Container Refrigeration

OPERATIONS AND SERVICE MANUAL

For

PrimeLINE with ML5 Controller

69NT40-571-100 to 199

69NT40-571-300 to 399

Container Refrigeration Units

T-372 Rev F

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69NT40-571-100 to 199

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Container Refrigeration Units

This manual and others may be viewed in Carrier's **ContainerLINK™** app. The QR code below provides a link to download the app, which can be installed on IOS or Android devices. ContainerLINK provides technicians with a suite of diagnostic and reference tools accessible from one location.

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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 CO2 (never use water).

1.5 Specific Hazard Statements

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

DANGER - 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 (O2) 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) (CB1 & CB2) 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 (CB1 & CB2) and disconnect main power supply before working on moving parts.

⚠ WARNING

Installation requires wiring to the main unit circuit breaker, CB1. 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 units are of lightweight aluminum frame construction, designed to be bolted onto the container front to serve as the container's front wall. Forklift pockets are provided for installation and removal.

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.

PrimeLINE unit models covered in this manual are:

- PrimeLINE standard units, models 69NT40-571-1xx
- PrimeLINE EDGE units, models 69NT40-571-3xx

These units, as shown in **Figure 2.1**, will appear identical with the exception of labels. The PrimeLINE EDGE unit may have an EDGE label in the center. The other way to determine the type of unit is to refer to the model number listed on the unit nameplate, which is shown in **Section 2.3**.

Figure 2.1 PrimeLINE Unit - Standard (left) vs EDGE (right)

2.2 Refrigerant

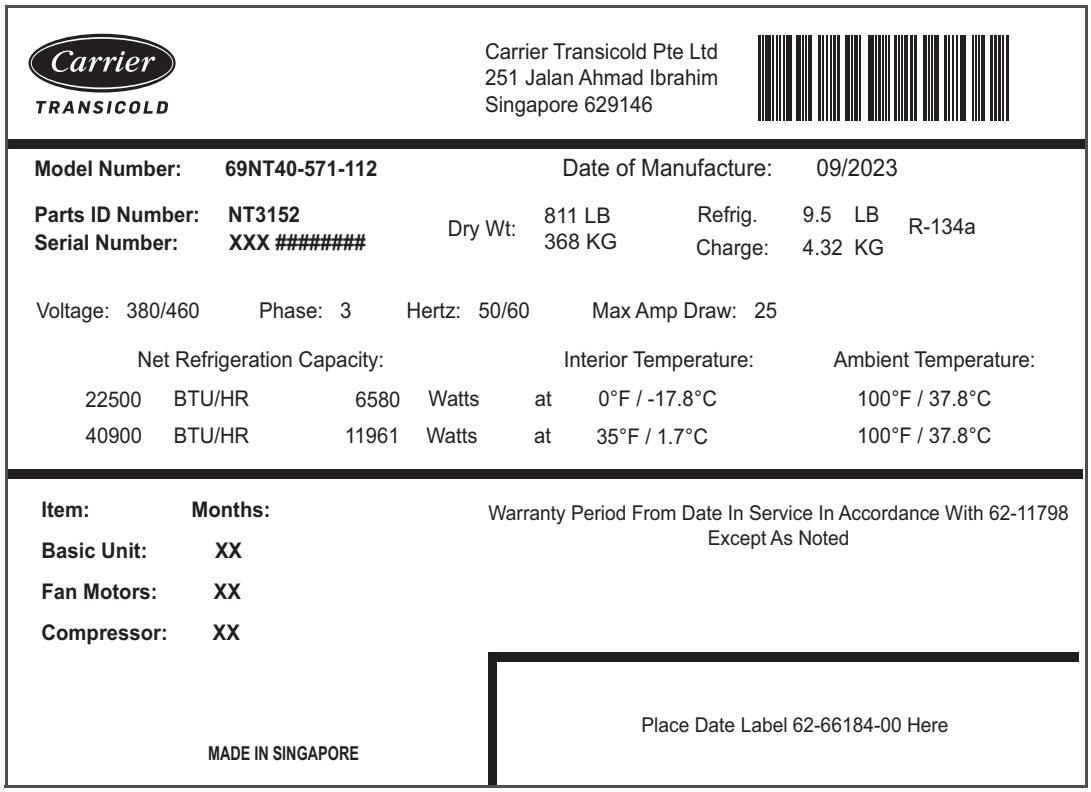
PrimeLINE unit models 69NT40-571-1xx and 571-3xx are R-513A-ready units. They are supplied with a complete charge of R-134a refrigerant. But, they are capable of being field converted to R-513A refrigerant at a later date as requested by the unit owner. All information in this manual pertaining to R-513A is only applicable to units that have either been converted or are being converted to R-513A.

The refrigerant charge amount is listed on the unit nameplate, as shown in **Section 2.3**.

2.3 Configuration Identification

Unit identification information is provided on a nameplate, as shown in **Figure 2.2**, located under the condenser fan near the power cable storage area. The plate provides helpful unit information including: date of manufacture, refrigerant charge, unit model number, and unit parts identification number (PID). The model number and PID number are helpful for a technician to determine specific configurations and spare parts applicable to that unit.

Figure 2.2 Unit Nameplate



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 Controller, Keypad, Display

The controller is a Carrier Transicold Micro-Link 5 microprocessor that automatically selects cooling, holding or heating as required to maintain the desired set point temperature within very close limits. See **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.

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.

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.

2.4.3 Temperature Readout

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

2.4.4 Pressure Readout

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

2.4.5 Compressor

The unit is fitted with a 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.

2.4.6 Condenser Coil

The unit is fitted with a micro channel heat exchanger condenser coil.

2.4.7 Condenser Fan

The unit is equipped with a three phase condenser fan motor. Opening of the condenser fan motor internal protector will stop the fan motor and the controller will subsequently shut down the compressor. The condenser fan grille is direct bolted.

PrimeLINE units model number 571-1xx have a single speed motor, while PrimeLINE EDGE units model number 571-3xx have a dual speed motor.

2.4.8 Evaporator

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

2.4.9 Evaporator Fan Operation

The unit is equipped with 2 three-phase, dual speed evaporator fan motors. Opening of an evaporator fan internal protector will shut down the unit.

2.4.10 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. There is one external calibration receptacle for connection of equipment for calibration. It is located inside the unit along side the USDA receptacles. It is used for USDA probe calibration. There are no write commands capable from this port.

2.5.4 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.

2.5.5 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.

2.5.6 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.

2.5.7 Back Panels

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

2.5.8 460 Volt Cable

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

2.5.9 230 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.

2.5.10 Cable Restraint

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

2.5.11 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.

2.5.12 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.

2.5.13 Condenser Grille

Condenser grilles are direct bolted.

2.5.14 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. See **Section 5.9.7** for more detail.

Detailed 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.

2.5.15 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. See **Section 5.9.1** for more detail.

2.5.16 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 5.9.3** for more detail.

2.5.17 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. See **Section 5.9.2** for more detail.

Section 3
Description

3.1 Introduction

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 Container Unit - Front View

1) Evaporator Section Access Panel(s)
2) Fresh Air Makeup Vent
3) Fork Lift Pockets
4) Condenser
5) Control Box with Unit Display and Keypad
6) Start-Stop Switch
7) Power Cables and Plug
8) Compressor
9) Unit Nameplate, see **Figure 2.2**
10) Unit Options Label

3.2 Component Overviews

The container unit components, as shown in **Figure 3.2**, can be separated into four sections:

1. Compressor section
2. Condenser section
3. Evaporator section
4. Control box section

Figure 3.2 Container Unit Sections

3.2.1 Compressor Section

The compressor receives refrigerant vapor from the evaporator and compresses it to a high pressure, high temperature gas before directing it to the condenser.

The compressor section includes a compressor, service valves (discharge and suction), pressure transducers (discharge, suction, evaporator), a high pressure switch, a discharge temperature sensor, a digital unloader valve and an economizer.

NOTE: PrimeLINE EDGE units (571-3xx models) also include a digital loader valve.

Compressor section components for standard units (571-1xx models) are shown in **Figure 3.3**.

Compressor section components for EDGE units (571-3xx models) are shown in **Figure 3.4**.

3.2.2 Condenser Section

The air-cooled condenser removes latent heat from the refrigerant gas by using a condenser fan to blow air across the condenser coil fins and tubes to cool the gas to saturation temperature. The condenser fan pulls air from around the coil and discharges it horizontally through the condenser fan grille.

The condenser section includes a condenser fan, condenser coil, receiver, liquid line service valve, and a filter drier.

Condenser section components for standard units (571-1xx models) are shown in **Figure 3.3**.

Condenser section components for EDGE units (571-3xx models) are shown in **Figure 3.4**.

3.2.3 Evaporator Section

The evaporator fans circulate air through the container by pulling it from the top of the unit, through the evaporator coil to be heated or cooled, and discharging it at the bottom of the refrigeration unit into the container.

The evaporator section includes two evaporator fans, an evaporator coil, heaters, defrost temperature sensor, heat termination thermostat, electronic expansion valve, evaporator temperature sensor and (optional) humidity sensor.

Evaporator section components are shown in **Figure 3.5**.

NOTE: This section is the same for standard units (571-1xx models) and EDGE units (571-3xx models).

3.2.4 Control Box Section

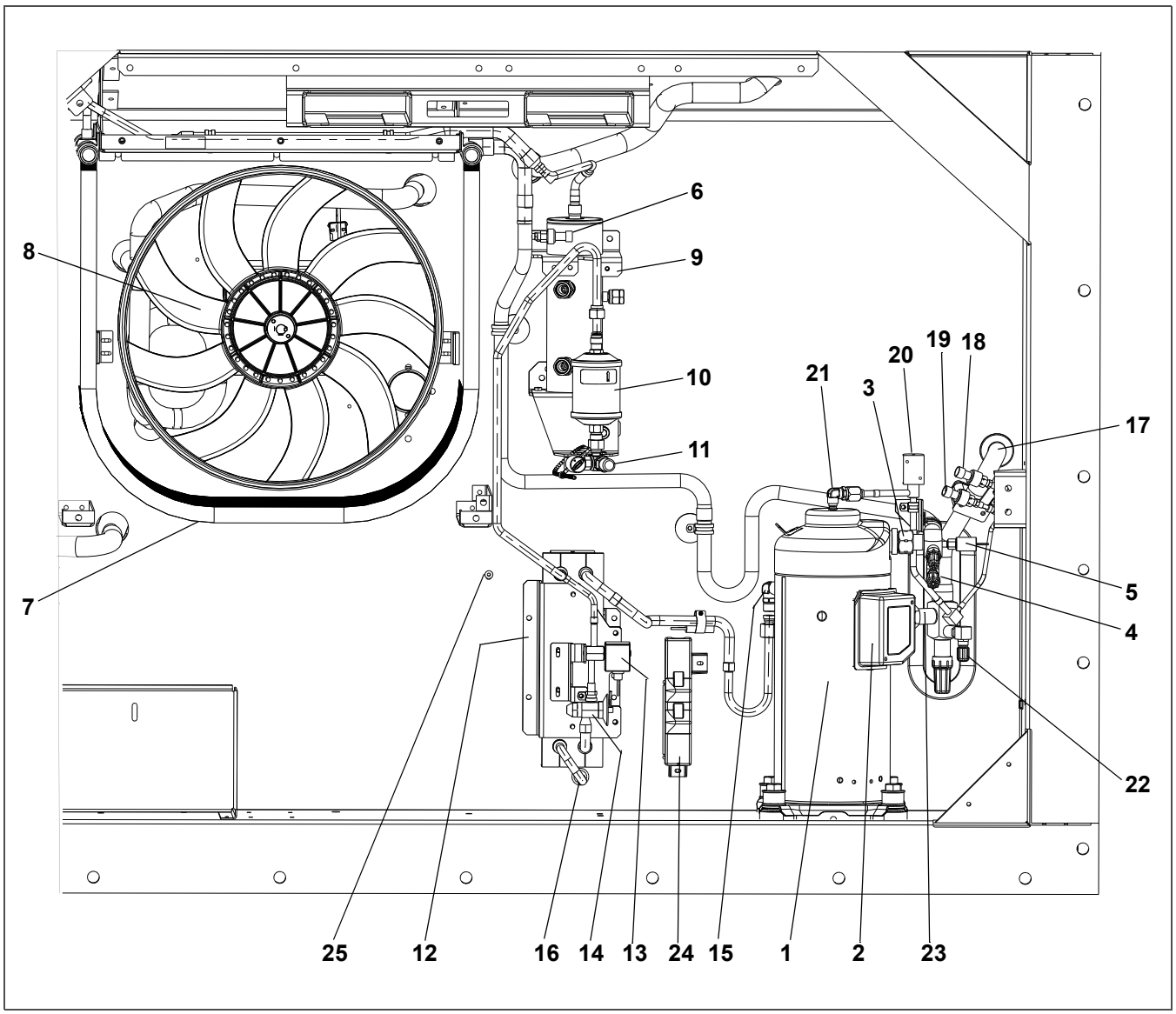
The control box section includes the display module and keypad on the control box door and the start/stop switch mounted to the right of the door. Inside the door are the unit controller (control module), controller battery pack, circuit breaker (CB1), contactors for the compressor, fans and heater, fuses, control power transformer, transformer AC line filter and the current sensor module.

The unit controller, display module and keypad are described in the Microprocessor chapter, see **Section 4.1**.

Control box section components for standard units (571-1xx models) are shown in **Figure 3.6**.

Control box section components for EDGE units (571-3xx models) are shown in **Figure 3.7**.

Figure 3.3 Compressor and Condenser Section - Standard Units (571-1xx models)



1) Compressor, R-513A ready
   Note: Discharge Temperature Sensor (CPDS) not shown, mounted on back of compressor
2) Compressor Terminal Box
3) Discharge Connection
4) Discharge Service Valve
5) High Pressure Switch (HPS)
6) Discharge Pressure Transducer (DPT)
7) Condenser Coil, MCHE
8) Condenser Fan and Motor, Single Speed
9) Receiver
10) Filter Drier
11) Liquid Line Service Valve (King Valve)
12) Economizer
13) Economizer Solenoid Valve (ESV)
14) Economizer Expansion Valve (EXV)
15) Economizer Connection to Compressor
16) Tubing, Economizer to Evaporator
17) Tubing, Evaporator to Compressor
18) Evaporator Pressure Transducer (EPT)
19) Suction Pressure Transducer (SPT)
20) Digital Unloader Valve (DUV)
21) DUV Connection
22) Suction Service Valve
23) Suction Connection
24) Supply Temperature Sensor (STS) / Supply Recorder Sensor (SRS)
25) Ambient Temperature Sensor (AMBS)

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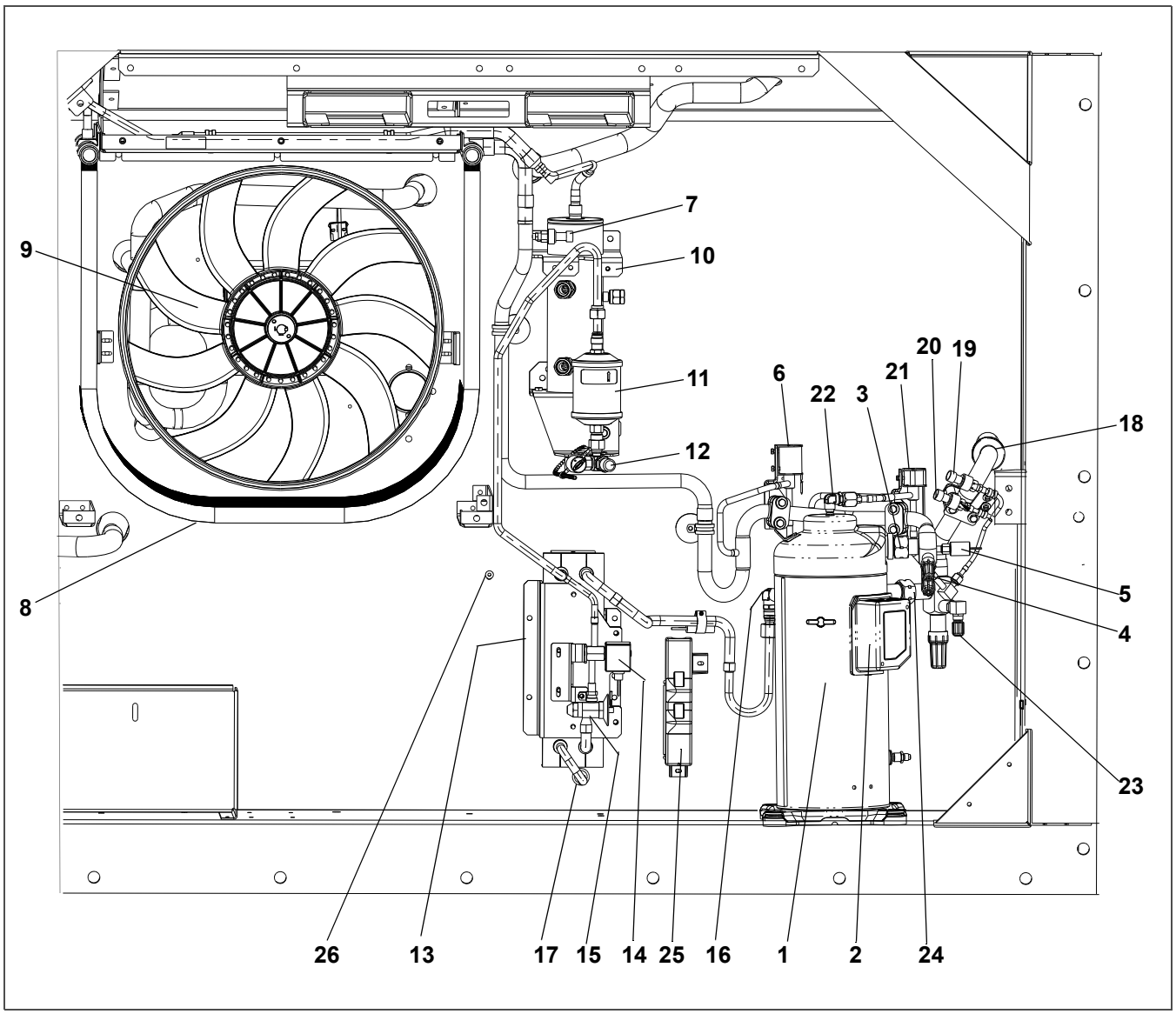
Figure 3.4 Compressor and Condenser Section - EDGE Units (571-3xx models)



1) Compressor, R-513A ready
   Note: Discharge Temperature Sensor (CPDS) not shown, mounted on back of compressor
2) Compressor Terminal Box
3) Discharge Connection
4) Discharge Service Valve
5) High Pressure Switch (HPS)
6) Digital Loader Valve (DLV)
7) Discharge Pressure Transducer (DPT)
8) Condenser Coil, MCHE
9) Condenser Fan and Motor, Dual Speed
10) Receiver
11) Filter Drier
12) Liquid Line Service Valve (King Valve)
13) Economizer
14) Economizer Solenoid Valve (ESV)
15) Economizer Expansion Valve (EXV)
16) Economizer Connection to Compressor
17) Tubing, Economizer to Evaporator
18) Tubing, Evaporator to Compressor
19) Evaporator Pressure Transducer (EPT)
20) Suction Pressure Transducer (SPT)
21) Digital Unloader Valve (DUV)
22) DLV / DUV Connection
23) Suction Service Valve
24) Suction Connection
25) Supply Air Temperature Sensors (STS) / (SRS)
26) Ambient Temperature Sensor (AMBS)

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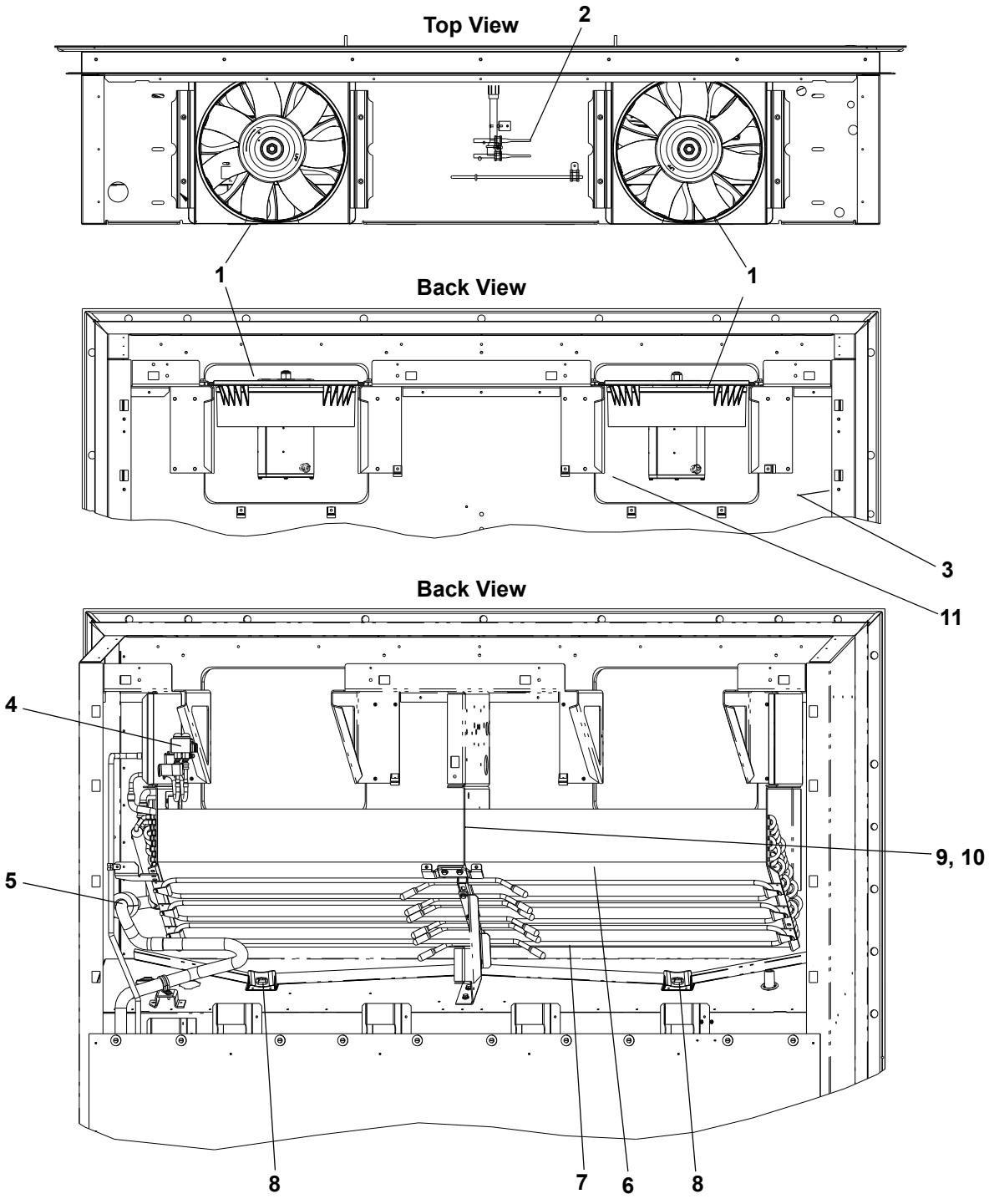
NOTE: The PrimeLINE EDGE unit (571-3xx models) layout shown above is the same as a PrimeLINE standard unit (571-1xx models) with a few differences:

- Item 6, 22: A digital loader valve is included to allow for compressor optimization.
- Item 9: A dual speed condenser motor is utilized to enable low speed operation under light load.

Figure 3.5 Evaporator Section



1) Evaporator Fan and Motor (EM1, EM2)
2) Return Temperature Sensor (RTS) / Return Recorder Sensor (RRS)
3) Humidity Sensor (HS), if installed**
4) Electronic Expansion Valve (EEV)
5) Evaporator Temperature Sensor (ETS1 / ETS2)
6) Evaporator Coil
7) Heaters (6)
8) Defrost Drain
9) Heat Termination Thermostat (HTT)**
10) Defrost Temperature Sensor (DTS)**
11) Vent Position Sensor (VPS), if installed**

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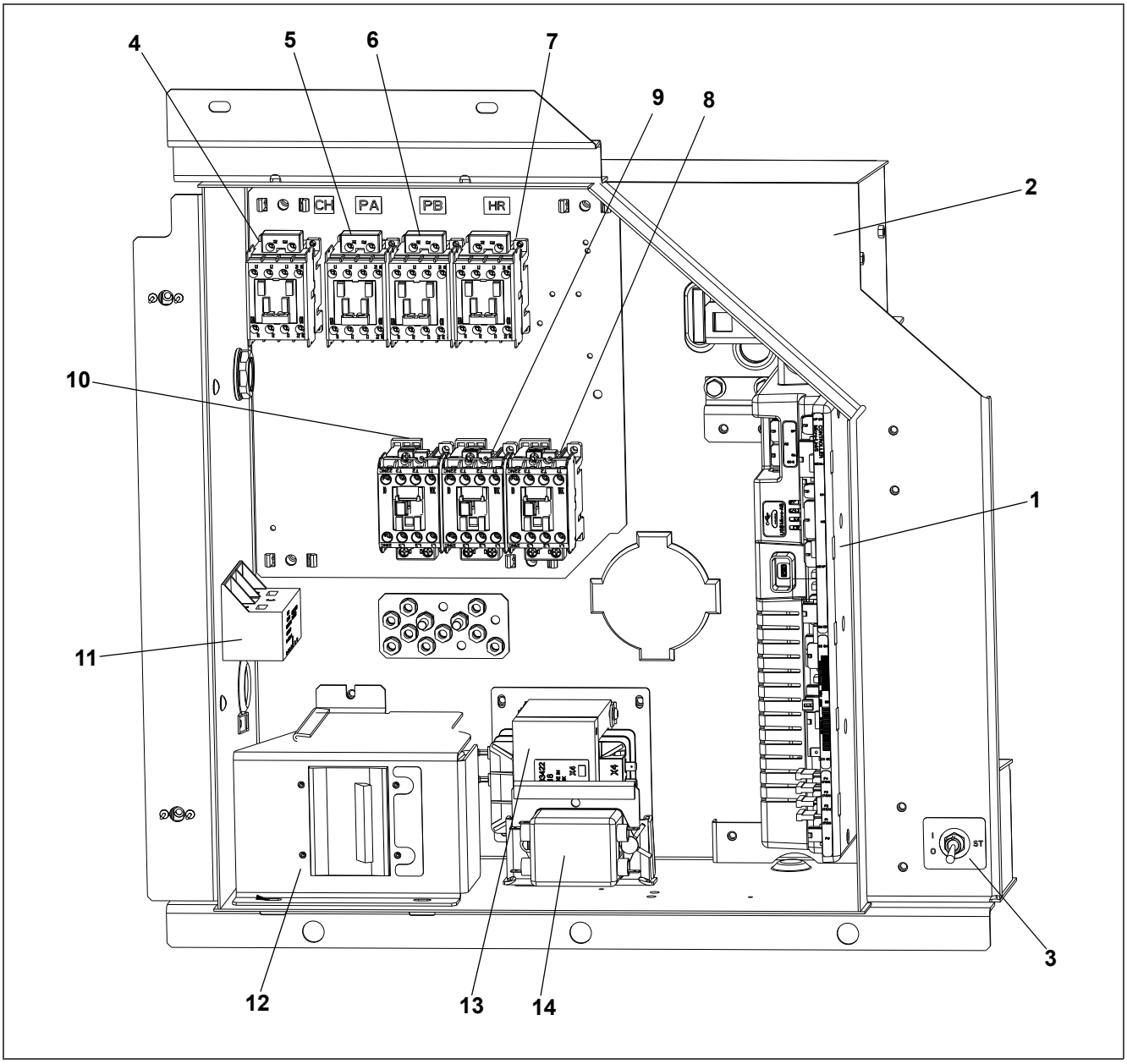
** general location, not shown in figure.

Figure 3.6 Control Box Section - Standard Units (571-1xx models)



1) Controller
2) Controller Battery Pack and Battery
   Note: Located above controller (not shown)
3) Start-Stop Switch (ST)
4) Compressor Contactor (CH)
5) Compressor Phase A Contactor (PA)
6) Compressor Phase B Contactor (PB)
7) Heater Contactor (HR)
8) Evaporator Fan Contactor High Speed (EF)
9) Evaporator Fan Contactor Low Speed (ES)
10) Condenser Fan Contactor (CF)
11) Current Sensor Module
12) Circuit Breaker (CB1) 460V
13) Control Transformer
14) Transformer AC Line Filter

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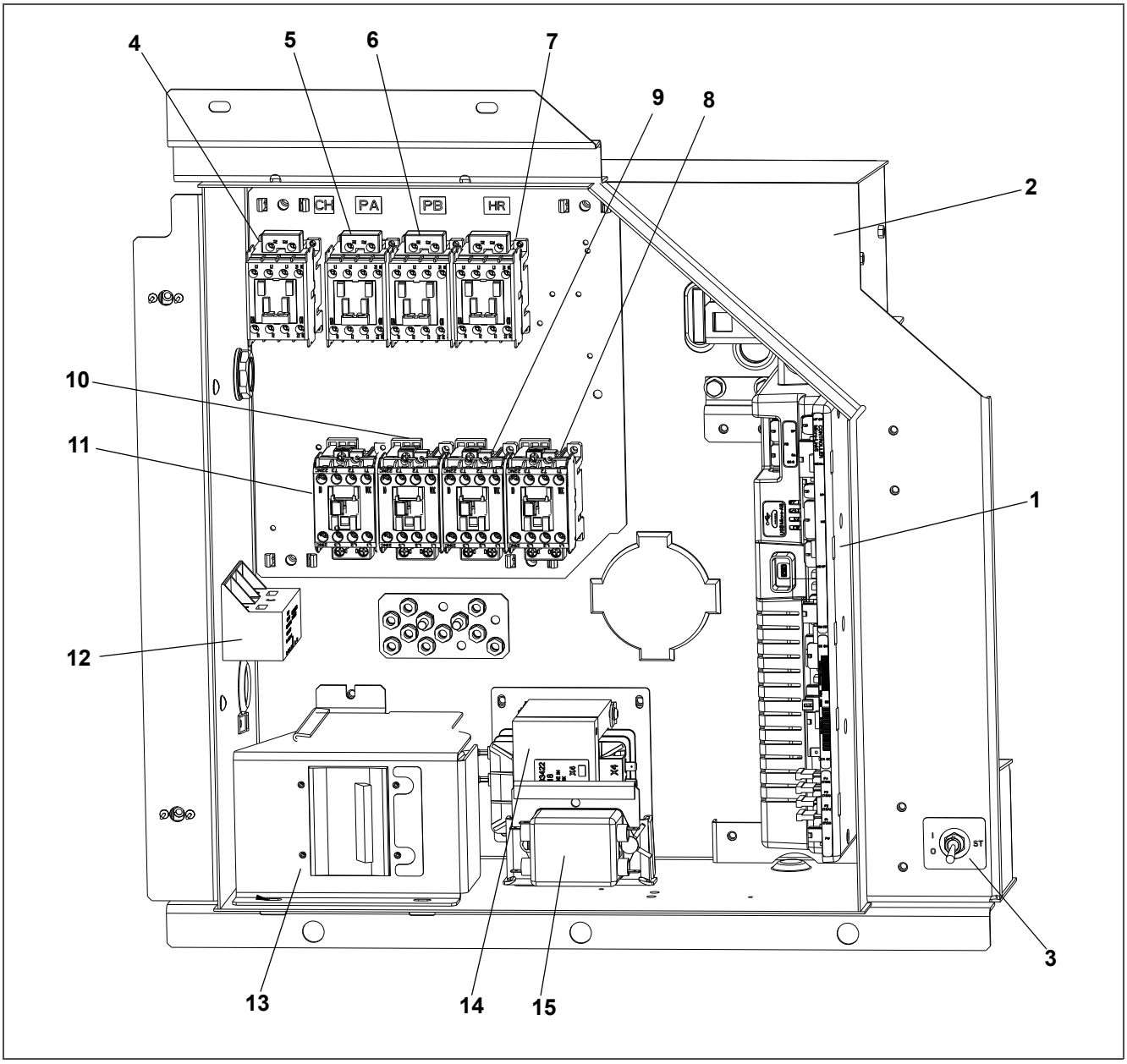
Figure 3.7 Control Box Section - EDGE Units (571-3xx models)



1) Controller
2) Controller Battery Pack and Battery
   Note: Located above controller (not shown)
3) Start-Stop Switch (ST)
4) Compressor Contactor (CH)
5) Compressor Phase A Contactor (PA)
6) Compressor Phase B Contactor (PB)
7) Heater Contactor (HR)
8) Evaporator Fan Contactor High Speed (EF)
9) Evaporator Fan Contactor Low Speed (ES)
10) Condenser Fan Contactor High Speed (CF)
11) Condenser Fan Contactor Low Speed (CL)
12) Current Sensor Module
13) Circuit Breaker (CB1) 460V
14) Control Transformer
15) Transformer AC Line Filter

- - - - -

NOTE: The PrimeLINE EDGE unit (571-3xx models) control box layout above is the same as a standard PrimeLINE unit (571-1xx models) with the exception of items 10 and 11: two contactors for the condenser fan (CF, CL).

3.3 Main Component Descriptions

3.3.1 Compressor

The compressor, shown in **Figure 3.8**, receives refrigerant vapor from the evaporator and compresses it to a high pressure, high temperature gas before directing it to the condenser. The compressor contains a terminal box, oil drain, refrigerant discharge and suction connections.

Figure 3.8 Compressor

3.3.2 Condenser Coil and Fan

From the compressor, the refrigerant flows to the air-cooled condenser, shown in **Figure 3.9**. The condenser fan blows the air across the coil fins and tubes to cool the gas to saturation temperature. By removing latent heat, the gas condenses to a high pressure / high temperature liquid and flows to the receiver.

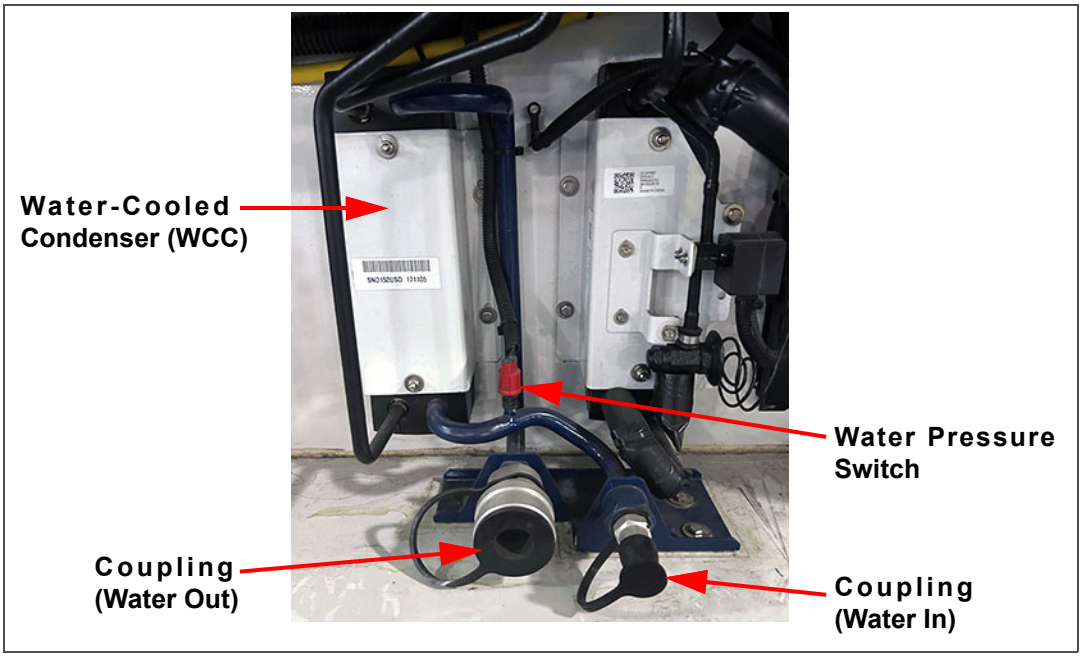
NOTE: Standard units (571-1xx models) use a single speed condenser fan while EDGE units (571-3xx models) use a dual speed fan to enable low speed operation under light load.

Figure 3.9 Condenser Coil and Fan

3.3.3 Water-Cooled Condenser Option

The unit may contain an optional brazed plate water-cooled condenser (WCC), shown in **Figure 3.10**, located to the left of the economizer. The WCC contains water in and water out couplings and a water pressure switch. When operating on the WCC, the condenser fan is deactivated by the water pressure switch. The receiver is retained in this configuration and the WCC is placed between the air-cooled condenser and the receiver.

Figure 3.10 Brazed Plate Water-Cooled Condenser

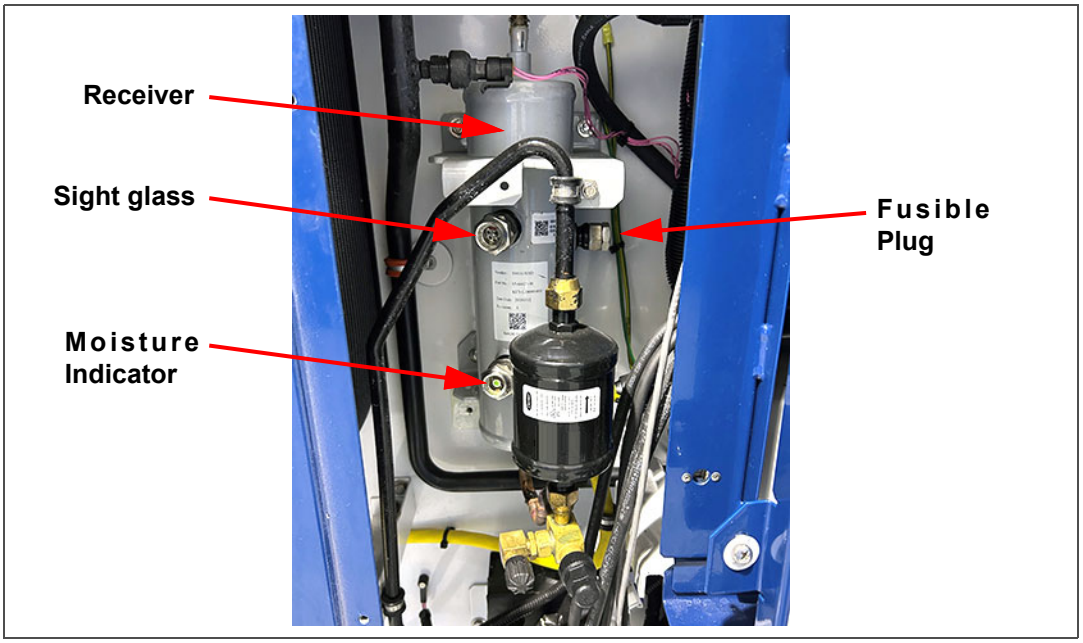


3.3.4 Receiver

The receiver, shown in **Figure 3.11**, receives high pressure / high temperature liquid refrigerant from the condenser and stores it for when it is needed during low temperature operation. The receiver contains a sight glass, moisture indicator and fusible plug.

NOTE: Units with PID number NT30xx (and NT3115), are shipped with a steel receiver. Units with PID number NT31xx and higher are shipped with an aluminum receiver.

Figure 3.11 Receiver (Aluminum)



3.3.5 Filter Drier

Refrigerant flows from the receiver through the filter drier, shown in **Figure 3.12**, which removes particulates and small amounts of water from the refrigerant to keep it clean and dry.

Figure 3.12 Filter Drier

3.3.6 Economizer

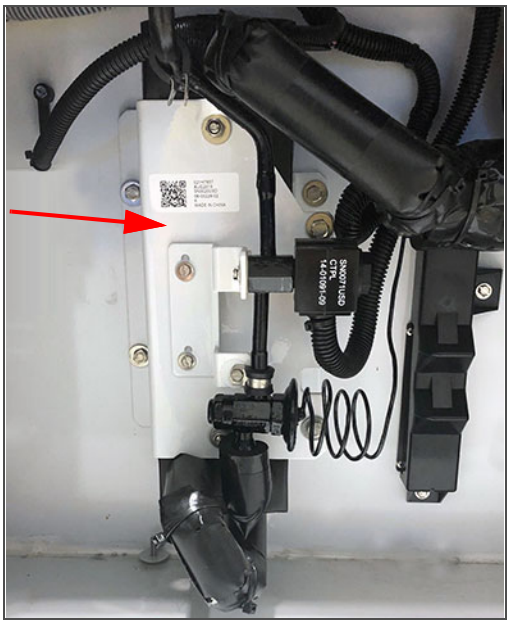
The economizer, shown in **Figure 3.13**, receives refrigerant from the filter drier. The economizer unit includes an economizer solenoid valve (ESV) and economizer expansion valve (EXV), as explained in **Section 3.5.4**.

The economizer is only active when the unit enables economized mode and the controller energizes the ESV. The liquid refrigerant flows through the ESV to the EXV internal passages, absorbing heat from the liquid refrigerant flowing to the electronic expansion valve (EEV). The resultant “medium” temperature/pressure gas is directed back to the compressor. An EXV bulb senses refrigerant temperature and will regulate the opening of the EXV to prevent liquid from returning to the compressor.

If economized mode is not active, the economizer is bypassed and refrigerant flows directly to the EEV.

NOTE: The EEV position (%) reading can be viewed on the unit display at function code Cd54.

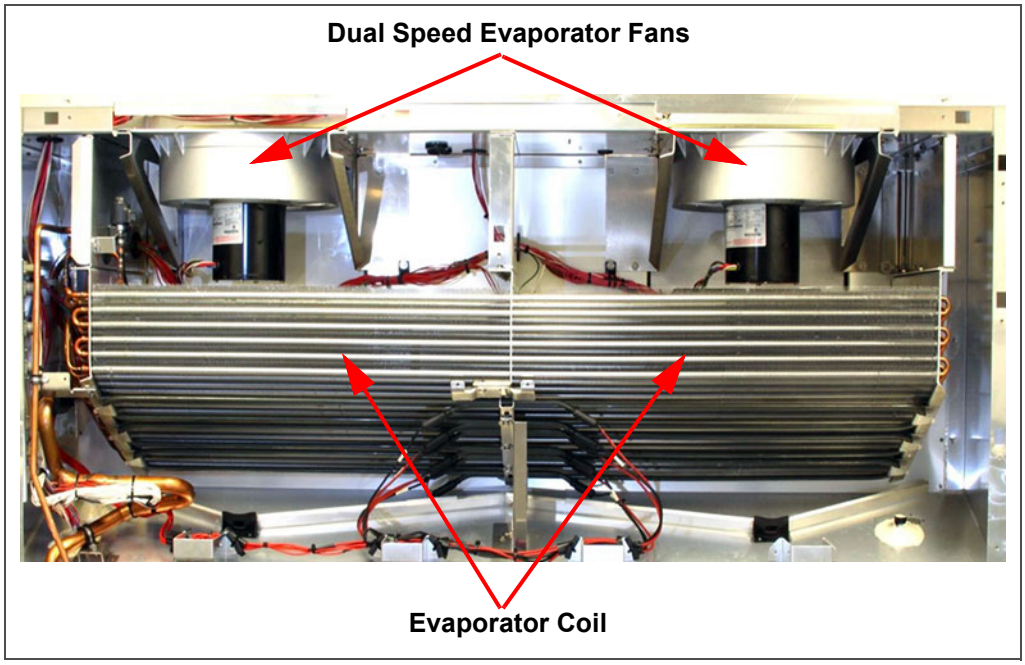
Figure 3.13 Economizer



3.3.7 Evaporator Coil and Fans

Refrigerant enters the evaporator coil, shown in **Figure 3.14**, as a low pressure, low temperature saturated mixture and exits as a vapor. As the refrigerant enters the coil, two dual speed evaporator fans blow air on the coil. Heat is absorbed from the air by the balance of the liquid, causing it to vaporize in the coil. And the cooler air is returned to the container unit.

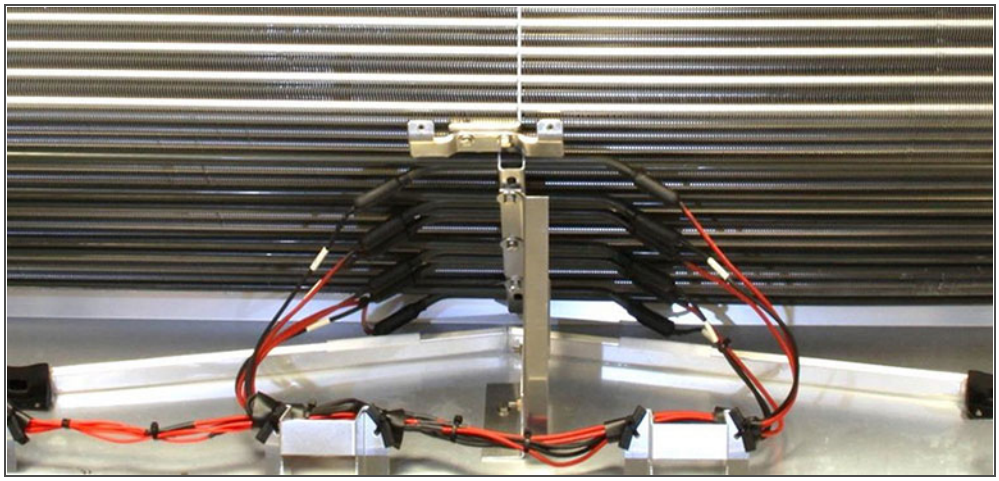
Figure 3.14 Evaporator Coil and Fans



3.3.8 Heaters

The heaters, shown in **Figure 3.15**, are energized when Heating mode or Defrost mode is called for by the controller.

Figure 3.15 Heaters



3.3.9 Heat Termination Thermostat

The heat termination thermostat (HTT), shown in **Figure 3.16**, is a safety device attached to an evaporator coil circuit that opens the heating circuit if overheating occurs.

Figure 3.16 Heat Termination Thermostat (HTT)

3.3.10 Evaporator Access Panels and Air Makeup Vent

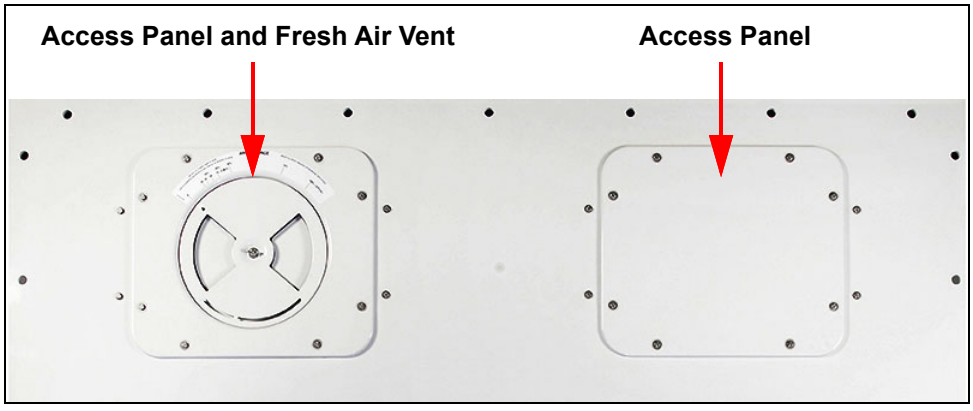
Most evaporator components are accessible by removing the upper back rear panel, inside the container unit. They may also be accessed via the evaporator fan access panels on the front of the unit, as shown in **Figure 3.17**.

The left access panel contains the fresh air makeup vent, which is a manually operated venting system that provides ventilation for commodities that require fresh air circulation. The fresh air makeup vent may be equipped with an optional vent position sensor (VPS) that determines the vent position.

Refer to **Section 5.3** for the procedure to adjust the fresh air makeup vent.

If a VPS is installed, the fresh air vent position can be viewed on the unit display at function code Cd45.

Figure 3.17 Access Panels and Fresh Air Makeup Vent

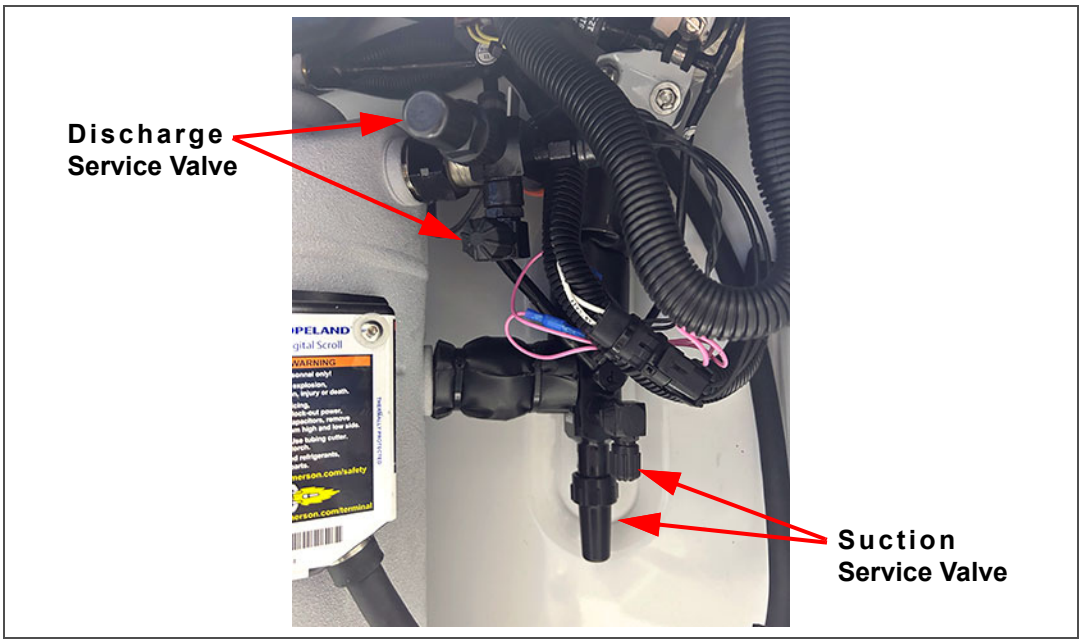


3.4 Service Valves Descriptions

3.4.1 Compressor Service Valves

There are two compressor service valves (discharge and suction), shown in **Figure 3.18**, that allow connecting of the manifold gauge set to perform refrigerant service. The service valves are provided with a double seat and an access valve which enables servicing of the compressor and refrigerant lines.

Figure 3.18 Compressor Service Valves



3.4.2 Liquid Line Service Valve

The liquid line service valve, shown in **Figure 3.19**, is for service procedures related to adding and removing refrigerant and also to assist with pumping refrigerant to the high side of the unit to allow service of specific components. This is also referred to as the king valve.

Figure 3.19 Liquid Line / King Valve

3.5 Refrigerant Valves Descriptions

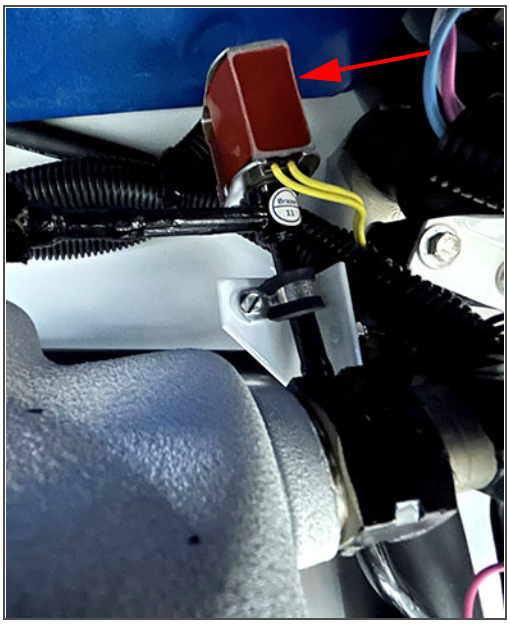
3.5.1 Digital Unloader Valve

The normally closed digital unloader valve (DUV), shown in **Figure 3.20**, in the standard mode of operation, controls the system refrigerant flow and capacity by loading and unloading the compressor in frequent discrete time intervals.

NOTE: The DUV reading (% closed) can be viewed on the unit display at function code Cd01.

NOTE: The DUV open/closed status can be viewed on the unit display at function code Cd15.

Figure 3.20 Digital Unloader Valve (DUV)

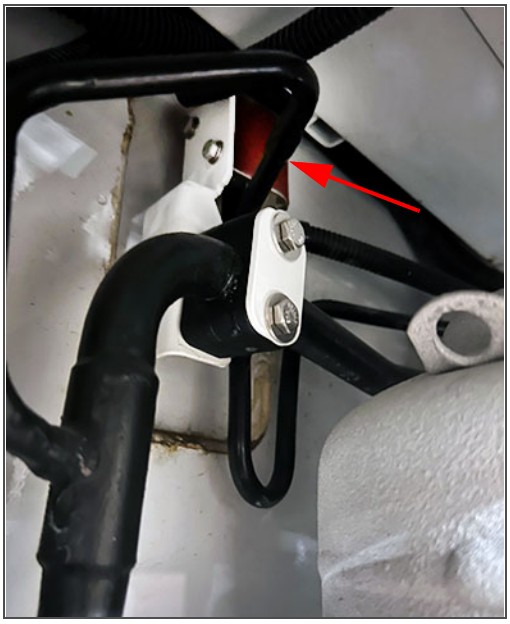


3.5.2 Digital Loader Valve

The digital loader valve (DLV), shown in **Figure 3.21**, is a unique component to PrimeLINE EDGE units (571-3xx models). The normally closed valves DLV and DUV, in the standard mode of operation, control the system refrigerant flow and capacity by loading and unloading the compressor in frequent discrete time intervals. The DLV and DUV operate in opposition to each other such that when the DLV is closed the DUV is open and vice versa.

NOTE: The DLV open/closed status can be viewed on the unit display at function code Cd15.

Figure 3.21 Digital Loader Valve (DLV)

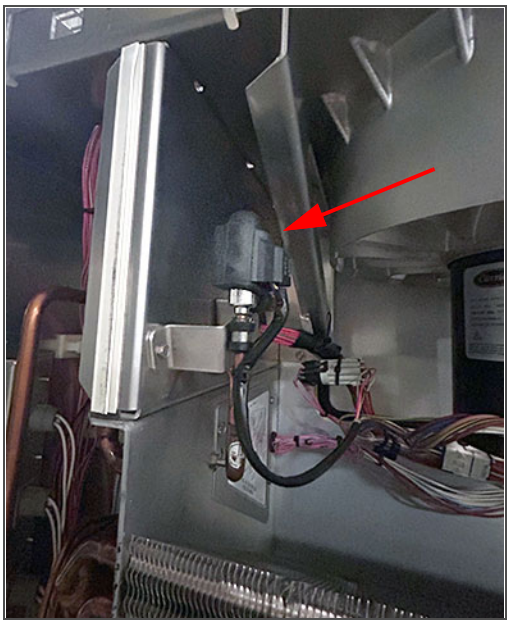


3.5.3 Electronic Expansion Valve

The electronic expansion valve (EEV), shown in **Figure 3.22**, drops the pressure of the liquid refrigerant to suction pressure. As this happens, some of the liquid vaporizes to a gas (flash gas), removing heat from the remaining liquid. The liquid is then sent to the evaporator as a low pressure, low temperature, saturated mix.

NOTE: The EEV position (%) can be viewed on the unit display at function code Cd54.

Figure 3.22 Electronic Expansion Valve (EEV)

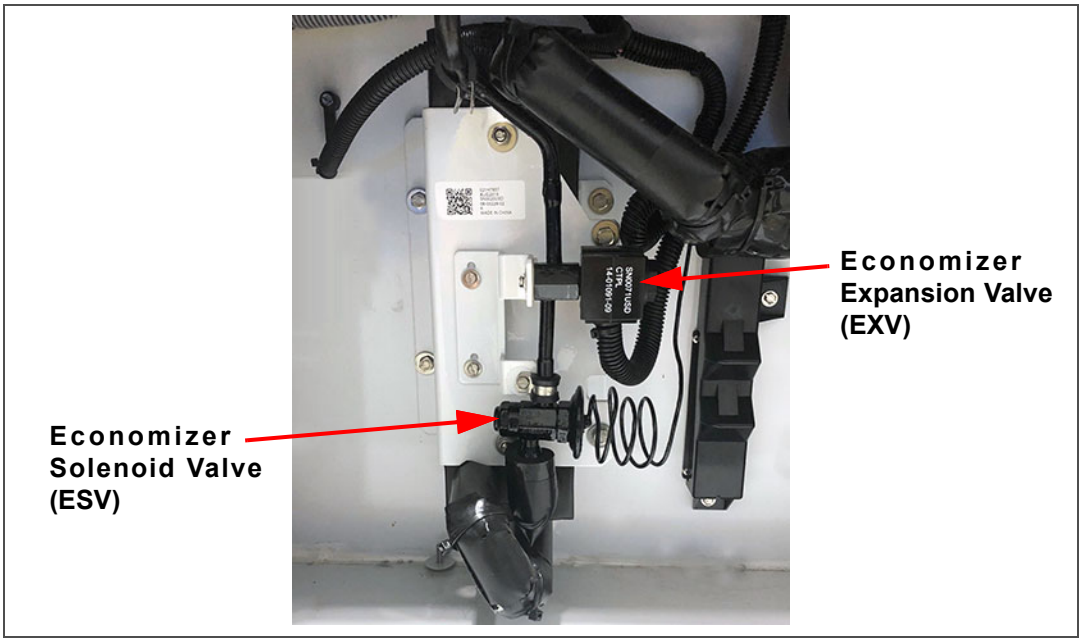


3.5.4 Economizer Valves

The economizer solenoid valve (ESV) and economizer expansion valve (EXV) are shown in **Figure 3.23**.

