Container Refrigeration

OPERATIONS AND SERVICE MANUAL

For

OptimaLINE

69NT40-701-001 to 099

Container Refrigeration Units

T-383 Rev C

OPERATIONS AND SERVICE MANUAL

OptimaLINE

69NT40-701-001 to 099

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 Lifting or Transporting Precautions

Care must be taken when lifting or transporting the container box to keep from damaging the refrigeration unit, which may result in damage to the refrigeration circuit.

1.4 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.

1.5 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 to extinguish.

Care must be taken when making any repairs to the container box to keep from damaging the refrigeration unit, which may result in damage to the refrigeration circuit.

1.6 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 - an immediate hazard that WILL result in severe personal injury or death.

WARNING - a hazards or unsafe condition that COULD result in severe personal injury or death.

CAUTION - a potential hazard or unsafe practice that could result in personal injury, product or property damage.

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

⚠ WARNING

EXPLOSION HAZARD Failure to follow this WARNING can result in death, serious personal injury and / or property damage. Never use air or gas mixtures containing oxygen (O_2) for leak testing or operating the product. Charge only with refrigerants R-134a or R-513A as specified for the unit model number: Refrigerant must conform to AHRI Standard 700 specification.

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

Make sure the start/stop switch is OFF, unit circuit breaker(s) (CB-1 and optional CB-2) is OFF and the power plug disconnected before servicing unit components or moving parts. Follow local lockout / tagout procedures for working on equipment.

⚠ WARNING

The compressor can run at hot surface temperatures. A compressor shield is in place to prevent contact with the compressor.

⚠ WARNING

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

⚠ WARNING

Do not use a nitrogen cylinder without a pressure regulator.

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ CAUTION

When charging the unit with R-513A refrigerant, charge as a liquid only. R-513A is an azeotrope blend containing R1234yf 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 a failure occurs during automatic Pre-Trip testing, the unit will suspend operation awaiting operator intervention.

⚠ 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

A hermetically sealed compressor 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

Electrical Hazard. After disconnecting the power supply, wait seven minutes before servicing the Variable Frequency Drive (VFD) to allow capacitors to completely discharge.

⚠ 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

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 OptimaLINE units, model numbers 69NT40-701-xxx, are of lightweight aluminum frame construction, designed to be bolted onto the front of a container and serve as the container's front wall. Forklift pockets are provided for unit installation and removal.

