, Electronic Expansion Valve (EEV), Heat Termination Thermostat (HTT)
3) Fork Lift Pockets
4) Control Panel
5) Unit Display
6) Keypad
7) Start-Stop Switch (ST)
8) Compressor
9) Access Panel for Supply Temperature Sensor / Supply Recorder Sensor (STS / SRS)
10) Ambient Temperature Sensor (AMBS)
11) Economizer Heat Exchanger
12) Options Label
13) Unit Nameplate
14) Power Cables and Plug
15) Autotransformer location (if equipped)
16) Condenser Fan

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3.1.2 Fresh Air Makeup Vent

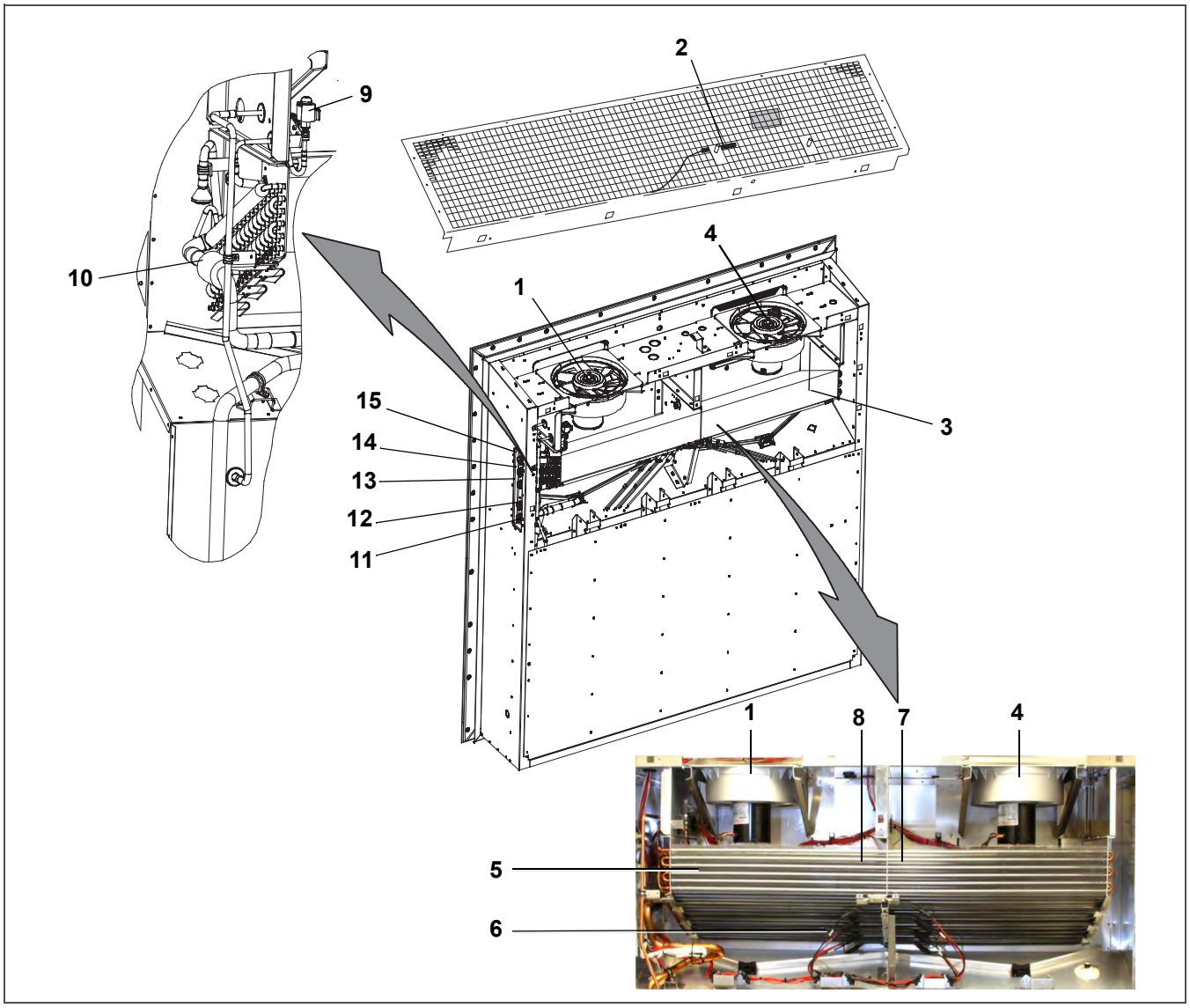
The function of the upper fresh air makeup vent is to provide ventilation for commodities that require fresh air circulation. A manually operated venting system is located in the upper left access panel.

3.1.3 Evaporator Section

The evaporator section is shown in **Figure 3.2**. The evaporator fans circulate air through the container by pulling it into the top of the unit, directing it through the evaporator coil to be heated or cooled, and discharging it at the bottom.

Most evaporator components are accessible by removing the upper rear panel or by removing the evaporator fan access panels.

Figure 3.2 Evaporator Section



1) Evaporator Fan #1
2) Return Temperature Sensor (RTS), Return Recorder Sensor (RRS)
3) Humidity Sensor (HS) location
4) Evaporator Fan #2
5) Evaporator Coil
6) Evaporator Coil Heaters
7) Defrost Temperature Sensor (DTS)
8) Heat Termination Thermostat (HTT)
9) Electronic Expansion Valve (EEV)
10) Evaporator Temperature Sensors (ETS1 / ETS2)
11) Interrogator Connector Receptacle (ICR)
12) USDA Probe Receptacle PR2
13) USDA Probe Receptacle PR1
14) USDA Probe Receptacle PR3
15) Cargo Probe Receptacle PR4

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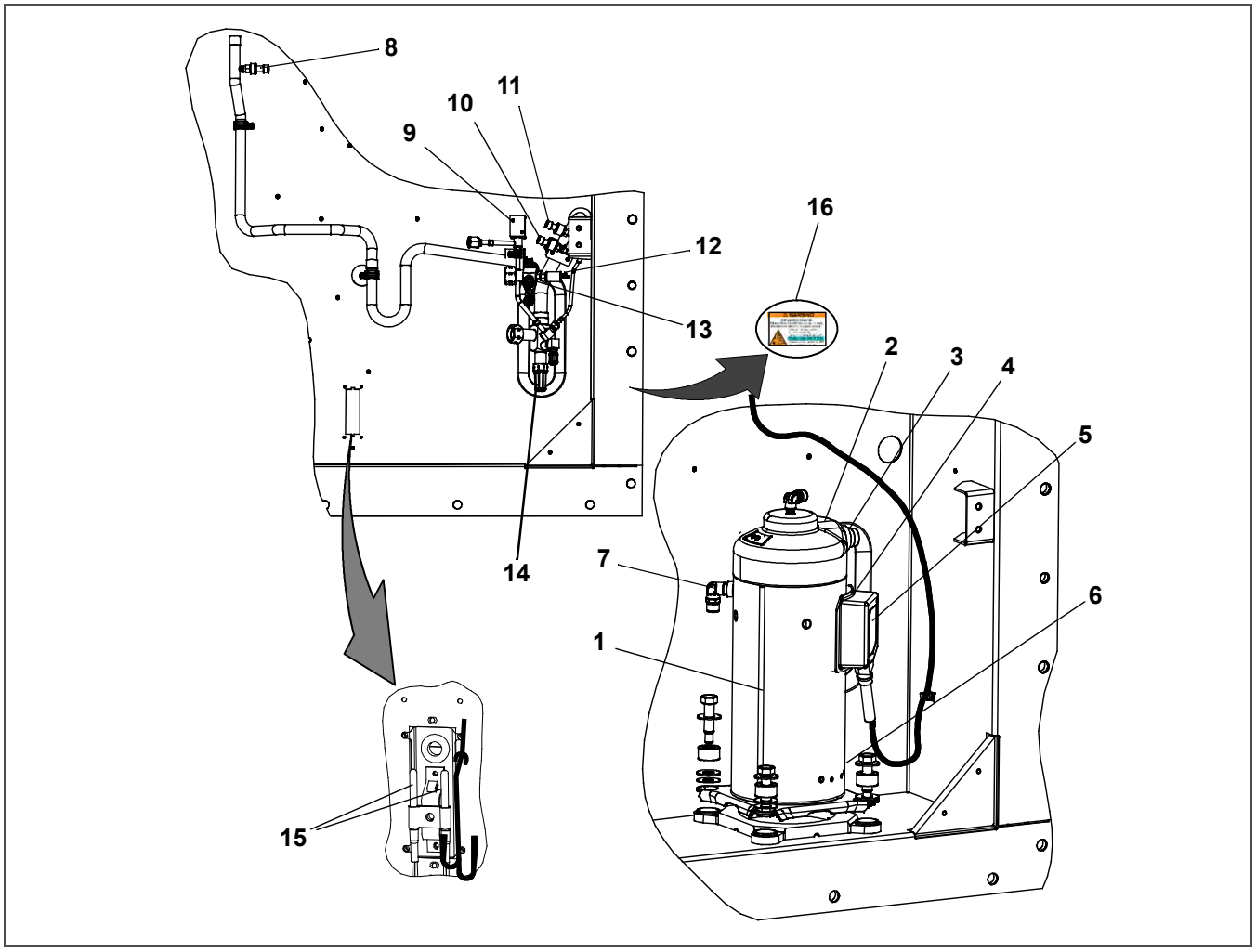
3.1.4 Compressor Section

The compressor section (see **Figure 3.3**) includes the compressor, digital unloader valve (DUV), high pressure switch, discharge pressure transducer (DPT), evaporator pressure transducer (EPT) and the suction pressure transducer (SPT). The supply temperature sensor (STS) and supply recorder sensor (SRS) are located to the left of the compressor.

Figure 3.3 Compressor Section



1) Compressor
2) Compressor Discharge Temperature Sensor (CPDS) location
3) Discharge Connection
4) Suction Connection location
5) Compressor Terminal Box
6) Oil Drain location
7) Economizer Connection
8) Discharge Pressure Transducer (DPT)
9) Digital Unloader Valve (DUV)
10) Suction Pressure Transducer (SPT)
11) Evaporator Pressure Transducer (EPT)
12) High Pressure Switch (HPS)
13) Discharge Service Valve
14) Suction Service Valve
15) Supply Temperature Sensor (STS), Supply Recorder Sensor (SRS)
16) Warning Label

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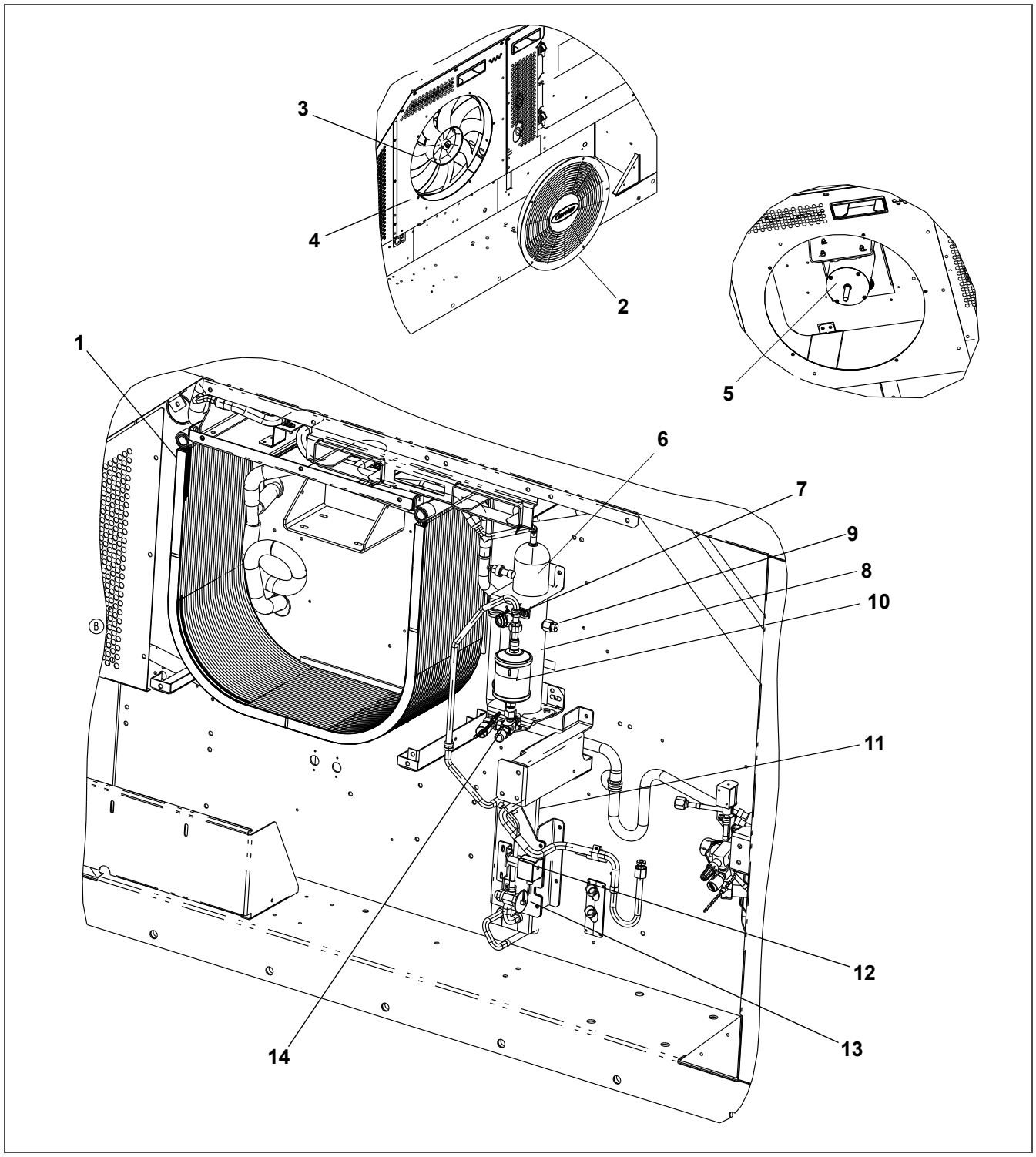
3.1.5 Air-Cooled Condenser Section

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

Figure 3.4 Air Cooled Condenser Section



1) Micro Channel Heat Exchanger (MCHE) Coil
2) Grille and Venturi Assembly
3) Condenser Fan
4) Condenser Coil Cover
5) Condenser Fan Motor
6) Receiver
7) Receiver Sight Glass*
8) Receiver Moisture & Liquid Indicator*
9) Fusible Plug
10) Filter Drier
11) Economizer
12) Economizer Solenoid Valve (ESV)
13) Economizer Expansion Valve (EXV)
14) Service Access Valve

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* Not visible in view, located behind Filter Drier.

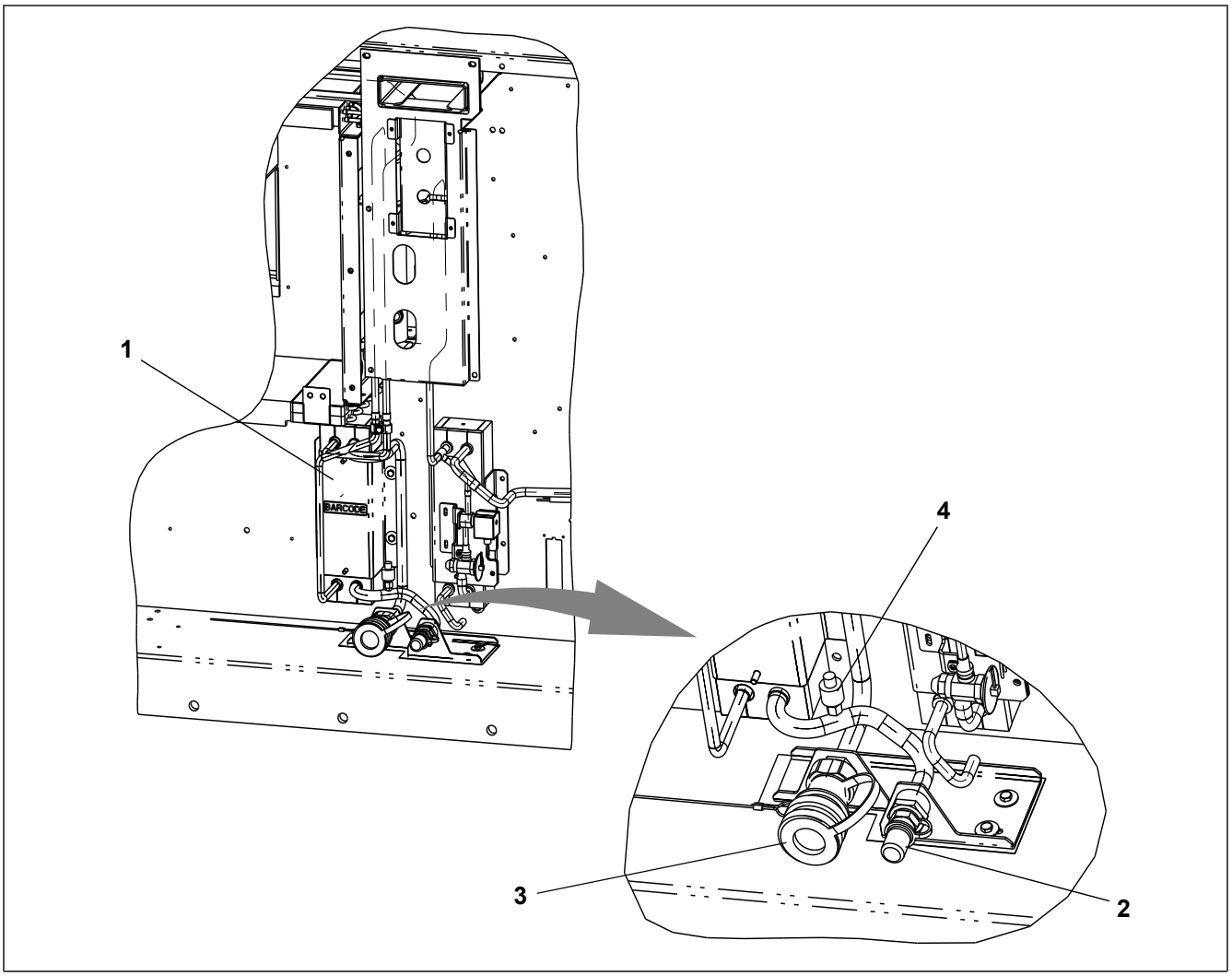
3.1.6 Water-Cooled Condenser Section

The unit may contain a water-cooled condenser (WCC) installed as an option. When operating on the water-cooled condenser, the condenser fan is deactivated by a water pressure switch or condenser fan switch.

Brazed Plate Water-Cooled Condenser

The brazed plate water-cooled condenser section (see **Figure 3.5**) consists of the brazed plate water-cooled condenser, water couplings, a water pressure switch and a fusible plug. The receiver is retained in this configuration and the brazed plate heat exchanger is placed between the air-cooled condenser and the receiver.

Figure 3.5 Brazed Plate Water-Cooled Condenser

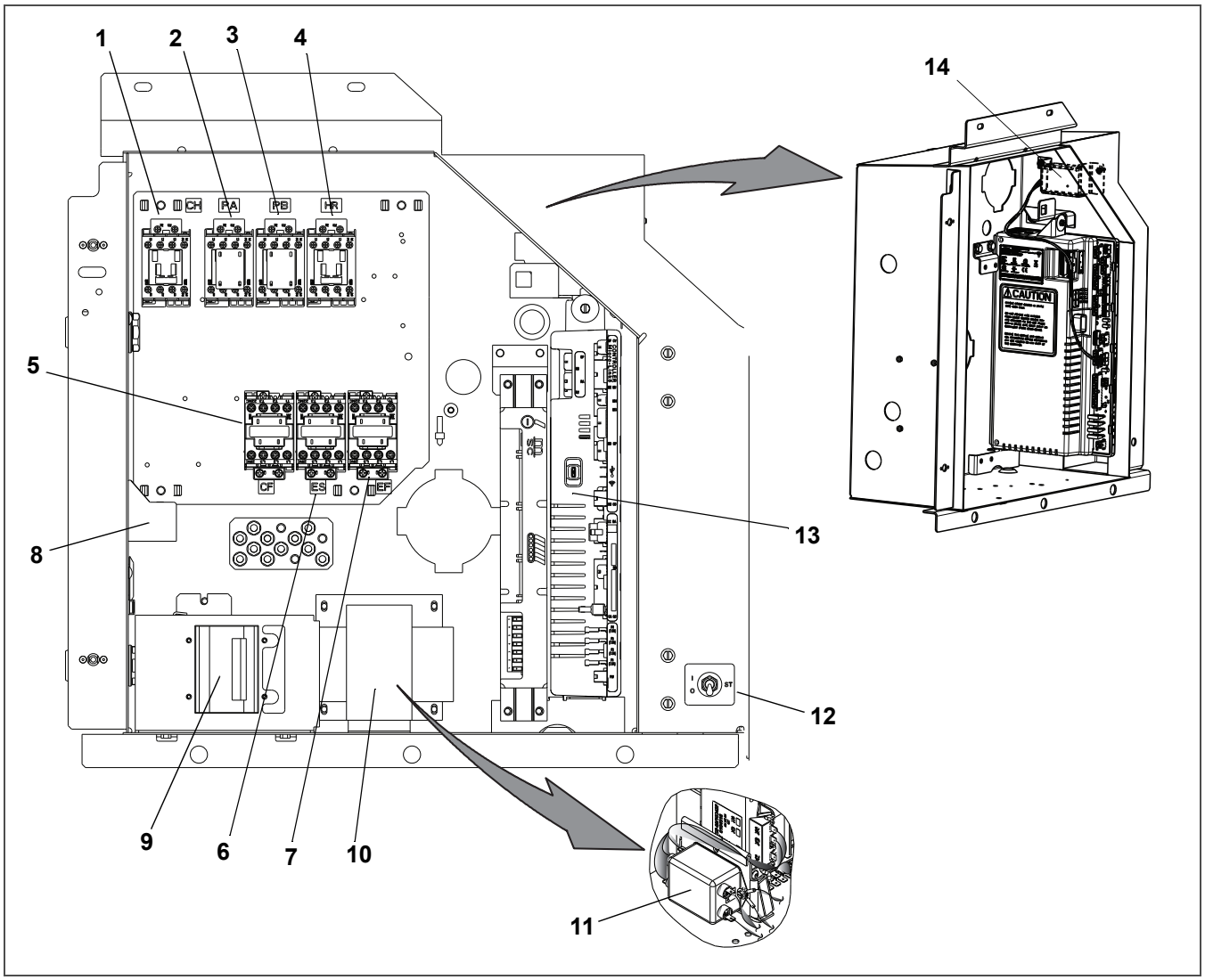


1) Water-Cooled Condenser (WCC)
2) Coupling (Water In)
3) Self Draining Coupling (Water Out)
4) Water Pressure Switch (WP)

3.1.7 Control Box Section

The control box (see **Figure 3.6**) includes: the manual operation switches, circuit breaker (CB-1), compressor, fan and heater contactors, control power transformer, transformer AC line filter, fuses, keypad, display module, current sensor module, and the controller module.

Figure 3.6 Control Box Section



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

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3.2 Refrigeration System Data

Table 3–1 Refrigeration System Data

Compressor / Motor Assembly	Model Number	ZMD26KVE-TFD-272
	Weight (With Oil)	42.9 kg (95 lb)
	Approved Oil	Uniqema Emkarate RL-32-3MAF
	Oil Charge	1774 ml (60 ounces)
Electronic Expansion Valve Superheat (Evaporator)	Verify at - 18°C (0°F) container box temperature	4.4 to 6.7°C (8 to 12°F)
Economizer Expansion Valve Superheat	Verify at - 18°C (0°F) container box temperature	4.4 to 11.1°C (8 to 20°F)
Heater Termination Thermostat	Opens	54° (+/- 3) C = 130° (+/- 5) F
	Closes	38° (+/- 4) C = 100° (+/- 7) F
High Pressure Switch	Cut-Out	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 refrigerants R-134a or R-513A as specified for the unit model number: Refrigerant must conform to AHRI Standard 700 specification.**		
Refrigerant	R-134a / R-513A	Conforming to AHRI standard 700 specifications.
⚠ CAUTION **Charge water-cooled condenser or receiver according to nameplate specifications to ensure optimal unit performance.**		
Refrigerant Charge	WCC Brazed Plate	4.58 kg (10.1 lbs)
	Receiver	4.26 kg (9.4 lbs)
Fusible Plug	Melting point	99°C = (210°F)
	Torque	6.2 to 6.9 mkg (45 to 50 ft-lbs)
Unit Weight	Refer to unit model number plate.	
Water Pressure Switch	Cut-In	0.5 +/- 0.2 kg/cm^2 (7 +/- 3 psig)
	Cut-Out	1.6 +/- 0.4 kg/cm^2 (22 +/- 5 psig)

3.3 Electrical Data

Table 3–2 Electrical Data

Circuit Breaker	CB-1 (25 amp)	Trips at 29 amps
	CB-2 (50 amp)	Trips at 62.5 amps
	CB-2 (70 amp)	Trips at 87.5 amps
Compressor Motor	Full Load Amps (FLA)	13 amps @ 460 VAC

Table 3–2 Electrical Data (Continued)

Condenser Fan Motor	Nominal Supply	**380 VAC / 3 Phase / 50 Hz**	**460 VAC / 3 Phase / 60 Hz**
	Full Load Amps	.71 amps	.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.	
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	
Evaporator Fan Motor(s)		**380 VAC / 3 Phase / 50 Hz**	**460 VAC / 3 Phase / 60 Hz**
	Full Load Amps High Speed	1.07	.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	
Fuses	Control Circuit	7.5 amps (F3, F4)	
	Controller / DataCORDER	7.5 amps (F1, F2)	
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)	
Solenoid Valve Coils (ESV) 24 VAC	Nominal Resistance @ 77°F (25°C)	7.7 ohms +/- 5%	
	Maximum Current Draw	0.7 amps	
DUV Coils 12 VDC	Nominal Resistance @ 77°F (20°C)	14.8 ohms +/- 5%	
	Maximum Current Draw	929 mA	
EEV Nominal Resistance	Coil Feed to Ground (Gray Wire)	47 ohms	
	Coil Feed to Coil Feed	95 ohms	

Table 3–2 Electrical Data (Continued)

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%	0.99 V
	50%	1.65 V
	70%	2.31 V
	90%	2.97 V
Controller	Setpoint Range	-35 to +30°C (-31 to +86°F)

3.4 Safety and Protective Devices

Unit components are protected from damage by safety and protective devices listed in **Table 3–3**. These devices monitor the unit operating conditions and open a set of electrical contacts when an unsafe condition occurs.

Open safety switch contacts on either or both of devices IP-CP or HPS will shut down the compressor.

Open safety switch contacts on device IP-CM will shut down the condenser fan motor.

The entire refrigeration unit will shut down if one of the following safety devices open: (a) circuit breaker(s); (b) fuse (F3 / F4, 7.5A); or (c) evaporator fan motor internal protector(s) - (IP).

Table 3–3 Safety and Protective Devices

Unsafe Condition	Device	Device Setting
Excessive current draw	Circuit Breaker (CB-1, 25 amp) - Manual Reset	Trips at 29 amps (460 VAC)
	Circuit Breaker (CB-2, 50 amp) - Manual Reset	Trips at 62.5 amps (230 VAC)
	Circuit Breaker (CB-2, 70 amp) - Manual Reset	Trips at 87.5 amps (230 VAC)
Excessive current draw in the control circuit	Fuse (F3 / F4)	7.5 amp rating
Excessive current draw by the controller	Fuse (F1 / F2)	7.5 amp rating
Excessive condenser fan motor winding temperature	Internal Protector (IP-CM) - Automatic Reset	N/A
Excessive compressor motor winding temperature	Internal Protector - 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 - Used on the Receiver	99°C = (210°F) 35 kg/cm^2 = (500 psig)
Abnormally high discharge pressure	High Pressure Switch (HPS)	Opens at 25 kg/cm^2 (350 psig)

3.5 Refrigeration Circuit

3.5.1 Standard Operation

Starting at the compressor, (see **Figure 3.7**) the suction gas is compressed to a higher pressure and temperature.

The refrigerant gas flows through the discharge line and continues into the air-cooled condenser. When operating with the air-cooled condenser active, 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.

When operating with the water-cooled condenser active (see **Figure 3.9**), the refrigerant gas passes through the air-cooled condenser and enters the water-cooled condenser shell. The water flowing inside the tubing cools the gas to saturation temperature in the same manner as the air passing over the air-cooled condenser. The refrigerant condenses on the outside of the tubes and exits as a high temperature liquid. The water-cooled condenser also acts as a receiver, storing refrigerant for low temperature operation.

The liquid refrigerant continues through the liquid line, the filter drier (which keeps refrigerant clean and dry) and the economizer (not active during standard operation) to the electronic expansion valve (EEV).

As the liquid refrigerant passes through the variable orifice of the EEV, 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.

On systems fitted with a water pressure switch, the condenser fan will be off when there is sufficient pressure to open the switch. If water pressure drops below the switch cut out setting, the condenser fan will automatically start.

During the standard mode of operation, the normally closed digital unloader valve (DUV) controls the system refrigerant flow and capacity by loading and unloading the compressor in frequent discrete time intervals. If the system capacity has been decreased to the lowest allowable capacity with the DUV, the unit will enter a trim heat mode of operation, during which the controller will pulse the evaporator heaters in sequence with the compressor digital signal in order to absorb the excess capacity.

3.5.2 Economized Operation

In the economized mode, (see **Figure 3.8**) the frozen and pull down capacity of the unit is increased by sub-cooling the liquid refrigerant entering the electronic expansion valve (EEV). Overall efficiency is increased because the gas leaving the economizer enters the compressor at a higher pressure, therefore requiring less energy to compress it to the required condensing conditions.

Liquid refrigerant for use in the economizer circuit is taken from the main liquid line as it leaves the filter drier. The flow is activated when the controller energizes the economizer solenoid valve (ESV).

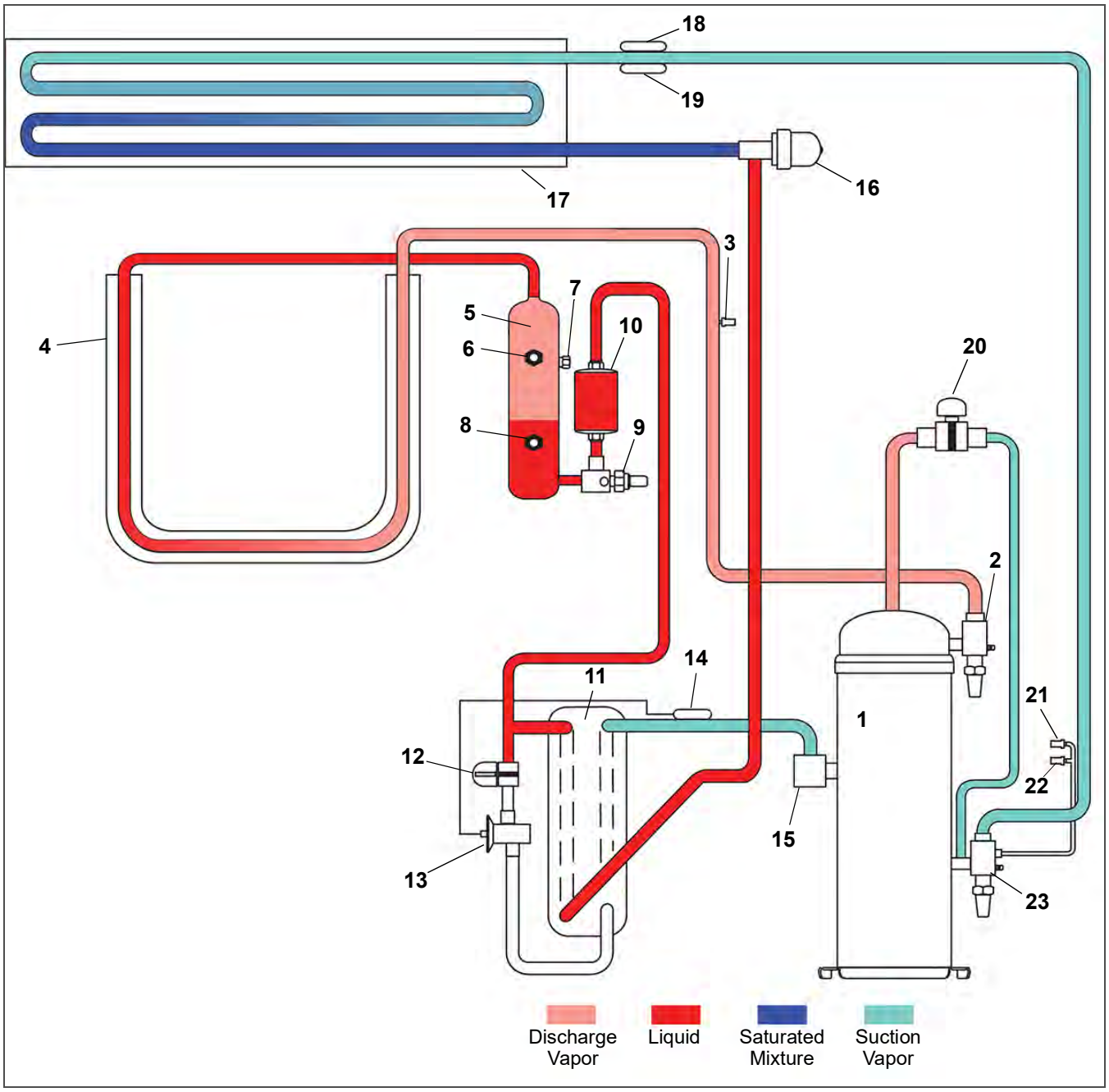
The liquid refrigerant flows through the ESV to the expansion valve internal passages, absorbing heat from the liquid refrigerant flowing to the electronic expansion valve (EEV). The resultant “medium” temperature / pressure gas enters the compressor at the economizer port fitting.

When the control air temperature falls to 2.0°C (3.6°F) above setpoint, the DUV unloads the compressor’s scroll and begins to reduce the capacity of the unit. Percentage of the unit capacity is accessed through code select 01 (Cd01). For example, if Cd01 displays 70, it indicates that the compressor is operating unloaded with the DUV engaged 30% of the time.

3.5.3 Electronic Expansion Valve (EEV)

The microprocessor controls the superheat leaving the evaporator via the electronic expansion valve (EEV), based on inputs from the evaporator pressure transducer (EPT). The microprocessor transmits electronic pulses to the EEV stepper motor, which opens or closes the valve orifice to maintain the superheat setpoint.

Figure 3.7 Refrigeration Circuit Schematic - Standard Operation



1) Compressor
2) Discharge Service Valve
3) Discharge Pressure Transducer (DPT)
4) Condenser
5) Receiver
6) Receiver Sight Glass
7) Fusible Plug
8) Receiver Liquid Level / Moisture Indicator
9) Liquid Line Service Valve
10) Filter Drier
11) Economizer
12) Economizer Solenoid Valve (ESV)
13) Economizer Expansion Valve (EXV)
14) Economizer Expansion Valve (EXV) Sensing Bulb
15) Economizer Connection
16) Electronic Expansion Valve (EEV)
17) Evaporator
18) Evaporator Temperature Sensor (ETS1)
19) Evaporator Temperature Sensor (ETS2)
20) Digital Unloader Valve (DUV)
21) Evaporator Pressure Transducer (EPT)
22) Suction Pressure Transducer (SPT)
23) Suction Service Valve

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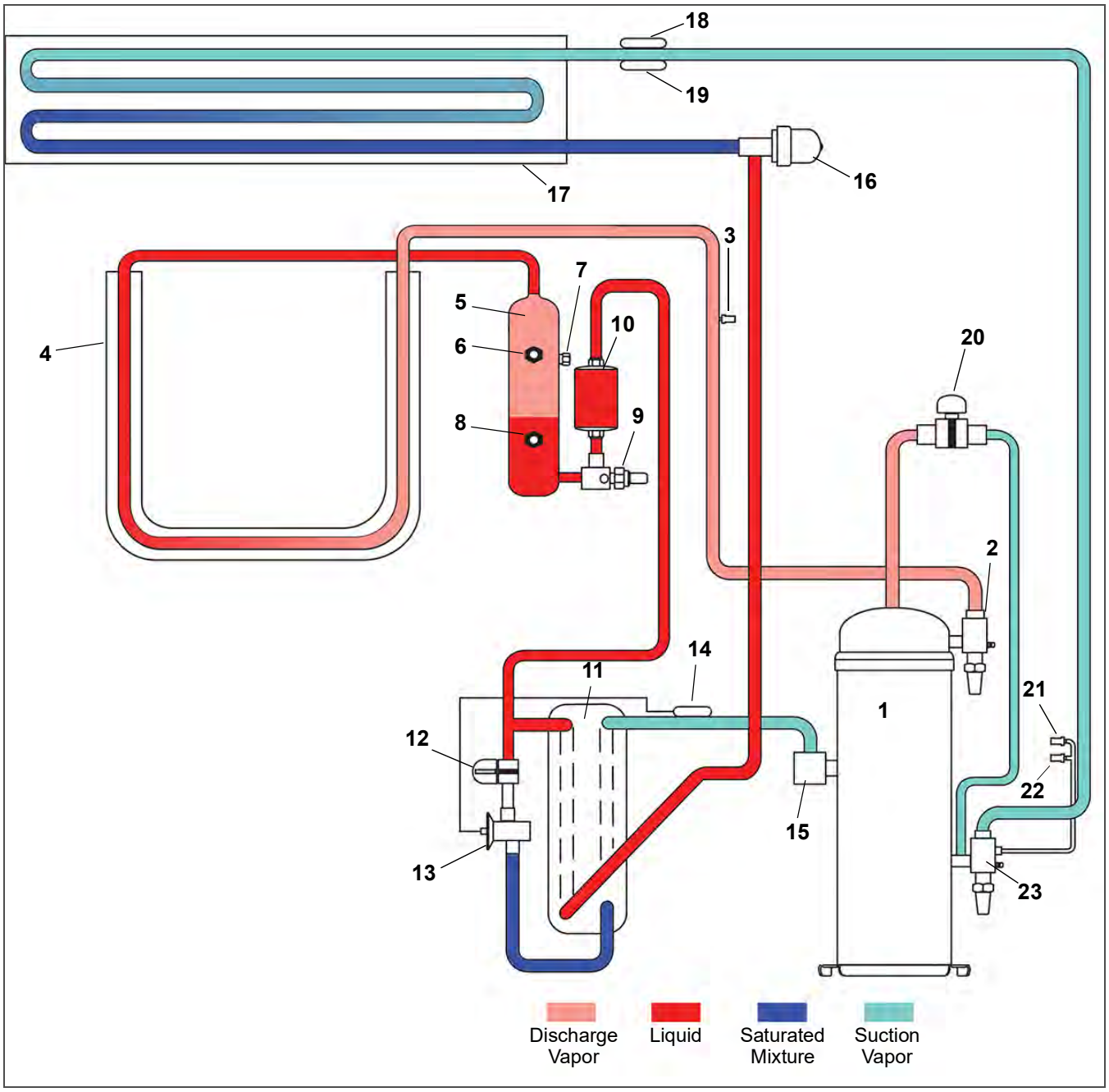
Figure 3.8 Refrigeration Circuit Schematic - Economized Operation



1) Compressor
2) Discharge Service Valve
3) Discharge Pressure Transducer (DPT)
4) Condenser
5) Receiver
6) Receiver Sight Glass
7) Fusible Plug
8) Receiver Liquid Level / Moisture Indicator
9) Liquid Line Service Valve
10) Filter Drier
11) Economizer
12) Economizer Solenoid Valve (ESV)
13) Economizer Expansion Valve (EXV)
14) Economizer Expansion Valve (EXV) Sensing Bulb
15) Economizer Connection
16) Electronic Expansion Valve (EEV)
17) Evaporator
18) Evaporator Temperature Sensor (ETS1)
19) Evaporator Temperature Sensor (ETS2)
20) Digital Unloader Valve (DUV)
21) Evaporator Pressure Transducer (EPT)
22) Suction Pressure Transducer (SPT)
23) Suction Service Valve

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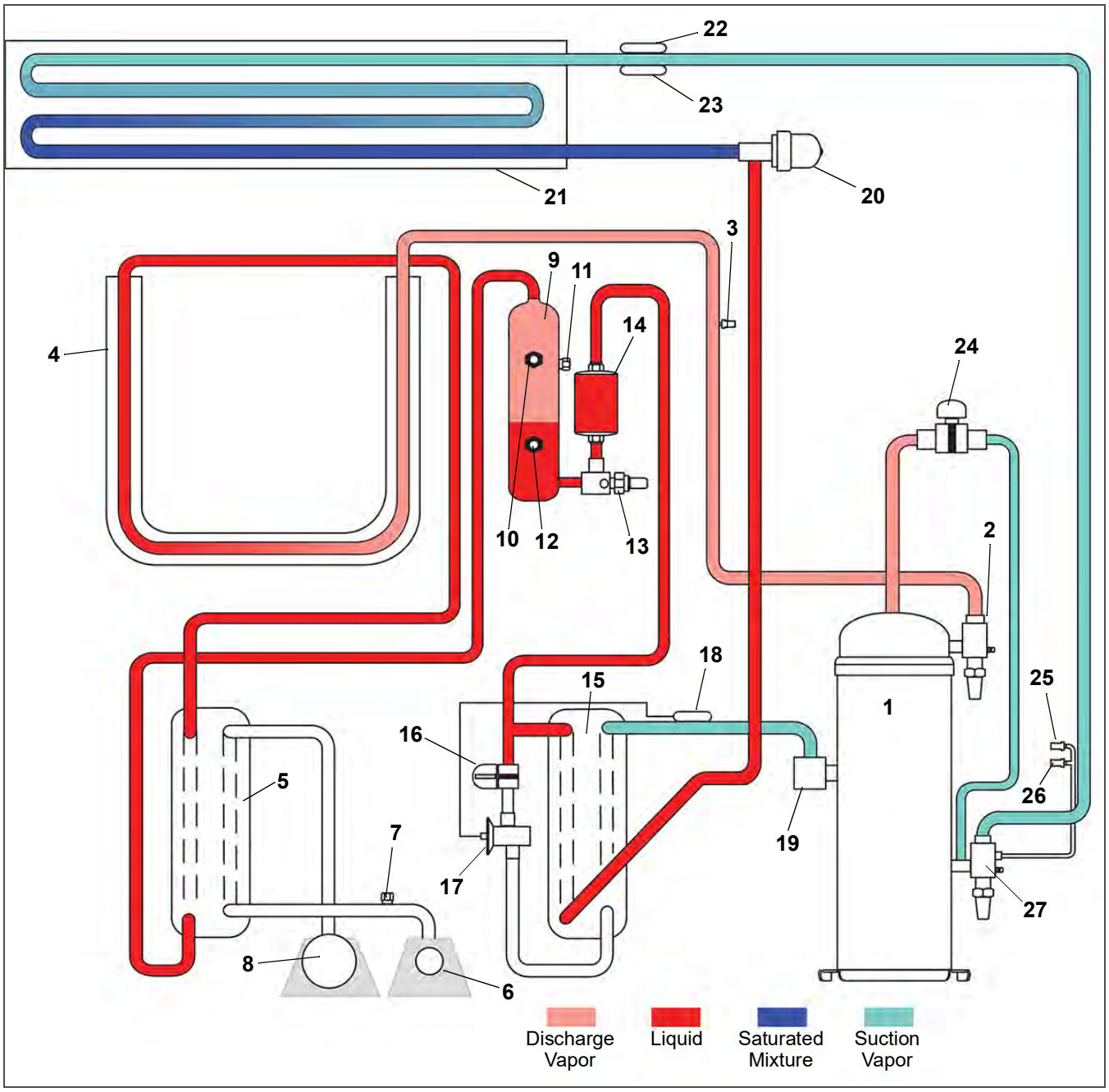
Figure 3.9 Refrigeration Circuit Schematic - Water-Cooled Condenser (Brazed Plate)



1) Compressor
2) Discharge Service Valve
3) Discharge Pressure Transducer (DPT)
4) Condenser
5) Water-Cooled Condenser
6) Coupling (Water In)
7) Water Pressure Switch
8) Coupling (Water Out)
9) Receiver
10) Receiver Sight Glass
11) Fusible Plug
12) Receiver Sight Glass / Moisture Indicator
13) Liquid Line Service Valve
14) Filter Drier
15) Economizer
16) Economizer Solenoid Valve (ESV)
17) Economizer Expansion Valve (EXV)
18) Economizer Expansion Valve (EXV) Sensing Bulb
19) Economizer Connection
20) Electronic Expansion Valve (EEV)
21) Evaporator
22) Evaporator Temperature Sensor (ETS1)
23) Evaporator Temperature Sensor (ETS2)
24) Digital Unloader Valve (DUV)
25) Evaporator Pressure Transducer (EPT)
26) Suction Pressure Transducer (SPT)
27) Suction Service Valve

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SECTION 4
MICROPROCESSOR

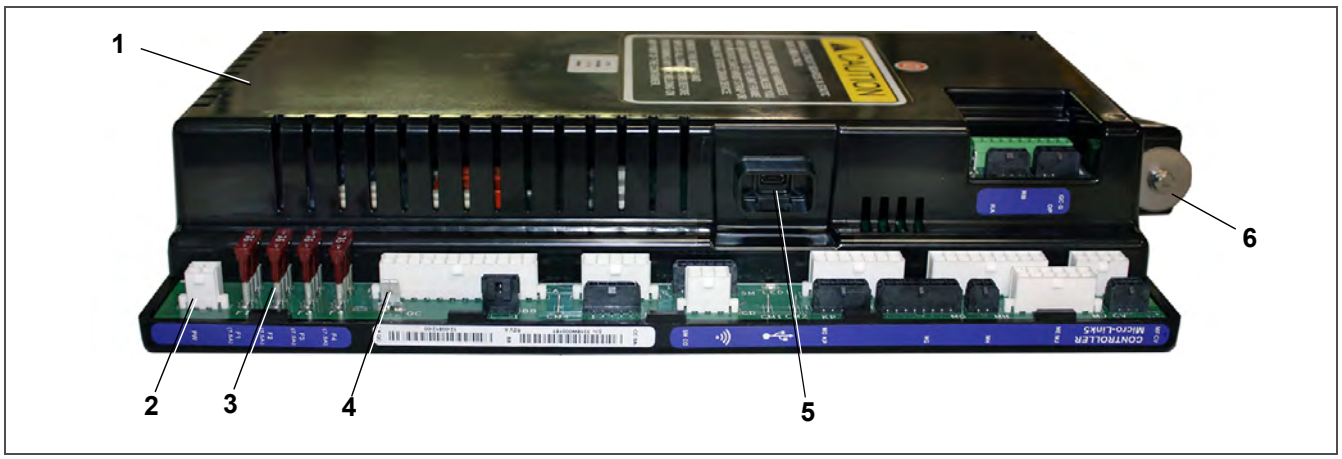
4.1 Temperature Control Microprocessor System

The temperature control Micro-Link 5 microprocessor system consists of a control module (controller), display module, keypad 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 4.6**.