The controller energizes the ESV during Economized mode. The liquid refrigerant flows through the ESV to the EXV internal passages, absorbing heat from the liquid refrigerant flowing to the electronic expansion valve (EEV). The resultant “medium” temperature / pressure gas is directed back to the compressor.

Figure 3.23 Economizer Valves



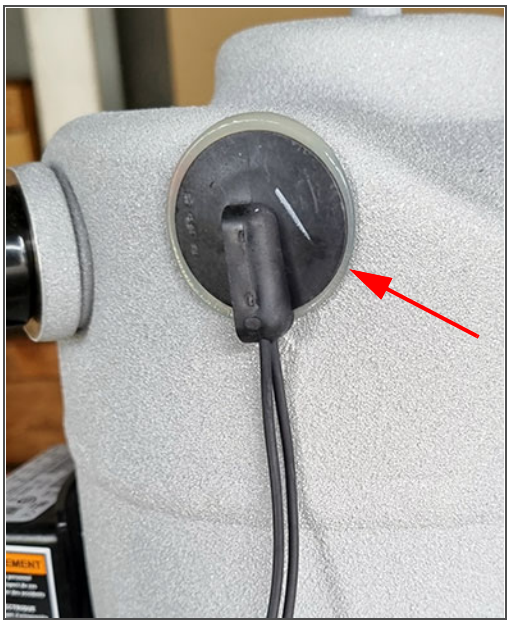
3.6 Refrigerant Probes Descriptions

3.6.1 Compressor Discharge Temperature Sensor

The compressor discharge temperature sensor (CPDS), shown in **Figure 3.24**, measures the temperature of the refrigerant as it is discharged from the compressor.

NOTE: The CPDS reading can be viewed on the unit display at function code Cd11.

Figure 3.24 Compressor Discharge Temperature Sensor (CPDS)



3.6.2 High Pressure Switch

The high pressure switch (HPS), shown in **Figure 3.25**, monitors abnormally high discharge pressure. It opens at 25 (+/- 1.0) kg/cm^2 | 350 (+/- 10) psig.

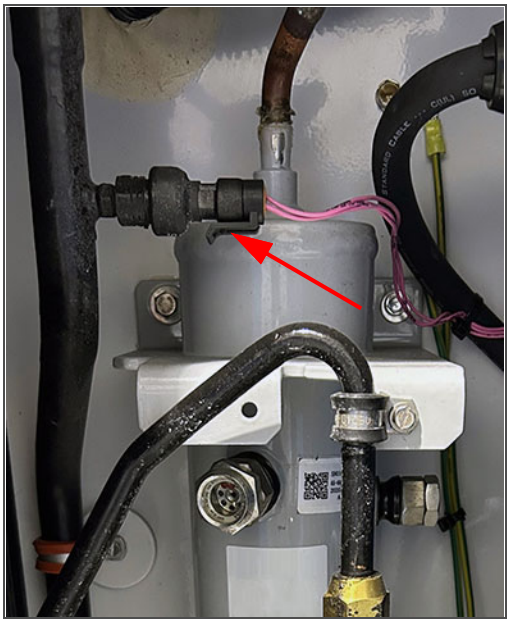
Figure 3.25 High Pressure Switch (HPS)

3.6.3 Discharge Pressure Transducer

The discharge pressure transducer (DPT), shown in **Figure 3.26**, monitors refrigerant pressure on the discharge side of the compressor. The DPT is located behind the receiver.

NOTE: The DPT reading can be viewed on the unit display at function code Cd14.

Figure 3.26 Discharge Pressure Transducer (DPT)

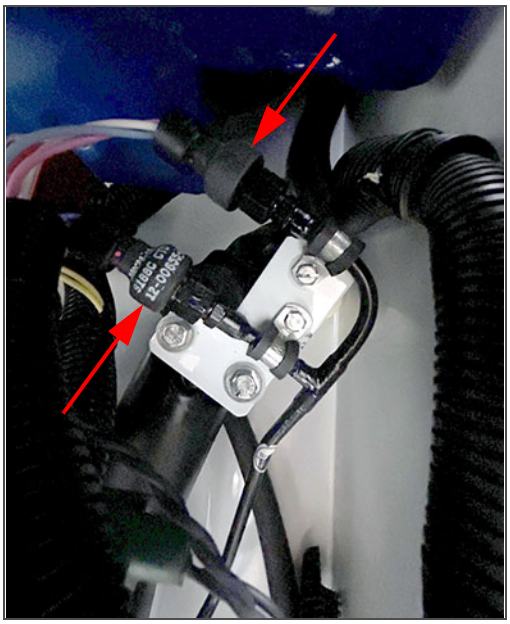


3.6.4 Evaporator / Suction Pressure Transducer

The evaporator pressure transducer (EPT) and suction pressure transducer (SPT), shown in **Figure 3.27**, monitors refrigerant on the suction side of the compressor.

NOTE: The EPT and SPT readings can be viewed on the unit display at function code Cd12.

Figure 3.27 Evaporator Pressure Transducers - EPT (top) and SPT (bottom)

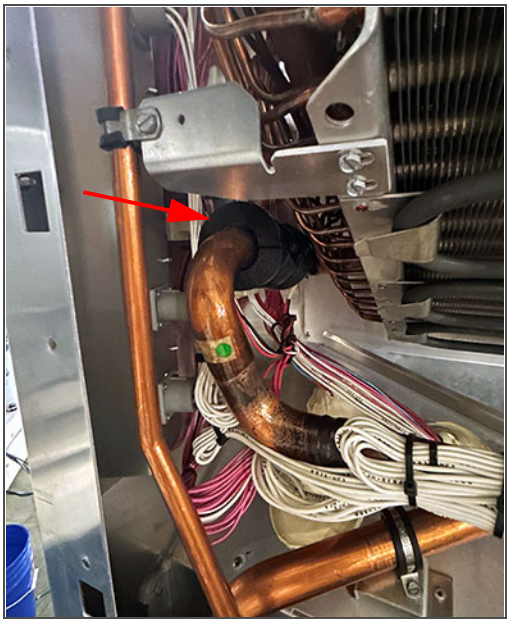


3.6.5 Evaporator Temperature Sensor

The evaporator temperature sensor (ETS1/2), shown in **Figure 3.28**, records the temperature of the refrigerant leaving the evaporator. It is located to the side of the evaporator coil.

NOTE: The ETS reading can be viewed on the unit display at function code Cd10.

Figure 3.28 Evaporator Temperature Sensor (ETS1/2)



3.7 Air Stream Sensors Descriptions

3.7.1 Supply Temperature Sensors

The supply temperature sensor (STS) and supply recorder sensor (SRS) are shown in **Figure 3.29**. The STS monitors the supply air temperature as it enters the container unit near the unit floor. The controller maintains the supply air temperature at setpoint during Perishable mode according to the STS. The SRS is for recording temperature and also to backup the STS in case of failure. See **Section 4.3.2** for details on Perishable mode.

NOTE: The SRS reading can be viewed on the unit display at function code dC1.

Figure 3.29 Supply Temperature Sensor (STS) / Supply Recorder Sensor (SRS)

3.7.2 Return Temperature Sensors

The return temperature sensor (RTS) and return recorder sensor (RRS) are shown in **Figure 3.30**. The RTS monitors the return air temperature at the top of the container unit above the evaporator fans. The controller maintains the return air temperature at setpoint during frozen mode according to the RTS. The RRS is for recording temperature and also to backup the RTS in case of failure. See **Section 4.3.4** for details on frozen mode.

NOTE: The RRS reading can be viewed on the unit display at function code dC2.

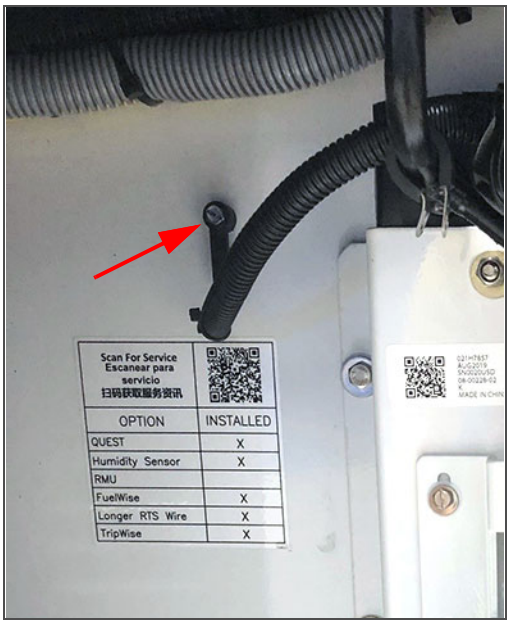
Figure 3.30 Return Temperature Sensor (RTS) / Return Recorder Sensor (RRS)

3.7.3 Ambient Temperature Sensor

The ambient temperature sensor (AMBS), shown in **Figure 3.31**, measures ambient temperature that the controller monitors to adjust operating modes accordingly inside the unit. It is located next to the economizer.

NOTE: The DTS reading can be viewed on the unit display at function code Cd09.

Figure 3.31 Ambient Temperature Sensor (AMBS)

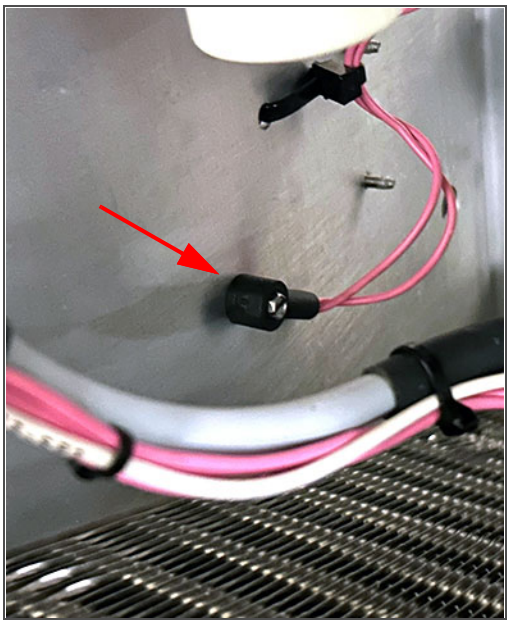


3.7.4 Defrost Temperature Sensor

The defrost temperature sensor (DTS), shown in **Figure 3.32**, determines the initiation of Defrost mode. 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. See **Section 4.3.6** for more information on defrost mode.

NOTE: The DTS reading can be viewed on the unit display at function code Cd26.

Figure 3.32 Defrost Temperature Sensor (DTS)



3.7.5 Humidity Sensor

The humidity sensor (HS), shown in **Figure 3.33**, is an optional component that detects the relative humidity inside the container unit.

NOTE: The HS reading of relative humidity (%) can be viewed on the unit display at function code Cd17.

NOTE: The humidity settings are controlled on the unit display at function code Cd33.

Figure 3.33 Humidity Sensor (HS)

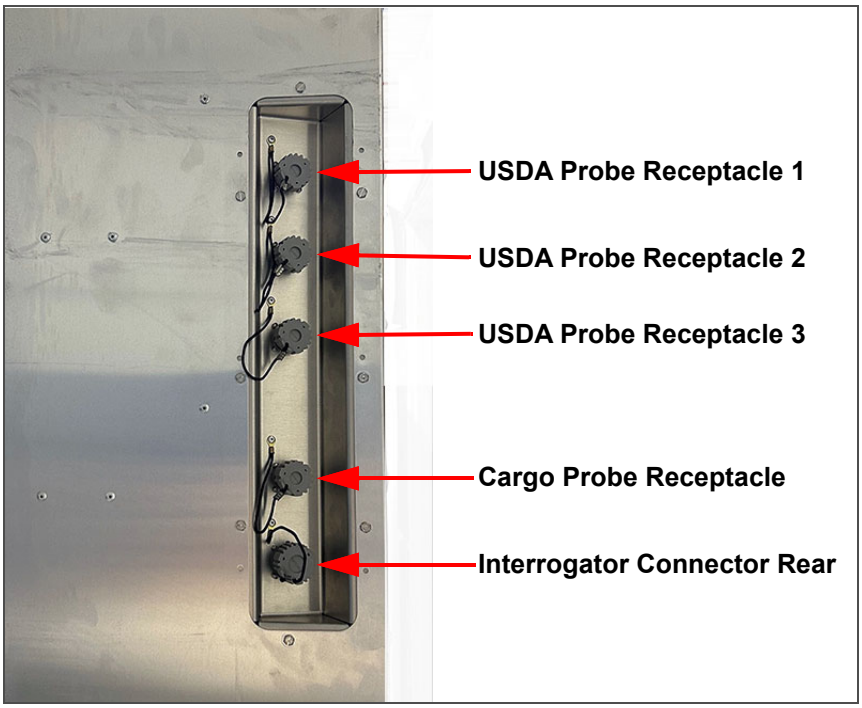
3.7.6 USDA Probes and Cargo Probe

If equipped, the unit has the capability of recording three USDA probes (USDA 1-3) and one cargo probe. The 3-pin receptacles for plugging in the probes are located in the evaporator section. The probe leads are plugged into the desired receptacle, shown in **Figure 3.34**. There is also a 5-pin interrogator receptacle (ICR) for third party device connectivity.

NOTE: USDA probe readings can be viewed on the unit display at function codes dC3, dC4 and dC5.

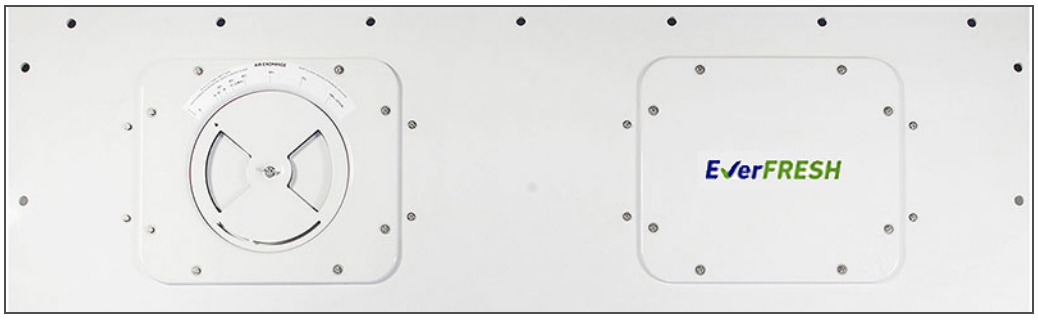
NOTE: The cargo probe reading can be viewed on the unit display at function code dC14.

Figure 3.34 Receptacles



3.8 EverFRESH Option

The EverFRESH® controlled atmosphere option controls container atmosphere by supplying nitrogen and oxygen into the container space and simultaneously controlling levels of oxygen and carbon dioxide. Units with EverFRESH installed will typically have the label placed on the access panel.



For units with EverFRESH installed, an air compressor is installed under the condenser and several other components located in the evaporator section inside the access panels. See **Section 5.9.7** for enabling or disabling EverFRESH operation on the unit.

NOTE: EverFRESH is controlled on the unit display from function codes Cd44, Cd71 and Cd76.

Detailed procedures and technical information related to the EverFRESH controlled atmosphere system can be found in the **T-374 EverFRESH Manual**. This can be found in the ContainerLINK™ app or from the Literature section of the Container Refrigeration website.

3.9 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 (EEV) Superheat	Verify at - 18°C (0°F) container box temperature	4.4 to 6.7°C (8 to 12°F)
Economizer Expansion Valve (EXV) Superheat	Verify at - 18°C (0°F) container box temperature	4.4 to 11.1°C (8 to 20°F)
Heater Termination Thermostat (HTT)	Opens	54° (+/- 3) C | 130° (+/- 5) F
	Closes	38° (+/- 4) C | 100° (+/- 7) F
High Pressure Switch (HPS)	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 nameplate.	
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)

3.10 Electrical Data

Table 3–2 Electrical Data

Circuit Breaker	CB1 (25 amp)	Trips at 29 amps	
	CB2 (50 amp)	Trips at 62.5 amps	
	CB2 (70 amp)	Trips at 87.5 amps	
Compressor Motor	Full Load Amps (FLA)	13 amps @ 460 VAC	
Condenser Fan Motor, Single Speed (571-1xx models)	Nominal Supply	**380 VAC, 3 Phase, 50 Hz**	**460 VAC, 3 Phase, 60 Hz**
	Full Load Amps	0.71 amps	0.72 amps
	Horsepower	0.21 hp (OK)	0.36 hp (OK)
	Rotations Per Minute	1425 rpm	1725 rpm
	Voltage and Frequency	360 to 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.	
Condenser Fan Motor, Two Speed (571-3xx models)	Nominal Supply	**380 VAC, 3 Phase, 50 Hz**	**460 VAC,3 Phase, 60 Hz**
	Full Load Amps (H / L)	1.0 / 0.6 amps	1.0 / 0.6 amps
	Horsepower (H / L)	0.21 hp / 0.03 hp	0.36 hp / 0.04 hp
	RPM (H / L)	1450 / 725 rpm	1750 / 850 rpm
	Voltage Range	360 - 460 VAC +/- 1.25 Hz	400 - 500 VAC +/- 1.5 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)	Nominal Supply	**380 VAC, 3 Phase, 50 Hz**	**460 VAC, 3 Phase, 60 Hz**
	Full Load Amps High Speed	1.07	0.9
	Full Load Amps Low Speed	0.47	0.47
	Nominal Horsepower High Speed	0.36	0.63
	Nominal Horsepower Low Speed	0.05	0.8
	Rotations Per Minute High Speed	2850 rpm	3450 rpm
	Rotations Per Minute Low Speed	1425 rpm	1725 rpm
	Voltage and Frequency	360 - 460 VAC +/- 1.25 Hz	400 - 500 VAC +/- 1.5 Hz
	Bearing Lubrication	Factory lubricated, additional grease not required	
	Rotation	CW when viewed from shaft end	

Table 3–2 Electrical Data (Continued)

Fuses	Control Circuit	7.5 amps (F3, F4)
	Controller / DataCORDER	7.5 amps (F1, F2)
Vent Positioning Sensor (VPS)	Electrical Output	0.5 VDC to 4.5 VDC over 90 degree range
	Supply Voltage	5 VDC +/- 10%
	Supply Current	5 mA (typical)
Economizer Solenoid Valve (ESV) Coils 24 VAC	Nominal Resistance @ 77°F (25°C)	7.7 ohms +/- 5%
	Maximum Current Draw	0.7 amps
Digital Loader Valve (DLV) Coils 12 VDC (571-3xx models)	Nominal Resistance @ 68°F (20°C)	14.8 ohms +/- 5%
Digital Unloader Valve (DUV) Coils 24 VAC	Nominal Resistance @ 68°F (20°C)	15.5 ohms +/- 5%
Electronic Expansion Valve (EEV) Nominal Resistance	Coil Feed to Ground (Gray Wire)	47 ohms
	Coil Feed to Coil Feed	95 ohms
Humidity Sensor (HS)	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)

3.11 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 (CB1, 25 amp) - Manual Reset	Trips at 29 amps (460 VAC)
	Circuit Breaker (CB2, 50 amp) - Manual Reset	Trips at 62.5 amps (230 VAC)
	Circuit Breaker (CB2, 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 Protectors (IP-EM1, IP-EM2) - Automatic Reset	N/A
Abnormal pressures / temperatures in the high refrigerant side	Fusible Plug - Used on the Receiver. Refer to **Figure 3.11** for location.	99°C (210°F) 35 kg/cm^2 (500 psig)
Abnormally high discharge pressure	High Pressure Switch (HPS) Refer to **Figure 3.25** for location.	Opens at 25 kg/cm^2 (350 psig)

3.12 Refrigeration Circuit

See **Figure 3.35** for circuit diagram of PrimeLINE standard units (571-1xx models).

See **Figure 3.36** for circuit diagram of PrimeLINE standard units (571-1xx models) with water-cooled condenser.

See **Figure 3.37** for circuit diagram of PrimeLINE EDGE units (571-3xx models).

Starting at the compressor, 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, 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.

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.

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.

3.12.1 Economized Operation

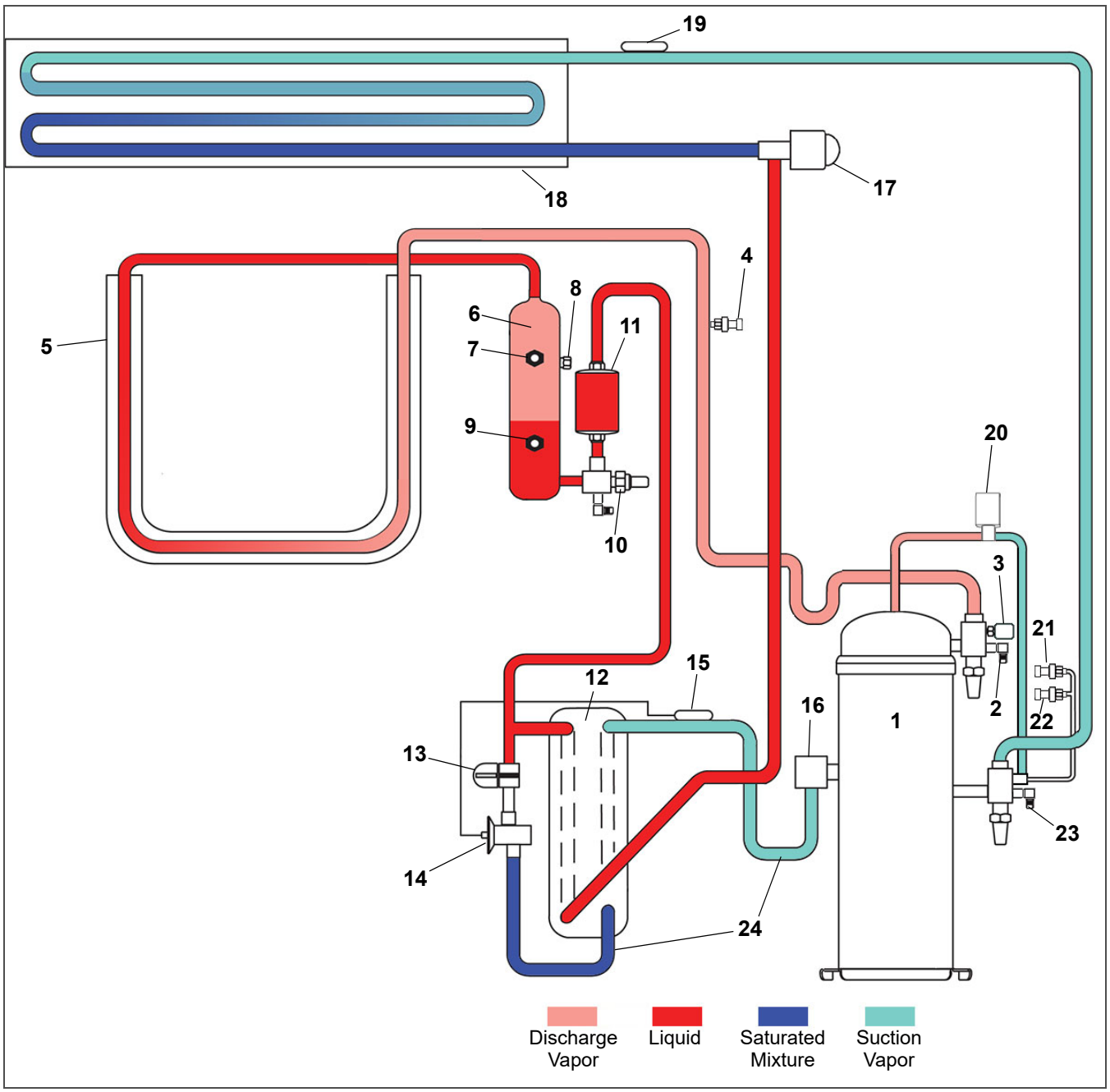
In economized operation, the frozen and pull down capacity of the unit is increased by sub-cooling the liquid refrigerant entering the electronic expansion valve (EEV). Overall efficiency is increased because the gas leaving the economizer enters the compressor at a higher pressure, therefore requiring 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.

Figure 3.35 Refrigeration Circuit - Standard Units (571-1xx models)



1) PrimeLINE Compressor, R-513A-ready
2) Discharge Service Valve
3) High Pressure Switch (HPS)
4) Discharge Pressure Transducer (DPT)
5) Condenser
6) Receiver
7) Receiver Sight Glass
8) Fusible Plug
9) Receiver Liquid Level / Moisture Indicator
10) Liquid Line Service Valve (King Valve)
11) Filter Drier
12) Economizer
13) Economizer Solenoid Valve (ESV)
14) Economizer Expansion Valve (EXV)
15) Economizer Expansion Valve (EXV) Sensing Bulb
16) Economizer Connection
17) Electronic Expansion Valve (EEV)
18) Evaporator
19) Evaporator Temperature Sensor (ETS1 / ETS2)
20) Digital Unloader Valve (DUV)
21) Evaporator Pressure Transducer (EPT)
22) Suction Pressure Transducer (SPT)
23) Suction Service Valve
24) Flow of refrigerant back to the compressor when Economized mode is active (ESV is energized)

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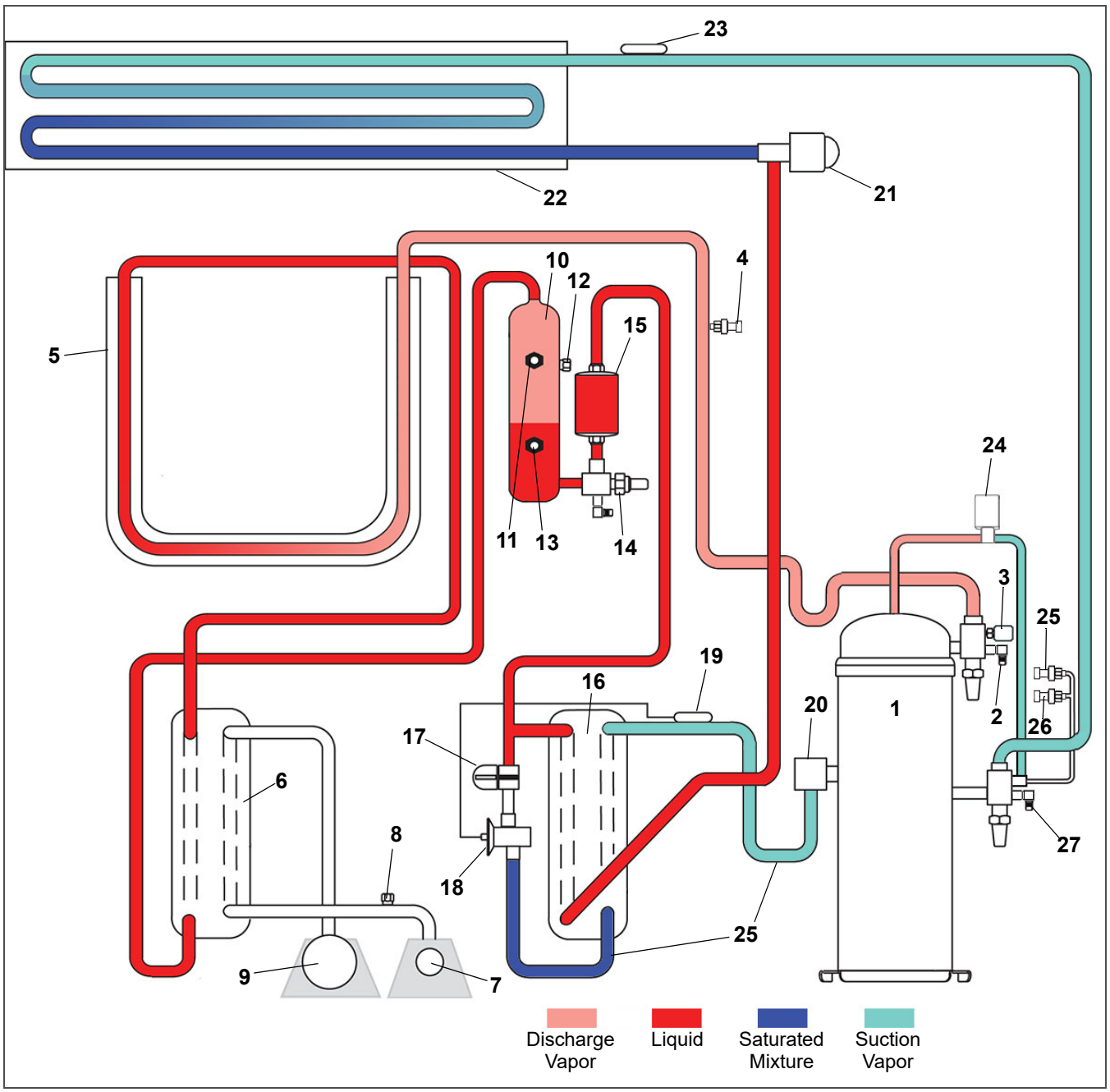
Figure 3.36 Refrigeration Circuit - Standard Units with WCC (571-1xx models)



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

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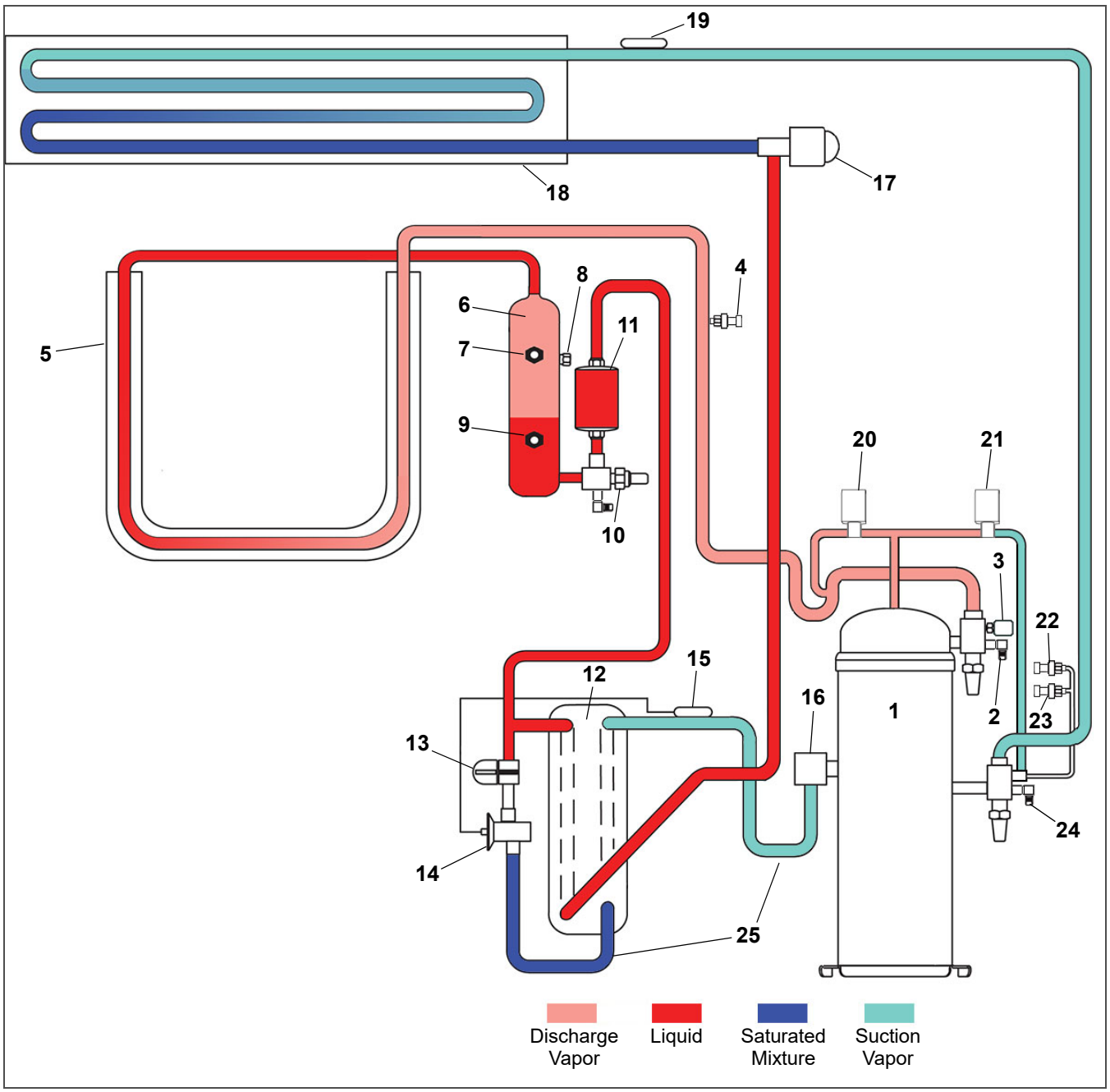
Figure 3.37 Refrigeration Circuit - EDGE Units (571-3xx models)



1) PrimeLINE Edge Compressor, R-513A-ready
2) Discharge Service Valve
3) High Pressure Switch (HPS)
4) Discharge Pressure Transducer (DPT)
5) Condenser
6) Receiver
7) Receiver Sight Glass
8) Fusible Plug
9) Receiver Liquid Level / Moisture Indicator
10) Liquid Line Service Valve (King Valve)
11) Filter Drier
12) Economizer
13) Economizer Solenoid Valve (ESV)
14) Economizer Expansion Valve (EXV)
15) Economizer Expansion Valve (EXV) Sensing Bulb
16) Economizer Connection
17) Electronic Expansion Valve (EEV)
18) Evaporator
19) Evaporator Temperature Sensor (ETS1 / ETS2)
20) Digital Loader Valve (DLV)
21) Digital Unloader Valve (DUV)
22) Evaporator Pressure Transducer (EPT)
23) Suction Pressure Transducer (SPT)
24) Suction Service Valve
25) Flow of refrigerant back to the compressor when Economized mode is active (ESV is energized)

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Section 4
Microprocessor

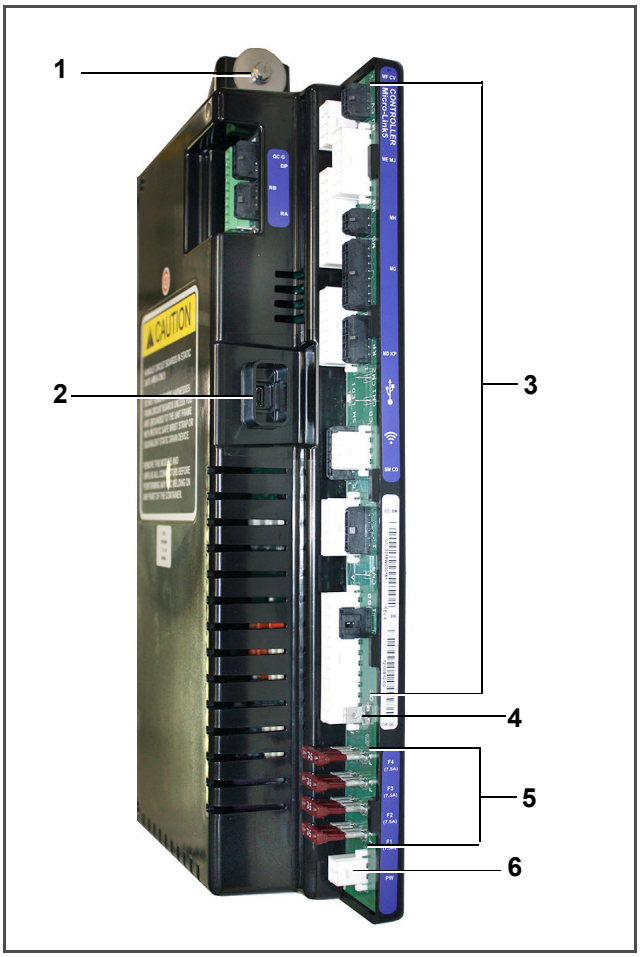
4.1 Temperature Control Microprocessor System

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

4.1.1 Controller

The controller, shown in **Figure 4.1**, is fitted with power connectors, a micro USB port and short range wireless connectivity. The controller contains temperature control software and DataCORDER software. The temperature control software functions to operate the unit components as required to provide the desired cargo temperature and humidity, see **Section 4.2** for details. The DataCORDER software functions to record unit operating parameters and cargo temperature parameters for future retrieval, see **Section 4.7** for details.

Figure 4.1 Controller / DataCORDER Module



1) Mounting Screw
2) Micro USB Port
3) Wire Harness Connectors
4) Device Power Connector
5) Fuses (7.5A)
6) Controller Power Connector

- - - - -

⚠ 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.

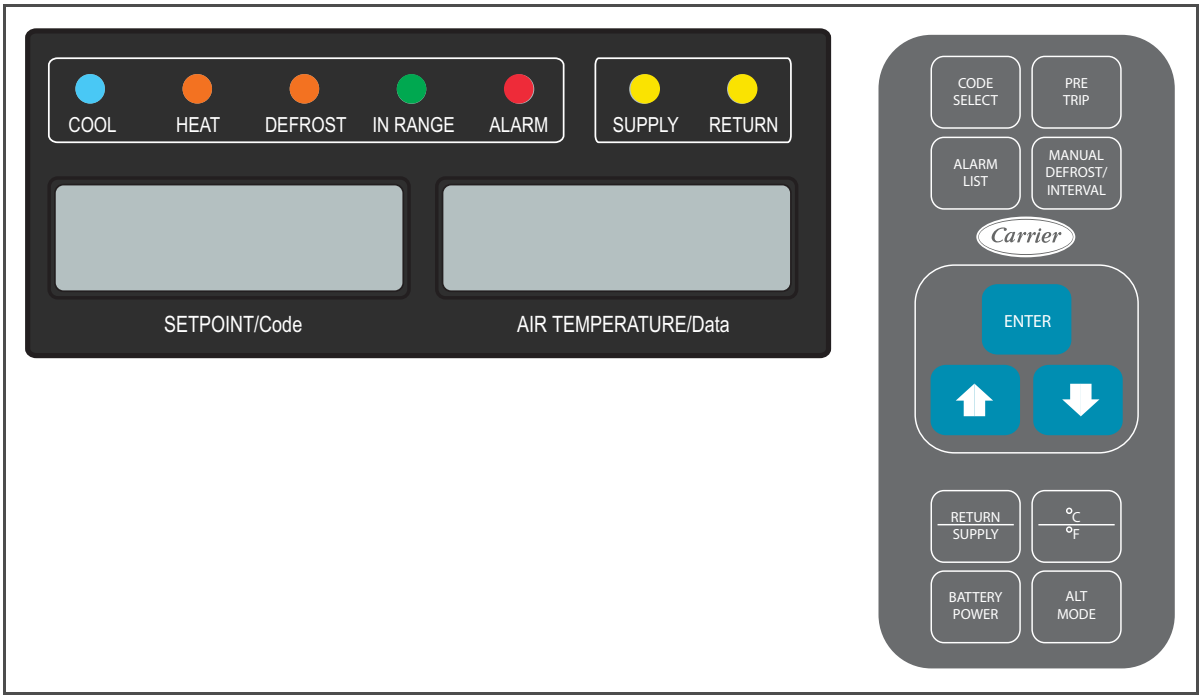
NOTE

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, see **Figure 4.2**, 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.

Figure 4.2 Display Module and Keypad



The display module consists of two 5-digit displays and seven indicator lights. Descriptions of the indicator lights are provided in **Table 4–1**.

The keypad 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**.

Table 4–1 Display Module Indicator Lights

Light	Description when Energized
COOL (Blue)	Indicates that the refrigerant compressor is turned on.
HEAT (Orange)	Indicates heater operation in heat mode, defrost mode, or dehumidification.
DEFROST (Orange)	Indicates that the unit is in defrost mode.
IN RANGE (Green)	Indicates that control temperature is within the in range specified tolerance of setpoint. The controlling probe in perishable range is the supply air temperature probe. The controlling probe in frozen range is the return air temperature probe.
ALARM (Red)	Indicates an active or inactive shutdown alarm is in the alarm queue.
SUPPLY (Yellow)	When illuminated solid, it Indicates that the supply air temperature probe is being used for control during perishable mode. The temperature displayed in the AIR TEMPERATURE display is the reading at the supply air temperature probe. When flashing, it indicates that dehumidification is enabled.
RETURN (Yellow)	When illuminated solid, it Indicates that the return air temperature probe is being used for control during frozen mode. The temperature displayed in the AIR TEMPERATURE display is the reading at the return air temperature probe.

Table 4–2 Keypad Function

Key	Function
CODE SELECT	Access function codes.
PRE TRIP	Display Pre-Trip selection menu. Discontinue a Pre-Trip in progress. If TripWise is enabled, display a current TripWise status message.
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:

- Controls supply or return air temperature to required limits; provides modulated refrigeration operation, economized operation, unloaded operation, electric heat control, and defrost.
- Provides default independent readouts of setpoint and supply or return air temperatures.
- Provides ability to read and (if applicable) modify the configuration software variables, operating software function codes and alarm code indications.
- Provides a pre-trip step-by-step testing of refrigeration unit performance including: proper component operation, electronic and refrigeration control operation, heater operation, probe calibration, pressure limiting and current limiting settings.
- Provides 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)

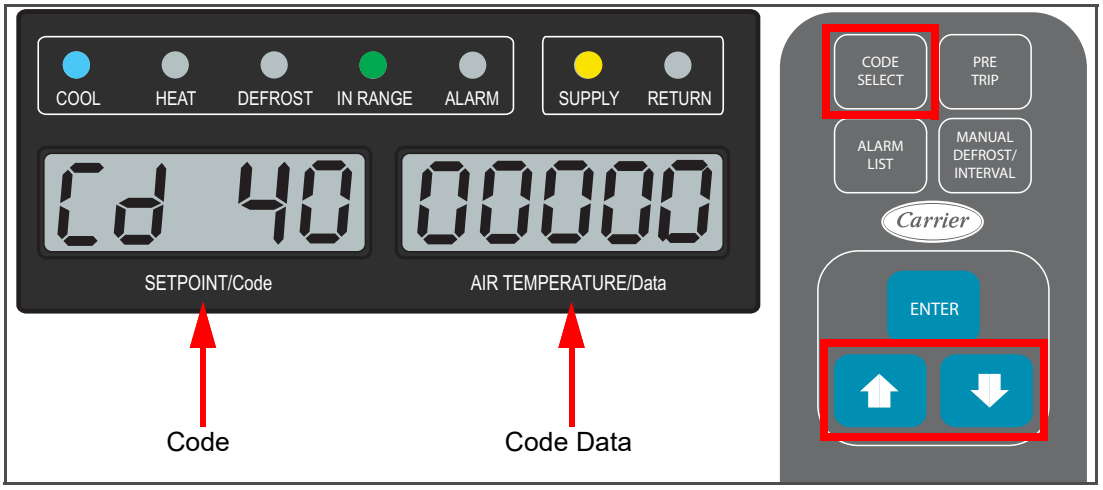
Configuration software is a variable listing of the components available for use by the operational software. This software is factory installed in accordance with the equipment fitted and options listed on the original purchase order. Changes to the configuration software are required only when a new controller has been installed or a physical change has been made to the unit such as the addition or removal of an option. Change to the factory-installed configuration software can be achieved via the controller micro USB port.

4.2.2 Operational Software (Cd Function Codes)

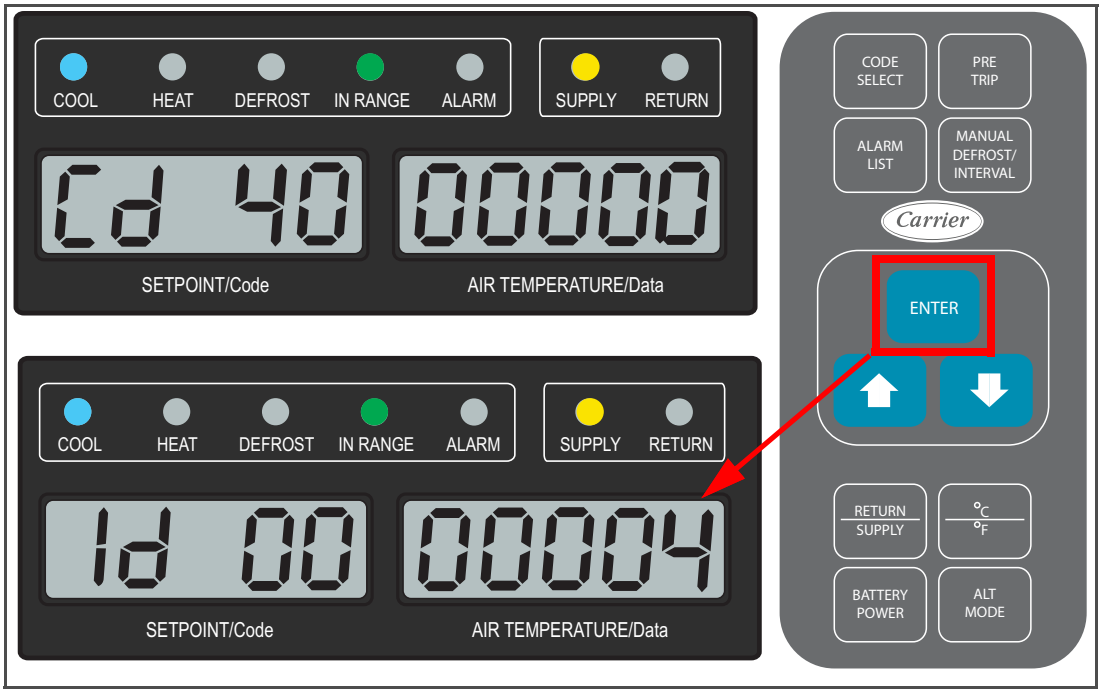
The operational software is the actual operation programming of the controller which activates or deactivates components in accordance with current unit operating conditions and selected modes of operation. The programming is divided into function codes. Some of the codes are read only, while the remaining codes may be user configured. The value of the user configurable codes can be assigned in accordance with user desired modes of operation. A summary of function codes is provided in **Table 4–3**, and completed descriptions in **Section 4.4.2**.

General Notes on Function Code Navigation:

1. Press the CODE SELECT key on the keypad. Then, use the Arrow keys to navigate through the function codes (Cd) in the left display. The right display shows the respective data. If the right display shows dashes "-----", then this is an optional code not available to a particular unit configuration.



2. Press the ENTER key to navigate into the menu of a selected code. Pressing ENTER will display the present selected value for 5 seconds, or until the user selects a different value. If additional time is required, press ENTER to extend the display time to 30 seconds.



3. Press the CODE SELECT key while in a selection menu to cancel the current selection and go back up to the higher selection menu. If no key is pressed for 5 seconds, the display reverts to a normal display and the current selection menu is cancelled. Any previously committed changes are retained.

Table 4–3 Controller Function Codes (Cd) - Summary

Code	Description	Configurable
Cd01	Capacity Modulation (%)	
Cd03	Compressor Motor Current	
Cd04	Line Current, Phase A	
Cd05	Line Current, Phase B	
Cd06	Line Current, Phase C	
Cd07	Main Power Voltage	
Cd08	Main Power Frequency	
Cd09	Ambient Temperature	
Cd10	Evaporator Temperature	
Cd11	Compressor Discharge Temperature	
Cd12	Evaporator Pressure / Compressor Suction Pressure	
Cd14	Compressor Discharge Pressure	
Cd15	Digital Unloader Valve / Digital Loader Valve	
Cd16	Compressor Motor / Unit Run Time Hour Meter	
Cd17	Relative Humidity (%)	
Cd18	Software Revision Number	
Cd19	Backup Battery Check	
Cd20	Config / Model Number	
Cd21	Capacity Mode	
Cd22	Compressor State	
Cd23	Evaporator Fan State	
Cd25	Compressor Run Time Remaining Until Defrost	
Cd26	Defrost Temperature Sensor	
Cd27	Defrost Interval (Hours or Automatic)	x
Cd28	Temperature Units (°C or F)	x
Cd29	Failure Action (Mode)	x
Cd30	In-Range Tolerance	x
Cd31	Stagger Start Offset Time (Seconds)	x
Cd32	System Current Limit (Amperes)	x
Cd33	Humidity Setpoint	x
Cd34	Economy Mode (On-Off)	x
Cd35	Bulb Mode	x
Cd36	Evaporator Fan Speed	x
Cd37	Variable DTT Setting (Bulb Mode)	x
Cd40	Container Identification Number	
Cd41	Valve Override	x
Cd43	XtendFRESH Mode	x
Cd44	EverFRESH Values	
Cd45	Vent Position Sensor (VPS) Position	
Cd46	Airflow Display Units	x

Code	Description	Configurable
Cd47	Variable Economy Temperature Setting	x
Cd48	Dehumidification / Bulb Cargo Mode Parameter Selection	x
Cd49	Days Since Last Successful Pre-Trip	
Cd50	QUEST Enable / Disable	x
Cd51	Automatic Cold Treatment (ACT) Mode Parameter Selection	x
Cd53	Automatic Setpoint Change (ASC) Mode Parameter Selection	x
Cd54	Suction Port Superheat / Electronic Expansion Valve Status	
Cd55	Discharge Superheat	
Cd56	Enable Comms Mode	
Cd58	Water Pressure Switch State / Override Logic State	
Cd59	Pump Down Logic	x
Cd62	High Speed Evaporator Fan Setting	x
Cd63	FuelWise	x
Cd64	Alternate Compressor Selection PrimeLINE Edge	x
Cd65	TripWise	x
Cd66	Instantaneous Power (kW)	
Cd67	Energy (kW-hr)	
Cd70	Temperature Setpoint Lock	x
Cd71	EverFRESH Mode	x
Cd72	Air Compressor Hours Since Last Service	x
Cd73	Air Compressor Total Operational Hours	x
Cd74	Controller Diagnostic	x
Cd75	Pharma Mode	x
Cd76	CO2 Injection Mode	x
Cd77	Baudrate Selection	
Cd78	EverFRESH Air Compressor State On-Off	
Cd79	EverFRESH Water Drain Valve (WDV) State On-Off	
Cd80	EverFRESH Air Valve (EAV) State On-Off	
Cd81	EverFRESH CO2 Valve State On-Off	
Cd82	Condenser Fan State On-Off	
Cd83	CO2 Gas Cooler Temperature	

Cd01 Capacity Modulation (%)

Cd01 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

Cd03 displays the current value passing through the compressor motor leg T3. 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.

Cd04 Line Current, Phase A

Cd05 Line Current, Phase B

Cd06 Line Current, Phase C

These codes display the measured of Phase A (Cd04), B (Cd05) and C (Cd06) in amperes. 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.

Cd07 Main Power Voltage

Cd07 displays the main supply voltage.

Cd08 Main Power Frequency

Cd08 displays the value of the main power frequency in Hertz. The frequency displayed will be halved if either fuse F1 or F2 is bad (alarm code AL021).

Cd09 Ambient Temperature

Cd09 displays the ambient temperature sensor (AMBS) reading.

Cd10 Evaporator Temperature

Cd10 displays the evaporator temperature sensor (ETS) reading.

Cd11 Compressor Discharge Temperature

Cd11 displays the compressor discharge temperature Sensor (CPDS) reading, using compressor dome temperature.

Cd12 Evaporator Pressure / Compressor Suction Pressure

Cd12 displays the evaporator pressure transducer (EPT) reading in the right display. Press the ENTER key to show the reading for the suction pressure transducer (SPT) in the left display and the EPT in the right display.

Cd14 Compressor Discharge Pressure

Cd14 displays the compressor discharge pressure transducer (DPT) reading.

Cd15 Digital Unloader Valve / Digital Loader Valve

Cd15 displays the status of the digital unloader valve (DUV) as Open or Closed.

For PrimeLINE EDGE units (571-3xx models) the status of the digital loader valve (DLV) can also be displayed. To display the DLV status, press and hold the ENTER key for 3 seconds and continue to hold. When the key is released, the display switches back to the DUV.

Cd16 Compressor Motor / Unit Run Time Hour Meter

Cd16 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 (%)

Cd17 displays the humidity sensor (HS) reading, as a percent value.

Cd18 Software Revision Number

Cd18 displays the software revision number.

Cd19 Backup Battery Check

Cd19 runs a backup battery test and also displays results.

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, the controller returns to displaying the setpoint.

Whenever the battery test is run, the Relative State of Charge (RSOC) is posted in the download.

Cd20 Config / Model Number

Cd20 displays the dash number of the model for which the Controller is configured (i.e., if the unit is a 69NT40-571-100, the display will show “71100”).

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

Cd21 displays the mode of operation as Unloaded, Standard or Economized.

Cd22 Compressor State

Cd22 displays the status of the compressor as OFF or On.

Cd23 Evaporator Fan State

Cd23 displays the current state of the evaporator fan as OFF, LOW or HIGH.

Cd25 Compressor Run Time Remaining Until Defrost

Cd25 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

Cd26 displays the defrost temperature sensor (DTS) reading.

Cd27 Defrost Interval (Hours or Automatic)

Cd27 controls the Defrost Timer Interval, which is the desired period of time between defrost cycles. The user-selected intervals are 2, 3, 6, 9, 12, 24 Hours, Off, AUTO, AUTO2, or AUTO3. Factory default is “AUTO”. This is the desired period of time between defrost cycles. Factory default is “AUTO”. See **Section 4.3.6** for information on Defrost Interval.

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, the defrost interval will be set to ‘AUTO’.

Unit configuration may be set so the operator is allowed to choose “OFF” as a defrost interval option.

Cd28 Temperature Units (°C or F)

Cd28 determines the temperature units (°C or F) that will be shown on all temperature values. The user selects C or F by selecting function code Cd28 and pressing the ENTER key. The factory default value is Celsius units. This function code will display “-----” if configuration variable Temperature Unit Display is set to F.

Cd29 Failure Action (Mode)

Cd29 controls the shutdown action to take if all of the control sensors are out of range (alarm code AL026) or there is a probe circuit calibration failure (alarm code AL027).

Cd29 has one of four possible actions to select 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)

Cd30 In-Range Tolerance

Cd30 controls the in-range tolerance, which determines the temperature band around the setpoint which will be designated as in-range. If the control temperature is in-range, the green IN-RANGE light is illuminated.

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

In-range tolerance shall be set to +/- 2.0°C upon activation of Dehumidification or Bulb Mode (Cd33, Cd35, Cd48).

When QUEST 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)

Cd31 displays the stagger start offset time, which is the amount of time that the unit will delay at start-up. This allows 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)

Cd32 displays the current limit, which 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, with factory default of 21 amperes.

Cd33 Humidity Setpoint

Cd33 controls dehumidification along with setting the relative humidity value in percent that will trigger dehumidification. Relative humidity is detected with a humidity sensor (HS) and this sensor reading can be viewed at Cd17. There are configuration variables that determine whether dehumidification capabilities are installed.

Cd33 has the following values / settings:

- "XX" - lower humidity setpoint
- "dISbL" - This disables dehumidification entirely; the humidity sensor is removed from the logic. The humidity sensor configuration variable is set to OFF. This is available with software revision 6310 and higher. See the Disabling the Humidity Sensor procedure in **Section 7.23.1** for detail.
- "tESt" - Dehumidification test can be run. Setpoint will be temporarily set to 1%, during the test. After 5 minutes, the normal setpoint is restored.
- "OFF" - Turns off dehumidification
- "XX" - upper humidity setpoint

If Pre-Trip Inspection is initiated, Cd33 will be set to “OFF” automatically.

If unit is configured for Enhanced Bulb Mode Interface to be active, then Cd33 will show instead Cd48 Dehumidification / Bulb Cargo Mode Parameter Selection.

Cd34 Economy Mode (On-Off)

Cd34 displays the current state of the Economy Mode option as “-----”, “On”, or “OFF”.

The unit’s configuration determines whether Economy Mode offered. Economy Mode is a user selectable mode of operation provided for power saving purposes.

Cd35 Bulb Mode

Cd35 displays the current state of the Bulb Mode option as “-----”, “nOr”, or “bULb”.