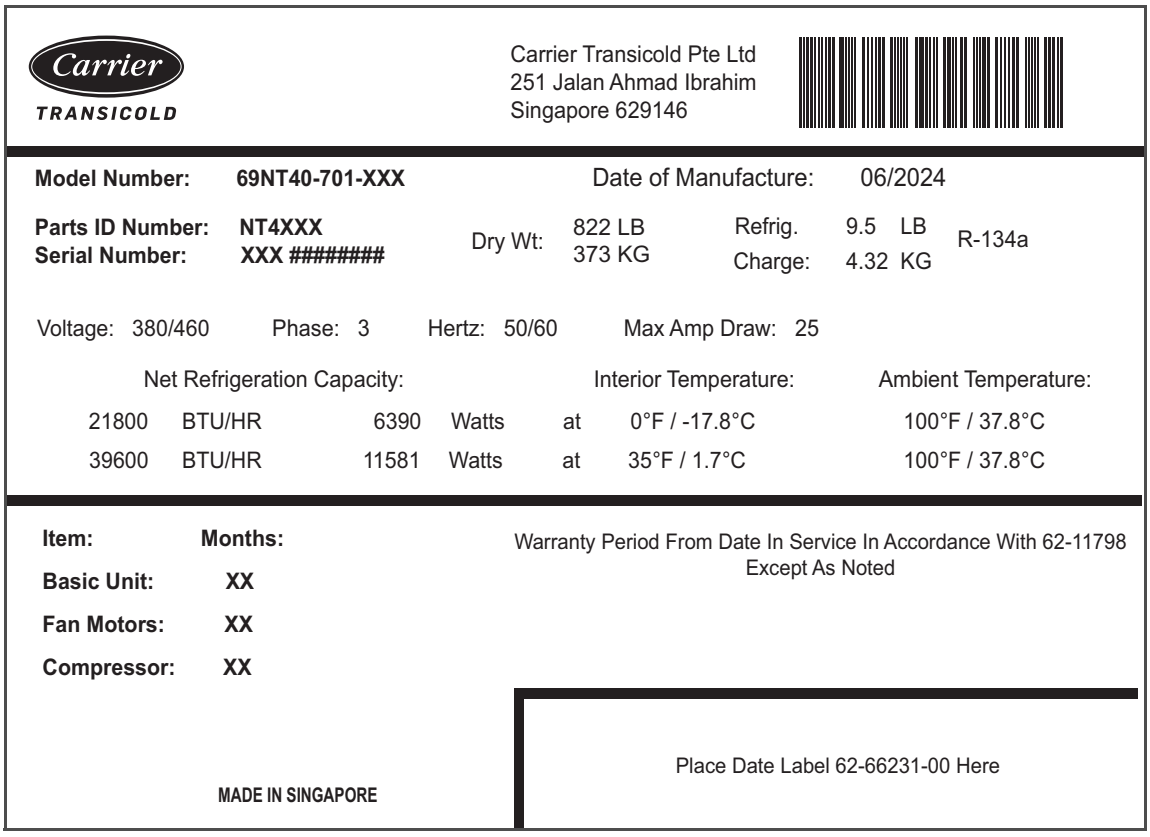
OptimaLINE units are self-contained, all electric units, which include cooling and heating systems to provide precise temperature control. The units are supplied with a complete charge of refrigerant and compressor lubricating oil, and are ready for operation upon installation.

The base unit operates on nominal 380/460 volt, 3-phase, 50/60 hertz (Hz) power. Control system power is provided by a transformer which steps the supply power down to 18 and 24 volts, single phase.

2.2 Configuration Identification

Unit identification information is provided on a nameplate, as shown in **Figure 2.1**, located on the inside wall of the container near the power cable storage area. The nameplate provides the unit model number, unit serial number and parts identification number (PID). The model number identifies the overall unit configuration, while the PID number provides information on specific optional equipment, factory provisioned to allow for field installation of optional equipment and differences in detailed parts.

Figure 2.1 Unit Nameplate



2.3 Refrigerant

OptimaLINE units covered in this manual are in the model range of 701-001 to 099. These units are supplied with a complete charge of R-134a refrigerant, and are R-513A-ready. This means the unit owner at a later date can perform a field conversion to recover R-134a refrigerant from the unit and replace with a complete charge of R-513A refrigerant. Refer to Service **Section 7.1.9** for instructions for field conversion.

The refrigerant charge amount is listed on the unit nameplate, shown in **Figure 2.1**.

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

The controller is a Carrier Transicold Micro-Link 5 microprocessor. 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.

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 variable speed scroll compressor equipped with suction and discharge service connections.

2.4.6 Condenser Coil

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

2.4.7 Condenser Fan Operation

The unit is equipped with a three phase, dual speed 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.

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

2.4.10 Plate Set

The 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.

2.4.11 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 more than 45°C, the carrier-provided rechargeable batteries will not charge.

2.5 Option Descriptions

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

2.5.1 Dehumidification

The unit is fitted with a humidity sensor and unit software can be configured to allow for dehumidification. In dehumidification mode, the controller will operate to reduce internal container moisture level.

2.5.2 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 and is for performing USDA probe calibration. There are no write commands capable from this port.

2.5.3 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.

2.5.4 Back Panels

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

2.5.5 460 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.

2.5.6 Cable Restraint

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

2.5.7 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.

2.5.8 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.