4.1.1 Control Module

The control module (see **Figure 4.1**) is fitted with the Micro-Link 5 controller, power connectors, a micro USB port and short range wireless connectivity.

Figure 4.1 Control Module



1) Micro-Link 5 Controller / DataCORDER Module
2) Controller Power Connector
3) Fuses (7.5A)
4) Device Power Connector
5) Micro USB Port
6) Mounting Screw

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⚠ 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

When disconnecting connectors from the controller, press the latch tab prior to pulling out the connector. Damage may occur if latch tab is not pressed in prior to removing the connector.

NOTE

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

4.1.2 Display Module and Keypad

The display module and keypad are mounted on the control box door and 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 display module (see **Figure 4.2**) consists of two 5-digit displays and seven indicator lights. Descriptions of the indicator lights are provided in **Table 4–1**. The keypad (see **Figure 4.3**) consists of eleven push button switches that act as the user's interface with the controller. Descriptions of the switch functions are provided in **Table 4–2**.

Figure 4.2 Display Module

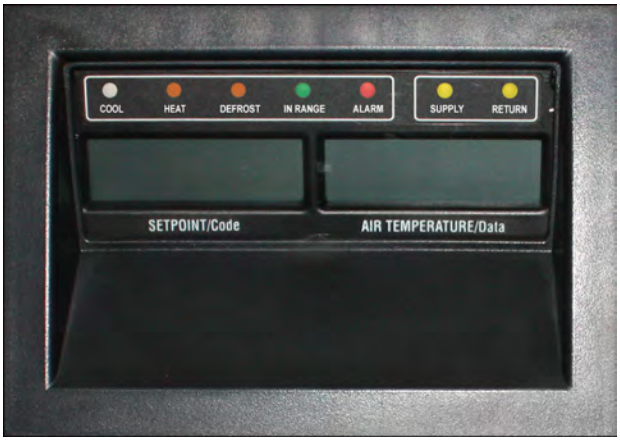


Figure 4.3 Keypad

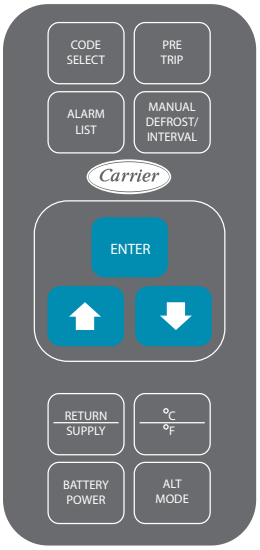


Table 4–1 Display Module LEDs

Light	Function
COOL (White / Blue)	Energized when the refrigerant compressor is energized.
HEAT (Orange)	Energized to indicate heater operation in heat mode, defrost mode, or dehumidification.
DEFROST (Orange)	Energized when the unit is in defrost mode.
IN RANGE (Green)	Energized when the controlled temperature probe is within specified tolerance of setpoint. The controlling probe in perishable range is the SUPPLY air probe and in frozen range is the RETURN air probe.
ALARM (Red)	Energized when an active or inactive shutdown alarm is in the alarm queue.
SUPPLY (Yellow)	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.
RETURN (Yellow)	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.

Table 4–2 Keypad Function

Key	Function
CODE SELECT	Access function codes.
PRE TRIP	Display Pre-Trip selection menu. Discontinue pre-trip in progress.
ALARM LIST	Display alarm list and clear alarm queue.
MANUAL DEFROST / INTERVAL	Display selected defrost mode. Press and hold this key for five seconds to initiate defrost using same logic as if the optional manual defrost switch was toggled on.
ENTER	Confirm a selection or save a selection to the controller.
Arrow Up	Change or scroll a selection up. Pre-trip advance or test interrupt.
Arrow Down	Change or scroll selection down. Pre-trip repeat backward.
RETURN / SUPPLY	Display non-controlling probe temperature (momentary display).
°C / °F	Display alternate english / metric scale (momentary display). When set to F, 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 C, pressure readings are in bars. "b" appears after the value to indicate bars.
BATTERY POWER	Initiate battery backup mode to allow setpoint & function code selection if AC power is not connected.
ALT MODE	Access DataCORDER configuration variables, function codes and stored temperatures. Access a USB software loading menu and a wireless setup menu.

4.2 Controller Software

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

- 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.
- Provide default independent readouts of setpoint and supply or return air temperatures.
- Provide ability to read and (if applicable) modify the configuration software variables, operating software function codes and alarm code indications.
- 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.
- Provide battery-powered ability to access or change selected codes and setpoint without AC power connected. This is only if the carrier-provided rechargeable battery option is installed.

4.2.1 Configuration Software (CnF Variables)

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 4–7**. Change to the factory-installed configuration software can be achieved via the controller micro USB port.

4.2.2 Operational Software (Cd Function Codes)

Operational software is the actual operation programming of the controller which activates or deactivates components in accordance with current unit operating 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 4–8**.

4.2.2.a Accessing Function Codes on the Display

1. Press the CODE SELECT key on the keypad.
2. Press an Arrow key until the left window displays the desired function code.
3. The right window will display the selected function code value for five seconds before returning to normal display mode.
4. If additional time is required, press the ENTER key to 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-sections. Schematic representation of controller operation is provided in **Figure 4.5**, **Figure 4.6** & **Figure 4.7**.

Operational software responds to various inputs. These inputs come from the temperature sensors and pressure transducers, the temperature setpoint, 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-sections.

4.3.1 Start Up - Compressor Phase Sequence

At start up, the controller logic checks for proper phase sequencing and compressor rotation. If incorrect sequencing is causing the compressor and three-phase evaporator fan motors to rotate in the wrong direction, the controller will energize or de-energize relay TCP as required. Relay TCP will switch its contacts, energizing or de-energizing relays PA and PB. Relay PA is wired to energize the circuits on L1, L2 and L3. Relay PB is wired to energize the circuits on L3, L2, and L1, thus providing reverse rotation.

4.3.2 Start Up - Compressor Bump Start

At start up, the controller logic will initiate a compressor bump start procedure to clear liquid refrigerant from the compressor. If suction and discharge pressures have equalized, the compressor will perform three compressor bump starts. A compressor bump start may also occur after a defrost cycle has been completed.

During bump start, the electronic expansion valve (EEV) will close. Relays TS, TN, TE, and TV will be de-energized (opened). The result of this action will close the economizer solenoid valve (ESV) and shut all fans off. The compressor will start for 1 second, then pause for five seconds. This sequence will be repeated two more times. After the final bump start, the unit will pre-position the EEV to the correct starting position, pause and then start up.

4.3.3 Perishable Mode (Temperature Control)

In Perishable Mode, the controller maintains the supply air temperature at setpoint, 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 variable CnF26 (Heat Lockout Temperature) is set to -10°C, Perishable mode is active with setpoints above -10°C (+14°F). When CnF26 is set to -5°C, Perishable mode is active with setpoints above -5°C (+23°F).

4.3.4 Perishable Pulldown Mode

In Perishable Pulldown Mode, the highest priority is given to bringing the container down to setpoint. When cooling from a temperature that is more than 2.5°C (4.5°F) above setpoint, the system will be in Perishable Pulldown mode in economized operation. However, pressure and current limit functions may restrict the valve if either exceeds the preset value.

4.3.5 Perishable Steady State Mode

In Perishable Steady State Mode, the control temperature is maintained near a setpoint that is above the Heat Lockout Temperature. Once setpoint is reached, the unit will transition to Perishable Steady State Mode. This results in unloaded operation by cycling the digital unloader valve (DUV) to limit capacity and maintain steady temperature control.

The unit is capable of maintaining supply air temperature to within +/- 0.2°C (+/- 0.36°F) of setpoint. Supply air temperature is controlled by positioning of the electronic expansion valve (EEV), cycling of the DUV, cycling of the compressor, and cycling of the heaters.

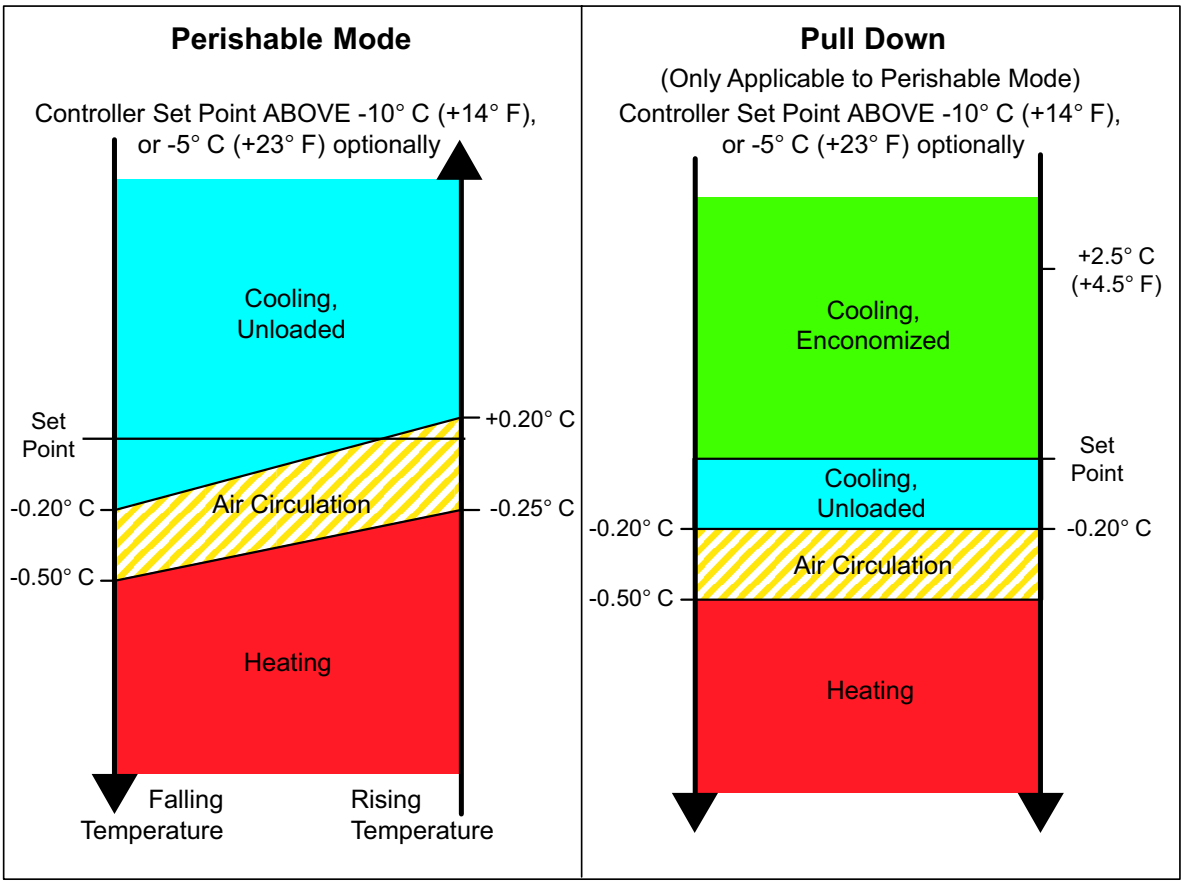
4.3.6 Perishable Idle Mode (Air Circulation)

When it is unnecessary to run the compressor to maintain control temperature, the system enters Perishable Idle Mode. 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. In this 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 (0.4°F) above setpoint, the unit will transition back to Perishable Steady State Mode.

4.3.7 Perishable Heating Mode

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 setpoint, 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 (0.4°F) below the setpoint, and the heaters will de-energize.

Figure 4.4 Controller Operation - Perishable Mode



4.3.8 Perishable Dehumidification

Perishable Dehumidification is provided to reduce the humidity levels inside the container. The dehumidification setpoint range is from 50% to 95%. 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, the controller will activate the heat relay to begin Dehumidification as long as the following conditions are satisfied:

1. The humidity sensor reading is above the humidity setpoint (Cd33).
2. The unit is in Perishable Steady State Mode and supply air temperature is less than 0.25°C (0.45°F) above setpoint.
3. The heater debounce timer (three minutes) has timed out.
4. The heater termination thermostat (HTT) is closed.

If the above conditions are 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 four conditions are met (see Bulb mode, **Section 4.3.9** for different evaporator fan speed options).

If any condition except item (1) becomes false OR if the relative humidity sensed is 2% below the dehumidification setpoint, 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 electronic expansion valve (EEV) to match the increased heat load while still holding the supply air temperature very close to the setpoint. Opening the EEV reduces the temperature of the evaporator coil surface, which increases the rate at which water is condensed and removes water from the passing air. Removing water from the air reduces the relative humidity. When the relative humidity sensed is 2% below setpoint, the controller de-energizes the heat relay. The controller will continue to cycle heating to maintain relative humidity below the selected setpoint. If dehumidification 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 heater contactor remains energized (or de-energized) for at least three minutes even if the setpoint criteria are 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 temperature exceeds in-range tolerance value set by Cd30.

4.3.9 Perishable Dehumidification - Bulb Mode

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

Bulb Mode is active when Cd35 is set to “Bulb.” Once Bulb Mode is activated, the user may then change dehumidification 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, this gives the user the additional capability of selecting dehumidification setpoints from 50 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:

- Bulb Mode function code Cd35 is set to “Nor.”
- Dehumidification function code Cd33 is set to “Off.”
- The user changes the setpoint to one that is in the frozen range.

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

4.3.10 Perishable Economy Fan Mode

Economy Fan Mode is an extension of 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 initiate Economy Fan Mode, a perishable setpoint must be selected prior to activation. When Economy Fan Mode is active, the evaporator fans will be controlled as follows:

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

b. The fans are then switched to low speed any time the supply air temperature is within +/- 0.2°C (0.36°F) of the setpoint and the return air temperature is less than or equal to the supply air temperature + 3°C (5.4°F).

c. The fans will continue to run in low speed for one hour.

d. At the end of the hour, the fans will switch back to high speed and the cycle will be repeated. If Bulb Mode is active, Economy Fan Mode will be overridden.

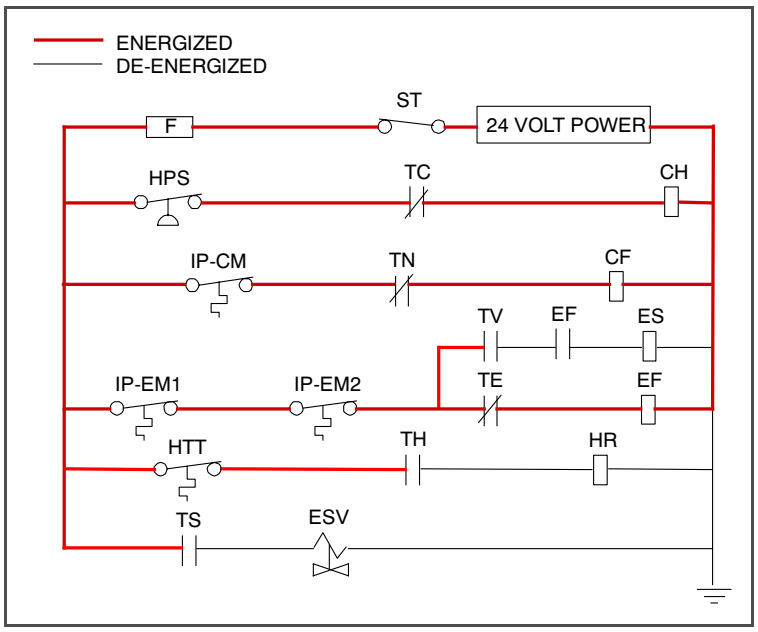
4.3.11 Perishable Mode Cooling - Sequence of Operation

NOTE

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

a. When supply air temperature is above setpoint and decreasing, the unit will cool with the condenser fan motor (CF), compressor motor (CH), and evaporator fan motors (EF) energized, and the white COOL light illuminated. (See **Figure 4.5**). Also, if current or pressure limiting is not active, the controller will close contacts TS to open the economizer solenoid valve (ESV) and place the unit in economized operation.

Figure 4.5 Perishable Mode Cooling



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

c. As air temperature continues to fall, unloaded cooling starts (DUV pulses opens) as the supply air temperature approaches setpoint. (See **Figure 4.4**).

d. When unloaded cooling starts, EEV control will transition from a full cool superheat setpoint to a lower modulated cool superheat setpoint. Once unloading starts, the EEV controls evaporator superheat based on the system duty cycle where instantaneous superheat will vary.

e. When the supply air temperature has fallen to within 1.9°C (3.4°F) of setpoint temperature and the average capacity of the system has fallen below 70%, the unit will open contacts TS to close the ESV and take the unit out of economized operation.

f. The controller continuously monitors supply air temperature. Once the supply air temperature falls below setpoint, the controller periodically records supply air temperature, setpoint and time. A calculation is then performed to determine temperature drift from setpoint 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. In addition the controller will close the EEV.

g. 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 temperature is within tolerance of the setpoint.

h. If the supply air temperature increases to 1.0°C (1.8°F) above setpoint and three minutes have elapsed, contacts TC and TN close to restart the compressor and condenser fan motors in standard mode (non-economized) operation. The white COOL light is also illuminated.

i. If the average system capacity has risen to 100% during unloaded cooling and three minutes off time has elapsed, relay TS will energize to open the ESV, placing the unit in economized mode.

j. If the supply air increases more than 2.5°C (4.5°F) above setpoint temperature, the microprocessor will transition the evaporator superheat control from modulation back to full cool control.

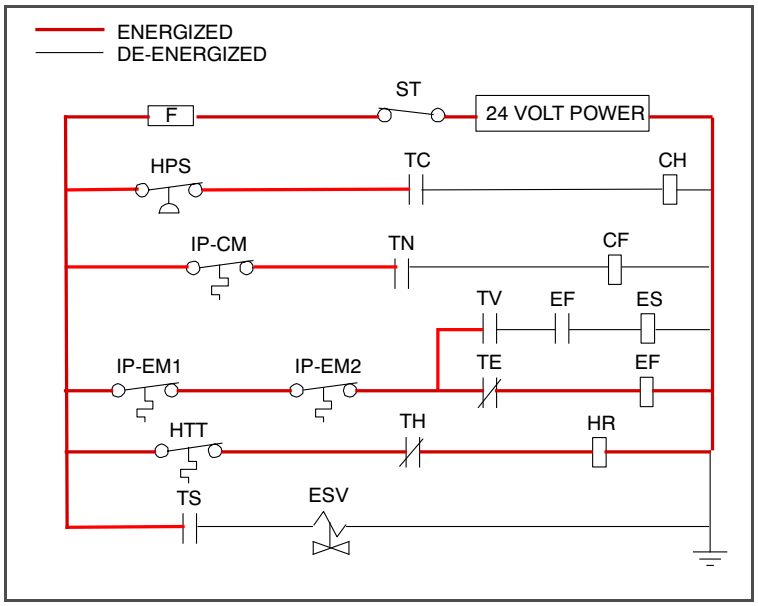
4.3.12 Perishable Mode Heating - Sequence of Operation

a. If the supply air temperature decreases 0.5°C (0.9°F) below setpoint, the system enters the Heating Mode (see **Figure 4.4**). The controller closes contacts TH (see **Figure 4.6**) 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 air temperature rises to 0.2°C (0.4°F) below setpoint, contact TH opens to de-energize the heaters. The orange HEAT light is also de-energized. The evaporator fans continue to run to circulate air throughout the container.

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

Figure 4.6 Perishable Mode Heating



NOTE

The electronic expansion valve (EEV) and digital unloader valve (DUV) are independently operated by the microprocessor. For full diagrams and legend, see **Section 8**.

4.3.13 Perishable Mode - Trim Heat

If the system capacity has been decreased to the lowest allowable capacity and conditions exist that warrant maximum temperature stability, the controller will pulse the HR relay to energize the evaporator heaters in sequence with the compressor digital signal.

4.3.14 Frozen Mode (Temperature Control)

In Frozen Mode, the controller maintains the return air temperature at setpoint, 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.

When CnF26 (Heat Lockout Temperature) is set to -10°C, Frozen Mode is active with setpoints below -10°C (+14°F). When CnF26 is set to -5°C, Frozen Mode is active with setpoints below -5°C (+23°F).

When the system is in Frozen Mode, the highest priority is given to bringing the container down to setpoint. The system will remain in economized operation.

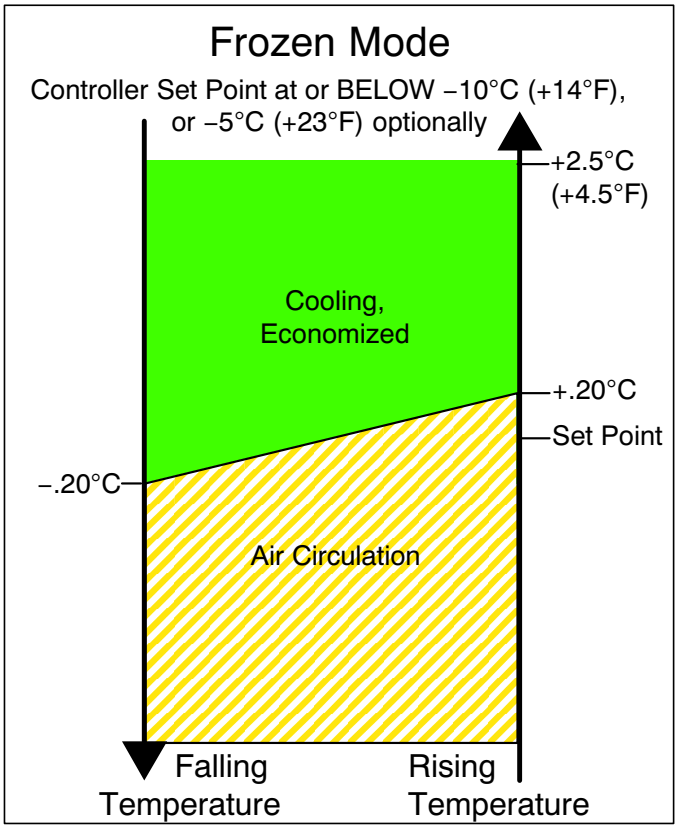
4.3.15 Frozen Steady State Mode

Frozen cargos are not sensitive to minor temperature changes, and the frozen temperature control system takes advantage of this to greatly improve the energy efficiency of the unit. Frozen range temperature control is accomplished by cycling the compressor on and off as the load demand requires. Once the frozen setpoint is reached, the unit will transition to Frozen Steady State Mode (economized operation).

4.3.16 Frozen Idle Mode

When temperature drops to setpoint minus 0.2°C (0.4°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 setpoint +0.2°C (0.4°F), the unit will transition back to the Frozen Steady State Mode.

Figure 4.7 Controller Operation - Frozen Mode



4.3.17 Frozen "Heat" Mode

If the temperature drops 10°C (18°F) below setpoint, the unit will transition to the Frozen "Heat" 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 Mode when the temperature rises back to the transition point.

4.3.18 Frozen Economy Mode

In order to activate Frozen Economy Mode, a frozen setpoint temperature must be selected, and Cd34 (Economy Mode) is set to "ON." When this 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 setpoint -2°C (4°F).

After an off-cycle period of 60 minutes, the unit will turn on the 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 setpoint +0.2°C (0.4°F), the unit will restart the refrigeration system and continue to cool until the off-cycle temperature criteria are met. If the control temperature is less than the frozen setpoint +0.2°C (0.4°F) the unit will turn off the evaporator fans and restart another 60 minute off-cycle.

4.3.19 Frozen Mode Cooling - Sequence of Operation

a. When the return air temperature is above setpoint and decreasing, the unit will transition to economized cooling with the condenser fan motor (CF), compressor motor (CH), economizer solenoid valve (ESV), low speed evaporator fan motors (ES) energized and the white COOL light illuminated. (See **Figure 4.8**).

b. When the return air temperature decreases to a predetermined tolerance above setpoint, the green IN RANGE light is illuminated.

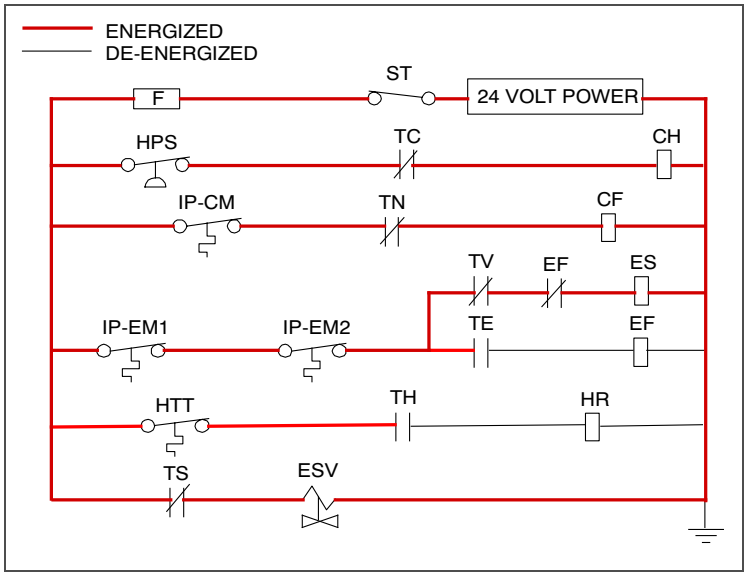
c. When the return air temperature decreases to 0.2°C (0.4°F) below setpoint, contacts TC, TS and TN are opened to de-energize the compressor, economizer solenoid valve and condenser fan motor. The white COOL light is also de-energized. The electronic expansion valve (EEV) will close.

d. The evaporator fan motors continue to run in low speed to circulate air throughout the container. The green IN RANGE light remains illuminated as long as the return air is within tolerance of setpoint.

e. If return air temperature drops to 10°C (18°F) or more below setpoint, the evaporator fans switch to high speed.

f. When the return air temperature increases to 0.2°C (0.4°F) above setpoint and three minutes have elapsed, the EEV opens and contacts TC, TS and TN close to restart the compressor, open the ESV and restart the condenser fan motor. The white COOL light is illuminated.

Figure 4.8 Frozen Mode



NOTE

The EEV and DUV are independently operated by the microprocessor. Complete schematics and legends are located in **Section 8**.

4.3.20 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.

- De-icing the coil consists of removing power to the cooling components (compressor, evaporator fans, and condenser fan), closing the EEV, 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 the 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.
- 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.

For more information on Probe Diagnostics refer to **Section 5.9**

4.3.21 Defrost Operation

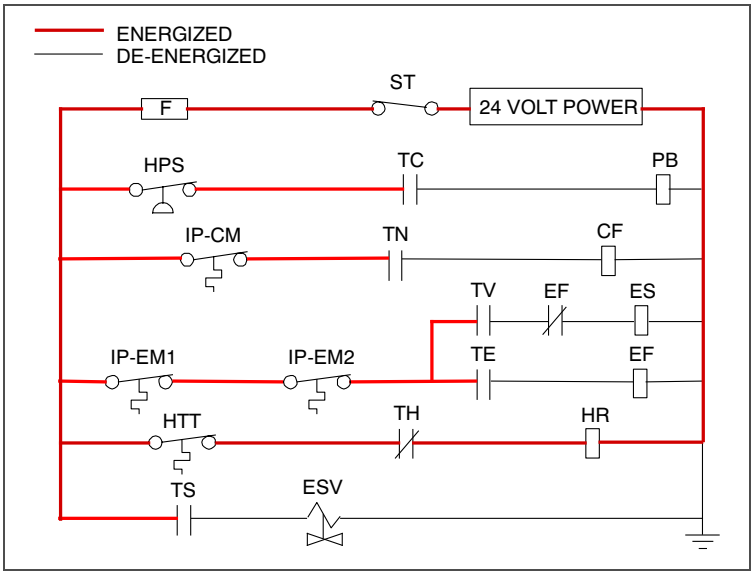
Initiation of defrost is dependent on the state of the defrost temperature sensor (DTS). When the DTS senses a temperature less than 10°C (50°F), the defrost options become active and the timer is engaged for the initiation of the defrost cycle. The defrost time accumulates when the compressor is running. 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:** While in the Defrost screen, when the Manual Defrost soft key is selected, if conditions will allow for a defrost, a manual defrost is initiated. The Defrost Indicator light is lit, and the user is brought back to the Main / Default screen. If conditions are NOT allowing for a defrost, a pop up message screen appears.
2. **Timer:** The Defrost Interval Timer reaches the user selectable Interval. The user-selected intervals are 3, 6, 9, 12, 24 Hours, Off, AUTO, or AUTO2; factory default is AUTO. Refer to Defrost Interval setting on the Trip Settings screen.
   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. 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. **Probe Check:** 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 its alarm set 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. **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.

When defrost is initiated, the controller closes the EEV, 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 4.9 Defrost



The EEV and DUV are independently operated by the microprocessor. Complete schematics and legends are located in Section 8.

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.

4.3.22 Defrost Related Settings

DTS 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 may choose “OFF” as a defrost interval option.

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 (AL259 & AL260). If the HTT does not open and termination does not occur within two hours, the controller will terminate defrost. AL260 will be activated to inform of a possible DTS failure.

4.3.23 Protection Mode - Evaporator Fan Operation

Opening of an evaporator fan internal protector will shut down the unit.

4.3.24 Protection Mode - Failure Action

Function code Cd29 may be operator set to select the action the controller will take upon a system failure. The factory default is full system shutdown. See **Table 4–8**.

4.3.25 Protection Mode - Generator Protection

Function codes Cd31 (Stagger Start, Offset Time) and Cd32 (Current Limit) may be operator set to control the start up sequence of multiple units and operating current draw. The factory default allows on demand starting (no delay) of units and normal current draw. See **Table 4–8**.

4.3.26 Protection Mode - Compressor High Temperature Protection

The controller continuously monitors compressor discharge pressure and temperature, and suction pressure. If discharge pressure or temperature rises above the allowed limit or suction pressure falls below the allowed limit, the compressor will be cycled off and on every 3 minutes. Condenser and evaporator fans will continue to operate during the compressor off cycle.

If high compressor dome temperature occurs, as measured by the CPDS, the controller will allow additional refrigerant to be released into the system in order to provide cooling to the evaporator coil and compressor dome. The controller is alerted to high compressor dome temperatures via the CPDS when ambient temperature is greater than 43.3°C (110°F), return air temperature is less than -17.5°C (0.5°F) and the compressor discharge temperature is greater than 117.7°C (244°F). Dome temperature control logic will disengage when return air temperature and ambient temperature return to allowed limits or when the compressor turns off.

4.3.27 Protection Mode - Compressor Low Pressure Protection

If the suction pressure low limit is triggered, the DUV will energize to raise the suction pressure.

4.3.28 Protection Mode - Perishable Mode System Pressure Regulation

In Perishable Mode, system pressures may need to be regulated at ambient temperatures of 20°C (68°F) and below. Once below this ambient temperature, the condenser fan may cycle on and off based on limits imposed for discharge pressure. For extremely cold ambient temperatures, -18°C (0°F), heater cycling may occur within normal system operation based on discharge pressure limits.

4.3.29 Protection Mode - Condenser Fan Override

When CnF17 (Discharge Temperature Sensor) is set to “In” and CnF48 (Condenser Fan Switch Override) is set to “On”, the condenser fan switch override logic is activated. If condenser cooling water pressure is sufficient to open the water pressure switch (de-energizing the condenser fan) when water flow or pressure conditions are not maintaining discharge temperature, the logic will energize the condenser fan as follows:

1. If the DUV is less than 80% open when the controller calls for it to be100% open, the condenser fan is energized. When the DUV is 100% open, the fan will de-energize.
2. If DPT reading is invalid or out of range (AL65), the condenser fan is energized and will remain energized until system power is cycled.
3. If the system is running on condenser fan override and the high pressure switch opens, the condenser fan is energized and will remain energized until the system power is cycled.

4.3.30 Quest

Quest (Quality and Energy Efficiency in Storage and Transport) power saving mode helps shipping lines lower their operating costs by decreasing the system’s run time, energy usage and emissions. Quest 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.

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, 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 that 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.

4.4 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 alarms is provided in **Section 4.10**.

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.

When an Alarm Occurs:

- The red ALARM light illuminates for alarm code numbers 003, 017, 020, 021, 022, 023, 024, 025, 026, 027, 028 and 072.
- If a detectable problem exists, its alarm code will be alternately displayed with the setpoint on the left display.
- 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:

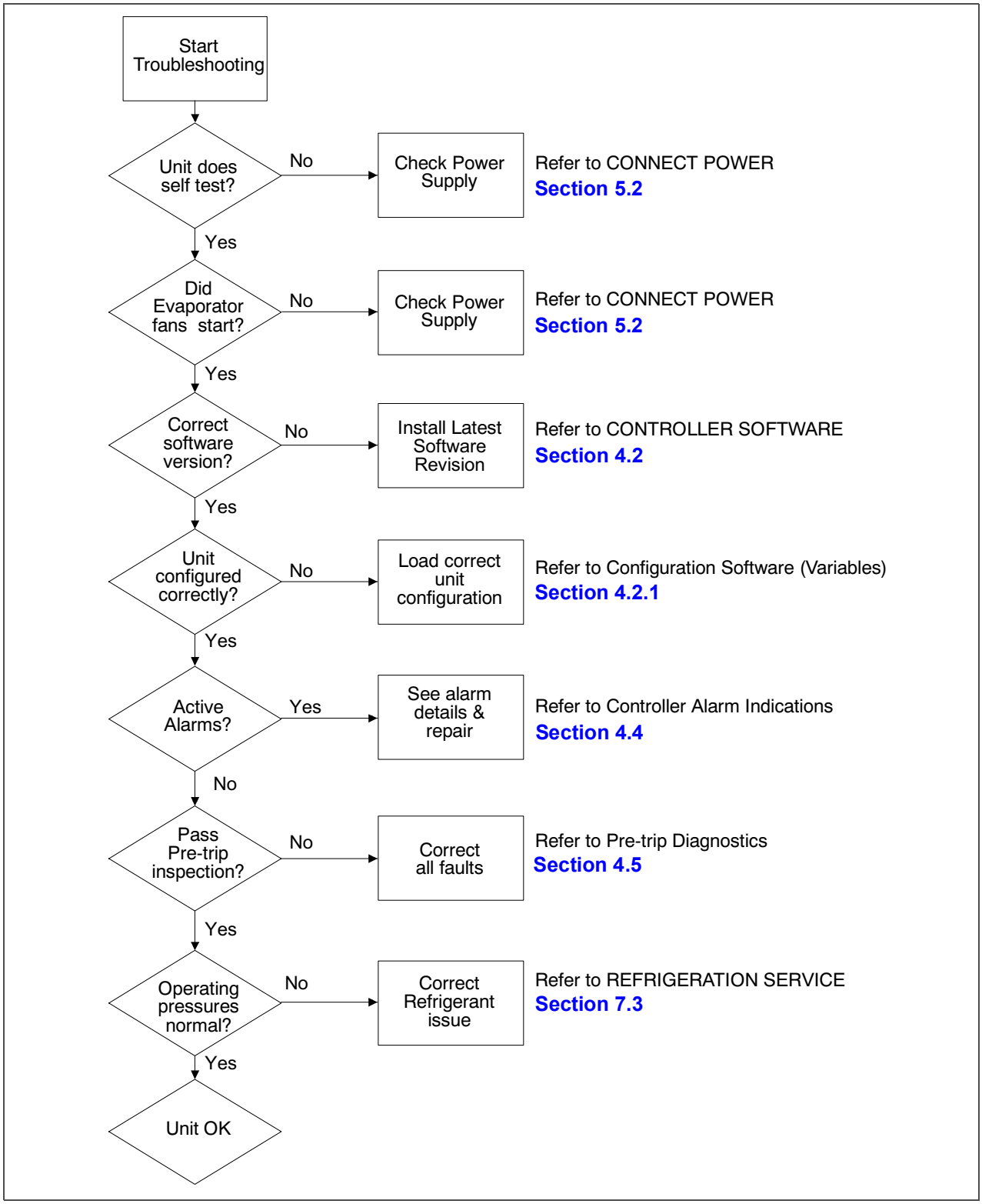
1. While in the default display mode, press the ALARM LIST key. This accesses the alarm list display mode, which displays any alarms archived in the alarm queue.The alarm queue stores up to 64 alarms in the sequence in which they occurred.
2. The user may scroll through the list by pressing an Arrow key. The left display will show “AL###,” where ## is the alarm number sequentially in the queue. 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, see **Section 4.10**.
3. “END” is displayed to indicate the end of the alarm list if any alarms are active.

4. “CLEAr” is displayed if all alarms are inactive. Press the ENTER key to clear the alarm queue. The alarm list will clear and “-----” will be displayed.

NOTICE

AL026 is active when none of the sensors are responding. Check the ME connector on the front of the controller. If it is loose or unplugged, reconnect it, then run a Pre-trip test (P5) to clear AL026.

Figure 4.10 Alarm Troubleshooting Sequence



4.5 Pre-Trip Diagnostics

Pre-Trip Diagnostics is an independent controller function that suspends normal refrigeration controller activities and provides preprogrammed test routines. The test routine can be run in Auto Mode, which automatically performs a preprogrammed sequence of tests, or Manual Mode, 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 the PRE TRIP key is pressed, Economy, Dehumidification and Bulb Mode will be deactivated. At the completion of the pre-trip test, Economy, 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. Press the ENTER key to allow the user to see the results for each of the sub-tests. The results will be displayed as “PASS” or “FAIL” for each test run to completion.