Bulb Mode is an extension of dehumidification control (Cd33). If the unit configuration variable for dehumidification is set to “OFF,” Cd35 will display “nOr” and the user will be unable to change it. Configuration variable Enable Bulb Mode 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.

If Enhanced Bulb Mode configuration variable is active, then Cd35 will instead show settings for Cd48.

Cd36 Evaporator Fan Speed

Cd36 sets the desired evaporator fan speed for use during the bulb Dehumidification Bulb Mode option.

This code is enabled only if Dehumidification Mode (Cd33) is “On” 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)

Cd37 displays the variable defrost termination thermostat (DTT) setting to be used with the optional Bulb Mode functionality. This item is only displayed if the Bulb Mode option is configured on.

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.

Cd40 Container Identification Number

Cd40 displays the Container ID number. If a valid Container ID exists, the default display for Cd40 will be “XXXXX” where “XXXXX” is the 5th character through the 9th character of the Container ID. Press the ENTER key 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 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.

Cd41 Valve Override

Cd41 is a Service Function. This code is for troubleshooting and allows manual positioning of the economizer solenoid valve (ESV), electronic expansion valve (EEV), and digital unloader valve (DUV).

When C41 is first displayed, the IOE communications/phase sequence detection status is displayed. When the ENTER key is pressed, navigation begins into the menu. Pressing ENTER takes the user down the menu, while pressing the CODE SELECT key goes backwards through the menu.

See **Section 7.18** for detailed information regarding Cd41.

Cd43 XtendFRESH Mode

Cd43 controls the XtendFRESH controlled atmosphere option. This code will display dashes "-----" on an ML5 unit due to XtendFRESH not currently being an option for an ML5 unit.

Cd44 EverFRESH Values

Cd44 displays the following EverFRESH values:

- CO2 setpoint
- CO2 percentage
- O2 setpoint
- O2 percentage
- O2 voltage
- Membrane Pressure Transducer (MPT) pressure.

For detailed procedures and technical information related to EverFRESH controlled atmosphere option, refer to the T-374 EverFRESH manual.

Cd45 Vent Position Sensor (VPS) Position

Cd45 displays positional values for the vent position sensor (VPS). Values are: 0 to 240. If a unit is not configured for a VPS, dashes "-----" will be displayed.

When configured for VPS, Cd45 displays the current VPS position in units of 5 CMH (displayed as "CM") or CFM (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 VPS unless AL50 is active. Cd45 will display for 30 seconds, then time out and return to the normal display mode.

Cd46 Airflow Display Units

Cd46 selects the airflow units to be displayed by Cd45 if configured for Vent Position Sensor (VPS) or Autoslide.

- CF = Cubic Feet per Minute
- CM = Cubic Meters per Hour
- bOth = Displays CF or CM based on the setting of Cd28 (Metric/Imperial) or pressing of the degree C/F key.

Cd47 Variable Economy Temperature Setting

Cd47 controls the Variable Economy Temperature setting. This is applicable when configuration variable Economy Mode is set to 3-cust. Cd47 will show dashes "-----" if 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 three 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 (0.5°C - 4.0°C, default is 3.0°C).

Cd48 Dehumidification / Bulb Cargo Mode Parameter Selection

Cd48 will initially display current Dehumidification Mode; "bUlb" (bulb cargo mode), "dEhUM" (normal dehumidification), or "OFF".

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.

Whenever any pre-trip test is initiated, Dehumidification Mode goes to OFF.

When Dehumidification Mode is OFF:

- Dehumidification control setpoint goes to 0% RH internally but will then initialize to 95% RH when Dehumidification Mode leaves OFF.
- Evaporator speed select goes to Alt for units configured without PWM Compressor Control, Evaporator speed select goes to Hi for units configured with PWM Compressor Control.
- DTT setting goes to 25.6°C or 18.0°C, depending on configuration setting for Enable Low DTT Setting.

When Dehumidification Mode is set to bUlb, DTT setting goes to 18.0°C if it had been set higher.

When Dehumidification Mode is set to dEhUM, DTT setting goes to 25.6°C or 18.0°C, depending on configuration setting for Enable Low DTT Setting.

For units configured without PWM Compressor Control:

- If dehumidification control setpoint is < 65% RH evaporator speed select goes to LO if it had been set to Hi.
- If dehumidification control setpoint is > 64% RH evaporator speed select goes to Alt if it had been set to LO.

For units with configured with PWM Compressor Control:

- When 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.

Cd49 Days Since Last Successful Pre-Trip

Cd49 displays the number of days since the 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 AUTO3 in sequence.

Press the CODE SELECT key to step back through the list and ultimately to exit the Cd49 display.

Cd50 QUEST Enable / Disable

Cd50 enables or disables QUEST Mode, which is a power saving option that reduces energy requirements. Cd50 applies to either QUEST or QUEST II, depending on which option was chosen for the particular unit. QUEST II provides additional savings over QUEST. Configuration variables Quest Enable and Quest/Quest II Selection determine the QUEST option available for the unit.

If the unit is not configured for QUEST Mode, then dashes "-----" will be displayed.

Depending on the fan mode of operation selected, the evaporator fans may be programmed to run at low speed some of the time

Turn On QUEST Mode:

1. Select "On" and press the ENTER key to enable QUEST Mode.

When QUEST Mode is enabled:

- Setpoint is maintained in Perishable Steady State Mode after Perishable Pulldown and QUEST Pulldown are complete. During Perishable Pulldown, supply air temperature is controlled according to the unit's nominal supply air setpoint. During QUEST pulldown, supply air temperature is lowered somewhat relative to the nominal setpoint. Evaporator fans are forced to operate at high speed.
- With QUEST, the compressor cycles on and off according to return air temperature.
- With QUEST II, the compressor and/or the heaters cycle on and off according to return air temperature.
- Dehumidification is not allowed.

QUEST Mode Suspended:

If "On" is selected, QUEST operation may be suspended as indicated by one of the suspension codes listed below. If QUEST is not "OFF" and is not suspended, "On" will be displayed.

- "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

Turn Off QUEST Mode:

1. Select "OFF" and press ENTER to disable QUEST Mode manually.
2. QUEST Mode is turned off automatically when any Trip Start occurs or Pre-Trip test is initiated.

Cd51 Automatic Cold Treatment (ACT) Mode Parameter Selection

Cd51 controls the Automated Cold Treatment (ACT) Mode option, which is a method to simplify the task of completing cold treatment by automating the process of changing the setpoints. Cold treatment is an effective post-harvest method to control Mediterranean and certain other tropical fruit flies.

If the unit is not configured for ACT or a valid probe setup is not detected (minimum of 3 USDA probes configured and detected), ACT can not be enabled. Cd51 will display dashes “-----”.

Cd51 initially displays the countdown timer in days and hours remaining, regardless of whether it is enabled. In the Cd51 menu, pressing the ENTER key will take the interface down into a hierarchy of parameter selections. After the last parameter selection, pressing ENTER will return to “Cd 51”.

Cd51 Parameter Selections:

- “Cd 51” | “X- X” (default “0-0”) || Countdown timer in days, hours
- “ACt” | “On” “OFF” or “----” (default “OFF“) || Enabled or disabled status
- “trEAt” | “X.X°C” (default “0.0°C“) || Cold treatment setpoint edited in increments of 0.1 degrees
- “DAyS” | “X” (default “0”) || 0 to 99 in increments of 1
- “ProbE” | “XXXX” (default “----“) || Probe positions, ex: “1234”
- “SPnEW” | “X.X°C” (default “10.0°C“) || Setpoint after ACT, edited in increments of 0.1 degrees

Turn On ACT:

1. With “ACt” displayed, select “On” and press the ENTER key to enable ACT Mode. See **Section 5.9.4** for detail procedure to set ACT values using Cd51.

While ACT is On:

- The left display will flash “COLd” and the right display will flash “trEAt”, and this will alternate between the unit setpoint and control temperature at 5 second intervals. Once ACT is successful, the cargo setpoint (SPnEW setting) will be displayed in the left display and control temperature in the right display, alternating with "COLd" "Done". This will continue until ACT is turned off.
- ASC (Cd53) is disabled. ACT and ASC can not be enabled simultaneously.
- Setpoint change via the keypad is disabled.
- QUEST Mode is suspended but QUEST II can still operate.

ACT Complete:

When ACT has completed, including reaching the new setpoint, the 2nd selection in the Cd51 menu will display “done” on the left display and the MONTH DAY of completion on the right. Turning ACT off clears this entry and also resets Cd51 to initial time remaining. ACT must then be turned on to view or modify the additional parameters.

Turn Off ACT:

1. Select “OFF” and press the ENTER key to disable ACT Mode manually.
2. ACT Mode is turned off automatically when any Auto Pre-Trip test or Trip Start is initiated.

Cd53 Automatic Setpoint Change (ASC) Mode Parameter Selection

Cd53 controls the Automated Setpoint Change (ASC) Mode option, which allows up to 6 setpoint changes to be pre-programmed over defined periods. If the unit is not configured for ASC, then this will not be allowed and Cd53 will display dashes “-----”.

Cd53 initially displays the countdown timer in days and hours remaining in the right display, regardless of whether it is enabled. In the Cd53 menu, pressing the ENTER key takes the interface down into a hierarchy of parameter selections. After the last parameter selection, pressing the ENTER key will return to “Cd 53”.

Cd53 Parameter Selections:

- “Cd 53” | “X- X” (default “0-0”) || Countdown timer in days, hours
- “ASC” | “On” “OFF” or “----” (default “OFF“) || Enabled or disabled status
- “nSC” | “X” (default “1“) || Number of setpoint changes, select from 1 to 6
- “SP X” | “XX.X°C” (default “0.0°C”) || Setpoint edited in increments of 0.1 degrees
- “DAY (nSC-1)” | “X” (default “1“) || 1 to 99 in increments of 1
- “SP (nSC)” | “X.X°C” (default “10.0°C“) || Setpoint after ACT, edited in increments of 0.1 degrees.

Turn On ASC:

1. With “ASC” displayed, select “On” and press the ENTER key to enable ASC Mode. See **Section 5.9.5** for detail procedure to set ASC values using Cd53.

While ASC is On:

- The left display will alternate between current unit setpoint and “ASC”. The right display will alternate between current control temperature and “ACtiV”.
- ACT (Cd51) is disabled. ASC and ACT can not be enabled simultaneously.
- QUEST Mode is suspended but QUEST II can still operate

ASC Complete:

At completion of 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 “Done”. The display will remain this way until ASC is turned off. With ASC complete, the second entry in the Cd53 menu will show “done” in the left display, and the Month / Day of completion in the right display.

Turn Off ASC:

1. Select “OFF” and press the ENTER key to disable ASC Mode manually.
2. ASC Mode is turned Off automatically when any Auto Pre-Trip test or Trip Start is initiated.

Cd54 Suction Port Superheat / Electronic Expansion Valve Status

Cd54 displays the reading for evaporator superheat (suction temperature minus suction saturation temperature as calculated from suction pressure) in the right display.

Press the ENTER key at Cd54 to show the reading for EEV position (%) in the left display.

Cd55 Discharge Superheat

Cd55 displays 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.

If this selection is not valid, dashes “-----” will be displayed.

Cd56 Enable Comms Mode

Cd56 is only active for specific model number units that disable access to the USB port or Rear Interrogation port. Cd56 will allow access to these ports for a period of one hour.

For all other model number units that allow access to the USB and Rear Interrogation ports, Cd56 will display dashes “-----”.

An event will be posted when Comms Mode is turned On or Off.

Turn On Comms Mode:

1. With “CPort” displayed, use the Arrow keys to select “On” and press the ENTER key.

While Comms Mode is On:

- A 60 minute timer will start. During this time the user will have access to the USB and Rear Interrogation port for 60 minutes.
- The display will toggle between setpoint \ active control temperature and Cd56 “CPort ON”.

Turn Off Comms Mode:

1. With “CPort” displayed, use the Arrow keys to select “OFF” and press the ENTER key.
2. Comms Mode will be turned off automatically if the timer expires or if the unit is power cycled.

While Comms Mode is Off:

- Access to the USB and Rear Interrogation ports is disabled.
- The display will show “CPort Off” when the user selects USB in the Alt menu.
- The display reverts back to the default display.

Cd58 Water Pressure Switch State / Override Logic State

Cd58 displays “CLOSE” if the water pressure switch (WPS) contacts are closed or if these options are not installed. “OPEn” is displayed when the WPS contacts are open. When the WPS Override Logic is “TRUE”, the right display will flash.

NOTE: The CLOSE / OPEn state displayed in this code select only applies to units that have the optional water-cooled condenser with a WPS.

NOTE: The ability of the WPS 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 wired in series with the fan contactor. Units wired in this configuration can indicate that the WPS Override Logic is active by flashing the right display, however, the wiring will not allow for control of the condenser fan.

Cd59 Pump Down Logic

Cd59 allows operation of pump down logic control. After pressing the ENTER key at Cd59, the display will flash between “STArT” | “P dN” and “PrESS” | “EnTEr”. Press ENTER to confirm the decision for pump down logic to begin. The logic will take complete control of the unit until pump down either succeeds or fails.

After logic has been initiated, the compressor is forced off and a 5 minute timer is started. The display will flash the messages “CLOSE” | “LLV” and “PrESS” | “EnTEr”. This is a notification to close the liquid line valve (LLV) within the 5 minute time period. Once the LLV is confirmed closed, press ENTER.

The display will now read “P dN” to the left, with the current suction pressure to the right. The digital unloader valve (DUV) is locked closed and the economizer solenoid valve (ESV) open and the unit setpoint changed to -22F (for remainder of pump down) which turns the compressor On.

The pump down will complete when the unit has reached a suction pressure < 1 psig for 10 consecutive seconds. If the pump down logic completes within 25 minutes, the compressor will turn off and the display will flash between "CLOSE” | “DSV" and "PrESS” | “EnTEr". At this time, another 5 minute timer will be started. This is a notification to close the discharge service valve (DSV) within the 5 minute time period. Once the DSV is confirmed closed, press ENTER.

The unit will turn itself off and the display will notify the operator that pump down is complete by flashing messages “P dN” | “DOnE” and “SHUT” | “OFF”. The operator must then shut off the unit.

If the ENTER key is not pressed to confirm the DSV is closed within the 5 minute time period, the unit will check the current suction pressure. If the suction pressure is > 1 psig, the unit will return to pump down operation. If the suction pressure < 1 psig the unit will repeat and restart the 5 minute timer and instruct on the display to close the DSV. This will repeat until the DSV is confirmed closed with the ENTER key.

If the automatic pump down logic does not complete within 25 minutes, the unit will move to all machinery off status.

<u>Aborting Automatic Pump Down</u>:

After logic has been initiated, the compressor is forced off and a 5 minute timer is started. The display will flash between “CLOSE” | “LLV” and “PrESS” | “EnTEr”. During this time, the arrow keys can be pressed to switch the display message to “AborT” | “P dN” and “PrESS” | “EnTEr”. By pressing the ENTER key, power down is aborted and “P dN” | “AbrTd” flashes on the display for 5 seconds.

If the ENTER key has not been pressed to confirm that the LLV is closed within the 5 minute timer, “P dN” | “AbrTd” and “PrESS” | “EnTEr” are displayed until the operator presses any key.

NOTE: If pump down is aborted in either situation, the compressor is allowed On and the unit returns to its previous operating state.

Cd62 High Speed Evaporator Fan Setting

Cd62 allows the evaporator fan speed to be forced to high while temperature control is being performed in the perishable setpoint range. When set to “On”, evaporator fans operate in high speed regardless of any other active option that can control evaporator fan speed.

Following a power cycle, the state of the function select code is retained at its state prior to the power cycle. If “On”, this function select code will be set to “OFF” when any Trip Start occurs or any pre-trip test is initiated.

Cd63 FuelWise

Cd63 controls FuelWise Mode, which is an option that saves energy while operating in the perishable setpoint range. When operating in the frozen setpoint range, Frozen Economy Mode complements FuelWise.

NOTE: FuelWise was previously referred to as Enhanced Economy Mode.

If the unit is not configured for FuelWise, then this will not be allowed and Cd63 will display dashes "-----".

Following a power cycle, the state of the function select code is retained at its state prior to the power cycle if configuration variable for FuelWise Mode is set to Default ON else if set to Default OFF this will be set to OFF.

Turn On FuelWise:

1. Select "On" and press the ENTER key to enable FuelWise Mode.

Turn Off FuelWise:

1. Select "OFF" and press ENTER to disable FuelWise Mode manually.
2. FuelWise Mode is turned off automatically when any Trip Start occurs or Pre-Trip test is initiated.

Cd64 Alternate Compressor Selection PrimeLINE Edge

Cd64 allows a standard PrimeLine compressor to be installed in a PrimeLine with EDGE model number unit. This is necessary if an Edge compressor is not available to be re-installed in a unit.

When "Std" is selected The Minimum allowable capacity ratio will be set to 10%, Standard PrimeLine current limiting logic will be utilized, the original PrimeLine P6-7 test will be used during PreTrip, and the DLV will remain de-energized.

"-----" will be displayed if the unit is not a PrimeLINE EDGE unit (571-3xx models).

Cd65 TripWise

Cd65 controls TripWise Mode, which is an option that can run software logic to check whether a standard Pre-trip Inspection (PTI) is needed and skip unless necessary.

If the unit is not configured for TripWise, then this will not be allowed and Cd65 will display dashes "-----".

A TripWise event is logged when TripWise is enabled, disabled or status is logged.

Components Checked During TripWise:

- Alarm Presence, RMU Presence, Compressor Test, Temperature Control, Compressor Current, Condenser Motor Current, Evaporator Motor Current, Heater Current
- Defrost Temperature Sensor (DTS), Evaporator Pressure Transducer (EPT), evaporator temperature sensor (ETS), Humidity Sensor (HS), Return Sensors (RRS / RTS), Supply Sensors (SRS / STS), Suction Pressure Transducer (SPT), Discharge Pressure Transducer (DPT), Discharge Temperature Sensor (CPDS)
- Electronic Expansion Valve (EEV), Economizer Expansion Valve (EXV), Digital Unloader Valve (DUV)

Turn On TripWise:

1. Select "On" and press the ENTER key to enable TripWise Mode. See **Section 5.9.3** for detail procedure to set TripWise values using Cd65.

Turn Off TripWise:

1. Select "OFF" and press the ENTER key to disable TripWise Mode manually.

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.

Cd66 Instantaneous Power (kW)

Cd66 displays real power (in kW) currently being used by the system.

Cd67 Energy (kW-hr)

Cd67 displays energy used by the system, in kW-hrs, since the last Trip Start.

Cd70 Temperature Setpoint Lock

Cd70 enables or disables the Temperature Setpoint Lock feature. When set to “On”, this will prevent setpoint change from the keypad. The default setting is “OFF”. An event will be recorded in the DataCorder each time an action is taken at Cd70.

Turn On Setpoint Lock:

1. Press the ENTER key. Use the Arrow keys to select “On” and press ENTER to confirm.

If Cd70 is set to “On” and a setpoint change is attempted with the keypad, “SPLk” | “On” is displayed for five seconds to show that setpoint lock is turned On.

Turn Off Setpoint Lock:

1. Press the ENTER key. Use the Arrow keys to select “OFF” and press ENTER to confirm.
2. Cd70 will automatically be set to “OFF” with the selection of PTI or a TripStart on the unit.

Cd71 EverFRESH Mode

Cd71 controls the EverFRESH controlled atmosphere option. If a unit does not have the EverFRESH option, or if a temperature setpoint below -1°C (30.2°F) is selected, dashes “-----” will be displayed and this menu will not be accessible.

Cd71 contains three selectable modes of operation:

- “FrESh” - All EverFRESH operations are enabled and setpoints for CO2 and O2 can be edited.
- “OFF” - All EverFRESH operations are disabled.
- “PUrgE” - EverFRESH operations are suspended while pre-charging gas levels in the container. All EverFRESH control actions and alarm 929 is suspended in order to purge the container to a desired gas concentration.

When Fresh Mode is active, the display will toggle between the message “FrESH” | “ACtiV” and the setpoint (left) with supply or return temperature (right).

When Purge Mode is active, the display will toggle between the message “PUrgE” | “XX” (time remaining) and the setpoint (left) with supply or return temperature (right).

See **Section 5.9.7** for enabling or disabling EverFRESH modes.

Detailed procedures and technical information related to the EverFRESH controlled atmosphere system can be found in the **T-374 EverFRESH Manual**. This can be found in the ContainerLINK™ app or from the Literature section of the Container Refrigeration website.

NOTE: If EverFRESH is installed and Cd71 is OFF, the CO2 and O2 readings will display as OFF in the data download.

Cd72 Air Compressor Hours Since Last Service

Cd72 displays the total hours of air compressor run time since last service. When the timer exceeds 5000 hours since last reset, the display will cycle the message “CA” “ChECk” until the timer is reset again. If a unit does not have the EverFRESH option, Cd72 displays dashes “-----”.

Press the ENTER key at “Cd 72” “ACHrS” to enter the menu with the following selections in the right display:

- “####” - Number of hours of air compressor run time since service.
- “rESEt” - Prompt to reset the hours. Press the ENTER key for five seconds to reset the counter to 0.

Cd73 Air Compressor Total Operational Hours

Cd73 displays the total number of operational hours for the EverFRESH system and air compressor. The total hours are displayed in increments in 10 hours (i.e. 3000 hours will be displayed as 300). If a unit does not have the EverFRESH option, Cd73 displays dashes “-----”.

Press the ENTER key at “Cd 73” “ACHrS” to enter the menu with the following selections in the right display:

- “####” - Number of hours of total air compressor run time.
- “rESEt” - Prompt to reset the hours. Press the ENTER key for five seconds to reset the counter to 0.

Cd74 Controller Diagnostic

Cd74 is for running a Controller Self Diagnostic test. After selecting CD74, press the ENTER key while “tESt” is displayed to run the 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.

Four Test Result Messages are possible:

- "PASS" - all power sources present and at the correct level, no input faults, and all output tests pass.
- "FAIL0" - a power source is not available or not at the correct level.
- "FAIL1" - all power sources present and at the correct level, but there is an input fault.
- "FAIL2" - all power sources present and at the correct level, there are no input faults, but an output test fails.

Cd75 Pharma Mode

Cd75 controls the Pharma Mode option, which allows cargoes to be maintained at temperature setpoints of either 5°C (41°F) or 20°C (68°F), while maintaining lower humidity levels.

Pharma Mode is an available option for units that have installed software versions 6318 or higher and a humidity sensor that has not been disabled. If not available, Cd75 will show dashes “-----”.

Turn On Pharma Mode:

1. Select “On” and press the ENTER key. Use the Arrow keys to choose your selected setpoint of “05” or “20” and then press ENTER to confirm.

While Pharma Mode is On:

- The left display toggles between Pharma setpoint and "PhArM". The right display shows the return temperature sensor (RTS) reading.
- The controller maintains return air temperature at setpoint, the yellow RETURN indicator light is illuminated.
- The unit operates in a normal perishable mode, while disabling any power saving features such as QUEST, etc.
- Keypad entries such as MANUAL DEFROST, PRE-TRIP and setpoint temperature change are locked out. If setpoint temperature change is attempted, then display will show "SpLK” | “On".
- Function codes related to operating modes are disabled and show dashes "-----" (Cd33, Cd34, Cd35, Cd36, Cd37, Cd41, Cd48 Cd50, Cd51, Cd53 Cd63, Cd65).

Turn Off Pharma Mode:

1. To disable Pharma Mode manually, use the Arrow keys to select “OFF” and press ENTER to confirm.

Cd76 CO2 Injection Mode

Cd76 enables or disables CO2 Injection Mode. This is an option to EverFRESH controlled atmosphere system that allows CO2 to be actively injected into the cargo space during transport. If a unit does not have EverFRESH, or if EverFRESH is installed but Cd71 EverFRESH Mode is not set to FrESh, dashes “-----” will be displayed.

Cd76 contains two selectable modes of operation along with disabling (OFF):

- “A-CO2” - CO2 injection enabled with A-CO2 logic.
- “PrCON” - CO2 injection enabled with PrCON logic.
- “OFF” - CO2 injection is disabled.

When A-CO2 Mode is active, the display will toggle between the message “FrESH” | “A-CO2” and the setpoint (left) with supply or return temperature (right).

When PrCON Mode is active, the display will toggle between the message “FrESH” | “PrCON” and the setpoint (left) with supply or return temperature (right).

Detailed procedures and technical information related to the EverFRESH controlled atmosphere system can be found in the **T-374 EverFRESH Manual**. This can be found in the ContainerLINK™ app or from the Literature section of the Container Refrigeration website.

Cd77 Baudrate Selection

Cd77 displays the communication baud rate data transfer speed via RMU port between telematics and the ML5 controller. The default is set to 9600.

Cd78 EverFRESH Air Compressor State

Cd78 displays the state of the EverFRESH Air Compressor as On or OFF. If a unit does not have the EverFRESH option, dashes “-----” will be displayed. This code has no sub menu.

Cd79 EverFRESH Water Drain Valve (WDV) State

Cd79 displays the state of the EverFRESH Water Drain Valve (WDV) as On or OFF. If a unit does not have the EverFRESH option, dashes “-----” will be displayed. This code has no sub menu.

Cd80 EverFRESH Air Valve (EAV) State

Cd80 displays the state of the EverFRESH Air Valve (EAV) as On or OFF. If a unit does not have the EverFRESH option, dashes “-----” will be displayed. This code has no sub menu.

Cd81 EverFRESH CO2 Valve State

Cd81 displays the state of the EverFRESH CO2 Valve as On or OFF. If a unit does not have the EverFRESH option, dashes “-----” will be displayed. This code has no sub menu.

Cd82 Condenser Fan State

Cd82 displays the state of the condenser fan as On or OFF. This code has no sub menu.

4.3 Modes of Operation

General operation sequences for cooling, heating and defrost are provided in the following sub-sections. Operational software responds to various inputs. These inputs come from the temperature sensors and pressure transducers, the temperature setpoint, configuration variables settings and 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

4.3.1.1 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.

4.3.1.2 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.

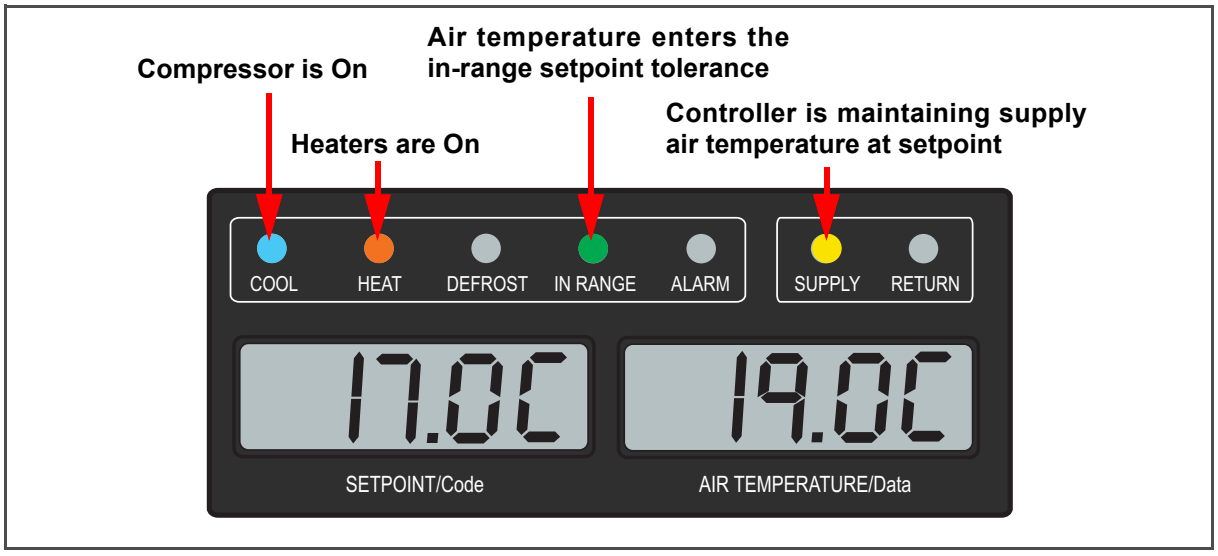
4.3.2 Perishable Mode Temperature Control

Perishable Mode is active with any perishable setpoint entered on the unit display that is above either -10°C (+14°F) or -5°C (+23°F). This is dependent on the setting in the Heat Lockout Temperature configuration variable. In Perishable Mode, the controller maintains the supply air temperature at setpoint, based on readings from the supply temperature sensor (STS). If the STS fails, the supply recorder sensor (SRS) serves as the controlling sensor. See **Section 3.7.1** for location of the supply air temperature sensors.

The unit display window and indicator lights react to Perishable Mode as follows. This is shown in **Figure 4.3**.

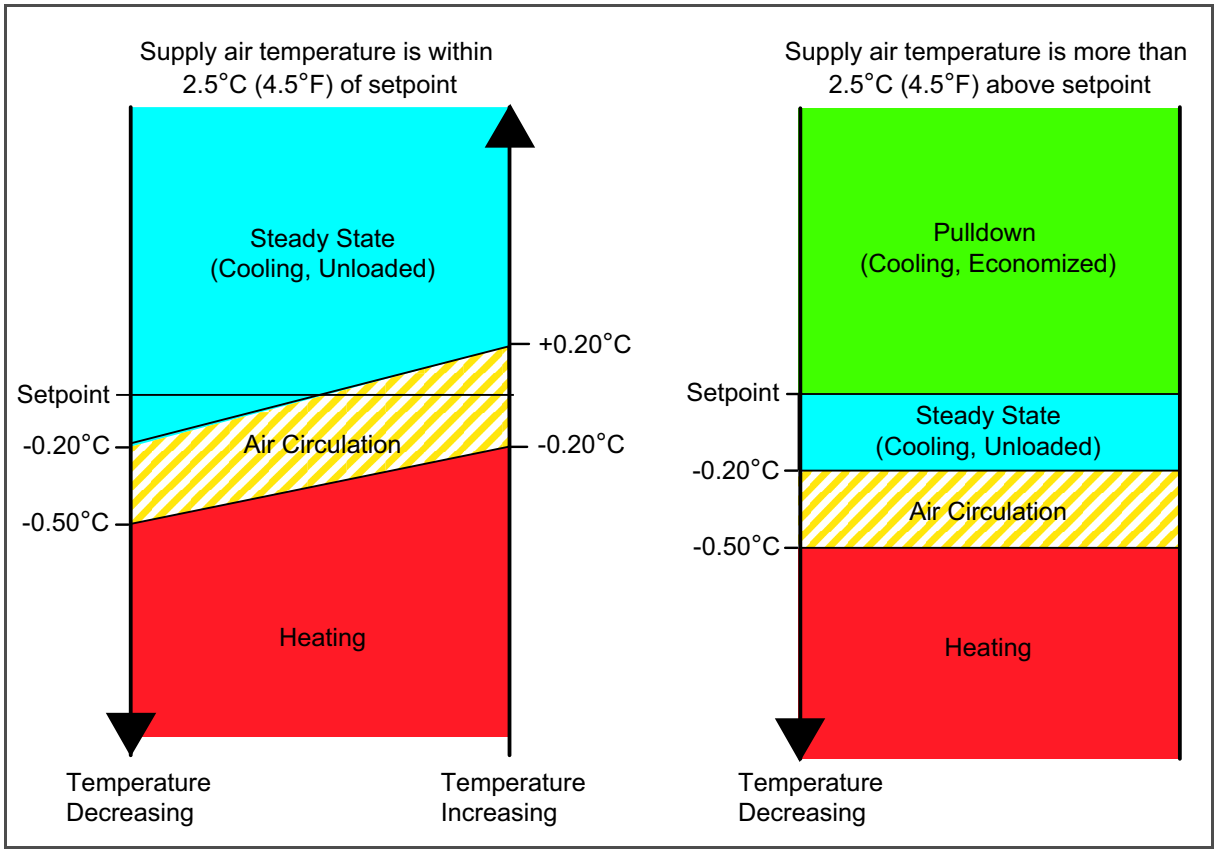
- The reading in the right display window is the reading from the supply air temperature sensor.
- The yellow SUPPLY indicator light illuminates to show that supply air temperature is controlling.
- The green IN-RANGE light illuminates when supply air temperature enters the in-range temperature tolerance (set at Cd30). This is the temperature band around the setpoint which is designated as in-range.
- The blue COOL light illuminates to show that the compressor is on.
- The orange HEAT light illuminates to show that the heaters are on.

Figure 4.3 Perishable Mode - Display and Indicator Lights



The Perishable Modes of operation are described in the following paragraphs. **Figure 4.4** is provided below to illustrate the perishable modes after a setpoint is selected on the unit display.

Figure 4.4 Perishable Mode - Setpoint Temperature Control



4.3.2.1 Perishable Pulldown

Perishable Pulldown Mode is only enabled if supply air temperature is greater than 2.5°C (4.5°F) above setpoint. The highest priority is given to bringing the container down to setpoint. The unit will cool with the compressor on, condenser fan on and the evaporator fans on and at high speed. The heaters are off. The controller will activate economized operation if it has the capability and does not exceed current or discharge pressure limits.

As supply air temperature reaches setpoint, the mode changes to Perishable Steady State Mode.

4.3.2.2 Perishable Steady State

Perishable Steady State Mode is enabled when:

- Supply air temperature is higher than setpoint but within 2.5°C (4.5°F) of setpoint.
- Supply air temperature rises +0.2°C (0.4°F) above setpoint.
- The unit was in Perishable Pulldown Mode and supply air temperature has been brought down to setpoint, so full capacity is no longer needed.

During Perishable Steady State Mode, unloaded cooling operation is activated. The controller energizes the Digital Unloader Valve (DUV) to limit capacity and maintain steady temperature control. The compressor is on and the evaporator fans are on and at high speed. The heaters are off. The unit is capable of maintaining supply air temperature to within +/- 0.2°C (+/- 0.36°F) of setpoint.

4.3.2.3 Perishable Idle / Air Circulation

The unit enters Perishable Idle Mode when the compressor is not necessary to maintain control temperature. The controller has determined that cooling is not required or the controller logic determines suction pressure is at the low pressure limit. The compressor is off but evaporator fans remain on 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.

4.3.2.4 Perishable Heating

The unit will transition to Perishable Heating Mode if the temperature drops to 0.5°C (0.9°F) below setpoint. The heaters are turned on. The evaporator fans remain on and at high speed to circulate air.

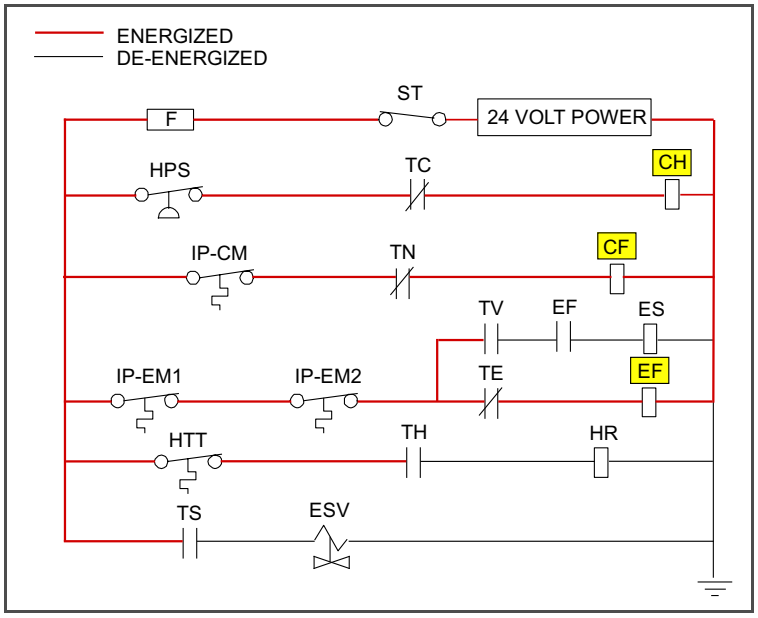
When the temperature rises to 0.2°C (0.4°F) below the setpoint, the unit will transition back to Perishable Idle Mode, and the heaters will turn off. The evaporator fans remain on to circulate air.

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. This is referred to as Trim Heat.

4.3.2.5 Perishable Mode Cooling - Sequence of Operation

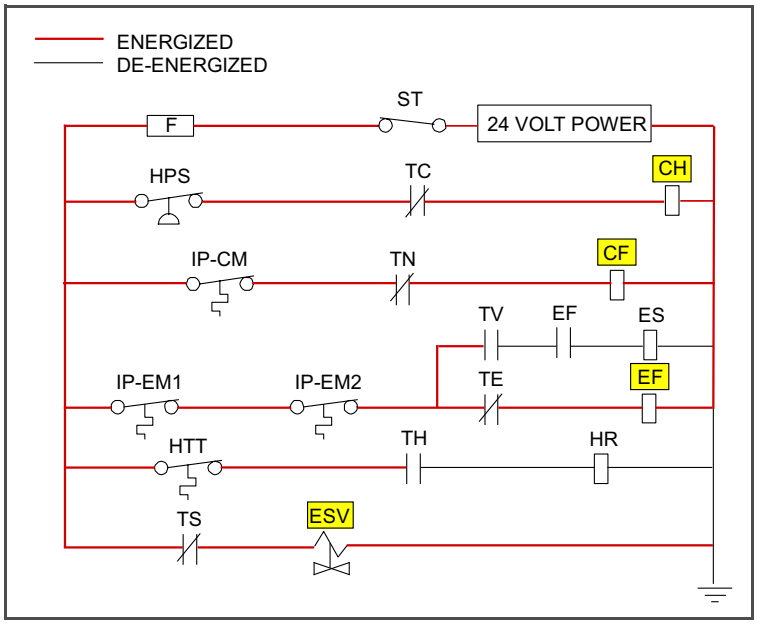
a. When supply air temperature is above setpoint and decreasing, the unit will cool with the compressor motor (CH), condenser fan motor (CF) and evaporator fan motors (EF) energized. See **Figure 4.5**.

Figure 4.5 Perishable Cooling Schematic - CH, CF, EF Energized



b. 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. See **Figure 4.6**.

Figure 4.6 Perishable Cooling Schematic - ESV Open, Economized Mode



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

d. As air temperature continues to fall, unloaded cooling starts (DUV pulses opens) as the supply air temperature approaches setpoint. 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.

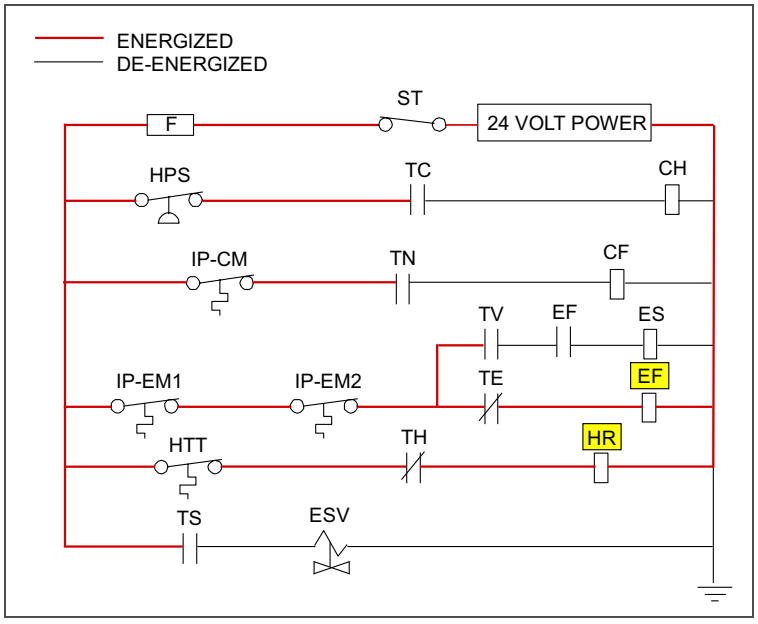
i. If the average system capacity has risen to 100% during unloaded cooling and three minutes off time has elapsed, relay TS will energize to open the ESV, placing the unit in economized mode.

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.

4.3.2.6 Perishable Mode Heating - Sequence of Operation

a. If the supply air temperature decreases 0.5°C (0.9°F) below setpoint, the system enters Heating Mode. The controller closes contacts TH to allow power flow through the heat termination thermostat (HTT) to energize the heaters (HR). The evaporator fans remain On to circulate air throughout the container. See **Figure 4.7**.

Figure 4.7 Perishable Heating Schematic - HR, EF Energized



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 evaporator fans remain On 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.

4.3.3 Perishable Mode - Modes and Options

While Perishable Mode is active, there are several additional modes and options available. These are selectable from various function codes on the unit display.

4.3.3.1 Perishable Dehumidification

Perishable Dehumidification is provided to reduce the humidity levels inside the container. This mode is active if the humidity in the container is above the humidity setpoint set at code Cd33 and dehumidification is not OFF or disabled (dISbL) in Cd33.

The yellow SUPPLY LED will flash ON and OFF every second to indicate that Dehumidification is active. Once active, the controller will activate the heat relay to begin Dehumidification if the following conditions are satisfied:

- The humidity sensor (HS) reading is within setpoint range.
- Perishable Steady State Mode is active and supply air temperature is less than 0.25°C (0.45°F) above setpoint.
- The heater debounce timer (three minutes) has not timed out.
- 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 4.3.3.2**, 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:

- 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.
- 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.

4.3.3.2 Perishable Dehumidification - Bulb Mode

Bulb Mode is an extension of Perishable Dehumidification which allows changes to the evaporator fan speed and/or defrost termination setpoints. Bulb Mode is active when code Cd35 is set to “Bulb.” When Bulb Mode is active, changes can be made to the evaporator fan speed using code Cd36. Default fan operation is for fan speed to alternate from low to high each hour, but this can be changed with Cd36 to constant low or constant high speed.

In addition, if Bulb Mode is active, code Cd37 may be set to override the previous Defrost Termination Thermostat (DTT) settings.

Bulb Mode is terminated when:

- Bulb Mode function code Cd35 is set to “Nor.”
- Dehumidification function code Cd33 is set to “Off.”
- The unit setpoint is changed to a frozen setpoint.

When Bulb Mode is disabled by any of the above conditions, evaporator fan operation in code Cd36 reverts to “alt” and the DTT setting in code Cd37 resets to the value determined by the Enable Low DTT Setting configuration variable.

4.3.3.3 Perishable Economy Mode

Perishable Economy Mode is an extension of Perishable Mode. This mode is a power saving option that is active when code Cd34 is set to ON. This mode is helpful for the transportation of temperature-tolerant cargo or non-respiration items which do not require high airflow for removing respiration heat.

When 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 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 continue to run in low speed for one hour.

d. At the end of the hour, the fans switch back to high speed and the cycle will be repeated.

If Bulb Mode is active, Perishable Economy Mode will be overridden.

4.3.3.4 QUEST or QUEST II Mode

QUEST is a power saving option that reduces energy requirements. Quest is a method of temperature control used during Perishable Steady State cooling that cycles the compressor on and off according to return air temperature. Code Cd50 enables/disables QUEST or QUEST II (additional savings over QUEST), depending on which option was chosen for the particular unit. Configuration variables for QUEST enable and QUEST/QUEST II selection determine the QUEST option available for the unit. See code Cd50 description for details.

4.3.3.5 Automatic Cold Treatment (ACT) Mode

Automated Cold Treatment (ACT) Mode option is a method to simplify the task of completing cold treatment by automating the process of changing the setpoints. Cold treatment is an effective post-harvest method to control Mediterranean and certain other tropical fruit flies. This is controlled with code Cd51. See code Cd51 description for details.

4.3.3.6 Automatic Setpoint Change (ASC) Mode

Automated Setpoint Change (ACT) Mode option allows up to 6 setpoint changes to be pre-programmed over defined periods. This is controlled with code Cd53. See code Cd53 description for details.

4.3.3.7 FuelWise Mode

FuelWise Mode is an option that saves energy while operating in the perishable setpoint range. This is enabled/disabled with code Cd63. See code Cd63 description for details.

4.3.3.8 TripWise

TripWise is an option that can run software logic to check whether a standard Pre-trip Inspection (PTI) is needed and skip unless necessary. TripWise is enable/disabled with code Cd65. See code Cd65 description for details.

4.3.3.9 EverFRESH Controlled Atmosphere

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. EverFRESH can be controlled with code Cd71.

Refer to the **T-374 EverFRESH Manual** for detailed procedures and technical information related to the EverFRESH controlled atmosphere system. The manual is located in the Literature section of the Container Refrigeration website. To find the manual from the Literature section, click on Options > EverFRESH.

4.3.3.10 Pharma Mode

Pharma Mode option (ML3 only for now) allows cargoes to be maintained at temperature setpoints of either 5°C (41°F) or 20°C (68°F), while maintaining lower humidity levels. Pharma Mode is active when a unit is equipped with a humidity sensor, code Cd75 is set to ON and a temperature setpoint has been chosen at Cd75. See code Cd75 description for details.

4.3.4 Frozen Mode Temperature Control

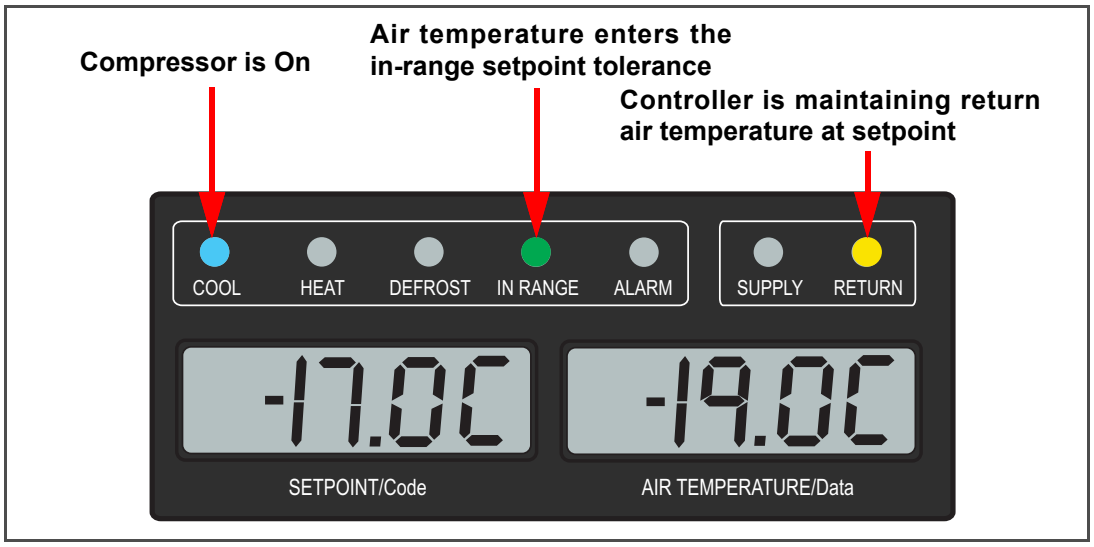
Frozen Mode is active with any setpoint entered on the unit display that is below either -10°C (+14°F) or -5°C (+23°F). This is dependent on the setting chosen in the Heat Lockout Temperature configuration variable.

In Frozen Mode, the controller maintains the return air temperature at setpoint, based on readings from the return temperature sensor (RTS). If the RTS fails, the return recorder sensor (RRS) serves as the controlling sensor. See **Section 3.7.2** for location of the return air temperature sensors. The highest priority is given to bringing the container down to setpoint. The system will remain in economized operation.

The unit display window and indicator lights react to Frozen Mode as follows. This is shown in **Figure 4.8**.

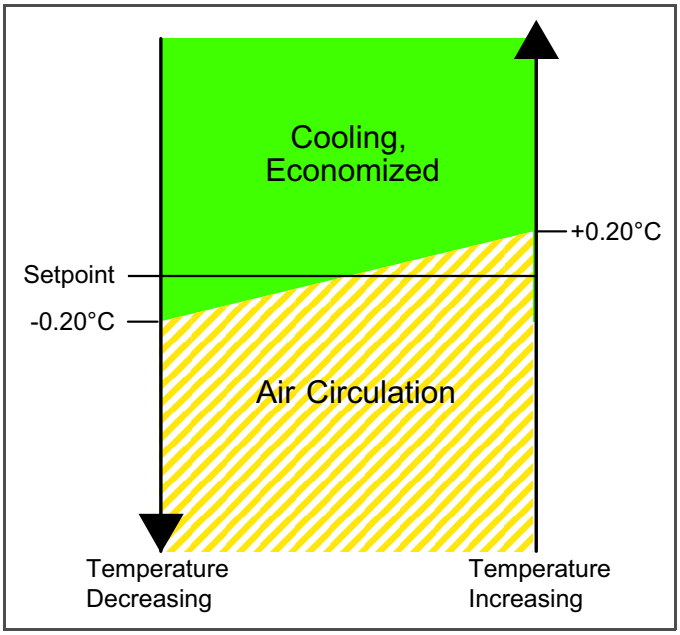
- The reading in the right display window is the reading from the return air temperature sensor.
- The yellow RETURN indicator light illuminates to show that return air temperature is controlling.
- The green IN-RANGE light illuminates when return air temperature enters the in-range temperature tolerance (set at Cd30). This is the temperature band around the setpoint which is designated as in-range.
- The blue COOL light illuminates to show that the compressor is on.

Figure 4.8 Frozen Mode - Display and Indicator Lights



The Frozen Modes of operation are described in the following paragraphs. **Figure 4.9** is provided below to illustrate the perishable modes after a setpoint is selected on the unit display.

Figure 4.9 Frozen Mode - Setpoint Temperature Control



4.3.4.1 Frozen Pulldown Mode

When the return air temperature is above setpoint and decreasing, the unit will transition to Frozen Economized cooling. The unit will cool with the condenser fan, compressor, economizer solenoid valve (ESV) and low speed evaporator fans. The COOL light is illuminated.

4.3.4.2 Frozen Steady State Mode

Once the frozen setpoint is reached, the unit will transition to Frozen Steady State Mode, economized cooling.

4.3.4.3 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.

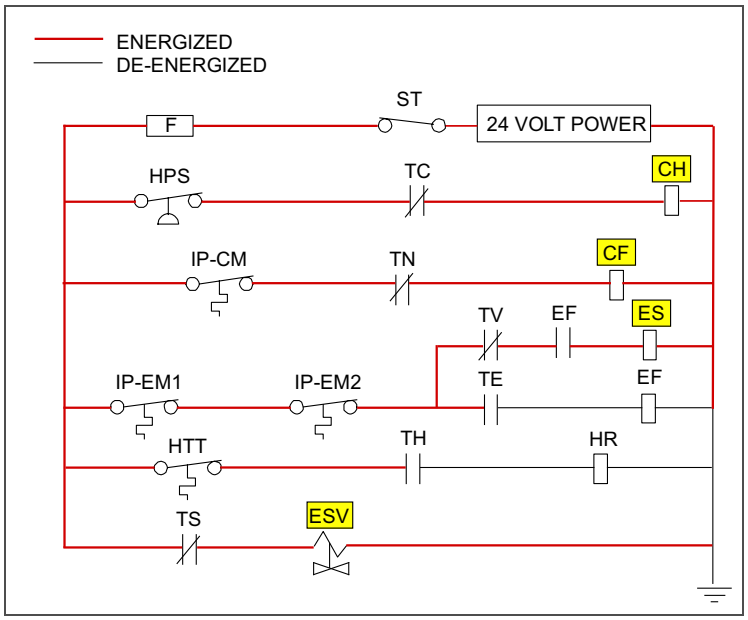
4.3.4.4 Frozen "Heat" Mode

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.

4.3.4.5 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) and low speed evaporator fan motors (ES) energized. See **Figure 4.10**.

Figure 4.10 Frozen Mode Schematic



b. When supply air temperature decreases to a predetermined tolerance above setpoint (set at Cd30), 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 (ESV) and condenser fan motor. 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.

4.3.5 Frozen Mode - Modes and Options

While Frozen Mode is active, there are several additional modes and options available. These are selectable from various function codes on the unit display.

4.3.5.1 Frozen Economy Mode

Frozen Economy Mode complements FuelWise and provides additional energy savings while operating in the frozen setpoint range. This mode is a power saving option that is active when Cd34 is set to ON. The Economy Mode configuration variable determines whether this mode is offered.

Frozen Economy Mode is active if the following conditions exist:

- Setpoint is below -15C
- Defrost mode (Cd27) is not set to AUTO 3.
- QUEST (Cd50) is set to On. And QUEST II is configured in

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 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.

4.3.6 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. For more information on Probe Diagnostics, see **Section 5.8**.
- Snap Freeze allows the system to cool for a period of time after de-icing, with the evaporator fans turned off and is only carried out if configured by model number. Snap-Freeze allows for the removal of latent de-icing heat from the evaporator coils, and freezes any remaining moisture that might otherwise be blown into the container.

4.3.7 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 2, 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. The internal adjusts on the next defrost based on ice accumulation 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.

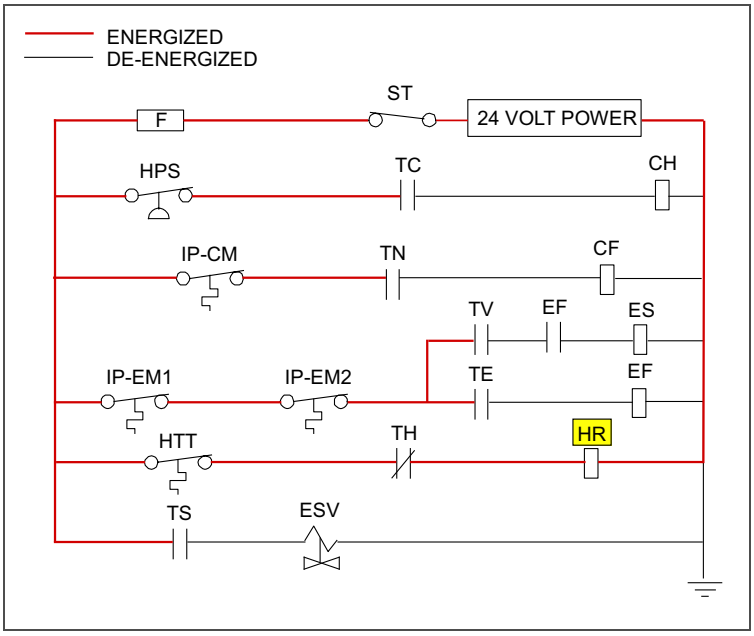
b. After a new Defrost Interval is selected, the previously selected Interval is used until the next defrost termination, the next time the DTS contacts are OPEN, or the next time power to the control is interrupted. If the previous value or the new value is “OFF”, the newly selected value will be used 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 Mode - Delta T increases to greater than 12°C, and 90 minutes of compressor run time have been recorded.
   b. In Perishable Steady State Mode - 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.

4.3.7.1 Defrost Sequence of Operations

a. 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. See **Figure 4.11** for schematic.

Figure 4.11 Defrost Schematic



b. 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.

4.3.8 Defrost Related Settings

4.3.8.1 Defrost Temperature Sensor (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 terminates after 2 hours of operation.

4.3.8.2 Defrost Timer

If the Enable Defrost Interval Save configuration variable 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 the Defrost “OFF” Selection configuration variable 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.

4.3.9 Protection Modes of Operation

4.3.9.1 Evaporator Fan Operation

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

4.3.9.2 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 a full system shutdown.

4.3.9.3 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.

4.3.9.4 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.

4.3.9.5 Compressor Low Pressure Protection

If the suction pressure low limit is triggered, the digital unloader valve (DUV) energizes to raise the suction pressure.

4.3.9.6 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.

4.3.9.7 Condenser Fan Override

When the Discharge Temperature Sensor configuration variable is set to “In” and Condenser Fan Switch Override variable 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.

4.4 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. The alarm action taken when an error is detected always considers the survival of the cargo. Rechecks are made to confirm that an error actually exists.

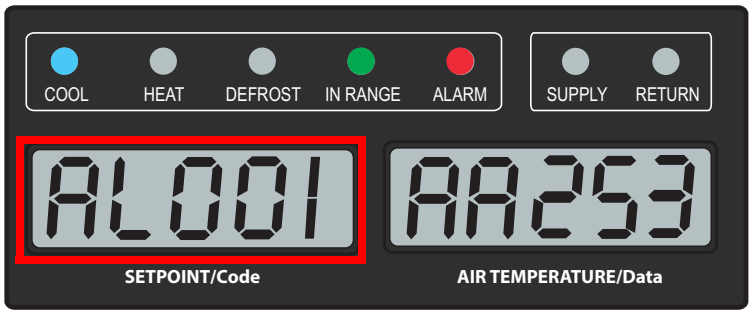
Some alarms requiring compressor shutdown have time delays before and after to try to keep the compressor on line. An example is alarm code “LO,” (low main voltage), when a voltage drop of over 25% occurs, an indication is given on the display, but the unit will continue to run.