2.5.9 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 5.9.6** for more detail.

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

2.5.10 FuelWise

FuelWise™ is a power-saving option available for OptimaLINE 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 5.9.1** for more detail.

2.5.11 TripWise

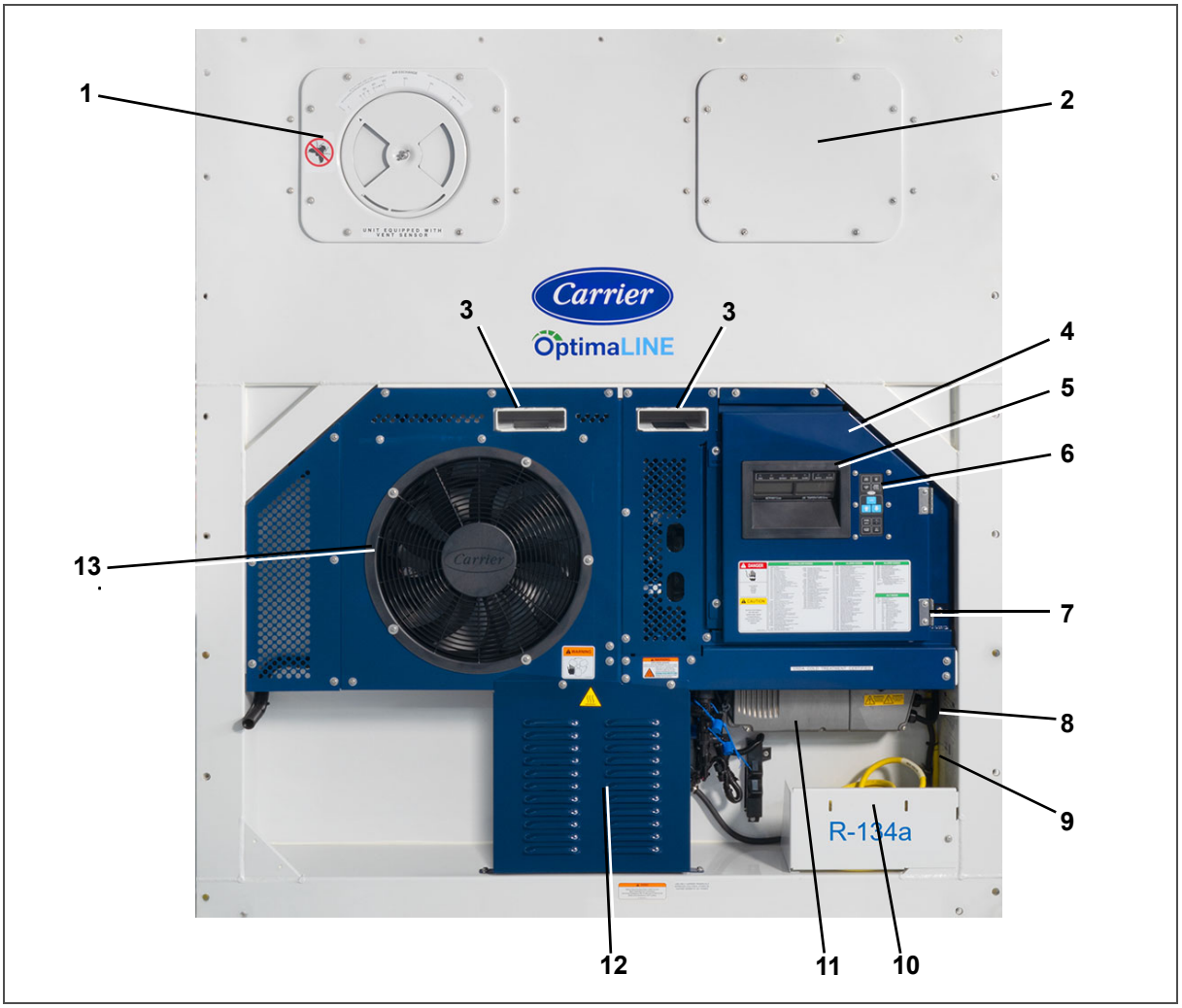
TripWise™ is a new premium option available for OptimaLINE units. TripWise is software logic that runs in the background during every voyage and will let you know whenever a standard pre-trip inspection (PTI) is needed. See **Section 5.9.2** for more detail.