A detailed description of the pre-trip tests and test codes is provided in **Table 4–9**. Detailed operating instructions are provided in **Section 5.8**.

4.6 DataCORDER

4.6.1 Description

Carrier Transicold “DataCORDER” software is integrated into the controller and serves to eliminate the temperature recorder and paper chart. DataCORDER Software is subdivided into operational software, configuration software, and data memory. DataCORDER functions may be accessed by keypad selections and viewed on the display module.

For a description of DataCORDER communications, refer to **Section 4.6.15**.

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:

- Logs configured sensor data at the configured time interval.
- Records alarm activity.
- Records PTI results.
- Records modifications to the controller (i.e. configuration, time, software upgrade, etc).
- Records operational events (i.e. defrost, dehumidification, setpoint change, power On/Off, cooling mode, etc).
- Records optional events (i.e. USDA activity, trip start, probe calibration, GDP calibration, XtendFresh operation, vent position sensor location, etc).

4.6.2 DataCORDER Operational Software

The operational software reads and interprets inputs for use by the configuration software. The inputs are labeled function codes.

Displaying DataCORDER Function Codes

1. Press the ALT. MODE key on the keypad.
2. Use the Arrow keys until “dC” is displayed, then press the ENTER key.
3. Press an Arrow key until the left window displays the desired function code number. The right window will display the value of this item for five seconds before returning to the normal display mode. If a longer display time is desired, press the ENTER key to extend the display time to 30 seconds.

The DataCORDER function code assignments (see **Table 4–3**) may be accessed by the operator to examine the current input data or stored data.

Table 4–3 DataCORDER Function Code Assignments

NOTE Functions that are not applicable will display “-----”		
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 1-8	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 1-5 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	Future Expansion	These codes are for future expansion, and are not in use at this time.
dC28	Minimum Days Left	An approximation of the number of logging days remaining until the DataCORDER 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. Press and hold the ENTER key for five seconds to initiate a “Trip Start.”
dC31	Battery Test Results	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.

4.6.3 DataCORDER Configuration Software

The configuration software controls the recording and alarm functions of the DataCORDER. Reprogramming to the factory-installed configuration is achieved via the USB flash drive menu with a flash drive installed. An ML5 software file or a compatible configuration database file must be on the USB flash drive in order to gain access to the menu.

Displaying DataCORDER Configuration Variables

1. Press the ALT. MODE key on the keypad.
2. Use the Arrow keys until “dCF” is displayed.
3. Press the ENTER key.
4. Press an Arrow key until the left window displays the desired variable number. The right window will display the value of this item for five seconds before returning to the normal display mode. If a longer display time is desired, press the ENTER key to extend the display time to 30 seconds.

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

Table 4–4 DataCORDER 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	Long
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

4.6.4 Sensor Configuration (dCF02)

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

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 4–5**.

The inputs of the six thermistors (supply, return, USDA #1, USDA #2, USDA #3 and cargo probe) and the humidity sensor input will be generated by the DataCORDER.

NOTE

The DataCORDER software uses the supply and return recorder sensors (SRS, RRS). The temperature control software uses the supply and return temperature sensors (STS, RTS).

Table 4–5 DataCORDER 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
6 sensors (dCF02=54)	2 thermistor inputs (supply & return) 3 USDA thermistor inputs 1 cargo probe (thermistor input)

Table 4–5 DataCORDER Standard Configurations

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

Generic Mode

The Generic 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. Changing the configuration to generic and selecting which data points to record may be done using the Carrier Transicold Data Retrieval Program. A list of the data points available for recording follows.

1. Control mode
2. Control temperature
3. Frequency
4. Humidity
5. Phase A current
6. Phase B current
7. Phase C current
8. Main voltage
9. Evaporator expansion valve percentage
10. Discrete outputs (Bit mapped - require special handling if used)
11. Discrete inputs (Bit mapped - require special handling if used)
12. Ambient temperature sensor (AMBS)
13. Evaporator temperature sensor (ETS)
14. Compressor discharge temperature sensor (CPDS)
15. Return temperature sensor (RTS)
16. Supply temperature sensor (STS)
17. Defrost temperature sensor (DTS)
18. Discharge pressure transducer (DPT)
19. Suction pressure transducer (SPT)
20. Evaporator pressure transducer (EPT)
21. Vent position sensor (VPS)

4.6.5 Logging Interval (dCF03)

The user may select four different 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 (GMT).

4.6.6 Thermistor Format (dCF04)

The user may configure the format in which the thermistor readings are recorded. The short resolution is a 1 byte format and the long resolution is a 2 byte format. The short requires less memory and records temperature with variable resolutions depending on temperature range. The long records temperature in 0.01°C (0.02°F) steps for the entire range.

4.6.7 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, supply and return temperature readings are averaged and the three USDA probe readings are snapshot.

4.6.8 Alarm Configuration (dCF07 - dCF10)

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

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

If a probe alarm is configured to ON, 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 the 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, all of the alarms are enabled and the remaining probes that are not installed will give active alarm indications.

4.6.9 Stored Temperature Display (Scrollback)

The DataCORDER records temperatures from the supply sensor, return sensor, P1, P2, P3 and C4 cargo sensors. The temperatures are recorded every hour.

Displaying Stored Temperatures

1. Press the ALT. MODE key on the keypad.
2. Use the Arrow keys until “dCdSP” is displayed.
3. Press the ENTER key.
4. Use the Arrow keys to toggle through S (supply), R (Return), P1, P2, P3 and C4 (Cargo) sensors.
5. Press the ENTER key and a temperature value will appear in the right window and 1 (with sensor designation) will appear in the left window to signify the temperature displayed is the most recent reading. Each press of the down Arrow key displays the temperature one hour earlier.
6. Press the ENTER key to alternate between sensors and times / temperatures. And use Arrow keys for scrolling.

4.6.10 DataCORDER Power Up

The DataCORDER may be powered up in any one of the following methods:

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 the user presses the battery key.
3. *Real Time Clock demand:* If the controller 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. Also, 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, it indicates that the battery pack needs replacement.

4.6.11 Pre-Trip Data Recording

The DataCORDER will record the initiation of a pre-trip test (refer to **Section 4.5**) and the results of each test included in pre-trip. The data is time-stamped and may be extracted via the Data Retrieval program. See **Table 4–10** for a description of the data stored in the DataCORDER for each corresponding pre-trip test.

4.6.12 USDA Cold Treatment

Sustained cold temperature has been employed as a post-harvest method for the control of fruit flies and other insect genera. The commodity, insect species, treatment temperatures and exposure times are found in sections T107, T108, and T109 of the USDA Treatment Manual.

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.

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 3-pin receptacles are for the probes. The 5-pin receptacle is for the Interrogator. The probe receptacles are sized to accept plugs with tri-cam 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.

USDA / Message Trip Comment

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

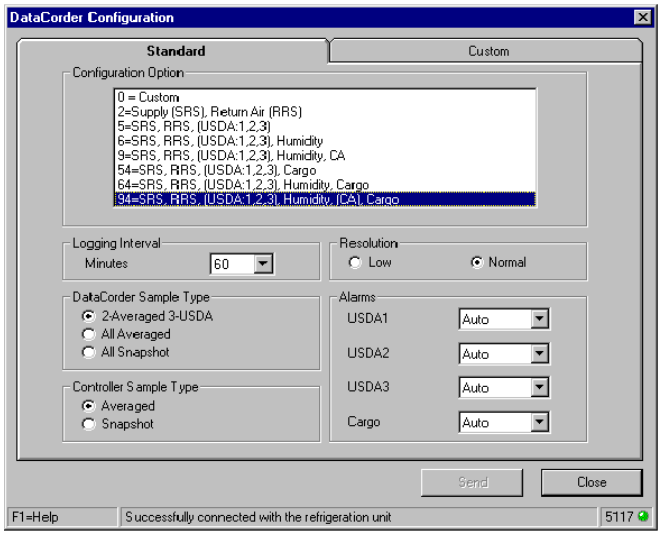
4.6.13 USDA Cold Treatment Procedure

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

If configured for USDA probes setup can be verified as follows (See **DataLine User manual 62-10629** for more details):

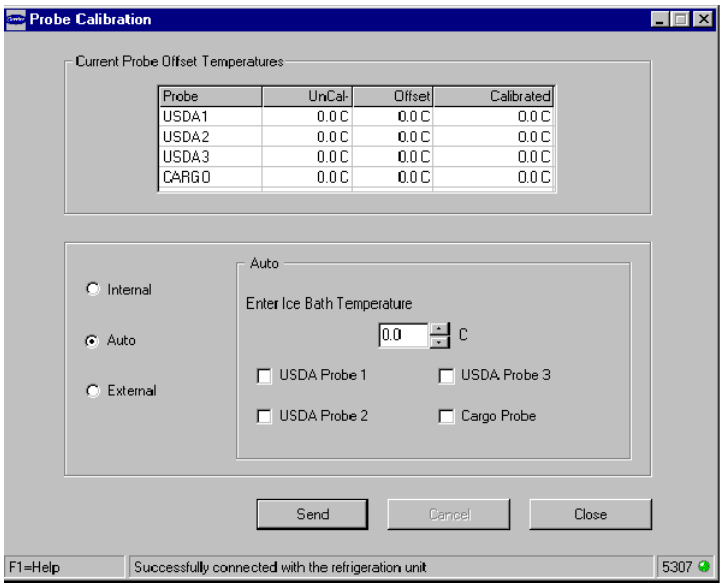
1. Ensure the DataCORDER is configured as follows:
   a. Configuration Option is set for USDA probes and logging interval set for 60 minutes.
   b. Sensor is set to “2 Averaged 3-USDA.”
   c. The resolution is set to “Normal.”

Figure 4.11 DataCORDER Configuration Screen



2. Calibrate the three USDA probes by ice bathing the probes and performing the calibration function with the DataLINE. This calibration procedure generates the probe offsets which are stored in the controller and applied to the USDA sensors for use in generating sensor type reports (see **Figure 4.12**).

Figure 4.12 DataCORDER Probe Calibration Screen



3. Pre-cool the container to the treatment temperature or below.
4. Install the controller battery pack (if not already installed).
5. Check the battery status by pressing the CODE SELECT key and using the Arrow keys to bring up code Cd19. Select btESt.
6. Place the three probes. Refer to the USDA Treatment Manual for directions on placement of probes in fruit and probe locations in container.

   Sensor 1 (USDA1): Place in a box at the top of the stack of the fruit nearest to the air return intake.

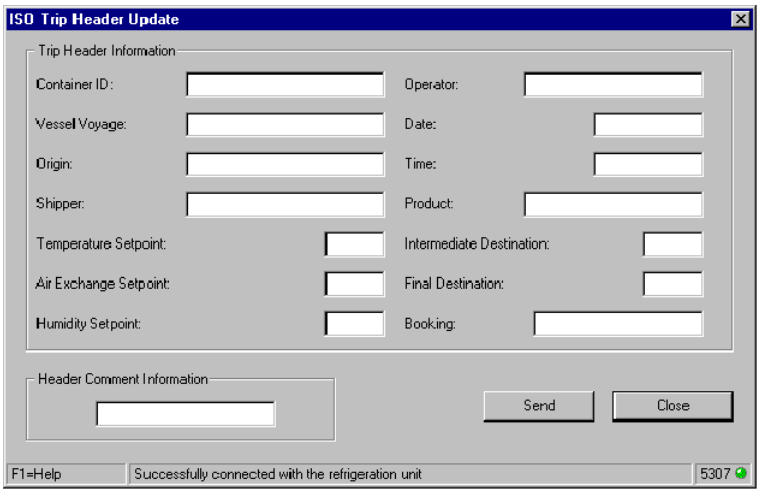
   Sensor 2 (USDA2): Place slightly aft of the middle of the container, halfway between the top and bottom of the stack.

   Sensor 3 (USDA3): Place one pallet stack in from the doors of the container, halfway between the top and bottom of the stack.
7. To initiate USDA recording, connect the personal computer and enter ISO header information using the DataLINE software.

   a. Enter ISO header information.

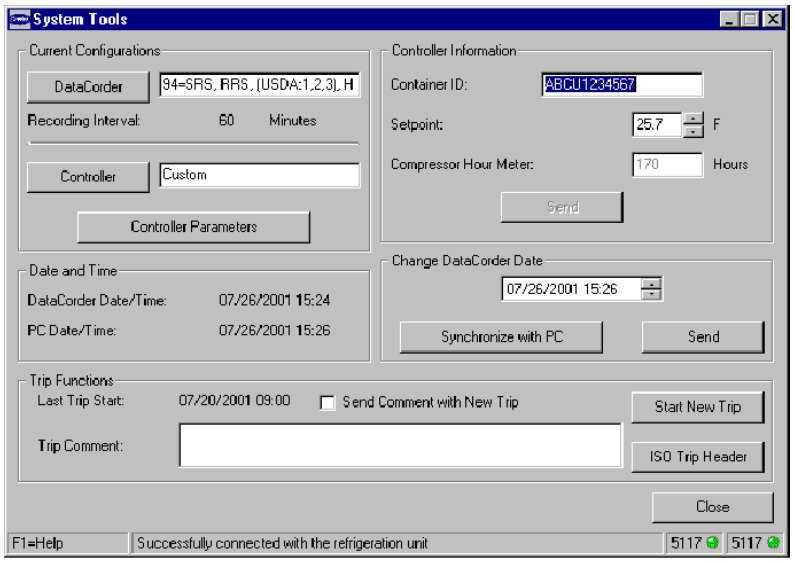
   b. Enter a trip comment if desired.

Figure 4.13 DataCORDER Probe Calibration Screen



c. Using the System Tools screen in the DataLine software perform a “trip start.” See **Figure 4.14**.

Figure 4.14 DataCORDER Systems Tool Screen



4.6.14 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.

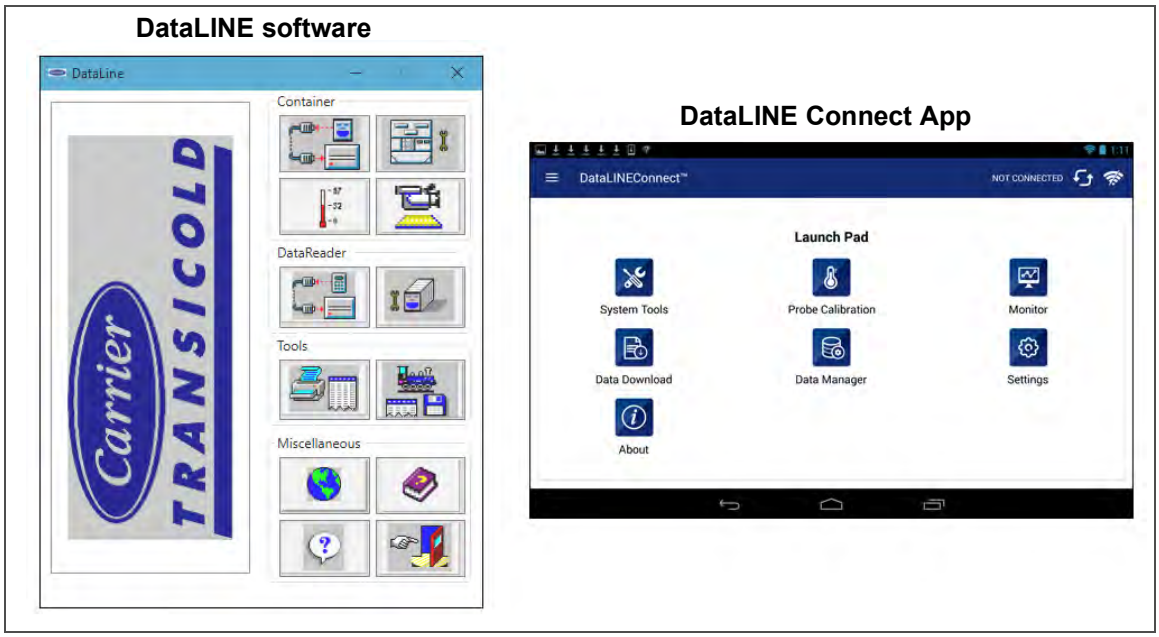
4.6.15 DataCORDER Communications

Data can be retrieved from the DataCORDER and viewed with DataLINE software or the DataLINE Connect app (see **Figure 4.15**). DataLINE allows interrogation, configuration variable assignment, screen view of the data, hard copy report generation, cold treatment probe calibration and file management.

The ML5 controller allows this data retrieval via wired or wireless communications. See **Section 4.7** for a description of ML5 communications. When connecting hard-wired with a cable, DataLINE software will be used. When connecting wirelessly to a phone or tablet, the DataLINE Connect App will be used.

Procedures and information related to DataLINE software and its interface with the DataCORDER can be found in the **62-10629 DataLINE User Manual**, located in the Literature section of the Container Refrigeration website. To find the manual from the Literature section, select Data Tools > DataLINE > All Documents.

Figure 4.15 DataLINE and DataLINE Connect



4.7 Controller Communications

4.7.1 Controller Wired Communications

Connect to the ML5 controller's micro USB port with a flash drive or cable:

- Use a flash drive to upload ML5 Controller Software with the ALT. MODE > USb menu.
- Use a flash drive to perform Controller Configuration / Setup tasks with the ALT. MODE > USb menu.
- Use a flash drive to download DataCORDER data with the ALT. MODE > USb menu.
- Connect a cable from a PC/laptop to view DataCORDER data with DataLINE or DataLINE Connect.

NOTE

If connecting a USB cable from the controller to a Windows 10 computer, follow the procedure in the DataLINE manual to set up a static IP address.

Connect via Interrogator Receptacle:

- The unit may be fitted with an optional external interrogator receptacle for connection of equipment for calibration and also to download recorded data from the DataCORDER.

NOTE

Downloading using the USDA port inside of the container is not supported by DataLINE.

4.7.2 Controller Wireless Communications

The ML5 controller offers short range wireless connectivity through wireless 802.11 b/g/n. A mobile device can wirelessly connect to the ML5 controller using the DataLINE Connect app.

NOTE

Wireless connectivity may only operate when ambient temperatures are above -20°C (-4°F). Connectivity will be intermittent below this temperature.

The unit display module provides a wireless menu that allows access to all necessary parameters needed for wireless configuration and status checks.

4.7.2.a Displaying the Wireless Settings Menu

1. On the keypad, press the ALT. MODE key.
2. Use the Arrow keys until "nEt" is displayed, then press the "ENTER" key.
3. The nEt menu is now active and menu options are accessible. See **Table 4–6** for menu description.

Table 4–6 Wireless Settings Menu (nEt) Options

Option	Description
EnbL	Enable / Disable Wireless Connection (On/Off). If On, wireless mode shall be initialized according to the last saved wireless role. If Off, all existing wireless connections will be shut down and wireless is disabled. • Controller will enable wireless by default. • Wireless will not be initialized if the system is running a battery and not on AC / USB 5V. • Wireless can be forcefully shut down in some cases during battery operation.
PASSW	View Wireless Connection Passcode. The wireless connectivity passcode accessed here can establish a connection from your wireless computer / tablet / phone to the ML5 controller. • Passcode resets every four hours (based on system clock). • Passcode is good for the customer's fleet (assuming all clocks are set properly). • If communicating at the passcode change time boundary, the session can run for an additional 4 hours without changing the passcode.

4.7.2.b Enabling or Disabling the Controller Wireless Network

1. On the keypad, press the ALT. MODE key.
2. Use the Arrow keys until "nEt" is displayed, then press the ENTER key.
3. Use the Arrow keys until "EnbL" is displayed, then press the ENTER key. The right display value will flash.
4. Use the Arrow keys to select "On" or "OFF, then press the ENTER key to confirm the selection.

4.7.2.c Looking Up the Controller Wireless Network Passcode

1. On the keypad, press the ALT. MODE key.
2. Use the Arrow keys until "nEt" is displayed, then press the ENTER key.
3. Use the Arrow keys until "PASSw EntR" is displayed, then press the ENTER key.
4. The display will show the eight character passcode that is required to connect a device to this unit’s controller. Write this value down.

4.7.2.d Communicating with the Controller using DataLINE Connect (IOS Device)

This procedure explains how to open the DataLINE Connect application and connect it directly to a unit’s controller.

1. Open the DataLINE Connect application.
2. Open the WiFi Settings menu (or Settings menu).
3. Under “Wi-Fi Login Credentials”, type in the Container ID of the unit to connect to. If this unit has already been entered, select from the list of available wireless connections.
4. Next to “Passcode” (or “Token”), enter the passcode obtained from the Net menu on the display if it is not already shown there. See **Section 4.7.2.c** for reference.
5. Select Login.
6. When DataLINE connect is connected, a message will appear “Connected to the WIFI successfully”.
7. After clicking OK to the message, the features of DataLINE Connect are now available. Refer to DataLINE Connect user manual for more detailed procedures for using DataLINE Connect.

4.7.2.e Communicating with the Controller using DataLINE Connect (Android Device)

This procedure explains how to open the DataLINE Connect application and connect it directly to a unit's controller.

1. Open the DataLINE Connect application.
2. Open the WiFi Settings menu (or Settings menu).
3. Verify that the "Wi-Fi ON" indicator is enabled.
4. Under "Wi-Fi Login Credentials", specify the name of the wireless connection next to "Container ID" by selecting from the list of available WiFi connections, or by typing in the Container ID of the unit you want to connect to.
5. Next to "Passcode" (or "Token"), enter the passcode obtained from the Net menu on the display if it is not already shown there. to **Section 4.7.2.c** for reference.
6. Select Login.
7. The message will appear "Connected to the WIFI successfully". The controller wireless network name appears on the top right corner of the interface.
8. After clicking OK to the message, the features of DataLINE Connect are now available. Refer to DataLINE Connect user manual for more detailed procedures for using DataLINE Connect.

4.8 Controller Configuration Variables

Table 4–7 Controller Configuration Variables

Config	Title	Default	Option
CnF02	Evaporator Fan Speed	dS (Dual)	SS (Single)
CnF03	Control Temperature Sensors	FOUr	duAL
CnF04	Enable Dehumidification	On	OFF
CnF08	Evaporator Motor Type	1Ph	3Ph
CnF09	Refrigerant Type	r134a	r744
CnF11	Defrost "Off" Selection	noOFF	OFF
CnF15	Enable Discharge Temperature Sensor	Out	In
CnF16	Enable DataCORDER	On (Yes)	(Not Allowed)
CnF17	Enable Discharge Pressure Sensor	Out (No)	In (Yes)
CnF18	Heater Type	Old (Low Watt)	nEW (High Watt)
CnF20	Enable Suction Pressure Transducer	Out (No)	In (Yes)
CnF22	Economy Mode	OFF	Std, Full
CnF23	Enable Defrost Interval Save	noSAv	SAv
CnF24	Enable Long Pre-Trip Test Series	Auto	Auto2, Auto 3
CnF25	Enable Pre-Trip Data Recording	rSLtS	dAtA
CnF26	Heat Lockout Temperature	Set to -10C	Set to -5C
CnF27	Enable Suction Temperature Sensor	Out	In
CnF28	Enable Bulb Mode	NOr	bULb
CnF31	Probe Check	SPEC	Std
CnF32	Enable Single Evaporator Operation	2EF0	(Not Allowed)
CnF33	Enable Snap Freeze	OFF	SnAP
CnF34	Temperature Unit Display	nOth	F
CnF37	Electronic Chart Probe	rEtUR	SUPPL, bOth
CnF41	Enable Low DTT Setting	Out	In
CnF44	Autoslide Enable	Out	LO, UP

Table 4–7 Controller Configuration Variables (Continued)

Config	Title	Default	Option
CnF45	Low Humidity Enabled	Out	In
CnF46	Quench / Liquid Injection Valve Type	nO=0=no	nC=1=nc
CnF47	Vent Position	OFF	UP, LOW, CUStOM
CnF49	OEM Reset Option	OFF	0-off,1-std, 2-spec,3-cust
CnF50	Enhanced Bulb Mode Interface	0-out	1-in
CnF51	Timed Defrost Disable	0-out	1-in
CnF52	Oil Return Algorithm	0-out	1-in
CnF53	Water Cool Oil Return Logic	0-out	1-in
CnF55	TXV Boost Relay	0-out	1-in
CnF56	TXV Boost Circuit	0-out	1-in
CnF57	PWM Compressor Control	0-out	1-in
CnF59	Electronic Evaporator Expansion Valve	0-none	1-EC, 2-KE, 3-NA
CnF61	ACT ASC Control Enable	0-out	1-in
CnF62	Extended Temperature Control Enable	0-out	1-in
CnF63	QUEST Pre-Trip / TripWise Default State	0-on	1-off
CnF67	Air Heaters	0-out	1-in
CnF70	Enable XtendFRESH Logic	0-out	1-in
CnF71	XtendFRESH Pre-Trip / TripWise Default State	0-off	1-on
CnF74	TripWise Pre-Trip / TripWise Default State	0-off	1-on
CnF78	XtendFRESH Scrubber Output Available	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.

4.9 Controller Function Codes

Table 4–8 Controller Function Codes

Code	Title	Description
NOTICE **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 DUV percent closed. The right display reads 100% when the valve is fully closed. The valve will usually be at 10% on start up of the unit except in very high ambient temperatures.
Cd03	Compressor Motor Current	The current sensor measures current draw in lines L1 & L2 by all of the high voltage components. It also measures current draw in compressor motor leg T3. The compressor leg T3 current is displayed.
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 energization. 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 pre-trip failure or a control alarm indication.

Table 4–8 Controller Function Codes (Continued)

Code	Title	Description
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 displayed will be halved if either fuse F1 or F2 is bad (alarm code AL021).
Cd09	Ambient Temperature	The ambient sensor reading is displayed.
Cd10	Compressor Suction Temperature / Evaporator Temperature	Evaporator temperature sensor reading is shown on the right display.
Cd11	Compressor Dome Temperature / Discharge Temperature	Compressor discharge temperature sensor reading, using compressor dome temperature, is displayed.
Cd12	Compressor Suction Port Pressure / Evaporator Pressure	Reading for evaporator pressure transducer (EPT) is shown on the left display; Press the ENTER key at Cd12 to show reading for compressor suction port pressure on right display.
Cd14	Compressor Discharge Pressure	Compressor discharges pressure transducer reading is displayed.
Cd15	Digital Unloader Valve	The status of the valve is displayed (Open - Closed).
Cd16	Compressor Motor State / Unit Run Time Hour Meter	This code displays the compressor motor hours. Press the ENTER key while in Cd16 to view unit run time. Total hours are recorded in increments of 10 hours (i.e., 3000 hours is displayed as 300). Press and hold the ENTER key for 5 seconds to reset the Compressor Motor Hour Meter display. 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.
Cd19	Battery Check	Request backup battery test and display results or scroll to last result. After selecting CD19, press the ENTER key while “btESt” is displayed to run the backup battery test. While the test is running, “btESt” will flash on the display. Once the test is complete, the Backup Battery Test Result will be displayed. After 5 seconds, the controller returns to displaying the setpoint. For the Test Result: • If the test result is Pass, the display will show “PASS” to indicate this. • If the test result is End of Life, the display will show “EOL” to indicate this. • If the test result is Fail, the display will show “FAIL” to indicate this. • If the test result detects a temperature out of range condition (greater than 45 deg C), the display will show “toor” to indicate this. The smart battery will not charge. • If the test result is Non-Carrier, the display will show “not C” to indicate this. • If the test result is No Battery, the display will show “nobAt” to indicate this. If the ENTER key is not pressed in 5 seconds, then the controller returns to displaying the setpoint. Whenever the battery test is run, the Relative State of Charge (RSOC) is posted in the download.

Table 4–8 Controller Function Codes (Continued)

Code	Title	Description
Cd20	Config / Model Number	This code indicates the dash number of the model for which the Controller is configured (i.e., if the unit is a 69NT40-551-100, the display will show “51100”). To display controller configuration database information, press the ENTER key. 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 represents the publication date of the model configuration database.
Cd21	Capacity Mode	The mode of operation is displayed (Standard - Economized).
Cd22	Compressor State	The status of the compressor is displayed (OFF, On).
Cd23	Evaporator Fan State	Displays the current evaporator fan state (OFF, LOW, HIGH).
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 reading is displayed.
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)	This is the desired period of time between defrost cycles. Factory default is “AUTO”. See **Section 4.3.20** for information on Defrost Interval. CnF11 determines whether the operator will be allowed to chose “OFF” as a defrost interval option. 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 Pre-trip sequence is initiated, Cd27 will be set to ‘AUTO’ unless CnF49 (OEM Reset) is set to “Custom”.
Cd28	Temperature Units (Degrees C or Degrees F)	This code determines the temperature units (C or F) that will be used for all temperature displays. The user selects C or F by selecting function code Cd28 and press 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)	If all of the control sensors are out of range (alarm code AL026) or there is a probe circuit calibration failure (alarm code AL027), the unit will enter the shutdown state defined by this setting. The user selects one of four possible actions as follows: A - Full Cooling (Compressor is on, economized operation.) b - Partial Cooling (Compressor is on, standard operation.) C - Evaporator Fan Only (Evaporator fans on high speed, not applicable with frozen setpoints.) d - Full System Shutdown - Factory Default (Shut down every component in unit.)

Table 4–8 Controller Function Codes (Continued)

Code	Title	Description
Cd30	In-Range Tolerance	The in-range tolerance will determine the temperature band around the setpoint 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 green IN-RANGE light is 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 start-up, 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. When desirable, the limit can be lowered. Note, however, that capacity is also reduced. The five values for 460 VAC operation are: 15, 17, 19, 21, or 23 amperes. The factory default setting is 21 amperes.
Cd33	Humidity Setpoint	This is the value in percent to which the system will dehumidify. There are configuration variables that determine whether dehumidification 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 the unit is configured for dehumidification, then the entire setpoint range will apply to dehumidification. If Pre-trip is initiated, this value will be set to "OFF" automatically. (Replaced by Cd48 interface if CnF50 Enhanced Bulb Mode Interface 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 setpoint 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 4–8 Controller Function Codes (Continued)

Code	Title	Description
Cd36	Evaporator Fan Speed	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 displayed (indicating that the evaporator fans will alternate their speed) and the display cannot be changed. If a dehumidification setpoint 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 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 interface if CnF50 Enhanced Bulb Mode Interface is active.)
Display Only Functions - Cd38 through Cd40 are display only functions.		
Cd38	Secondary Supply Temperature Sensor	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, Cd38 will display the supply recorder sensor reading.
Cd39	Secondary Return Temperature Sensor	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, 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. Press the Enter key while on Cd40 to 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”. Press the ENTER key while on Cd40 in this state to prompt the Set Id Interface. On start up if the container id is not valid, Cd40 will 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. 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.
Cd41	Valve Override	**SERVICE FUNCTION:** This code is used for troubleshooting, and allows manual positioning of the economizer solenoid valve, electronic expansion valve, and digital unloader valve. Provides readings such as: Percent Capacity, EEV, Capacity Mode, LIV and DUV. See **Section 7.25** for operating instructions.
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	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.

Table 4–8 Controller Function Codes (Continued)

Code	Title	Description
Display Only Function - Cd44 is a display only function.		
Cd44	XtendFRESH Values | EverFRESH Values	**When XtendFRESH option enabled:** 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%. **When EverFRESH option enabled:** Cd44 allows the user to view the following EverFRESH values: CO_2 setpoint, CO_2 percentage, O_2 setpoint, O_2 percentage, O_2 voltage, and MPT pressure. For the CO_2 setpoint, the range is from 2 to 19% in 1% increments with a default setting of 5%. For the O_2 setpoint, the range is from 3% to 17% 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.
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 4–8 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. Press the ENTER key to take the interface down into a hierarchy of parameter selection menus (mode, setpoint, evaporator speed, DTT setting). Press the ENTER key in any parameter selection menu to commit selection of the currently displayed parameter and cause 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. Press the CODE SELECT key in a selection menu to cancel the current selection activity and ascend 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 pre-trip test is initiated, dehumidification-mode goes to OFF. Whenever dehumidification-mode goes to OFF: • Dehumidification control setpoint goes to0%RHinternally 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 setpoint 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 setpoint 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 Pre-Trip	Displays the number of days since last successful pre-trip sequence. Press the ENTER key to view the number of days since the last successful pre-trip for Auto1, Auto2, and Auto2 in sequence. Press the CODE SELECT key to step back through the list and ultimately to exit the Cd49 display.
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		

Table 4–8 Controller Function Codes (Continued)

Code	Title	Description
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 QUEST. ”PrtrP” = pre-trip active. ”C LIM” = suspended by cool limit logic. ”PULL” = pulldown active. “ALArM ” = suspended by shutdown alarm Press the ENTER key, Arrow keys, and then ENTER key to select “OFF” or “On”. If “On” is selected, QUEST operation may be suspended as indicated by one of the suspension codes listed above. If QUEST is not “OFF” and is not suspended, “On” will be displayed.
Cd51	Automatic Cold Treatment (ACT) Mode Parameter Selection	Automatic Cold Treatment (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), default “0_0. See **Section 5.11** for procedure to set ACT using Cd51. Press the ENTER key to take the interface down into a hierarchy of parameter selection menus (act, treat, days, probe and spnew setting). Press the ENTER key in any of the parameter selection menus to commit selection of the currently displayed parameter and cause 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. Press the CODE SELECT key in a selection menu to cancel the current selection activity and ascend back up to the next higher selection menu (or to Cd51 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. 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 pre-trip test or Trip Start is initiated, ACT mode goes to OFF.

Table 4–8 Controller Function Codes (Continued)

Code	Title	Description
Cd53	Automatic Setpoint Change (ASC) Mode Parameter Selection	Automatic Setpoint Change (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 Cd53 will display current count down timer increments of (1 day)_(1hr), default “0_0 Press the ENTER key to take the interface down into a hierarchy of parameter selection menus, (mode, act, treat, days, probe and spnew setting). Press the ENTER key in any of the parameter selection menus to select the currently displayed parameter and cause 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. Press the CODE SELECT key in a selection menu to cancel the current selection activity and ascend back up to the next higher selection menu (or to Cd53 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. 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 pre-trip test or Trip Start is initiated, ASC mode goes to OFF.
Display Only Functions - Cd54 through Cd58 are display only functions.		
Cd54	Suction Port Superheat / Electronic Expansion Valve Status	Reading for evaporator superheat (suction temperature minus suction saturation temperature as calculated from suction pressure) is shown on the right display. Press the ENTER key at Cd54 to show reading for EEV position (in %) on left display.
Cd55	Discharge Superheat	Cd55 will display discharge superheat (discharge temperature minus discharge saturation temperature as calculated from discharge pressure) 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 4–8 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 - Cd59 through Cd61 are user-selectable functions. The operator can change the value of these functions to meet the operational needs of the container.		
Cd59	Pump Down Logic	Cd59 allows operation of the pump down logic control. The display will flash between “STArT PdN” and “PrESS EnTEr”. Upon entering Cd59 the operator will be required to acknowledge that they want to initiate the pump down control. The display will flash between “STArT PdN” and “PrESS EnTEr”. Once the decision to continue is confirmed pump down logic will begin, and will take complete control of the unit until pump down either succeeds or fails. This operation can not be halted once it begins without power cycling the unit. After pump down logic has been initiated, the operator will be notified to close the Liquid Line Valve, the display will flash between “CLOSE LLV” and “PrESS EnTEr”. Once complete the display will read “P dN” to the left, and the current suction pressure to the right. If the automatic pump down logic succeeds within 20 minutes, the unit will turn itself off, and the display will notify the operator that pump down is complete by flashing between “P dN DOnE” and “SHUT OFF”. The operator must then shut off the unit. If the automatic pump down logic does not complete within 20 minutes, the unit will drop out of Cd59 and return to its previous control condition.
Cd63	FuelWise	Cd63 is used to enable FuelWise. Following a power cycle, the state of the function select code is retained at its state prior to the power cycle if CNF72 = Default ON else if Default OFF this will be set to OFF. If “On”, this function select code will be set to “OFF” when any trip start occurs or any pretrip test is initiated. Event 120 shall be logged when ever CD63 is Turned ON OR if CD63 state is ON at Mid night. “-----” will be displayed if Cnf72 is configured OFF.

Table 4–8 Controller Function Codes (Continued)

Code	Title	Description
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 1 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
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 TripStart on the unit.
Cd71	EverFRESH Mode	Cd71 has three selectable modes of operation: FRESH - All EverFRESH operations are enabled and setpoints for CO_2 and O_2 can be edited. OFF - All EverFRESH operations are disabled. PURGE - the operator has the ability to suspend EverFRESH operations while per-charging gas levels in the container.
Cd74	Controller Diagnostic	Request Test "tESt", Displayed Test Result "PASS," "FAIL0," "FAIL1," "FAIL2" After selecting CD74, press the ENTER key while "tESt" is displayed to run the Controller Self Diagnostic test. While the test is running, "tESt" will flash on the display. Once the test is complete, the Test Result will be displayed. After 30 seconds, the controller returns to displaying the setpoint. "PASS" will be the result if all power sources are present and at the correct level, there are no input faults, and all output tests pass. "FAIL0" will be the test result if a power source is not available or not at the correct level. "FAIL1" will be the test result if all power sources are present and at the correct level, but there is an input fault. "FAIL2" will be the test result if all power sources are present and at the correct level, and there are no input faults, but an output test fails.

4.10 Controller Alarm Indications

There are three alarm categories:

- AL0XX Refrigeration Critical Alarms
- AL2XX Refrigeration Non-Critical Alarms
- AL9XX Atmosphere Critical and Non-Critical Alarms

AL003	Loss of Superheat Control	
Cause:	Superheat has remained below 1.66°C (3°F) degrees for five minutes continuously while compressor running. Compressor drawing more than 2.0 amps, compressor pressure ratio is greater than 1.8, and Electronic Expansion Valve (EEV) is at 0% open.	
	Component	Electronic Expansion Valve (EEV)
	Troubleshooting	Check the operation of the EEV using Cd41.
	Corrective Action	Replace EEV if defective.
	Component	Evaporator Temperature Sensors (ETS1 & ETS2)
	Troubleshooting	Verify accuracy of temperature sensors. See Sensor Checkout Procedure **Section 7.28.2**.
	Corrective Action	Replace ETS1 or ETS2 if defective.
	Component	Evaporator Fans
	Troubleshooting	Confirm fans operating properly.
	Corrective Action	Replace fan(s) if defective. See Evaporator Fan Motor Assembly **Section 7.17**.

AL017	Compressor Pressure Delta Failure	
Cause:	Compressor has attempted to start in both directions and fails to generate sufficient pressure differential between Suction Pressure Transducer (SPT) and Discharge Pressure Transducer (DPT).	
	Component	N/A
	Troubleshooting	Controller will attempt to restart every 20 minutes and deactivate the alarm if successful.
	Corrective Action	Resume normal operation.
	Component	Discharge Pressure Transducer (DPT)
	Troubleshooting	Confirm accurate DPT pressure readings. See Manifold Gauge Set **Section 7.2**.
	Corrective Action	Replace DPT if defective.
	Component	Suction Pressure Transducer (SPT)
	Troubleshooting	Confirm accurate SPT pressure readings. See Manifold Gauge Set **Section 7.2**.
	Corrective Action	Replace SPT if defective.
	Component	Monitor Unit
	Troubleshooting	Alarm is display only; the alarm may clear itself during operation.
	Corrective Action	If alarm remains active or is repetitive, replace compressor at next available opportunity.

AL020	Control Fuse (F3) Open	
Cause:	Control power fuse (F3 or F4) is open.	
	Component	Check F3 fuse.
	Troubleshooting	If fuse is open, check PA, PB, CH coils for short to ground.
	Corrective Action	If short is found, replace the defective coil. Replace the fuse.
	Component	Check F4 fuse.
	Troubleshooting	If fuse is open, check ESV coil resistance at CA1 to TRX2. If short to ground, or if resistance is less than 4 ohms, coil is defective. 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 not present, check ST7. If voltage is present, it indicates a defective microprocessor.
	Corrective Action	See Controller Service **Section 7.27**.

AL021	Control Fuse (F1 / F2) Open	
Cause:	One of the 18 VAC controller fuses (F1 or 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. See Controller Service **Section 7.27**.

AL022	Evaporator IP Open	
Cause:	Evaporator motor internal protector (IP) is open.	
	Component	Evaporator Motor
	Troubleshooting	Shut down unit, disconnect power. Check harness between CA22 and CA12. If open circuit, check Evaporator Motor IP at plug connection pins 4 & 6.
	Corrective Action	Replace defective Evaporator Fan Motor. See Evaporator Fan Motor Service **Section 7.17**.

AL023	Loss of Phase B	
Cause:	Compressor is running and controller determines that compressor internal protector and HPs are closed. Or, the High Speed Evaporator Fan motor is energized and internal protector is not tripped and current reading is less than 0.5 amps.	
	Component	Incoming Power
	Troubleshooting	Verify proper voltage input and proper operation of compressor contactor and high speed evaporator contactor.
	Corrective Action	Replace defective component.

AL024	Compressor IP Open	
Cause:	Compressor internal protector (IP) is open.	
	Component	Compressor
	Troubleshooting	Shut down unit disconnect power and 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. See Compressor Service, **Section 7.9**.

AL025	Condenser IP Open	
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 resistance at harness between CA23 and CA11. If open, check condenser fan motor IP at plug connection pins 4 & 6.
	Corrective Action	Replace defective condenser fan motor. See Condenser Fan Motor Assembly Service, **Section 7.12**.

AL026	All Supply / Return Probes Failure	
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. See Temperature Sensor Service **Section 7.28**.

AL027	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. See Controller Service **Section 7.27**.

AL028	Low Suction Pressure	
Cause:	Suction pressure too low for normal operation.	
	Component	N/A
	Troubleshooting	Power cycle the unit.
	Corrective Action	Resetting the unit may correct problem. Check charge. Monitor the unit.

AL028	Low Suction Pressure	
	Component	Suction Pressure Transducer (SPT)
	Troubleshooting	Confirm accurate SPT pressure readings. See Manifold Gauge Set **Section 7.2**.
	Corrective Action	Replace SPT if defective.
	Component	Discharge Pressure Transducer (DPT)
	Troubleshooting	Confirm accurate DPT pressure readings. See Manifold Gauge Set **Section 7.2**.
	Corrective Action	Replace DPT if defective.