A summary of alarms is provided in **Table 4–4**, and completed descriptions are detailed in **Section 4.4.2**.

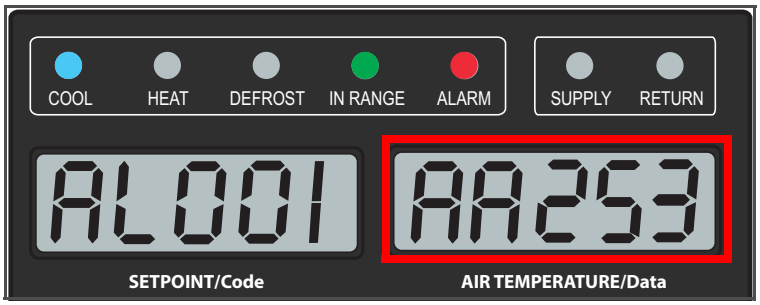
NOTE: AL026 is active when none of the sensors are responding. Check the ME connector on the front of the controller. If it is loose or unplugged, reconnect it, then run a Pre-Trip test (P5) to clear AL026.

4.4.1 Alarm Action

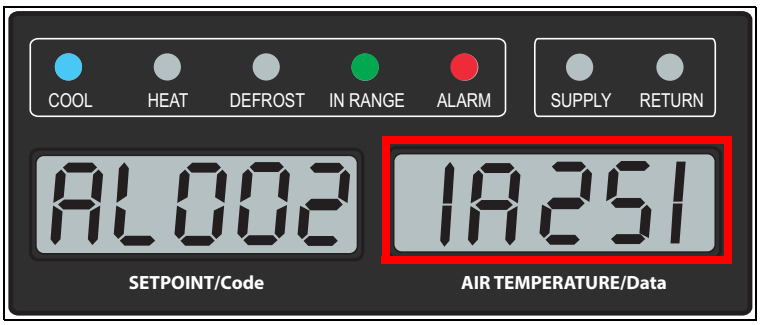
1. When a detectable problem exists, its alarm code will be alternately shown in the left display along with the setpoint. The red ALARM light illuminates for alarm code numbers 003, 017, 020 through 028 and 072.
2. The alarm list should be scrolled through to determine what alarms exist or have existed. Alarms must be diagnosed and corrected before the alarm list can be cleared.
3. On the keypad, press the ALARM LIST key, then use the Arrow keys to scroll any alarms archived in the alarm queue. The alarm queue stores up to 64 alarms in the sequence in which they occurred.
4. The left display will show “AL###,” where ### is the alarm number sequentially in the queue.



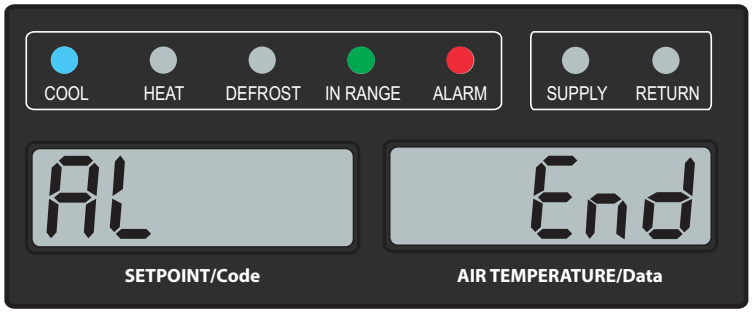
5. The right display shows the alarm code. Active alarms appear as “AA###”, with ### being the alarm code.



6. Inactive alarms appear as “IA###”, with ### being the alarm code.



7. “END” is displayed to indicate the end of the alarm list if any alarms are active.



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

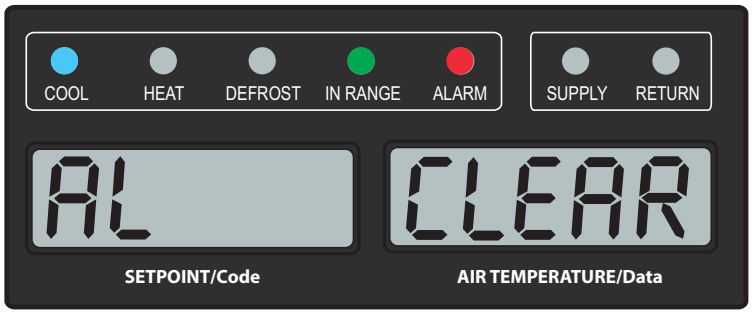


Table 4–4 Alarm Indications - Summary

Code	Description
AL003	Loss of Superheat Control
AL017	Compressor Pressure Delta Fault
AL020	Control Fuse (F3 / F4) Open
AL021	Control Fuse (F1 / F2) Open
AL022	Evaporator IP Open
AL023	Loss of Phase B
AL024	Compressor IP Open
AL025	Condenser IP Open
AL026	All Supply / Return Probes Failure
AL027	Analog to Digital Accuracy Failure
AL028	Low Suction Pressure
AL072	Control Temp Out of Range
AL098	Chill Injury Alarm
AL205	Manual Defrost Switch Failure
AL206	Keypad or Keypad Harness Fail
AL207	Fresh Air Vent Open with Frozen Setpoint
AL208	High Compressor Pressure Ratio
AL214	Phase Sequence Detect Fault
AL216	Compressor Current High
AL218	Discharge Pressure High / Low
AL219	Discharge Temperature High
AL250	Air Vent Position Sensor (VPS) Fault

Code	Description
AL251	Data Storage Fault
AL252	Alarm List Full
AL253	Battery Pack Fault
AL254	Primary Supply Temperature Sensor (STS) Fault
AL256	Primary Return Temperature Sensor (RTS) Fault
AL257	Ambient Sensor (AMBS) Fault
AL258	Compressor High Pressure Safety Open
AL259	Heat Termination Thermostat (HTT) Open
AL260	Defrost Temperature Sensor (DTS) Fault
AL261	Improper Heater Current Fault
AL263	Exceed Current Limit Setting
AL264	Discharge Temperature Sensor (CPDS) Fault
AL265	Discharge Pressure Transducer (DPT) Fault
AL266	Suction Pressure Transducer (SPT), Evaporator Pressure Transducer (EPT) Fault
AL267	Humidity Sensor (HS) Fault
AL269	Evaporator Temperature Sensors (ETS1 / ETS2) Fault
AL270	Supply Recorder Sensor (SRS) Fault
AL271	Return Recorder Sensor (RRS) Fault
AL272	USDA Temp 1 Out of Range
AL273	USDA Temp 2 Out of Range
AL274	USDA Temp 3 Out of Range
AL275	Cargo Probe 4 Out of Range
AL286	RTC Battery Low
AL287	RTC Fault
AL289	Data Storage Fault
AL907	Manual Fresh Air Vent Open
AL909	Oxygen Sensor (O2) Fault
AL910	Carbon Dioxide Sensor (CO2) Fault
AL929	Loss of Atmospheric Control
AL962	Oxygen (O2) Out of Range
AL976	Air Compressor Internal Protector Open
AL977	Membrane Pressure Transducer (MPT) Fault
AL978	Air Compressor Pressure Low
AL979	Air Compressor Pressure High
AL980	Fresh Air Valve (EA) Fault
AL981	Water Drain Valve (WDV) Fault
AL982	CO2 Injection Fault
AL983	CO2 Injection Pressure Transducer Fault
AL996	Scrubber Rotation Fault

4.4.2 Alarm Code Descriptions

AL003 Loss of Superheat Control

Cause:

Superheat has remained below 1.67°C (3°F) for two to four minutes continuously while the compressor is running. The compressor is drawing more than 2.0 amps, compressor pressure ratio is greater than 1.68, and the electronic expansion valve (EEV) is at 0% open.

Component:

Electronic Expansion Valve (EEV)

Troubleshooting:

Check the operation of the EEV using Cd41. Replace the EEV if defective.

Component:

Evaporator Temperature Sensors (ETS1 & ETS2)

Troubleshooting:

Verify the accuracy of the temperature sensors. See **Section 7.22**, Sensor Checkout Procedure.

Replace ETS1 or ETS2 if defective.

Component:

Evaporator Fans

Troubleshooting:

Confirm that the fans are operating properly. Replace fan(s) if defective. See **Section 7.10**, Evaporator Fan Motor Assembly.

AL017 Compressor Pressure Delta Fault

Cause:

The compressor has attempted to start in both directions and fails to generate sufficient pressure differential between the suction pressure transducer (SPT) and discharge pressure transducer (DPT). The controller will attempt to restart every 20 minutes and deactivate the alarm if successful.

Component:

Discharge Pressure Transducer (DPT)

Troubleshooting:

Confirm accurate DPT pressure readings. Hook up the manifold gauge set to check pressures. See Manifold Gauge Set, **Section 7.1.1**.

Replace the DPT if defective.

Component:

Suction Pressure Transducer (SPT)

Troubleshooting:

Confirm accurate SPT pressure readings. Hook up the manifold gauge set to check pressures. See **Section 7.1.1**, Manifold Gauge Set.

Replace the SPT if defective.

Component:

Monitor the unit. The alarm is display only; the alarm may clear itself during operation.

Troubleshooting:

If the alarm remains active or repeats, replace the compressor at next available opportunity. See **Section 7.2**, Compressor Service.

AL020 Control Fuse (F3) Open

Cause:

Control power fuse (F3 or F4) is open.

Component:

F3 fuse

Troubleshooting:

Check the fuse. If it is open, check PA, PB, CH coils for short to ground. If a short is found, replace the defective coil. Replace the fuse.

Component:

F4 fuse

Troubleshooting:

Check the fuse. If fuse is open, check economizer solenoid valve (ESV) coil resistance at CA1 to TRX2. If short to ground, or if resistance is less than 4 ohms, coil is defective. Check the CF, ES, EF, HR coils for short to ground. If a short is found, the coil is defective. Replace the defective coil. Replace the fuse.

Component:

Voltage at QC1

Troubleshooting:

If voltage is not present, check ST7. If voltage is present, it indicates a defective microprocessor. See **Section 7.20**, Controller Service.

AL021 Control Fuse (F1 / F2) Open

Cause:

One of the 18 VAC controller fuses (F1 or F2) is open. See Cd08.

Component:

System Sensors

Troubleshooting:

Check system sensors for short to ground. Replace defective sensor(s).

Component:

Wiring

Troubleshooting:

Check wiring for short to ground. Repair as needed.

Component:

Controller

Troubleshooting:

Controller may have an internal short. Replace the controller. See **Section 7.20**, Controller Service.

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. Replace defective evaporator fan motor. See **Section 7.10**, Evaporator Fan Motor Service.

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. 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. Monitor unit, if alarm remains active or is repetitive replace the compressor at the next available opportunity. See **Section 7.2**, Compressor Service.

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.

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. Replace defective condenser fan motor. See **Section 7.5**, Condenser Fan Motor Assembly Service.

AL026 All Supply / Return Probes Failure

Cause:

Sensors out of range.

Component:

All sensors detected as out of range.

Troubleshooting:

Perform pre-trip P5.

If P5 passes, no further action is required.If P5 fails, replace the defective sensor as determined by P5. See Temperature Sensor Service, **Section 7.22**.

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. Replace defective microprocessor. See **Section 7.20**, Controller Service.

AL028 Low Suction Pressure

Cause:

Suction pressure too low for normal operation.

Component:

N/A

Troubleshooting:

Power cycle the unit.

Resetting the unit may correct problem. Check charge. Monitor the unit.

Component:

Suction Pressure Transducer (SPT)

Troubleshooting:

Confirm accurate SPT pressure readings. See **Section 7.1.1**, Manifold Gauge Set. Replace the SPT if defective.

Component:

Discharge Pressure Transducer (DPT)

Troubleshooting:

Confirm accurate DPT pressure readings. See **Section 7.1.1**, Manifold Gauge Set. Replace the 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.

Power cycle the unit.

Control temperature is in range.

Any pre-trip mode resets the timers.

AL098 Chill Injury Protection

Cause:

When a unit is in perishable mode, it will monitor its setpoint, return probe value and compressor status. This alarm is triggered when all of the following conditions are true:

1. Setpoint > heat lockout temperature (perishable control)
2. Return Temperature Sensor (RTS) ≤ Setpoint - 4K Or Return Recorder Sensor (RRS) ≤ Setpoint - 4K Or Defrost Temperature Sensor (DTS) ≤ Setpoint - 4K
3. Supply Temperature Sensor (STS) or Supply Recorder Sensor (SRS) >= Setpoint.
4. Compressor is running (ON).

If the alarm is triggered, the unit will go into an idle state. The compressor and condenser motor will stop running. The unit will operate under air circulation mode with the evaporator motors running. The controller will continue to monitor thermistor probe value in idle state. If RRS, RTS, or DTS goes +2K above temperature control setpoint, the alarm will clear itself. Power cycling of the unit will reset the counters.

Component:

Sensors

Troubleshooting:

Run Pre-Trip test P5 to test the return recorder sensor (RRS), return temperature sensor (RTS) or defrost temperature sensor (DTS). If any sensor fails, then replace. If all sensors pass, then check the compressor.

Component:

Compressor

Troubleshooting:

Check to see why the compressor is over-shooting setpoint temperature. Run a Pre-Trip test P6 to test the compressor and related components.

AL205 Manual Defrost Switch Failure

Cause:

Controller has detected continuous manual defrost switch activity for five minutes or more.

Component:

Keypad

Troubleshooting:

Power cycle the unit.

Reset the unit to attempt to correct the problem. Monitor the unit.

If the alarm re-appears after five minutes, replace the keypad.

AL206 Keypad or Keypad Harness Fault

Cause:

Controller has detected that one of the keypad keys is continuously active.

Component:

Keypad or Harness

Troubleshooting:

Power cycle the unit.

Reset the unit to attempt to correct the 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:

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. See **Section 7.1.1**, Manifold Gauge Set. Replace the 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.

Reset the unit to attempt to correct the 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.

Correct wiring.

Component:

Current Sensor

Troubleshooting:

Check Cd41, the right-most digit. If the display is 3 or 4, check compressor / sensor wiring. If the display is 5, the current sensor is defective. Replace the current sensor if defective.

AL216 Compressor Current High

Cause:

Compressor current draw is over the calculated maximum for 10 minutes.

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.

Replace the current sensor if defective.

Component:

Amperage Too High

Troubleshooting:

Confirm that supply voltage / frequency is within specification and balanced according to **Section 3.10**, Electrical Data table.

Correct power supply.

Component:

Operating Conditions

Troubleshooting:

Make sure system pressures are relevant to operating conditions.

Check condenser air flow. Check refrigerant charge, See **Section 7.1.7**, Refrigeration System Service.

Component:

Monitor Unit

Troubleshooting:

The alarm is display only. The alarm may clear itself during operation.

If the alarm remains active or is repetitive, replace the compressor at the next available opportunity. See Compressor Service, **Section 7.2**.

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.

Open liquid line service valve as needed.

Component:

Filter Drier

Troubleshooting:

Check the filter drier. If it is iced up or very cold, then the filter drier needs replacement.

Replace the filter drier if needed. See **Section 7.7**, Filter Drier Service.

Component:

Condenser Fan

Troubleshooting:

Check condenser fan for proper operation.

Correct as required.

Component:

Discharge Pressure Transducer (DPT)

Troubleshooting:

Confirm accurate DPT pressure readings. See **Section 7.1.1**, Manifold Gauge Set.

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**.

Correct as required. See **Section 7.1.7.1**, Checking Refrigerant Charge.

Component:

Refrigerant

Troubleshooting:

Check refrigerant level.

Correct as required. See **Section 7.1.7.1**, Checking Refrigerant Charge.

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. Check the unit for air flow restrictions.

Open the discharge service valve as needed. Clean or remove 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**.

Correct as required. See **Section 7.1.7.1**, Checking Refrigerant Charge.

Component:

Additional Alarms such as AL216, AL024.

Troubleshooting:

Check compressor operation.

If the alarm persists, it may indicate a failing compressor, replace the compressor. See Compressor Service, **Section 7.2**.

AL250 Air Vent Position Sensor Fault

Cause:

The vent position sensor (VPS) reading has not been stable for four minutes. Or, the VPS is outside of its valid range (shorted or open).

Component:

Vent Position Sensor (VPS)

Troubleshooting:

Make sure the VPS is secure.

Power the unit Off. Manually tighten the panel. Turn the unit On. If the alarm persists, replace the sensor or the assembly. See **Section 7.24**, VPS Service Procedures.

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.

If action is successful (all alarms are inactive), alarm 251 will reset.

Power cycle the unit. If the alarm persists, it indicates defective controller memory.

Replace defective controller. See **Section 7.20**, Controller Service Procedures.

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”.

Clear alarms. See **Section 4.4**, Controller Alarms.

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.

To clear the alarm, replace the battery pack. See **Section 7.20.4**, Battery Replacement Procedure. 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.

If P5 passes, no further action is required. If P5 fails, replace the defective sensor as determined by P5. See **Section 7.22**, Temperature Sensor Service Procedures.

AL256 Primary Return Temperature Sensor (RTS) Fault

Cause:

Invalid Return Temperature Sensor (RTS) reading.

Component:

Return Temperature Sensor (RTS)

Troubleshooting:

Perform pre-trip P5.

If P5 passes, no further action is required. If P5 fails, replace the defective sensor as determined by P5. See **Section 7.22**, Temperature Sensor Service Procedures.

AL257 Ambient Sensor (AMBS) Fault

Cause:

Invalid Ambient Temperature Sensor (AMBS) reading.

Component:

Ambient Temperature Sensor (AMBS)

Troubleshooting:

Test the AMBS. See **Section 7.22.2**, Sensor Checkout Procedure.

Replace the AMBS if defective. See **Section 7.22**, Temperature Sensor Service Procedures.

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 7.3.1**.

Replace the HPS if defective. See Sensor Replacement, **Section 7.22**.

Component:
Refrigeration System

Troubleshooting:
Check unit for air flow restrictions.

Clean or remove any debris from coils.

AL259 Heat Termination Thermostat (HTT) Fault

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.

Replace the HTT if defective. See **Section 7.22**, Temperature Sensor Service Procedures.

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. See **Section 7.22.2**, Sensor Checkout Procedure.

Replace the DTS if defective. See **Section 7.22**, Temperature Sensor Service Procedures.

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 **Section 3.10**, Electrical Data. Replace heater(s) if defective. See **Section 7.9**, Evaporator Heater Service.

Component:
Contactor

Troubleshooting:
Check voltage at heater contactor on the heater side. 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. Clean or remove any debris from coils.

Check unit for proper operation. Repair as needed.

Component:

Power supply

Troubleshooting:

Confirm supply voltage / frequency is within specification and balanced. See **Section 3.10**, Electrical Data. Correct power supply.

Component:

Current limit set too low.

Troubleshooting:

Check current limit setting with function code Cd32. 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 **Section 7.22.2**, Sensor Checkout Procedure. Replace the CPDS if defective. See **Section 7.22**, Sensor Replacement.

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 **Section 7.1.1**, Manifold Gauge Set. Replace the 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 **Section 7.1.1**, Manifold Gauge Set. Performing a pre-trip 5-9 test will also check the transducers. Replace the SPT / EPT if defective.

Monitor. If the alarm persists, it may indicate a failing compressor. See **Section 7.2**, Compressor Service.

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. Monitor, replace the HS if the alarm persists.

Monitor. If the alarm persists, it may indicate a failing compressor. See **Section 7.2**, Compressor Service.

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 **Section 7.22.2**, Sensor Checkout Procedure. 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. If P5 passes, no further action is required. If P5 fails, replace the defective sensor as determined by P5. See **Section 7.22**, Temperature Sensor Service.

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. If P5 passes, no further action is required. If P5 fails, replace the defective sensor as determined by P5. See **Section 7.22**, Temperature Sensor Service.

AL272 USDA Temp 1 Out of Range Fault

Cause:

USDA Temp 1 Sensor is out of range.

Component:

Sensor

Troubleshooting:

Validate sensor values. See **Section 7.22**, Sensor Checkout Procedure. If the sensor is bad, replace. If not, verify harness wiring and controller connections.

AL273 USDA Temp 2 Out of Range Fault

Cause:
USDA Temp 2 Sensor is out of range.

Component:
Sensor

Troubleshooting:
Validate sensor values. See **Section 7.22**, Sensor Checkout Procedure. If the sensor is bad, replace. If not, verify harness wiring and controller connections.

AL274 USDA Temp 3 Out of Range Fault

Cause:
USDA Temp 3 Sensor is out of range.

Component:
Sensor

Troubleshooting:
Validate sensor values. See **Section 7.22**, Sensor Checkout Procedure. If the sensor is bad, replace. If not, verify harness wiring and controller connections.

AL275 Cargo Probe 4 Out of Range Fault

Cause:
Cargo Probe 4 Sensor is out of range.

Component:
Sensor

Troubleshooting:
Validate sensor values. See **Section 7.22**, Sensor Checkout Procedure. If the sensor is bad, replace. If not, verify harness wiring and controller connections.

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. If the alarm stays active, replace the battery.

AL287 RTC Fault

Cause:
RTC time invalid.

Component:
Real Time Clock

Troubleshooting:
Power cycle. Reset the clock. Verify it maintains the correct time. Replace the 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. If the alarm stays active, replace the controller.

AL907 Manual Fresh Air Vent Open

Cause:

For units equipped with EverFRESH and a vent position sensor (VPS), 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)

Troubleshooting:

Manually reposition vent to 0% and confirm using Cd45. If Cd45 is not reading 0%, perform a calibration of the panel. See **Section 7.24** for VPS service procedures. If unable to obtain a zero reading, replace the defective VPS. If the unit is loaded, ensure the vent is closed. Note and replace the VPS on the next PTI. The alarm will not affect the EverFRESH system from operating.

AL909 Oxygen Sensor (O2) Fault

Cause:

Triggered anytime the O2 sensor reading is outside of the normal operation range, after an initial signal was detected.

Action:

EverFRESH Air Compressor (EAC) 100% duty cycle and open the EverFRESH Air Valve (EA). Will prevent low O2 and cargo loss. If both AL909 and AL910 are active, run the EAC and open the EA.

Component:

O2 Sensor, O2 Amplifier

Troubleshooting:

Check Cd44 and scroll down to 02V. The O2 sensor output will be displayed in millivolts (130mV to 4100mV is a good range). Check wiring (See schematic), and check for bad connections or wires improperly positioned.

If O2 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 CO2 sensor reading is outside of the normal operation range, after an initial signal was detected.

Action:

EverFRESH Air Compressor (EAC) 100% duty cycle and open the EverFRESH Air Valve (EA). Will prevent low O2 and cargo loss. If both AL909 and AL910 are active, run the EAC and open the EA.

Component:

CO2 Sensor

Troubleshooting:

Check wiring 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 CO2 level is above its setpoint by 2%. Or, when the O2 level is below its setpoint for longer than 30 minutes. 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.

Verify all EverFRESH components are functioning properly by checking for EverFRESH alarms and running a P-20 PreTrip. 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 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).

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. O2 level reaches pulldown limit and then O2 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 T-374 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 T-374 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 and remove. 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 and remove. 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 CO2 injection option, this alarm is triggered when Cd76 is set to “A-CO2” or “PrCON” to enable CO2 injection and CO2 < CO2 setpoint - 0.5% volume and the IPT < 20 PSIG.

Component:

CO2 Supply

Troubleshooting:

Verify CO2 supply is available and supplied at the recommended pressure.

Component:

CO2 Injection Port Schrader Valve

Troubleshooting:

If proper pressure is available at the CO2 injection supply port, verify that the Schrader valve is being depressed by the supply hose properly to allow flow.

Component:

CO2 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 configured with the CO2 injection option, this alarm is triggered when Cd76 is set to “On” to enable CO2 injection and volts are not in the range of 0.5 to 4.95 VDC.

Component:

CO2 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.

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.

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 Setpoint (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.

4.5 Pre-Trip Inspection

Pre-Trip Inspection is an independent controller function that suspends the normal refrigeration control mode activities and provides pre-programmed test routines of unit operations. The test routines can be run in Auto Mode, which automatically performs a sequence of pre-programmed tests, or Manual Mode, which allows individual tests to be selected and run with the keypad. The tests are called P tests.

A summary of tests is provided in **Table 4–5**, and completed descriptions are detailed in **Section 4.5.4**.As the tests are conducted, the display will provide a "PASS" or "FAIL" message to indicate test results.

⚠ CAUTION

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

4.5.1 Auto Mode and Manual Mode

There are two **Auto Mode** test sequences: the Pre-Trip Short Sequence and the Pre-Trip Long Sequence. The Long Sequence will only be available if enabled by configuration. The Long Sequence begins with and includes the Short Sequence. Units configured with the Long Sequence enabled can nonetheless run just the Short Sequence if desired. The Short Sequence is selected on the display as either "AUtO" or "AUtO1". This runs tests P0 through P6, which includes most functions, sensors, and system components. It does not test the High Pressure Switch (HPS), heater performance, or cooling performance, since these are lengthy tests. The Long Sequence is selected on the display as either "AUtO2" or "AUtO3". The Long Sequence includes all of the Short Sequence tests and also tests for the High Pressure Switch (HPS), heater performance and cooling performance. "AUtO2" runs tests P0 through P10 and "AUtO3" runs tests P0 through P8.

Manual Mode refers to executing an individual sub-test by selecting it with the keypad.

4.5.2 Pre-Trip Inspection Initiation

A Pre-Trip inspection in Auto Mode may be initiated by the PRE-TRIP key or via communication, but individual Manual Mode tests can only be initiated by the PRE-TRIP key. See **Section 5.7.1** for operating procedure to initiate a Pre-Trip.

The following conditions must exist prior to initiating a Pre-Trip:

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

Whenever any Auto Pre-Trip Inspection sequence or individual Pre-Trip Inspection test is initiated:

- Dehumidification and Bulb Mode is de-activated. This must be manually re-activated after Pre-Trip complete.
- Economy Mode is de-activated. This must be manually re-activated after Pre-Trip complete.
- QUEST Mode temperature control is forced to its Pre-Trip Inspection/Trip Start state (if configured).

In addition, whenever any Auto Pre-Trip Inspection sequence is initiated:

- Automatic Cold Treatment (ACT) is de-activated.
- Defrost Interval is set to AUTO.

4.5.3 Pre-Trip Inspection Termination

Pre-Trip inspection is terminated if any of the following scenarios occur:

- After selecting the PRE-TRIP key, no selection is made after five seconds. The system will resume normal operations.
- While tests are being executed, press and hold the PRE-TRIP key for 1 to 2 seconds. The system will resume normal operations.
- Pre-Trip was initiated by communications and any Pre-Trip test fails.

Table 4–5 Pre-Trip Codes - Summary

Code	Description	Auto 1	Auto 2	Auto 3
P0-0	RMU Detection	x	x	x
P1-0	Heaters On	x	x	x
P1-1	Heaters Off	x	x	x
P2-0	Condenser Fan On	x	x	x
P2-1	Condenser Fan Off	x	x	x
P3-0	Low Speed Evaporator Fan On	x	x	x
P3-1	Low Speed Evaporator Fan Off	x	x	x
P4-0	High Speed Evaporator Fan Motors On	x	x	x
P4-1	High Speed Evaporator Fan Motors Off	x	x	x
P5-0	Supply / Return Probe	x	x	x
P5-1	Supply Probes	x	x	x
P5-2	Return Probes	x	x	x
P5-3	Evaporator Fan Direction	x	x	x
P5-7	Primary vs. Secondary Evaporator Temperature Sensor	x	x	x
P5-8	Primary Evaporator Pressure Transducer	x	x	x
P5-9	Primary vs. Secondary Evaporator Pressure Transducer	x	x	x
P5-10	Humidity Sensor Controller Configuration Verification	x	x	x
P5-11	Humidity Sensor Installation Verification	x	x	x
P5-12	Humidity Sensor Range Check	x	x	x
P6-0	Discharge Thermistor	x	x	x
P6-1	Suction Thermistor	x	x	x
P6-2	Discharge Pressure Sensor	x	x	x
P6-3	Suction Pressure Sensor	x	x	x
P6-4	Compressor Current Draw	x	x	x
P6-5	Compressor Leak Test	x	x	x
P6-6	Economizer Valve Test	x	x	x
P6-7	Digital Loader / Unloader Valve	x	x	x
P6-9	Future Expansion	x	x	x
P6-10	Electronic Expansion Valve	x	x	x
P7-0	High Pressure Switch (HPS) Open		x	x
P7-1	High Pressure Switch (HPS) Close		x	x
P8-0	Perishable Mode		x	x
P8-1	Perishable Mode Pulldown		x	x
P8-2	Perishable Mode Maintain Temperature		x	x
P9-0	Defrost Termination Thermostat Close and Open		x	
P10-0	Frozen Mode Heat		x	
P10-1	Frozen Mode Pulldown		x	
P10-2	Frozen Mode Maintain Temperature		x	

4.5.4 Pre-Trip Code Descriptions

P0 - 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.

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 - Heaters Current Draw

For P1 tests, the heater is turned on, then off. Current draw must fall within specified range. No other system components will change state during this test.

P1-0 Heaters On

The 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.

The test passes if the change in current draw test is in the range specified.

P1-1 Heaters Off

The 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.

The test passes if the change in current draw test is in the range specified.

P2 - Condenser Fan Current Draw

For P2 tests, the 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 (WPS) is open this test will be skipped.

P2-0 Condenser Fan On

The 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.

The test passes if change in current draw test is in the specified range.

P2-1 Condenser Fan Off

The condenser fan is then turned off. After 10 seconds the current draw is measured. The change in current draw is then recorded.

The test passes if change in current draw test is in the specified range.

P3 - Low Speed Evaporator Fans Current Draw

For P3 tests, the system must be equipped with a low speed evaporator fan, as determined by 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

The 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.

The test passes if change in current draw test is in the specified range.

P3-1 Low Speed Evaporator Fan Motors Off

The low speed evaporator fans are then turned off. After 10 seconds the current draw is measured. The change in current draw is then recorded.

The test passes if change in current draw test is in the specified range.

P4 - High Speed Evaporator Fans Current Draw

For P4 test, the 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.

P4-0 High Speed Evaporator Fan Motors On

The 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.

The 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

The high speed evaporator fans are then turned off. After 10 seconds the current draw is measured. The change in current draw is then recorded.

The test passes if change in current draw test is in the specified range.

P5 - Air Stream Temperature Sensor Tests

The P5 tests are to check 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.

The 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 Probes Test

This test compares the temperature difference between supply temperature sensor (STS) and supply recorder sensor (SRS).

The 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) pass, because of the multiple tests, the display will read “P5” “PASS.”

P5-2 Return Probes Test

This test compares the temperature difference between return temperature sensor (RTS) and return recorder sensor (RRS).

The test passes if temperature comparison falls within the specified range.

NOTE:

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 are used to activate or clear control probe alarms.

P5-3 Evaporator Fan Direction Test

With the evaporator fan running on high speed, measure the temperature difference between the supply temperature sensor (STS) and return temperature sensor (RTS). Turn the heaters on for 60 seconds then measure the temperature difference between the STS and RTS probes for up to 120 additional seconds.

This is a Pass / Fail test. The test passes if differential of STS to RTS is higher than 0.25°C.

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).

The test passes if secondary evaporator temperature sensor (ETS2) is within +/- 0.5°C of the primary evaporator temperature sensor (ETS1).

P5-8 Primary Evaporator Pressure Transducer Test

This is a Pass / Fail test of the primary evaporator pressure transducer.

The test passes if primary evaporator pressure is within range of saturation pressure at current primary evaporator temperature.

Test P5-7 must pass before this test is run.

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.

The test passes if pressure difference between the two pressure transducers is within tolerance as noted below:

- Temperature range of SRS is between -30°C and -18°C: Pass / Fail tolerance is +/- 4.4 psig.
- Temperature range of SRS is between -18°C to 15.6°C: Pass / Fail tolerance is +/- 1.5 psig.
- Temperature range of SRS is between 15.6°C and 50°C: Pass / Fail tolerance is +/- 4.4 psig.

P5-10 Humidity Sensor Controller Configuration Verification Test

This is a Pass / Fail / Skip test of the humidity sensor (HS) configuration.

The test passes if the controller configuration has HS in.

The test fails if the controller configuration has HS out and Vout is greater than 0.20 Volts for the HS.

Test is skipped if the controller configuration has the HS 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 the humidity sensor (HS) installation (sensor is present).

The test passes if Vout is greater than 0.20 Volts for the HS.

The test fails if Vout is less than 0.20 Volts for the HS.

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 (HS) range.

The test passes if Vout for HS is between 0.33 and 4 Volts.

The test fails if Vout is outside of this range.

Test P5-11 must pass before this test is run.

P6 - Refrigerant Probes, Compressor and Refrigerant Valves

The P6 tests are for Pass / Fail testing of the discharge temperature sensor (CPDS), suction temperature sensor (ETS1/2), discharge pressure transducer (DPT), suction pressure transducer (SPT), electronic expansion valve (EEV), digital loader valve (DLV), digital unloader valve (DUV) and economizer solenoid valve (ESV).

Tests 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.

P6-0 Discharge Thermistor Test

If Alarm 264 (CPDS) is active the test fails. Otherwise, the test passes.

P6-1 Suction Thermistor Test

If the evaporator temperature sensor (ETS1/2) is invalid, the test fails. Otherwise the test passes.

P6-2 Discharge Pressure Transducer Test

If Alarm 265 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 266 is active, the test fails. Otherwise the test passes.

P6-4 Compressor Current Draw Test

Compressor current is tested before start up 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.

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.

P6-6 Economizer Valve Test

This test passes if suction pressure increases a minimum of 4 psia when the valve opens for 15 seconds.

P6-7 Digital Loader / Unloader Valve Test

This test passes if pressure change and current change are within 3 seconds of DUV switch signal and either of the following conditions are met:

- For PrimeLINE standard units (571-1xx models): the change rate of pressure change is less than -5 psi/second while the DUV is open AND change rate is greater than 5 psi/second while the DUV is closed.
- For PrimeLINE EDGE units (571-3xx models): the change rate of pressure change is less than 10 psi/second while the DUV is open AND change rate is greater than 10 psi/second while the DUV is closed.
- The difference of maximum and minimum current drawn is above 1.5A.

P6-9 Future Expansion

This is no longer active and will be displayed as "-----" at this time.

P6-10 Electronic Expansion Valve Test

This 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.

P7 - High Pressure Tests

For the P7 tests, the unit is run at full capacity without condenser fan running to make sure that the HPS opens and closes properly. P7 tests are included with "Auto2 & Auto3" only.

P7-0 High Pressure Switch (HPS) Opening Test

This 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 (WPS) 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 (AMBS) is invalid
- Composite Return Temperature Sensor is invalid
- High Pressure Switch (HPS) is open

The test fails if:

- HPS fails to open before 900 seconds total test time.
- Evaporator or Compressor IP Alarm is active.
- Calculated Dome Temperature exceeds 137.78°C (280°F).
- Discharge pressure exceeds 370 psig.
- Compressor Current exceeds limits

The test passes if the HPS opens within the 15 minute time limit.

P7-1 High Pressure Switch (HPS) Closing Test

If return temperature is greater than -2.4°C, set setpoint to -5.0°C, else set setpoint to -30°C. Restart the unit according to normal startup logic. Run the unit normally for 120 seconds.

The test passes if the high pressure switch (HPS) closes within 75 seconds after the end of Test 7-0, otherwise the test fails.

Test P7-0 must pass for this test to execute.

P8 - Perishable Mode Tests

In order for P8 tests to execute, Pre-trip tests P7-0 and P7-1 must have passed or have been skipped. P8 tests are included with “Auto2 & Auto3” only.

P8-0 Perishable Mode Pulldown Setup

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 Pulldown Test / CO2 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 CO2 sensor status indicates that a CO2 sensor is present, calibration of the CO2 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 CO2 sensor voltage reads within the 0.95 <>1.15Vdc range before the end of P8-1, the sensor will be calibrated by holding the CO2 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, CO2 sensor calibration fails.

P8-2 Perishable Mode Maintain Temperature Test

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.

The test passes if the average temperature error is within +/- 1.0°C.

The 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.

Test P8-1 must pass for P8-2 to execute.

P9 - DTT Close and Open Test

For the P9 tests, the defrost termination thermostat (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 (DTS). P9 tests are included with “Auto2” only.

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 defrost termination thermostat (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.

The test fails if any of the following conditions are true:

- The DTT is not considered closed after the 30 minutes of full cooling and also if the HTT opens when the DTT is considered closed prior to applying heat.
- The HTT opens any time during the heat cycle when the DTT is considered closed and also if the return air temperature rises above 49°C (120°F).
- If any time, the return temperature sensor (RTS) & return recorder sensor (RRS) values exceed each other by more than 2°C for more than 30 seconds. The RTS and RRS values from this test will be posted. Failure of this portion of the test indicates a mis-wiring between the RTS and DTS.

The test passes if the DTT is considered open within the 2 hour heat cycle time limit.

P10 - Frozen Mode Tests

P10 tests are included with “Auto2” only.

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.

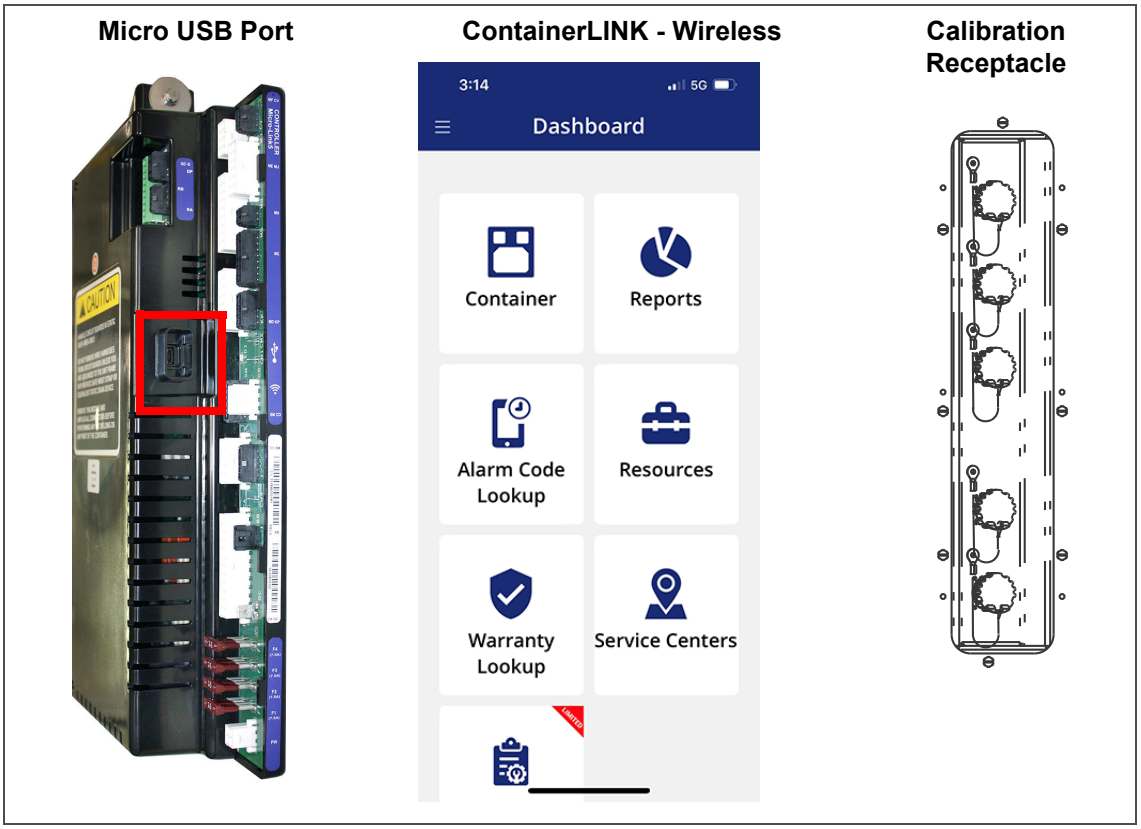
4.6 Controller Communications

The ML5 controller allows the following methods for connectivity (see **Figure 4.12**):

- Micro USB port allows USB connection to PC for advanced functions
- Wireless connection (short-range) capability for remote access via the ContainerLINK™ app
- Optional interrogator receptacles for probe calibration and third party device connectivity.

Refer to the **T-372PL parts manual** for a list of available tools for interfacing with the ML5 controller.

Figure 4.12 Connections to the Controller



4.6.1 Micro USB Port Connection

Insert a Micro USB device into the controller's USB port to perform the following tasks:

- Download data from the DataCORDER. See **Section 7.21.1** for procedure.
- Upload controller software. See **Section 7.21.2** for procedure.
- Upload controller configuration. See **Section 7.21.3** for procedure.

Connect a cable from a laptop to the controller's USB port to perform the following tasks:

- Download data from the DataCORDER. See **Section 7.21.1** for procedure.
- Upload controller configuration. See **Section 7.21.3** for procedure.
- View downloaded data or real time data with the ContainerLINK™ app.

4.6.2 Wireless Connection

The ML5 controller offers short range wireless connectivity through wireless 802.11 b/g/n. Wireless connectivity may only operate when ambient temperatures are above -20°C (-4°F). Connectivity will be intermittent below this temperature. A mobile device can wirelessly connect to the ML5 controller using Carrier's ContainerLINK™ app, which provides container technicians with access to a suite of tools and resources from one location.

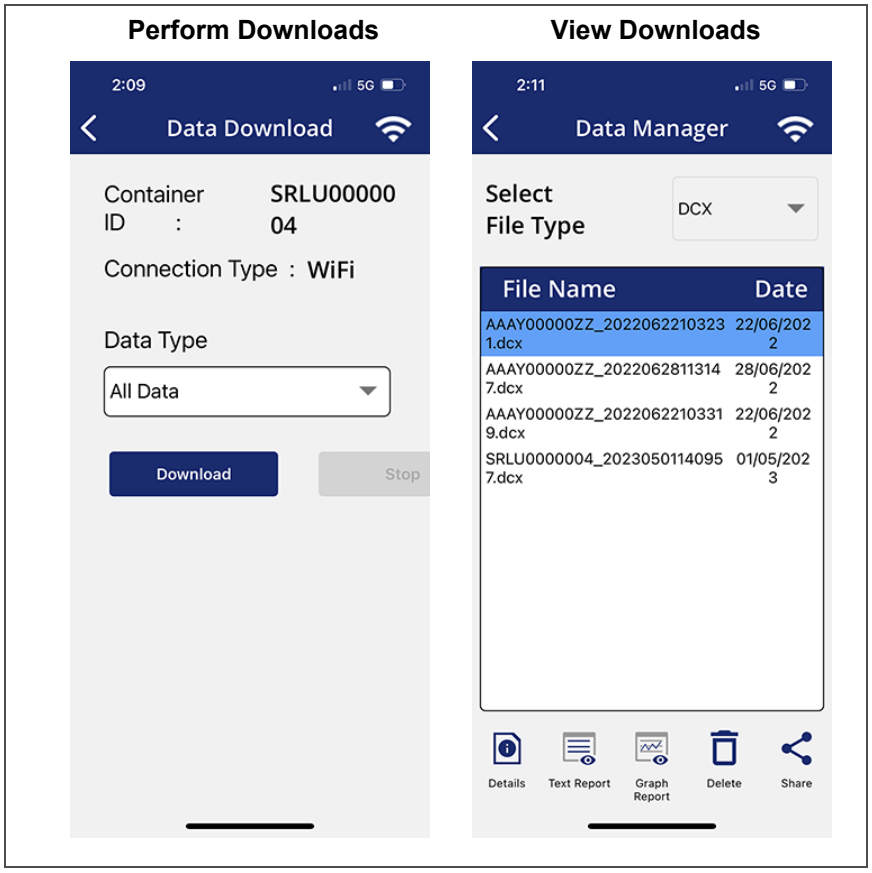
The unit display will show whether the unit WiFi is connected and transmitting:

1. Press the ALT MODE key.
2. Use the Arrow keys to display "nEt", then press the ENTER key.
3. The display will toggle between messages "APStA" "idLE", to show WiFi connected and transmitting, or "APStA" "OFF", to show WiFi not connected.

When connected wirelessly in ContainerLINK app, the user can perform DataCORDER, downloads and view saved downloads. See **Section 4.7**.

Unit data details, text reports and graph reports are available from the downloads. See **Figure 4.13**.

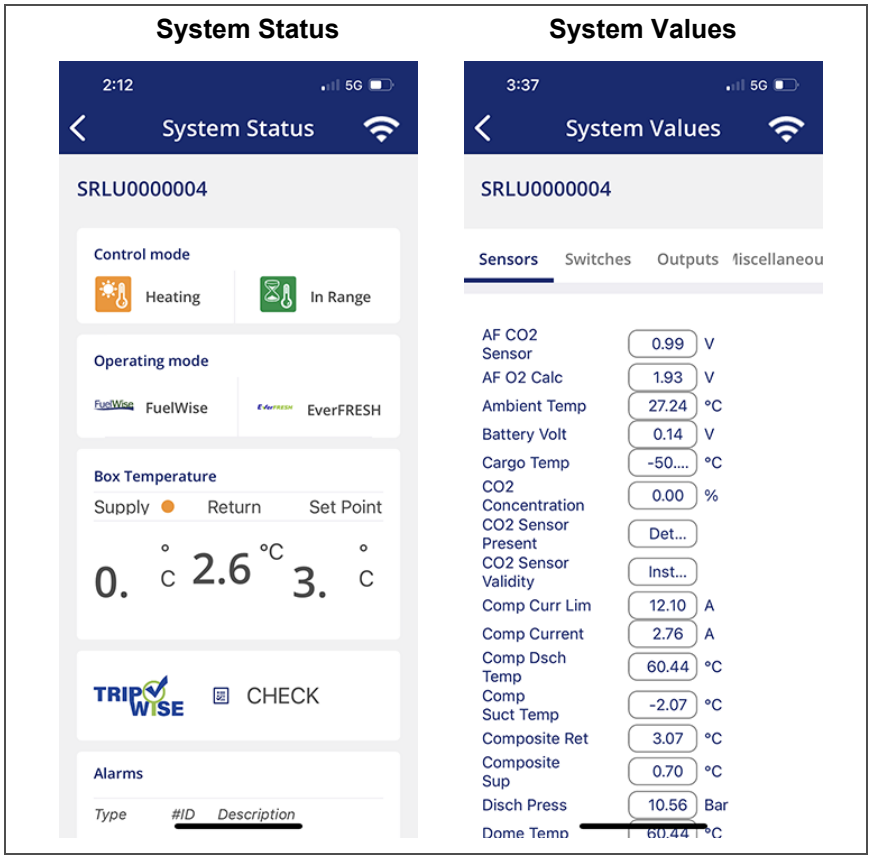
Figure 4.13 ContainerLINK - Downloads



ContainerLINK will also display real time data from the unit in the app when a connection is established. The following components and details can be monitored, see **Figure 4.14**:

- System status including: control mode, operating mode, box temperature, and alarms.
- System values including: sensors, switches, outputs and miscellaneous items.

Figure 4.14 ContainerLINK - View Real Time Data

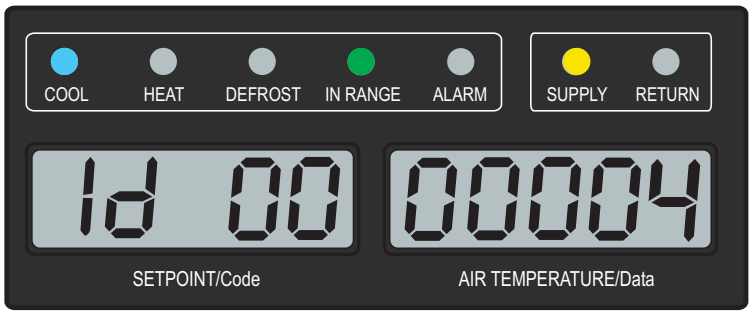


4.6.2.1 Obtaining Container Unit ID and Wireless Password

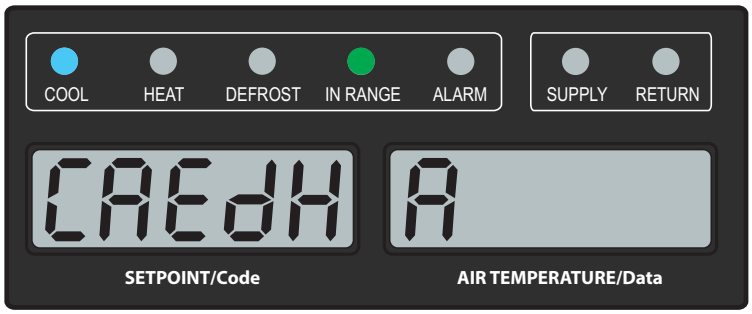
This procedure explains how to use the unit display to determine the container unit ID and wifi password. These are needed to connect to the ContainerLINK™ app.

Procedure:

1. Determine the container ID of the unit. This is an 11 character ID and is typically stamped on the container frame. To look up the ID on the unit display continue with the steps below.
   a. Press the CODE SELECT key.
   b. Use the Arrow keys to navigate to Cd40, then press ENTER. The last 7 characters of the ID are displayed.



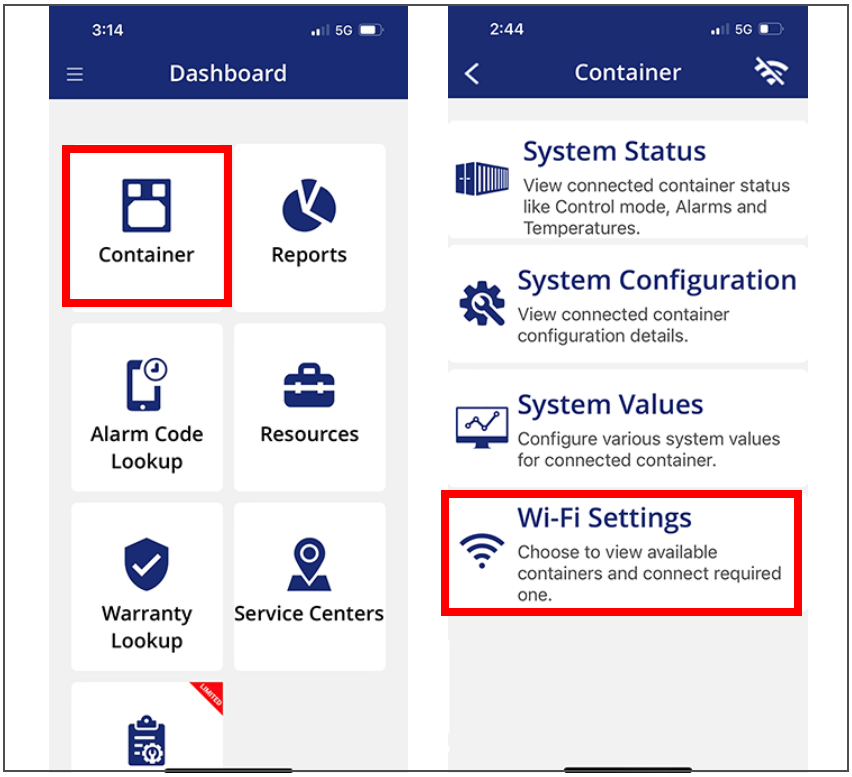
2. On the display, look up the six character wireless password. The password changes every four hours.
   a. Press the ALT MODE key.
   b. Use the Arrow keys to display "nEt", then press ENTER.
   c. Use the Arrow keys to display "PASSW EntR", then press ENTER.
   d. The display will show a 6 character password required to connect to this unit's controller. Write down or take a picture of the password. The password is not case sensitive, so upper or lower case is not relevant.



4.6.2.2 Connecting a Phone with ContainerLINK to a Unit

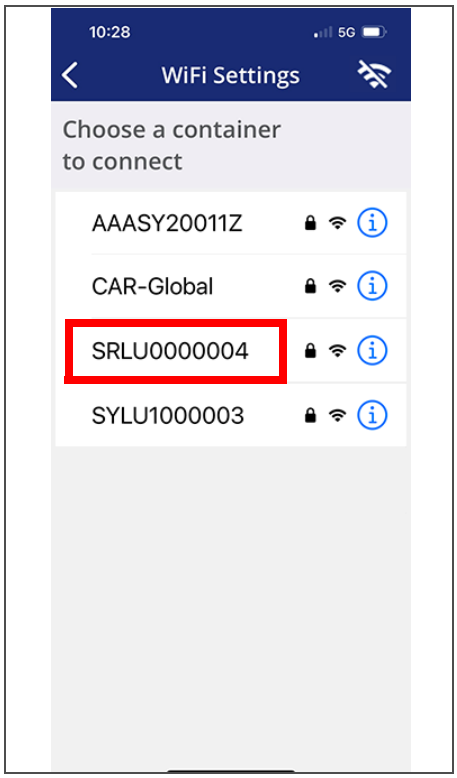
This procedure explains how to enter wifi settings for a particular container unit into the ContainerLINK app to establish a connection to the unit.

1. Open the ContainerLINK™ app and navigate to the Container screen, then the Wi-Fi Settings screen.

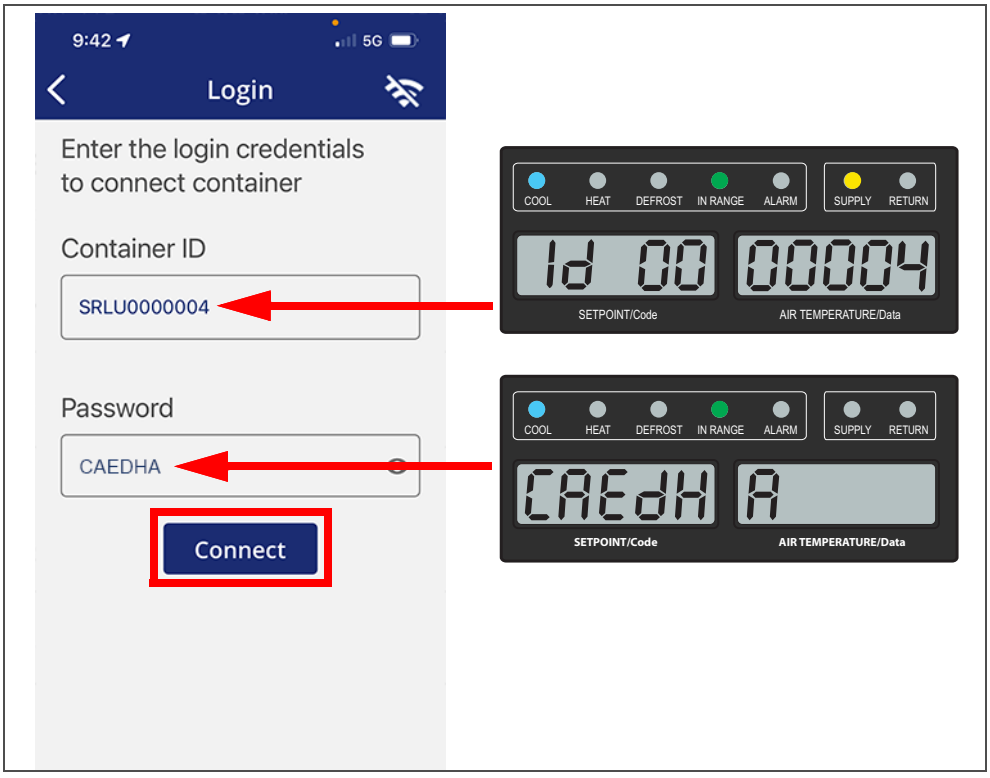


2. Depending on the mobile device, all available networks (along with Container IDs) within range may appear. Choose a Container ID to connect to. See **Section 4.6.2.1** for obtaining Container ID.