Section 3
Description

3.1 Introduction

The container unit, shown in **Figure 3.1**, is designed so that the majority of the components are accessible from the front. The unit model number, unit serial number and parts identification number can be found on the unit nameplate on the side wall next to the power cable storage area.

Figure 3.1 Container Unit - Front Section



1) Access Panel with Fresh Air Makeup Vent (Evaporator Fan location)
2) Access Panel (Evaporator Fan location)
3) Fork Lift Pockets
4) Control Panel
5) Unit Display
6) Keypad
7) Start-Stop Switch (ST)
8) Unit Nameplate
9) Options Label and PED Label
10) Power Cables and Plug
11) Variable Frequency Drive (VFD)
12) Compressor (behind guard)
13) Condenser Fan and Coil

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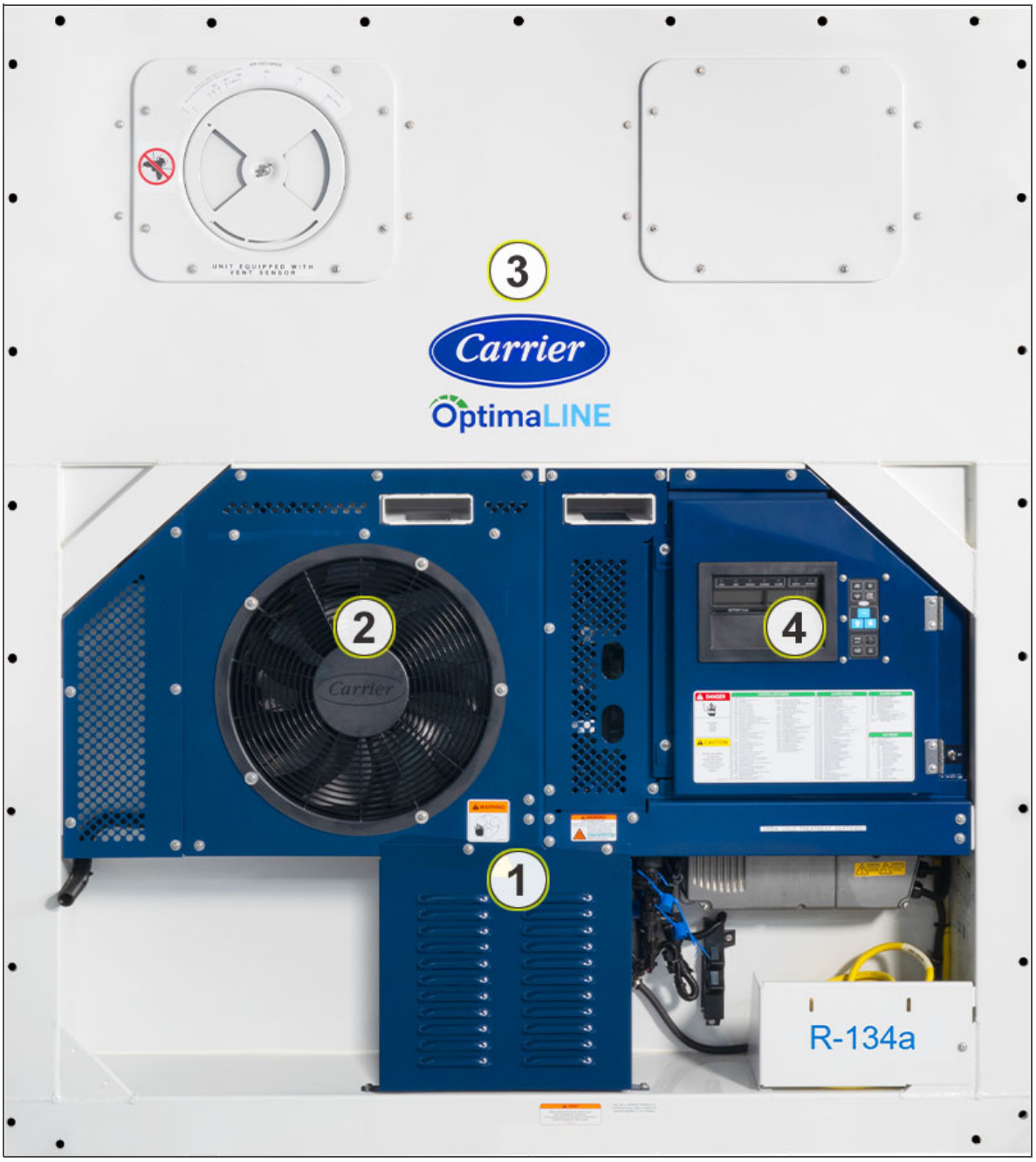
3.2 Component Overviews