AL072	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 the unit. Control temperature is in range. Any pre-trip mode, resets the timers.

AL206	Keypad or Keypad Harness Fault	
Cause:	Controller has detected that one of the keypad keys has continuous 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.

AL207	Fresh Air Vent Open with Frozen Setpoint	
Cause:	Unit has a frozen setpoint and Vent Position Sensor (VPS) is indicating that the fresh air vent is open.	
	Component	Vent Position Sensor (VPS)
	Troubleshooting	Manually reposition vent to 0% and confirm using Cd45. If Cd45 is not reading 0%, perform a calibration of the panel. Refer to Vent Position Sensor Service, **Section 7.29**.
	Corrective Action	If unable to obtain a zero reading, replace the defective VPS. If unit is loaded, make sure that the vent is closed. Note and replace VPS on next PTI.

AL208	High Compressor Pressure Ratio	
Cause:	Controller detects discharge pressure to suction pressure ratio is too high. The controller will attempt to correct the situation by restarting the compressor.	
	Component	Discharge Pressure Transducer (DPT)
	Troubleshooting	Confirm accurate DPT pressure readings. Refer to Manifold Gauge Set **Section 7.2**.
	Corrective Action	Replace DPT if defective.

AL214	Phase Sequence Detect Fault	
Cause:	Controller is unable to determine the correct phase relationship.	
	Component	N/A
	Troubleshooting	Power cycle the unit.
	Corrective Action	Resetting the unit may correct problem, monitor the unit.
	Component	Wiring
	Troubleshooting	Check unit wiring. Confirm pressure readings during start-up; suction pressure should decrease and discharge pressure should increase.
	Corrective Action	Correct wiring.
	Component	Current Sensor
	Troubleshooting	Check Cd41, right most digit: If display is 3 or 4, check compressor / sensor wiring. If display is 5, the current sensor is defective.
	Corrective Action	Replace current sensor if defective.

AL216	Compressor Current High	
Cause:	Discharge pressure is over the maximum for 10 minutes within the last hour.	
	Component	Current Sensor
	Troubleshooting	Compare Cd03 to actual measured current at wire T1-T2 or T3 going to the compressor contactor. If there is a difference, determine whether this is caused by the current sensor or the amp clamp tool.
	Corrective Action	Replace the current sensor if defective.
	Component	Amperage Too High
	Troubleshooting	Confirm that supply voltage / frequency is within specification and balanced according to Electrical Data listed in **Section 3.3**.
	Corrective Action	Correct power supply.
	Component	Operating Conditions
	Troubleshooting	Make sure system pressures are relevant to operating conditions.
	Corrective Action	Check condenser air flow. Check refrigerant charge, refer to Refrigeration System Service in **Section 7.7**.
	Component	Monitor Unit
	Troubleshooting	The alarm is display only. The alarm may clear itself during operation.
	Corrective Action	If the alarm remains active or is repetitive, replace the compressor at the next available opportunity. Refer to Compressor Service in **Section 7.9**.

AL218	Discharge Pressure High / Low	
Cause:	Discharge pressure is over the maximum for 10 minutes within the last hour.	
	Component	Restrictions in the refrigeration system.
	Troubleshooting	Ensure liquid line service valve is fully open.
	Corrective Action	Open liquid line service valve as needed.
	Component	Filter Drier
	Troubleshooting	Check the filter drier. If it is iced up or very cold, it indicates that the filter drier needs replacement.

AL218	Discharge Pressure High / Low	
	Corrective Action	Replace the filter drier if needed. See Filter Drier Service **Section 7.14**.
	Component	Condenser Fan
	Troubleshooting	Check condenser fan for proper operation.
	Corrective Action	Correct as required.
	Component	Discharge Pressure Transducer (DPT)
	Troubleshooting	Confirm accurate DPT pressure readings. See Manifold Gauge Set **Section 7.2**.
	Corrective Action	Replace DPT if defective.
	Component	Non-condensables in the refrigeration system.
	Troubleshooting	With the unit off, allow system to stabilize to ambient temperature. Check system pressure against Pressure Temperature Chart. See **Table 7–4**, **Table 7–5**.
	Corrective Action	Correct as required. See Refrigerant Charge **Section 7.7.1**.
	Component	Refrigerant
	Troubleshooting	Check refrigerant level.
	Corrective Action	Correct as required. See Refrigerant Charge **Section 7.7.1**.

AL219	Discharge Temperature High	
Cause:	Discharge temperature exceeds 135°C (275°F) for 10 minutes within the last hour.	
	Component	Restrictions in the refrigeration system.
	Troubleshooting	Ensure the discharge service valve is fully open.
	Corrective Action	Open the discharge service valve as needed.
	Troubleshooting	Check the unit for air flow restrictions.
	Corrective Action	Clean or remove any debris from coils.
	Component	Non-condensables in the refrigeration system.
	Troubleshooting	With the unit off allow system to stabilize to ambient temperature. Check system pressure against Pressure Temperature Chart. See **Table 7–4**, **Table 7–5**.
	Corrective Action	Correct as required. See Refrigerant Charge **Section 7.7.1**.
	Component	Additional Alarms such as AL216, AL024.
	Troubleshooting	Check compressor operation.
	Corrective Action	If the alarm persists, it may indicate a failing compressor, replace the compressor. See Compressor Service **Section 7.9**.

AL250	Air Vent Position Sensor Fault	
Cause:	Vent Position Sensor (VPS) out of range.	
	Component	Vent Position Sensor (VPS)
	Troubleshooting	Make sure VPS is secure.
	Corrective Action	Manually tighten panel.
	Troubleshooting	If the alarm persists, replace the sensor or the assembly.
	Corrective Action	Replace VPS.

AL251	Data Storage Fault	
Cause:	Controller memory failure.	
	Component	Controller
	Troubleshooting	Press the ENTER key when “CLEAr” is displayed to attempt to clear the alarm.
	Corrective Action	If action is successful (all alarms are inactive), alarm 251 will reset.
	Troubleshooting	Power cycle the unit. If the alarm persists, it indicates defective controller memory.
	Corrective Action	Replace defective controller. See Controller Service, **Section 7.27**.

AL252	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. See Controller Alarms **Section 4.4**.

AL253	Battery Pack Fault	
Cause:	Any of the USDA1, USDA2, or USDA3 probes have been detected AND the Backup Battery Test Result is Failure. Or, no Battery.	
	Component	Battery
	Troubleshooting	Perform battery test in function code Cd19 to determine failure mode of battery.
	Corrective Action	To clear the alarm, replace the battery pack. See **Section 7.27.9** Battery Replacement. If after replacement the alarm continues, run Cd19 to determine whether the replaced battery is good.

AL254	Primary Supply Temperature Sensor (STS) Fault	
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. See Temperature Sensor Service **Section 7.28**.

AL256	Primary Return Temperature Sensor (RTS) Fault	
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. See Temperature Sensor Service **Section 7.28**.

AL257	Ambient Sensor (AMBS) Fault	
Cause:	Invalid Ambient Temperature Sensor (AMBS) reading.	
	Component	Ambient Temperature Sensor (AMBS)
	Troubleshooting	Test the AMBS. See Sensor Checkout Procedure **Section 7.28.2**.
	Corrective Action	Replace AMBS if defective. See Temperature Sensor Service **Section 7.28**.

AL258	Compressor High Pressure Safety Open	
Cause:	High pressure safety switch remains open for at least one minute.	
	Component	High Pressure Switch (HPS)
	Troubleshooting	Test the HPS. See Checking High Pressure Switch, **Section 7.10.1**.
	Corrective Action	Replace HPS if defective. See Sensor Replacement, **Section 7.28**.
	Component	Refrigeration System
	Troubleshooting	Check unit for air flow restrictions.
	Corrective Action	Clean or remove any debris from coils.

AL259	Heat Termination Thermostat (HTT) Open	
Cause:	Heat Termination Thermostat (HTT) is open.	
	Component	Heat Termination Thermostat (HTT)
	Troubleshooting	Check resistance between CA21 and CA10. If 0 ohms, switch closed. if infinite (OL), switch open.
	Corrective Action	Replace HTT if defective. See Sensor Replacement **Section 7.28**.

AL260	Defrost Temperature Sensor (DTS) Fault	
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 7.28.2**.
	Corrective Action	Replace the DTS if defective. See Sensor Replacement **Section 7.28**.

AL261	Improper Heater Current 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. See Electrical Data, **Section 3.3**.
	Corrective Action	Replace heater(s) if defective. See Evaporator Heater Removal and Replacement **Section 7.16**.
	Component	Contactor
	Troubleshooting	Check voltage at heater contactor on the heater side.
	Corrective Action	If no voltage present, replace heater contactor if defective.

AL263	Exceed Current Limit Setting	
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.
	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 with function code Cd32.
	Corrective Action	The current limit can be raised (maximum of 23 amps) using Cd32.

AL264	Discharge Temperature Sensor (CPDS) Fault	
Cause:	Discharge Temperature Sensor (CPDS) out of range.	
	Component	Discharge Temperature Sensor (CPDS).
	Troubleshooting	Test the CPDS. See Sensor Checkout Procedure, **Section 7.28.2**.
	Corrective Action	Replace the CPDS if defective. See Sensor Replacement **Section 7.28**.

AL265	Discharge Pressure Transducer (DPT) Fault	
Cause:	Compressor Discharge Pressure Transducer (DPT) is out of range.	
	Component	Discharge Pressure Transducer (DPT)
	Troubleshooting	Confirm accurate DPT pressure readings. See Manifold Gauge Set **Section 7.2**.
	Corrective Action	Replace DPT if defective.

AL266	Suction Pressure Transducer (SPT), Evaporator Pressure Transducer (EPT) Fault	
Cause:	Suction Pressure Transducer (SPT) or Evaporator Pressure Transducer (EPT) out of range.	
	Component	Suction Pressure Transducer (SPT); Evaporator Pressure Transducer (EPT)
	Troubleshooting	Confirm accurate SPT and EPT pressure readings. See Manifold Gauge Set **Section 7.2**. Performing a pre-trip 5-9 test will also check the transducers.
	Corrective Action	Replace SPT / EPT if defective.
	Troubleshooting	Monitor
	Corrective Action	If the alarm persists, it may indicate a failing compressor. See Compressor Service **Section 7.9**.

AL267	Humidity Sensor (HS) Fault	
Cause:	Humidity Sensor (HS) reading out of range.	
	Component	Humidity Sensor (HS)
	Troubleshooting	Make sure the HS is properly connected in the socket. Make sure the HS wires have not been damaged.
	Corrective Action	Monitor, replace HS if alarm persists.

AL269	Evaporator Temperature Sensors (ETS1 / ETS2) Fault	
Cause:	Evaporator Temperature Sensors (ETS1 / ETS2) out of range.	
	Component	Evaporator Temperature Sensors (ETS1 / ETS2)
	Troubleshooting	Test the sensors. See Sensor Checkout Procedure **Section 7.28.2**.
	Corrective Action	Replace Evaporator Temperature Sensors (ETS1 / ETS2) if defective.

AL270	Supply Recorder Sensor (SRS) Fault	
Cause:	Supply Recorder Sensor (SRS) is out of range.	
	Component	Supply Recorder 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. See Temperature Sensor Service **Section 7.28**.

AL271	Return Recorder Sensor (RRS) Fault	
Cause:	Return Recorder Sensor (RRS) is out of range.	
	Component	Return Recorder 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. See Temperature Sensor Service **Section 7.28**.

AL272	USDA Temp 1 Out of Range	
Cause:	USDA Temp 1 Sensor is out of range.	
	Component	Sensor
	Troubleshooting	Validate sensor values by following the Sensor checkout procedure. See **Section 7.28**.
	Corrective Action	If the sensor is bad, replace. If not, verify the harness wiring and connections to the controller.

AL273	USDA Temp 2 Out of Range	
Cause:	USDA Temp 2 Sensor is out of range.	
	Component	Sensor
	Troubleshooting	Validate sensor values by following the Sensor checkout procedure. See **Section 7.28**.
	Corrective Action	If the sensor is bad, replace. If not, verify the harness wiring and connections to the controller.

AL274	USDA Temp 3 Out of Range	
Cause:	USDA Temp 3 Sensor is out of range.	
	Component	Sensor
	Troubleshooting	Validate sensor values by following the Sensor checkout procedure. See **Section 7.28**.
	Corrective Action	If the sensor is bad, replace. If not, verify the harness wiring and connections to the controller.

AL275	Cargo Probe 4 Out of Range	
Cause:	Cargo Probe 4 Sensor is out of range.	
	Component	Sensor
	Troubleshooting	Validate sensor values by following the Sensor checkout procedure. See **Section 7.28**.
	Corrective Action	If the sensor is bad, replace. If not, verify the harness wiring and connections to the controller.

AL286	RTC Battery Low	
Cause:	RTC Battery output low.	
	Component	RTC Battery
	Troubleshooting	Power cycle unit and monitor 24 hours to verify alarm goes inactive.
	Corrective Action	If alarm stays active, replace battery.

AL287	RTC Fault	
Cause:	RTC time invalid.	
	Component	Real Time Clock
	Troubleshooting	Power cycle. Reset clock. Verify it maintains correct time.
	Corrective Action	Replace RTC Battery. Retest.

AL289	Data Storage Fault	
Cause:	Unable to store data in DataCORDER.	
	Component	DataCORDER
	Troubleshooting	Power cycle and verify that the alarm goes inactive.
	Corrective Action	If alarm stays active, replace the controller.

AL907	Manual Fresh Air Vent Open	
Cause:	For units equipped with EverFRESH and a Vent Position Sensor, the controller will monitor the manual fresh air opening at a pre-determined time. If during this time the fresh air vent is open and EverFRESH is active, an alarm will be generated. If an alarm is active, the controller monitors the manual fresh air once per hour. Upon clearing the alarm, the controller goes back to monitoring at the pre-determined time.	
	Component	Vent Position Sensor (VPS)

AL907	Manual Fresh Air Vent Open	
	Troubleshooting	Manually reposition vent to 0% and confirm using Cd45. If Cd45 is not reading 0%, perform a calibration of the panel. See **Section 7.29** for Vent Position Sensor service procedures.
	Corrective Action	If unable to obtain a zero reading, replace the defective VPS. If unit is loaded, ensure vent is closed. Note and replace VPS on next PTI. The alarm will not affect the EverFRESH system from operating.

AL909	Oxygen Sensor (O2) Fault	
Cause:	Triggered anytime the O_2 sensor reading is outside of the normal operation range, after an initial signal was detected.	
Action:	Control CO_2 by running the EverFRESH Air Compressor (EAC) and opening the EverFRESH Air Valve (EA). Controlling CO_2 via the EA will also prevent low O_2 and cargo loss. If both AL909 and AL910 are active, run the EAC and open the EA.	
	Component	O_2 Sensor, O_2 Amplifier
	Troubleshooting	Check Cd44 and scroll down to 02V. The O_2 sensor output will be displayed in millivolts (130mV to 4100mV is a good range). Check wiring (refer to schematic), and check for bad connections or wires improperly positioned. If O_2 sensor is available, remove the upper fresh air panel and evaporator motor and replace the sensor. If after replacing the sensor Cd44 reads outside of the normal range and AL909 continues, replace the amplifier. If parts are not available, turn the EverFRESH option off via Cd71 and open the manual fresh air vent.

AL910	Carbon Dioxide Sensor (CO2) Fault	
Cause:	Triggered anytime the CO_2 sensor reading is outside of the normal operation range, after an initial signal was detected.	
Action:	Control O_2 to setpoint. Controlling O_2 may allow CO_2 to increase. Replace sensor as soon as possible. If both AL909 and AL910 are active, run the EverFRESH Air Compressor (EAC) and open the EverFRESH Air Valve (EA).	
	Component	CO_2 Sensor
	Troubleshooting	Check wiring (refer to schematic), and check for bad connections or wires improperly positioned. Check the voltage on the back of MD connectors pin MD09 (-) and MD03 (+12 VDC) with the controller energized. If 12 VDC is not available, check the controller. If 12 VDC is available, check the back of pin MD02 for a voltage between 1.0 - 4.7 VDC. If not present, replace the sensor. If part is available, remove the upper fresh air panel and evaporator motor and replace the sensor. If no part is available, take no action and service at next PTI.

AL929	Loss of Atmospheric Control	
Cause:	Triggered whenever the CO_2 level is above its upper limit by 1% for 45 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.	
Action:	Enable Alarm LED. Open the fresh air vent and air compressor is enabled.	
	Setup	Verify all EverFRESH components are functioning properly by checking for EverFRESH alarms and running a P-20 PreTrip.

AL929	Loss of Atmospheric Control	
	Troubleshooting	If a component is not functioning properly, it will fail the appropriate P-20 sub test. Note components in order below.
	Component	Membrane Pressure Transducer (MPT)
	Troubleshooting	Remove the MPT. Turn on the container unit. Using Cd44, verify the MPT pressure reads between -5 and +5 psig. Outside this range or if AL977 active, replace the sensor.
	Component	EverFRESH Air Compressor (EAC)
	Troubleshooting	Verify EAC fuses FEF1, FEF2 & FEF3. Check P20 results for a failure mode: • Possible detected failure with EAC current consumption, check compressor motor windings, and verify voltage on all 3 phases. • MPT failure. Follow steps above. • Failure of AC contactor for EAC. Ohm contactor coil and check resistance across contactor legs, with power removed.
	Component	EverFRESH Air Valve (EA)
	Troubleshooting	A closed or plugged EA solenoid could prevent fresh air from entering the container. P20-2 tests the valve. Potential failure results: • MPT pressure fails to change when the valve is energized. Check for signs of blockage in the valve or piping. • EA current is not correct. Access function code Cd74 and perform a ML5 self-check to verify the controller is functioning properly. If it passes, perform a ohm check on the back of CA08 pin and TRX2 (ground) using the carrier service tool (part # 22-50485-00).

AL929	Loss of Atmospheric Control	
	Component	Water Drain Valve (WDV)
	Troubleshooting	A closed or plugged WDV or filter housing could prevent any air from entering the container. P20-3 tests valve operation. Potential failure results: • MPT pressure fails to change when the valve is energized. Check for signs of blockage by removing the WDV housing and particulate filter housings. Clean any debris. While removed, inspect the WDV and associated piping for blockage. • EA current not correct. Access function code Cd74 and perform a ML5 self-check to verify the controller is functioning properly. If it fails, replace the controller. If it passes self-check, replace the WDV.
	Component	EverFRESH Nitrogen Valve (EN)
	Troubleshooting	An open or leaky EN valve would allow N2 to go into the sensor sensing chamber causing an inaccurate reading. P20-5 tests this valve. Potential failure results: • If tests fail, remove the EN and verify the valve is not clogged or damaged. • EA current is not correct. Access function code Cd74 and perform a ML5 self-check to verify the controller is functioning properly. If it fails, replace the controller. If it passes self-check, replace the EN.

AL962	Oxygen (O2) Out of Range	
Cause:	This is a notification alarm and does not pose a risk to fresh produce, however the benefit of atmosphere control will not be lost. O_2 level reaches pulldown limit and then O_2 exceeds 5% over setpoint for 30 minutes.	
	Component	Upper Fresh Air Panel
	Troubleshooting	Verify the Upper Fresh Air Panel has not been opened.
	Component	EverFRESH Air Valve (EA)
	Troubleshooting	An EA that is stuck open can allow continuous flow of fresh air into the container when the compressor is on. See troubleshooting in the AL929 section.
	Component	Container Air Tightness
	Troubleshooting	Seal container where possible (access panels, rear doors, mounting hardware, etc).

AL976	Air Compressor Internal Protector Open	
Cause:	EverFRESH Air Compressor (EAC) internal protector opens.	
	Component	EverFRESH Air Compressor (EAC)
	Troubleshooting	Follow steps defined in AL929 EAC testing.
	Component	ML5 Controller
	Troubleshooting	Access function code Cd74 to perform an ML5 self-diagnostic test.

AL977	Membrane Pressure Transducer (MPT) Fault	
Cause:	When the EverFRESH Air Compressor (EAC) is running and pressure is not between -5 psig and 200 psig or the EAC has been OFF for five minutes and pressure is not within the range of -5 psig and 5 psig.	
	Component	Membrane Pressure Transducer (MPT)
	Troubleshooting	With the EverFRESH system off for 15 minutes, bring up function code Cd44 and scroll to "EF Pt". Verify that the value is between -5 psig and 5 psig. A "- - - - " value indicates a failed sensor or harness. Pressure outside of range indicates a bad sensor, replace the sensor.
	Component	ML5 Controller
	Troubleshooting	Access function code Cd74 to perform an ML5 self-diagnostic test.

AL978	Air Compressor Pressure Low	
Cause:	EverFRESH Air Compressor (EAC) engaged and Fresh Air Vent (FAV) and Water Drain Valve (WDV) are closed and compressor has been running for longer than 20 seconds and Membrane Pressure Transducer (MPT) Pressure < 75 psig.	
	Component	Membrane Pressure Transducer (MPT)
	Troubleshooting	With the EverFRESH system off for 15 minutes, bring up function code Cd44 and scroll to "EF Pt". Verify that the value is between -5 psig and 5 psig. A "- - - - " value indicates a failed sensor or harness. Pressure outside of range indicates a bad sensor, replace the sensor.
	Component	System Plumbing
	Troubleshooting	Inspect plumbing, hoses, fittings, check valve, and orifices for signs of leakage. Repair as required. With the compressor running, spray the pressure relief valve with soapy water. Replace if leaking. If a spare pressure relief valve is not available, try opening and closing the valve with an O-Ring on the valve to try and re-seat. See the condition for Membrane Pressure Transducer (MPT) Reading Low in the EverFRESH manual.

AL979	Air Compressor Pressure High	
Cause:	EverFRESH Air Compressor (EAC) engaged and Pressure > 135 psig.	
	Component	Membrane Pressure Transducer (MPT)
	Troubleshooting	With the EverFRESH system off for 15 minutes, bring up function code Cd44 and scroll to "EF Pt". Verify that the value is between -5 psig and 5 psig. A "- - - - " value indicates a failed sensor or harness. Pressure outside of range indicates a bad sensor, replace the sensor.
	Component	System Plumbing
	Troubleshooting	Inspect plumbing, hoses, fittings, check valve, and orifices for signs of blockage. Repair as required. See the condition for Membrane Pressure Transducer (MPT) Reading High in the EverFRESH manual.

AL980	Fresh Air Valve (EA) Fault	
Cause:	When the system energizes the EverFRESH Air Valve (EA) solenoid and membrane pressure does not drop 40 psi, the alarm is triggered. The alarm triggers OFF when membrane pressure transducer (MPT) pressure drop is more than 40 psi when EA is opened.	
	Component	EverFRESH Air Valve (EA) Solenoid
	Troubleshooting	Run a P20 test to verify mechanical and electrical performance of the solenoid. If the electrical test fails, replace the valve. If the mechanical test fails, check for obstructions blocking system flow. Remove obstructions. If it still fails, replace the valve.
	Component	ML5 Controller
	Troubleshooting	Access function code Cd74 to perform an ML5 self-diagnostic test.

AL981	Water Drain Valve (WDV) Fault	
Cause:	When the system energizes the Water Drain Valve (WDV) and membrane pressure does not drop 40 psi, the alarm is triggered. The alarm triggers OFF when membrane pressure transducer (MPT) pressure drop is more than 40 psi when the EverFRESH Air Valve (EA) is opened.	
	Component	Water Drain Valve (WDV)
	Troubleshooting	Inspect WDV bowl and outlet piping for obstructions, clean components. Run P20 test to verify mechanical and electrical performance of solenoid. If the electrical test fails, replace the valve. If the mechanical test fails, check for obstructions blocking system flow. Remove obstructions. If it still fails, replace the valve.
	Component	ML5 Controller
	Troubleshooting	Access function code Cd74 to perform an ML5 self-diagnostic test.

AL982	CO2 Injection Failure	
Cause:	If unit is configured with the CO_2 injection option, this alarm is triggered when Cd71 is set to “On” to enable CO_2 injection and CO_2 is less than the CO_2 setpoint by 0.5% and IPT < 20 PSIG.	
	Component	CO_2 Supply
	Troubleshooting	Verify CO_2 supply is available and supplied at the recommended pressure.
	Component	CO_2 Injection Port Schrader Valve
	Troubleshooting	If proper pressure is available at the CO_2 injection supply port, verify that the Schrader valve is being depressed by the supply hose properly to allow flow.
	Component	CO_2 Injection Solenoid
	Troubleshooting	Run a P20 test to evaluate the solenoid and replace if test fails.

AL983	CO2 Injection Pressure Transducer Failure	
Cause:	If unit is equipped with the CO_2 injection option, this alarm is triggered when Cd71 is set to “On” to enable CO_2 injection and volts are not in the range of 0.5 to 4.95 VDC.	
	Component	CO_2 Injection Pressure Transducer (IPT)
	Troubleshooting	From function code Cd74, run a controller self-diagnostic test. Evaluate results to see if there is a controller or transducer issue. If there is a sensor issue, or the test passes, change the transducer.

AL996	Scrubber Rotation Fault	
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.

ERR#	Internal Microprocessor Failure	
Cause:	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 replaced.	
	Error	**Description**
	ERR 0-RAM failure	Indicates that the controller working memory has failed.
	ERR 1-Program Memory Failure	Indicates a problem with the controller program.
	ERR 2-Watchdog time-out	The controller program has entered a mode whereby the controller program has stopped executing.
	ERR 3-N/A	N/A
	ERR 4-N/A	N/A
	ERR 5-A-D failure	The controller’s Analog to Digital (A-D) converter has failed.
	ERR 6-IO Board failure	Internal program/update failure.
	ERR 7-Controller failure	Internal version/firmware incompatible.
	ERR 8-DataCORDER failure	Internal DataCORDER memory failure.
	ERR 9-Controller failure	Internal controller memory failure.

Entr StPt	Enter Set point (Press Arrow & Enter)
Cause:	The controller is prompting the operator to enter a setpoint.

LO	Low Main Voltage (Function Codes Cd27-38 disabled and No alarm stored.)
Cause:	This message will be alternately displayed with the setpoint whenever the supply voltage is less than 75% of its proper value.

4.11 Controller Pre-Trip Test Codes

Table 4–9 Controller Pre-Trip Test Codes

NOTE: "Auto" or "Auto1" menu includes the: P0, P1, P2, P3, P4, P5, P6 and rSLts. "Auto2" menu includes P0, P1, P2, P3, P4, P5, P6, P7, P8, P9, P10 and rSLts. "Auto3" menu includes P0, P1, P2, P3, P4, P5, P6, P7 and P8.		
P0-0	Pre-Trip 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 pre-trip. 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 Turned On	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 Turned Off	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.
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. If the Water Pressure Switch is open this test will be skipped.		
P2-0	Condenser Fan On	Condenser fan starts in the off condition, current draw is measured, and condenser 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	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.		
P3-0	Low Speed Evaporator Fan Motors On	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.
P3-1	Low Speed Evaporator Fan Motors Off	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.

Table 4–9 Controller Pre-Trip Test Codes (Continued)

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, 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.		
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 current 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, “P5-0” and “FAIL” will be displayed. If both Probe tests (this test and the PRIMARY/SECONDARY) pass, 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, “P5-1” 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 “P5” “PASS.”
P5-2	Return Probe Test	For units equipped with secondary return probe only. The temperature difference between return temperature sensor (RTS) and return temperature sensor (RRS) probe is compared. Test passes if temperature comparison falls within the specified range. **NOTES** 1. If this test fails, “P5-2” 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 pre-trip tests 5-0, 5-1 and 5-2 will be used to activate or clear control probe alarms.

Table 4–9 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 supply and primary return probes for up to 120 additional seconds. This is a Pass/Fail test. The test passes if differential of STS is 0.25°C higher than RTS. Test P5-0 must pass before this test is run.
P5-7	Primary vs. Secondary Evaporator Temperature Sensor Test	This is a Pass/Fail test of the primary evaporator temperature sensor (ETS1) and secondary evaporator temperature sensor (ETS2). Test passes if secondary evaporator temperature sensor (ETS2) is within +/- 0.5°C of the primary evaporator temperature sensor (ETS1).
P5-8	Future Expansion	This is no longer active and will be displayed as "-----" at this time.
P5-9	Primary vs. Secondary Evaporator Pressure Transducer Test	This is a Pass / Fail test of the primary Evaporator Pressure Transducer and secondary Evaporator Pressure Transducer. Test passes if secondary Evaporator pressure is within +/- 1.5 psi of the primary Evaporator pressure.
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. Test P5-9 must pass before 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 humidity sensor is between 0.33 and 4 Volts. Test fails if Vout is outside of this range. Test P5-11 must pass before this test is run.
P6 Tests - Refrigerant Probes, Compressor and Refrigerant Valves: Pass/Fail testing is performed for the compressor, EEV, DUV, LIV (if equipped), ESV, and the refrigerant pressure and temperature sensors.		
P6-0	Discharge Thermistor Test	If Alarm 64 is active the test fails. Otherwise, the test passes.
P6-1	Suction Thermistor Test	If the Suction Temperature Sensor (CPSS) both is configured ON and is invalid, the test fails. Otherwise the test passes.
P6-2	Discharge Pressure Transducer Test	If Alarm 65 is active any time during the first 45 second period, the test fails. Otherwise, the test passes.
P6-3	Suction Pressure Transducer Test	If Alarm 66 is active the test fails. Otherwise the test passes.
P6-4	Compressor Current Draw Test	Compressor current is tested before and 10 seconds after start up. If current does not increase, the test fails. P6-7 is run at the end of P6-4. If this test fails, P6-6 is skipped.

Table 4–9 Controller Pre-Trip Test Codes (Continued)

P6-5	Compressor Leak Test	Pre-trip P6-5 ensures that the compressor holds pressure. After compressor pump up and pump down, the compressor is turned off for 62 seconds. When suction side pressure holds (less than 8 psi rise) for 10 seconds, P6-5 passes, otherwise the Compressor Leak Test fails. See the **July 2017 issue of TechLine** for a procedure to assist the technician in troubleshooting a P6-5 occurrence.
NOTE P6-6 through P6-10 are conducted by changing status of each valve and comparing suction pressure change and/or compressor current change with predetermined values. Tests will cause compressor and condenser fans to cycle on and off as needed to generate the pressure required for individual pre-trip sub tests. The compressor will start in order to build discharge pressure, followed by compressor pump down sequence. At the conclusion of compressor pump down sequence, the compressor will shut down and the valve test will start.		
P6-6	Economizer Valve Test	Passes if suction pressure increases a minimum of 4 psia when the valve opens for 15 seconds.
P6-7	Digital Unloader Valve Test	Passes if pressure and current changes are within 3 seconds of DUV switch signal and either the pressure change or the current draw change is above 5 psi or above 1.5A, respectively.
P6-9	Liquid Injection Valve Test	(If equipped) Test passes if change of suction pressure is greater than 4 psia when the valve opens for 10 seconds. Otherwise, it fails.
P6-10	Electronic Expansion Valve Test	The test records the suction pressure during the open valve position and passes if the suction pressure increase is above 3 psi when the valve opens for 10 seconds.
NOTE P7-0 & P8 are included with “Auto 2 & Auto 3” only. P9-0 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 (HPS) Opening Test	Test is skipped if sensed ambient temperature is less than 7.2°C (45°F), return air temperature is less than -17.8°C (0°F), or the water pressure switch is open. With the unit running, the condenser fan is turned off and a 900 second (15 minute) timer is started. The right display shows Discharge Pressure if the sensor is configured and valid, else Discharge Temperature. The unit needs to disable Discharge Pressure limit and enable Current Limit checks.
		The test fails immediately if: - Ambient Temperature Sensor invalid - Composite Return Temperature Sensor invalid - HPS is open The test fails if: - HPS fails to open before 900 seconds total test time. - Evaporator or Compressor IP Alarm. - Calculated Dome Temperature exceeds 137.78°C (280°F). - Discharge pressure exceeds 370 psig. - Compressor Current exceeds limits The test passes if HPS opens within the 15 minute time limit.

Table 4–9 Controller Pre-Trip Test Codes (Continued)

P7-1	High Pressure Switch (HPS) Closing Test	If return temperature greater than -2.4°C, set setpoint to -5.0°C, else set setpoint to -30°C. Restart unit according to normal startup logic. Run unit normally for 120 seconds. The test passes if the high pressure switch closes within 75 seconds after end of Test 7-0, else the test fails. Test P7-0 must pass for this test to execute.
P8 Tests - Perishable Mode Tests: Pre-trip tests P7-0 and P7-1 must have passed or have been skipped for these tests to execute.		
P8-0	Perishable Mode Test	If the control temperature is below 15.6°C, the setpoint is changed to 15.6°C, and a 180 Minute timer is started. The control will then be placed in the equivalent of normal heating. If the control temperature is above 15.6°C. at the start of the test, then the test proceeds immediately to test 8-1. While in test 8-0 the right display will show the value of the control temperature. The 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 setpoint, the test proceeds to test 8-1.
P8-1	Perishable Mode Pull Down Test / eAutoFresh CO_2 Sensor Calibration	Control temperature must be at least 15.6°C (60°F). The setpoint is changed to 0°C (32°F), and a 180-minute timer is started. The left display will read “P8-1,” the right display will show the supply air temperature. The unit will then start to pull down the temperature to the 0°C setpoint. The test passes if the container temperature reaches setpoint 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 P8-1 must pass for P8-2 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 P8-2. During P8-2, the left display will read “P8-2,” 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 contacts, 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.		

Table 4–9 Controller Pre-Trip Test Codes (Continued)

P9-0	DTT Closed and Open Test	During P9-0 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. This step may not have to be executed. 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 48°C (120°F). Test passes if the DTT is considered open within the 2 hour heat cycle time limit.
P10 Tests - Frozen Mode Tests:		
P10-0	Frozen Mode Heat 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 10-1. During this test, the control temperature will be shown on the right display. The 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 setpoint, the test proceeds to test 10-1.
P10-1	Frozen Mode Pulldown Test	Control temperature must be at least 7.2°C (45°F) The setpoint is changed to -17.8°C. The system will then attempt to pull down the control temperature to setpoint using normal frozen mode cooling. During this test, the control temperature will be shown on the right display. The test passes if the control temperature reaches setpoint minus 0.3°C before the 180 minute timer expires. Otherwise, the test fails. Upon failure and when initiated by an automatic pre-trip sequence, P10-1 will auto-repeat once by starting P10-0 over again.
P10-2	Frozen Mode Maintain Temperature Test	Test P10-1 must pass for this test to execute. Same as for test 8-2 except the control temperature is the return probe temperature. The average error must be +/-1.6°C. If the DataCORDER supply temperature probe is invalid, the test fails and the control probe temperature will be recorded as -50°C. Upon failure and when initiated by an automatic pre-trip sequence, P10-2 will auto-repeat by starting P10-0 over again.

Table 4–10 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 (SRS) Test	Pass / Fail / Skip
5-2	Secondary Return Probe (RRS) Test	Pass / Fail / Skip
5-3	Evaporator Fan Direction Test	Pass / Fail / Skip
5-7	Primary vs. Secondary Evaporator Temperature Sensor Test	Pass / Fail / Skip
5-8	Future Expansion	"-----"
5-9	Primary vs. Secondary Evaporator Pressure Transducer Test	Pass / Fail / Skip
5-10	Humidity Sensor Controller Configuration Verification Test	Pass / Fail / Skip
5-11	Humidity Sensor Installation Verification Test	Pass / Fail / Skip
5-12	Humidity Sensor Range Check Test	Pass / Fail / Skip
6-0	Discharge Thermistor Test	Pass / Fail / Skip
6-1	Suction Thermistor Test	Pass / Fail / Skip
6-2	Discharge Pressure Transducer Test	Pass / Fail / Skip
6-3	Suction Pressure Transducer Test	Pass / Fail / Skip
6-4	Compressor Current Draw Test	Pass / Fail / Skip
6-5	Compressor Leak Test	Pass / Fail / Skip
6-6	Economizer Valve Test	Pass / Fail / Skip
6-7	Digital Unloader Valve Test	Pass / Fail / Skip
6-9	Liquid Injection Valve Test (If equipped)	Pass / Fail / Skip
6-10	Electronic Expansion Valve Test	Pass / Fail / Skip
7-0	High Pressure Switch Closed	Pass / Fail / Skip Result, AMBS, DPT or CPT (if equipped) Input values that component opens

Table 4–10 DataCORDER Pre-Trip Result Records (Continued)

Test	Title	Data
7-1	High Pressure Switch Open	Pass / Fail / Skip Result, STS, DPT or CPT (if equipped) Input values that component closes
8-0	Perishable Mode Heat Test	Pass / Fail / Skip Result, STS, time it takes to heat to 16°C (60°F)
8-1	Perishable Mode Pulldown Test	Pass / Fail / Skip Result, STS, time it takes to pull down to 0°C (32°F)
8-2	Perishable Mode Maintain Test	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 Heat Test	Pass / Fail / Skip Result, STS, time unit is in heat.
10-1	Frozen Mode Pulldown Test	Pass / Fail / Skip Result, STS, time to pull down unit to -17.8°C (0°F).
10-2	Frozen Mode Maintain Test	Pass / Fail / Skip Result, Averaged DataCORDER return temperature (RRS) over last recording interval.

SECTION 5
OPERATION

5.1 Inspection

⚠ WARNING

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

1. Check inside the unit for the following conditions:
   - Check channels or “T” bar floor for cleanliness. Channels must be free of debris for proper air circulation.
   - Check container panels, insulation and door seals for damage. Perform permanent or temporary repairs.
   - Check visually that the evaporator fan motor mounting bolts are properly secured (refer to **Section 7.17**).
   - Check for visible corrosion on the evaporator stator and fan deck (refer to **Section 7.18**).
   - Check for dirt or grease on evaporator fans or fan deck and clean if necessary (refer to **Section 7.18**).
   - Check evaporator coil for cleanliness or obstructions. Wash with fresh water (refer to **Section 7.18**).
   - Check defrost drain pans and drain lines for obstructions and clear if necessary. Wash with fresh water.
   - 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 7.11**).
3. Open the control box door. Check for loose electrical connections or hardware.
4. Check color of moisture-liquid indicator.

5.2 Connect Power

⚠ WARNING

Do not attempt to remove power plug(s) before turning OFF the 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 Connecting to 380/460 VAC Power

1. Make sure the Start-Stop switch (ST), located on the control panel, is in “0” position (Off).
2. Make sure circuit breaker CB-1, located in the control box, is in “0” position (Off).
3. Plug the 460 VAC (yellow) cable into a de-energized 380/460 VAC, 3-phase power source and energize the power source.
4. Place circuit breaker CB-1 in “I” position (On).
5. Close and secure the control box door.

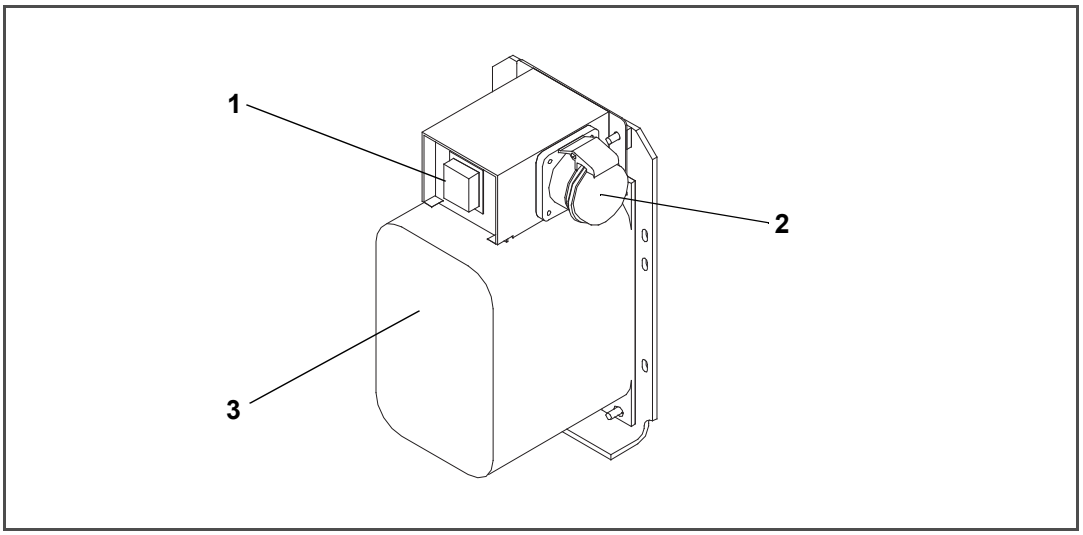
5.2.2 Connecting to 190/230 VAC Power

To allow unit operation on nominal 230 volt power, an autotransformer (see **Figure 5.1**) is required. The autotransformer is fitted with a 230 VAC cable and a receptacle to accept the standard 460 VAC 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 provides 380/460 VAC, 3-phase, 50/60 Hz power to the unit when the 230 VAC power cable is connected to a 190/230 VAC, 3-phase power source.

PROCEDURE:

1. Make sure the Start-Stop switch (ST), located on the control panel, is in “0” position (Off).
2. Make sure circuit breaker CB-1, located in the control box, and CB-2, located on the transformer, are both in “0” position (Off).
3. Plug in and lock the 460 VAC power plug at the receptacle on the transformer.
4. Plug the 230 VAC (black) cable into a de-energized 190/230 VAC, 3-phase power source and energize the power source.
5. Set circuit breakers CB-1 and CB-2 to “I” position (On).
6. Close and secure the control box door.

Figure 5.1 Autotransformer



1) Circuit Breaker (CB-2) 230-Volt
2) 460 VAC Power Receptacle
3) Dual Voltage Modular Autotransformer

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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 upper fresh air vent (as equipped) and sends data to the controller display.