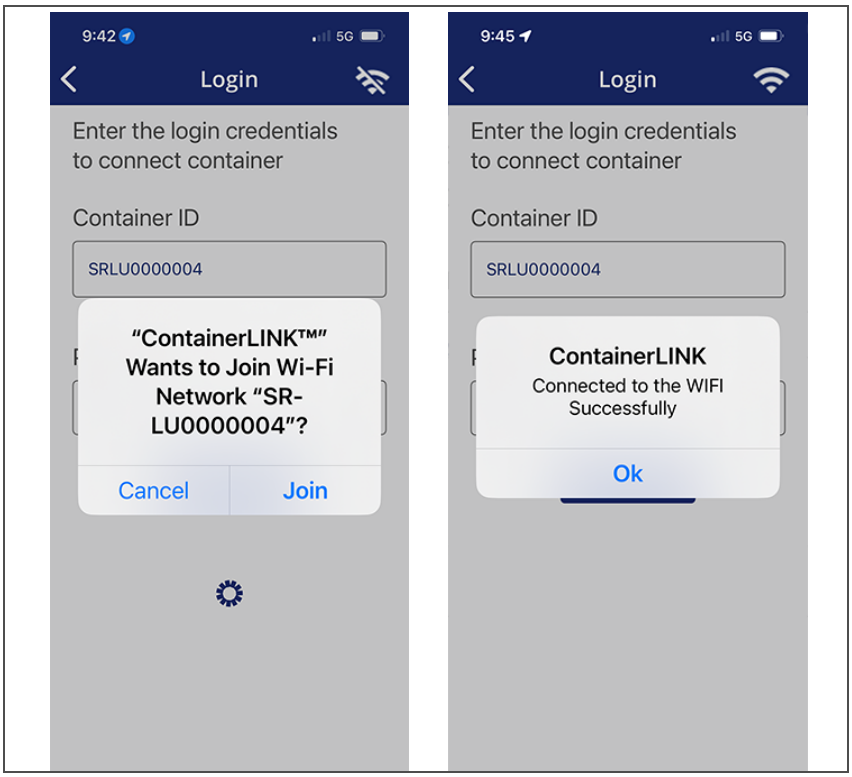
   On some mobile devices, this screen is bypassed and the Login screen appears directly.



3. At the Login screen, enter or verify the **Container ID** and **Password** and select **Connect**. The values may be inputted automatically. If not, input the values without using any spaces. The password is not case sensitive, so upper or lower case is not relevant. See **Section 4.6.2.1** for obtaining a password.



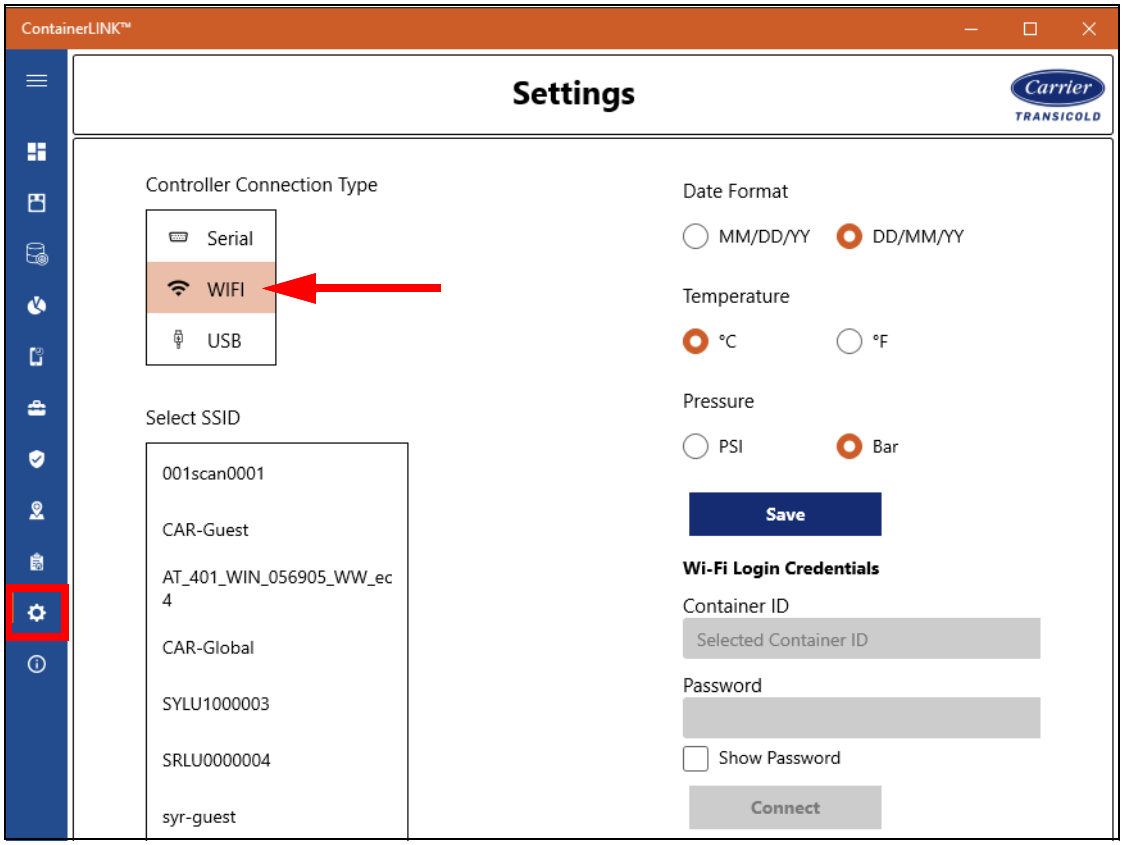
4. If a prompt asks to Join the network, select Join. After clicking Connect, a message will appear “Connected to the WIFI Successfully”. Click OK to begin using the connected features of ContainerLINK™.



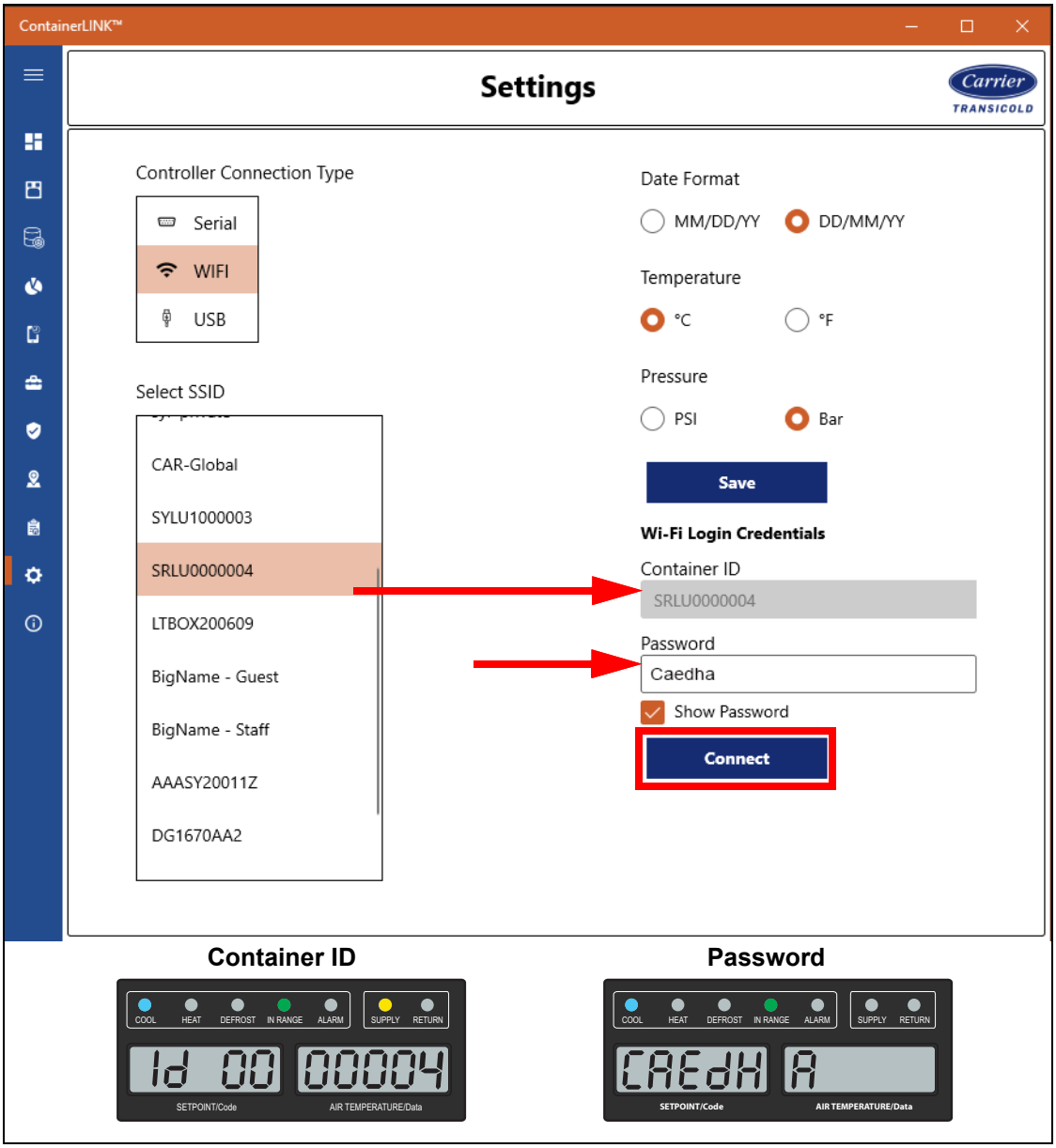
4.6.2.3 Connecting a Laptop with ContainerLINK to a Unit

This procedure explains how to enter wifi settings for a particular container unit into the ContainerLINK app to establish a connection to the unit.

1. Open the ContainerLINK™ app, navigate to the Settings page and select “WiFi” in the upper left corner.

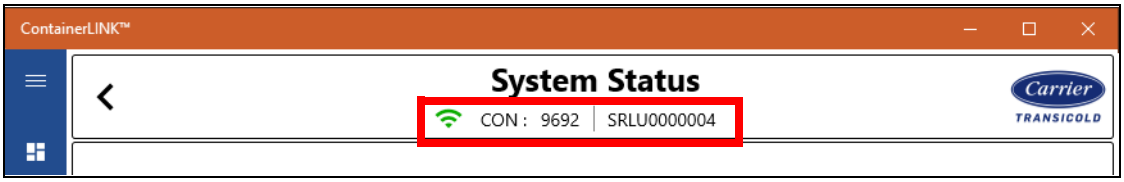


2. Choose the container unit to connect from the Select SSID box. After selecting, the ID is filled into the Container ID box on the right. Type in the password and click Connect. See **Section 4.6.2.1** for container ID and password information.



3. Wait for the confirmation message that connection was successful.

4. At the Container screens (System Status, System Configuration, System Values, Probe Calibration), the connected container ID will appear under the page title.



4.6.3 Optional Interrrogator Ports Connection

For units with ML5 controller, an optional front and rear interrogation receptacle are available. The front receptacle, mounted under the control box is for connectivity to third party devices. The rear receptacle, located inside the unit along side the USDA receptacles, is for USDA probe calibration only. There are no write commands capable from this port other than those related to USDA calibration.

4.7 DataCORDER

4.7.1 DataCORDER 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, see **Section 4.7.6**.

The DataCORDER consists of the following components:

- 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).

4.7.2 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 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.

Procedure to Display DataCORDER Configuration Variables:

1. Press the ALT MODE key on the keypad.
2. Use the Arrow keys until “dCF” is displayed, then press the ENTER key.
3. 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 4–6**. Descriptions of DataCORDER operation for each variable setting are provided in the following paragraphs.

Table 4–6 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

Sensor Configuration (dCF02)

Two modes of operation may be configured, the Standard Mode and the Generic 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 4–7**.

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.

Table 4–7 DataCORDER Sensor 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)
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

The Generic Mode allows user selection of up to eight network data points to be recorded. 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)

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).

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.

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.

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.

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.

Procedure to Display Stored Temperatures:

1. Press the ALT MODE key on the keypad.
2. Use the Arrow keys until “dCdSP” is displayed, then press the ENTER key.
3. Use the Arrow keys to toggle through S (supply), R (Return), P1, P2, P3 and C4 (Cargo) sensors.
4. 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.
5. Press the ENTER key to alternate between sensors and times / temperatures. And use Arrow keys for scrolling.

4.7.3 DataCORDER Operational Software

The operational software reads and interprets inputs for use by the configuration software. The inputs are labeled function codes. The DataCORDER function code assignments, see **Section 4.7.4**, may be accessed by the operator to examine the current input data or stored data.

Procedure to Display 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.
4. If a function is not applicable for the unit, dashes “-----” are shown on the display.

4.7.4 DataCORDER Function Codes

dC1 Recorder Supply Temperature

Current reading of the supply recorder sensor (SRS).

dC2 Recorder Return Temperature

Current reading of the return recorder sensor (RRS).

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 Future Expansion

These codes are for future expansion, and are not in use at this time.

dC16 GDP Last Supply Sensors Calibration Date

The most recent date of GDP calibration of the supply sensors (STS / SRS) is displayed.

dC17 GDP Last Return Sensors Calibration Date

The most recent date of GDP calibration of the return sensors (RTS / RRS) is displayed.

dC18 GDP Supply Temperature Sensor Calibration Offset

The most recent calibration offset value of the supply temperature sensor (STS) is displayed.

dC19 GDP Return Temperature Sensor Calibration Offset

The most recent calibration offset value of the return temperature sensor (RTS) is displayed.

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.

dC65 Future Expansion

This code is for future expansion, and is not in use at this time.

dC27 Future Expansion

This code is for future expansion, and is 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.

4.7.5 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.

4.7.6 DataCORDER Communications

Data can be retrieved from the DataCORDER and viewed with DataLINE software for Windows or the ContainerLINK™ app, see **Figure 4.12**. These programs allow interrogation, configuration variable assignment, screen view of the data, hard copy report generation, cold treatment probe calibration and file management. After software revision 6315, DataLINE 3.12 or ContainerLINK™ 2.2 or greater are required.

The ML5 controller allows this data retrieval via wired or wireless communications. See **Section 4.6** for a description of ML5 communications. When connecting hard-wired with a cable, DataLINE software or ContainerLINK™ can be used. When connecting wirelessly with a phone or tablet, ContainerLINK™ must 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.

4.7.7 Pre-Trip Data Recording

The DataCORDER will record the initiation of a pre-trip test, see **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 4–8** for a description of the data stored in the DataCORDER for each corresponding pre-trip test.

Table 4–8 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

Table 4–8 DataCORDER Pre-Trip Result Records (Continued)

Test	Title	Data
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
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 Inspecting the Unit

⚠ 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 7.10**.
   - Check for visible corrosion on the evaporator stator and fan deck. See **Section 7.11**.
   - Check for dirt or grease on evaporator fans or fan deck and clean if necessary. See **Section 7.11**.
   - Check evaporator coil for cleanliness or obstructions. Wash with fresh water. See **Section 7.11**.
   - 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. See **Section 7.4**.
3. Open the control box door. Check for loose electrical connections or hardware.
4. Check color of moisture-liquid indicator.

5.2 Connecting 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 unit Start-Stop switch (ST) is Off (“0”). See **Figure 3.6**.
2. Make sure circuit breaker CB1 in the control box is Off (“0”). See **Figure 3.6**.
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 CB1 On (“I”).
5. Close and secure the control box door.

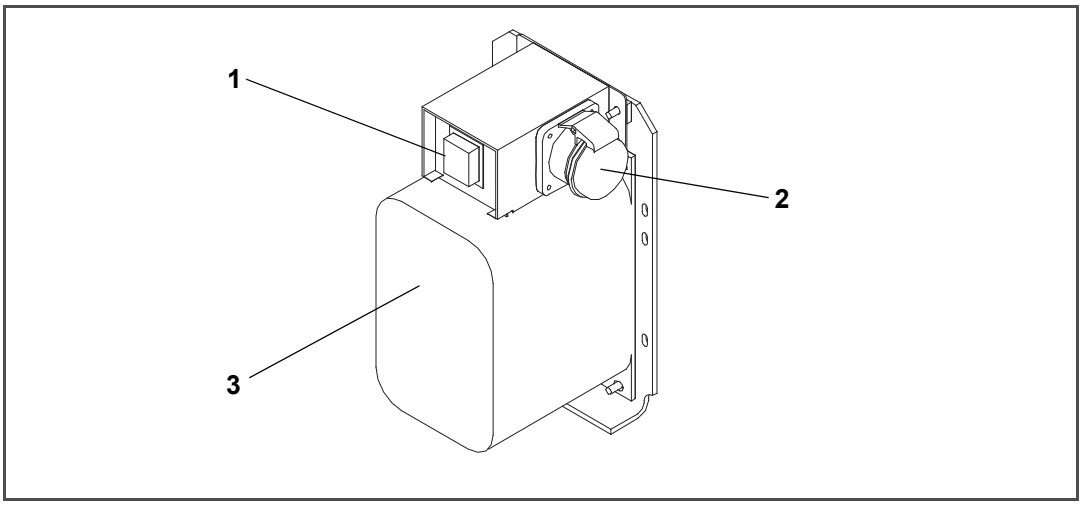
5.2.2 Connecting to 190/230 VAC Power

To allow unit operation on nominal 230 volt power an autotransformer, as shown in **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 (CB2). 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 unit Start-Stop switch (ST) is Off (“0”). See **Figure 3.6**.
2. Make sure circuit breaker CB1 in the control box is Off (“0”). See **Figure 3.6**.
3. Make sure circuit breaker CB2 on the transformer is Off (“0”). See **Figure 5.1**
4. Plug in and lock the 460 VAC power plug at the receptacle on the transformer.
5. Plug the 230 VAC (black) cable into a de-energized 190/230 VAC, 3-phase power source and energize the power source.
6. Set both circuit breakers CB1 and CB2 to On (“I”).
7. Close and secure the control box door.

Figure 5.1 Autotransformer



1) Circuit Breaker (CB2) 230-Volt
2) 460 VAC Power Receptacle
3) Dual Voltage Modular Autotransformer

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5.3 Adjusting the Fresh Air Makeup Vent

The purpose of the fresh air makeup vent, see **Section 3.3.10**, 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) to determine 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

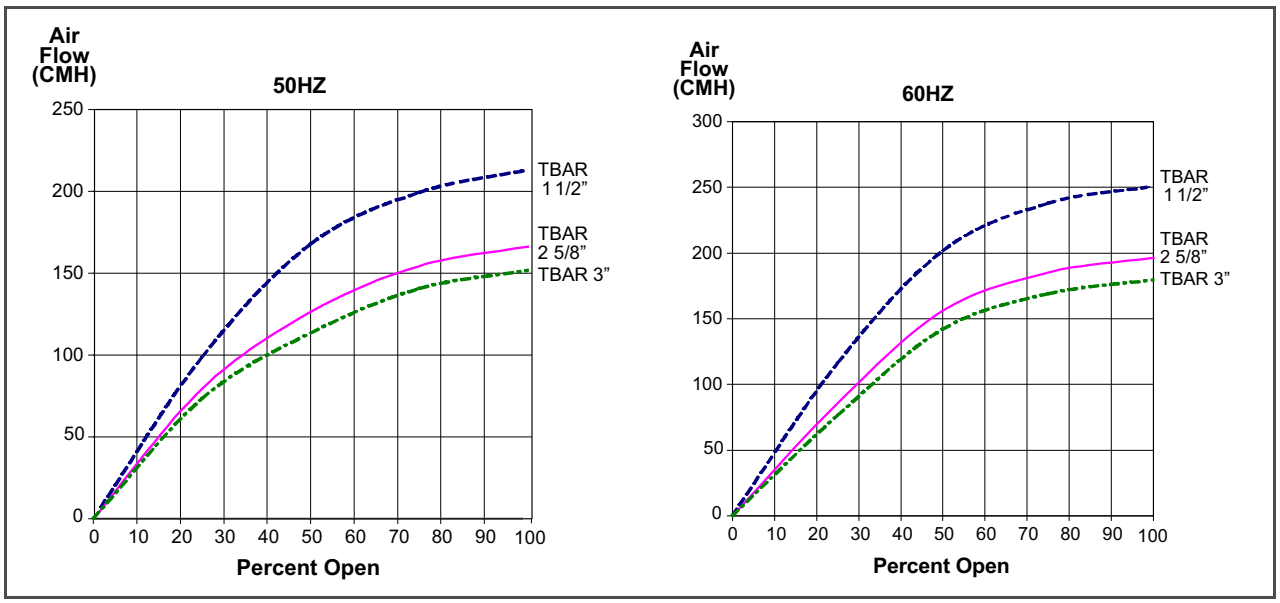
Two slots and a stop are designed into the upper fresh air disc for air flow adjustments. The first slot allows for a 0 to 30% air flow; the second slot allows for a 30 to 100% air flow.

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 view the fresh air vent position from the unit display at function code Cd45. This code is accessible via the CODE SELECT key.

The VPS 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).

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 Connecting Water-Cooled Condenser

The water-cooled condenser (WCC), see **Section 3.3.3**, is an optional component chosen 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 procedure.

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 3.10**.
2. Maintain a flow rate of 11 to 26 liters per minute (3 to 7 gallons per minute). The Water Pressure Switch (WPS) will open to de-energize the condenser fan relay. The condenser fan motor will stop and remain stopped until the WPS closes.
3. To shift to air-cooled condenser operation, disconnect the water supply and the discharge line to the water-cooled condenser. The refrigeration unit will shift to air-cooled condenser operation when the WPS closes.

5.5 Starting and Stopping Instructions

⚠ WARNING

Make sure that the unit circuit breaker(s) CB1 & CB2 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.

5.5.1 Starting the Unit

1. Verify that power is properly applied, the fresh air vent is in position, and (if required) the water-cooled condenser is connected.
2. Turn the Start-Stop (ST) switch ON ("I"). See **Figure 3.6**.

   As the controller is starting up, the display will show in sequence function codes: Cd40 (Container ID), Cd18 (Software Version) and Cd20 (Unit Model Number).
3. Continue with the Start Up Inspection. See **Section 5.6**.

5.5.2 Stopping the Unit

1. Turn the Start-Stop (ST) switch OFF ("0"). See **Figure 3.6**.

5.6 Start-Up Inspection

1. Check rotation of the condenser fan and evaporator fans.
2. Check, and if required, set controller Function Codes Cd27 through Cd39 in accordance with desired operating parameters. See **Section 4.2.2** for more details.
   - Cd27: Defrost Interval
   - Cd28: Temperature Units (C or F)
   - Cd29: Failure Action (Mode)
   - Cd30: In-Range Tolerance
   - Cd31: Stagger Start Offset Time
   - Cd32: System Current Limit
   - Cd33: Humidity Setpoint
   - Cd34: Economy Mode
   - Cd35: Bulb Mode
   - Cd36: Evaporator Fan Speed
   - Cd37: Variable DTT Setting (Bulb Mode)
3. Check and, if required, set the DataCORDER Sensor Configuration at variable dCF02 in accordance with desired recording parameter. See **Table 4–7** for sensor configurations.
4. Enter a Trip Start with the following instructions:
   a. Press the ALT MODE key.
   b. Use the Arrow keys to display "dC", then press the ENTER key.
   c. Use the Arrow keys to display "dC30", then press and hold the ENTER key for 5 seconds.
   d. The "Trip Start" event will be entered in the DataCORDER.

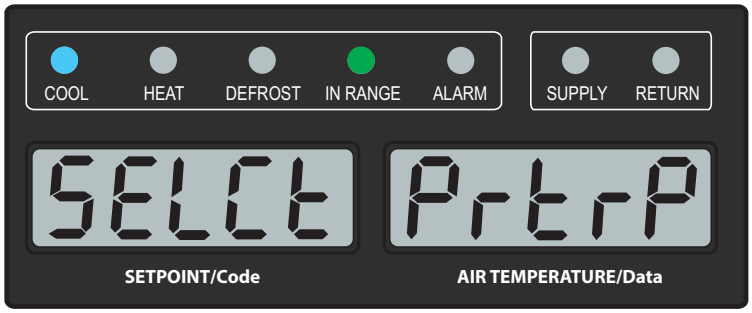
5.7 Performing a Pre-Trip

Pre-Trip Inspection is an independent controller function that suspends the normal refrigeration control mode activities and provides pre-programmed test routines of unit operations. See **Section 4.5** for an explanation of Pre-Trip Inspection, the different modes of operation and a description of all Pre-Trip test codes.

5.7.1 Starting a Pre-Trip from the Keypad

1. Press the PRE-TRIP key to access the Pre-Trip test selection menu.
2. The display will show “SELCt PrtrP” for up to five seconds. Press the ENTER key to bring up the Pre-Trip Inspection Test Selection menu.

   If the unit is configured for TripWise and TripWise is On (code Cd65), the display shows “tripW OFF/EX/ PASS/CHECK” for one second and then “SELCt PrtrP” for one second. The messages will alternate back and forth for a total of five seconds. Press the ENTER key while “SELCt PrtrP” is displayed to bring up the Pre-Trip Inspection Test Selection menu.



3. To Run an Automatic Test: Scroll through the selections by pressing the Arrow keys to display AUtO, AUtO1, AUtO2 or AUtO3 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.

   NOTE: 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.

   NOTE: 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 presses the ENTER key.
4. 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.

5. 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 P-7 High Pressure Switch tests), the current limiting and pressure limiting processes are both active. The current limiting process is only active for P-7.

5.7.2 Displaying Pre-Trip Test Results from the Keypad

1. Press the PRE-TRIP key to access the Pre-Trip test selection menu. “SELCt PrtrP” will be displayed.
2. Use the Arrow keys until “P rSLts” (Pre-Trip results) is displayed, then press the ENTER key.
3. 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, dashes “-----” will be displayed.

5.8 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.

5.8.1 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.

5.9 Enabling Operating Modes

There are several additional operating modes that can be enabled from the controller function codes. Some of these are purchased as options. Descriptions of the operating modes are provided below. If the unit is not configured for a particular operating mode, dashes “-----” will be displayed at the function code.

5.9.1 QUEST Mode

QUEST Mode, controlled with function code Cd50, is a power saving option that reduces energy requirements. QUEST Mode can apply to either QUEST or QUEST II option depending on the option chosen for a particular unit. See Cd50 description for more detailed information.

Turning On QUEST:

1. Press the CODE SELECT key.
2. Use the Arrow keys to bring up Cd50 and press the ENTER key.
3. Use the Arrow keys to bring up “On” and press the ENTER key.

Turning Off QUEST:

QUEST will be turned off automatically with a Trip Start, or if a Pre-Trip is initiated.

1. To manually turn QUEST Mode Off, press the CODE SELECT key.
2. Use the Arrow keys to bring up Cd50 and press the ENTER key.
3. Use the Arrow keys to bring up “OFF” and press the ENTER key.

5.9.2 FuelWise Mode

FuelWise Mode, controlled with function code Cd63, is an option that saves energy while operating in the perishable setpoint range. See Cd63 description for more detailed information.

Turning On FuelWise:

1. Press the CODE SELECT key.
2. Use the Arrow keys to bring up Cd63 and press the ENTER key.
3. Use the Arrow keys to bring up “On” and press the ENTER key.

Turning Off FuelWise:

FuelWise Mode is turned off automatically with a Trip Start, or if a Pre-Trip is initiated.

1. To manually turn FuelWise Off, press the CODE SELECT key.
2. Use the Arrow keys to bring up Cd63 and press the ENTER key.
3. Use the Arrow keys to bring up “OFF” and press the ENTER key.

5.9.3 TripWise Mode

TripWise™ Mode, controlled with function code Cd65, is an option that checks 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. See Cd65 description for more detailed information.

Turning On TripWise:

1. Press the CODE SELECT key on the keypad.
2. Use the Arrow keys to bring up code Cd65 and press the ENTER key.
3. Use the Arrow Keys to bring up “On” and press the ENTER key.
4. 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 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.

Turning Off TripWise:

1. To manually turn TripWise Off, press the CODE SELECT key.
2. Use the Arrow keys to bring up Cd65 and press the ENTER key.
3. Use the Arrow keys to bring up “OFF” and press the ENTER key.

5.9.4 Automatic Cold Treatment (ACT) Mode

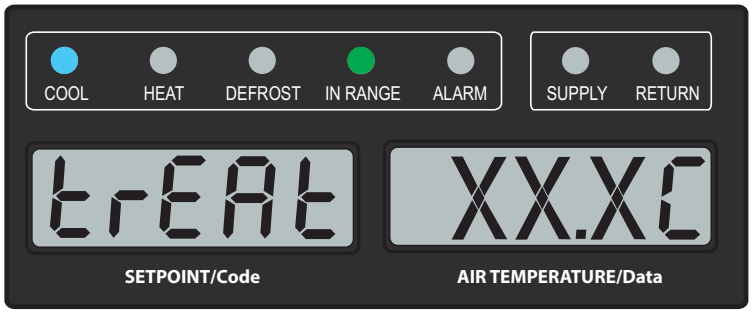
Automated Cold Treatment (ACT) Mode is a method to simplify the task of completing cold treatment by automating the process of changing the setpoints. ACT is set up through function code Cd51. See Cd51 description for more detailed information and menu selections.

NOTE: Automatic Cold Treatment (ACT) and Automatic Setpoint Change (ASC) can not be enabled simultaneously. Setting one will deactivate the other.

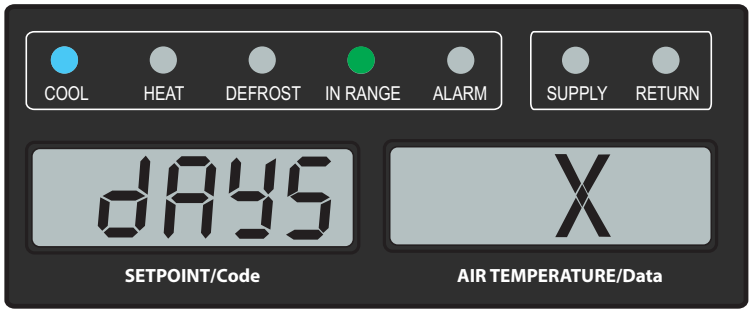
Turning On and Setting ACT:

1. Press the CODE SELECT key.
2. Use the Arrow keys to scroll to Cd51, and then press the ENTER key.
3. From Cd51, use the Arrow keys to bring up "On" and press the ENTER key.
4. The display will show “trEAt | ##.#°C” with the right display flashing the last setting. Use the Arrow keys to select the desired cold treatment setpoint and press ENTER to confirm.

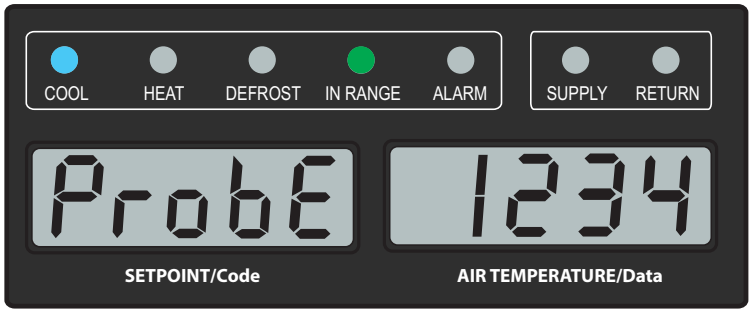
   This is the maximum value that the USDA probes need to remain below to pass the Cold Treatment protocol. For instance, if the treat value is set at 35.0°F (1.7°C) then the USDA probe temperatures must remain below 35.0°F (1.7°C) to pass.



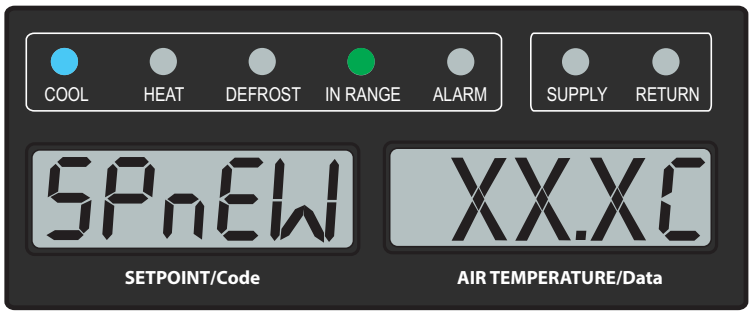
5. The display will show “dAyS | #” with the right display flashing the days for cold treatment. Use the Arrow keys to select the desired days and press ENTER to confirm.



6. The display will show “ProbE | 1234” with the right display showing the probe numbers that are connected. Press ENTER.



7. The display will show “SPnEW | ##.#°C” with the right display flashing the setpoint for when cold treatment process has completed. Use the Arrow keys to select the setpoint and press ENTER to confirm.



8. The Cd51 menu is returned to the top level and the display will show “Cd 51 | # #“. The right display is the countdown timer of days and hours remaining. The unit will start to countdown once all detected USDA probes have reached the specified cold treatment temperature. The countdown timer will remain in the Cd51 display until the cold treatment process is complete

Turning Off ACT:

ACT will be automatically turned off when ASC, a TripStart, or a Pre-Trip 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. From Cd51, ese the Arrow keys to bring up "Off" and press the ENTER key.

5.9.5 Automatic Setpoint Change (ASC) Mode

Automatic Setpoint Change (ASC) allows up to 6 setpoint changes to be pre-programmed over defined periods of time using function code Cd53. See Cd53 description for more detailed information and menu selections.

NOTE: Automatic Setpoint Change (ASC) and Automatic Cold Treatment (ACT) and can not be enabled simultaneously. Setting one will deactivate the other.

NOTE: Before starting this procedure, be aware that inaction to confirm a menu selection in a timely fashion will result in the procedure being stopped and the menu will return to the top level.

Turning On and Setting ASC:

1. Press the CODE SELECT key.
2. Use the Arrow keys to bring up Cd53 and press the ENTER key.
3. From Cd53, use the Arrow keys to scroll to ON and press the ENTER key.
4. The display will show “nSC | “#”, where # is the number of setpoint changes.

   For example, if 3 setpoints are chosen, 2 setpoints will be established along with associated days that they are to be active. Then, the 3rd setpoint is chosen for the temperature desired after this procedure is complete
5. Use the Arrow keys to select the desired number (1-6) and press ENTER to confirm.

6. The display will show “SP 0 | #.#°C”, where # is the desired setpoint temperature. This is the first setpoint to be programmed.
7. Use the Arrow keys to select the desired setpoint and press ENTER to confirm.
8. The display will show “dAY 0 | #”, where # is the amount of days to keep this setpoint active.
9. Use the Arrow keys to select the desired number of days (1-99) and press ENTER to confirm.
10. The display will return back to “SP # | #.#°C”.
11. If there was more than 1 programmed setpoint chosen (nSc value), then the process will repeat itself of selecting a setpoint along with days to run that setpoint. Repeat steps 7-10 for all setpoints.

    If there are no more programmed setpoints, then this last setpoint will be for unit temperature after ASC has completed. Continue to the next step.
12. Use the Arrow keys to select the setpoint after completion and press ENTER to confirm.
13. The Cd53 menu is returned to the top level and the display will show “Cd 53 | 0 0“. Upon exiting Cd53 and then returning, the display will now show “Cd 53 | # #“, where the right display is the countdown timer of days and hours remaining.
14. While ASC Mode is in progress, the user can choose to view only the settings chosen for ASC. Once at Cd53, “On” is flashing. Press ENTER and then continue to press ENTER to toggle through all of the current selections. No edits will be allowed.
15. While ASC Mode is in progress, the user can choose to edit the settings for the ASC Mode currently in progress. Once at Cd53, “On” is flashing. Use the arrow keys to display “OFF” and press ENTER. Then, use Arrow keys to select “On” and press ENTER. The procedure will start over to create settings for ASC mode. Repeat this procedure starting at step 4.

Turning Off ASC:

ASC will be turned off automatically when ACT, a Trip Start, or a Pre-Trip is initiated.

1. To manually turn ACT off, press the CODE SELECT key.
2. Use the Arrow keys to bring up Cd53 and press the ENTER key.
3. From Cd53, use the Arrow keys to bring up “OFF” and press the ENTER key.
4. The Cd53 menu is returned to the top level and the display will show “Cd 53 0 0“.

5.9.6 Pharma Mode

Pharma Mode, controlled with function code Cd75, is an option that allows cargoes to be maintained at temperature setpoints of either 5°C (41°F) or 20°C (68°F), while maintaining lower humidity levels. See Cd75 description for detail information of Pharma Mode menu selections and operation.

Turning On Pharma Mode:

1. Press the CODE SELECT key.
2. Use the Arrow keys to bring up Cd75 and press the ENTER key.
3. From Cd75, use the Arrow keys to bring up "On" and press the ENTER key.
4. The display will show “Sp | 05“, where 05 is blinking. Press ENTER to select 05. Or use the Arrow keys to select “20” and press ENTER.

Turning Off Pharma Mode:

1. To manually turn Pharma Mode Off, press the CODE SELECT key.
2. From Cd75, use the Arrow keys to bring up Cd75 and press the ENTER key.
3. Use the Arrow keys to bring up “OFF” and press the ENTER key.

5.9.7 EverFRESH Mode

EverFRESH is a controlled atmosphere option, setup through function code Cd71, that controls container atmosphere by supplying nitrogen and oxygen into the container space and simultaneously controlling levels of oxygen and carbon dioxide. See Cd44, Cd71 and Cd76 descriptions for detail information of EverFRESH Mode menu selections and operation.

For detailed procedures and technical information related to the EverFRESH controlled atmosphere system, refer to the **T-374 EverFRESH Manual**.

Turning On and Setting EverFRESH:

Turning on EverFRESH enables all EverFRESH operations and setpoints for CO2 and O2 are confirmed.

1. Press the CODE SELECT key on the keypad.
2. Use the Arrow keys until “Cd 71” is displayed, then press the ENTER key.
3. From Cd71, use the Arrow keys until “FrESh” is in the right display, then press the ENTER key.
4. The CO2 setpoint is displayed. “CO2SP” appears in the left display with the setpoint value blinking in the right display. Use the Arrow keys to change the setpoint and press ENTER to confirm. Or, just press ENTER to keep the originally displayed value.
5. Next, the O2 setpoint is displayed. “O2 SP” appears in the left display with its setpoint blinking in the right display. Use the Arrow keys to change the setpoint and press ENTER to confirm. Or, just press ENTER to keep the originally displayed value.

Turning Off EverFRESH:

Turning off EverFRESH disables all EverFRESH operations.

1. Press the CODE SELECT key on the keypad.
2. From Cd71, use the Arrow keys until “Cd 71” is displayed, then press the ENTER key.
3. Use the Arrow keys until “OFF” is displayed and press the ENTER key.

Section 6
Troubleshooting

Figure 6.1 Unit Troubleshooting Sequence

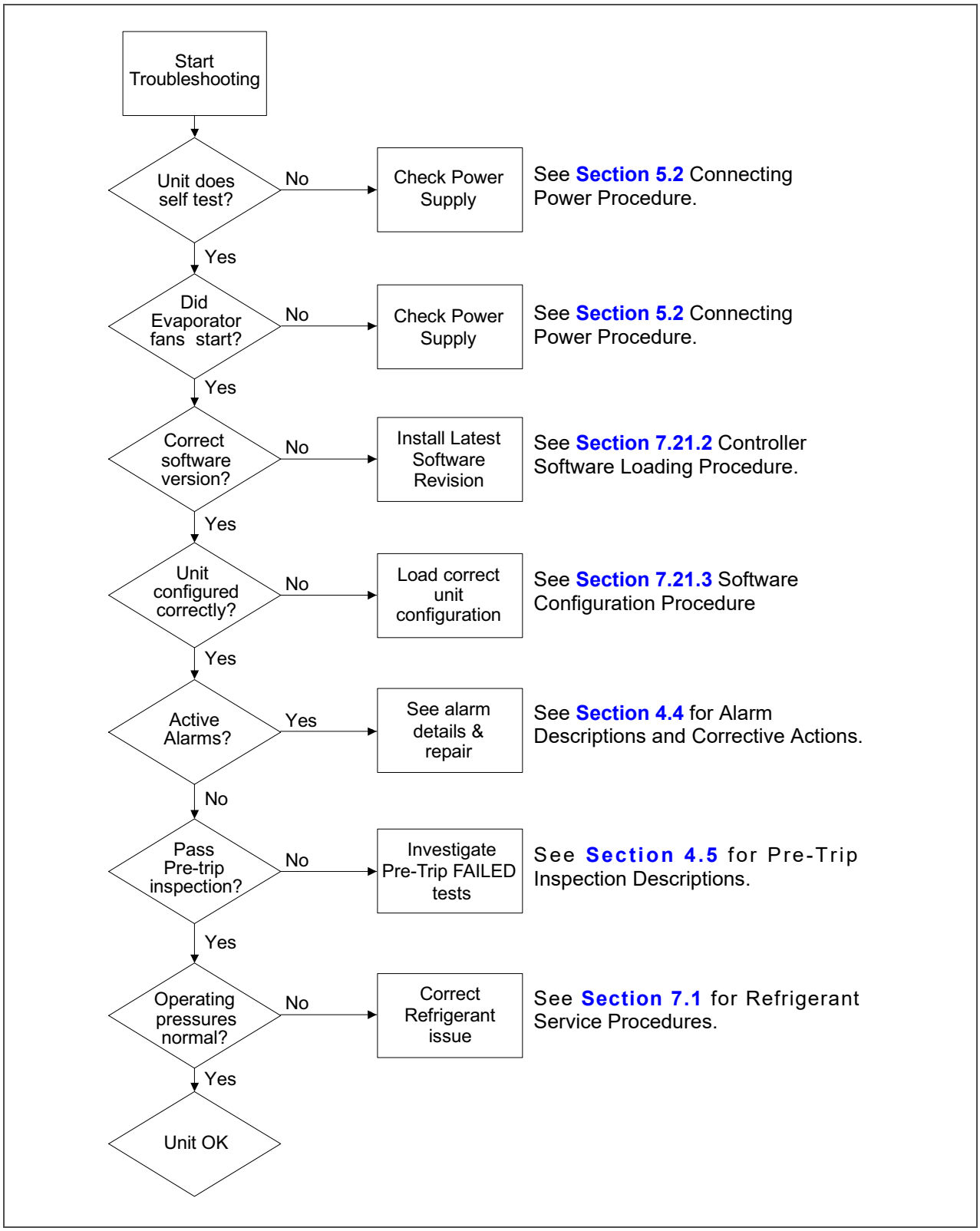


Table 6–1 Troubleshooting Symptoms

Condition	Possible Cause	Remedy / Reference
6.1 Unit will not Start or Unit 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
	AC Line Filter fails or is defective	**Section 7.20.5**
Component(s) not operating	Evaporator fan motor internal protector open	**Section 7.10**
	Condenser fan motor internal protector open	**Section 7.5**
	Compressor internal protector open	**Section 7.2**
	High Pressure Switch (HPS) open	**Section 6.7**
	Heat Termination Thermostat (HTT) open	Replace
	Current sensor malfunction	Replace
Compressor hums, but does not start	Line voltage is low	Check
	Single phasing	Check
	Motor windings shorted or grounded	**Section 7.2**
	Compressor seized	**Section 7.2**
6.2 Unit Operates Long or Continuously in Cooling		
Container	Hot load	Normal
	Box insulation defective or air leak	Repair
Refrigeration system	Refrigerant shortage	**Section 7.1.7**
	Evaporator coil covered with ice	**Section 6.6**
	Evaporator coil plugged with debris	**Section 7.8**
	Evaporator fan(s) rotating backwards	**Section 7.10**
	Air bypass around evaporator coil	Check
	Controller set too low	Reset
	Compressor service valves or liquid line shutoff valve partially closed	Open valves completely
	Condenser dirty	**Section 7.4.1**
	Compressor worn	**Section 7.2**
	Current limit (Cd32) set to wrong value	Cd32
	Economizer Solenoid Valve (ESV) malfunction	**Section 7.13**
	Digital Unloader Valve (DUV) stuck open	Replace
	Electronic Expansion Valve (EEV)	Replace

Table 6–1 Troubleshooting Symptoms (Continued)

Condition	Possible Cause	Remedy / Reference
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 7.10**
	Compressor service valves or liquid line shutoff valve partially closed	Open valves completely
	Frost on coil	**Section 6.10**
	Digital Unloader Valve (DUV) stuck open	Replace
	Electronic Expansion Valve (EEV)	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 7.10**
	Heat relay defective	Check
	Heater termination thermostat open	**Section 7.8**
Unit will not heat or has insufficient heat	Heater(s) defective	**Section 7.9**
	Heater contactor or coil defective	Replace
	Evaporator fan motor(s) defective or rotating backwards	**Section 7.10**
	Evaporator fan motor contactor defective	Replace
	Controller malfunction	**Section 6.9**
	Wiring defective	Replace
	Terminal connections loose	Tighten
	Line voltage is low	**Section 3.10**
6.5 Unit will not Terminate Heating		
Unit fails to stop heating	Controller improperly set	Reset
	Controller malfunction	**Section 6.9**
	Heater Termination Thermostat (HTT) remains closed along with the heat relay	**Section 7.8**
6.6 Unit will not Defrost Properly		
Will not initiate defrost automatically	Defrost timer malfunction (Cd27)	Cd27
	Terminal connections loose	Tighten
	Wiring defective	Replace
	Defrost Temperature Sensor (DTS) defective or Heat Termination Thermostat (HTT) open	Replace
	Heater contactor or coil defective	Replace

Table 6–1 Troubleshooting Symptoms (Continued)

Condition	Possible Cause	Remedy / Reference
Will not initiate defrost manually	Manual defrost switch defective	Replace
	Keypad defective	Replace
	Defrost Temperature Sensor (DTS) open	Replace
Initiates but relay (DR) drops out	Line voltage is low	**Section 3.10**
Initiates but does not defrost	Heater contactor or coil defective	Replace
	Heater(s) burned out	**Section 7.9**
Frequent defrost	Load is wet	Normal
6.7 Abnormal Pressures		
High discharge pressure	Condenser coil dirty	**Section 7.4.1**
	Condenser fan rotating backwards	**Section 7.5**
	Condenser fan inoperative	**Section 7.5**
	Refrigerant overcharge or non-condensibles	**Section 7.1.7**
	Discharge service valve partially closed	Open
	Electronic Expansion Valve (EEV) control malfunction	Replace
Low suction pressure	Software and/or controller configuration incorrect	Check
	Suction Pressure Transducer (SPT) or Evaporator Pressure Transducer (EPT) failed	Replace
	Suction service valve partially closed	Open
	Filter drier partially plugged	**Section 7.7**
	Refrigerant charge low	**Section 7.1.7**
	Evaporator air flow not existent or air flow restricted	**Section 7.8**
	Frost on evaporator coil excessive	**Section 6.6**
	Evaporator fan(s) rotating backwards	**Section 7.10**
	Electronic Expansion Valve (EEV) control malfunction	Replace
	Digital Unloader Valve (DUV) failed	Replace
Suction and discharge pressures tend to equalize when unit is operating	Compressor operating in reverse	**Section 6.14**
	Compressor cycling / stopped	Check
	Digital Unloader Valve (DUV) failed	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**
	Mounting bolts loose or resilient mounts worn	Tighten / Replace
	Upper mounting loose	**Section 7.2**
	Slugging loose	**Section 7.2**
Condenser or Evaporator Fan	Bent, loose or striking venturi	Check
	Motor bearings worn	**Section 7.5** / **Section 7.10**
	Motor shaft bent	**Section 7.5** / **Section 7.10**

Table 6–1 Troubleshooting Symptoms (Continued)

Condition	Possible Cause	Remedy / Reference
6.9 Microprocessor Malfunction		
Will not control	Software and/or controller configuration incorrect	Check
	Sensor defective	**Section 7.22**
	Wiring defective	Check
	Refrigerant charge low	**Section 7.1.7**
6.10 No Evaporator Air Flow or Restricted Air Flow		
Evaporator coil blocked	Coil has frost build-up	**Section 6.6**
	Coil dirty	**Section 7.8**
No or partial evaporator air flow	Evaporator fan motor internal protector open	**Section 7.10**
	Evaporator fan motor(s) defective	**Section 7.10**
	Evaporator fan(s) loose or defective	**Section 7.10**
	Evaporator fan contactor defective	Replace
6.11 Electronic Expansion Valve Malfunction		
Low suction pressure	Software and/or controller configuration incorrect	Check
	Suction Pressure Transducer (SPT) or Evaporator Pressure Transducer (EPT) failed	Replace
	Suction Service Valve partially closed	Open
	Filter drier partially plugged	**Section 7.7**
	Refrigerant charge low	**Section 7.1.7**
	Evaporator air flow not existent or air flow restricted	**Section 7.8**
	Evaporator coil excessive frost build-up	**Section 6.6**
	Evaporator fan(s) rotating backwards	**Section 7.10**
	Electronic Expansion Valve (EEV) control malfunction	**Section 7.12**
	Digital Unloader Valve (DUV) failed	Replace
	Sensor loose or insufficiently clamped	Replace
High suction pressure with low superheat	Valve contains foreign material	**Section 7.12**
	Suction Pressure Transducer (SPT) or Evaporator Pressure Transducer (EPT) failed	Replace
	Electronic Expansion Valve (EEV) control malfunction	**Section 7.12**
	Powerhead improperly seated	Ensure powerhead is locked and in place
Liquid slugging in compressor	Suction Pressure Transducer (SPT) or Evaporator Pressure Transducer (EPT) failed	Replace
	Electronic Expansion Valve (EEV) failed	**Section 7.12**
6.12 Autotransformer Malfunction		
Unit will not start	Circuit breaker (CB1 or CB2) tripped	Check
	Autotransformer defective	**Section 7.19**
	Power source not turned ON	Check
	460 VAC power plug not inserted into the receptacle	**Section 5.2.1**

Table 6–1 Troubleshooting Symptoms (Continued)

Condition	Possible Cause	Remedy / Reference
6.13 Water-Cooled Condenser or Water Pressure Switch		
High discharge pressure	Coil dirty	**Section 7.6**
	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	Compressor incorrectly wired	Check
	Compressor contactor(s) incorrectly wired	
	Current sensor incorrectly wired	
6.15 Abnormal Temperatures		
High discharge temperature	Condenser coil dirty	**Section 7.4.1**
	Condenser fan rotating backwards	**Section 7.5**
	Condenser fan inoperative	**Section 7.5**
	Refrigerant overcharge or non-condensibles	**Section 7.1.7**
	Discharge service valve partially closed	Open
	Electronic Expansion Valve (EEV) control malfunction	Replace
	Suction Pressure Transducer (SPT) or Evaporator Pressure Transducer (EPT) failed	Replace
	Discharge temperature sensor drifting high	Replace
	Economizer Expansion Valve (EEV), Economizer coil, or Economizer Solenoid Valve failed	Replace
	Economizer Expansion Valve (EEV), Economizer coil, or Economizer Solenoid Valve plugged	Replace
	Sensor loose or insufficiently clamped	Replace
6.16 Abnormal Currents		
Unit reads abnormal currents	Current sensor wiring	Check

Section 7
Service

7.1 Refrigerant 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.

⚠ 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

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

⚠ 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.

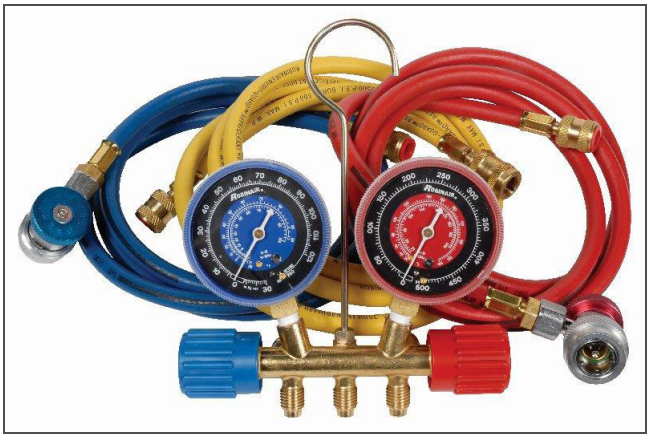
NOTE: Use a refrigerant recovery system whenever removing refrigerant. When working with refrigerants you must comply with all local government environmental laws. In the U.S.A., refer to EPA section 608.

7.1.1 Manifold Gauge Set

The manifold gauge set, as shown in **Figure 7.1**, contains self-sealing hoses and couplers. The manifold gauge set connects to a refrigeration system to determine system operating pressures, add refrigerant charge and to equalize or evacuate the system. The set is available from Carrier Transicold, part number 07-00294-00 or 07-00294-05 (metric). Hoses are refrigeration and/or evacuation hoses (SAE J2196/R-134a).

NOTE: It is recommended to dedicate the manifold gauge set to a specific refrigerant (R-134a or R-513A).

Figure 7.1 Manifold Gauge Set



The gauge set layout with hoses and couplings is shown in **Figure 7.2**. The gauge set connects to the service connections on the refrigeration unit using the blue and red hoses. Service connections are described in **Section 7.1.3**. The yellow hose is a utility connection that can be connected to a a refrigerant cylinder or vacuum pump.

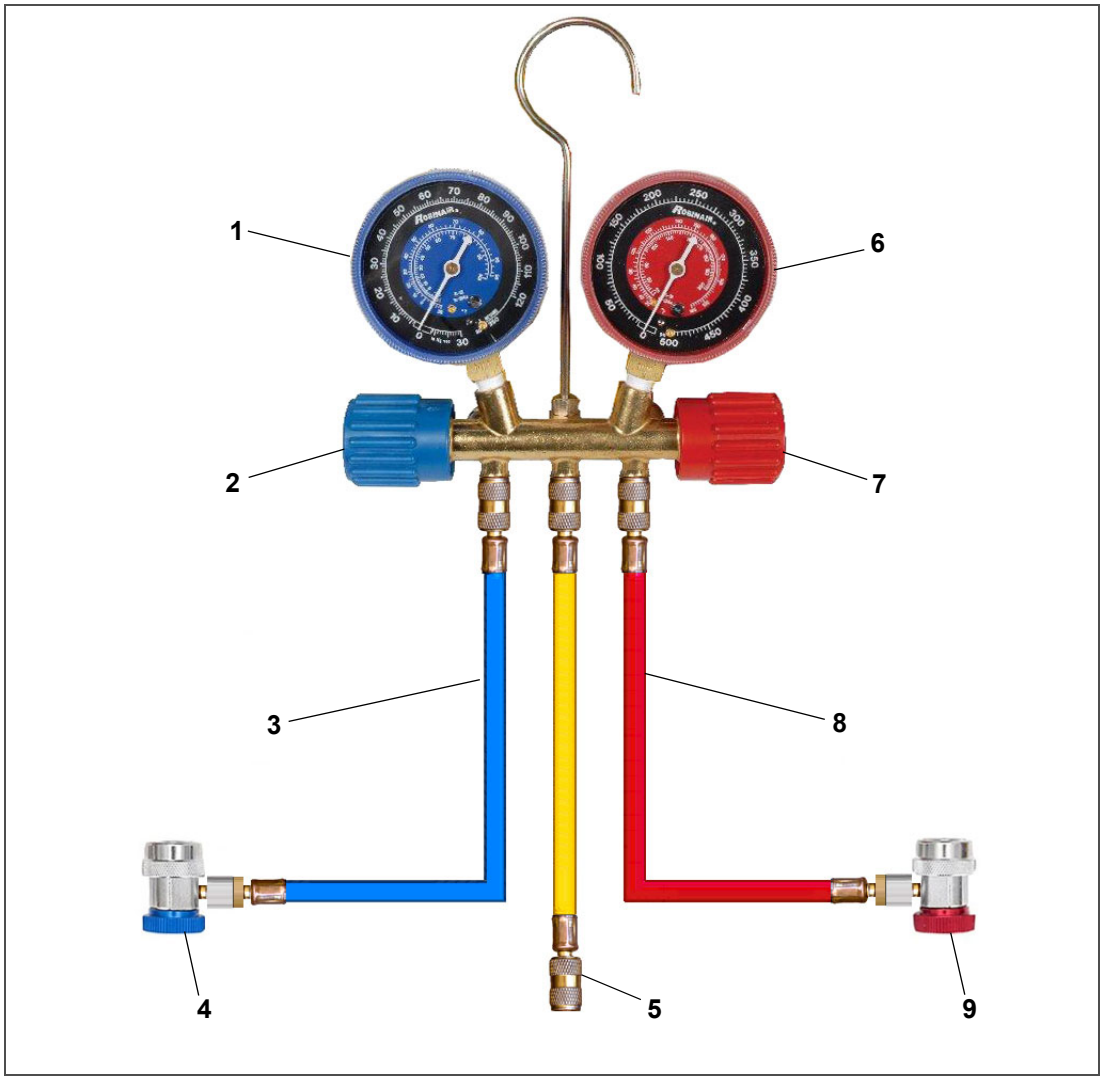
Once connected, the following procedures can be performed:

- Checking system operating pressures. When the hand valves on the gauge set are frontseated (turned clockwise), the gauges will read system pressure.
- Removing refrigerant charge
- Evacuating and dehydrating the system
- Adding refrigerant charge

Turning the hand valves clockwise will frontseat the valve (closed) to read system pressures at the gauge.

Turning the hand valves counter-clockwise will backseat the valve (open) to allow flow to the rest of the gauge set and hoses.

Figure 7.2 Manifold Gauge Set Layout



1) Suction Pressure Gauge (low side)
2) Suction Hand Valve (low side)
3) Suction Hose (low side)
4) Suction Coupling (low side)
5) Utility connection
6) Discharge Pressure Gauge (high side)
7) Discharge Hand Valve (high side)
8) Discharge Hose (high side)
9) Discharge Coupling (high side)

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7.1.2 Evacuating the Manifold Gauge Set

If a manifold gauge set is new or was exposed to the atmosphere, it will need to be evacuated to remove contaminants and air. This is done while the gauge set blue and red hoses are not connected to the service connections. Follow the procedure below.