The container unit components, as shown in **Figure 3.2**, are explained in this manual by dividing 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 is a variable speed scroll compressor that 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, variable frequency drive (VFD), discharge service valves (discharge and suction), discharge pressure transducer (DPT), suction pressure transducer (SPT), evaporator pressure transducer (EPT), a high pressure switch (HPS), a discharge temperature sensor (CPDS) and connections to the compressor.

Compressor section components are shown in **Figure 3.3** and **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 the following components: condenser fan and coil, receiver with sight glass & indicator, liquid line service valve, filter drier, economizer, economizer expansion valve (ECV) economizer pressure transducer (ECP) and economizer temperature sensor (ECT).

Condenser section components are shown in **Figure 3.3** and **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 the following components: evaporator fan and motor (EM1, EM2), return temperature sensor (RTS), return recorder sensor (RRS), humidity sensor (HS), evaporator coil, heaters, heat termination thermostat (HTT), defrost temperature sensor (DTS), electronic expansion valve (EEV), evaporator temperature sensor (ETS), receptacles, and interrogator connector.

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

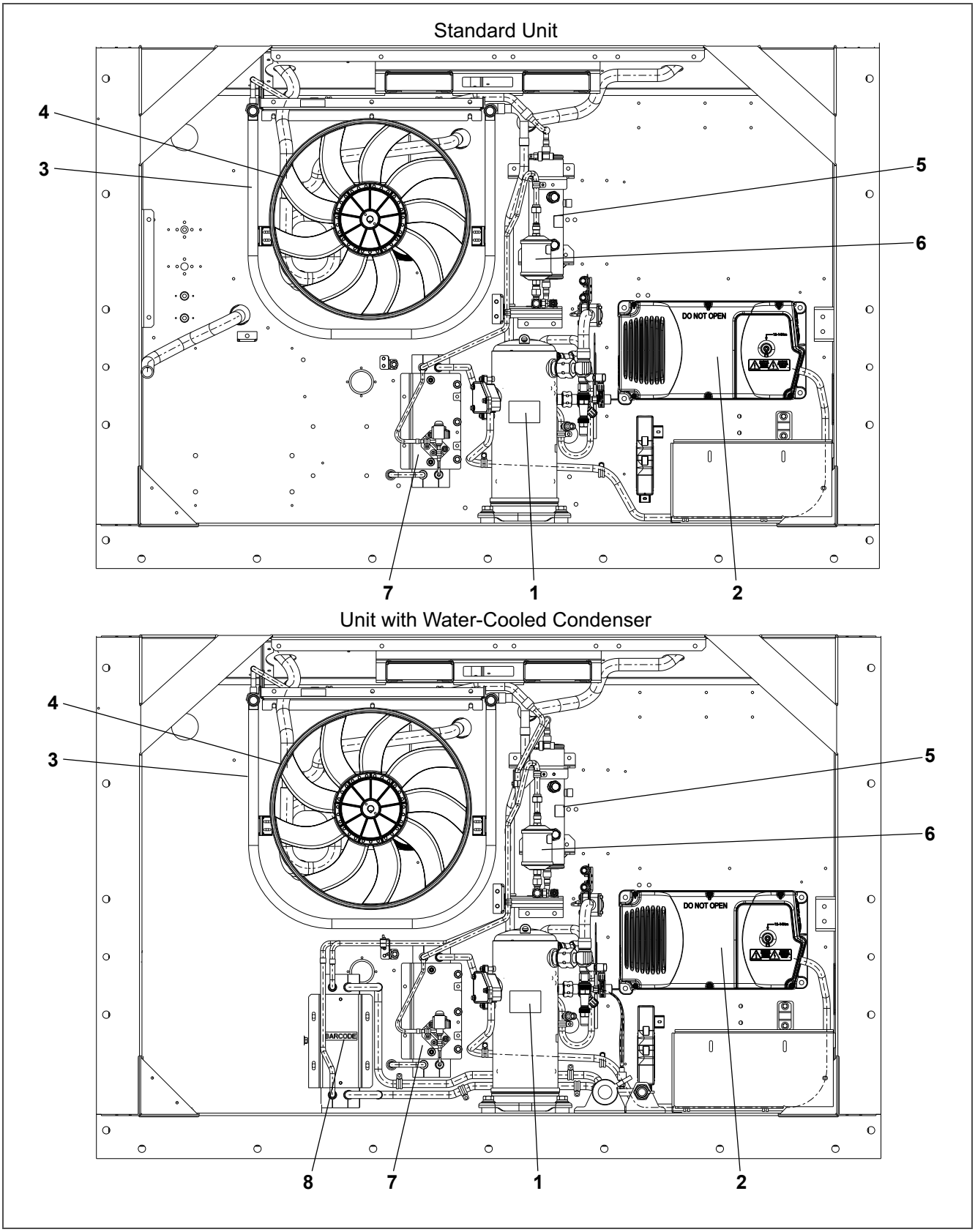
3.2.4 Control Box Section

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.

Control box section components are shown in **Figure 3.6**.

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

Figure 3.3 Compressor and Condenser Sections



1) Compressor
2) Variable Frequency Drive (VFD)
3) Condenser Coil, MCHE
4) Condenser Fan and Motor
5) Receiver with Sight Glass and Moisture Indicator
6) Filter Drier
7) Economizer
8) Water Cooled Condenser (Option)