5.3.1 Upper Fresh Air Makeup Vent

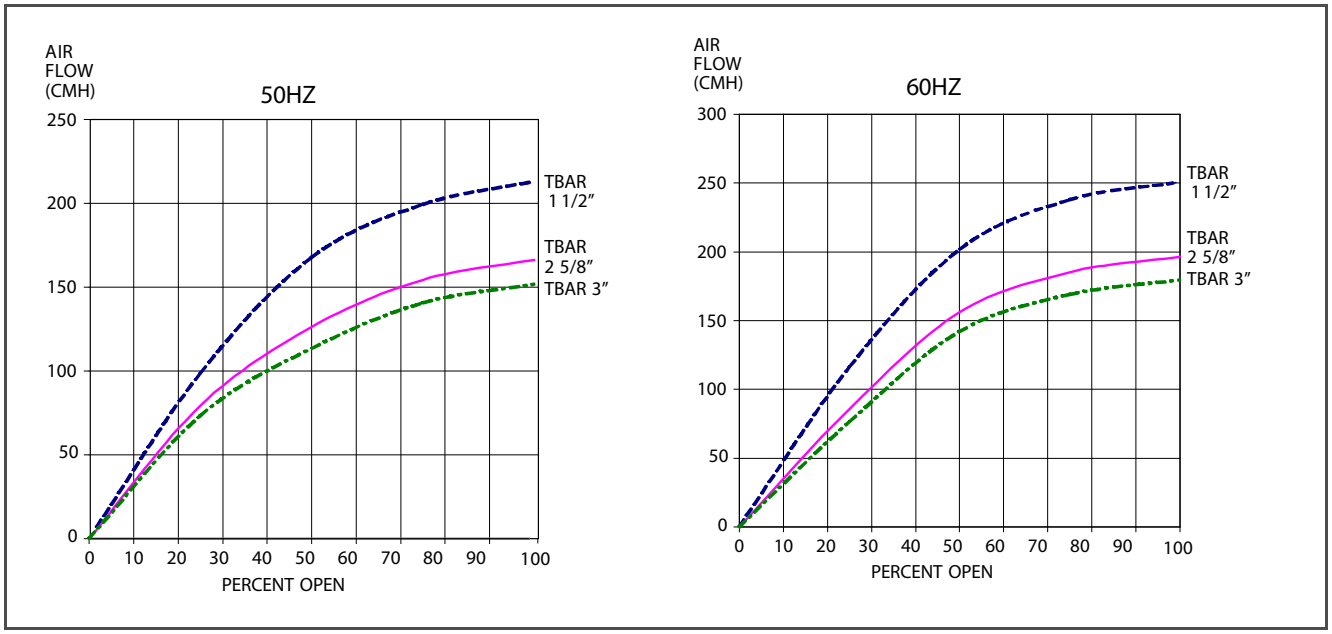
Two slots and a stop are designed into the Upper Fresh Air disc for air flow adjustments. The first slot allows for a 0 to 30% air flow; the second slot allows for a 30 to 100% air flow.

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.

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

Figure 5.2 Upper Fresh Air Make Up Flow Chart



5.3.2 Vent Position Sensor

The vent position sensor (VPS) allows the user to determine the 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 5 CMH (3 CFM) or greater is detected. It will scroll in intervals of 5 CMH (3 CFM). 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 during any of the following conditions:

- Trip start
- Every power cycle
- Midnight
- Manual changes greater than 5 CMH (3 CFM) remaining in the new 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, AL250 will be generated. This provides the user with the ability to change the vent setting without generating multiple events in the DataCORDER.

5.4 EverFRESH Operation

Procedures and technical information related to the EverFRESH controlled atmosphere system can be found in the **T-374 EverFRESH Manual**, located in the Literature section of the Container Refrigeration website. To find the manual from the Literature section, click on Options > EverFRESH.

5.5 Connect Water-Cooled Condenser

The water-cooled condenser is used when cooling water is available and heating the surrounding air is objectionable, such as in a ship's hold. If water-cooled operation is desired, connect in accordance with the following subparagraphs.

5.5.1 Water-Cooled Condenser with Water Pressure Switch

1. Connect the water supply line to the inlet side of the condenser and the discharge line to the outlet side of the condenser (see **Figure 3.5**).
2. Maintain a flow rate of 11 to 26 liters per minute (3 to 7 gallons per minute). The water pressure switch will open to de-energize the condenser fan relay. The condenser fan motor will stop and will remain stopped until the water pressure switch closes.
3. To shift to air-cooled condenser operation, disconnect the water supply and the discharge line to the watercooled condenser. The refrigeration unit will shift to air-cooled condenser operation when the water pressure switch closes.

5.5.2 Water-Cooled Condenser with Condenser Fan Switch

1. Connect the water supply line to the inlet side of condenser and the discharge line to the outlet side of the condenser (see **Figure 3.5**).
2. Maintain a flow rate of 11 to 26 lpm (3 to 7 gpm).
3. Set the condenser fan switch to position “O.” This will de-energize the condenser fan relay. The condenser fan motor will stop and remain stopped until the CFS switch is set to position “I.”

⚠ CAUTION

When condenser water flow is below 11 lpm (3 gpm) or when water-cooled operation is not in use, the CFS switch MUST be set to position “1” or the unit will not operate properly.

4. To shift to air-cooled condenser operation, stop the unit, set the CFS switch to position “I” and restart the unit. Disconnect the water lines to the water-cooled condenser.

5.6 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.

NOTE

The electronic phase detection system will check for proper compressor rotation within the first 30 seconds. If rotation is not correct, the compressor will be stopped and restarted in the opposite direction. If the compressor is producing unusually loud and continuous noise after the first 30 seconds of operation, stop the unit and investigate.

5.6.1 Starting the Unit

1. Verify that power is properly applied, the fresh air vent is in proper position, and (if required) the water-cooled condenser is connected.
2. Place the Start-Stop switch (ST) to position “I” (ON) (see **Figure 3.6**). 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 the Start Up Inspection. See **Section 5.7**.

5.6.2 Stopping the Unit

1. To stop the unit, place the Start-Stop switch (ST) in position “0” (OFF).

5.7 Start-Up Inspection

5.7.1 Physical Inspection

Check rotation of the condenser and evaporator fans.

5.7.2 Check Controller Function Codes

Check, and if required, reset controller Function Codes (Cd27 through Cd39) in accordance with desired operating parameters. See **Table 4–8**.

5.7.3 Start Temperature Recorder in DataCORDER

1. Check and, if required, set the DataCORDER Configuration in accordance with desired recording parameter. See **Section 4.6.4**.
2. Enter a “Trip Start” with the following instructions:
   a. Press the ALT MODE key.
   b. When the left display shows “dC”, press the ENTER key.
   c. Use the Arrow keys to bring up function code dC30.
   d. Press and hold the ENTER key for five seconds.
   e. The “Trip Start” event will be entered in the DataCORDER.

5.7.4 Complete Inspection

Allow the unit to run for five minutes to stabilize conditions, and then perform a pre-trip diagnosis in accordance with **Section 5.8**.

5.8 Pre-Trip Diagnosis

⚠ 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 diagnosis 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 two 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 4–9**. 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.

NOTE

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.

Prior to starting a pre-trip test, very the following:

- Unit voltage (Cd07) is within tolerance
- Unit amperage draw (Cd04, Cd05, Cd06) are within expected limits
- All alarms are cleared and rectified.

5.8.1 Starting a Pre-Trip

1. Press the PRE-TRIP key to access the pre-trip test selection menu. “SELCt PrtrP” will be displayed.
2. To Run an Automatic Test: Scroll through the selections by pressing the Up or Down Arrow keys to display AUTO, AUTO 1, AUTO 2 or AUTO 3 as desired, 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; 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.

     When a Pre-trip Auto 1 test runs to completion without a failure, the unit will exit Pre-trip mode and return to normal control operation. However, dehumidification and bulb mode must be reactivated manually if required.

     ⚠ CAUTION

     When a Pre-trip Auto 2 test 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!
3. 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 key to repeat the test, the Up Arrow key to skip to the next test, or the PRE-TRIP key to terminate testing. The unit will wait indefinitely or until the user manually enters a command.

   ⚠ CAUTION

   When a failure occurs during automatic testing, the unit will suspend operation awaiting operator intervention.
4. To Run an Individual Test: Scroll through the selections by pressing the Up or Down Arrow keys to display an individual test code. Press the ENTER key 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.
   - Throughout the duration of any Pre-trip test (except the P-7 high pressure switch tests), the current limiting and pressure limiting processes are both active. The current limiting process only is active for P-7.

5.8.2 Displaying Pre-Trip Test Results

1. Press the PRE-TRIP key to access the Pre-trip test selection menu. “SELCt PrtrP” will be displayed.
2. Press the Arrow keys until the message “P,” “rSLts” (Pre-trip results) is displayed.
3. Press the ENTER key. The results for all Pre-trip sub tests are available from this menu (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.

5.9 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.

5.10 TripWise (Option)

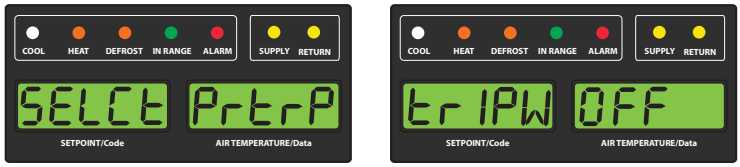
TripWise™ is a new premium option available for PrimeLINE and PrimeLINE with Edge units. TripWise is software logic that runs during every voyage as often as possible to indicate whether a standard Pre-trip Inspection (PTI) is needed and skip unless necessary. The tests run in the background and are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

5.10.1 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.

5.10.2 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.

5.10.3 TripWise Status Event

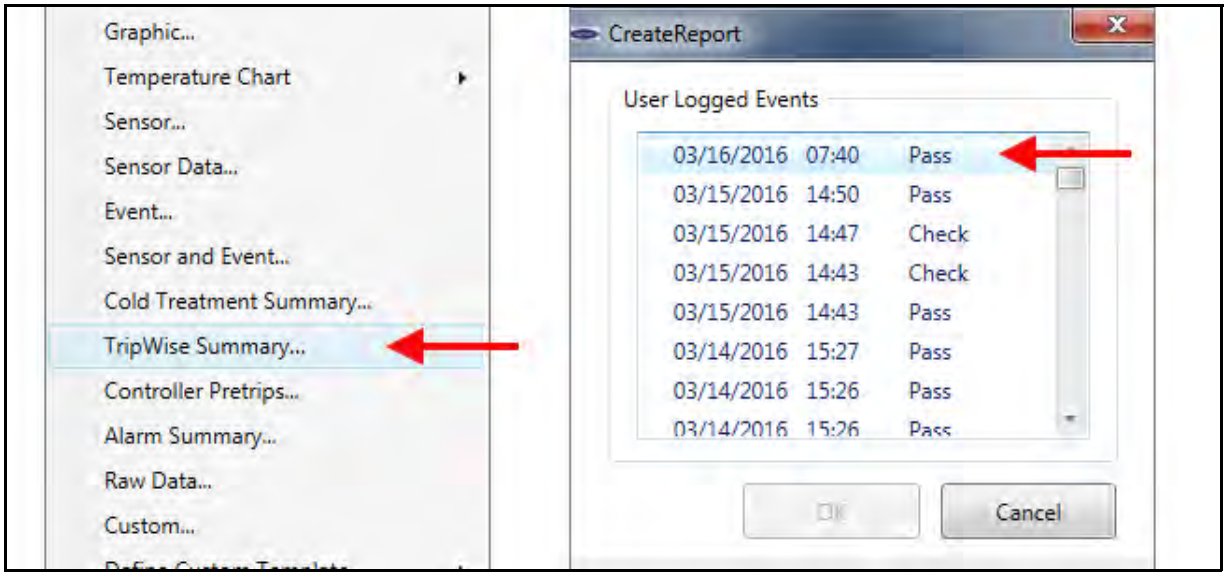
A TripWise status event will be recorded in the DataCORDER recorder when the PTI is selected. In the current DataLINE software release, the event will show the status of the unit.

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, 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	

5.11 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.

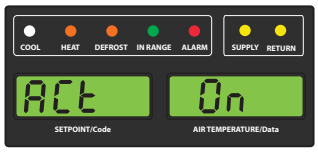
Automated Cold Treatment (ACT) in the Carrier Transicold unit is a method to simplify the task of completing cold treatment by automating the process of changing the setpoints. ACT is set up through function code Cd51. Refer to Function Code table in this manual for Cd51 menu processing and displays.

NOTE

ACT, setup with Cd51, and Automatic Setpoint Change (ASC), setup with Cd53, will not work simultaneously. Setting one will deactivate the other.

Procedure to Set ACT:

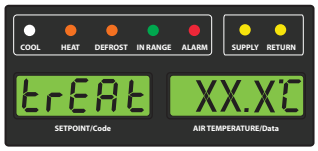
1. Enter the required cargo setpoint. It must be lower than the treatment temperature discussed in step 5.
2. Press the CODE SELECT key.
3. Use the Arrow keys to scroll to Cd51, and then press the ENTER key.
4. "ACt" is now displayed in the left display and the right will display "Off". Use the Arrow keys to bring up "On" in the right display and press the ENTER key.



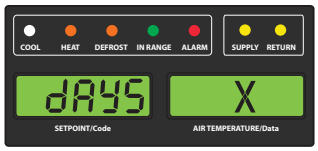
5. “trEAt" is now displayed in the left display and the right will be flashing the last setting (shown as XX.X°C). Use the Arrow keys to select the desired cold treatment setpoint and press the ENTER key.

NOTE

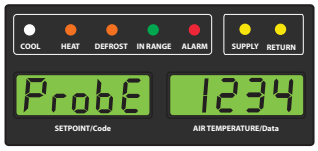
"trEAt" is the maximum value that the USDA probes need to remain below, to pass the Cold Treatment protocol. For instance, if the treat value is set at 35.0°F (1.7°C) then the USDA probe temperatures must remain below 35.0°F (1.7°C) to pass.



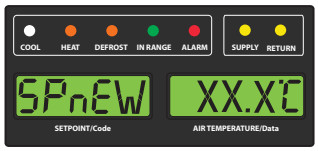
6. "dAyS" is now displayed in the left display and the right will be flashing. Use the Arrow keys to select the desired days for cold treatment and press the ENTER key.



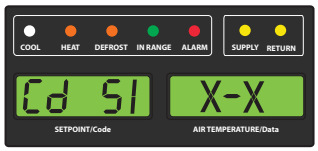
7. "ProbE" is now displayed in the left display and the right will display the probe numbers that are connected. Press the ENTER key. For instance, if "1234" is displayed, then all four of the probes are connected.



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



9. Cd51 is now displayed in the left display and the right will display days / hours remaining in cold treatment.

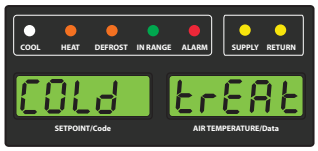


10. The unit will start to countdown once all detected USDA probes have reached the specified cold treatment temperature. The cold treatment process will continue until the specified number of days is reached. During operation, Cd51 will show the number of days and hours remaining in the cold treatment.

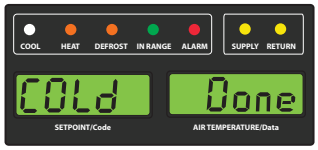
NOTE

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

11. 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 8.



12. 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.



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.

5.12 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

Condition	Possible Cause	Remedy / Reference Section
6.1 Unit will not Start or Starts then Stops		
No power to unit	External power source OFF	Turn on
	Start-Stop switch (ST) OFF or defective	Check
	Circuit breaker tripped or OFF	Check
	Autotransformer not connected	**Section 5.2.2**
Loss of control power	Circuit breaker OFF or defective	Check
	Control transformer defective	Replace
	Fuse (F3 / F4) blown	Check
	Start-Stop switch (ST) OFF or defective	Check
Component(s) not operating	Evaporator fan motor internal protector open	**Section 7.17**
	Condenser fan motor internal protector open	**Section 7.9**
	Compressor internal protector open	**Section 7.9**
	High pressure switch open	**Section 6.7**
	Heat termination thermostat open	Replace
	Malfunction of current sensor	Replace
Compressor hums, but does not start	Low line voltage	Check
	Single phasing	Check
	Shorted or grounded motor windings	**Section 7.9**
	Compressor seized	**Section 7.9**
6.2 Unit Operates Long or Continuously in Cooling		
Container	Hot load	Normal
	Defective box insulation or air leak	Repair
Refrigeration system	Shortage of refrigerant	**Section 7.3**
	Evaporator coil covered with ice	**Section 6.6**
	Evaporator coil plugged with debris	**Section 7.15**
	Evaporator fan(s) rotating backwards	**Section 7.15** / **Section 7.17**
	Air bypass around evaporator coil	Check
	Controller set too low	Reset
	Compressor service valves or liquid line shutoff valve partially closed	Open valves completely
	Dirty condenser	**Section 7.11.2**
	Compressor worn	**Section 7.9**
	Current limit (function code Cd32) set to wrong value	**Section 4.3.25**
	Economizer solenoid valve malfunction	**Section 7.25**
	Digital unloader valve stuck open	Replace
	Electronic expansion valve	Replace

Condition	Possible Cause	Remedy / Reference Section
6.3 Unit Runs but has Insufficient Cooling		
Refrigeration system	Abnormal pressures	**Section 6.7**
	Abnormal temperatures	**Section 6.15**
	Abnormal currents	**Section 6.16**
	Controller malfunction	**Section 6.9**
	Evaporator fan or motor defective	**Section 7.17**
	Compressor service valves or liquid line shutoff valve partially closed	Open valves completely
	Frost on coil	**Section 6.10**
	Digital unloader valve stuck open	Replace
	Electronic expansion valve	Replace
6.4 Unit will not Heat or has Insufficient Heating		
No operation of any kind	Start-Stop switch (ST) 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	**Section 7.17**
	Heat relay defective	Check
	Heater termination thermostat open	**Section 7.15**
Unit will not heat or has insufficient heat	Heater(s) defective	**Section 7.15**
	Heater contactor or coil defective	Replace
	Evaporator fan motor(s) defective or rotating backwards	**Section 7.15** / **Section 7.17**
	Evaporator fan motor contactor defective	Replace
	Controller malfunction	**Section 6.9**
	Defective wiring	Replace
	Loose terminal connections	Tighten
	Low line voltage	**Section 3.3**
6.5 Unit will not Terminate Heating		
Unit fails to stop heating	Controller improperly set	Reset
	Controller malfunction	**Section 6.9**
	Heater termination thermostat remains closed along with the heat relay	**Section 7.15**
6.6 Unit will not Defrost Properly		
Will not initiate defrost automatically	Defrost timer malfunction (Cd27)	**Table 4–7**
	Loose terminal connections	Tighten
	Defective wiring	Replace
	Defrost temperature sensor defective or heat termination thermostat open	Replace
	Heater contactor or coil defective	Replace

Condition	Possible Cause	Remedy / Reference Section
Will not initiate defrost manually	Manual defrost switch defective	Replace
	Keypad is defective	Replace
	Defrost temperature sensor open	Replace
Initiates but relay (DR) drops out	Low line voltage	**Section 3.3**
Initiates but does not defrost	Heater contactor or coil defective	Replace
	Heater(s) burned out	**Section 7.15**
Frequent defrost	Wet load	Normal
6.7 Abnormal Pressures		
High discharge pressure	Condenser coil dirty	**Section 7.11.2**
	Condenser fan rotating backwards	**Section 7.11**
	Condenser fan inoperative	**Section 7.12**
	Refrigerant overcharge or non-condensibles	**Section 7.3**
	Discharge service valve partially closed	Open
	Electronic expansion valve (EEV) control malfunction	Replace
Low suction pressure	Incorrect software and/or controller configuration	Check
	Failed suction pressure transducer (SPT) or evapora-tor pressure transducer (EPT)	Replace
	Suction service valve partially closed\	Open
	Filter drier partially plugged	**Section 7.14**
	Low refrigerant charge	**Section 7.3**
	No evaporator air flow or restricted air flow	**Section 7.15**
	Excessive frost on evaporator coil	**Section 6.6**
	Evaporator fan(s) rotating backwards	**Section 7.17.3**
	EEV control malfunction	Replace
	Failed digital unloader valve (DUV)	Replace
Suction and discharge pressures tend to equalize when unit is operating	Compressor operating in reverse	**Section 6.14**
	Compressor cycling/stopped	Check
	Failed digital unloader valve (DUV)	Replace
6.8 Abnormal Noise or Vibrations		
Compressor	Compressor start up after an extended shutdown	Normal
	Brief chattering when manually shut down	
	Compressor operating in reverse	**Section 6.14**
	Loose mounting bolts or worn resilient mounts	Tighten / Replace
	Loose upper mounting	**Section 7.9.1**
	Loose slugging	**Section 7.15**
Condenser or Evaporator Fan	Bent, loose or striking venturi	Check
	Worn motor bearings	**Section 7.12** / **Section 7.17**
	Bent motor shaft	**Section 7.12** / **Section 7.17**

Condition	Possible Cause	Remedy / Reference Section
6.9 Microprocessor Malfunction		
Will not control	Incorrect software and/or controller configuration	Check
	Defective sensor	**Section 7.28**
	Defective wiring	Check
	Low refrigerant charge	**Section 7.3**
6.10 No Evaporator Air Flow or Restricted Air Flow		
Evaporator coil blocked	Frost on coil	**Section 6.6**
	Dirty coil	**Section 7.15**
No or partial evaporator air flow	Evaporator fan motor internal protector open	**Section 7.17**
	Evaporator fan motor(s) defective	**Section 7.17**
	Evaporator fan(s) loose or defective	**Section 7.17**
	Evaporator fan contactor defective	Replace
6.11 Electronic Expansion Valve Malfunction		
Low suction pressure	Incorrect software and/or controller configuration	Check
	Failed suction pressure transducer (SPT) or evaporator pressure transducer (EPT)	Replace
	Suction service valve partially closed	Open
	Filter drier partially plugged	**Section 7.14**
	Low refrigerant charge	**Section 7.3**
	No evaporator air flow or restricted air flow	**Section 7.15**
	Excessive frost on evaporator coil	**Section 6.6**
	Evaporator fan(s) rotating backwards	**Section 7.17.3**
	EEV control malfunction	**Section 7.19**
	Failed digital unloader valve (DUV)	Replace
	Loose or insufficiently clamped sensor	Replace
High suction pressure with low superheat	Foreign material in valve	**Section 7.19**
	Failed suction pressure transducer (SPT) or evaporator pressure transducer (EPT)	Replace
	EEV control malfunction	Replace
	Improperly seated powerhead	Ensure powerhead is locked and in place
Liquid slugging in compressor	Failed suction pressure transducer (SPT) or evaporator pressure transducer (EPT)	Replace
	Failed EEV	Replace
6.12 Autotransformer Malfunction		
Unit will not start	Circuit breaker (CB-1 or CB-2) tripped	Check
	Autotransformer defective	**Section 7.26**
	Power source not turned ON	Check
	460 VAC power plug is not inserted into the receptacle	**Section 5.2.1**

Condition	Possible Cause	Remedy / Reference Section
6.13 Water-Cooled Condenser or Water Pressure Switch		
High discharge pressure	Dirty coil	**Section 7.13**
	Non-condensibles	
Condenser fan starts and stops	Water pressure switch malfunction	Check
	Water supply interruption	Check
6.14 Compressor Operating in Reverse **NOTE** **The compressor may start in reverse for up to 10 seconds to determine correct phase rotation if required for phase detection.**		
⚠ CAUTION **Allowing the scroll compressor to operate in reverse for more than two minutes will result in internal compressor damage. Turn the start- stop switch OFF immediately.**		
Electrical	Incorrect wiring of compressor	Check
	Incorrect wiring of compressor contactor(s)	
	Incorrect wiring of current sensor	
6.15 Abnormal Temperatures		
High discharge temperature	Condenser coil dirty	**Section 7.11.2**
	Condenser fan rotating backwards	**Section 7.12**
	Condenser fan inoperative	**Section 7.12.1**
	Refrigerant overcharge or non-condensibles	**Section 7.3**
	Discharge service valve partially closed	Open
	Electronic expansion valve (EEV) control malfunction	Replace
	Failed suction pressure transducer (SPT) or evaporator pressure transducer (EPT)	Replace
	Discharge temperature sensor drifting high	Replace
	Failed economizer expansion valve, economizer coil, or economizer solenoid valve	Replace
	Plugged economizer expansion valve, economizer coil, or economizer solenoid valve	Replace
	Loose or insufficiently clamped sensor	Replace
6.16 Abnormal Currents		
Unit reads abnormal currents	Current sensor wiring	Check

SECTION 7
SERVICE

⚠ 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 refrigerants R-134a or R-513A as specified for the unit model number: Refrigerant must conform to AHRI Standard 700 specification.

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.

NOTE

Annual maintenance procedures for PrimeLINE units 69NT40-561 can be found in the **62-10327 Annual Maintenance Manual**, located in the Literature section of the Container Refrigeration website. To find the manual from the Literature section, click on Container Units > All Container Units > Operation.

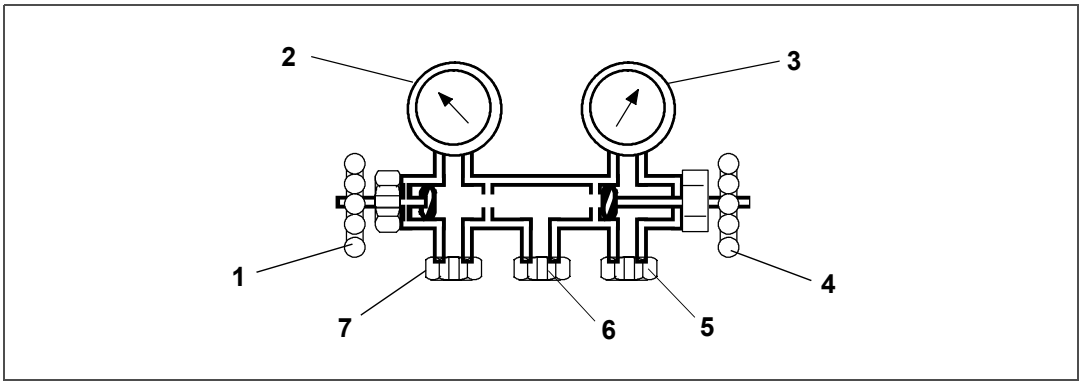
7.1 Section Layout

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) Suction Pressure Valve (shown backseated)
2) Suction Pressure Gauge
3) Discharge Pressure Gauge
4) Discharge Pressure Valve (shown frontseated)
5) High Side Connection
6) Utility Connection to:
   a. Refrigerant Cylinder
   b. Vacuum Pump
   c. Oil Container
7) Low Side Connection

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When the suction pressure valve (1) is frontseated (turned all the way in), the suction (low) pressure can be checked at the suction pressure gauge (2).

When the discharge pressure valve (4) is frontseated, the discharge (high) pressure can be checked at the discharge pressure gauge (3).

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

When the suction pressure valve (1) is open and the discharge pressure valve (4) shut, the system can be charged through the utility connection (6). Oil can also be added to the system.

A 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 (part number 07-00294-00, which includes items 1 through 6, **Figure 7.2**).

NOTE

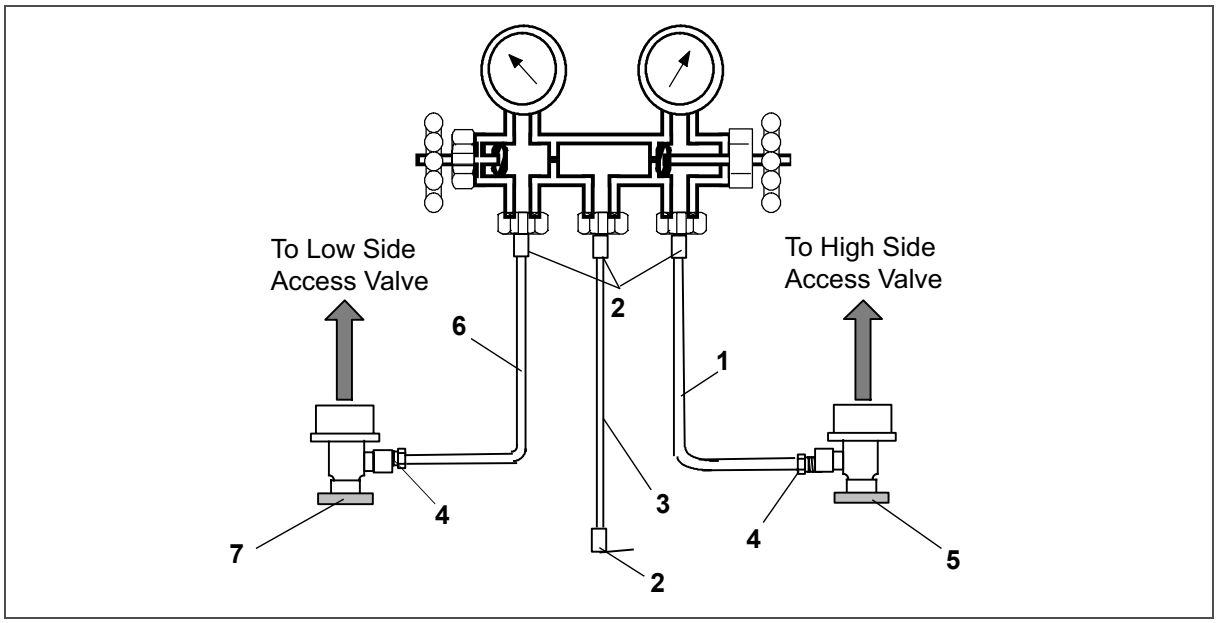
It is recommended that the manifold gauge set be dedicated to specified refrigerant (R-134a or R-513A).

7.2.1 Evacuating the Manifold Gauge Set

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 cylinder.
3. Evacuate to 10 inches of vacuum and then charge with refrigerant to a slightly positive pressure of 0.1 kg / cm2 (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 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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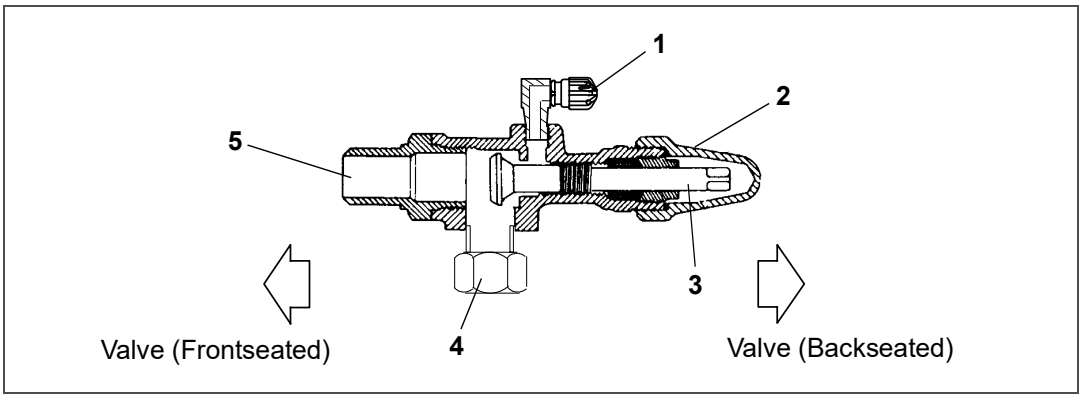
7.3 Service Connections

The compressor suction, compressor discharge, and the liquid line service valves (see **Figure 7.3**) are provided with a double seat and an access valve 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 line connection and open a path to the access valve. Turning the stem counterclockwise (all the way out) will backseat the valve to open the line connection and close off the path to the access valve.

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) Access Valve
2) Step Cap
3) Valve Stem
4) Compressor or Filter Drier Inlet Connection
5) Line Connection

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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.).

7.3.1 Connecting the Manifold Gauge Set

1. Remove the service valve stem cap and make sure the valve is backseated.
2. Remove the access valve cap (see **Figure 7.3**).
3. Connect the field service coupling (see **Figure 7.2**) to the access valve.
4. Turn the field service coupling knob clockwise to open the system to the gauge set.
5. Slightly midseat the service valve to read system pressures.
6. Repeat the procedure to connect the other side of the gauge set.

⚠ CAUTION

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

7.3.2 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 low side pressure. This returns any liquid that may be in the high side hose to the system.
3. Backseat the low side service valve.
4. Backseat both field service couplings and frontseat both manifold hand valves.
5. Remove couplings from the access valves.
6. Install both service valve stem caps and service port caps (finger-tight only).

7.4 Pump Down the Unit

To service the filter drier, economizer, expansion valves, economizer solenoid valve, digital unloader valve or evaporator coil, pump the refrigerant into the high side of the unit:

⚠ CAUTION

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

7.4.1 Automatic Pump Down

1. To perform an Automatic Pump Down, use function code Cd59 Pump Down Logic. Refer to Cd59 description in **Table 4–8** Controller Function Codes.

7.4.2 Manual Pump Down:

1. Attach manifold gauge set to the compressor suction and discharge service valves. See **Section 7.2**.
2. Start the unit and run in the frozen mode, with controller set below -10°C (14°F), for 10 to 15 minutes.
3. Check function code Cd21 (see **Section 4.2.2**). The economizer solenoid valve should be open. If not, continue to run until the valve opens.
4. Frontseat the liquid line service valve. When the suction reaches a positive pressure of 0.1 bar (1.4 psig), place the Start-Stop switch (ST) to “0” to turn the unit Off.
5. Frontseat the suction service valve and discharge service valve. The refrigerant will be trapped between the discharge service valve and the liquid line valve.
6. Before opening up any part of the system, a slight positive pressure should be indicated on the pressure gauge. Remove power from the unit before opening any part of the system. If a vacuum is indicated, emit refrigerant by cracking the liquid line valve momentarily to build up a slight positive pressure.
7. 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.
8. After repairs have been made, make sure to perform a refrigerant leak check (see **Section 7.5**), and evacuate and dehydrate the low side (see **Section 7.6**).
9. Check refrigerant charge. See **Section 7.7.1**.

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 refrigerants R-134a or R-513A as specified for the unit model number: Refrigerant must conform to AHRI Standard 700 specification.

1. The recommended procedure for finding leaks in a system is with an appropriate 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 to build up pressure between 2.1 to 3.5 bar (30.5 to 50.8 psig). To ensure complete pressurization of the system, refrigerant should be charged at the compressor suction valve and the liquid line service valve. Remove refrigerant cylinder and leak-check all connections.

NOTE

Only refrigerant R-134a or R-513A, as specified for the unit model number, 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. Check for leaks.
4. Evacuate and dehydrate the unit. See **Section 7.6**.
5. Charge unit. See **Section 7.7**.

7.6 Evacuation and Dehydration

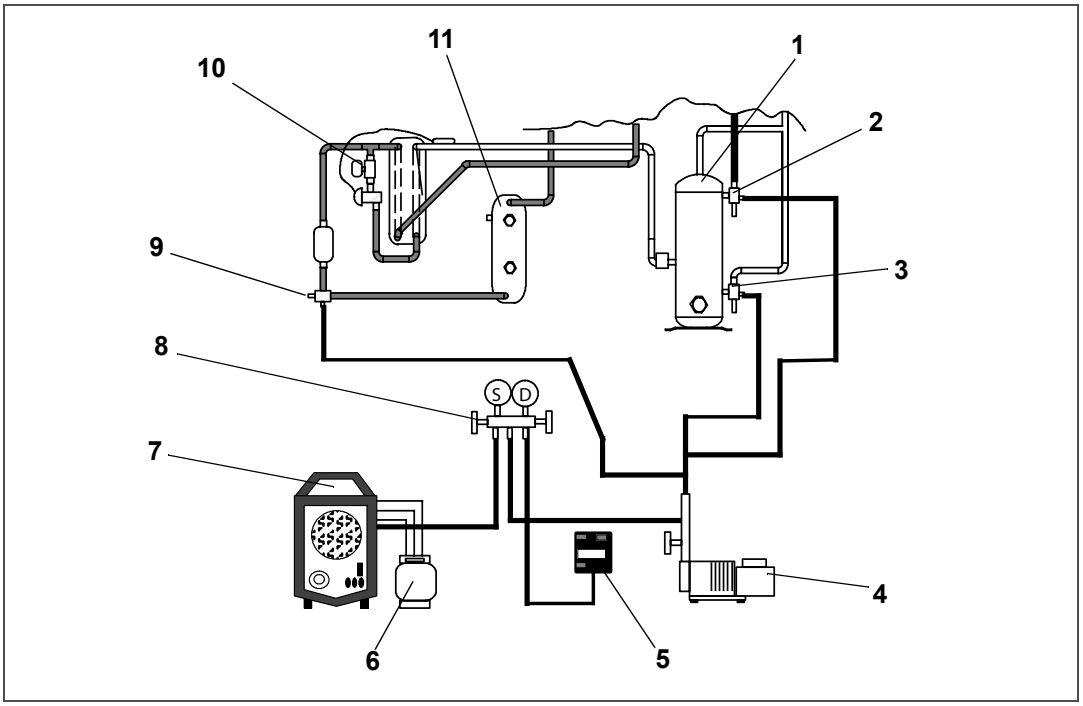
7.6.1 General

Moisture is detrimental to 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 completing a pressure leak test. See **Section 7.5**.
2. Essential tools to properly evacuate and dehydrate any system include a vacuum pump (8m3/hr = 5 cfm 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) Compressor
2) Discharge Service Connection
3) Suction Service Connection
4) Vacuum Pump
5) Electronic Vacuum Gauge
6) Refrigerant Cylinder
7) Reclaimer
8) Manifold Gauge Set
9) Liquid Service Connection
10) Economizer Solenoid Valve (ESV)
11) Receiver or Water-Cooled Condenser

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7.6.3 Evacuate and Dehydrate - Complete System

NOTE

Refer to Partial System procedure for information pertaining to partial system evacuation and dehydration.

1. Remove all refrigerant using a refrigerant recovery system.

2. The recommended method to evacuate and dehydrate the system is to connect evacuation hoses at the compressor suction and liquid line service valve (see **Figure 7.4**). Make sure the service hoses are suited for evacuation purposes.

NOTE

To prevent the area between the Economizer Solenoid Valve (ESV) and the compressor from being isolated during evacuation, it is necessary to open the ESV using a magnet tool (Carrier Transicold P/N 07-00512-00).

3. Remove the ESV coil from the valve body. Place the magnet tool over the valve stem. An audible click will be heard when the ESV opens.

NOTE

Make sure to replace the valve coil before restating the unit. Starting the unit with the coil removed from the valve will burn out the coil.

4. 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.
5. Midseat the refrigerant system service valves.
6. Open the vacuum pump and electronic vacuum gauge valves, if they are not already open. Start the vacuum pump. Evacuate the 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.
7. Break the vacuum with either clean refrigerant (R-134a or R-513A as specified for the unit model number) or dry nitrogen. Raise system pressure to roughly 0.14 bar (2 psig), monitoring it with the compound gauge.
8. If refrigerant was used, remove using a refrigerant recovery system. If nitrogen was used, relieve the pressure.
9. Repeat steps 6 and 7 one time.
10. 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.
11. With a vacuum still in the unit, the refrigerant charge may be drawn into the system from a refrigerant container on weight scales.

7.6.4 Evacuate and Dehydrate - Partial System

1. If refrigerant charge has been removed from the low side only, evacuate the low side by connecting the evacuation set-up at the compressor suction valve and the liquid service valve but leave the service valves frontseated until evacuation is completed.
2. 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 gases containing oxygen (O_2) for leak testing or operating the product. Charge only with refrigerants R-134a or R-513A as specified for the unit model number: Refrigerant must conform to AHRI Standard 700 specification.

7.7.1 Checking the Refrigerant Charge

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.

1. Connect the gauge manifold to the compressor discharge and suction service valves. For units operating on a water-cooled condenser, change over to air-cooled operation.
2. Bring the container temperature to approximately 0°C (32°F) or below. Then set the controller setpoint to -25°C (-13°F).
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 units equipped with a receiver, the level should be between the glasses. On units equipped with a watercooled condenser, the level should be at the center of the glass. If the refrigerant level is not correct, see **Section 7.7.2** and **Section 7.7.3** to add or remove refrigerant as required.

7.7.2 Adding Refrigerant to System - Full Charge

1. Evacuate the unit and leave in a deep vacuum. See **Section 7.6.1**.
2. Place the refrigerant cylinder on a scale and connect the charging line from cylinder to liquid line valve. Purge the charging line at the liquid line valve and then note the weight of the cylinder and refrigerant.
3. Open the liquid valve on the cylinder. Open the liquid line valve halfway and allow liquid refrigerant to flow into the unit until the correct weight of refrigerant has been added as indicated by scales. See **Section 3.2**.
4. It may be necessary to finish charging the unit through the suction service valve in gas form, due to pressure rise in the high side of the system.
5. Backseat the manual liquid line valve to close off the gauge port. Close the liquid valve on the cylinder.
6. Start the unit in cooling mode. Run for approximately 10 minutes and check the refrigerant charge.

7.7.3 Adding Refrigerant to System - Partial Charge

1. Examine the refrigerant system for any evidence of leaks, and repair as necessary. See **Section 7.5**.
2. Maintain the conditions outlined in the beginning of this section, **Section 7.7.1**.
3. Fully backseat the suction service valve and remove the service port cap.
4. Connect the charging line between the suction service valve port and the refrigerant cylinder. Open the Vapor valve.
5. Partially frontseat (turn clockwise) the suction service valve and slowly add charge until the refrigerant appears at the proper level. Be careful not to frontseat the suction valve fully. If the compressor is operated in a vacuum, internal damage may result.

7.8 Converting to R-513A Refrigerant

This procedure only applies to R-513A-ready units for 69NT40-561-500 models. This conversion is only by approval of the equipment owner.

1. The compressor will have a green dot on the DUV fitting to note that it can accept R-513A.
2. Recover all R-134a refrigerant from the unit, by following procedure in **Section 7.6**.
3. Change the filter drier.
4. Evacuate to 500 microns by placing the vacuum pump on the liquid line and suction service valve.
5. Charge the unit with a full charge of R-513A refrigerant, by following procedure in **Section 7.7.2**. Charge amounts are found in **Section 3.2** Refrigeration System Data.

⚠ CAUTION

When charging the unit with R-513A refrigerant, charge as a liquid only. R-513A is an azeotrope blend containing R-1234yf and R-134a. Charging or topping off as a vapor will result in an incorrect mixture of blend in the system.

6. Upon completion, change the refrigerant label (Carrier P/N 76-50235-00) on the front of the unit indicating the change in refrigerant.

7.9 Compressor

⚠ WARNING

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

⚠ WARNING

Before disassembly of the compressor, be sure to relieve the internal pressure very carefully by slightly loosening the couplings to break the seal.