1. Backseat (turn counterclockwise) both service couplings
2. Midseat both hand valves.
3. Connect the yellow hose to a vacuum pump and refrigerant cylinder.
4. Evacuate to 10 inches of vacuum
5. Charge with refrigerant to a slightly positive pressure of 0.1 kg / cm2 (1.0 psig).
6. Frontseat (turn clockwise) both hand valves.
7. Disconnect from the cylinder. The gauge set is now ready for use.

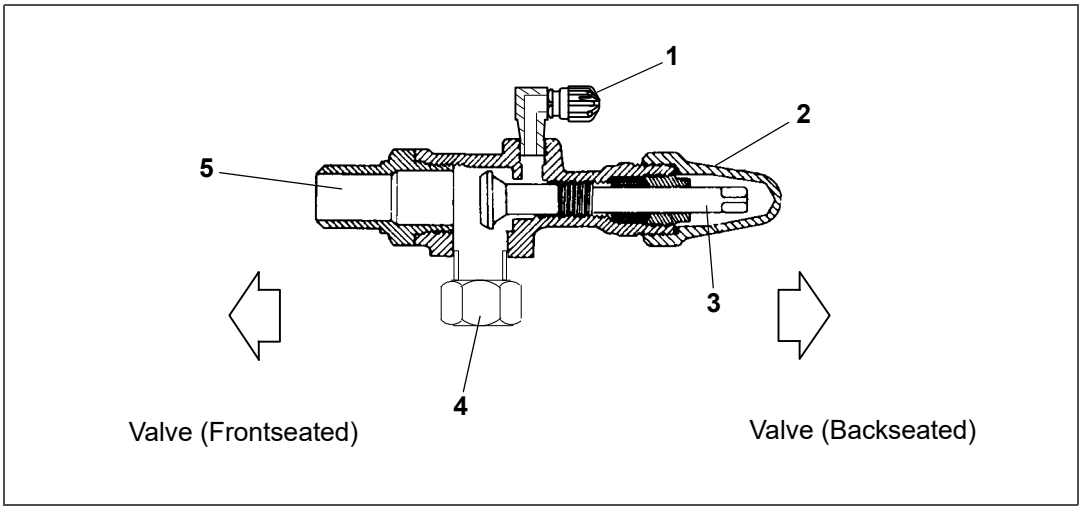
7.1.3 Service Connections

There are three service valves on the unit for connecting to the manifold gauge set and performing refrigerant service: compressor suction section valve and compressor discharge service valve and the liquid line (king) service valve. The service valves are provided with a double seat and an access valve which enables servicing of the compressor and refrigerant lines. See **Figure 7.3** for diagram.

See **Figure 3.18** for compressor suction valve and discharge valve.

See **Figure 3.19** for liquid line valve.

Figure 7.3 Service Valve



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

- - - - -

Turning the service valve stem clockwise will frontseat the valve to close off the line connection and open a path to the access valve.

Turning the service valve stem counterclockwise will backseat the valve to open the line connection and close off the path to the access valve.

With the service 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.

7.1.4 Connecting the Manifold Gauge Set

Connection of the manifold gauge set is dependent on the procedure performed or components serviced.

For reading system pressures, performing a manual pump down, or checking refrigerant charge, the manifold gauge set connects to the suction service valve (blue hose) and discharge service valve (red hose):

See **Figure 7.4** for illustration.

For the procedure for adding a partial refrigerant charge, the manifold gauge set connects to the suction service valve (blue hose), discharge service valve (red hose) and refrigerant cylinder (yellow hose).

See **Figure 7.5** for illustration.

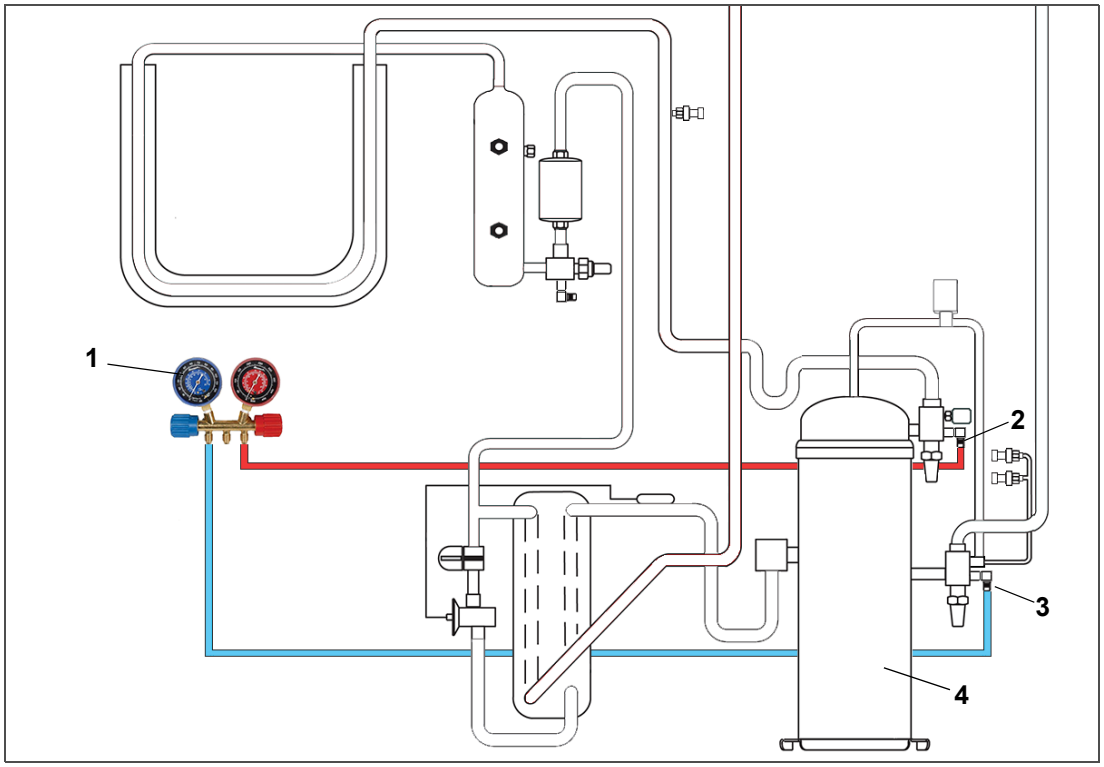
For the procedure for adding a full refrigerant charge, the manifold gauge set connects to the suction service valve (blue hose), liquid line service valve (red hose) and refrigerant cylinder (yellow hose).

See **Figure 7.6** for illustration.

For the procedure to evacuate and dehydrate the system, see Section, the manifold gauge set connects to the refrigerant recovery system (blue hose), vacuum micron gauge (red hose) and vacuum pump (yellow hose). The service valves (suction, discharge, liquid line) all connect with evacuation hoses directly to the vacuum pump.

See **Figure 7.7** for illustration.

Figure 7.4 Connection for Reading Pressures, Manual Pump Down and Checking Charge



1) Manifold Gauge Set
2) Discharge Service Valve
3) Suction Service Valve
4) Compressor

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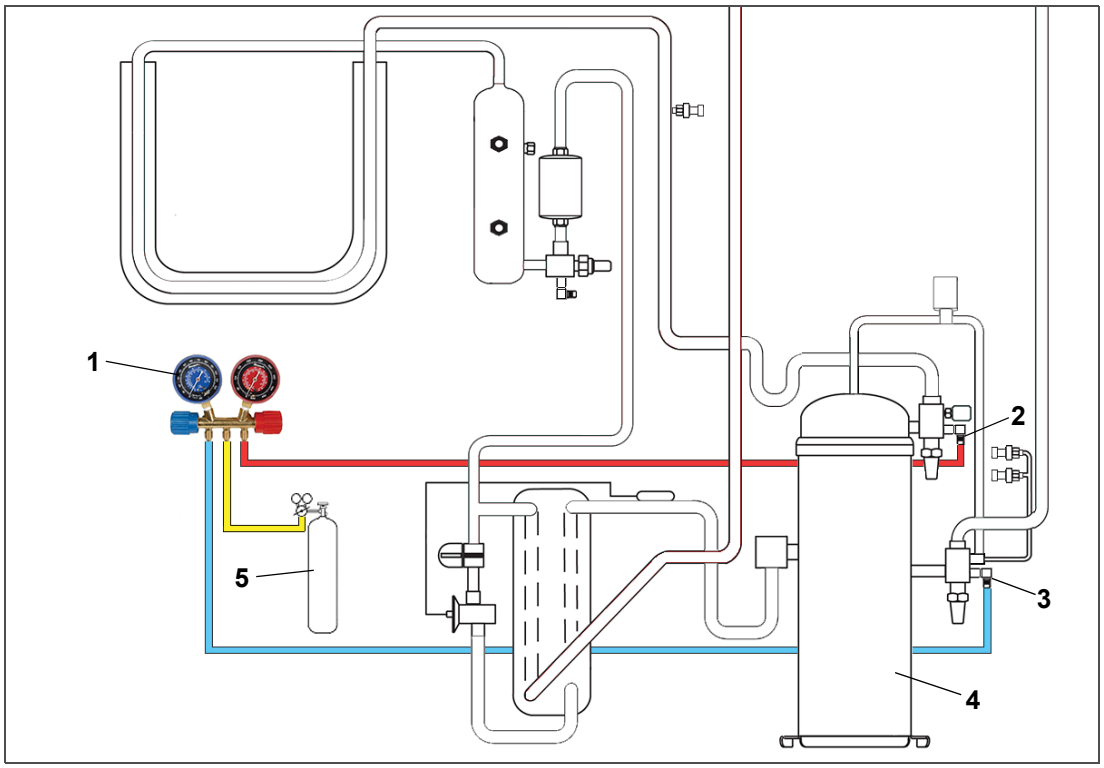
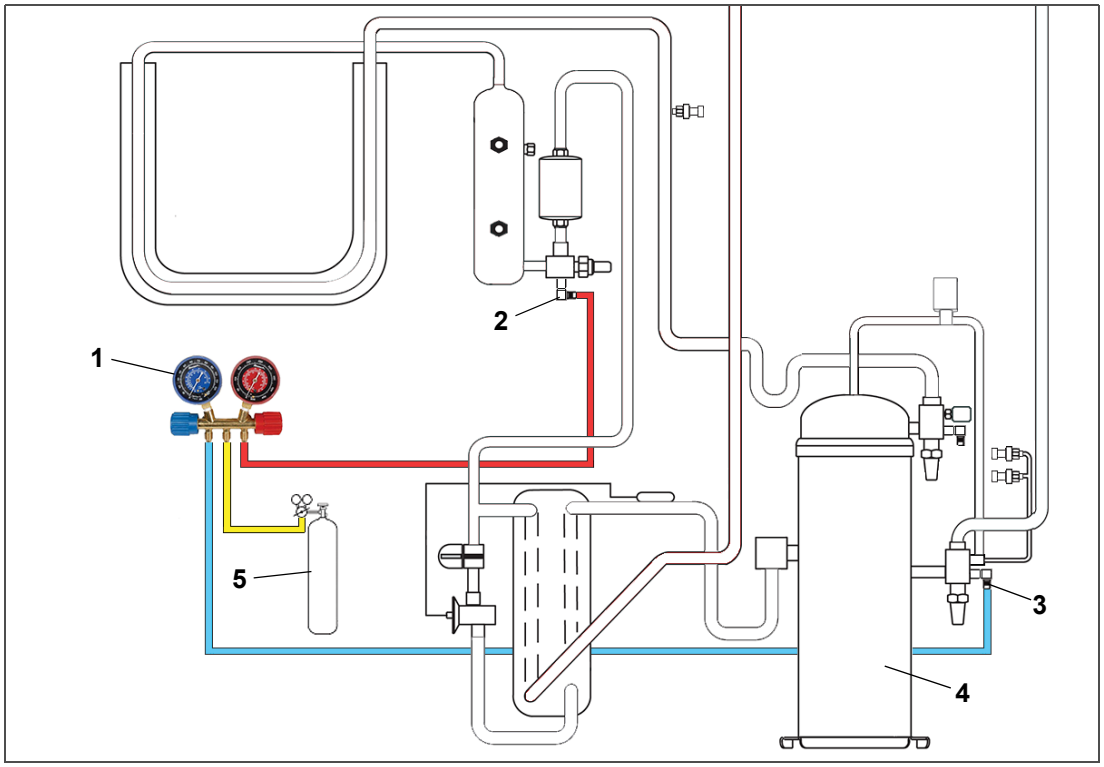
Figure 7.5 Connection for Adding a Partial Charge



1) Manifold Gauge Set
2) Discharge Service Valve
3) Suction Service Valve
4) Compressor
5) Refrigerant Cylinder

- - - - -

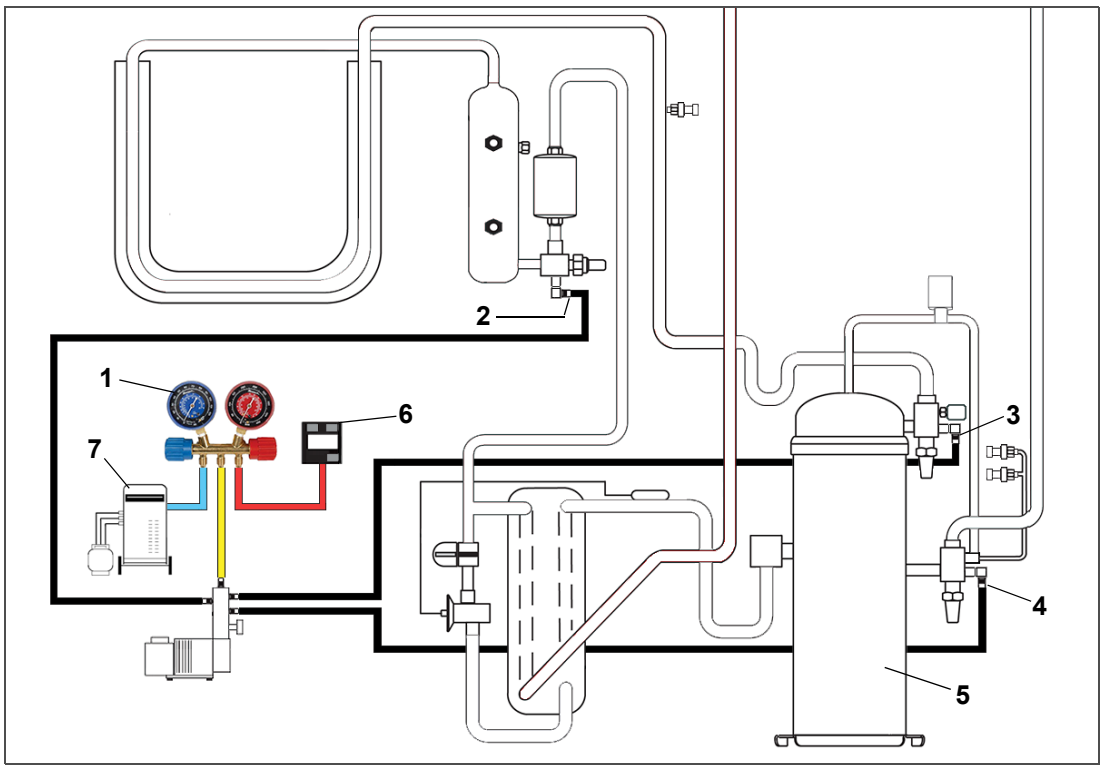
Figure 7.6 Connection for Adding a Full Charge (Liquid)



1) Manifold Gauge Set
2) Liquid Line Service Valve
3) Suction Service Valve
4) Compressor
5) Refrigerant Cylinder

- - - - -

Figure 7.7 Connection for Evacuation and Dehydration



1) Manifold Gauge Set
2) Liquid Line Service Valve
3) Discharge Service Valve
4) Suction Service Valve
5) Compressor
6) Vacuum Micron Gauge
7) Refrigerant Recovery System
8) Vacuum Pump

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7.1.4.1 Connect the Manifold Gauge Set to Access Valves

1. Verify that both hand valves on the manifold gauge set are fully closed.
2. Remove the service valve stem cap and make sure the service valve is backseated.
3. Remove the service access valve cap.
4. Connect the hose coupling to the service access valve; blue for suction (low side), red for discharge (high side).
5. Repeat the steps to connect the gauges to both suction (low side) and discharge (high side).

7.1.4.2 Removing the Manifold Gauge Set from Access Valves

1. While the compressor is still ON, backseat the discharge (high side) service valve.
2. Midseat both gauge set hand valves and allow the pressure in the gauge set to be drawn down to suction (low side) pressure. This returns any liquid that may be in the discharge (high side) hose to the system.

⚠ CAUTION

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

3. Backseat the suction (low side) service valve.
4. Backseat both service couplings.
5. Frontseat both hand valves on the manifold gauge set.
6. Remove both couplings from the access valves.
7. Install both service valve stem caps and service port caps, finger-tight only.

7.1.5 Reading System Pressures

1. Connect the manifold gauge set to the suction service valve and discharge service valve.

   See **Section 7.1.4.1** for procedure to connect to valves. See **Figure 7.4** for connection diagram.
2. Make sure both hand valves on the manifold gauge set are fully closed.
3. For suction pressure, turn the blue coupling (low side) knob clockwise to open the system to the manifold gauge set.
4. Slightly midseat the suction service valve to read system low side pressure at the manifold gauge set.
5. For discharge pressure, turn the red coupling (high side) knob clockwise to open the system to the manifold gauge set.
6. Slightly midseat the discharge service valve to read system high side pressure at the manifold gauge set.

7.1.6 Pump Down the Unit

The pump down procedure is to pump the refrigerant into the high side of the unit to service components. These components include the filter drier, electronic expansion valve (EEV), economizer, economizer expansion valve (EXV), economizer solenoid valve (ESV), digital unloader valve (DUV) or evaporator coil.

⚠ 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.

7.1.6.1 Automatic Pump Down

1. To perform an automatic pump down, use function code Cd59 Pump Down Logic. See Cd59 description for more detailed information.
2. If the automatic pump down succeeds within 25 minutes, the display will alternate the messages “P dN” | “DOnE” and “SHUT” | “OFF” to notify that pump down is complete. Turn the unit off.
3. 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.
4. After the system has been opened up and repairs have been made, perform a refrigerant leak check. See **Section 7.1.8**.
5. Evacuate and dehydrate the low side. See **Section 7.1.9**.
6. Check refrigerant charge. See **Section 7.1.7.1**.

7.1.6.2 Manual Pump Down

1. Connect the manifold gauge set to the suction service valve and discharge service valve.

   See **Section 7.1.4.1** for procedure to connect to valves. See **Figure 7.4** for connection diagram.
2. Start the unit and run in frozen mode, with the controller setpoint below -10°C (14°F), for 10 to 15 minutes.
3. The economizer solenoid valve (ESV) should be open. If not, continue to run until the valve opens. Function code Cd21 will state if economized mode is active.
4. Frontseat the liquid line service valve. When the suction reaches a positive pressure of 0.1 bar (1.4 psig), turn the unit Off (“0”) at the Start-Stop switch (ST).
5. Frontseat the suction service valve and discharge service valve. The refrigerant will be trapped between the discharge service valve and the liquid line service 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 the system has been opened up and repairs have been made, perform a refrigerant leak check. See **Section 7.1.8**.
9. Evacuate and dehydrate the low side. See **Section 7.1.9**.
10. Check refrigerant charge. See **Section 7.1.7.1**.

7.1.7 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 (O2) 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.

⚠ 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.

NOTE: When working with refrigerants you must comply with all local government environmental laws. In the U.S.A., refer to EPA Section 608.

7.1.7.1 Checking the Refrigerant Charge

1. Connect the manifold gauge set to the suction service valve and discharge service valve.

   See **Section 7.1.4.1** for procedure to connect to valves. See **Figure 7.4** for connection diagram.
2. For units operating on a water-cooled condenser, change over to air-cooled operation. Disconnect the water supply and the discharge line to the water-cooled condenser. The refrigeration unit will shift to air-cooled condenser operation when the water pressure switch (WPS) closes.
3. Bring the container temperature to approximately 0°C (32°F) or below. Then, set the controller unit setpoint to -25°C (-13°F).
4. 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). This is viewed at code Cd14.
5. The level on the receiver should be between the glasses. On units equipped with a water-cooled condenser, the level should be at the center of the glass. If the refrigerant level is not correct, add or remove refrigerant as required.

7.1.7.2 Adding Refrigerant to System - Full Charge

1. Evacuate the unit and leave in a deep vacuum. See **Section 7.1.9**.
2. Place the refrigerant cylinder on a scale.
3. Connect the manifold gauge set to the suction service valve, liquid line service valve and refrigerant cylinder.

   See **Section 7.1.4.1** for procedure to connect to valves. See **Figure 7.6** for connection diagram.
4. Purge the charging line at the liquid line service valve and then note the weight of the cylinder and refrigerant.
5. Open the liquid valve on the cylinder. Open the liquid line service valve halfway and allow liquid refrigerant to flow into the unit until the correct weight of refrigerant has been added as indicated by scales.
6. 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.
7. Backseat the liquid line service valve to close off the gauge port. Close the liquid valve on the cylinder.
8. Start the unit in cooling mode. Run for approximately 10 minutes and check the refrigerant charge.

7.1.7.3 Adding Refrigerant to System - Partial Charge

1. Examine the refrigerant system for any evidence of leaks, and repair as necessary. See **Section 7.1.8**.
2. Maintain the conditions outlined in the beginning of this section. See **Section 7.1.7.1**.
3. Fully backseat the suction service valve and remove the service port cap.
4. Connect the charging line from the refrigerant cylinder to the suction service valve port.
5. Open the vapor valve.
6. Partially frontseat (turn clockwise) the suction service valve and slowly add charge until the refrigerant appears at the proper level.

NOTE: Be careful not to frontseat the suction service valve fully. If the compressor is operating in a vacuum, internal damage may result.

7.1.8 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.

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.

NOTE: 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.

1. 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.
2. If required, remove refrigerant using a refrigerant recovery system and repair any leaks. Check for leaks.
3. Evacuate and dehydrate the unit. See **Section 7.1.9**.
4. Charge the unit with refrigerant. See **Section 7.1.7**.

7.1.9 Evacuation and Dehydration

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.

Tools Required:

- Refrigerant recovery system. Carrier part # 07-00609-00.
- Vacuum pump, 2 stage, 3 to 5 cfm capacity. Carrier part # 07-00176-11.
- Electronic micron vacuum gauge. Carrier part # 07-00414-00.

7.1.9.1 Preparation

- Make necessary repairs to the unit and perform a refrigerant leak check to the system. See **Section 7.1.8** for procedure.
- 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.
- Additional time may be saved during a complete system evacuation by replacing the filter drier with a section of copper tubing and the appropriate fittings. Installation of a new filter drier may be performed during the charging procedure.

7.1.9.2 Evacuating and Dehydrating - Complete System

1. Connect a manifold gauge set to a refrigerant recovery system (blue hose), electronic micron gauge (red hose) and a vacuum pump (yellow hose). Then, connect the suction service valve, discharge valve and liquid line service valve to the vacuum pump with service hoses suitable for evacuation.

   See **Figure 7.4** for connection diagram.

2. Remove all refrigerant using the refrigerant recovery system. First recover liquid refrigerant from the receiver. Then, finish the recovery procedure in vapor mode.

3. The recommended method to evacuate and dehydrate the system is to connect evacuation hoses at the compressor suction and liquid line service valve. 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).

4. 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 restarting the unit. Starting the unit with the coil removed from the valve will burn out the coil.

5. 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.

6. Midseat the refrigerant system service valves.

7. Open the vacuum pump and electronic vacuum gauge valves, if they are not already open.

8. Start the vacuum pump and 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.

9. 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.

10. If refrigerant was used, remove using a refrigerant recovery system. If nitrogen was used, relieve the pressure.

11. Repeat steps 6 and 7 one time.

12. 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.

13. With a vacuum still in the unit, the refrigerant charge may be drawn into the system from a refrigerant container on weight scales.

7.1.9.3 Evacuating and Dehydrating - 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.

7.1.10 Converting to R-513A Refrigerant

This procedure only applies to units with a R-513A-ready compressor. This conversion is only by approval of the equipment owner.

1. Recover all R-134a refrigerant from the unit, by following procedure in **Section 7.1.9**.

2. Change the filter drier.

3. Evacuate to 500 microns by placing the vacuum pump on the liquid line service valve and suction service valve.

4. Charge the unit with a full charge of R-513A refrigerant, by following procedure in **Section 7.1.7.2**. Charge amounts are found in **Section 3.9** 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.

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

7.2 Compressor

⚠ WARNING

Before servicing the unit, make sure the circuit breakers (CB1 & CB2) and start-stop switch (ST) are in the OFF position and the unit is disconnected from power.

⚠ 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.

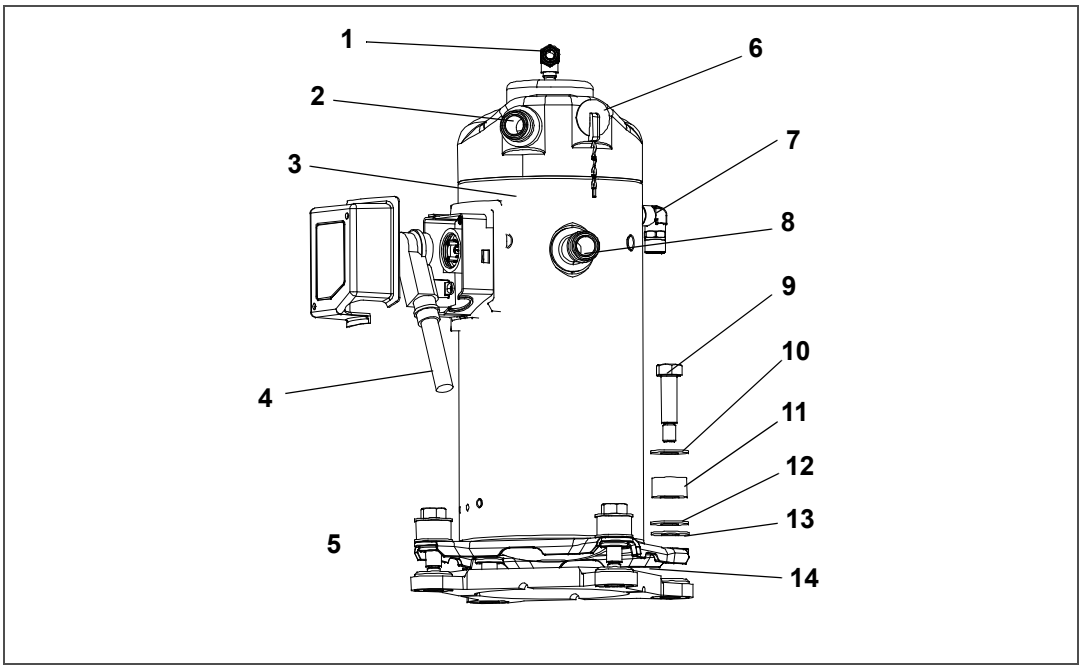
⚠ CAUTION

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.

7.2.1 Removing and Replacing the Compressor

The compressor and related components are described in **Section 3.3.1**. See **Figure 7.8** for compressor kit illustration.

Figure 7.8 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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Procedure:

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 service valve and discharge service valve and go to step 5 below.

2. Frontseat the liquid line service valve and allow the unit to pull-down to 0.1 kg/cm2 (1 psig).
3. Turn the unit Off “0” at the Start-Stop switch (ST), turn the unit circuit breaker (CB1) Off and disconnect power to the unit.
4. Frontseat the discharge service valve and suction service valve.
5. Remove all remaining refrigerant from the compressor using a refrigerant recovery system.

   See **Figure 7.4** for connection diagram.
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 service and discharge service connections, and uncouple the digital unloader valve (DUV) and economizer lines from the compressor.

8. Cut the dome 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.
13. Slide the new compressor into the unit.

NOTE: DO NOT add any oil to the replacement compressor. Replacement compressor is shipped with a full oil charge of 60 oz.

14. Cut and discard the wire ties used to hold the base plate to the compressor.
15. 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 7.8**. Install the four base mounting bolts loosely.
16. Place the new Teflon seals at the compressor suction and discharge ports as well as the O-rings at the DUV and economizer line connection ports. Hand tighten all four connections.
17. Torque the four base-mounting screws to 6.2 mkg (45 ft-lbs).
18. 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.)

19. 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.
20. 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 7.1.9** for evacuation procedure.

    See **Section 7.1.7.2** for adding refrigerant charge procedure.
21. 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.
22. Backseat all service valves, connect the power to the unit and run for at least 20 minutes.
23. Perform a leak check of the system. See **Section 7.1.8** for procedure.

7.3 High Pressure Switch

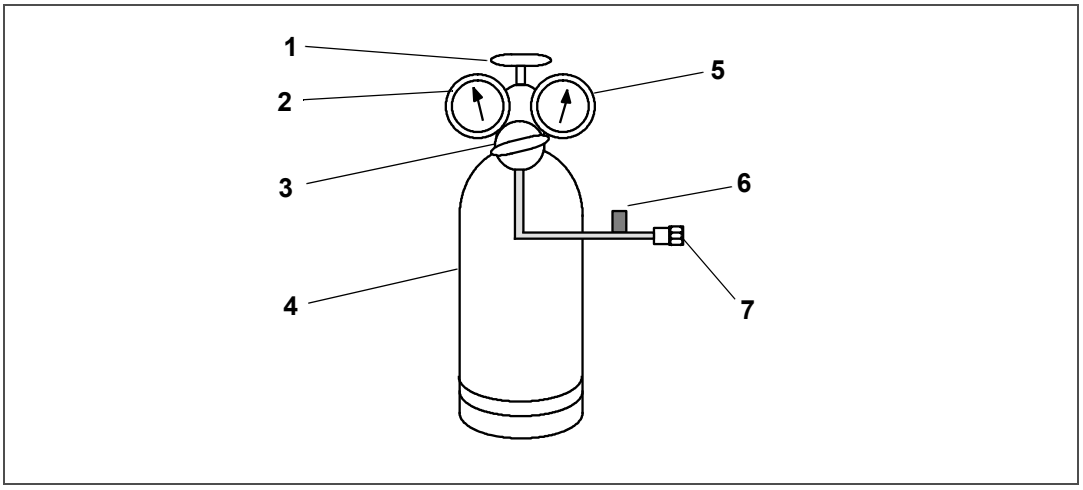
The high pressure switch (HPS), shown in **Figure 3.25**, monitors abnormally high discharge pressure. It opens at 25 (+/- 1.0) kg/cm^2 | 350 (+/- 10) psig. It closes at 18 (+/- 0.7) kg/cm^2 | 250 (+/- 10) psig.

NOTE: The HPS is not adjustable, it needs to be replaced if not operating properly.

7.3.1 Checking the High Pressure Switch

1. Remove switch as outlined in **Section 7.3.2**.
2. Connect an ohmmeter or continuity light across switch terminals. An ohmmeter 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, as illustrated in **Figure 7.9**.

Figure 7.9 High Pressure Switch Testing with Nitrogen



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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⚠ WARNING

Do not use a nitrogen cylinder if it does not have a pressure regulator.

4. Set the nitrogen pressure regulator at 26.4 kg/cm^2 (375 psig) with the bleed-off valve closed.
5. Close the valve on the cylinder and open the bleed-off valve.
6. Open the cylinder valve. Slowly close the bleed-off valve to increase pressure on the switch. The switch should open at a static pressure up to at 25 (+/- 1.0) kg/cm^2 | 350 (+/- 10) psig. If a light is used, the light will go out. If an ohmmeter is used, the meter will indicate an open circuit.
7. Slowly open the bleed-off valve to decrease pressure. The switch should close at 18 (+/- 0.7) kg/cm^2 | 250 (+/- 10) psig.

7.3.2 Replacing the High Pressure Switch

1. Remove the refrigerant charge.
2. Disconnect wiring from defective switch. The high pressure switch (HPS) is located on the discharge connection or line and is removed by turning counterclockwise.
3. Install a new HPS after verifying switch settings.
4. Evacuate, dehydrate and recharge the system. See **Section 7.1.9** for procedure.
5. Start the unit, verify refrigeration charge and oil level.

7.4 Condenser Coil

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

7.4.1 Cleaning the Condenser Coil

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

Before servicing the unit, make sure the circuit breakers (CB1 & CB2) and start-stop switch (ST) are in the OFF position and the unit is disconnected from power.

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, 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.

7.4.2 Removing the Condenser Coil

1. Connect a manifold gauge set to a refrigerant recovery system (blue hose), electronic micron gauge (red hose) and a vacuum pump (yellow hose). Then, connect the suction service valve, discharge valve and liquid line service valve to the vacuum pump with service hoses suitable for evacuation.

   See **Figure 7.4** for connection diagram.

1. Remove all refrigerant using the refrigerant recovery system. First recover liquid refrigerant from the receiver. Then, finish the recovery procedure in vapor mode.

⚠ WARNING

Before servicing the unit, make sure the circuit breakers (CB1 & CB2) and start-stop switch (ST) are in the OFF position and the unit is disconnected from power.

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.

7.4.3 Preparing the Condenser Coil

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

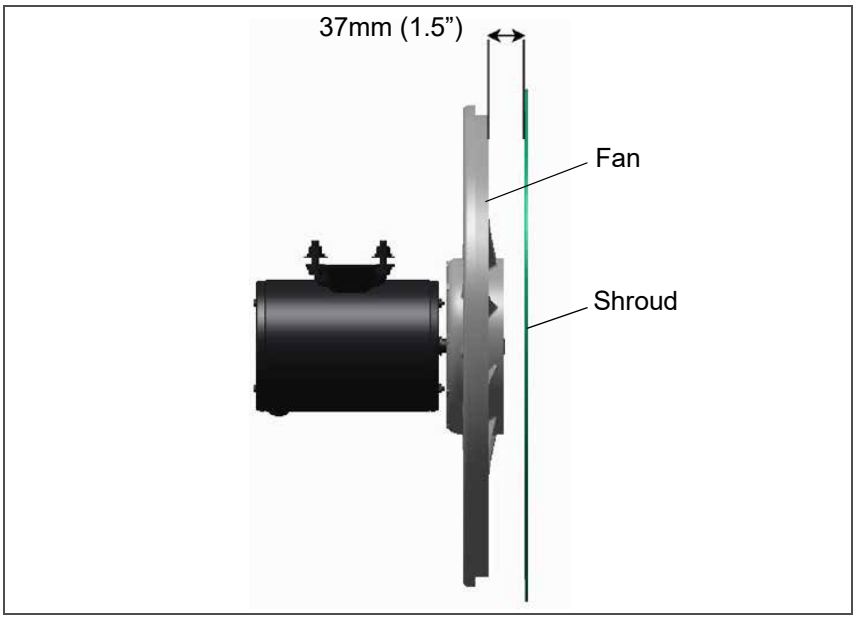
1. From the old coil, unbolt the receiver assembly from the side support bracket.
2. Unbraze the receiver assembly from the coil outlet line and remove from the coil assembly.
3. Unbolt the side support bracket from the top and bottom coil supports and remove from the old coil.
4. Refit the side support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

7.4.4 Installing the Condenser Coil

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 7.1.8**.
10. Evacuate the entire unit. See **Section 7.1.9**.
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 7.10**.

Figure 7.10 Condenser Fan Position



19. Use Loctite "H" on the fan set screws, and tighten.
20. Refit the 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 7.1.9**.
23. Recharge the unit with the charge shown on the unit serial plate. See **Section 7.1.7**. It is important for proper unit operation that the charge is weighed into the unit.

7.5 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.

7.5.1 Removing and Replacing the Condenser Fan Motor

⚠ WARNING

Before servicing the unit, make sure the circuit breakers (CB1 & CB2) and start-stop switch (ST) are in the OFF position and the unit is disconnected from power.

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. The same configuration is 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 7.10**.
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.

7.6 Water-Cooled Condenser Cleaning

The water-cooled condenser can accumulate rust, scale and slime on the water-cooling surfaces. This can 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.

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, contact a local Oakite technical service representative for suggestions in planning the procedure.

7.6.1 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.

7.6.2 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.

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, 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.
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.

7.7 Filter Drier

As a general practice the filter drier, shown in **Figure 3.12**, should be replaced any time the system is opened for service. 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.

7.7.1 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.

7.7.2 Replacing the Filter Drier

1. Pump down the unit. See **Section 7.1.6** for procedure.
2. Replace the filter drier. Torque to 43-47 Nm (32-35 ft-lbs).
3. Evacuate the low side in accordance with **Section 7.1.9**, evacuation procedure.
4. After unit is in operation, inspect for moisture in the system and check the charge.

7.8 Evaporator Coil

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.

7.8.1 Replacing the Evaporator Coil

1. Pump down the unit. See **Section 7.1.6** for procedure.

⚠ WARNING

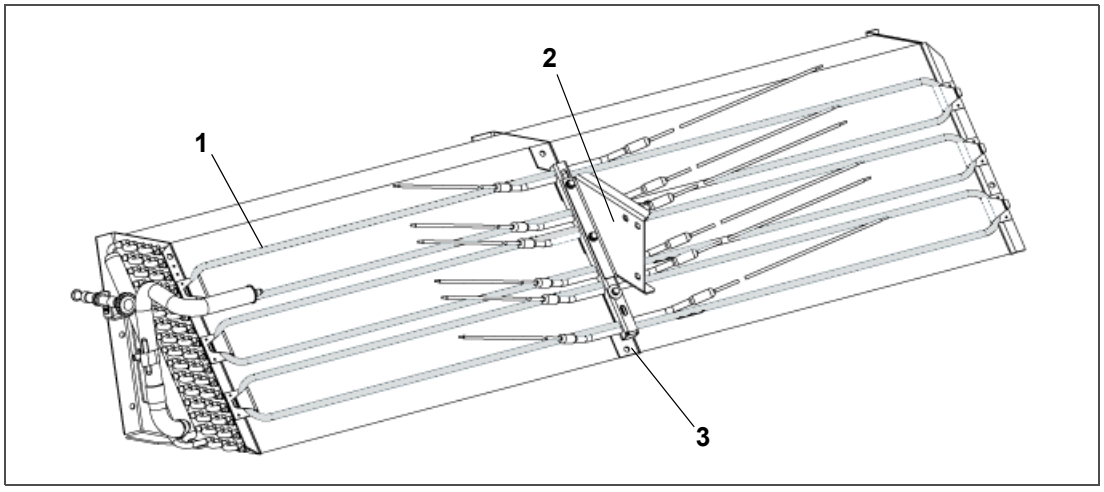
Before servicing the unit, make sure the circuit breakers (CB1 & CB2) and start-stop switch (ST) are in the OFF position and the unit is disconnected from power.

2. With power OFF and power plug removed, remove the screws securing the panel covering the evaporator section (upper panel).
3. Disconnect the defrost heater wiring.
4. Remove the mounting hardware from the coil.
5. Unsolder the two coil connections, one at the distributor and the other at the coil header.
6. Disconnect the defrost temperature sensor from the coil. See **Section 7.22**.
7. Remove middle coil support.
8. After defective coil is removed from unit, remove defrost heaters and install on replacement coil.
9. Install the coil assembly by reversing the above steps.
10. Leak check the connections. Evacuate and add refrigerant charge. See **Section 7.1.9**, evacuation procedure.

7.9 Evaporator Heaters

The heaters, see **Figure 7.11**, 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.

Figure 7.11 Heater Arrangement



1) Heater Element (6)
2) Bracket
3) Retainer

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7.9.1 Megger Testing the Heaters

⚠ WARNING

Before servicing the unit, make sure the circuit breakers (CB1 & CB2) and start-stop switch (ST) are in the OFF position and the unit is disconnected from power.

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.

   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 setpoint 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.

3. Identify the faulty heater(s):

   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.

4. 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.

5. If the unit is empty, replace the faulty heater:

   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. Replace any heater where the Megger readings are < 1 Mohms. 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 a heater, reverse steps.

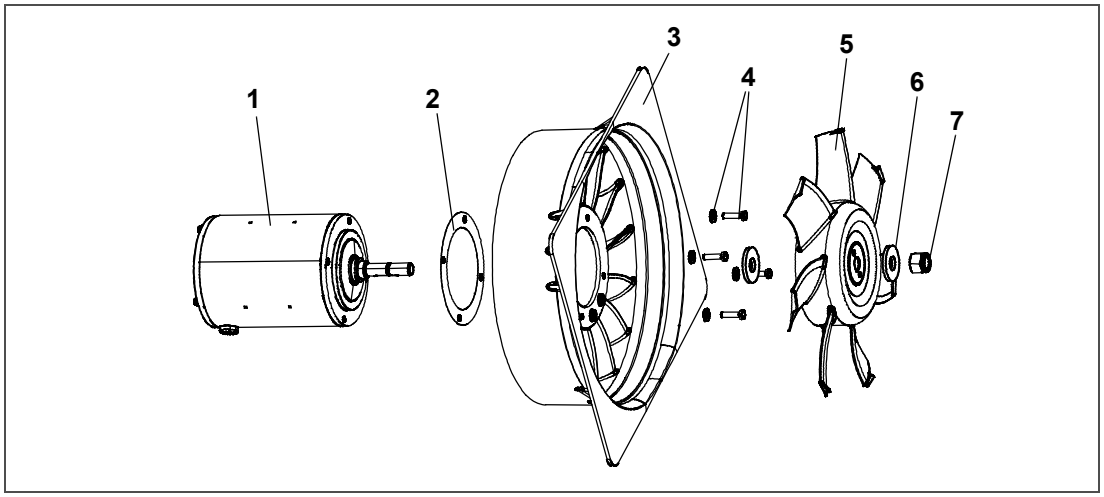
i. Reconnect all wiring using new splices and heat shrink where needed. The heat shrink MUST have a 'meltable' liner to ensure that the connections are properly sealed when shrunk. This can be seen as a 'ring' of melt liner pushed from under the heat shrink at each end of the shrink tube.

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

7.10 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.

Figure 7.12 Evaporator Fan Assembly



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

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7.10.1 Replacing the Evaporator Fan Assembly

⚠ WARNING

Before servicing the unit, make sure the circuit breakers (CB1 & CB2) and start-stop switch (ST) are in the OFF position and the unit is disconnected from power.

1. Remove the access panel by removing the mounting bolts and TIR locking device.
2. Reach inside of the unit and remove the Ty-Rap securing the wire harness loop.
3. Disconnect the connector by twisting to unlock and pulling to separate.
4. 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.
5. Slide the fan assembly out from the unit and place on a sturdy work surface.

7.10.2 Disassembling the Evaporator Fan Assembly

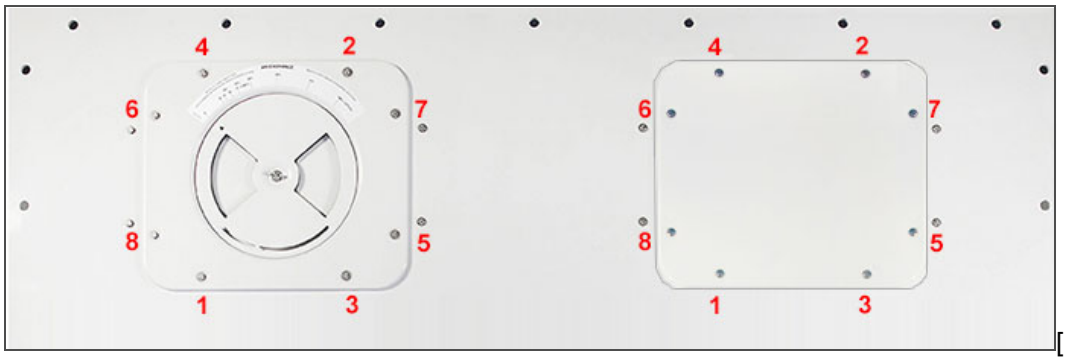
1. Attach a spanner wrench to the two 1/4-20 holes located in the fan hub. Loosen the 5/8-18 shaft nut by holding the spanner wrench stationary and turning the 5/8-18 nut counter-clockwise. See **Figure 7.12**.
2. Remove the spanner wrench. Use a universal wheel puller and remove the fan from the shaft. 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.

7.10.3 Assembling the Evaporator Fan Assembly

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.

1. Assemble the motor and plastic spacer onto the stator.
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.
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 7.13**. Repeat the pattern twice for a proper seal.

Figure 7.13 Access Panel Torque Pattern



7.11 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, which is a coarse crystalline deposit most likely caused by surface corrosion on the aluminum parts within the container. If left untreated over time, it may build up in thickness and eventually flake as a lightweight white powder.

The surface corrosion of aluminum is caused 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 that is 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.

7.11.1 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.

7.11.2 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.

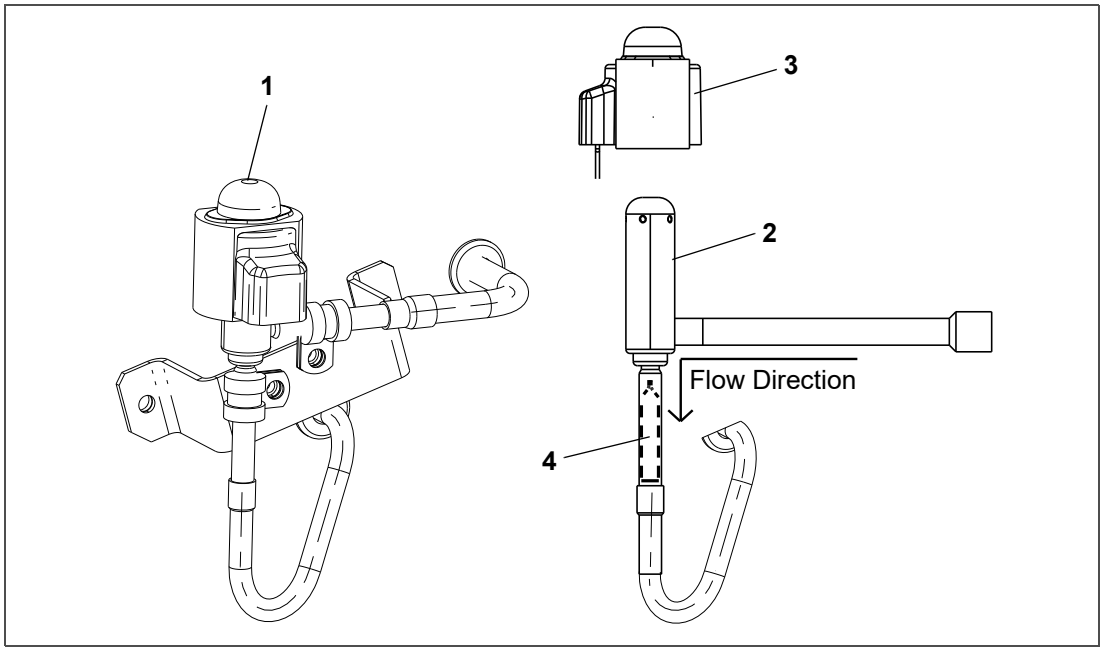
7.12 Electronic Expansion Valve (EEV)

The electronic expansion valve (EEV), as shown in **Figure 7.14**, is an automatic device which maintains required superheat of the refrigerant gas leaving the evaporator. Unless the valve is defective, it seldom requires any maintenance. The valve functions are:

- Automatic response of refrigerant flow to match the evaporator load
- prevention of liquid refrigerant entering the compressor.

NOTE: The EEV is independently operated by the microprocessor. See **Section 8** for schematics.

Figure 7.14 Electronic Expansion Valve (EEV)



1) EEV Assembly
2) EEV
3) EEV Coil, with boot
4) Strainer

7.12.1 Removing an EEV

⚠ WARNING

Before servicing the unit, make sure the circuit breakers (CB1 & CB2) and start-stop switch (ST) are in the OFF position and the unit is disconnected from power.

1. Pump down the compressor. See **Section 7.1.6** for pump down procedure.
2. Frontseat the suction service valve and discharge service valve.
3. Turn unit power off and remove power from the unit.
4. Remove the coil.
5. 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, then remove the valve. Alternatively, use a wet rag to keep the valve cool. Heat inlet and outlet connections to valve body and then remove the valve.
6. Clean the valve stem with mild cleaner, if necessary.

7.12.2 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.
3. Replace the filter drier. See **Section 7.7.2** for replace procedure.
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. It should be 4.4 to 6.7°C (8 to 12°F).
7. Check unit operation by running a Pre-Trip inspection. See **Section 5.7** for pre-trip procedure.

7.13 Economizer Solenoid Valve (ESV)

The economizer solenoid valve (ESV), as shown in **Figure 3.23**, opens when the unit is in Economized operation. The liquid refrigerant flows through the ESV to the expansion valve internal passages, absorbing heat from the liquid refrigerant flowing to the EEV. The resultant “medium” temperature / pressure gas enters the compressor at the economizer port fitting.

7.13.1 Removing an ESV

1. Pump down the compressor. See **Section 7.1.6** for pump down procedure.
2. Frontseat the suction service valve and discharge service valve.
3. 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, then remove the valve. Alternatively, heat inlet and outlet connections to valve body and then remove the valve.
4. Clean the valve stem with mild cleaner, if necessary.

7.13.2 Installing an ESV

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

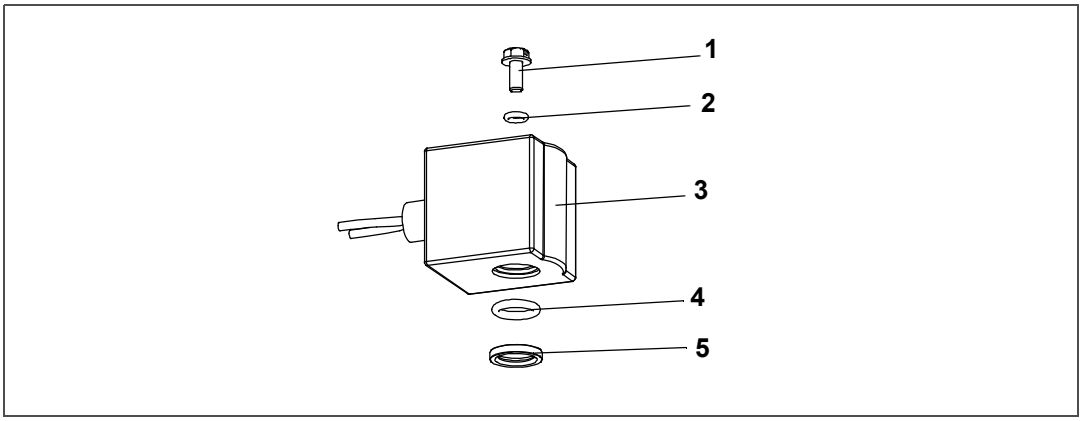
7.13.3 Removing an ESV Coil

⚠ WARNING

Before servicing the unit, make sure the circuit breakers (CB1 & CB2) and start-stop switch (ST) are in the OFF position and the unit is disconnected from power.

1. Turn unit power off and remove power from the unit. Disconnect leads.
2. Remove the top screw and o-ring.
3. Remove the coil and save mounting hardware, seals and spacer for reuse. See **Figure 7.15**.

Figure 7.15 Economizer Solenoid Valve (ESV) Coil Assembly



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

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7.13.4 Installing an ESV Coil

1. Install the brass spacer on the valve stem.
2. Lubricate both o-rings with silicone provided in the kit.
3. Install the 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.

7.14 Economizer Expansion Valve (EXV)

The Economizer Expansion Valve (EXV), as shown in **Figure 3.23**, 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.

7.14.1 Removing an EXV

⚠ WARNING

Before servicing the unit, make sure the circuit breakers (CB1 & CB2) and start-stop switch (ST) are in the OFF position and the unit is disconnected from power.

1. Pump down the compressor. See **Section 7.1.6** for pump down procedure.
2. Frontseat the suction service valve and discharge service valve.
3. Turn unit power off and remove power from the unit.
4. Remove cushion clamps located on the inlet and outlet lines.
5. Remove insulation (Presstite) from the expansion valve bulb.
6. Unstrap the bulb, located on the economizer line.

7. 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.
8. Clean the valve stem with a mild cleaner, if necessary.

7.14.2 Installing an EXV

1. The Economizer Expansion Valve (EXV) 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 7.7**.
6. Evacuate to 500 microns by placing a vacuum pump on the liquid line and suction service valve.
7. Check EXV superheat. It should be 4.4 to 11.1°C (8 to 20°F).

7.15 Digital Unloader Valve (DUV)

The normally closed digital unloader valve (DUV), as shown in **Figure 3.20**, will open during unloaded operation to allow pressure from the top of scroll elements to return to the suction service valve. A failed DUV can result in the unit running continually in the fully loaded mode causing it to undershoot its setpoint temperature.

NOTE: The DUV is independently operated by the microprocessor. See **Section 8** for schematics.

7.15.1 Removing the DUV

⚠ WARNING

Before servicing the unit, make sure the circuit breakers (CB1 & CB2) and start-stop switch (ST) are in the OFF position and the unit is disconnected from power.

1. Pump down the compressor. See **Section 7.1.6** for pump down procedure.
2. Frontseat the suction service valve and discharge service valve. In the event the DUV is stuck open and the compressor cannot pump down, remove charge.
3. Turn unit power off and remove power from the unit.
4. 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.

5. Remove the clamps holding the DUV to the line.
6. Loosen the nuts securing the DUV in place.
7. 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, then remove the valve. Alternatively, use a wet rag to keep the valve cool. Heat the outlet connection to valve body and then remove the valve.
8. Examine the compressor and service valves. Ensure that the o-ring is not stuck in the gland of the valve.
9. Discard the o-ring on the o-ring face seal connection.

7.15.2 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 the service valve connection.
4. Reinstall and tighten the brackets that secure the valve body to the 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.
8. Open the service valves.

7.16 Digital Loader Valve (DLV)

PrimeLINE EDGE units (571-3xx models) have a normally closed digital loader valve (DLV), as shown in **Figure 3.21**. A DLV failure will result in the unit's inability to cool due to a reduction in refrigerant flow.

7.16.1 Removing the DLV

⚠ WARNING

Before servicing the unit, make sure the circuit breakers (CB1 & CB2) and start-stop switch (ST) are in the OFF position and the unit is disconnected from power.

1. Connect a manifold gauge set to a refrigerant recovery system (blue hose), electronic micron gauge (red hose) and a vacuum pump (yellow hose). Then, connect the suction service valve, discharge valve and liquid line service valve to the vacuum pump with service hoses suitable for evacuation.

   See **Figure 7.4** for connection diagram.
2. Remove all refrigerant using the refrigerant recovery system.
3. Turn unit power off and remove power from the unit.
4. Loosen the bolt on top of the DLV and remove 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.

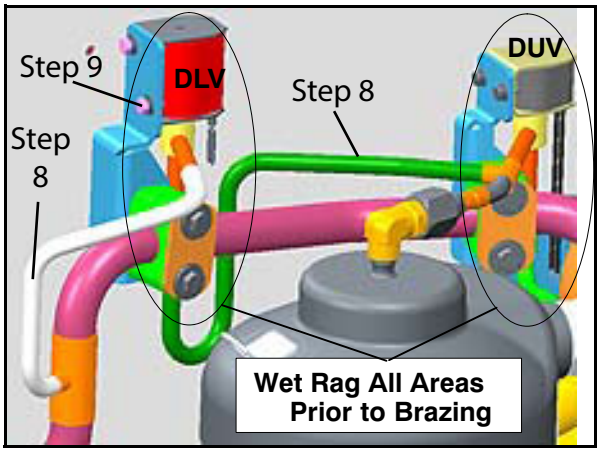
5. Remove clamps holding the DLV to the line.
6. Loosen the nuts securing the DLV in place.
7. Remove the valve. The preferred method of removing the solenoid valve is to cut the connection between the brazed section and the valve, using a small tube cutter, then remove the valve. Alternatively, use a wet rag to keep the valve cool. Heat the outlet connection to valve body and then remove the valve.
8. Examine the compressor and service valves. Ensure that the o-ring is not stuck in the gland of the valve.
9. Discard the o-ring on the o-ring face seal connection.

7.16.2 Installing the DLV

1. Power unit off and lock/tag out to prevent inadvertent power up.
2. Remove 8 bolts from guard under control box and remove guard.
3. Remove the digital unloader valve coil (DUV) and place a magnet tool on the valve to open it. If a magnet is not available perform the Jumper procedure:
   a. Remove all 4 controller fuses (F1, F2, F3a, F3b).
   b. Remove the wire from the KA6 connector on the front of the controller.
   c. Disconnect the X1 wire from the 24VAC side of transformer (black wire) and locate it away for the transformer.
   d. Jumper the black transformer wire to the KA6 wire removed from the connector.
   e. Connect power to unit and turn circuit breaker on (DUV coil is now energized).
4. Connect a refrigerant recovery machine and recover refrigerant from the unit. (refer to the recovery machines Operation and Service manual for proper procedures).
5. If jumper procedure was used for the recovery, turn the circuit breaker off and disconnect the power. Follow the regional lock out tag out procedure for electrical.
6. Isolate valve by removing wire type wraps and conduit. Save any removed conduit for re-installation.