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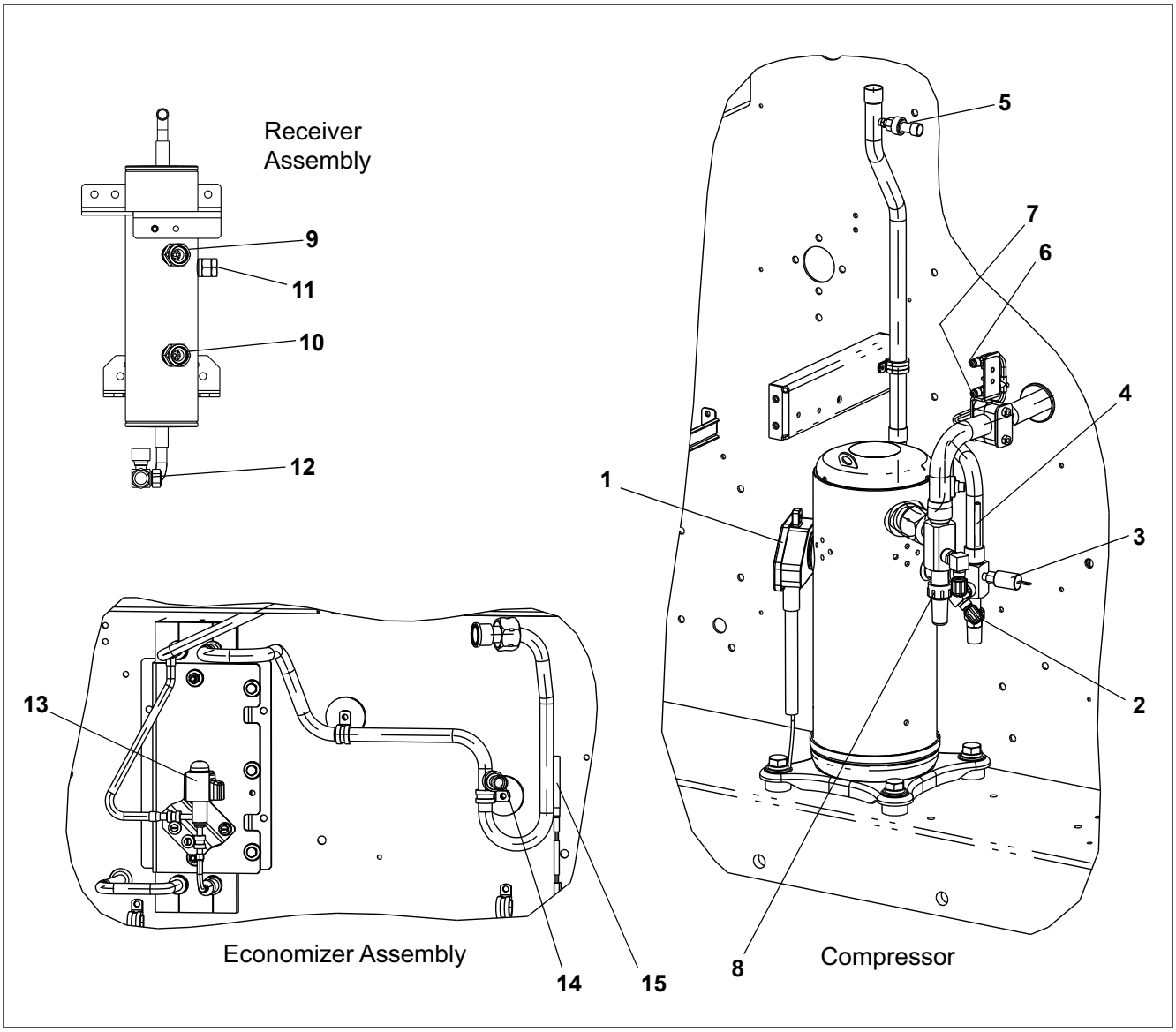
Figure 3.4 Compressor and Condenser Sections



1) Compressor Terminal Box
2) Discharge Service Valve
3) High Pressure Switch (HPS)
4) Discharge Temperature Sensor (CPDS)
5) Discharge Pressure Transducer (DPT)
6) Suction Pressure Transducer (SPT)
7) Evaporator Pressure Transducer (EPT)
8) Suction Service Valve
9) Receiver Sight Glass
10) Receiver Moisture Indicator
11) Fusible Plug
12) Liquid Line Service Valve / King Valve
13) Economizer Expansion Valve (ECV)
14) Economizer Pressure Transducer (ECP)
15) Economizer Temperature Sensor (ECT)