⚠ CAUTION

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

⚠ CAUTION

The PrimeLINE unit has a hermetically sealed compressor that should not be opened and/or repaired. Doing so can cause a loss in performance and premature system failure due to the precision machinery and assembly required within the compressor. To repair the unit, remove the faulty compressor and replace with an approved Carrier compressor. If the return of the compressor is not required, follow local waste collection & recycling regulations in discarding the compressor.

NOTICE

Replacement compressors are supplied without oil.

7.9.1 Removal and Replacement of Compressor

1. Turn the unit ON and run it in full cool mode for 10 minutes.

NOTE

If the compressor is not operational, frontseat the suction and discharge service valves and go to step 5 below.

2. Frontseat the manual liquid line valve and allow the unit to pull-down to 0.1 kg/cm2 (1 psig).
3. Place the Start-Stop switch (ST) to “0”, turn the unit circuit breaker (CB-1) OFF, and disconnect power to the unit.
4. Frontseat the discharge and suction service valves.
5. Remove all remaining refrigerant from the compressor using a refrigerant recovery system.
6. Remove the compressor terminal cover, disconnect the ground wire and pull the cable plug from the compressor terminals. Install the terminal cover back after removing the power cable.

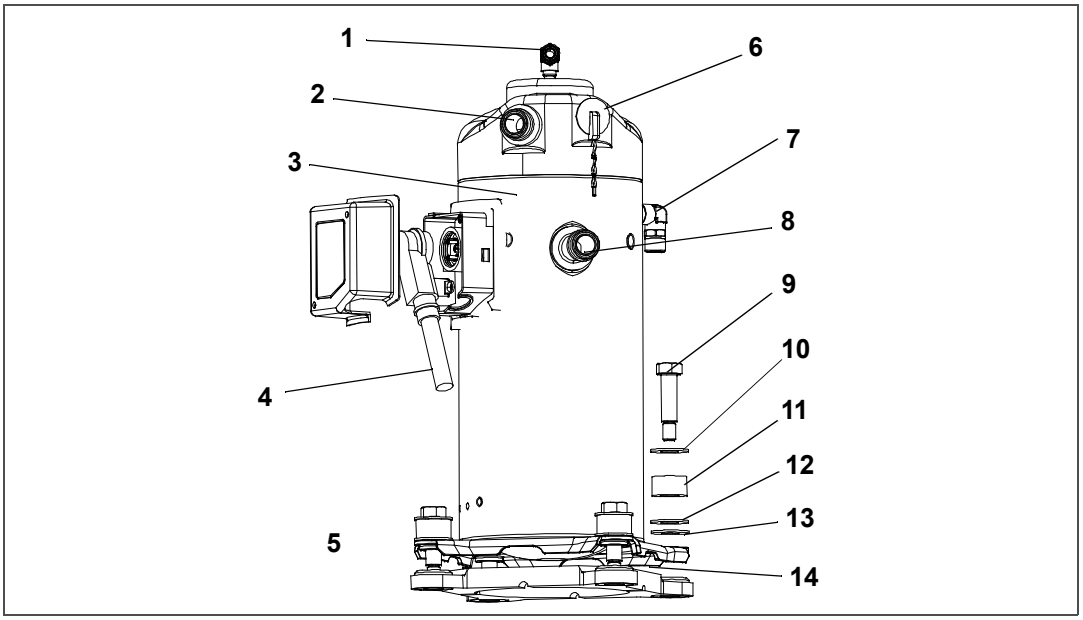
NOTE

Inspect the power cable (plug) terminals to ensure they are not deformed or have any signs of heat or arcing. If any damage is noted, replace the power cable.

7. Remove the Rotalock fittings from the suction and discharge service connections, and uncouple the unloader and economizer lines from the compressor.
8. Cut the dome ambient temperature sensor (CPDS) wires. The replacement compressor comes with a CPDS already assembled.
9. Remove and save the compressor base mounting bolts. Discard the four top resilient mounts and washers.

10. Remove (slide out) the old compressor from the unit.
11. Inspect the compressor base plate for wear. Replace, if necessary.
12. Wire tie the compressor base plate to the compressor, and slide the new compressor into the unit. (See **Figure 7.5**).

Figure 7.5 Compressor Kit



1) O-Ring (Unloader Connection)
2) Teflon Seal for Valve Connection (2)
3) Compressor
4) Power Cable Gasket, Ground Connection Screw
5) Power Cable Lubricant - Krytox (not shown)
6) Compressor Discharge Temperature Sensor
7) O-Ring (Economizer Connection)
8) Teflon Seal for Valve Connection (2)
9) Base Mounting Bolts
10) SST Washers
11) Resilient Mount
12) SST Washers
13) Mylar Washers
14) Wire Ties

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13. Cut and discard the wire ties used to hold the base plate to the compressor.
14. Place the new SST washers on each side of the resilient mounts, and the new Mylar washer on the bottom of it as shown in **Figure 7.5**. Install the four base mounting bolts loosely.
15. Place the new Teflon seals at the compressor suction and discharge ports as well as the O-rings at the unloader and economizer line connection ports. Hand tighten all four connections.
16. Torque the four base-mounting screws to 6.2 mkg (45 ft-lbs).
17. Torque the compressor ports / connections.

Service Valve / Connection	Torque Value
Suction and Discharge Rotalocks	108.5 to 135.5 Nm (80 to 100 ft-lbs.)
Unloader connection	24.5 to 27 Nm (18 to 20 ft-lbs.)
Economized connection	32.5 to 35 Nm (24 to 26 ft-lbs.)

18. Connect (butt-splice and heat shrink) the new compressor dome temperature sensor with the old sensor wires removed in step 8. Wire-tie any loose wiring as appropriate.

19. Evacuate the compressor to 1000 microns if the unit was pumped down before the replaced compressor was removed. Otherwise, evacuate the complete unit and charge it with refrigerant (see **Section 7.6.1** and **Section 7.7.1**).
20. Open the compressor terminal cover and connect the compressor power cable following the steps below:
    a. Liberally coat the orange gasket surfaces with the Krytox lubricant.
    b. Install the orange gasket part onto the compressor fusite with the grooved or threaded side out. Ensure that the gasket is seated onto the fusite base.
    c. Coat the inside of the power plug (female) connector pins with the Krytox lubricant, and insert the plug onto the compressor terminal connections. Make sure the orange gasket has bottomed out onto the fusite and fits securely onto the terminal pins while fully inserted into the orange plug.
    d. Connect the green ground wire to the grounding tab located inside the terminal box of the compressor using the self-tapping grounding screw. Close the compressor terminal box using the terminal cover removed in step 20.
21. Backseat all service valves, connect the power to the unit and run for at least 20 minutes.
22. Perform a leak check of the system.

7.10 High Pressure Switch

7.10.1 Checking High Pressure Switch

⚠ WARNING

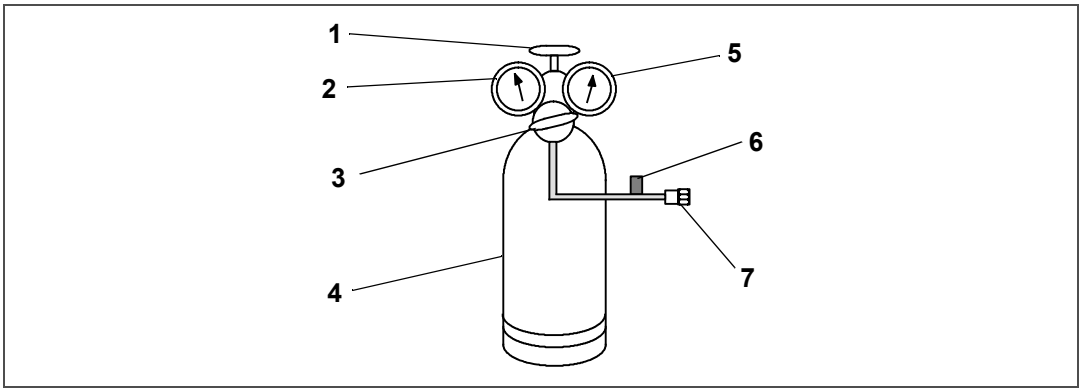
Do not use a nitrogen cylinder without a pressure regulator.

NOTE

The high pressure switch is non-adjustable.

1. Remove switch as outlined in **Figure 7.10.2**.
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 7.6**).

Figure 7.6 High Pressure Switch Testing



1) Cylinder Valve
2) Cylinder Gauge
3) Pressure Regulator
4) Nitrogen Cylinder
5) Pressure Gauge (0 to 36 kg/cm2 = 0 to 400 psig)
6) Bleed-Off Valve
7) 1/4 inch Connection

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4. Set nitrogen pressure regulator at 26.4 kg/cm^2 (375 psig) 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 25 kg/cm^2 (350 psig). If a light is used, the 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 18 kg/cm^2 (250 psig).

7.10.2 Replacing High Pressure Switch

1. Remove the refrigerant charge.
2. Disconnect wiring from defective switch. The high pressure switch is located on the discharge connection or line and is removed by turning counterclockwise.
3. Install a new high pressure switch after verifying switch settings.
4. Evacuate, dehydrate and recharge the system.
5. Start the unit, verify refrigeration charge and oil level.

7.11 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.

7.11.1 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.

⚠ 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.

7.11.2 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, approximately 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 the filter drier.
11. Unbraze the inlet connection to the 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 the receiver out of the unit.

7.11.3 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 the 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 the 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.

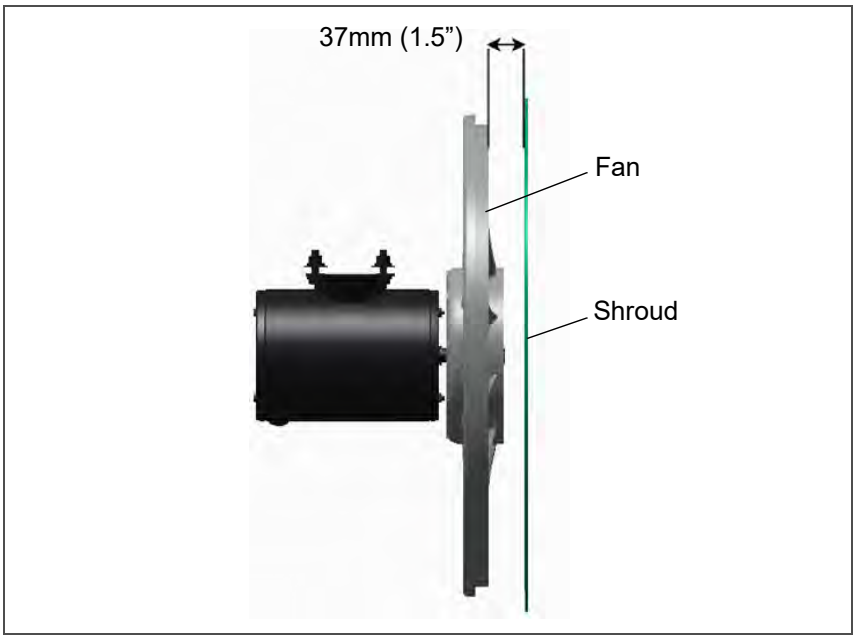
7.11.4 Condenser Coil Installation

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. See **Section 7.5**.
10. Evacuate the entire unit. See **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 the 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 7.7**.

Figure 7.7 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. See **Section 7.6**.
23. Recharge the unit with the charge shown on the unit serial plate. See **Section 7.7**. It is important for proper unit operation that the charge is weighed into the unit.

7.12 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.

7.12.1 Condenser Fan Motor Remove and 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 the motor.
6. Loosely mount the new motor using new lock nuts.
7. Connect the fan motor wiring to the new fan motor.
8. Replace the shims in the same configuration as they were removed.
9. Tighten the fan motor mounting bolts to properly secure the motor.
10. To make sure that the motor is aligned properly, slide the condenser fan onto the motor shaft reversed but do not secure.
11. Rotate the fan to make sure the fan blades do not contact the shroud:
    - If the fan motor is misaligned vertically, add or remove shims to align.
    - 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.
12. Remove the condenser fan, and connect the fan motor wiring to the fan motor.
13. 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 7.7**.
14. Use Loctite “H” on the fan set screws, and tighten.
15. Refit the left and right infill panels.
16. Refit the condenser fan grille, ensuring the grille is properly centered around condenser fan.

7.13 Water-Cooled Condenser Cleaning

The water-cooled condenser is of the shell and coil type with water circulating through the cupro-nickel coil. The refrigerant vapor is admitted to the shell side and is condensed on the outer surface of the coil.

Rust, scale and slime on the water-cooling surfaces inside of the coil interfere with the transfer of heat, reduce system capacity, cause higher head pressures and increase the load on the system.

By checking the leaving water temperature and the actual condensing temperature, it can be determined if the condenser coil is becoming dirty. A larger than normal difference between leaving condensing water temperature and actual condensing temperature, coupled with a small difference in temperature of entering and leaving condensing water, is an indication of a dirty condensing coil.

If the water-cooled condenser is dirty, it may be cleaned and de-scaled.

7.13.1 Cleaning Supplies Needed

- Oakite Aluminum Cleaner® 164, available as a powder in 20 kg (44 lb) pails and 205 kg (450 lb) drums.
- Oakite Composition No. 32, available as a liquid in cases, each containing 3.785 liters (4 U.S. gallon) bottles and also in carboys of 52.6 kg (116 lbs) net.
- Fresh clean water.
- Acid proof pump and containers or bottles with rubber hose.

NOTE

When Oakite Compound No. 32 is used for the first time, the local Oakite technical service representative should be called in for suggestions in planning the procedure. The representative will advise the reader on how to do the work with a minimum dismantling of equipment: how to estimate the time and amount of compound required; how to prepare the solution; how to control and conclude the de-scaling operation by rinsing and neutralizing equipment before putting it back into service. The representative’s knowledge of metals, types of scale, water conditions and de-scaling techniques will be highly useful.

7.13.2 Cleaning Procedure Summary

1. Turn the unit off and disconnect main power.
2. Disconnect the water pressure switch tubing by loosening the two flare nuts. Install a 1/4 inch flare cap on the water-cooled condenser inlet tube (replaces tubing flare nut). De-scale tubing if necessary.
3. Drain water from the condenser tubing circuit.

4. Clean the water tubes with Oakite Aluminum Cleaner® 164 to remove mud and slime.
5. Flush.
6. De-scale the water tubes with Oakite No. 32 to remove scale.
7. Flush.
8. Neutralize.
9. Flush.
10. Put the unit back in service under normal load and check head (discharge) pressure.

7.13.3 Cleaning Procedure Detailed

1. Drain and flush the water circuit of the condenser coil. If scale on the tube inner surfaces is accompanied by slime, a thorough cleaning is necessary before de-scaling process can be accomplished.
2. To remove slime or mud, use Aluminum Cleaner® 164. Mix 170 grams (6 ounces) per 3.785 liters (1 U.S. gallon) of water. Mix cleaner in one half the volume of water, while stirring, and then add remaining water. Warm this solution and circulate through the tubes until all slime and mud has been removed.
3. After cleaning, flush the tubes thoroughly with fresh clean water.
4. Prepare a 15% by volume solution for de-scaling, by diluting Oakite Compound No. 32 with water. Do this by slowly adding 0.47 liter (1 U.S. pint) of the acid (Oakite No. 32) to 2.8 liters (3 U.S. quarts) of water.

⚠ WARNING

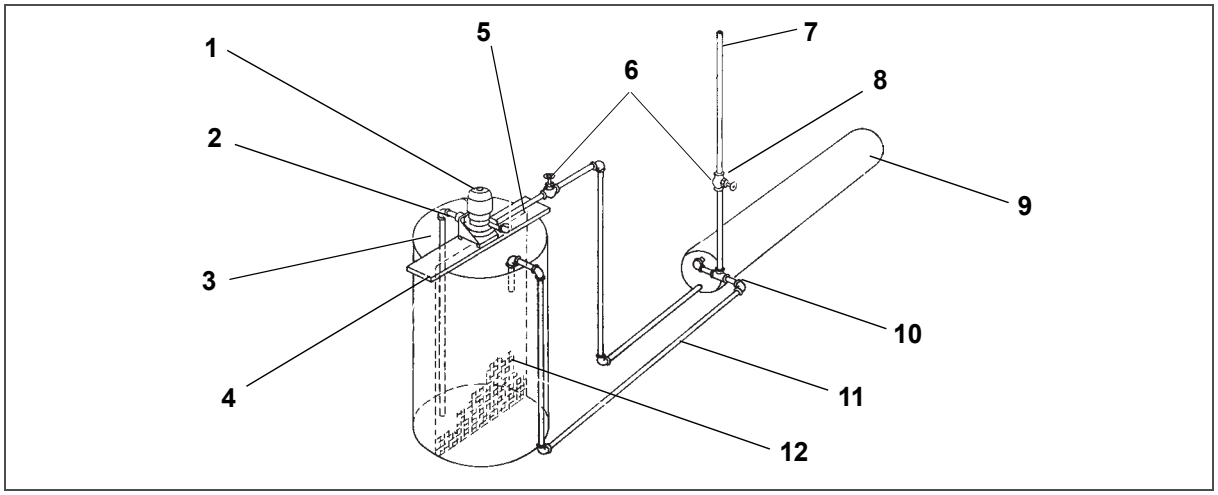
Oakite No. 32 is an acid. Be sure that the acid is slowly added to the water. DO NOT PUT WATER INTO THE ACID - this will cause spattering and excessive heat.

⚠ WARNING

Wear rubber gloves and wash the solution from the skin immediately if accidental contact occurs. Do not allow the solution to splash onto concrete.

5. Fill the tubes with this solution by filling from the bottom. See **Figure 7.8**.

Figure 7.8 Water-Cooled Condenser Cleaning - Forced Circulation



1) Pump
2) Suction
3) Tank
4) Pump support
5) Priming Connection (Centrifugal pump 50 gpm at 35' head)
6) Globe valves
7) Vent
8) Close vent pipe valve when pump is running
9) Condenser
10) Remove water regulating valve
11) Return
12) Fine mesh screen

- - - - -

NOTE

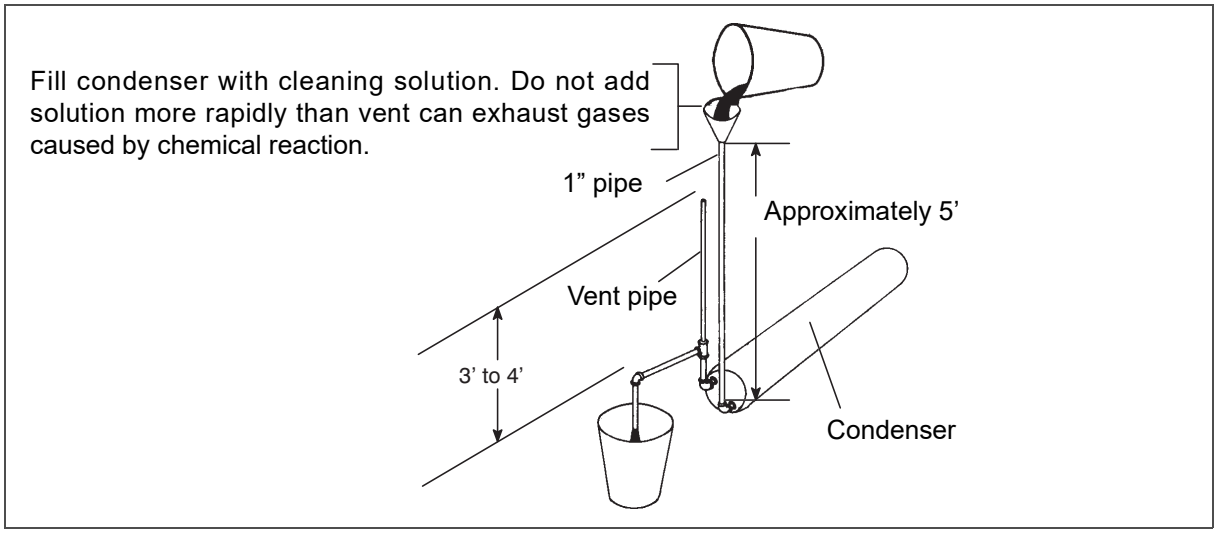
It is important to provide a vent at the top for escaping gas.

6. Allow the Oakite No. 32 solution to soak in the tube coils for several hours, periodically pump-circulating it with an acid-proof pump.

   An alternate method may be used whereby a pail (see **Figure 7.9**) filled with the solution and attached to the coils by a hose can serve the same purpose by filling and draining. The solution must contact the scale at every point for thorough de-scaling. Air pockets in the solution should be avoided by regularly opening the vent to release gas. Keep flames away from the vent gases.

7. The time required for de-scaling will vary, depending upon the extent of the deposits. One way to determine when de-scaling has been completed is to titrate the solution periodically, using titrating equipment provided free by the Oakite technical service representative. As scale is being dissolved, titrate readings will indicate that the Oakite No. 32 solution is losing strength. When the reading remains constant for a reasonable time, this is an indication that scale has been dissolved.

Figure 7.9 Water-Cooled Condenser Cleaning - Gravity Circulation



8. When de-scaling is complete, drain the solution and flush thoroughly with water.

NOTE

If condenser cooling water is not being used as drinking water or is not re-circulated in a closed or tower system, neutralizing is not necessary.

9. Following the water flush, circulate a 56.7 gram (2 ounce) per 3.785 liter (1 U.S. gallon) solution of Oakite Aluminum Cleaner® 164 through the tubes to neutralize. Drain this solution.
10. Flush the tubes thoroughly with fresh water.
11. Put the unit back in service and operate under normal load. Check the head pressure. If normal, a thorough de-scaling has been achieved.

What You Can Do For Further Help:

Contact the Engineering and Service Department of OAKITE PRODUCTS CO., 675 Central Avenue, New Providence, NJ 07974 U.S.A. (or visit www.oakite.com)

7.14 Filter Drier

On units equipped with a water-cooled condenser, if the sight glass appears to be flashing or bubbles are constantly moving through the sight glass, the unit may have a low refrigerant charge or the filter drier may be partially plugged.

7.14.1 Checking the Filter Drier:

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

7.14.2 Replacing the Filter Drier:

1. Pump down the unit (see **Section 7.4**). If the unit is not equipped with service values, evacuate the unit. Then replace filter drier.
2. Evacuate the low side in accordance with **Section 7.6**.
3. After unit is in operation, inspect for moisture in the system and check charge.

7.15 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.

7.15.1 Evaporator Coil Replacement

1. Pump unit down. (See **Section 7.4**).

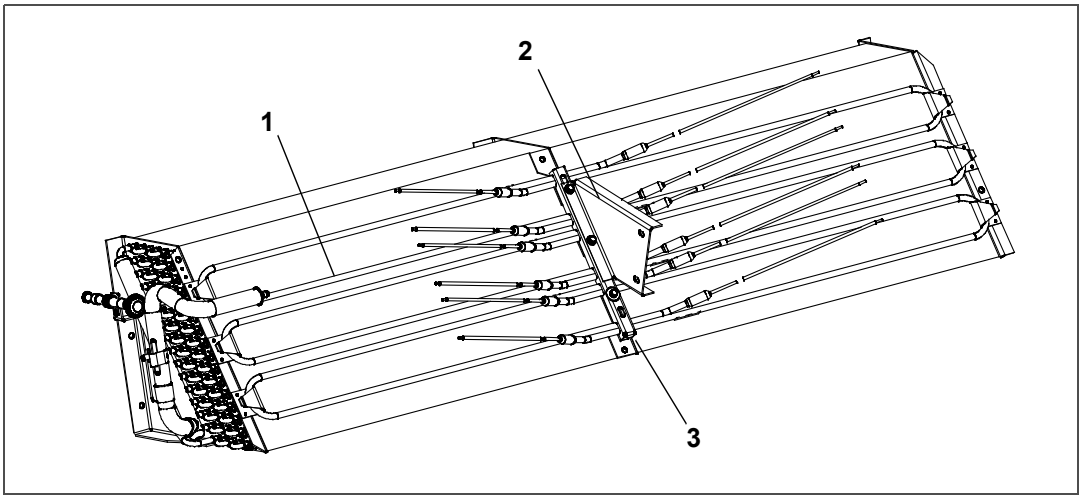
⚠ WARNING

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 (see **Section 7.28**) from the coil.
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.

7.16 Evaporator Heaters

Figure 7.10 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.

7.16.1 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.

7.17 Evaporator Fan and Motor Assembly

The evaporator fans circulate air throughout the container by pulling air in at 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.

7.17.1 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 the access panel by removing the mounting bolts and TIR locking device. Reach inside of the unit and remove the Ty-Rap securing the wire harness loop. Disconnect the connector by twisting to unlock and pulling to separate.
2. Loosen the 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.

7.17.2 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 7.11**).
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.

7.17.3 Assemble the Evaporator Fan Assembly

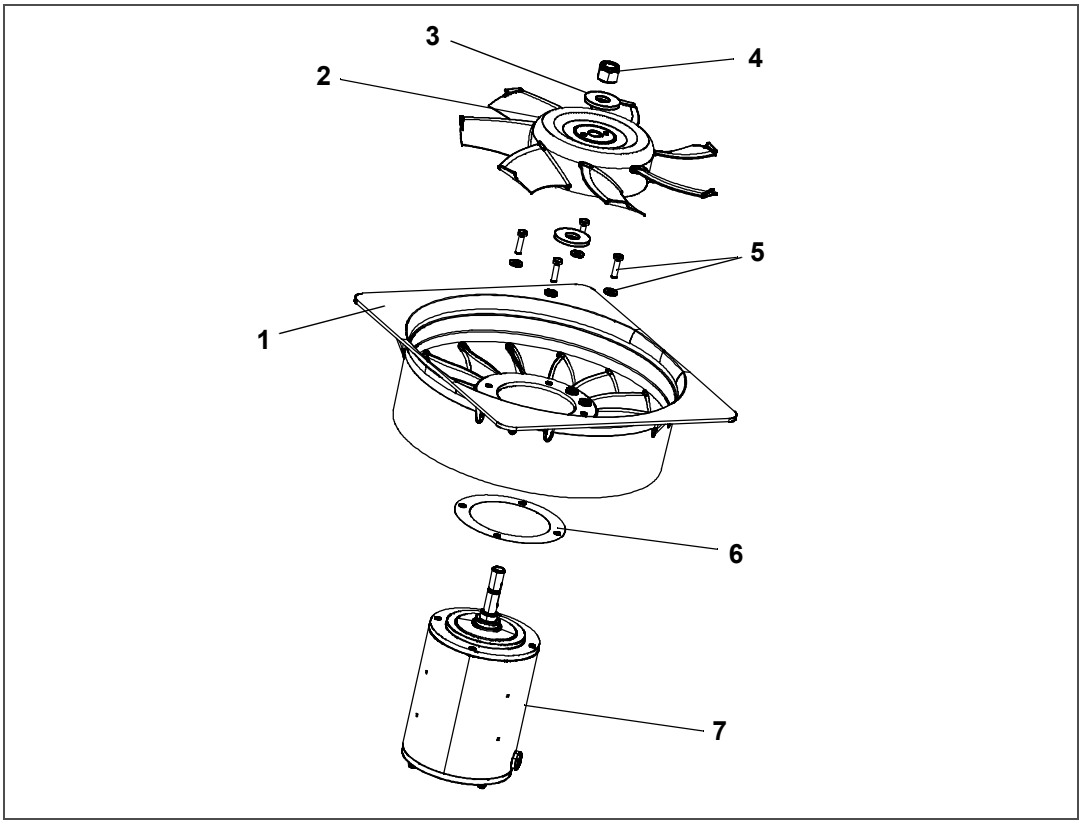
1. Assemble the motor and plastic spacer onto the stator.

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 7.11 Evaporator Fan Assembly

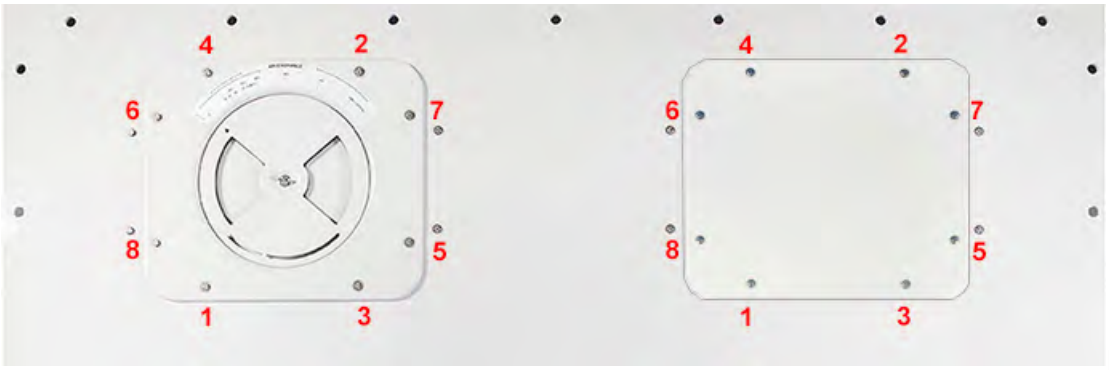


1) Stator
2) Fan
3) Washer
4) Nut
5) Screws / Washers
6) Protector
7) Motor

- - - - -

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 the access panel making sure that the panel does not leak. Make sure that the TIR locking device is lockwired. Torque the access panel hardware to 69 kg-cm (60 in/lbs.) using a crossing pattern as shown in **Figure 7.12**. Repeat the pattern twice for a proper seal.

Figure 7.12 Access Panel Torque Pattern



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7.18 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.

Analysis 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 light-weight 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.

7.18.1 Cleaning Preparation

- 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.

7.18.2 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 five to seven 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.

7.19 Electronic Expansion Valve (EEV)

The electronic expansion valve (EEV) is an automatic device which maintains required superheat of the refrigerant gas leaving the evaporator. The valve functions are: (a) automatic response of refrigerant flow to match the evaporator load and (b) prevention of liquid refrigerant entering the compressor. Unless the valve is defective, it seldom requires any maintenance.

7.19.1 Removing an EEV

⚠ WARNING

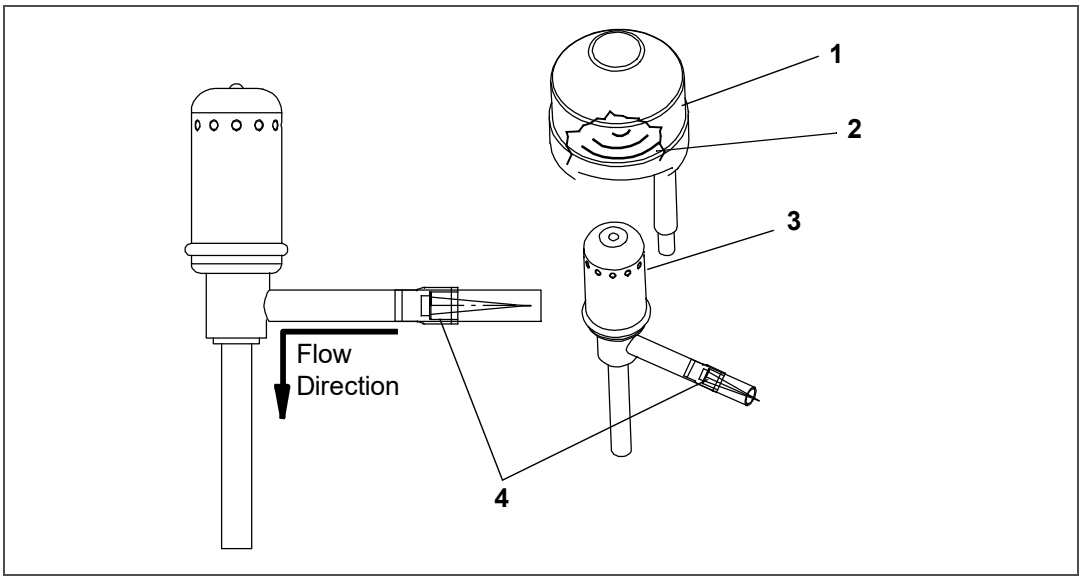
Always turn OFF the unit circuit breakers (CB-1 & CB-2) and disconnect main power supply before working on moving parts.

1. Pump down the compressor (see **Section 7.4**) and frontseat both suction and discharge valves.
2. Turn unit power off and remove power from the unit.
3. Remove the coil.
4. Remove the valve. The preferred method of removing the valve is to cut the connection between the brazed section and the valve, using a small tube cutter. Remove the valve.
   Alternatively, use a wet rag to keep the valve cool. Heat inlet and outlet connections to valve body and remove valve.
5. Clean the valve stem with mild cleaner, if necessary.

7.19.2 Installing an EEV

1. Install the valve and a new strainer with the cone of the strainer / screen pointing into the liquid line at the inlet to the valve.
2. During installation, make sure the EEV coil is snapped down fully, and the coil retention tab is properly seated in one of the valve body dimples. Also, ensure that coil boot is properly fitted over valve body. See **Figure 7.13**.
3. Replace the filter drier.
4. Evacuate to 500 microns by placing the vacuum pump on the liquid line and suction service valve.
5. Open the liquid line service valve and check refrigerant level.
6. Check superheat. See **Section 3.2**.
7. Check unit operation by running a pre-trip. See **Section 4.6**.

Figure 7.13 Electronic Expansion Valve



1) Coil Boot
2) Coil
3) Electronic Expansion Valve (EEV)
4) Strainer

- - - - -

7.20 Humidity Sensor

The humidity sensor is an optional component that allows setting of a humidity set point in the controller. In dehumidification mode, the controller will operate to reduce internal container moisture level.

7.20.1 Checking the Operation of the Humidity Sensor

This procedure is to be performed in an effort to ease the troubleshooting of the humidity sensor. When performing this procedure and while working on the unit, always follow the proper lockout/tagout procedures.

Items Required:

- One 7/16” socket wrench or nut driver.
- One 1/4” socket wrench or nut driver.
- One clean, clear water bottle with a minimum 6 cm (2.5 in) opening and capacity to hold 500 ml (16.9 oz).
- 100 ml (3.4 oz) of fresh water - distilled if available.
- 50 gm of Salt (NaCl).

Procedure:

1. Remove the left Upper Fresh Air Makeup Vent panel.
2. Remove the humidity sensor from the mounting hardware and bring to the front of the access panel.
3. Disconnect the humidity sensor from the harness.
4. Drill a 3 cm (1.25 in) hole in the cap of a bottle.
5. Pour approximately 100 ml (3.4 oz) of water into the empty clean bottle.
6. Add salt to the water until it is present at the bottom of the bottle.
7. Cap the bottle and tape over the drilled hole.
8. Shake the bottle until the salt dissolves and water is saturated.

NOTE

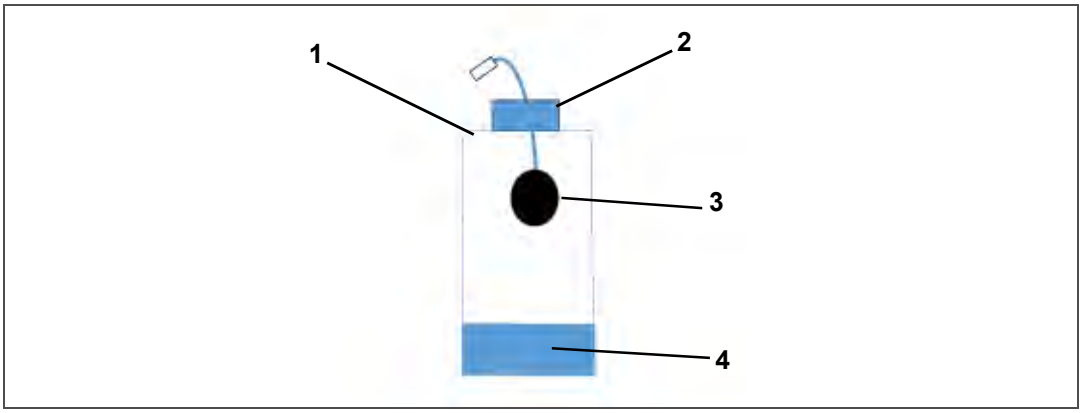
To ensure saturation, add additional salt until it settles at the bottom without dissolving while shaking.

9. Remove the cap and insert the humidity sensor into the bottle through the bottle opening and pull the connector back through the drilled hole in the cap. Then, secure the cap and seal the wire going through the cap.

NOTE

Make sure that the sensor is not at all in contact with the salt water.

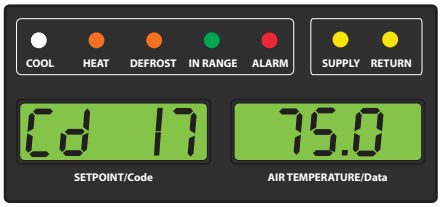
Figure 7.14 Humidity Sensor



1) Cap opening (6 cm)
2) Cap hole (3 cm)
3) Humidity Sensor (HS)
4) Salt water solution

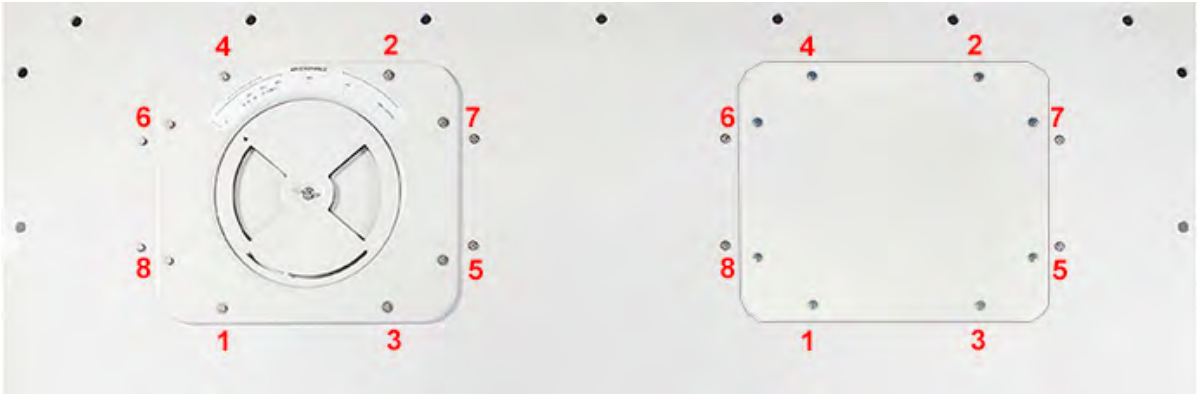
- - - - -

10. Allow the saturated salt mixture to settle for approximately ten minutes.
11. Reconnect the humidity sensor to the harness and power the reefer unit on.
12. Press the CODE SELECT key on the keypad.
13. Use the Arrow keys until “Cd17” is displayed then press the ENTER key.



14. This displays the humidity sensor reading. Verify the reading is between 60% and 85% relative humidity.
15. If the humidity sensor display is outside of this range, reconfirm the salt mixture and retest. If not in range, replace the sensor at the next opportunity.
16. Wipe clean and reinstall the humidity sensor and access panel. Torque the access panel hardware to 69 kg-cm (60 in.-lbs.) using a crossing pattern similar to the numbering below.

Figure 7.15 Access Panel Torque Sequence



17. If the panel gasket is damaged, replace it.

7.21 Economizer Solenoid Valve

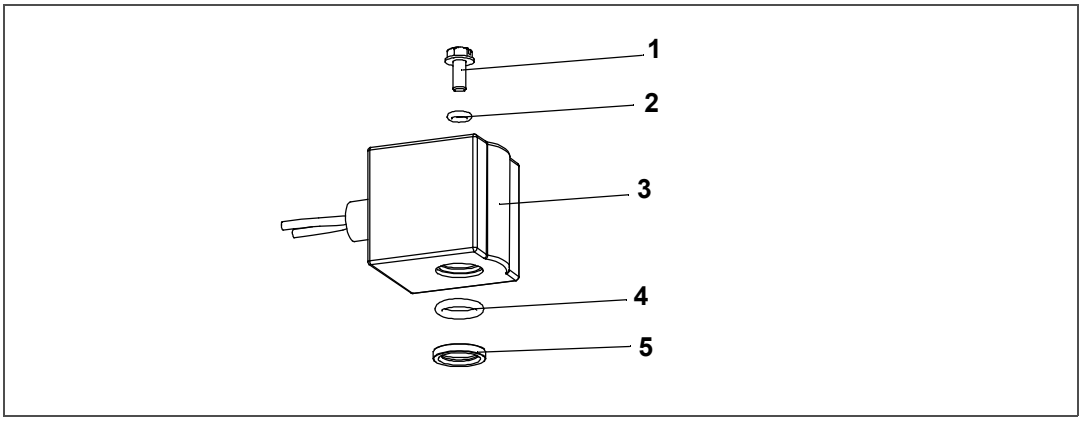
7.21.1 Removing a Solenoid Valve Coil

⚠ WARNING

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

1. Turn unit power off and remove power from the unit. Disconnect leads.
2. Remove the top screw and o-ring. Remove the coil and save mounting hardware, seals and spacer for reuse (see **Figure 7.16**). See Valve Coil Installation Procedure.

Figure 7.16 Coil View of Economizer Solenoid Valve (ESV)



1) Slotted Screw
2) Top Coil (small) O-ring
3) Solenoid Coil, Enclosing Tube and Body
4) Bottom Coil (large) O-ring
5) Brass Spacer

- - - - -

7.21.2 Removing the Solenoid Valve

1. Pump down the compressor (see **Section 7.4**) and frontseat both suction and discharge valves.
2. Remove the valve. The preferred method of removing the solenoid valve is to cut the connection between the brazed section and the valve, using a small tube cutter. Remove valve.
   Alternatively, heat inlet and outlet connections to valve body and remove valve.
3. Clean the valve stem with mild cleaner, if necessary.

7.21.3 Installing the Solenoid Valve

1. Fit the new solenoid valve into position and braze. Use a wet rag to keep valve cool whenever brazing.

7.21.4 Installing the Solenoid Valve Coil

1. Install the brass spacer on the valve stem.
2. Lubricate both o-rings with silicone provided in the kit.
3. Install bottom coil o-ring on the valve stem.
4. Install the solenoid coil on the valve stem.
5. Place the top coil o-ring on the coil mounting screw and secure the coil to the valve using a torque wrench. Torque the screw to 25 in-lbs.
6. Connect coil wires using butt-splices and heat shrink tubing.