7. Remove top screw from the valve coil removing the coil and spacer. Ensure to retain the spacer as it is required for proper operation of the valve. Position coil away from valve body.
8. Using a tubing cutter cut the DLV refrigerant line as marked in **Figure 7.16**.

Figure 7.16 DLV Installation



9. Unbolt the valve from the mounting bracket and remove the valve assembly from the unit.
10. Clean pipework stubs on both unit and valve assembly in preparation for brazing.
11. Refit valve coil to the valve body ensuring the spacer ring is in place.
12. Slide new valve assembly into place, coupling the refrigerant lines.
13. Attach the solenoid coil to the mounting bracket of the new valve body and tighten.
14. Wet rag valve body and bracket mounting clamp. Failure to wet rag the body may result in the failure of the valve.
15. Using silver solder braze both bell connections.
16. Replace the filter drier.
17. With magnet still on the DUV stem, evacuate the compressor to 1000 Microns. If jumper procedure was used in step 3, reconnect unit to power and turn on the circuit breaker to again power the DUV.
18. On completion of the vacuum, remove the magnet and reinstall the DUV coil. If a jumper was used, turn off the circuit breaker and disconnect power. Remove jumper and reconnect the X1 wire to the black transformer wire. Reinstall and secure the KA6 wire to the KA plug at the controller.
19. Weigh the proper refrigerant charge into the unit as per the units operation and service manual and perform a leak check of the system.
20. Replace the guard under the control box.
21. If changed under the units warranty, tag part with unit information and cause of failure.
22. If possible collect unit data download for future failure analysis.

7.17 Troubleshooting P6-7 Test

A Pre-Trip P6-7 test can check the operation of a digital unloader valve (DUV), or a digital loader valve (DLV) for PrimeLINE EDGE units (571-3xx models). When running the P6-7 test, 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.

A failed 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.A failed DLV, which is normally closed, will result in the unit's inability to cool due to a reduction in refrigerant flow

If the P6-7 test, fails, then refer to the following procedures to diagnose what component caused the test to fail.

⚠ WARNING

Before servicing the unit, make sure the circuit breakers (CB1 & CB2) and start-stop switch (ST) are in the OFF position and the unit is disconnected from power.

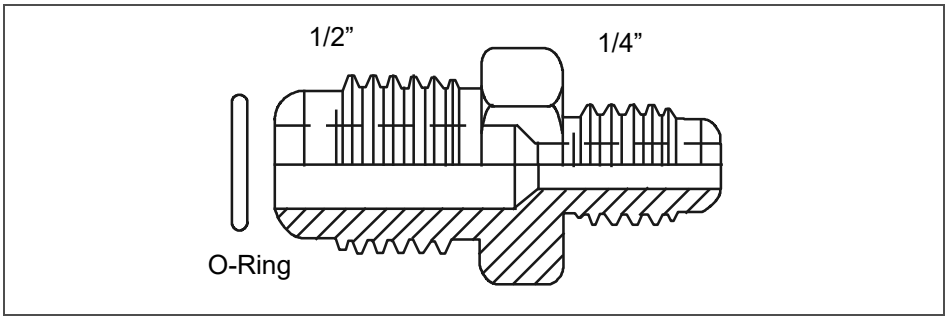
7.17.1 Troubleshooting for Standard Units (DUV Only)

1. Connect the manifold gauge set to the suction service valve and discharge service valve.

   See **Section 7.1.4.1** for connection procedure. See **Figure 7.4** for connection diagram.

2. Front seat the suction service valve and pump down the compressor.
3. Front seat the discharge service valve to isolate the compressor.
4. Disconnect the DUV from the top of compressor and install a 1/2 to 1/4” flared adapter and O-ring. See **Figure 7.17** for illustration.

Figure 7.17 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 the valve is not leaking, 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 suction service valve 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:

   a. Remove all four controller fuses (F1, F2, F3, F4).

   b. Remove the KA6 wire from the KA controller connector on the front of the controller.

   c. Disconnect the X1 wire from the 24VAC side of the transformer (black wire) and locate it away from the transformer.

   d. Jumper between the black transformer wires to the KA6 wire removed from the connector.

   e. Connect power to the unit and turn the circuit breaker on. The DUV coil is now energized. Pressure should drop.

   f. Power the circuit breaker off, reconnect wires and reinstall fuses.

   If the valve opens and closes properly, the failure mode is with the compressor and it should be changed at the earliest opportunity.

7.17.2 Troubleshooting for EDGE Units (DUV/DLV)

1. Connect the manifold gauge set to the suction service valve and discharge service valve.

   See **Section 7.1.4.1** for connection procedure. See **Figure 7.4** for connection diagram.

2. Use function code Cd41 Valve Override Controls to set an override to the DUV percentage (PCnt) value. Then, monitor compressor amperage and discharge pressure to determine which components has failed. See **Section 7.18** for details on using Cd41.

   Set the PCnt value at Cd41 to 100% and set the timer (tIM) to 5 minutes. This is a DLV Capacity Test. If the compressor is able to load, the compressor amperage (Cd03) and discharge pressure will increase and suction pressure will decrease; the DLV is working properly. If discharge pressure does not increase, the DLV should be replaced.

NOTE: The Digital Loader Valve Solenoid coil cycles: 0 to 0.6 amp DC (AC/DC current clamp).

Set the PCnt value at Cd41 to 20% and set the timer (tIM) to 5 minutes. This is a DUV Modulation Test. If the compressor is able to unload, the compressor amperage (Cd03) and discharge pressure drops and the suction pressure will rise; the DUV is working properly. If the discharge pressure does not decrease after the valve energizes, the DUV should be replaced.

NOTE: Unloader Valve Solenoid coil cycles: 0 to 0.4 amp AC (AC/DC current clamp).

7.18 Valve Override Controls

Controller function code Cd41 is a configurable code that allows timed override operation of the automatic valves for troubleshooting. Test sequences are provided in **Table 7–1**. An event is posted when Cd41 is utilized. It is recommended to only override one valve at a time.

Valves that can be controlled:

- Digital Unloader Valve (DUV) Setting - open / close to various percentages. This is set at the **PCnt** sub menu.
- Electronic Expansion Valve (EEV) Setting - open / close to various percentages. This is set at the **EEV** sub menu.
- Economizer Solenoid Valve (ESV) Capacity - open / close in different operating configurations, see **Table 7–1**. This is set at the **CAP** sub menu.

The Override Timer (tIM) selection is provided to enter a time period of up to five minutes, during which the override(s) are active. This is set at the **tIM** sub menu.

- If the timer is active, valve override selections will take place immediately.
- If the timer is not active, changes will not take place until the timer is started.
- When the timer times out, the override function is automatically terminated and the valves return to normal machinery control.

Procedure to Perform a Valve Override:

1. Press the CODE SELECT key.
2. Use the Arrow keys until Cd41 is displayed in the left display, then press the ENTER key.
3. Press the ENTER key to go down the Cd41 menu selections. Or, press the CODE SELECT key to go back up through the menu selections. The menu items in order are:
   - **tIM** - timer
   - **PCnt** - Digital Unloader Valve (DUV) percentage
   - **EEV** - Electronic Expansion Valve (EEV) percentage
   - **CAP** - Electronic Solenoid Valve (ESV) standard or economized.
4. The standard practice is to override one valve at a time and observe. To do this, stop at a valve menu item (PCnt, EEV, or CAP) and use the Arrow keys to scroll through the choices available, as detailed in **Table 7–1**. Press ENTER to confirm the choice. If the selection is set to AUtO, no override action is taken.
5. Then, press the CODE SELECT key to navigate back to the **tIM** menu. Use the Arrow keys to select the desired time interval and press ENTER to confirm. The timer will start immediately and the valve override action chosen is executed. When the timer expires, the valve returns to normal machinery control.

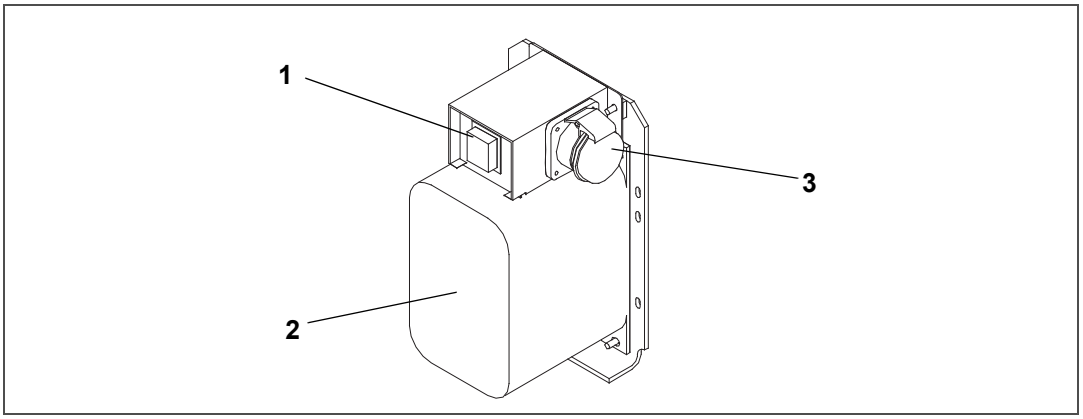
Table 7–1 Cd41 Valve Override Control Menu

Controller Codes (Left Display)	Settings (Right Display)
tIM (Override Timer)	0 minutes to 5 minutes in 30 second increments to
PCnt Digital Unloader Valve (DUV) % Setting	AUtO (Normal Machinery Control), 0, 3, 6, 10, 25, 50, 100
EEV Electronic Expansion Valve (EEV) % Setting	AUtO (Normal Machinery Control) CLOSE (Closed) 0, 3, 6, 10, 25, 50, 100
CAP Economizer Solenoid Valve (ESV)	AUtO (Normal Control) Std; UnLd (Economizer = Closed) ECOn (Economizer = Open)

7.19 Autotransformer

The optional Autotransformer, as shown in **Figure 7.18**, allows 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.

Figure 7.18 Autotransformer



1) Circuit Breaker (CB2) 230-Volt
2) Dual Voltage Autotransformer
3) 460 VAC Power Receptacle

- - - - -

If the Autotransformer unit does not start, check the following:

1. Verify the 460 VAC (yellow) power cable is plugged into the receptacle.
2. Verify that circuit breakers CB1 and CB2 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).
4. Next, check secondary (output) voltage (230 VAC). If output voltage is not available, the transformer is defective.

7.20 Controller Service Procedures

A controller self diagnostic test can be performed with function code Cd74. 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.

7.20.1 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 placed on the mat.

7.20.2 Removing a Controller

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.

7.20.3 Installing a Controller

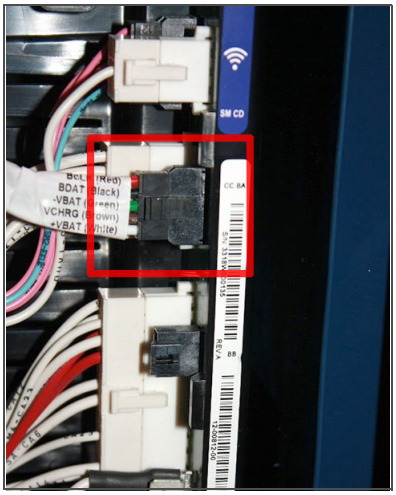
1. Install the module by reversing the removal steps.

   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).

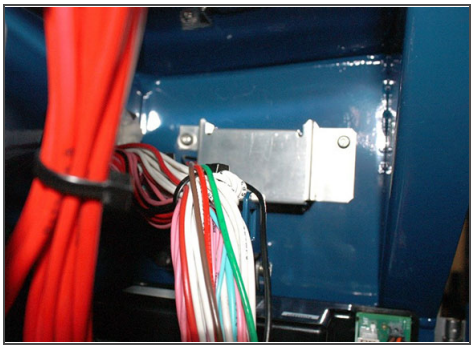
7.20.4 Battery Replacement

The Carrier rechargeable battery pack part # is 79-66081-20.

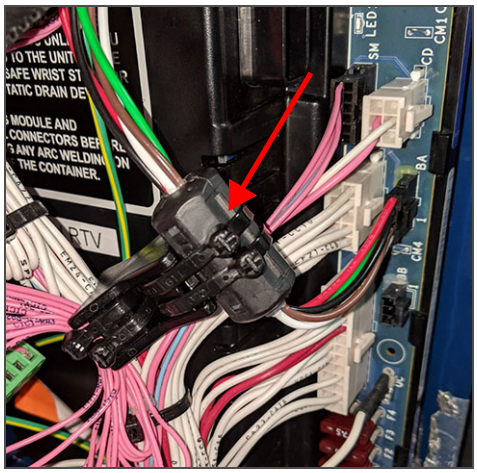
1. Turn the unit power Off and disconnect the power supply.
2. Open the control box door and remove both the high voltage shield and clear plastic rain shield (if installed).
3. Disconnect the battery connection at the BA connector and carefully remove wire ties along the battery wires leading back to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



4. Using a driver bit, Carrier 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.

7.20.5 AC Line Filter

There is an AC Line Filter installed between the Control Transformer and the PW Connector on the ML5 controller. This filter reduces electromagnetic voltage transients induced / coupled on to the 36 VAC Control Transformer secondary of the Transformer.

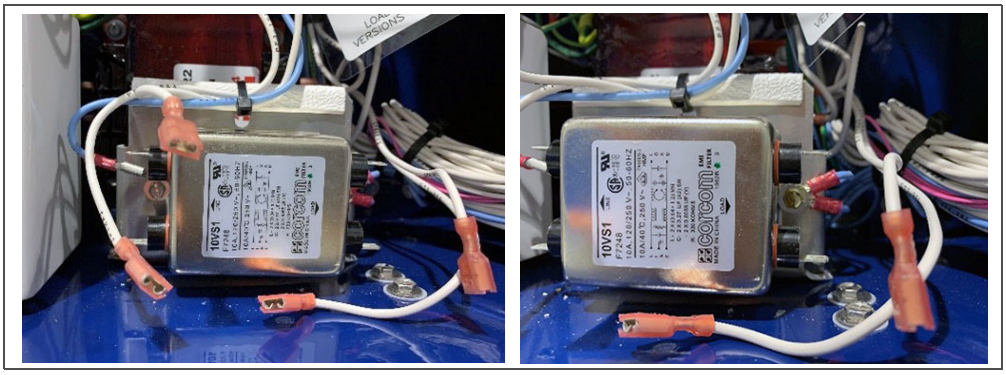
When the AC Line filter fails, 18 VAC will not be provided to the controller and the system will not power up. Checking for a nominal 36 VAC across the input and output of the filter will verify if the correct voltage is getting provided to the controller.

Apply power to the container, turn on the ST switch, and verify that 36 VDC is present across pins 1 and 3 on the AC Line Filter. Once input power is verified, check the power on the output of the filter on pins 2 and 4. Input and output voltages should match. If the control voltages so not match, or output power appears to be fluctuating, the filter capability of the power filter can be tested.

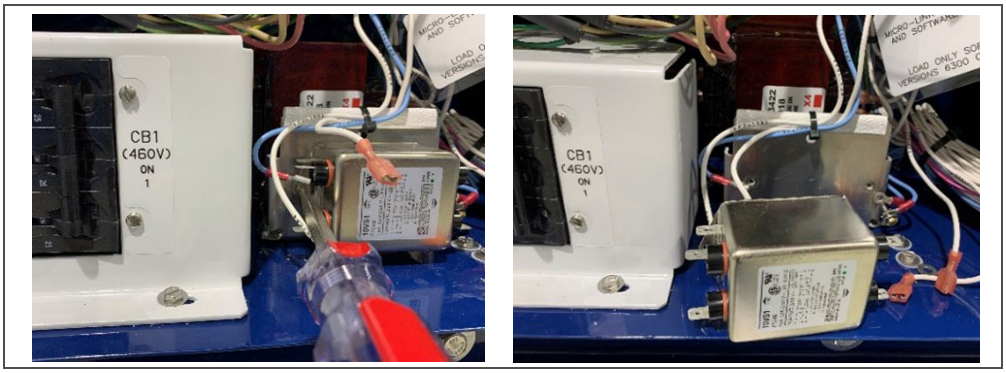
Power Filter Test

1. Disconnect power and lock out the container.

2. Remove the AC Power Filter from the system. Disconnect all spade connectors from the power filter, then remove the ground wire on the right side (line output) of power filter.

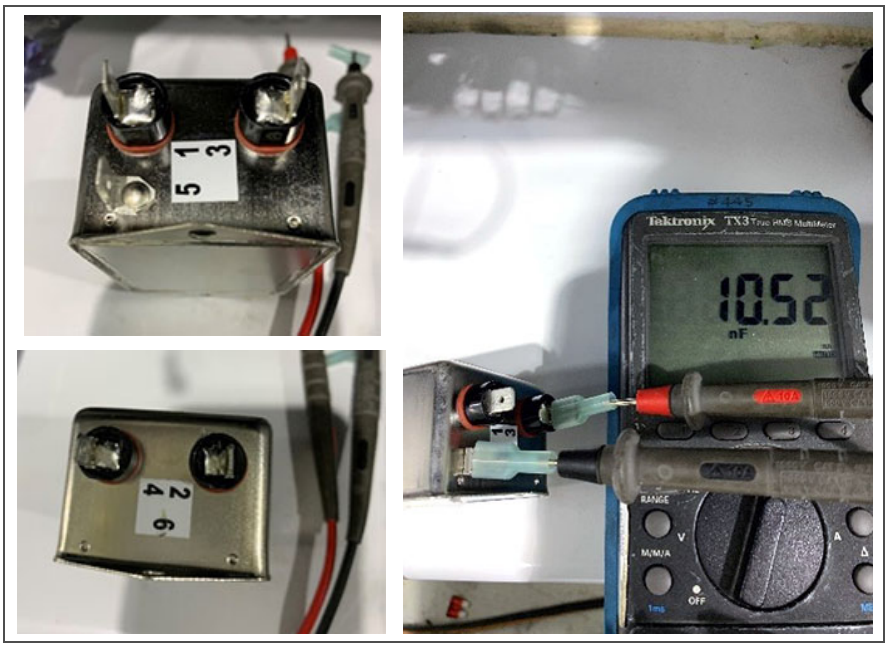


3. Remove the remaining mounting bolt on the left side (line input) and pull from the system control box.

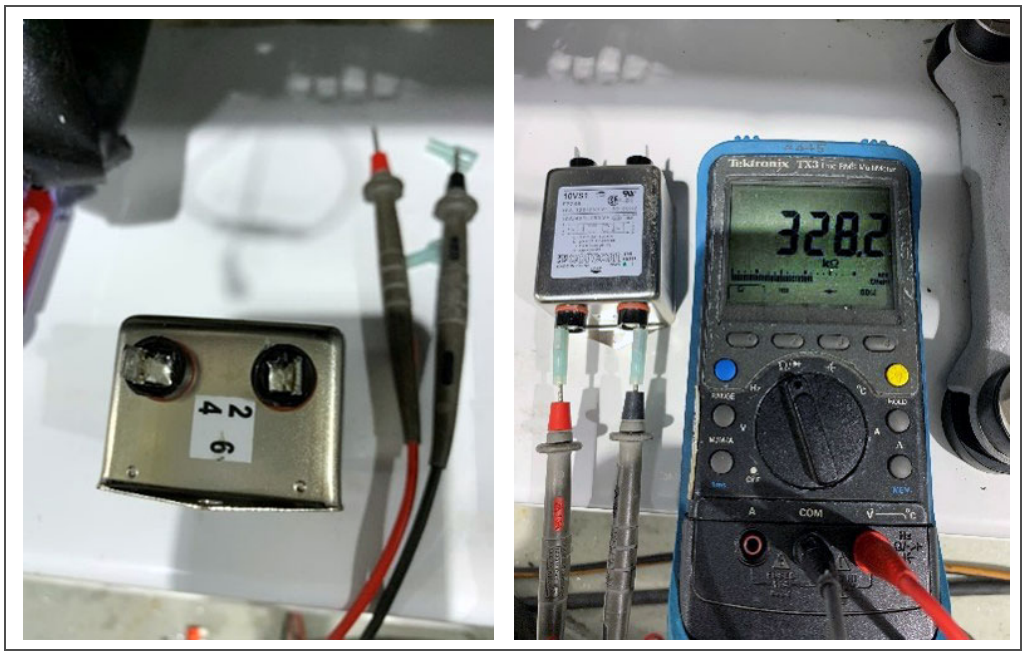


4. With the power filter removed, check for a capacitance reading of 0.54 uF +/-10% across pins 1 and 3. And then across pins 2-4.

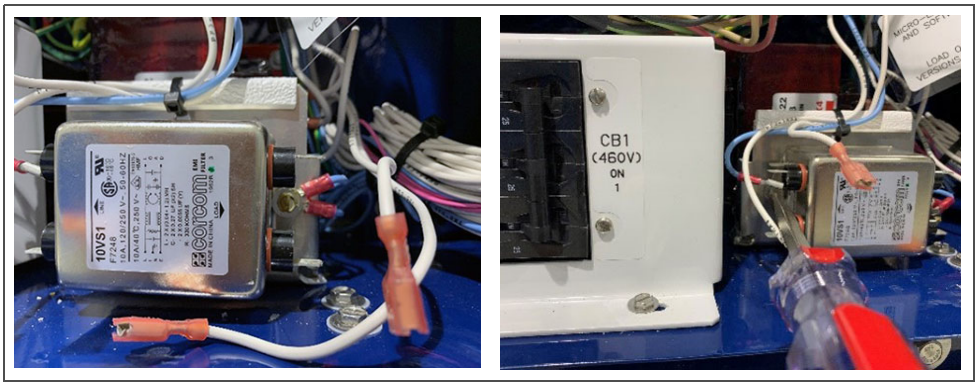
5. Each individual pin can also be verified between the ground pin #5 and 1, 2, 3, 4. Testing each individual pin to the ground pin should read a capacitance of 0.011 uF +/-10%. Note that meter to left reading in nF but passing value 0.01052 uF.



6. Final check on the power filter is to verify the discharge resistor on the power filter output. Check resistance between pins 2 and 4 on the load side of the power filter for 330kΩ +/- 10%.



7. Reinstall the power filter. Install the right side of the power filter to the bracket with ground leads.Then, install the mounting screw on the right side of the power filter.

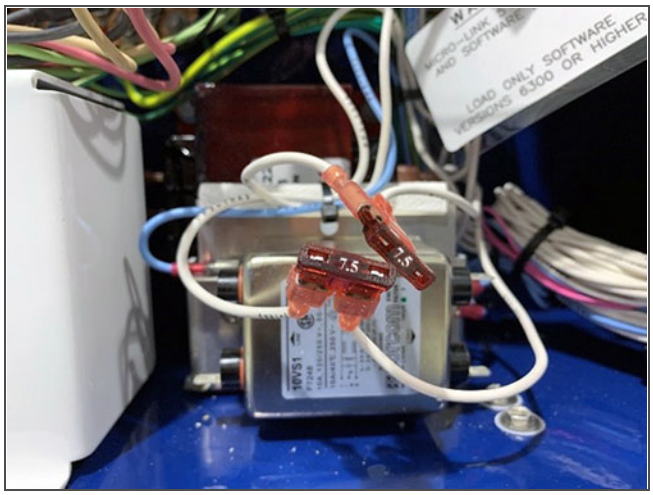


8. Connect wires to the power filter using the hot stamping on the wire harness and pin marking on the power filter.

Line or Load	Wire	Filter
Line	PF5-TRX2 to	Pin 5
Line	PF3-TRX3 to	Pin 3
Line	PF1-TRX4 to	Pin 1
Load	ST5-PF2 to	Pin 2
Load	ST2-PF4 to	Pin 4

Power Filter Emergency Bypass Procedure

1. Connect the following with a 7.5 Amp automotive type fuse and cover the connections with electrical tape:
   - PF1-TRX4 to ST5-PF2
   - PF3-TRX3 to STS2-PF4



7.21 Controller Programming Procedures

Refer to the **T-372PL parts manual** for a list of available tools for interfacing with the ML5 controller.

Notes Regarding USB Devices:

- 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.
- If upgrading from version 6325 or less to 6326 or higher, both configuration files (cf5 and cf6) must be on the usb drive at the time of upload. After completing the upgrade, only the cf6 file is required for upload.

- If more than one configuration database file is on the USB device at the root level, then only the file with the latest date will be considered.
- During a programming procedure, if “no USb” is displayed, wait up to 15 seconds for this message to be replaced with a different message. If the “no USb” message continues, remove and insert the USB device.

7.21.1 Downloading DataCORDER Data to a USB Device

1. Turn unit power on (“I”) at the Start-Stop switch (ST). Wait for controller information to be displayed.
2. Insert the Micro USB drive (part # 12-50173-00) 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.
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, 90dAy and 180.
7. Confirm the selection by pressing the ENTER key. The download starts.
8. When the download is complete, the display will show “dLOAd donE”.
9. Remove the USB flash drive from the USB port.

7.21.2 Uploading Controller Software from a USB Device

Refer to Carrier’s YouTube Channel to watch a video of this procedure.

1. Turn unit power on (“I”) at the Start-Stop switch (ST). Wait for controller information to be displayed.
2. Insert the Micro USB drive (part # 12-50173-00), pre-loaded with controller software, into the controller Micro USB port.
3. Press the ALT MODE key on the keypad.
4. Wait for the display to show “USb” or use Arrow keys to show “USb”, then press the ENTER key.
5. Use the Arrow keys until “UP LoAd” is displayed, then press ENTER.
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. The display will flash “LoAd SoFt”.
8. When “CAn PULL” and “USb noW” appears on the displayed, remove the USB drive from the port.
9. The display will flash “Pro SoFt”, then display “rE StArt” and “StArt UP” after that.
10. When the controller restarts, the following are displayed in order: the Unit ID (Cd40), software version (Cd18), configuration number (Cd20) and configuration file date. And finally the message “Pro donE”. The software has been loaded.
11. Bring up function code Cd 18 to confirm the correct software revision.

7.21.3 Uploading a Software Configuration from a USB Device

Refer to Carrier’s YouTube Channel to watch a video of this procedure.

1. Turn unit power on (“I”) at the Start-Stop switch (ST). Wait for controller information to be displayed.
2. Insert the Micro USB drive (part # 12-50173-00), pre-loaded with software configuration files, into the controller Micro USB port. The software files will have an extension of .ml5.
3. Press the ALT MODE key on the keypad.
4. Wait for the display to show “USb” or use Arrow keys to show “USb”, then press the ENTER key.
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.
7. The display module will go blank briefly and then display “571 XXX”.

8. Use the Arrow keys to scroll through the list to obtain the proper model number, then press ENTER. The model number can be found on the unit nameplate.

IMPORTANT:

For units with software 6320 or greater loaded, when model numbers 571-113 or 571-123 are chosen the left display will show “rU” “SurE” and the right display shows “yES”. This is an attempt to prevent users from installing a customer specific configurations which CAN NOT be changed once entered. Use the Arrow keys to toggle selection between “yES” and “nO” and press ENTER to confirm. If “yES” is selected, any attempt afterwards to load a different model number will result in a “LoAd bAd” message. If “nO” is selected, the display returns to the main configuration menu.

9. Once the model number is selected, the display will show the message “rE StArt” briefly, and then “StArt UP” while the controller restarts. Do not take action during this time.
10. When the controller restarts, the following are displayed in order: the Unit ID (Cd40), software version (Cd18), configuration number (Cd20) and configuration file date. Remove the USB drive from the port.
11. Bring up function code Cd20 to confirm that the correct model configuration was loaded. The model should match what is shown on the unit nameplate.

7.21.4 Setting the Date and Time

1. Turn unit power on (“I”) at the Start-Stop switch (ST). 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.
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.

7.21.5 Setting the Container ID

This procedure explains how to set the Container ID, which can be found in Function Code Cd40. See **Section 4.2.2**. 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. Turn unit power on (“I”) at the Start-Stop switch (ST). Wait for controller information to be displayed.
2. Insert the 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.
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.

7.22 Temperature Sensor Service

Service procedures for the following temperature sensors are provided in this section:

- Supply (STS / SRS)
- Return (RTS / RRS)
- Ambient (AMBS)
- Defrost (DTS)
- Evaporator (ETS)
- Compressor Discharge (CPDS).

7.22.1 Preparing an Ice-Water Bath

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 mixture is good.
    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).

7.22.2 Sensor Checkout Procedure - Ice-Water Bath

This procedure is to verify the accuracy of a temperature sensor by placing in an ice-water bath.

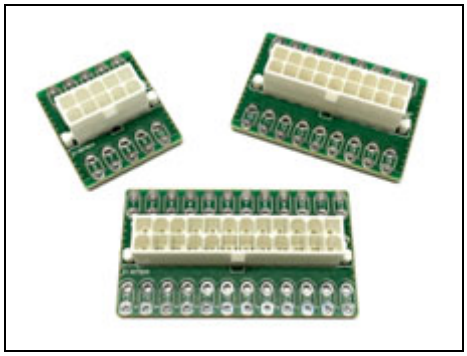
1. Remove the sensor and place in a 0°C (32°F) ice-water bath. See **Section 7.22.1** for procedure.
2. Start the unit and check the sensor reading on the control panel. Readings should be 0°C (32°F).

   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.

7.22.3 Sensor Checkout Procedure - Control Box

A sensor can be tested from the control box by utilizing the controller harness tool, see **Figure 7.19**, part # 76-50256-00. This tool reduces the risk of damaging the controller pins when probing the system harness. This procedure is described in detail in TechLINE article TL004-2022.

Figure 7.19 Controller Harness Tool



1. Remove power from the unit and follow lockout / tagout regulations.
2. Disconnect the harness from the ML5 controller and install the harness tool.

3. Locate the proper wires to be ohmed by referring to the system schematic.

4. Check against the temperature resistance chart provided in **Table 7–2** and **Table 7–3**.

7.22.4 Supply and Return Sensor Calibration - GDP

European Commission GDP (Good Distribution Practices) guidelines, used worldwide, call for the equipment that controls 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.

NOTE: 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.

NOTE: 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 run the test again.

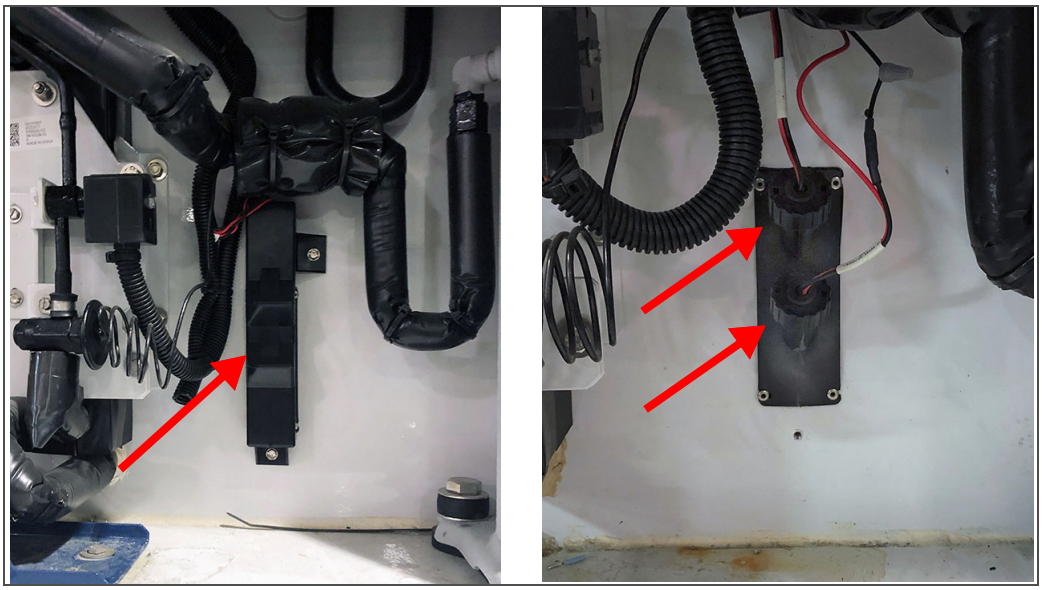
Tools Required:

- 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:

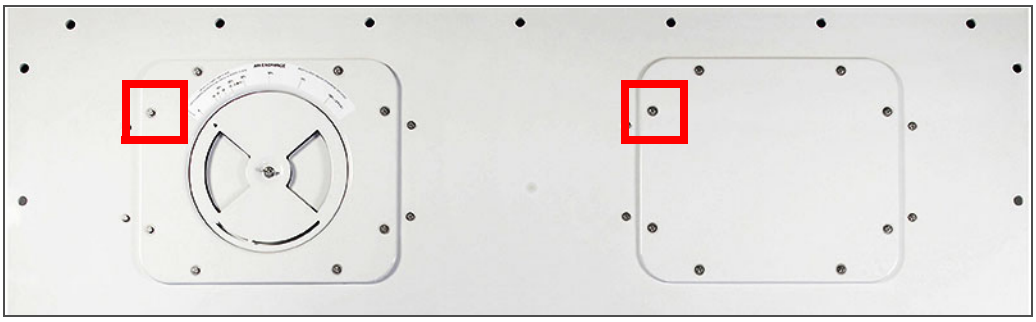
1. Locate the supply sensors cover assembly on the suction side of the compressor. Remove the two fasteners securing the cover of the sensors.

Remove the cover and rotate the supply air sensors, STS / SRS, in a clockwise direction and remove the sensors from the sensor housing.

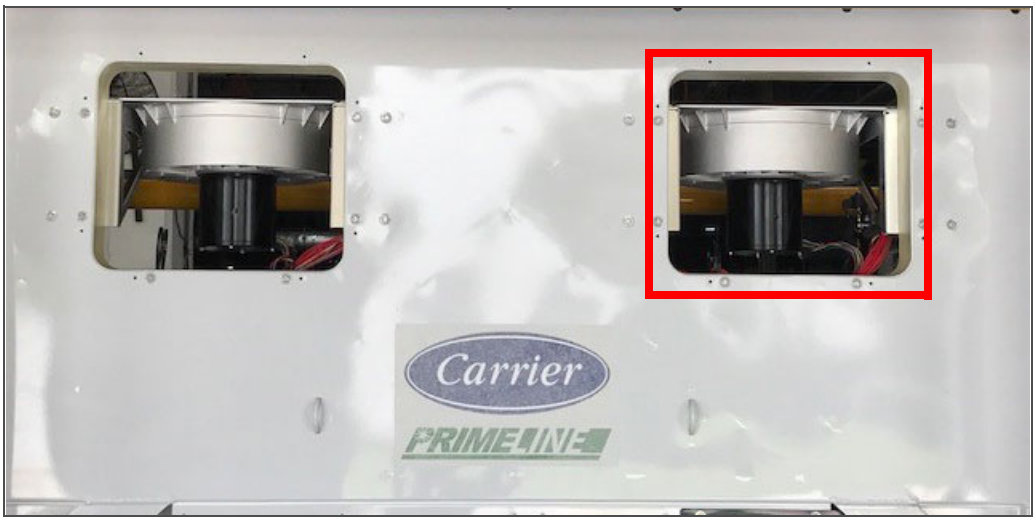


GDP Calibration, Removing Return Sensors (RTS / RRS) from Unit:

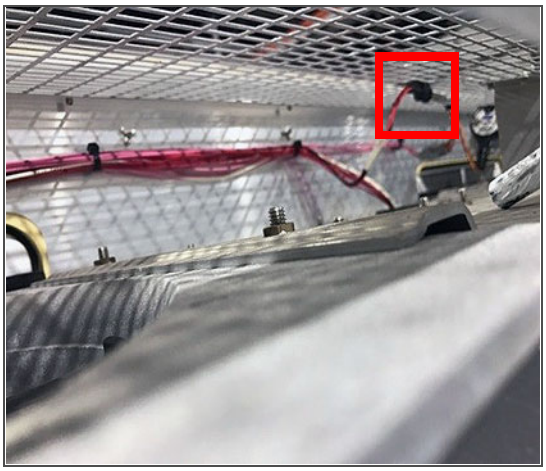
1. Remove both front access panels from the unit by removing 8 fasteners from each panel. Save all hardware for re-installation.



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



3. Loosen the fastener on the sensor bracket.



4. Cut all the wire ties that are securing the sensors to the harness and remove sensor.

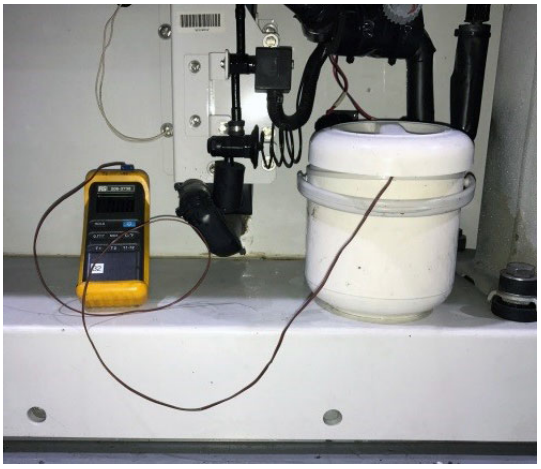
GDP Calibration, Perform Calibration:

⚠ 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.

1. Connect the interrogator cable to the interrogator port. Then, power on the unit.
2. From DataLINE or ContainerLINK application, open the Probe Calibration screen. If a pop-up window appears reminding the user to ensure proper ice bath temperature, click OK to acknowledge.
3. On the Probe Calibration screen, click on the Calibrate Supply Sensors or Calibrate Return Sensors button.
4. A Location of Service pop-up window will appear. In the appropriate fields, enter the Service Center Name and Service Center Location where the calibration is being performed. Then, click the Save button. If a pop-up window appears 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).
5. Prepare the ice-water bath. See **Section 7.22.1** for Ice Bath Preparation procedure.

6. Place the ice bath in a location near sensors. For Return Sensors, place the ice bath on an elevated platform or ladder of appropriate height.



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. Make sure the thermometer is regularly maintained and cleaned.

   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 Uncalibrated column in the Current Probe Offset Temperatures table.
9. After confirming the sensor readings have stabilized, click on the Start Calibration button. The process begins automatically and will complete in less than 5 minutes. Continue to stir the ice bath during the testing. Calibration fails if stability cannot be achieved or sensor offset is greater than 0.3°C (0.5°F).
10. Once the calibration has completed, a pop-up will appear with the message Calibrate Complete. Click OK to acknowledge and the results will then be displayed on the screen in the Results column. If the sensor can not pass calibration, then see **Section 7.22.6** for sensor replacement procedures.
11. After completing the calibration, download a DCX file and check that all of the following event information is captured: service center name, location, the results of the calibration and the offset applied. The event is considered a success when all the intended sensors in calibration have passed.

7.22.5 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.

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 Cold Treatment Procedure:

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

1. From the DataLINE or ContainerLINK application, navigate to the DataCorder Configuration screen. In DataLINE this is found under System Tools. In ContainerLINK this is found under System Configuration.

2. Verify that the DataCORDER is configured as follows and then close all screens when finished:
   - Configuration Option is set for USDA probes
   - Logging interval is set for 60 minutes.
   - DataCorder Sample Type is set to 2 Averaged 3-USDA.
   - Resolution is set to Normal.
3. Prepare a proper ice bath and ensure that it has stabilized at 0°C (32°F) using a calibrated reference thermometer. See **Section 7.22.1** for Ice Bath Preparation procedure.
4. Submerge the sensors in the ice bath. Make certain that the sensors do not contact the container sides or bottom, or each other. Continuously stir the slurry mixture during calibration.
5. Navigate to the Probe Calibration screen in DataLINE or ContainerLINK. By default the screen should have the Auto Calibration option chosen. Click on Auto if it is not already selected. For Auto Calibration, the controller calculates the offsets for all probes using an assumed ice-bath temperature of 0.0°C (32°F).
6. 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 Uncalibrated column in the Current Probe Offset Temperatures table.
7. After the sensor readings have stabilized, click the Start Calibration button. Probes are calibrated individually once they are determined to be stable. This calibration generates the probe offsets which are stored in the controller and applied to the USDA sensors for use in generating sensor type reports.
8. Pre-cool the container to the treatment temperature or below.
9. Install the controller battery pack (if not already installed). Then, check the battery status at code Cd19.
   a. Press the CODE SELECT key on the display.
   b. Use the Arrow keys to bring up Cd19 and press the ENTER key.
   c. Use the Arrow keys to select bTEST and press the ENTER key. Refer to Cd19 description for more details and testing the battery
10. 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: Place USDA 1 in a box at the top of the stack of fruit nearest to the air return intake.
    - Sensor 2: Place USDA 2 slightly aft of the middle of the container, halfway between the top and bottom of the stack.
    - Sensor 3: Place USDA 3 one pallet stack in from the container doors, halfway between the top and bottom of the stack.
11. Navigate to the ISO Trip Header screen to enter ISO Header information and a header comment if desired. Close the screen when finished. In DataLINE, this is found under System Tools. In ContainerLINK this is found under System Configuration.
12. Click the Start New Trip button to perform a Trip Start.
13. Bring up Code Cd51 on the unit display, enable Automatic Cold Treatment (ACT) and configure as required. See **Section 5.9.4** for procedure.

7.22.6 Replacing a Sensor

⚠ WARNING

Before servicing the unit, make sure the circuit breakers (CB1 & CB2) and start-stop switch (ST) are in the OFF position and the unit is disconnected from power.

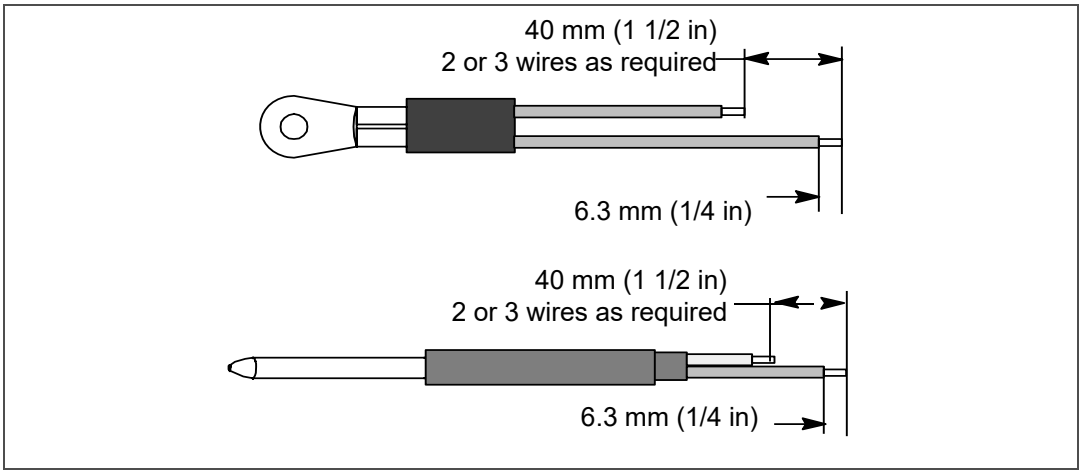
NOTE: Include white date code label when cutting out and removing defective sensors. The label could be required for warranty returns.

NOTE: The P5 Pre-Trip test must be run to deactivate probe alarms. See **Section 5.7**.

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

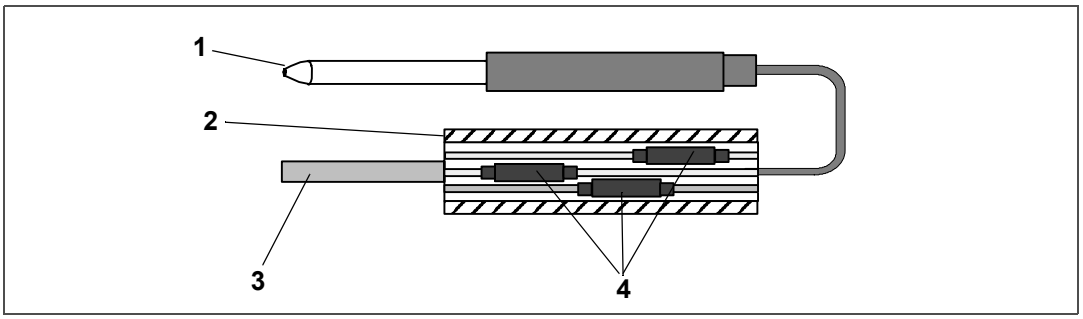
4. Cut the replacement sensor wires (opposite colors) back 40 mm (1-1/2 inches). See **Figure 7.20**.

Figure 7.20 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 7.21**.

Figure 7.21 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 7.21**.
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 7.21** and re-check sensor resistance:

    For Supply Sensor,. see **Figure 7.22**; For Return Sensor, see **Figure 7.23**; For ETS Sensor, see **Figure 7.24**

14. Reinstall sensor. Refer to:

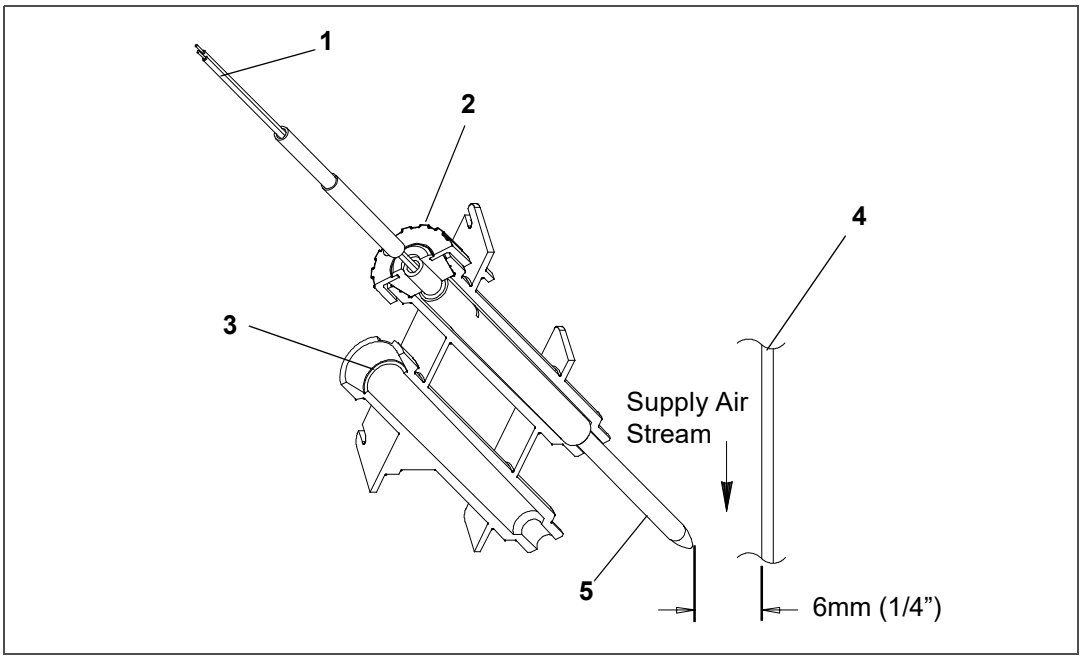
    For Supply Sensor, see **Section 7.22.7**; For Return Sensor, see **Section 7.22.8**. For Defrost Temperature Sensor, see **Section 7.22.9**; For Evaporator Temperature Sensor, see **Section 7.22.10**.

7.22.7 Installing a Supply Sensor (STS / SRS)

To properly position a unit Supply Temperature or Supply Recorder sensor (STS / 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 7.22**.

Figure 7.22 Supply Sensor (SRS / STS) Positioning



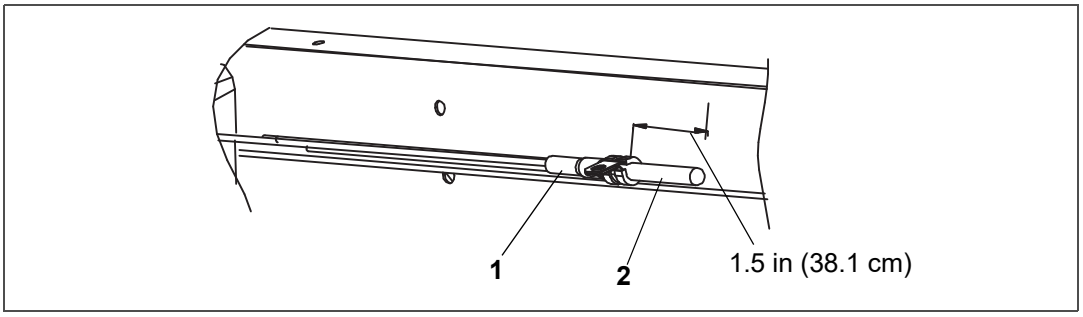
1) Sensor Wire
2) Cap & Grommet Assembly
3) Probe Holder
4) Evaporator Back Panel
5) Supply Sensor

- - - - -

7.22.8 Installing a Return Sensor (RTS / RRS)

Reinstall the Return Temperature or Return Recorder sensor (RTS / RRS), as shown in **Figure 7.23**. For proper sensor placement, position the enlarged positioning section of the sensor against the side of the mounting clamp.

Figure 7.23 Return Sensor (RRS / RTS) Positioning



1) Mounting Clamp
2) Return Sensor

- - - - -

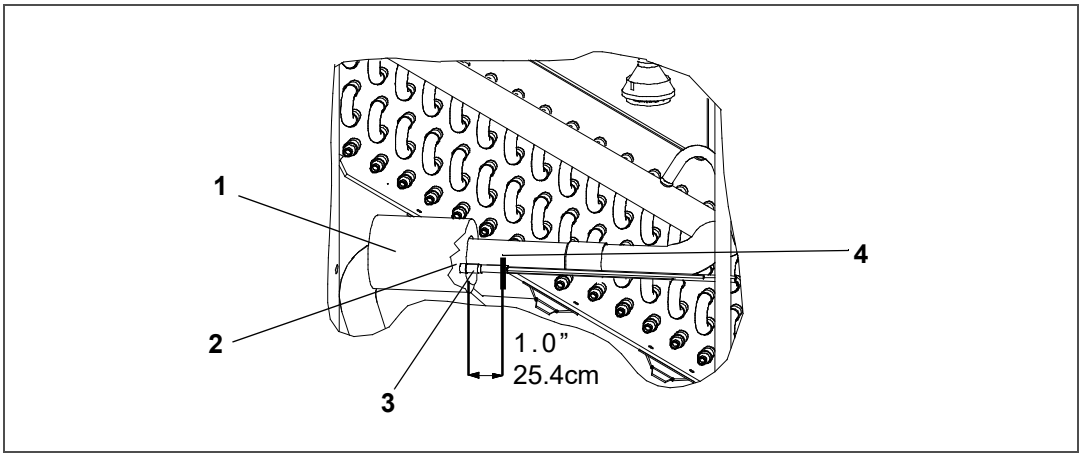
7.22.9 Installing a Defrost Temperature Sensor (DTS)

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

7.22.10 Installing an Evaporator Temperature Sensor (ETS1 / ETS2)

The evaporator temperature sensors, ETS1 and ETS2 are located in a tube holder under insulation, as illustrated in **Figure 7.24**. 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 7.24 Evaporator Temperature Sensor Positioning



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

- - - - -

7.22.11 Installing a Compressor Discharge Temperature Sensor (CPDS)

The Compressor Discharge Temperature Sensor (CPDS), see **Figure 7.25**, monitors refrigerant temperature in the dome of the compressor.

Figure 7.25 Compressor Discharge Temperature Sensor (CPDS)

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.
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 and run a Pre-Trip P5. See **Section 4.5** for Pre-Trip Descriptions.

7.22.12 Sensor Resistance Values

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

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

Table 7–3 Sensor Resistance - PrimeLINE CPDS

°C	°F	OHMS	°C	°F	OHMS
-40	-40	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

7.23 Humidity Sensor (HS)

The Humidity Sensor (HS) 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. When the sensor is disabled, it will be added as an event in the DataLINE report.

7.23.1 Disabling the Humidity Sensor

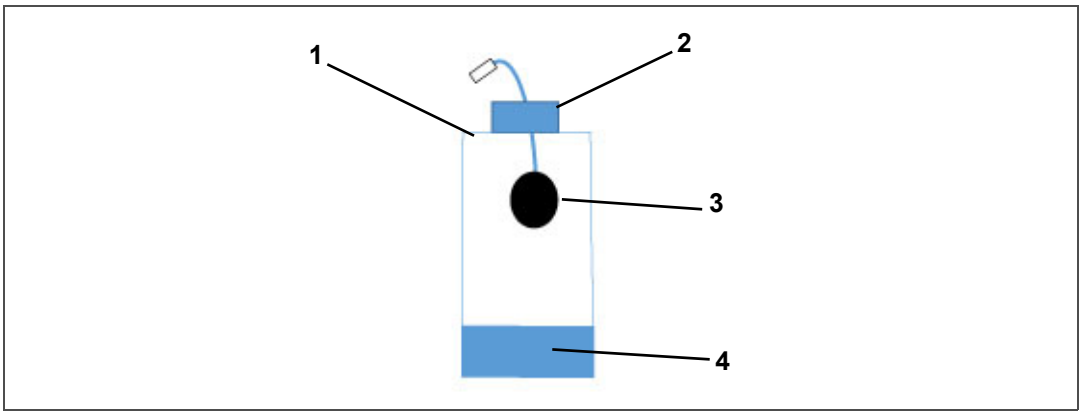
If a humidity sensor fails and is not going to be replaced, the sensor operation can be disabled at the unit display. Once disabled, any related alarms will be masked and PTI tests will be skipped.

1. Press the CODE SELECT key.
2. Use the Arrow keys until Cd33 is displayed, then press the ENTER key.
3. Use the Arrow keys to select “diSbl” and press ENTER. This sets the humidity sensor configuration variable to OFF.
4. It is recommended to unplug the humidity sensor from the unit (capping off the sensor plug). This is essential as the humidity sensor shares the power source with other components.

7.23.2 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. See **Figure 7.26** for reference.

Figure 7.26 Humidity Sensor (HS)



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

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.

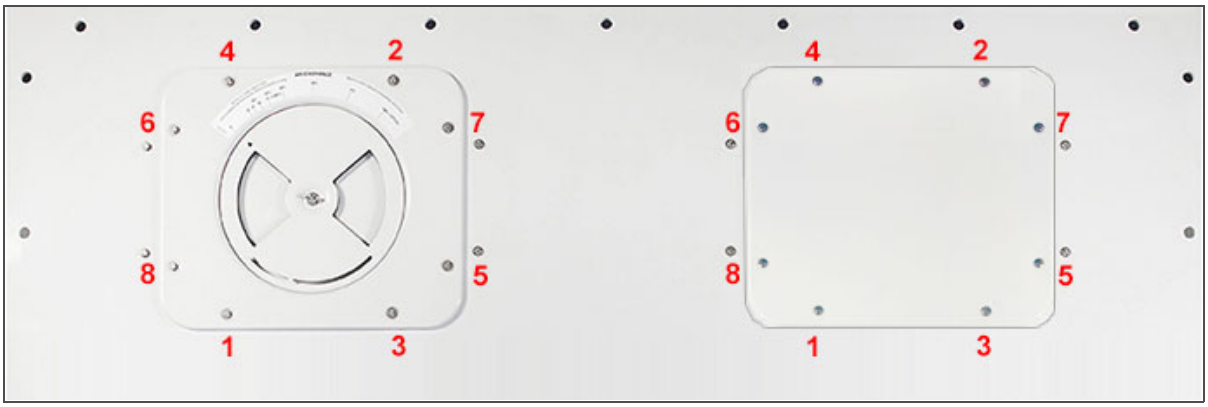
NOTE: To ensure saturation, add additional salt until it settles at the bottom without dissolving while shaking.

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.

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.

    If the panel gasket is damaged, replace it.



7.24 Vent Position Sensor (VPS)

The optional 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.

7.24.1 Vent Position Sensor (VPS) Calibration

1. Rotate the vent to the 0 CMH / CFM position. Cd45 will automatically appear on the unit 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.

7.25 Cargo Sensor

The optional cargo sensor outputs a resistance that is read by the controller as a temperature. The sensor will update the cargo status every 6 hours and display the last reading, whenever the controller is powered on.

7.25.1 Cargo Sensor Operational Values

When diagnosing the cargo sensor, the box temperatures should be above 3°C (37.4°F). Temperatures lower than this can cause frost to build up on the lens of the cargo sensor, giving a false reading.

To check the last reading of the cargo sensor, follow the instructions below.

1. Press the ALT MODE key on the keypad.
2. Use the Arrow keys until “dC” is displayed, then press the ENTER key.
3. Use the Arrow keys until “dC14” is displayed, then press ENTER to display the readout.
4. The temperature displayed should fall within one of the temperature ranges listed in the table below. Check the table to see the recommended action to take. If battery replacement is necessary, ensure proper connections and a fresh set of batteries (kit number 76-00931-00) are installed.

Signal Range	Condition	Recommended Action
21 to 16°C	Cargo Sensor Fault	1. Verify wiring to interrogator port #4 inside container. 2. Check IR sensor window on cargo sensor for obstruction. 3. Replace cargo sensor.
14 to 9°C	Cargo present, battery low	No immediate action, replace battery before next trip
7° to 2°C	**Cargo present**	**No action required**
1° to -4°C	Cargo not present, battery low	No immediate action, replace battery before next trip
-6° to -11°C	**Cargo not present**	**No action required**
-14° to -49°C	Open circuit / dead battery	Replace battery with service kit 76-00931-00
-50°C	Interrogator installed incorrectly	Remove plug and reinstall with proper orientation.
33°C	Interrogator installed incorrectly	Remove plug and reinstall with proper orientation.

7.26 EverFRESH® Service

Refer to the **T-374 EverFRESH Manual** for detailed procedures and technical information related to the EverFRESH controlled atmosphere system. The manual is located in the Literature section of the Container Refrigeration website. To find the manual from the Literature section, click on Options > EverFRESH.

7.27 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

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

Note: Underline figures are inches of mercury vacuum

°F	°C	PSIG		°C	°F	BAR
124	51.1	181.8		42	107.6	9.72
126	52.2	187.4		43	109.4	10.01
128	53.3	193.0		44	111.2	10.30
130	54.4	198.7		45	113.0	10.60
132	55.6	204.6		46	114.8	10.90
134	56.7	210.6		47	116.6	11.21
136	57.8	216.7		48	118.4	11.53
138	58.9	222.9		49	120.2	11.85
140	60.0	229.2		50	122.0	12.18
142	61.1	235.7		51	123.8	12.51
144	62.2	242.3		52	125.6	12.85
146	63.3	249.0		53	127.4	13.20
148	64.4	255.9		54	129.2	13.56
150	65.6	262.9		55	131.0	13.92
				56	132.8	14.28
				57	134.6	14.66
				58	136.4	15.04
				59	138.2	15.42
				60	140.0	15.82
				61	141.8	16.22
				62	143.6	16.63
				63	145.4	17.04
				64	147.2	17.47
				65	149.0	17.90

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

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

Note: Underline figures are inches of mercury vacuum

°F	°C	PSIG		°C	°F	BAR
124	51.1	204.7		42	107.6	11.10
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 Schematic and Wiring Diagrams

This chapter contains sets of electrical schematics and wiring diagrams for the technician to reference when troubleshooting the unit.

Each set contains four pages. The Schematic Legend is the first page of each set. It lists the components that are contained in the second page Schematic, along with a coordinate location. Pages three and four of the set are the Wiring Diagrams, sheet 1 and 2.

There are three sets depending on the unit configuration:

- PrimeLINE Standard Units (571-1xx Models)
- PrimeLINE Standard Units with EverFRESH (571-1xx Models)
- PrimeLINE EDGE Units (571-3xx Models)

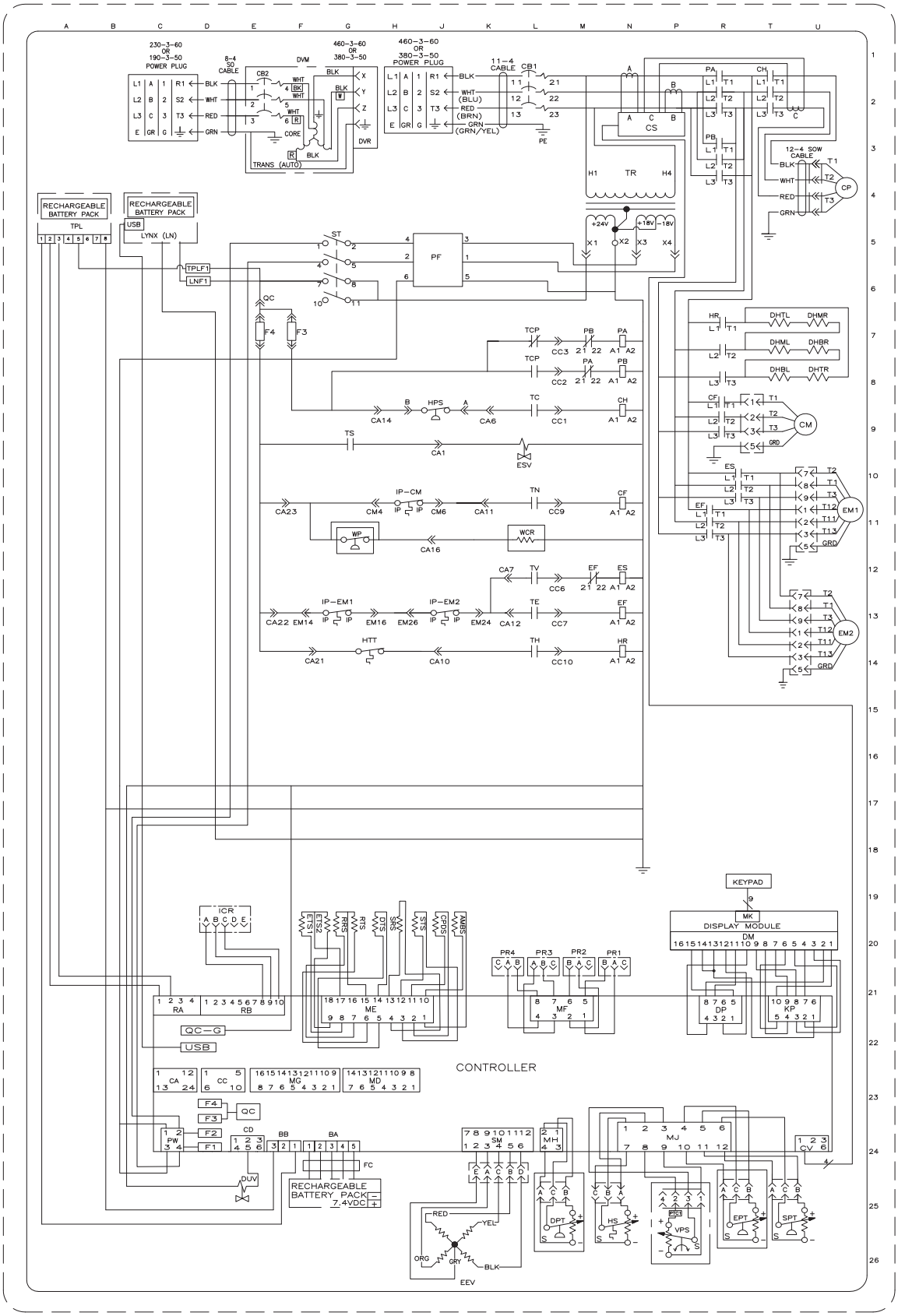
Electrical Schematic and Wiring Diagrams

Schematic Legend for Standard Unit (571-1xx Models)

ZONE	SYMBOL		DESCRIPTION
J20	AMBS	—	AMBIENT SENSOR
K22	C	—	CONTROLLERS
L1	CB1	—	CIRCUIT BREAKER 460V
E1	CB2	—	OPTIONAL CIRCUIT BREAKER 230V (DVM OPTION) TERMINAL BLOCK WHEN CB2 NOT PRESENT
R8,N11	CF	—	CONDENSER FAN CONTACTOR
N8,T1	CH	—	COMPRESSOR CONTACTOR
G11,J11,U9	CM	—	CONDENSER FAN MOTOR
U4	CP	—	COMPRESSOR MOTOR
J20	CPDS	—	DISCHARGE TEMPERATURE SENSOR
N2	CS	—	CURRENT SENSOR
T8	DHBL	—	DEFROST HEATER – BOTTOM LEFT
U7	DHBR	—	DEFROST HEATER – BOTTOM RIGHT
T7	DHML	—	DEFROST HEATER – MIDDLE LEFT
U7	DHMR	—	DEFROST HEATER – MIDDLE RIGHT
T7	DHTL	—	DEFROST HEATER – TOP LEFT
U8	DHTR	—	DEFROST HEATER – TOP RIGHT
R20	DM	—	DISPLAY MODULE
L25	DPT	—	DISCHARGE PRESSURE TRANSDUCER
H20	DTS	—	DEFROST TEMPERATURE SENSOR
E25	DUV	—	DIGITAL UNLOADER VALVE
F1	DVM	—	DUAL VOLT MODULE (OPTIONAL)
G3	DVR	—	DUAL VOLTAGE RECEPTACLE (OPTIONAL)
J26	EEV	—	EVAPORATOR EXPANSION VALVE
M12,N13,P11	EF	—	EVAPORATOR FAN CONTACTOR (HIGH SPEED)
U11,U13 G13,H13,J13	EM	—	EVAPORATOR FAN MOTOR
R25	EPT	—	EVAP. PRESSURE TRANSDUCER
R10,N12	ES	—	EVAPORATOR FAN CONTACTOR (LOW SPEED)
F20	ETS	—	EVAPORATOR TEMPERATURE SENSOR (SUCTION)
L10	ESV	—	ECONOMIZER SOLENOID VALVE
D23,D24,E7	F	—	FUSE
	FLA	—	FULL LOAD AMPS
F24	FC	—	FERRITE CLAMP
J9	HPS	—	HIGH PRESSURE SWITCH
R7,N14	HR	—	HEATER CONTACTOR
N25	HS	—	HUMIDITY SENSOR (OPTIONAL)
G14	HTT	—	HEAT TERMINATION THERMOSTAT
D19	ICR	—	INTERROGATOR CONNECTOR REAR
G13,H11,J13	IP	—	INTERNAL PROTECTOR
C5	LN	—	LYNX TELEMATICS
N7,M8,R1	PA	—	UNIT PHASE CONTACTOR
M7,N8,R3	PB	—	UNIT PHASE CONTACTOR
J5	PF	—	POWER FILTER
L20,M20,N20	PR	—	PROBE RECEPTACLE (USDA OPTION)
P25	PTC1	—	PTC FOR VENT POSITION SENSOR (UPPER)
G20	RRS	—	RETURN RECORDER SENSOR
G20	RTS	—	RETURN TEMPERATURE SENSOR
T25	SPT	—	SUCTION PRESSURE TRANSDUCER
H20	SRS	—	SUPPLY RECORDER SENSOR
G5	ST	—	START–STOP SWITCH
H20	STS	—	SUPPLY TEMPERATURE SENSOR
L9	TC	—	CONTROLLER RELAY (COOLING)
L7,L8	TCP	—	CONTROLLER RELAY (PHASE SEQUENCING)
L13	TE	—	CONTROLLER RELAY (HIGH SPEED EVAPORATOR FANS)
L14	TH	—	CONTROLLER RELAY (HEATING)
L11	TN	—	CONTROLLER RELAY (CONDENSER FAN)
A5	TPL	—	TRIPLINK (OPTION)
N3	TR	—	TRANSFORMER
E3	TRANS	—	TRANSFORMER AUTO 230/460 (OPTION)
G9	TS	—	CONTROLLER RELAY (ECONOMIZER SOLENOID VALVE)
L13	TV	—	CONTROLLER RELAY (LOW SPEED EVAPORATOR FANS)
P25	VPS	—	VENT POSITIONING SENSOR (UPPER) (OPTION)
L12	WCR	—	WETTING CURRENT SENSOR (OPTION)
G12	WP	—	WATER PRESSURE SWITCH (OPTION)

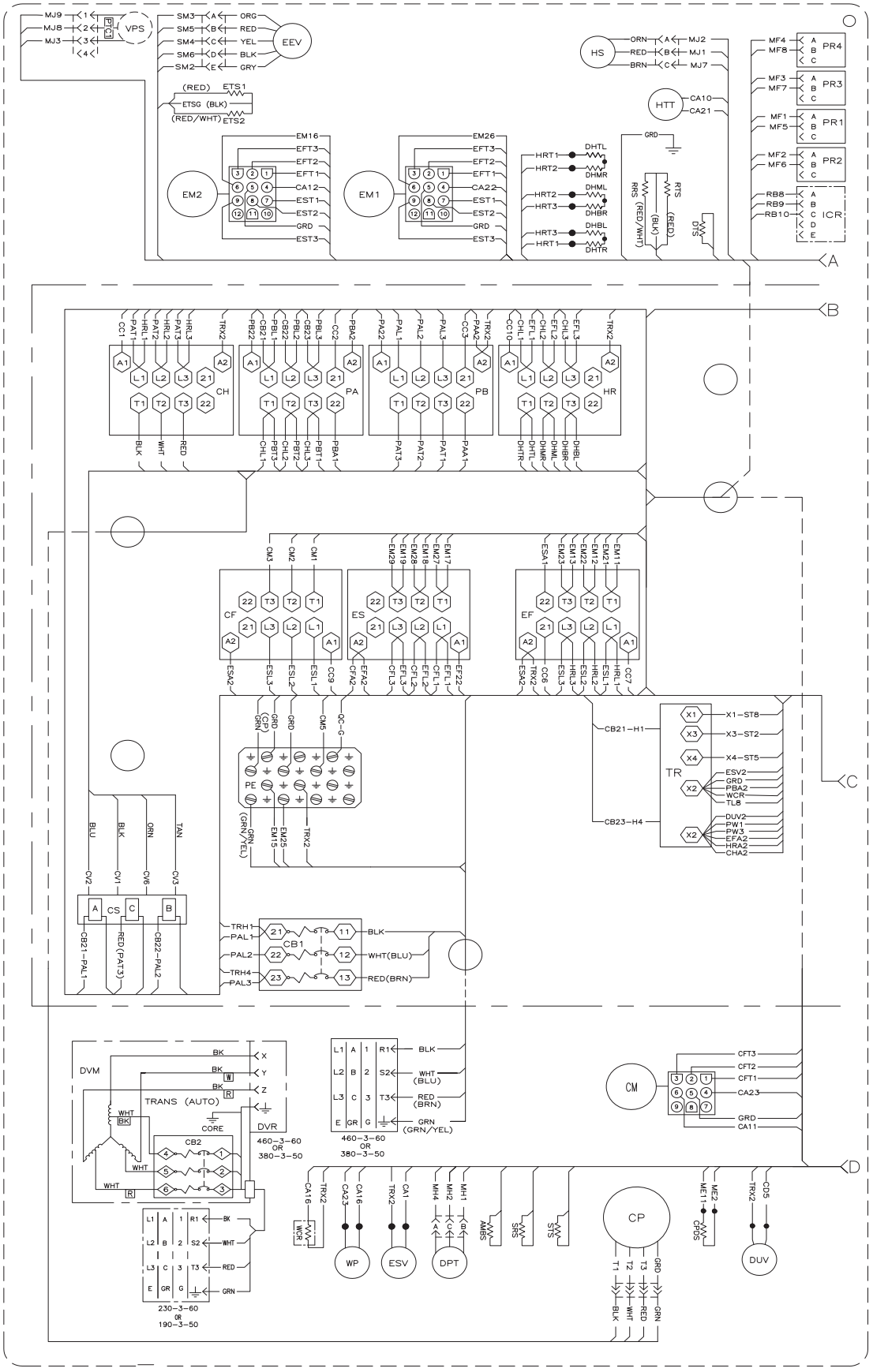
Electrical Schematic and Wiring Diagrams

Schematic for Standard Unit (571-1xx Models)



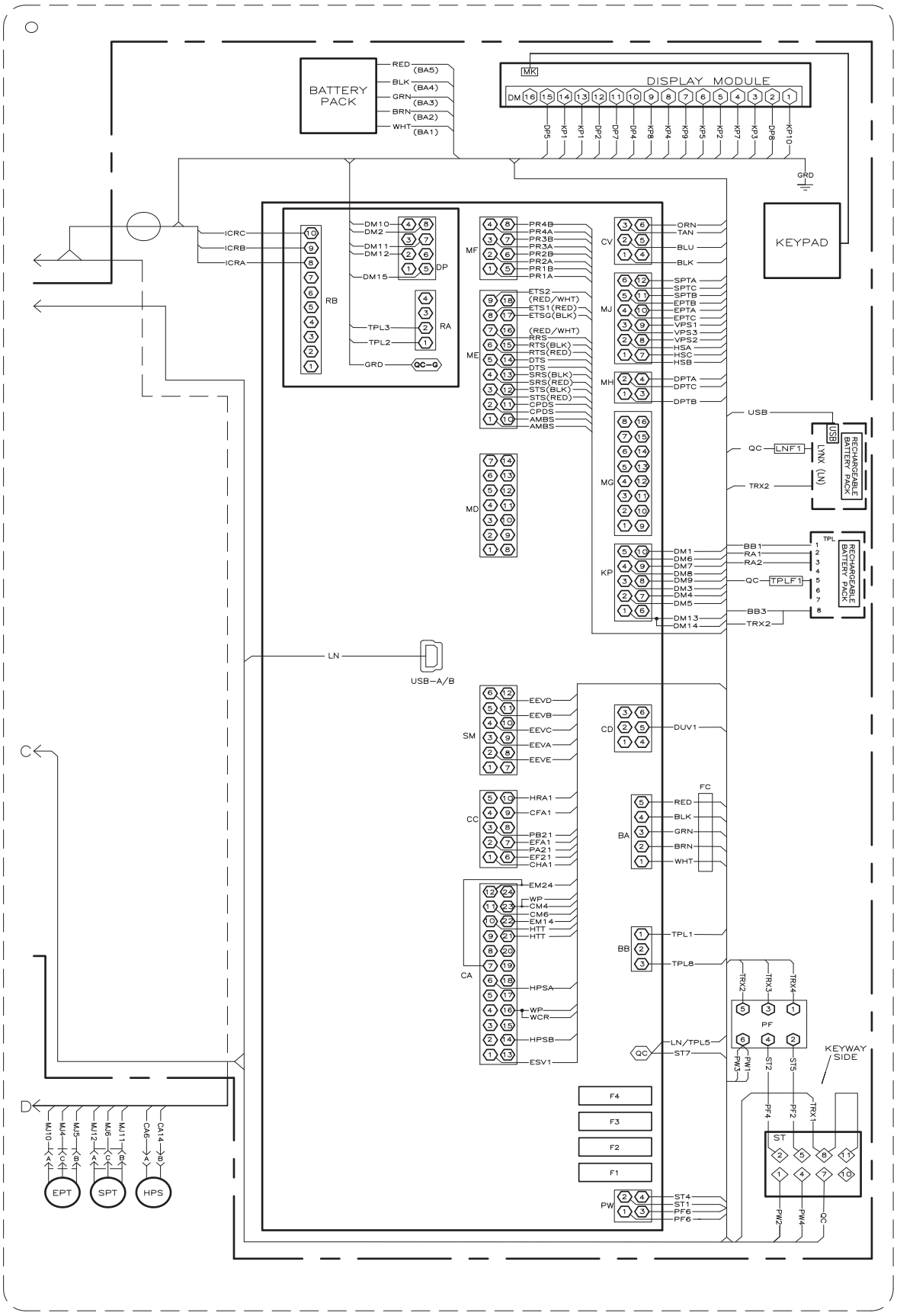
Electrical Schematic and Wiring Diagrams

Wiring Diagram Sheet 1 for Standard Unit (571-1xx Models)



Electrical Schematic and Wiring Diagrams

Wiring Diagram Sheet 2 for Standard Unit (571-1xx Models)



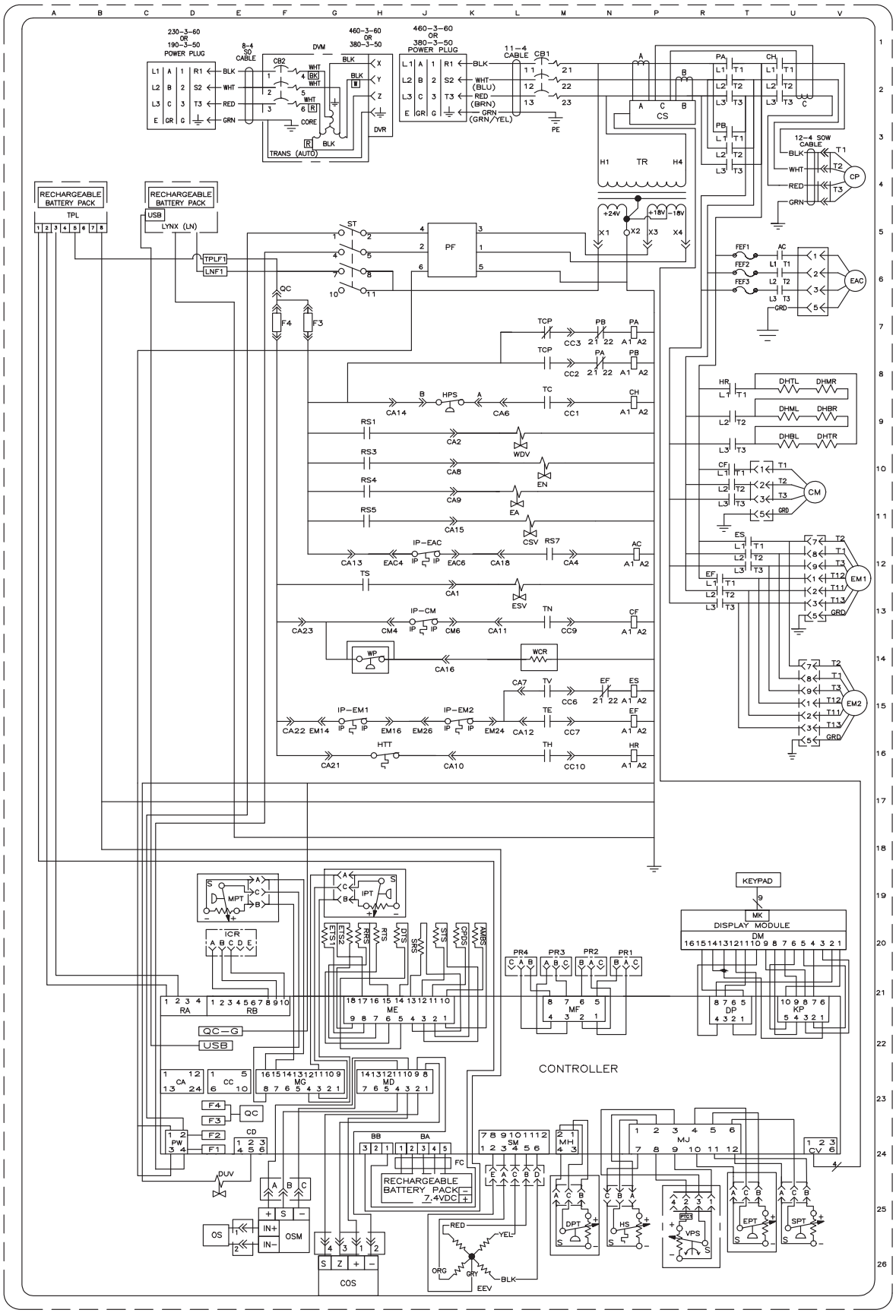
Electrical Schematic and Wiring Diagrams

Schematic Legend for Standard Unit (571-1xx Models) with EverFRESH

ZONE	SYMBOL		DESCRIPTION
N11	AC	—	AIR COMPRESSOR CONTACTOR
K20	AMBS	—	AMBIENT SENSOR
M22	C	—	CONTROLLERS
L1	CB1	—	CIRCUIT BREAKER 460V
F1	CB2	—	OPTIONAL CIRCUIT BREAKER 230V (DVM OPTION) TERMINAL BLOCK WHEN CB2 NOT PRESENT
R10,N13	CF	—	CONDENSER FAN CONTACTOR
N8,T1	CH	—	COMPRESSOR CONTACTOR
H13,J13,U10	CM	—	CONDENSER FAN MOTOR
G26	COS	—	C02 SENSOR
V4	CP	—	COMPRESSOR MOTOR
K20	CPDS	—	DISCHARGE TEMPERATURE SENSOR
P2	CS	—	CURRENT SENSOR
L11	CSV	—	C02 INJECTION VALVE
U8	DHTL	—	DEFROST HEATER — TOP LEFT
U9	DHML	—	DEFROST HEATER — MIDDLE LEFT
	DHBL	—	DEFROST HEATER — BOTTOM LEFT
V8	DHMR	—	DEFROST HEATER — MIDDLE RIGHT
V9	DHBR	—	DEFROST HEATER — BOTTOM RIGHT
	DHTR	—	DEFROST HEATER — TOP RIGHT
T20	DM	—	DISPLAY MODULE
M25	DPT	—	DISCHARGE PRESSURE TRANSDUCER
H20	DTS	—	DEFROST TEMPERATURE SENSOR
E25	DUV	—	DIGITAL UNLOADER VALVE
G1	DVM	—	DUAL VOLT MODULE (OPTIONAL)
H3	DVR	—	DUAL VOLTAGE RECEPTACLE (OPTIONAL)
L11	EA	—	EVERFRESH FRESH AIR VALVE
V6	EAC	—	EVERFRESH AIR COMPRESSOR
K26	EEV	—	EVAPORATOR EXPANSION VALVE
N14,N15,R12	EF	—	EVAPORATOR FAN CONTACTOR (HIGH SPEED)
V12,V15,G15 H15,J15,K15	EM	—	EVAPORATOR FAN MOTOR
L10	EN	—	EVERFRESH N2 SAMPLE
T25	EPT	—	EVAP. PRESSURE TRANSDUCER
T11,N14	ES	—	EVAPORATOR FAN CONTACTOR (LOW SPEED)
G20	ETS	—	EVAPORATOR TEMPERATURE SENSOR (SUCTION)
L12	ESV	—	ECONOMIZER SOLENOID VALVE
D23,D24,F7	F	—	FUSE
	FLA	—	FULL LOAD AMPS
J24	FC	—	FERRITE CLAMP
T6	FEF	—	FUSE EVERFRESH
J9	HPS	—	HIGH PRESSURE SWITCH
R8,N16	HR	—	HEATER CONTACTOR
N25	HS	—	HUMIDITY SENSOR (OPTIONAL)
H16	HTT	—	HEAT TERMINATION THERMOSTAT
E19	ICR	—	INTERROGATOR CONNECTOR REAR
G15,J13,J15	IP	—	INTERNAL PROTECTOR
H19	IPT	—	C02 INJECTION PRESSURE TRANSDUCER
D5	LN	—	LYNX TELEMATICS
D18,E18	MPT	—	MEMBRANE PRESSURE TRANSDUCER
D25	OS	—	02 SENSOR
F25	OSM	—	02 SENSOR AMPLIFIER
N7,N8,R1	PA	—	UNIT PHASE CONTACTOR
N7,N8,R3	PB	—	UNIT PHASE CONTACTOR
J5	PF	—	POWER FILTER
L20,M20,N20	PR	—	PROBE RECEPTACLE (USDA OPTION)
R25	PTC1	—	PTC FOR VENT POSITION SENSOR (UPPER)
H20	RRS	—	RETURN RECORDER SENSOR
H9	RS1	—	CONTROLLER RELAY (WATER DRAIN VALVE)
H9	RS3	—	CONTROLLER RELAY (N2 SAMPLE VALVE)
H10	RS4	—	CONTROLLER RELAY (FRESH AIR VALVE)
H11	RS5	—	CONTROLLER RELAY (C02 INJECTION VALVE)
M11	RS7	—	CONTROLLER RELAY (AIR COMPRESSOR CONTACTOR)
H20	RTS	—	RETURN TEMPERATURE SENSOR
U25	SPT	—	SUCTION PRESSURE TRANSDUCER
J20	SRS	—	SUPPLY RECORDER SENSOR
G5	ST	—	START—STOP SWITCH
J20	STS	—	SUPPLY TEMPERATURE SENSOR
L9	TC	—	CONTROLLER RELAY (COOLING)
L7,L8	TCP	—	CONTROLLER RELAY (PHASE SEQUENCING)
L15	TE	—	CONTROLLER RELAY (HIGH SPEED EVAPORATOR FANS)
L16	TH	—	CONTROLLER RELAY (HEATING)
L13	TN	—	CONTROLLER RELAY (CONDENSER FAN)
A5	TPL		TRIPLINK (OPTION)
P3	TR	—	TRANSFORMER
F3	TRANS	—	TRANSFORMER AUTO 230/460 (OPTION)
H12	TS	—	CONTROLLER RELAY (ECONOMIZER SOLENOID VALVE)
M15	TV	—	CONTROLLER RELAY (LOW SPEED EVAPORATOR FANS)
R25	VPS	—	VENT POSITIONING SENSOR (UPPER) (OPTION)
L14	WCR	—	WETTING CURRENT SENSOR (OPTION)
L9	WDV	—	WATER DRAIN VALVE
H14	WP	—	WATER PRESSURE SWITCH (OPTION)

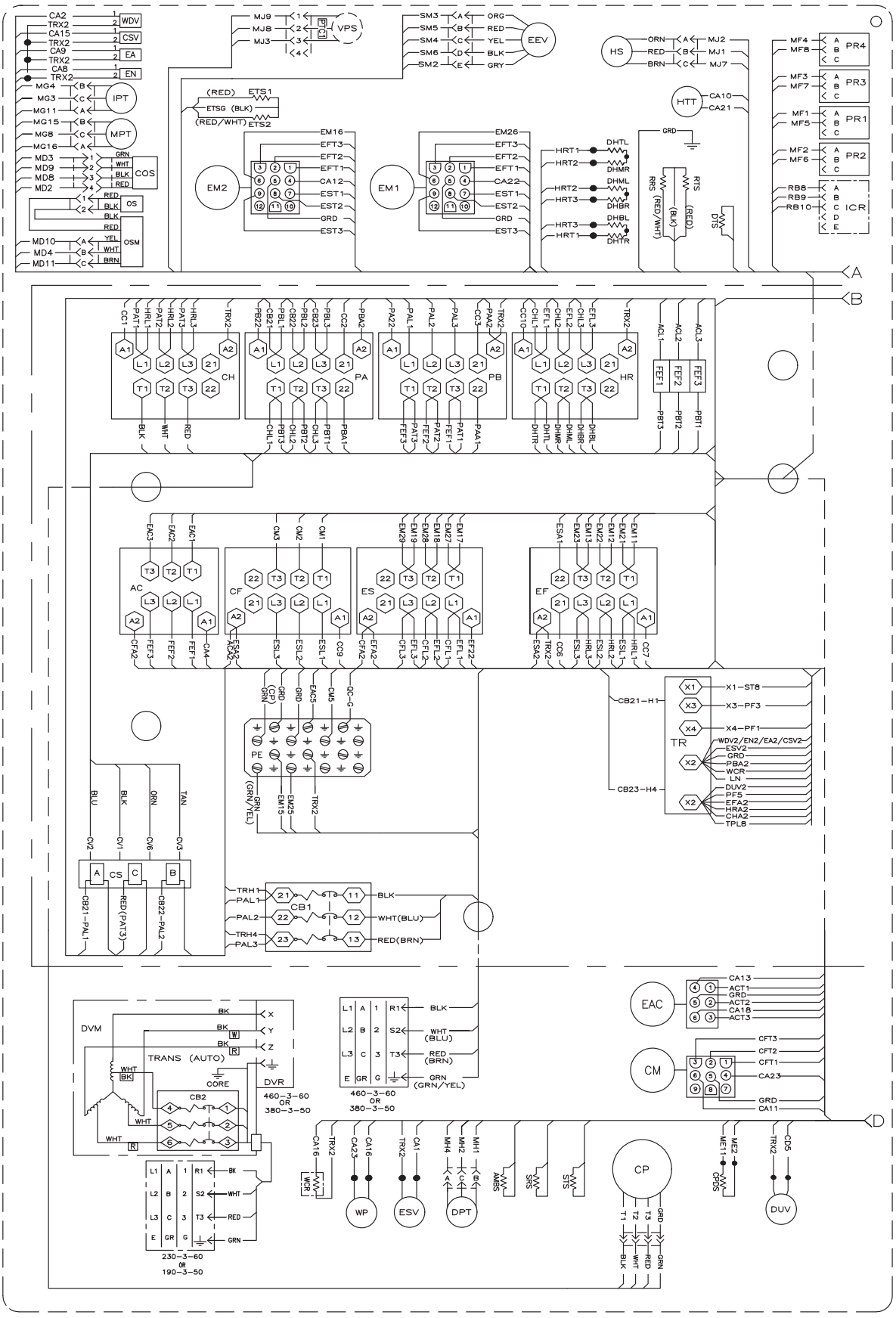
Electrical Schematic and Wiring Diagrams

Schematic for Standard Unit (571-1xx Models) with EverFRESH



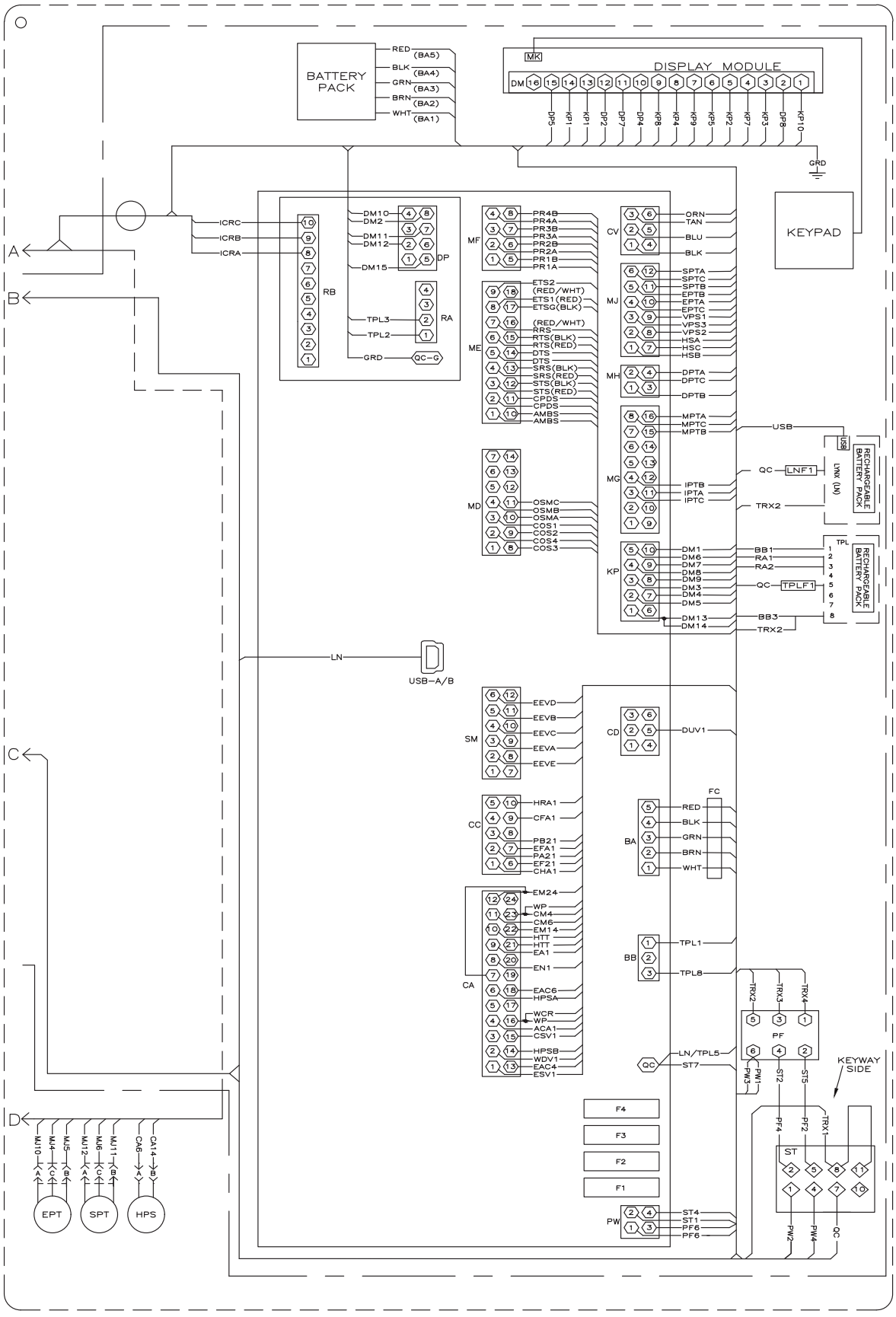
Electrical Schematic and Wiring Diagrams

Wiring Diagram Sheet 1 for Standard Unit (571-1xx Models) with EverFRESH



Electrical Schematic and Wiring Diagrams

Wiring Diagram Sheet 2 for Standard Unit (571-1xx Models) with EverFRESH



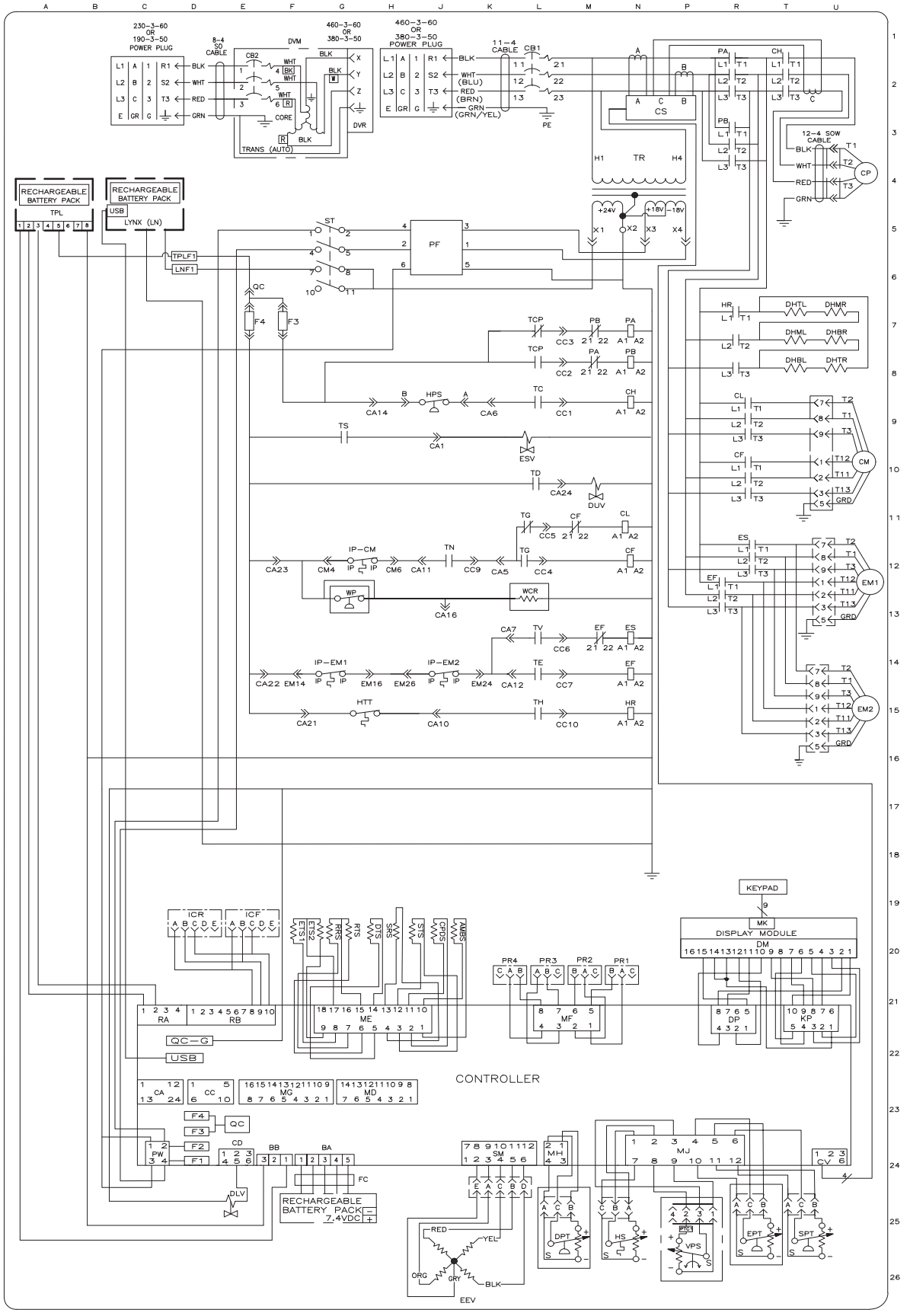
Electrical Schematic and Wiring Diagrams

Schematic Legend for EDGE Unit (571-3xx Models)

ZONE	SYMBOL		DESCRIPTION
J20	AMBS	–	AMBIENT SENSOR
K22	C	–	CONTROLLER
L1	CB1	–	CIRCUIT BREAKER 460V
E1	CB2	–	OPTIONAL CIRCUIT BREAKER 230V (DVM OPTION) TERMINAL BLOCK WHEN CB2 NOT PRESENT
M11,N12	CF	–	CONDENSER FAN CONTACTOR (HIGH SPEED)
N11,R9	CL	–	CONDENSER FAN CONTACTOR (LOW SPEED)
N8,T1	CH	–	COMPRESSOR CONTACTOR
F12,G12,U10	CM	–	CONDENSER FAN MOTOR
U4	CP	–	COMPRESSOR MOTOR
J20	CPDS	–	DISCHARGE TEMPERATURE SENSOR
N3	CS	–	CURRENT SENSOR
T8	DHBL	–	DEFROST HEATER – BOTTOM LEFT
U7	DHBR	–	DEFROST HEATER – BOTTOM RIGHT
T7	DHML	–	DEFROST HEATER – MIDDLE LEFT
U7	DHMR	–	DEFROST HEATER – MIDDLE RIGHT
T7	DHTL	–	DEFROST HEATER – TOP LEFT
U8	DHTR	–	DEFROST HEATER – TOP RIGHT
R20	DM	–	DISPLAY MODULE
L25	DPT	–	DISCHARGE PRESSURE TRANSDUCER
H20	DTS	–	DEFROST TEMPERATURE SENSOR
M11	DUV	–	DIGITAL UNLOADER VALVE
E25	DLV	–	DIGITAL LOADER VALVE
F1	DVM	–	DUAL VOLT MODULE (OPTIONAL)
G3	DVR	–	DUAL VOLTAGE RECEPTACLE (OPTIONAL)
J26	EEV	–	EVAPORATOR EXPANSION VALVE
M13,N14,P12	EF	–	EVAPORATOR FAN CONTACTOR (HIGH SPEED)
U12,U15 G14,H14,K14	EM	–	EVAPORATOR FAN MOTOR
R25	EPT	–	EVAP. PRESSURE TRANSDUCER
R12,N13	ES	–	EVAPORATOR FAN CONTACTOR (LOW SPEED)
F20	ETS	–	EVAPORATOR TEMPERATURE SENSOR (SUCTION)
L9	ESV	–	ECONOMIZER SOLENOID VALVE
D23,D24,E7	F	–	FUSE
	FLA	–	FULL LOAD AMPS
G24	FC	–	FERRITE CLAMP
J9	HPS	–	HIGH PRESSURE SWITCH
R7,N15	HR	–	HEATER CONTACTOR
N25	HS	–	HUMIDITY SENSOR (OPTIONAL)
G15	HTT	–	HEAT TERMINATION THERMOSTAT
D19	ICR	–	INTERROGATOR CONNECTOR REAR
G14,J14,G12	IP	–	INTERNAL PROTECTOR
C5	LN	–	LYNX TELEMATICS
M8,N7,R1	PA	–	UNIT PHASE CONTACTOR
M7,N8,R3	PB	–	UNIT PHASE CONTACTOR
J5	PF	–	POWER FILTER
K20,L20,M20	PR	–	PROBE RECEPTACLE (USDA OPTION)
P25	PTC1	–	PTC FOR VENT POSITION SENSOR (UPPER)
G20	RRS	–	RETURN RECORDER SENSOR
G20	RTS	–	RETURN TEMPERATURE SENSOR
T25	SPT	–	SUCTION PRESSURE TRANSDUCER
H20	SRS	–	SUPPLY RECORDER SENSOR
G5	ST	–	START–STOP SWITCH
H20	STS	–	SUPPLY TEMPERATURE SENSOR
L8	TC	–	CONTROLLER RELAY (COOLING)
L7,L8	TCP	–	CONTROLLER RELAY (PHASE SEQUENCING)
L14	TE	–	CONTROLLER RELAY (HIGH SPEED EVAPORATOR FANS)
L11,L12	TG	–	CONTROLLER RELAY (HIGH & LOW SPEED CONDENSER FANS)
L15	TH	–	CONTROLLER RELAY (HEATING)
A5	TPL	–	TRIPLINK (OPTION)
J12	TN	–	CONTROLLER RELAY (CONDENSER FAN)
N4	TR	–	TRANSFORMER
E3	TRANS	–	TRANSFORMER AUTO 230/460 (OPTION)
G9	TS	–	CONTROLLER RELAY (ECONOMIZER SOLENOID VALVE)
L13	TV	–	CONTROLLER RELAY (LOW SPEED EVAPORATOR FANS)
P25	VPS	–	VENT POSITIONING SENSOR (UPPER) (OPTION)
L13	WCR	–	WETTING CURRENT SENSOR (OPTION)
G13	WP	–	WATER PRESSURE SWITCH (OPTION)

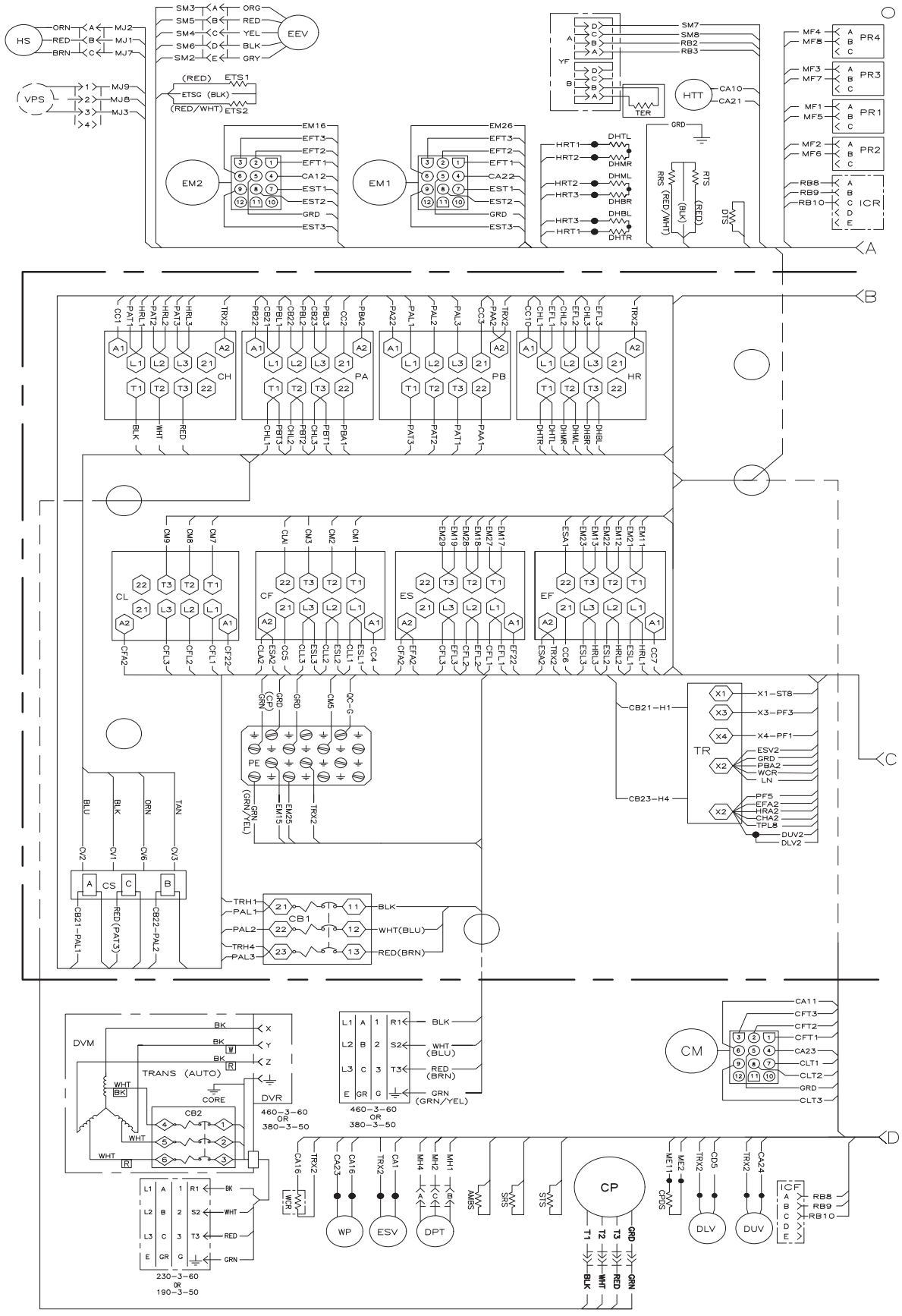
Electrical Schematic and Wiring Diagrams

Schematic for EDGE Unit (571-3xx Models)



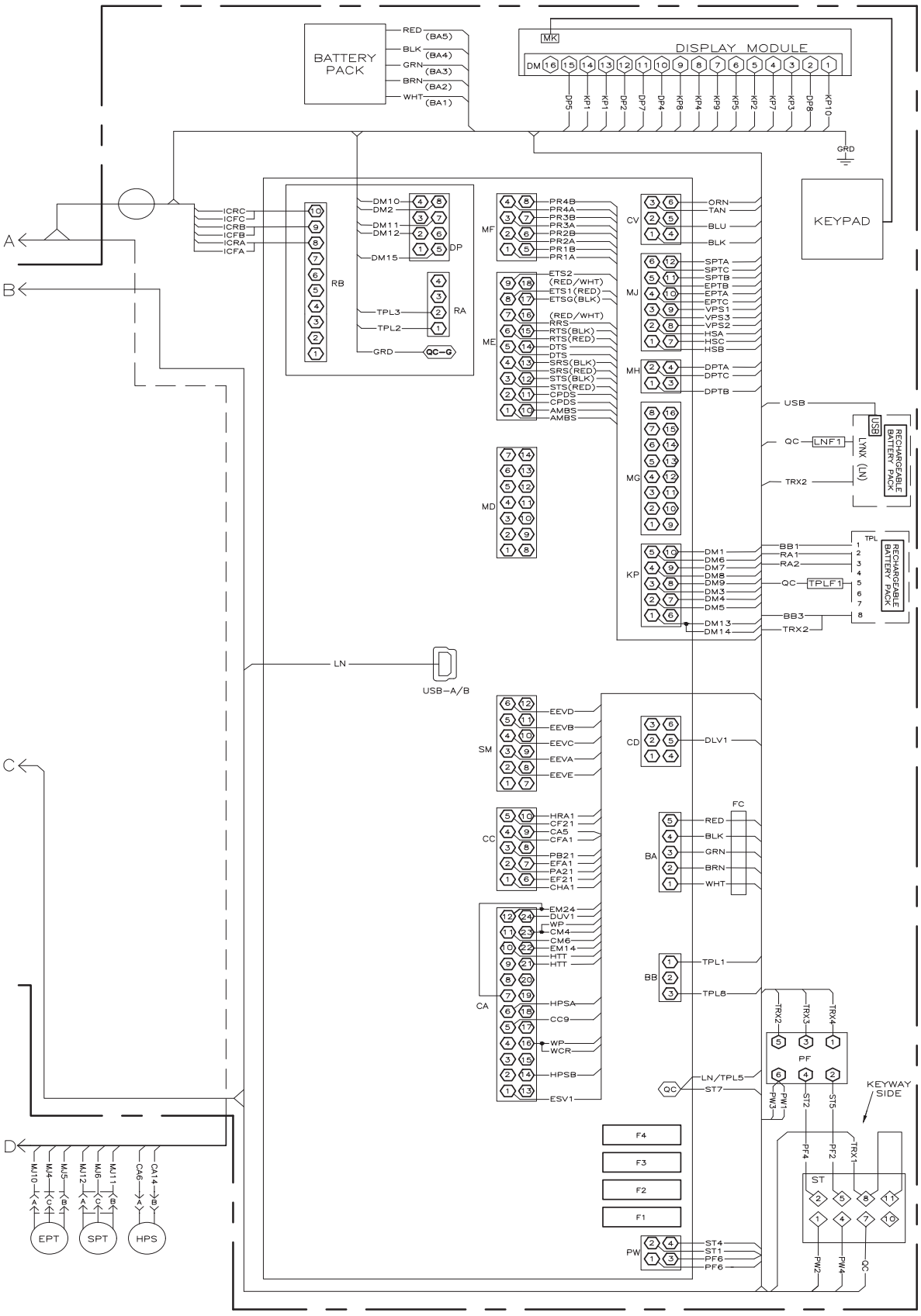
Electrical Schematic and Wiring Diagrams

Wiring Diagram Sheet 1 for EDGE Unit (571-3xx Models)



Electrical Schematic and Wiring Diagrams

Wiring Diagram Sheet 2 for EDGE Unit (571-3xx Models)



Section 9
EU Declaration of Conformity

Serial Number:

_____-_____

Manufacturing Date:

_____

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:

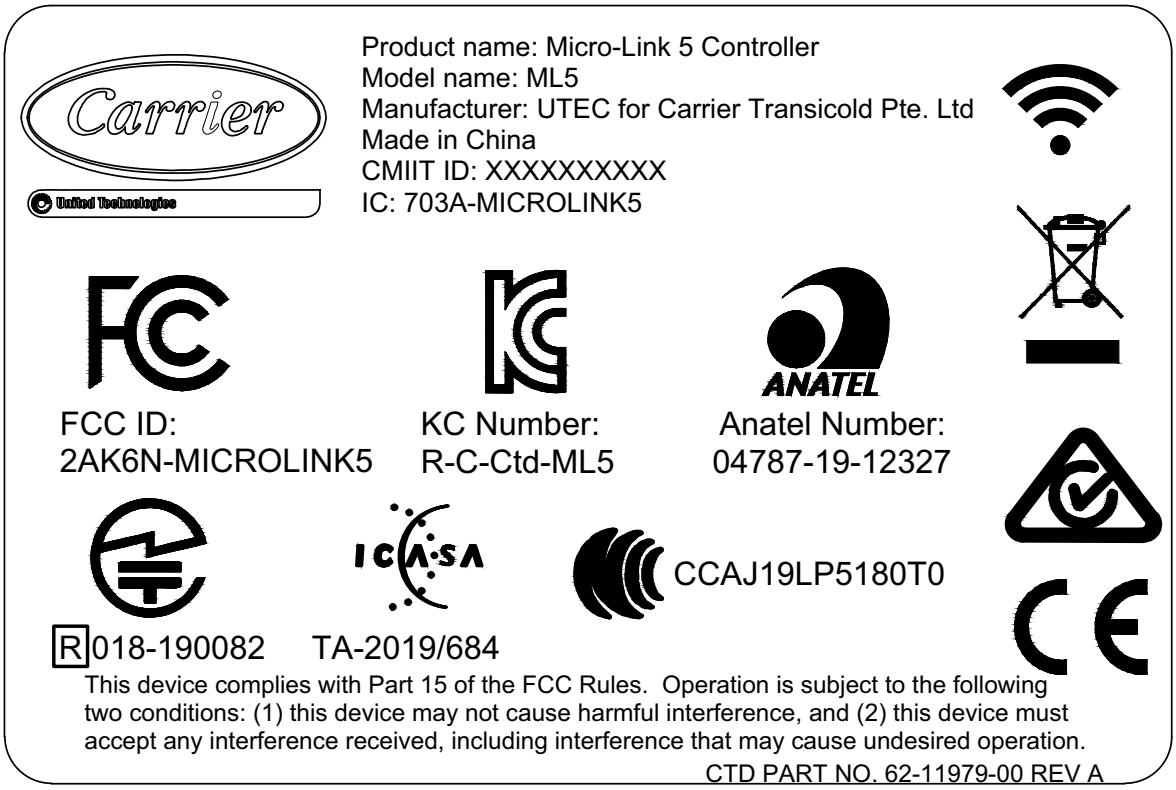
- ISO 1496-2:2008

Person established in Europe authorized to compile a copy of the Technical File:
Shaun Bretherton
Regional Service Manager EMEA
Waalhaven Oostzijde 85 3087 BM Rotterdam
The Netherlands

_____ _____

Nader Awwad, Engineering Director Date
Carrier Transicold
P.O. Box 4805
Syracuse, New York 13221 USA (Authorized person to sign declaration on behalf of the manufacturer)

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。

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Carrier Transicold Division,
Carrier Corporation
P.O. Box 4805
Syracuse, NY 13221 USA

www.carrier.com/container-refrigeration/