7.22 Economizer Expansion Valve

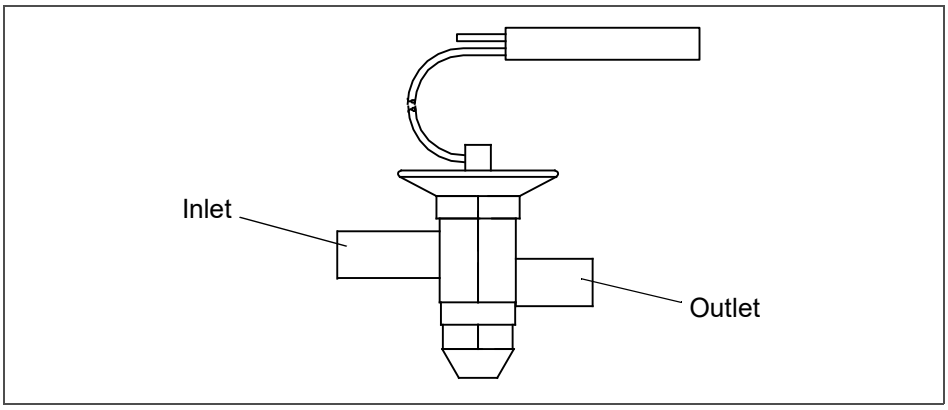
The economizer expansion valve (see **Figure 7.17**) is an automatic device that maintains constant superheat of the refrigerant gas leaving at the point of bulb attachment, regardless of suction pressure.

Unless the valve is defective, it seldom requires maintenance other than periodic inspection to ensure that the thermal bulb is tightly secured to the suction line and wrapped with insulating compound.

NOTE

The economizer expansion valve is a hermetic valve, it does not have adjustable superheat.

Figure 7.17 Economizer Expansion Valve



7.22.1 Removing the Economizer Expansion Valve

1. Pump down the compressor (see **Section 7.4**) and frontseat both suction and discharge valves. If unit is not equipped with service valves, evacuate unit. See **Section 7.6.1**.
2. Turn unit power off and remove power from the unit.
3. Remove cushion clamps located on the inlet and outlet lines.
4. Remove insulation (Presstite) from the expansion valve bulb.
5. Unstrap the bulb, located on the economizer line.
6. Remove the valve. The preferred method of removing the valve is to cut the connection between the brazed section and the valve, using a small tube cutter. Remove valve. Alternatively, use a wet rag to keep valve cool. Heat inlet and outlet connections to valve body and remove valve.
7. Clean the valve stem with a mild cleaner, if necessary.

7.22.2 Installing the Economizer Expansion Valve

1. The economizer expansion valve should be wrapped in a soaked cloth for brazing.
2. Braze the inlet connection to the inlet line.
3. Braze the outlet connection to the outlet line.
4. Reinstall the cushion clamps on the inlet and outlet lines.
5. Replace the filter drier. See **Section 7.14**.
6. Evacuate to 500 microns by placing vacuum pump on liquid line and suction service valve.
7. Check economizer expansion valve superheat (see **Section 3.2**).

7.23 Troubleshooting P6-7 (DUV)

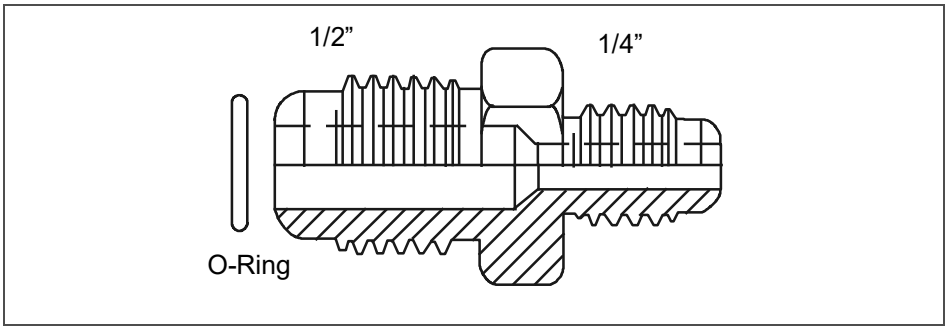
A failed digital unloader valve (DUV), which is normally closed, or an internal seal failure of the compressor can result in the unit running continually in the fully loaded mode causing it to undershoot its setpoint temperature.

Both of these conditions can be evaluated by running pre-trip test P6-7. When running P6-7, the controller is looking for the differences in pressure and current draw between loaded mode and unloaded mode to make a judgment. If there are no differences, then it will show fail.

To confirm what caused the test to fail, perform the following additional test.

1. Connect the manifold gauge set to discharge service valve (DSV) and suction service valve (SSV).
2. Front seat the SSV and pump down the compressor.
3. Front seat the DSV valve to isolate the compressor.
4. Disconnect the DUV from the top of compressor and install a 1/2 to 1/4 flared adapter / O-ring (P/N 40-50076-00sv).

Figure 7.18 Adapter and O-Ring



5. Using refrigerant (R-134a or R-513A as specified for the unit model number) or Nitrogen, pressurize the line to 50 psi (3.5 bar) at the adapter connection and close supply at the tank. Pressure should hold as the valve is normally closed. If pressure drops, check for leaks at the installed fitting (part number 40-50076-00sv); repair and retest. If pressure increases at the suction service valve and decreases at the pressure supply; the valve is leaking and should be replaced. If no leak proceed to step 6.
6. Energize the DUV by removing the coil and placing a magnet on the valve stem opening the valve. If the pressure does not increase at the SSV and decrease at the supply, replace the valve as it did not open.

If a magnet is not available, a jumper procedure can be used as follows:

1. Remove all four controller fuses (F1, F2, F3a, F3b).
2. Remove the KA6 wire from the KA controller connector on the front of the controller.
3. Disconnect the X1 wire from the 24VAC side of the transformer (black wire) and locate it away from the transformer.
4. Jumper between the black transformer wires to the KA6 wire removed from the connector.
5. Connect power to the unit and turn the circuit breaker on. The DUV coil is now energized.
6. Pressure should drop.
7. Power the circuit breaker off, reconnect wires and reinstall fuses.
8. If the valve opens and closes properly, the failure mode is with the compressor and it should be changed at the earliest opportunity.

7.24 Digital Unloader Valve (DUV)

7.24.1 Removing the DUV

1. Pump down the compressor (see **Section 7.4**) and frontseat both suction and discharge valves. In the event the DUV is stuck open and compressor cannot pump down, remove charge.

⚠ CAUTION

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

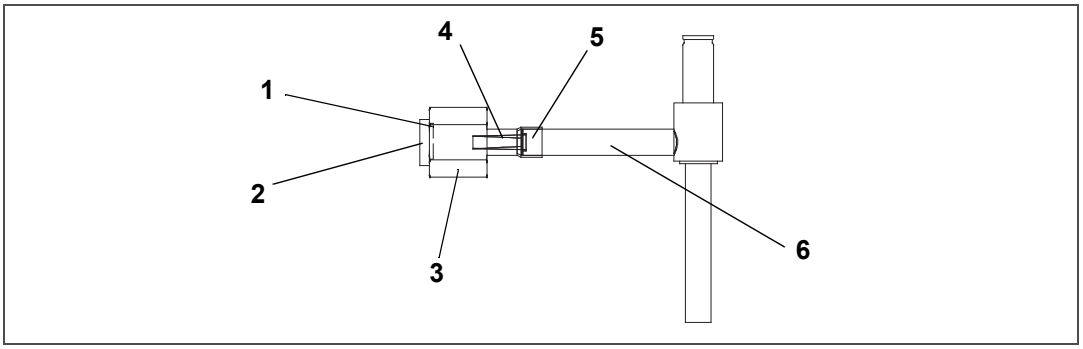
2. Turn unit power off and remove power from the unit.
3. Loosen the bolt on top of the DUV and remove the coil assembly.

NOTE

There is a small spacer tube between the top of the valve and the 12 VDC coil that needs to be reinstalled into the solenoid valve coil. When removing the coil, it may fall out when lifted from the valve body. Take care that the spacer is not lost; the valve will not function correctly without it.

4. Remove the clamps holding the DUV to the discharge line.
5. Loosen the nuts attaching the DUV to the top of the compressor.
6. Remove the valve. The preferred method of removing the solenoid valve is to cut the connection between the brazed section and the valve, using a small tube cutter. Remove valve. (see **Figure 7.19**). Alternatively, use a wet rag to keep valve cool. Heat outlet connection to valve body and remove valve.

Figure 7.19 View of Digital Unloader Valve (DUV) Assembly



1) O-ring (hidden)
2) Sleeve
3) Hex Nut, 1/2 OD
4) Screen Valve Strainer
5) Tube
6) Solenoid Valve Body

- - - - -

7. Examine the compressor and service valves. Ensure that the o-ring is not stuck in the gland of the valve.
8. Discard the o-ring on the o-ring face seal connection.

7.24.2 Installing the DUV

1. Lubricate the gland shoulder area and o-ring with refrigerant oil.
2. Fit the new valve in position and hand-tighten the o-ring nut.
3. Use a wet rag to keep the valve cool while brazing. Braze the DUV to service valve connection.
4. Reinstall and tighten the brackets that secure the valve body to the discharge line.
5. Torque the o-ring face seal connections to 18 to 20 ft-lbs.
6. Install the coil onto the valve body and tighten the attachment bolt.

NOTE

Confirm that the small spacer tube is inserted into the coil prior to attaching it to the valve body. The valve will not function correctly without it.

7. Leak check and evacuate the low side of unit as applicable. See **Section 7.6.1**.
8. Open the service valves.

7.25 Valve Override Controls

Controller function code Cd41 is a configurable code that allows timed operation of the automatic valves for troubleshooting. Test sequences are provided in **Table 7–1**. Capacity mode (CAP) allows alignment of the economizer solenoid valve in the standard and economized operating configurations. DUV Capacity Modulation% Setting (PCnt) and Electronic Expansion Valve (EEV) allows opening of the digital unloader valve and electronic expansion valve, respectively, to various percentages. If the unit is equipped with an LIV, the Liquid Valve Setting allows the LIV to be automatically controlled, or manually opened and closed.

The Override Timer (tIM) selection is also provided to enter a time period of up to five minutes, during which the override(s) are active. If the timer is active, valve override selections 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, the override

function is automatically terminated and the valves return to normal machinery control. To operate the override:

1. Press the CODE SELECT key.
2. Use the Arrow keys until Cd41 is displayed in the left window. The right window will display a controller communications code.
3. Press the ENTER key. The left display will show a test name alternating with the test setting or time remaining.
4. Use the Arrow keys to scroll to the desired test, and then press the ENTER key. “SELCt” will appear in the left display.
5. Use the Arrow keys to scroll to the desired setting, and then press the ENTER key. Selections available for each of the tests are provided in **Table 7–1**.
6. 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 the ENTER key to start the timer.
7. The above described sequence may be repeated during the timer cycle to change to another override.

Table 7–1 Valve Override Control Displays for Cd41 “SELCt”

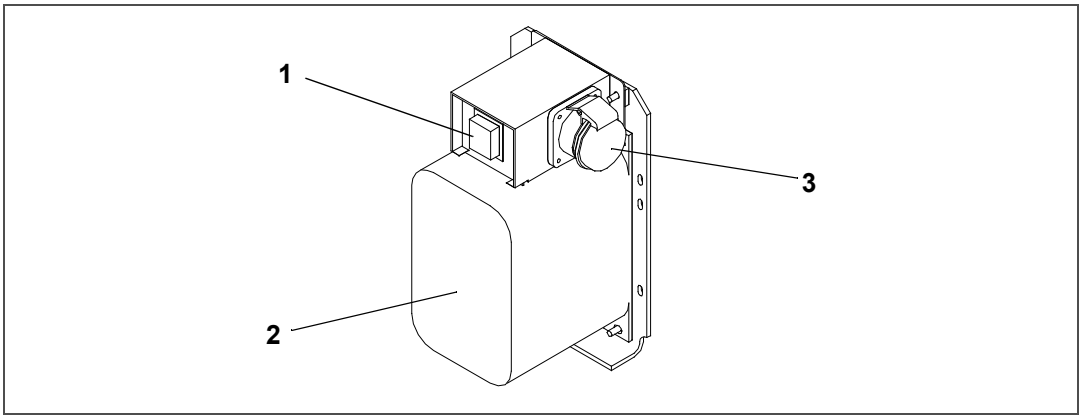
Controller Communication Codes (Right Display)	Setting Codes (Right Display)
tIM (Override Timer)	**0 00** (0 minutes/0 Seconds) In 30 second increments to **5 00** (5 minutes/ 0 seconds)
PCnt (% Setting - DUV Capacity Modulation)	**AUtO** (Normal Machinery Control), 0, 3, 6, 10, 25, 50, 100
EEV (% Setting - Electronic Expansion Valve)	**AUtO** (Normal Machinery Control) **CLOSE** (Closed) 0, 3, 6, 10, 25, 50, 100
CAP (Capacity Mode)	**AUtO** (Normal Control) **Std; UnLd (**Economizer = Closed**)** **ECOn** (Economizer = Open)

7.26 Autotransformer

If the unit does not start, check the following:

1. Verify the 460 VAC (yellow) power cable is plugged into the receptacle (see **Figure 7.20**) and locked in place.
2. Verify that circuit breakers CB-1 and CB-2 are in the “ON” position. If the circuit breakers do not hold in, check voltage supply.
3. Using a voltmeter, and with the primary supply circuit ON, check the primary (input) voltage (460 VAC). Next, check the secondary (output) voltage (230 VAC). The transformer is defective if output voltage is not available.

Figure 7.20 Autotransformer



1) Circuit Breaker (CB-2) 230-Volt
2) Dual Voltage Autotransformer
3) 460 VAC Power Receptacle

- - - - -

7.27 Controller

7.27.1 Handling Modules

⚠ 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 modules. These precautions and procedures should be implemented when replacing a module, when doing any arc welding on the unit, or when service to the refrigeration unit requires handling and removal of a module.

1. Obtain a grounding wrist strap (Carrier Transicold P/N 07-00304-00) and a static dissipation mat (Carrier Transicold P/N 07-00277-00). The wrist strap, when properly grounded, will dissipate any potential static buildup on the body. The dissipation mat will provide a static-free work surface on which to place and/or service the modules.
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 module. Do not touch any of the electrical connections if possible. Place the module on the static mat.

NOTE

The strap should be worn during any service work on a module, even when it is placed on the mat.

7.27.2 Controller Troubleshooting

For reference of the controller location in the control box, see **Section 3.1.7**.

For a description of the controller software, see **Section 4.2**.

See function code Cd74 (see **Section 4.9**) for controller self diagnostic test.

7.27.3 Loading Controller Operational Software from a USB Drive

1. Place the Start-Stop switch (ST) to “I” to turn the unit On. Wait for controller information to be displayed.
2. Insert the USB flash drive, containing controller software, into the controller micro USB port.
3. Press the ALT. MODE key on the keypad.
4. Use the Arrow keys until “USb” is displayed, then press the ENTER key.

NOTE

If “no USb” is displayed, wait up to 15 seconds for this message to be replaced with a different message. If “no USb” continues to be displayed, remove and insert the USB flash drive and repeat steps 3 and 4.

5. Use the Arrow keys until “UP LoAd” is displayed, then press the ENTER key.
6. “LOAd XXXX” is now on the display. If more than one ML5 software revision file is on the USB flash drive at the root level, press the Arrow keys until the desired revision is displayed.
7. Press the ENTER key to load the software to the controller.
8. When “PULL USB NOW” is displayed, remove the USB drive from the port.
9. The following messages will appear to confirm successful programming: “LoAd SoFt” and “Pro SoFt” will each appear for several seconds and then “Restart” appears briefly. Then, the controller restarts.
10. As the controller starts up, the message “Cd 18” displays the new software loaded and then “Pro donE” appears.

7.27.4 Uploading a Software Configuration from a USB Drive

1. Place the Start-Stop switch (ST) to “I” to turn the unit On. Wait for controller information to be displayed.
2. Insert the USB flash drive containing the software configuration files into the controller micro USB port. The software multi-configuration files will have an extension of .ml5.
3. Press the ALT. MODE key on the keypad.
4. Use the Arrow keys until “USb” is displayed, then press the ENTER key.

NOTE

If “no USb” is displayed, wait up to 15 seconds for this message to be replaced with a different message. If “no USb” continues to be displayed, remove and insert the USB flash drive and repeat steps 3 and 4.

5. Use the Arrow keys until “SEt UP” is displayed, then press the ENTER key.
6. Use the Arrow keys until “ruN COnFG” is displayed, then press the ENTER key.

NOTE

If more than one configuration database file is on the USB flash drive at the root level, then only the file with the latest date will be considered.

7. The display module will go blank briefly and then display “551000”, based on the operational software installed.
8. Use the Arrow keys to scroll through the list to obtain the proper model number, then press the ENTER key.
9. Once the model number is selected, the display will show the message “re Start” briefly, and then the controller will restart.
10. Remove the USB flash drive from the USB port.
11. Use the Arrow keys to navigate to function code Cd20 and confirm that the correct model configuration is displayed. The model displayed in Cd20 should match what is shown on the unit nameplate.

7.27.5 Downloading DataCORDER Data to a USB Drive

1. Place the Start-Stop switch (ST) to “I” to turn the unit On. Wait for controller information to be displayed.
2. Insert the designated USB flash drive into the controller micro USB port.
3. Press the ALT. MODE key on the keypad.
4. Use the Arrow keys until “USb” is displayed, then press the ENTER key.

NOTE

If “no USb” is displayed, wait up to 15 seconds for this message to be replaced with a different message. If “no USb” continues to be displayed, remove and insert the USB flash drive and repeat steps 3 and 4.

5. Use the Arrow keys until “dn LoAd” is displayed, then press the ENTER key.
6. The Download Menu is now displayed. The amount of free space available on the drive is displayed first. Use the Arrow keys to scroll down through the choices: ALL, trIP, 30dAy, 60dAy, and 90dAy.
7. Confirm the selection by pressing the ENTER key. The download starts.
8. While the download is in progress, the display will show “dLOAd” flashing.
9. When the download is complete, the display will show “dLOAd donE”.
10. Remove the USB flash drive from the USB port.

7.27.6 Setting the Date and Time

1. Place the Start-Stop switch (ST) to “I” to turn the unit On. Wait for controller information to be displayed.
2. Insert the designated USB flash drive into the controller micro USB port.

NOTE

The USB must have an ML5 software file or ML5 configuration file on the root level. If not, the “SEt UP” menu will not be accessible from underneath the “USb” menu.

3. Press the ALT. MODE key on the keypad.
4. Use the Arrow keys until “USb” is displayed, then press the ENTER key.

NOTE

If “no USb” is displayed, wait up to 15 seconds for this message to be replaced with a different message. If “no USb” continues to be displayed, remove and insert the USB flash drive and repeat steps 3 and 4.

5. Use the Arrow keys until “SEt UP” is displayed, then press the ENTER key.
6. Use the Arrow keys until “SEt tIM” is displayed, then press the ENTER key.
7. The date values are displayed in YYYY MM-DD format. Configure the date using the keypad.
   - The values will be edited from left to right: the year first (YYYY), then month (MM) and then day (DD).
   - Press the Arrow keys to increase or decrease a date value.
   - Press the ENTER key to confirm the date value being modified and bring up the next value for editing.
   - Press the CODE SELECT key to return to the previous date value.
8. Once date editing is complete and the day (DD) value is selected, press the ENTER key.
9. The time values are now displayed in HH MM format. Configure the time using the keypad.
   - The values will be edited from left to right: the hours first (HH), then minutes (MM).
   - Press the Arrow keys to increase or decrease a time value.
   - Press the ENTER key to confirm the time value being modified and bring up the next value for editing.
   - Press the CODE SELECT key to return to the previous time value.
10. Once time editing is complete, with the minutes (MM) value active, press the ENTER key.
11. The display returns to the USb menu. The date and time will be committed when the ENTER key is pressed.

7.27.7 Setting the Container ID

This procedure explains how to set the Container ID, which can be found in Function Code Cd40 (See **Section 4.9**). The characters will be preset to the container ID of the box that the refrigeration unit was originally commissioned in. If no ID has been loaded, Cd40 will show dashes as the ID will be invalid.

1. Place the Start-Stop switch (ST) to “I” to turn the unit On. Wait for controller information to be displayed.
2. Insert the USB flash drive into the controller micro USB port. The USB must have an ML5 software file or ML5 configuration file on the root level. If not, the “SEt UP” menu will not be accessible from underneath the “USb” menu.
3. Press the ALT. MODE key on the keypad.
4. Use the Arrow keys until “USb” is displayed, then press the ENTER key.

NOTE

If “no USb” is displayed, wait up to 15 seconds for this message to be replaced with a different message. If “no USb” continues to be displayed, remove and insert the USB flash drive and repeat steps 3 and 4.

5. Use the Arrow keys until “SEt UP” is displayed, then press the ENTER key.
6. Use the Arrow keys until “SEt Id” is displayed, then press the ENTER key. The current ID is displayed.
7. Configure the Container ID using the keypad.
   - The first four characters are Alpha type and the last seven are numeric.
   - The character being modified will always be on the right most position on the display.
   - Press the Arrow keys to scroll through the selectable characters available.
   - Press the ENTER key to confirm the choice and shift the selected character one position to the left to modify the next character.
   - Press the CODE SELECT key to shift the characters one position to the right (backspace) to modify the previous character.
8. When the last value of Container ID is entered, press the ENTER key to enter the information to the controller.

7.27.8 Removing and Installing a Controller

Removal:

1. Disconnect all front wire harness connectors and move wiring out of the way.
2. The lower controller mounting is slotted. Loosen the top mounting screw (see **Figure 4.1**) and lift up and out.
3. Remove the module.
4. When removing the replacement module from its packaging, note how it is packaged. When returning the old module for service, place it in the packaging in the same manner as the replacement. The packaging has been designed to protect the module from both physical and electrostatic discharge damage during storage and transit.

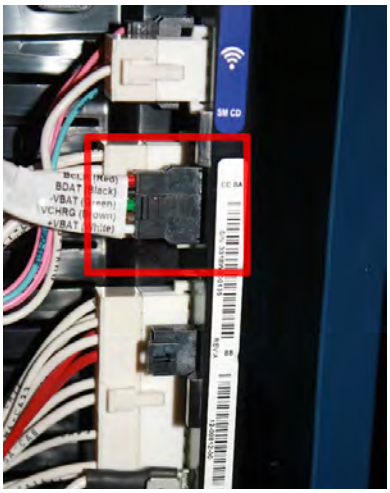
Installation:

1. Install the module by reversing the removal steps.
2. Torque values for mounting screws (see **Figure 4.1**) are 0.23 mkg (20 inch-pounds). Torque value for the connectors is 0.12 mkg (10 inch-pounds).

7.27.9 Battery Replacement

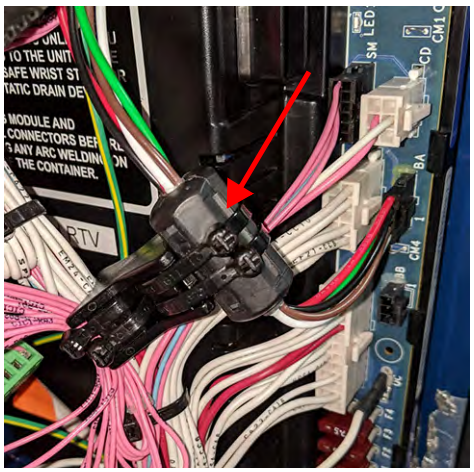
The Carrier rechargeable battery pack part # is 79-04262-01.

1. Turn unit power Off and disconnect the power supply.
2. Open the control box door and remove both the high voltage shield and clear plastic rain shield (if installed).
3. Disconnect the battery connection at the "BA" connector and carefully remove wire ties along the battery wires leading back to the battery pack.



4. Using a Driver Bit, Carrier Transicold part number 07-00418-00, loosen the left hand screw on the battery pack cover then remove the second screw on the outer edge of the battery pack cover.

5. Remove the old battery from the bracket and assemble the new battery to the bracket.
6. Secure the battery wires from the battery along the previous route and then reconnect the BA connector. Heat shrink a ferrite clamp to the harness to reduce electromagnetic voltage transients onto this interface.



7. Replace wire ties that were removed. Replace shields and close the control panel door.

7.28 Temperature Sensor Service

Service procedures for the return recorder, return temperature, supply recorder, supply temperature, ambient, defrost temperature, evaporator temperature, and compressor discharge temperature sensors are provided in this section.

7.28.1 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. Finer ice particles will produce a more accurate 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 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).

7.28.2 Sensor Checkout Procedure

This procedures is to be performed to verify the accuracy of a temperature sensor. This procedure describes how to check using a ice-water bath and also by using an OHM check.

1. Remove the sensor 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 the bulb) with ice cubes or chipped ice, then filling the voids between the ice with water and agitating until the mixture reaches 0°C (32°F) measured on a laboratory thermometer.
2. Start the unit and check the sensor reading on the control panel. Readings should be 0°C (32°F).

   If the reading is correct, reinstall the sensor. If the reading is incorrect, continue with the next step.
3. If the reading is off slightly, then re-calibrate. If the reading is not within 0°C (32°F) +/- 0.25 degrees, replace the sensor and re-check.
4. A sensor can be tested against from the control box utilizing the carrier harness adapter.

   The carrier harness adapter part numbers are 22-50485-00 (CA connector), 22-50486-00 (CC connector) and 22-50487-00 (ME connector). All readings from the adapter will be resistance readings with power removed and the harness disconnected from the ML5 controller.
5. Locate the proper wires to be ohmed on the system schematic and check against the temperature resistance chart provided in **Table 7–2** and **Table 7–3**. If unable to soak in an ice bath, the sensor resistance can be compared against a calibrated sensor located with the sensor being tested.

NOTE

Performing resistance checks on the controller connector is discouraged due to potential damage to the pins.

Resistive Sensors:

- STS, SRS, RTS, RRS: ice-bath, GDP calibration, replace. Remove check against chart. Ambient - easy to ice-bath check on display, if bad reading replace, remove ohm against chart.
- DTS: ice-bath check on display, if bad replace, can remove and check against chart.
- CPDS: remove from compressor, ice-bath check against display, if bad replace, can remove and check against chart.
- ETS1 / ETS2: ice-bath check against display, if bad replace, can remove and check against
- USDA 1-4: ice-bath, GDP, remove at socket check resistance

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

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

°C	°F	OHMS		°C	°F	OHMS
-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	2,889,600	18	64.4	117,656
-38	-36.4	2,532,872	20	68.0	107,439
-36	-32.8	2,225,078	22	71.6	98,194
-34	-29.2	1,957,446	24	75.2	89,916
-32	-25.6	1,724,386	**25**	**77**	**86,113**
-30	-22.0	1,522,200	26	78.8	82,310
-28	-18.4	1,345,074	28	82.4	75,473
-26	-14.8	1,190,945	30	83.0	69,281
-24	-11.2	1,056,140	32	89.6	63,648
-22	-7.6	938,045	34	93.2	58,531
-20	-4.0	834,716	36	96.8	53,887
-18	-0.4	743,581	38	100.4	49,656
-16	3.2	663,593	40	104.0	45,812
-14	6.8	593,030	42	107.6	42,294
-12	10.4	530,714	44	111.2	39,078
-10	14.0	475,743	46	114.8	36,145
-8	17.6	426,904	48	118.4	33,445
-6	21.2	383,706	50	122.0	30,985
-4	24.8	345,315	52	125.6	28,724
-2	28.4	311,165	54	129.2	26,651
0	**32.0**	**280,824**	56	132.8	27,750
2	35.6	253,682	58	136.4	23,005
4	39.2	229,499	60	140.0	21,396
6	42.8	207,870	62	143.6	19,909
8	46.4	188,494	64	147.2	18,550
10	50.0	171,165	66	150.8	17,294
12	53.6	155,574	68	154.4	16,133
14	57.2	141,590	70	158.0	15,067
16	60.8	129,000	72	161.6	14,078

7.28.3 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.

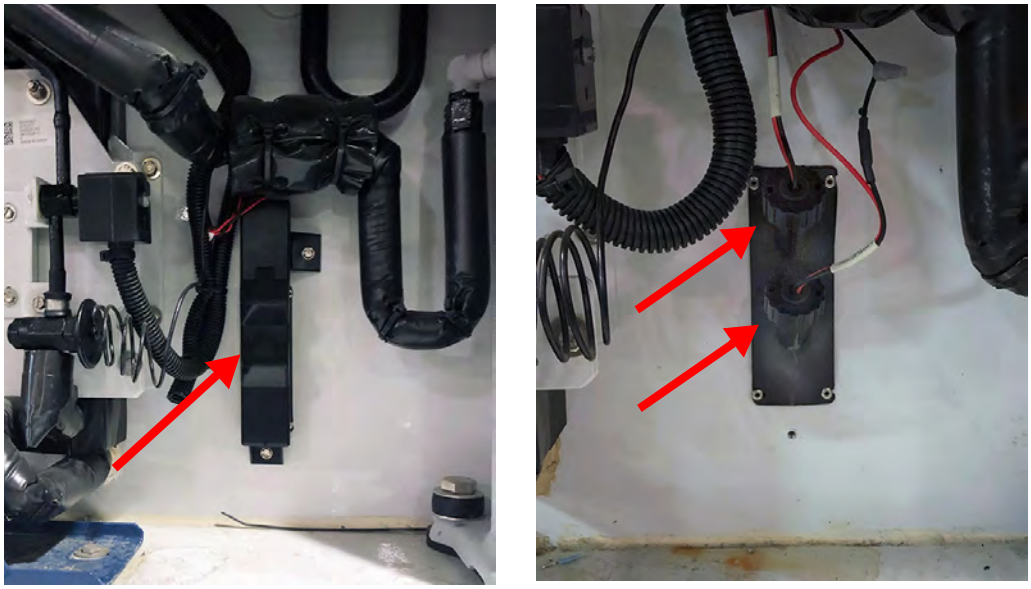
Tools Required:

- 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 places.

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 7.21**).
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 7.21**).

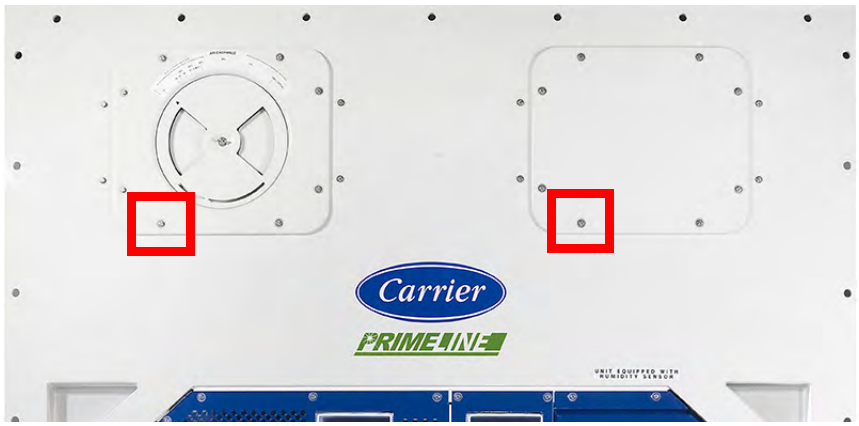
Figure 7.21 Supply Sensors - Cover Assembly and Sensors



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 7.22**). Save all hardware for re-installation.

Figure 7.22 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 7.23**).

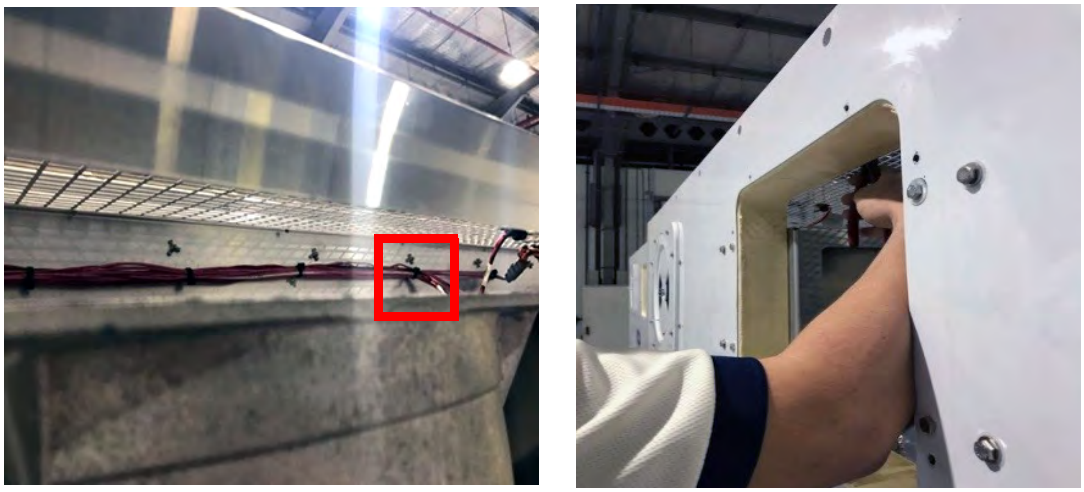
Figure 7.23 Removing Evaporator Motor

3. Loosen the fastener on the sensor bracket (see **Figure 7.24**).

Figure 7.24 Return Sensors - Bracket

4. Cut all the wire ties (see **Figure 7.25**) that are securing the sensors to the harness and remove sensor.

Figure 7.25 Return Sensors - Cutting Wire Ties



GDP Calibration, Perform Calibration:

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

⚠ WARNING

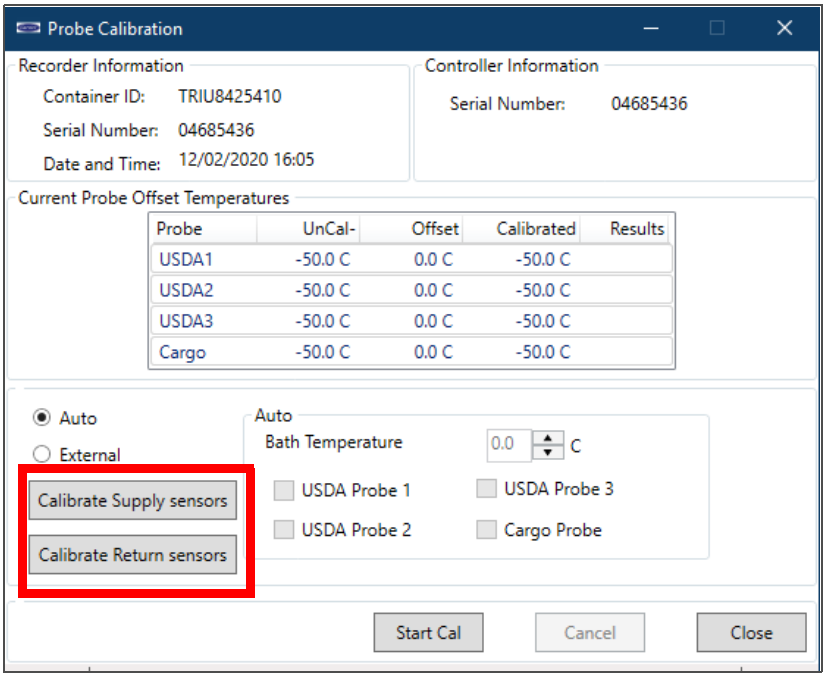
Before powering on the unit, it is important to ensure that all dismantling work is done and tools are away and service personnel are not working on the unit at the time of power on.

2. Open DataLINE version 3.1 or above. From the DataLINE launch pad, click on the Probe Calibration button (see **Figure 7.26**) 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 7.26 DataLINE - Probe Calibration

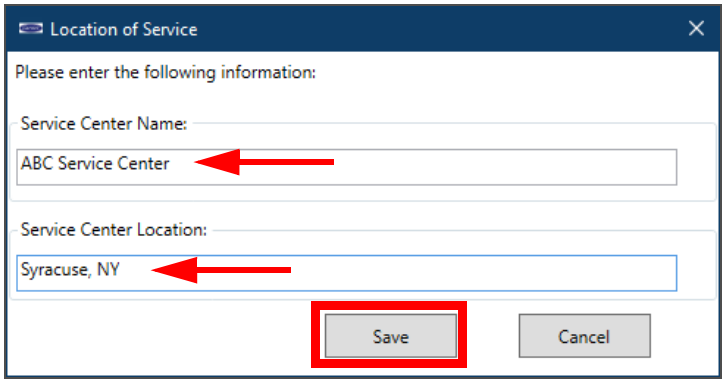
3. On the Probe Calibration screen, click on the Calibrate Supply sensors or Calibrate Return sensors button (see **Figure 7.27**).

Figure 7.27 DataLINE - Calibrate Sensors Button



4. A Location of Service pop-up window will appear (see **Figure 7.28**). 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 7.28 DataLINE - Enter Service Center Information

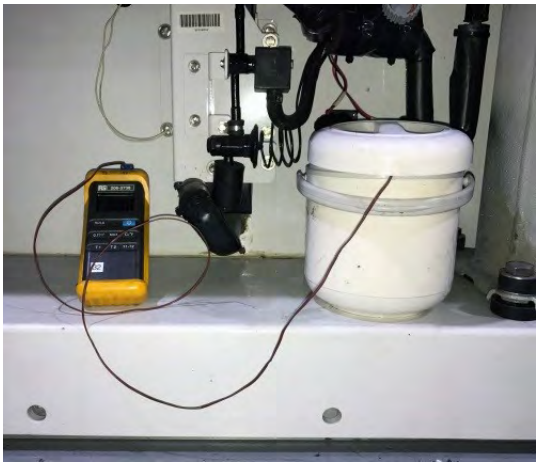


5. Prepare the ice bath. Refer to the Ice bath preparation procedure.

   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.

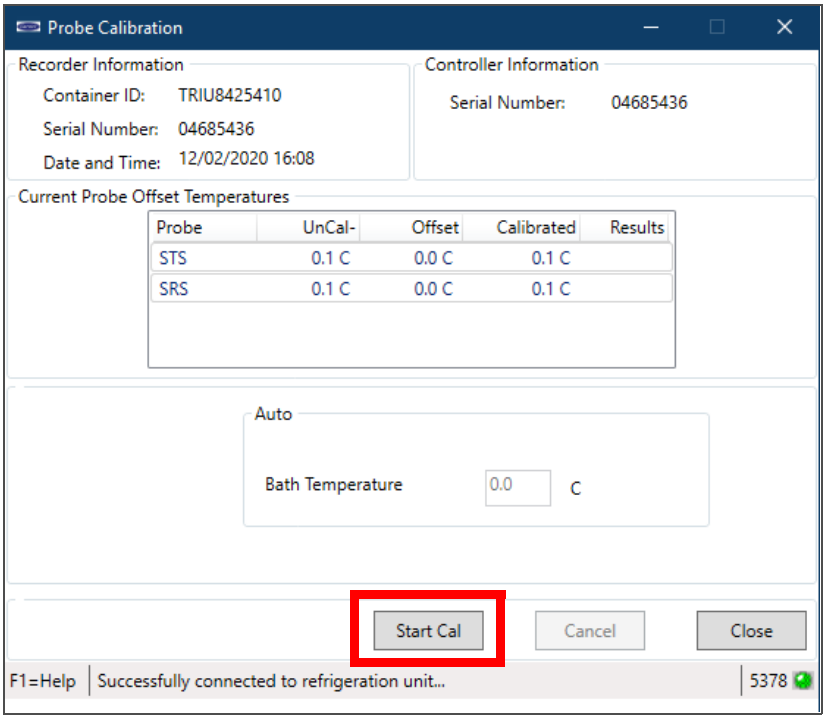
6. Place the ice bath in a location near sensors (see **Figure 7.29**). For Return Sensors, place the ice bath on an elevated platform (ladder) of appropriate height.

Figure 7.29 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 7.30**). After clicking Start Cal, the process begins automatically and will complete in less than 5 minutes.

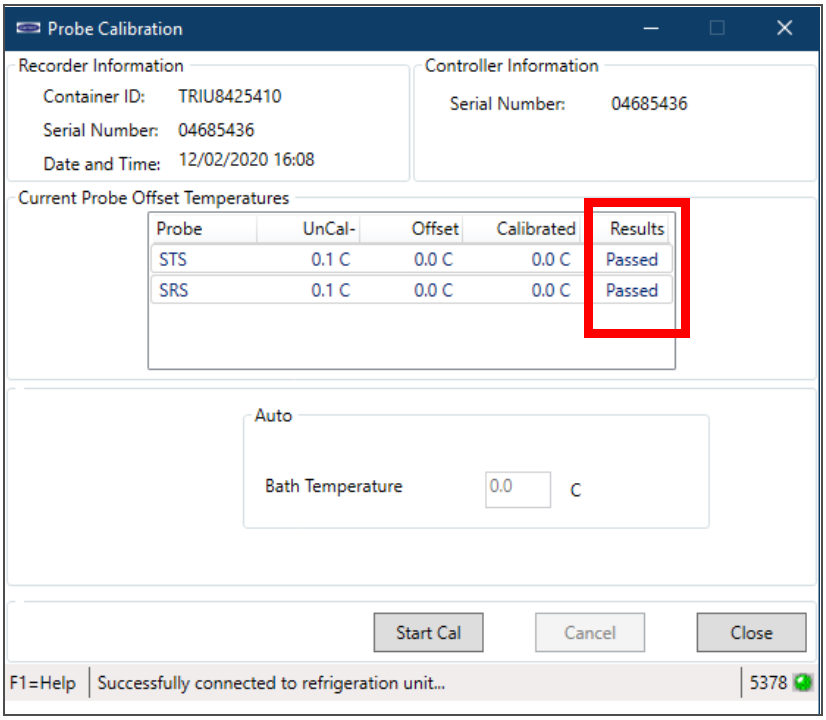
Figure 7.30 DataLINE - Start Cal Button



10. Continue to stir the ice bath during the testing. Calibration will fail if the stability cannot be achieved or the sensor offset is greater than 0.3°C (0.5°F). Replace the sensor and recalibrate the sensors. See the **Section 7.28.4** for sensor replacement procedures.

11. 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 7.31**).

Figure 7.31 DataLINE - Calibration Results



12. 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.
13. After the completion of the calibration, restore the unit to its original state.

7.28.4 Sensor Replacement

⚠ WARNING

Always turn OFF the unit circuit breaker (CB-1) and disconnect main power supply before removing electrical parts.

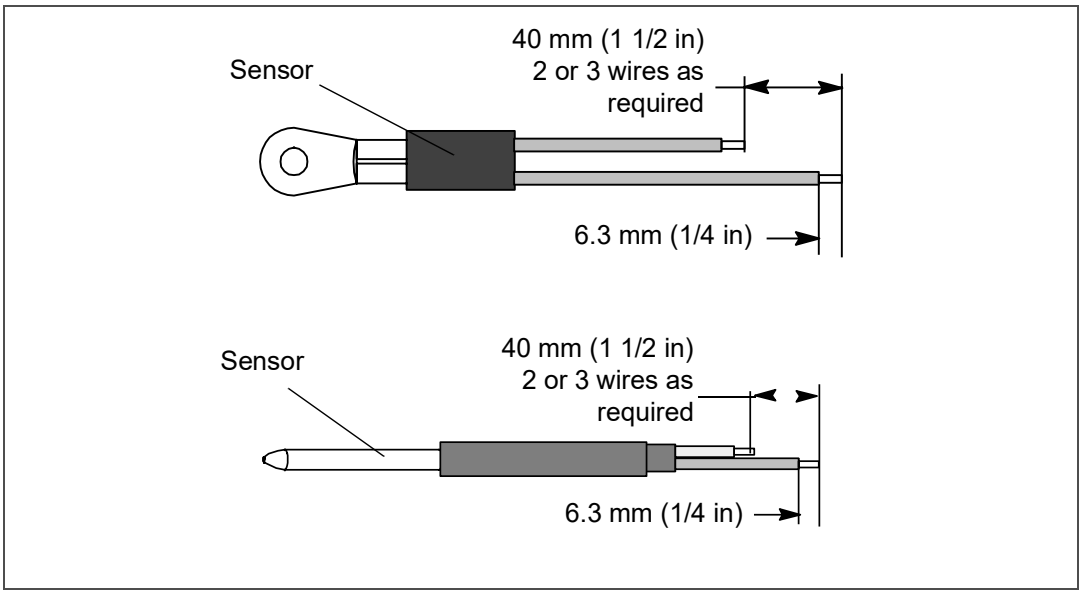
1. Place the Start-Stop switch (ST) to “0” to turn the unit Off. Disconnect the power supply.

NOTE

Include white date code label when cutting out and removing defective sensors. The label could be required for warranty returns.

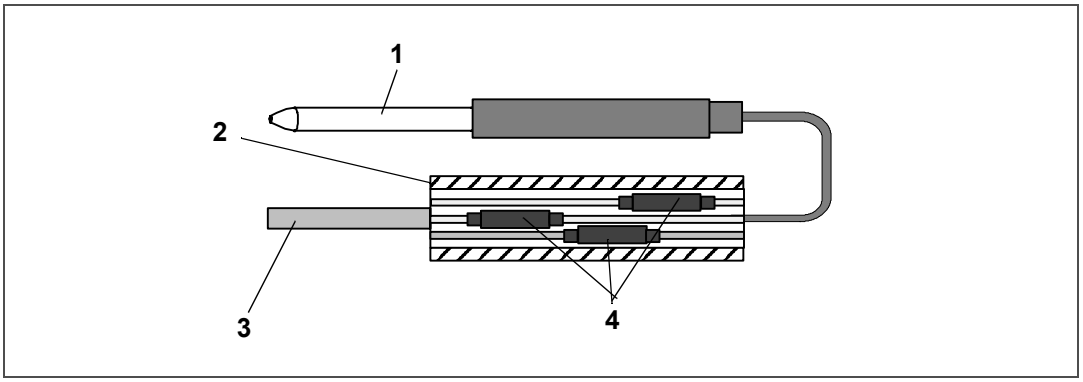
2. Cut the cable. Slide the cap and grommet off the bulb type sensor and save for reuse. **Do not cut the grommet**.
3. Cut one wire of existing cable 40 mm (1-1/2 inches) shorter than the other wire.
4. Cut the replacement sensor wires (opposite colors) back 40 mm (1-1/2 inches). See **Figure 7.32**.

Figure 7.32 Sensor Types



5. Strip back insulation on all wiring 6.3 mm (1/4 inch).
6. Slide a large piece of heat shrink tubing over the cable, and place the two small pieces of heat shrink tubing, one over each wire, before adding crimp fittings as shown in **Figure 7.33**.

Figure 7.33 Sensor and Cable Splice



1) Sensor (typical)
2) Large Heat Shrink Tubing (1)
3) Cable
4) Heat Shrink Tubing, 2 or 3 as required

- - - - -

7. If required, slide the cap and grommet assembly onto the replacement sensor.
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 each splice so that ends of tubing cover both ends of crimp as shown in **Figure 7.33**.
11. Heat tubing to shrink over splice.Make sure all seams are sealed tightly against the wiring to prevent moisture seepage.

⚠ CAUTION

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

12. Slide large heat shrink tubing over both splices and shrink.

13. Position sensor in unit as shown in **Figure 7.33** and re-check sensor resistance:
    Figure 7.35 - Return Sensor Positioning
    Figure 7.34 - Supply Sensor Positioning
    Figure 7.36 - ETS Sensor Positioning

14. Reinstall sensor. Refer to:
    Section 7.28.5 - For STS and SRS Reinstallation
    Section 7.28.6 - For RRS and RTS Reinstallation
    Section 7.28.7 - For DTS Reinstallation
    Section 7.28.8 - For ETS1 and ETS2 Reinstallation

NOTE

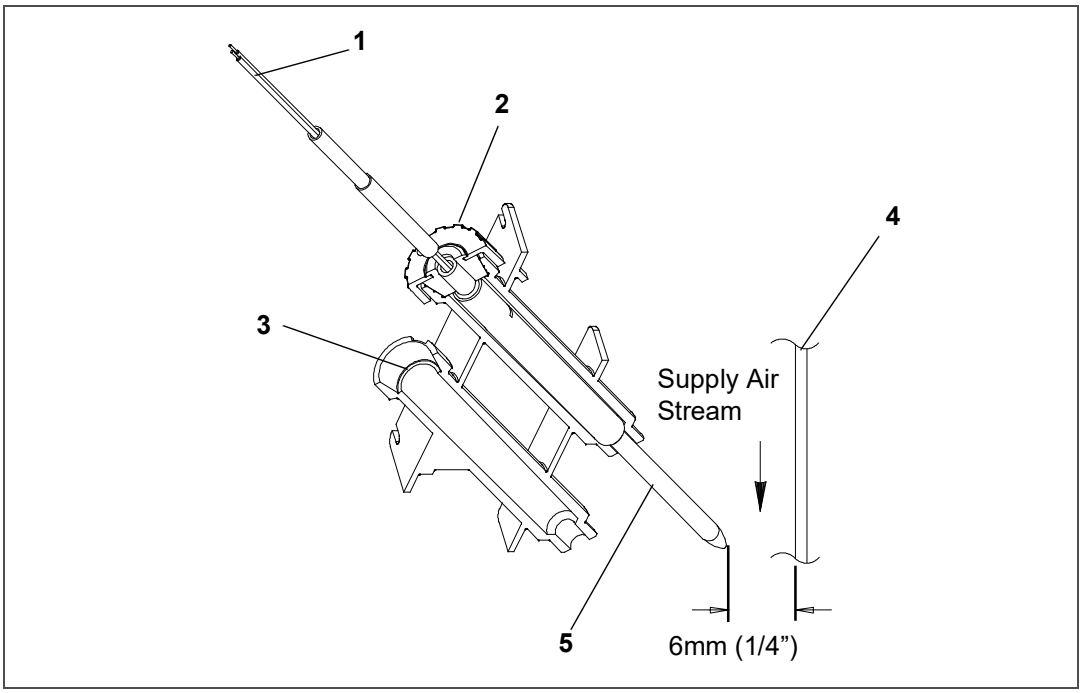
The P5 Pre-Trip test must be run to deactivate probe alarms (see **Section 5.8**).

7.28.5 Sensor STS and SRS Reinstallation

To properly position a unit supply sensor (Supply Temperature Sensor STS or Supply Recorder Sensor SRS), 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 back panel. The design minimum clearance of 6 mm (1/4 inch) should be maintained (see **Figure 7.34**).

Figure 7.34 Supply Sensor Positioning



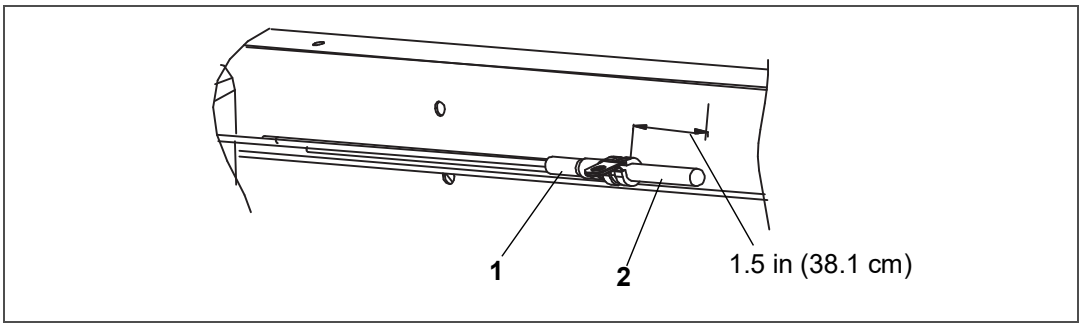
1) Sensor Wire
2) Cap & Grommet Assembly
3) Probe Holder
4) Evaporator Back Panel
5) Supply Sensor

- - - - -

7.28.6 Sensor RTS and RRS Reinstallation

Reinstall the return sensor (Return Temperature Sensor RTS or Return Recorder Sensor RRS), as shown in **Figure 7.35**. For proper placement of the return sensor, be sure to position the enlarged positioning section of the sensor against the side of the mounting clamp.

Figure 7.35 Return Sensor Positioning



1) Mounting Clamp
2) Return Sensor

- - - - -

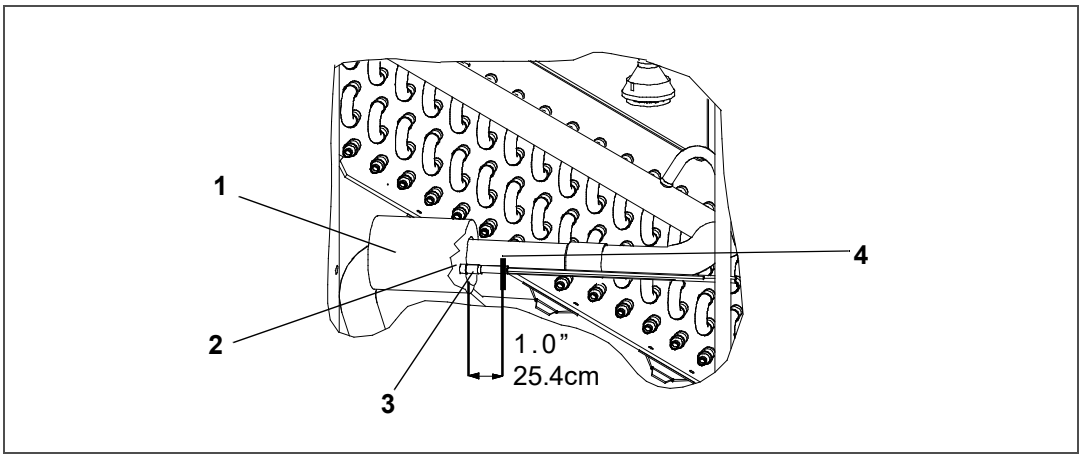
7.28.7 Sensor DTS Reinstallation

The Defrost Temperature Sensor (DTS) must have insulating material placed completely over the sensor to ensure the coil metal temperature is sensed.

7.28.8 Sensor ETS1 and ETS2 Reinstallation

The Evaporator Temperature Sensors, ETS1 and ETS2 are located in a tube holder under insulation, as illustrated in **Figure 7.36**. When the combo sensor is removed and reinstalled, it must be placed in a tube holder by applying thermal grease. Insulating material must completely cover the sensor to ensure the correct temperature is sensed.

Figure 7.36 Evaporator Temperature Sensor Positioning



1) Insulation
2) ETS Tube Holder
3) ETS1 and ETS2
4) Wire Tie

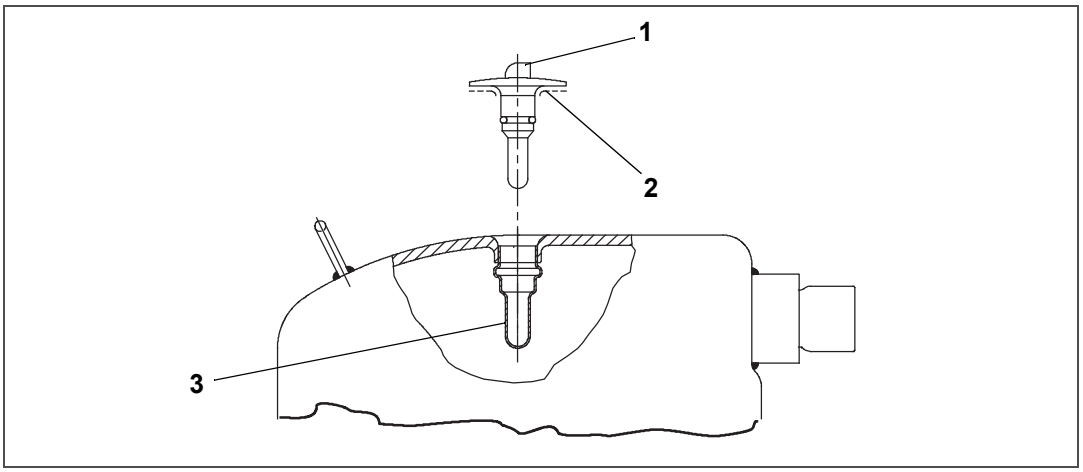
- - - - -

7.28.9 Sensor, CPDS Reinstallation

To replace the Compressor Discharge Temperature Sensor, see **Figure 7.37**.

1. Ensure the unit is disconnected from the power source.
2. Verify that the Start-Stop switch (ST) is in the “0” position.
3. Remove the existing sensor.
4. Clean all silicone sealer and dielectric compound from the sensor well. Make sure that the well is clean and dry. The top of the compressor, where the sensor seals, must also be clean and dry.

Figure 7.37 Compressor Discharge Temperature Sensor



1) Sensor
2) Silicon Bead
3) Sensor Well

- - - - -

5. Using the syringe supplied with the replacement sensor, squeeze all of the dielectric compound into the sensor well.
6. Place a bead of the silicone sealer supplied with the replacement sensor around the sensor sealing ring. Insert sensor into the well with the leads parallel to the suction fitting.
7. Reconnect the sensor (see **Figure 7.33**) and run pre-trip P5.

7.29 Vent Position Sensor (VPS)

The vent position sensor (VPS) determines fresh air vent position in near real-time via function code Cd45.

The fresh air vent position sensor alarm (AL250) will occur if the sensor reading is not stable for four 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. If the alarm immediately reappears as active, the panel should be replaced.

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 sensor should be replaced.

In order to replace the Upper 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.

1. Rotate the vent to the 0 CMH / CFM position. Cd45 will automatically display.
2. Press and hold the ENTER key for five seconds.
3. After the ENTER key has been pressed the display will read “CAL” (for calibration).
4. Press and hold the ALT MODE key for five seconds.
5. After the calibration has been completed, Cd45 will display 0 CMH / CFM.

7.30 EverFRESH Service

Procedures and technical information related to the EverFRESH controlled atmosphere system can be found in the **T-374 EverFRESH Manual**, located in the Literature section of the Container Refrigeration website. To find the manual from the Literature section, click on Options > EverFRESH.

7.31 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 the area to bare metal using a wire brush, emery paper or equivalent cleaning method. Immediately following cleaning, apply paint to the area, and allow to dry. Refer to the Parts List for proper paint selection.

Table 7–4 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
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

Table 7–4 R-134a Refrigerant Pressure Temperature Chart

Note: Underline figures are inches of mercury vacuum

°F	°C	PSIG		°C	°F	BAR
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
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

Table 7–4 R-134a Refrigerant Pressure Temperature Chart

Note: Underline figures are inches of mercury vacuum

°F	°C	PSIG		°C	°F	BAR
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

Table 7–5 R-513A Refrigerant Pressure Temperature Chart

Note: Underline figures are inches of mercury vacuum

°F	°C	PSIG		°C	°F	BAR
-40	-40.0	9.8		-40	-40.0	-0.32
-38	-38.9	8.6		-39	-38.2	-0.28
-36	-37.8	7.4		-38	-36.4	-0.25
-34	-36.7	6.2		-37	-34.6	-0.21
-32	-35.6	4.9		-36	-32.8	-0.17
-30	-34.4	3.6		-35	-31.0	-0.13
-28	-33.3	2.2		-34	-29.2	-0.09
-26	-32.2	0.7		-33	-27.4	-0.05
-24	-31.1	0.4		-32	-25.6	0.00
-22	-30.0	1.1		-31	-23.8	0.04
-20	-28.9	1.9		-30	-22.0	0.09
-18	-27.8	2.8		-29	-20.2	0.14
-16	-26.7	3.7		-28	-18.4	0.19
-14	-25.6	4.6		-27	-16.6	0.25
-12	-24.4	5.5		-26	-14.8	0.30
-10	-23.3	6.5		-25	-13.0	0.36
-8	-22.2	7.5		-24	-11.2	0.42
-6	-21.1	8.5		-23	-9.4	0.48
-4	-20.0	9.6		-22	-7.6	0.54
-2	-18.9	10.7		-21	-5.8	0.61
0	-17.8	11.9		-20	-4.0	0.67
2	-16.7	13.1		-19	-2.2	0.74
4	-15.6	14.3		-18	-0.4	0.81
6	-14.4	15.6		-17	1.4	0.89
8	-13.3	16.9		-16	3.2	0.96
10	-12.2	18.3		-15	5.0	1.04
12	-11.1	19.7		-14	6.8	1.12
14	-10.0	21.1		-13	8.6	1.21
16	-8.9	22.6		-12	10.4	1.29
18	-7.8	24.2		-11	12.2	1.38
20	-6.7	25.8		-10	14.0	1.47
22	-5.6	27.5		-9	15.8	1.56
24	-4.4	29.2		-8	17.6	1.66
26	-3.3	30.9		-7	19.4	1.76
28	-2.2	32.7		-6	21.2	1.86
30	-1.1	34.6		-5	23.0	1.97
32	0.0	36.5		-4	24.8	2.07
34	1.1	38.5		-3	26.6	2.18
36	2.2	40.5		-2	28.4	2.30
38	3.3	42.6		-1	30.2	2.41
40	4.4	44.8		0	32.0	2.53

Table 7–5 R-513A Refrigerant Pressure Temperature Chart

Note: Underline figures are inches of mercury vacuum

°F	°C	PSIG		°C	°F	BAR
42	5.6	47.0		1	33.8	2.65
44	6.7	49.3		2	35.6	2.78
46	7.8	51.6		3	37.4	2.91
48	8.9	54.0		4	39.2	3.04
50	10.0	56.5		5	41.0	3.18
52	11.1	59.0		6	42.8	3.32
54	12.2	61.6		7	44.6	3.46
56	13.3	64.3		8	46.4	3.60
58	14.4	67.0		9	48.2	3.75
60	15.6	69.8		10	50.0	3.91
62	16.7	72.7		11	51.8	4.06
64	17.8	75.7		12	53.6	4.22
66	18.9	78.7		13	55.4	4.39
68	20.0	81.8		14	57.2	4.56
70	21.1	85.0		15	59.0	4.73
72	22.2	88.2		16	60.8	4.91
74	23.3	91.6		17	62.6	5.09
76	24.4	95.0		18	64.4	5.27
78	25.6	98.5		19	66.2	5.46
80	26.7	102.1		20	68.0	5.65
82	27.8	105.7		21	69.8	5.85
84	28.9	109.5		22	71.6	6.05
86	30.0	113.3		23	73.4	6.26
88	31.1	117.3		24	75.2	6.47
90	32.2	121.3		25	77.0	6.68
92	33.3	125.4		26	78.8	6.90
94	34.4	129.6		27	80.6	7.13
96	35.6	133.9		28	82.4	7.36
98	36.7	138.3		29	84.2	7.59
100	37.8	142.8		30	86.0	7.83
102	38.9	147.4		31	87.8	8.07
104	40.0	152.0		32	89.6	8.32
106	41.1	156.8		33	91.4	8.57
108	42.2	161.7		34	93.2	8.83
110	43.3	166.7		35	95.0	9.10
112	44.4	171.8		36	96.8	9.37
114	45.6	177.0		37	98.6	9.64
116	46.7	182.3		38	100.4	9.92
118	47.8	187.7		39	102.2	10.21
120	48.9	193.3		40	104.0	10.50
122	50.0	198.9		41	105.8	10.79
124	51.1	204.7		42	107.6	11.10

Table 7–5 R-513A Refrigerant Pressure Temperature Chart

Note: Underline figures are inches of mercury vacuum

°F	°C	PSIG		°C	°F	BAR
126	52.2	210.5		43	109.4	11.40
128	53.3	216.5		44	111.2	11.72
130	54.4	222.7		45	113.0	12.04
132	55.6	228.9		46	114.8	12.36
134	56.7	235.2		47	116.6	12.70
136	57.8	241.7		48	118.4	13.03
138	58.9	248.3		49	120.2	13.38
140	60.0	255.1		50	122.0	13.73
142	61.1	261.9		51	123.8	14.09
144	62.2	268.9		52	125.6	14.45
146	63.3	276.1		53	127.4	14.82
148	64.4	283.3		54	129.2	15.20
150	65.6	290.8		55	131.0	15.58
				56	132.8	15.97
				57	134.6	16.37
				58	136.4	16.77
				59	138.2	17.18
				60	140.0	17.60
				61	141.8	18.03
				62	143.6	18.46
				63	145.4	18.90
				64	147.2	19.35
				65	149.0	19.80

Table 7–6 Recommended Bolt Torque Values (Dry, Non-Lubricated for 18-8 Stainless Steel)

Bolt Diameter	Threads	In-Lbs	Ft-Lbs	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

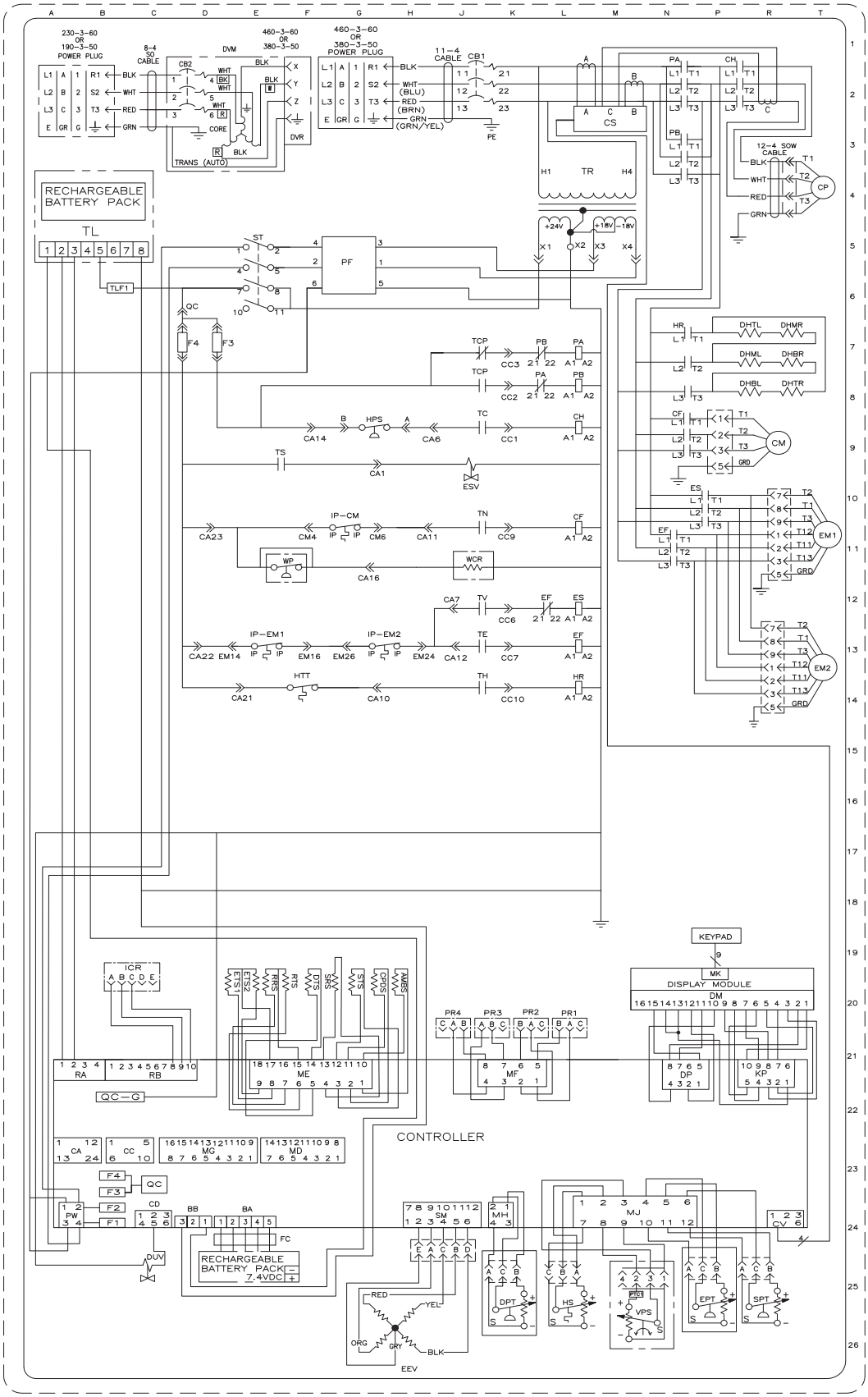
SECTION 8
ELECTRICAL WIRING SCHEMATIC AND DIAGRAMS

Figure 8.1 Legend - Standard Unit Configuration

ZONE	SYMBOL		DESCRIPTION
G20	AMBS	—	AMBIENT SENSOR
H22	C	—	CONTROLLERS
J1	CB1	—	CIRCUIT BREAKER 460V
D1	CB2	—	OPTIONAL CIRCUIT BREAKER 230V (DVM OPTION) TERMINAL BLOCK WHEN CB2 NOT PRESENT
N8,L11	CF	—	CONDENSER FAN CONTACTOR
L8,P1	CH	—	COMPRESSOR CONTACTOR
F11,G11,R9	CM	—	CONDENSER FAN MOTOR
T4	CP	—	COMPRESSOR MOTOR
G20	CPDS	—	DISCHARGE TEMPERATURE SENSOR
M2	CS	—	CURRENT SENSOR
R8	DHBL	—	DEFROST HEATER – BOTTOM LEFT
T7	DHBR	—	DEFROST HEATER – BOTTOM RIGHT
R7	DHML	—	DEFROST HEATER – MIDDLE LEFT
T7	DHMR	—	DEFROST HEATER – MIDDLE RIGHT
R7	DHTL	—	DEFROST HEATER – TOP LEFT
T8	DHTR	—	DEFROST HEATER – TOP RIGHT
P20	DM	—	DISPLAY MODULE
K25	DPT	—	DISCHARGE PRESSURE TRANSDUCER
F20	DTS	—	DEFROST TEMPERATURE SENSOR
C25	DUV	—	DIGITAL UNLOADER VALVE
D1	DVM	—	DUAL VOLT MODULE (OPTIONAL)
F3	DVR	—	DUAL VOLTAGE RECEPTACLE (OPTIONAL)
H26	EEV	—	EVAPORATOR EXPANSION VALVE
L12,L13,N11	EF	—	EVAPORATOR FAN CONTACTOR (HIGH SPEED)
T11,T13 E13,F13,G13	EM	—	EVAPORATOR FAN MOTOR
P25	EPT	—	EVAP. PRESSURE TRANSDUCER
P10,L13	ES	—	EVAPORATOR FAN CONTACTOR (LOW SPEED)
D20	ETS	—	EVAPORATOR TEMPERATURE SENSOR (SUCTION)
J10	ESV	—	ECONOMIZER SOLENOID VALVE
B23,B24,D7	F	—	FUSE
	FLA	—	FULL LOAD AMPS
E24	FC	—	FERRITE CLAMP
G9	HPS	—	HIGH PRESSURE SWITCH
N7,L14	HR	—	HEATER CONTACTOR
L25	HS	—	HUMIDITY SENSOR (OPTIONAL)
E15	HTT	—	HEAT TERMINATION THERMOSTAT
C19	ICR	—	INTERROGATOR CONNECTOR REAR
E13,F11,G13	IP	—	INTERNAL PROTECTOR
L7,K8,N1	PA	—	UNIT PHASE CONTACTOR
K7,L8,N3	PB	—	UNIT PHASE CONTACTOR
G5	PF	—	POWER FILTER
J20,K20,L20	PR	—	PROBE RECEPTACLE (USDA OPTION)
M25	PTC1	—	PTC FOR VENT POSITION SENSOR (UPPER)
E20	RRS	—	RETURN RECORDER SENSOR
E20	RTS	—	RETURN TEMPERATURE SENSOR
R25	SPT	—	SUCTION PRESSURE TRANSDUCER
F20	SRS	—	SUPPLY RECORDER SENSOR
K5	ST	—	START–STOP SWITCH
F20	STS	—	SUPPLY TEMPERATURE SENSOR
J9	TC	—	CONTROLLER RELAY (COOLING)
J7,J8	TCP	—	CONTROLLER RELAY (PHASE SEQUENCING)
J13	TE	—	CONTROLLER RELAY (HIGH SPEED EVAPORATOR FANS)
J14	TH	—	CONTROLLER RELAY (HEATING)
B4	TL	—	TRIPLINK (OPTION)
J11	TN	—	CONTROLLER RELAY (CONDENSER FAN)
M3	TR	—	TRANSFORMER
D3	TRANS	—	TRANSFORMER AUTO 230/460 (OPTION)
E10	TS	—	CONTROLLER RELAY (ECONOMIZER SOLENOID VALVE)
J13	TV	—	CONTROLLER RELAY (LOW SPEED EVAPORATOR FANS)
M25	VPS	—	VENT POSITIONING SENSOR (UPPER) (OPTION)
J12	WCR	—	WETTING CURRENT SENSOR (OPTION)
E12	WP	—	WATER PRESSURE SWITCH (OPTION)

ELECTRICAL WIRING SCHEMATIC AND DIAGRAMS

Figure 8.2 Schematic Diagram



ELECTRICAL WIRING SCHEMATIC AND DIAGRAMS

Figure 8.3 Unit Wiring Diagram (Sheet 1 of 2)

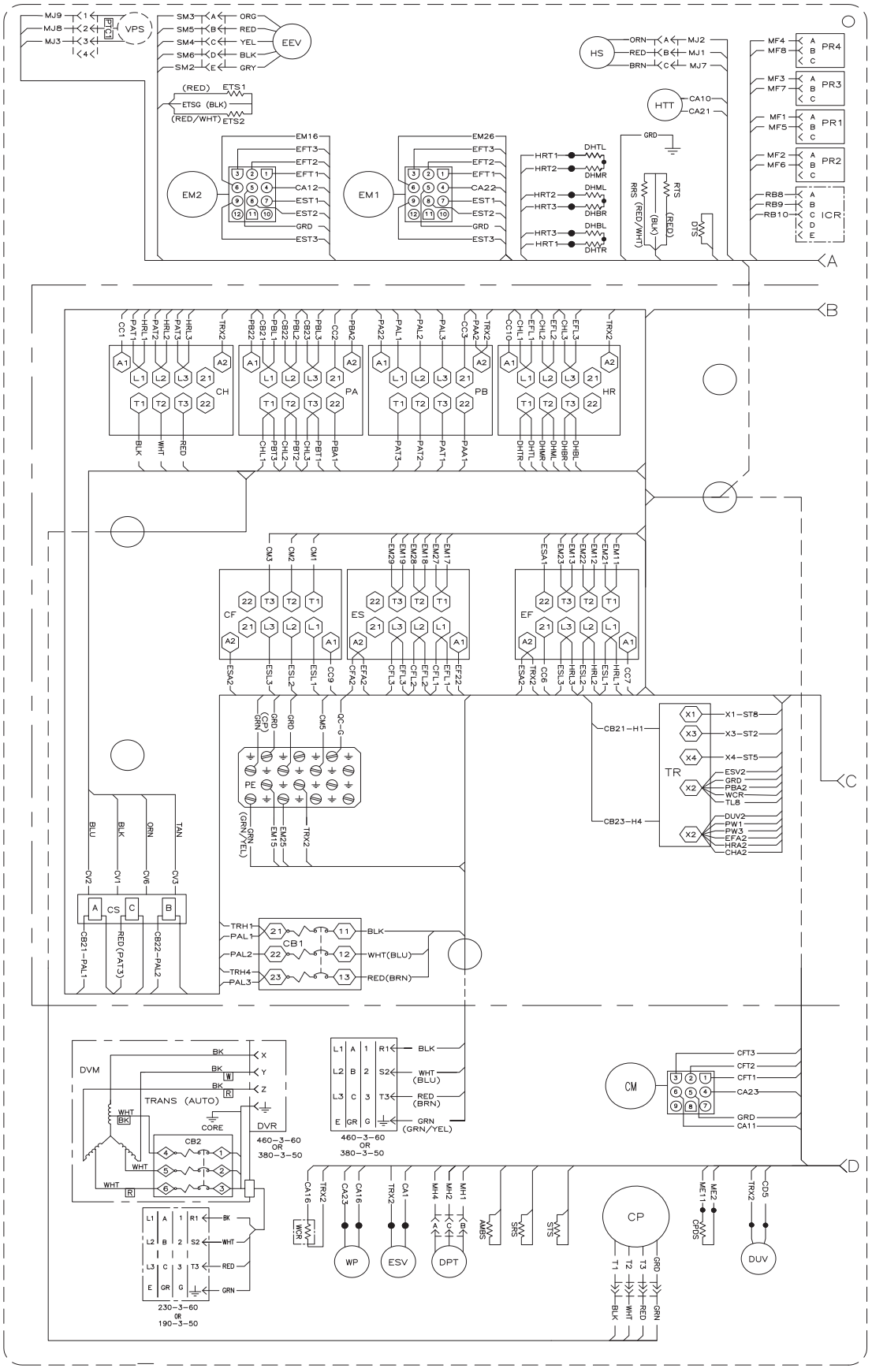
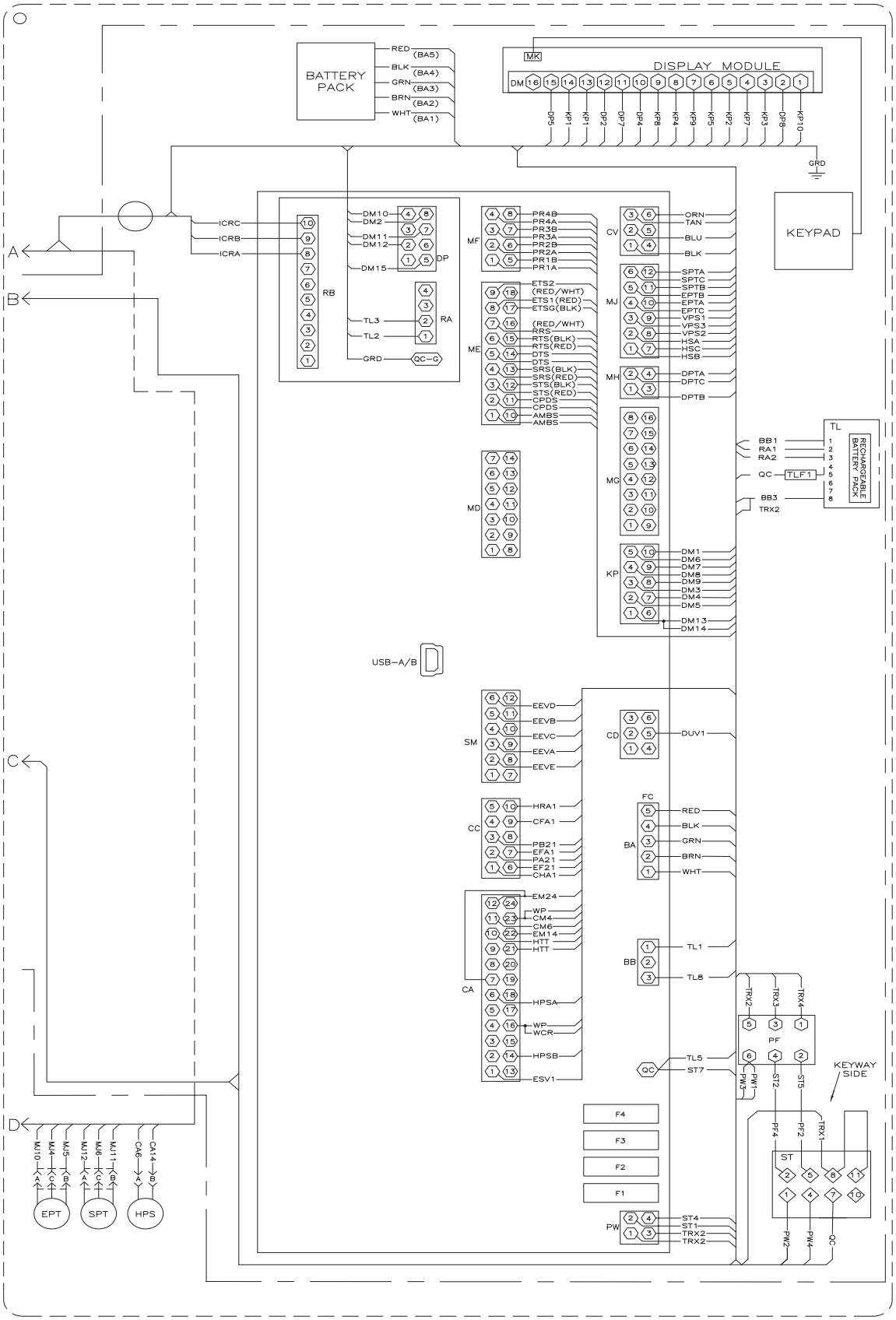


Figure 8.4 Unit Wiring Diagram (Sheet 2 of 2)



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 PrimeLINE Container Unit:

Model: 69NT40-571

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
- Radio Equipment Directive 2014/53/EU 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	RED Directive
EN ISO 12100:2010 EN 60204-1:2006 EN 13857:2008	EN 61000-6-4:2007 EN 61000-6-2:2005 EN 55011:2009 EN 61000-3-12:2011 EN 61000-4-2:2009 EN 61000-4-3:2006 EN61000-4-4:2004 EN 61000-4-5:2006 EN 61000-4-6:2009 EN 61000-3-11:2000	EN 301 489-1 v2.2.0 EN 300 328 V2.1.1 EN 301 489-17 V3.2.0 EN 60950-1 +A2

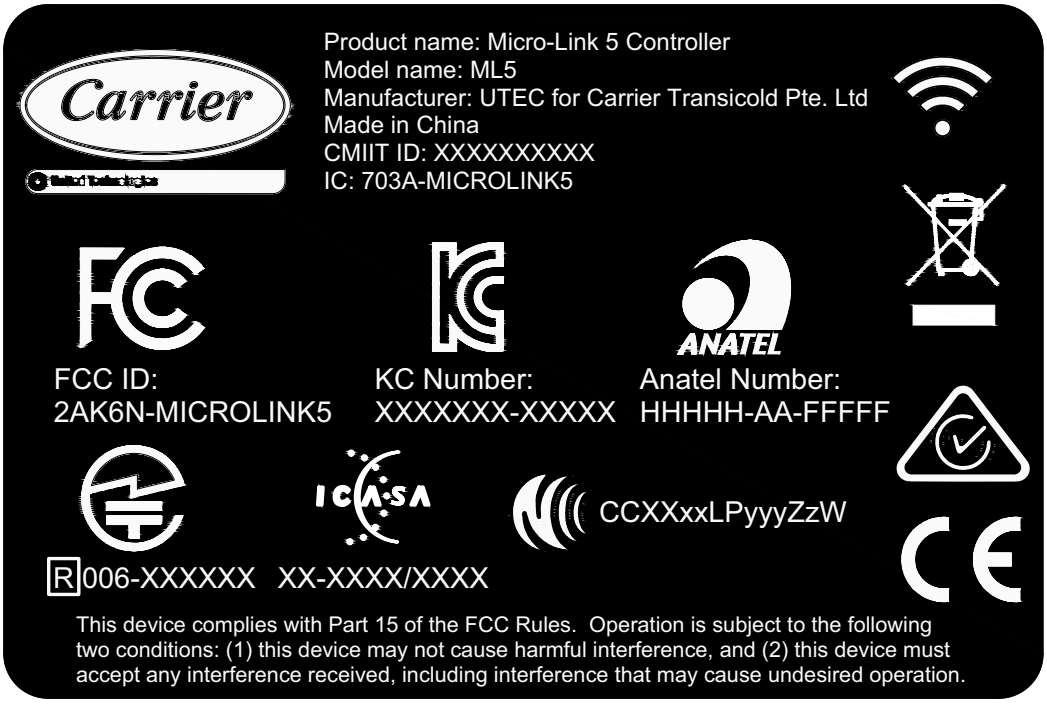
The following Technical Standards were applied for this equipment:

- 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

SECTION 10
WIRELESS CERTIFICATION



This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil contient des émetteurs / récepteurs exemptés de licence conformes aux RSS (RSS) d'Innovation, Sciences et Développement économique Canada. Le fonctionnement est soumis aux deux conditions suivantes:

1. Cet appareil ne doit pas causer d'interférences.
2. Cet appareil doit accepter toutes les interférences, y compris celles susceptibles de provoquer un fonctionnement indésirable de l'appareil.

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	O	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。

62-66122-00, Rev A

INDEX

F

G

H

I

K

L

M

O

P

Q

R

S

T

U

V

W

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