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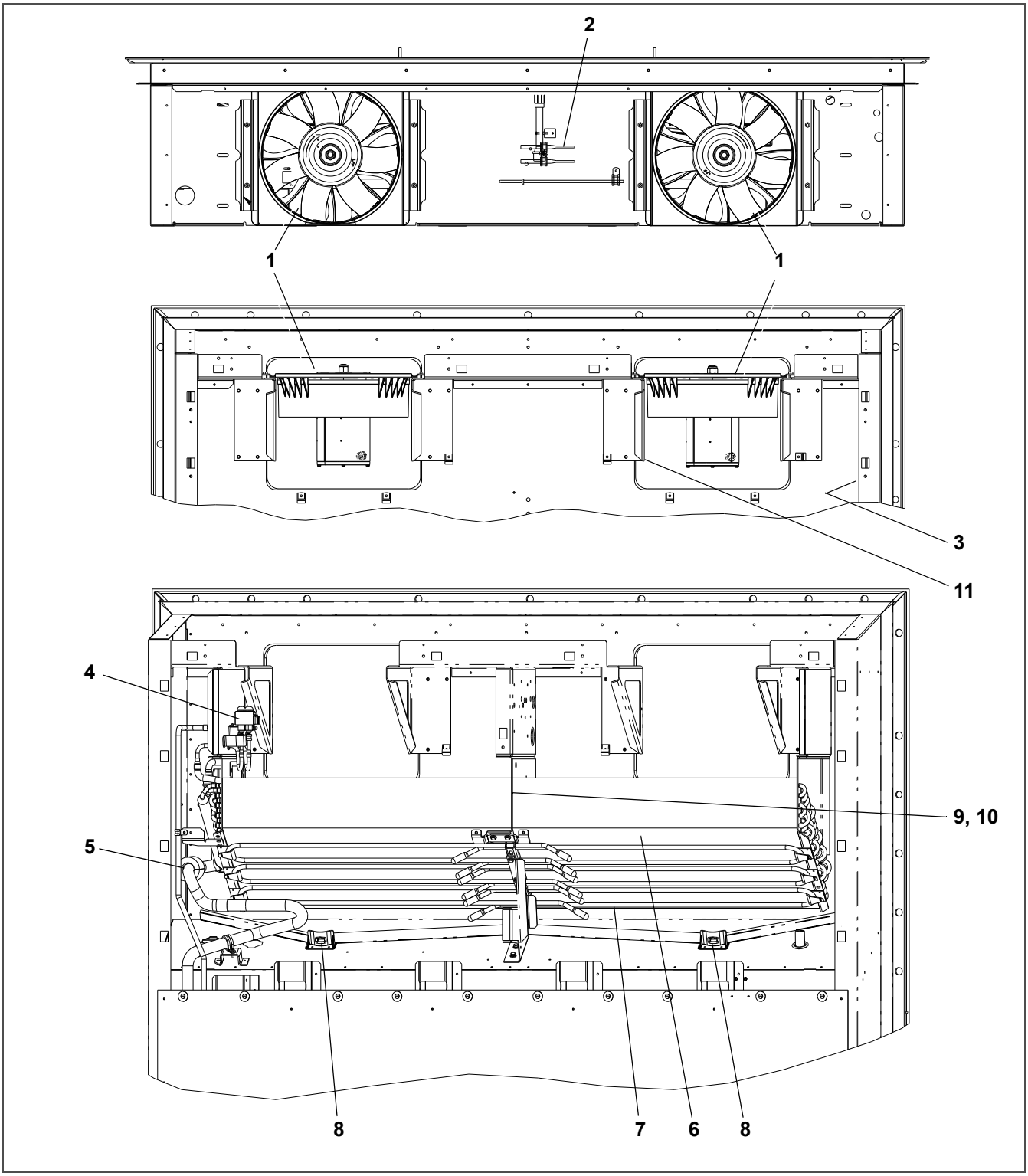
Figure 3.5 Evaporator Section



1) Evaporator Fan and Motor (EM1, EM2)
2) Return Temperature Sensor (RTS) / Return Recorder Sensor (RRS)
3) Humidity Sensor (HS)**
4) Electronic Expansion Valve (EEV)
5) Evaporator Temperature Sensors (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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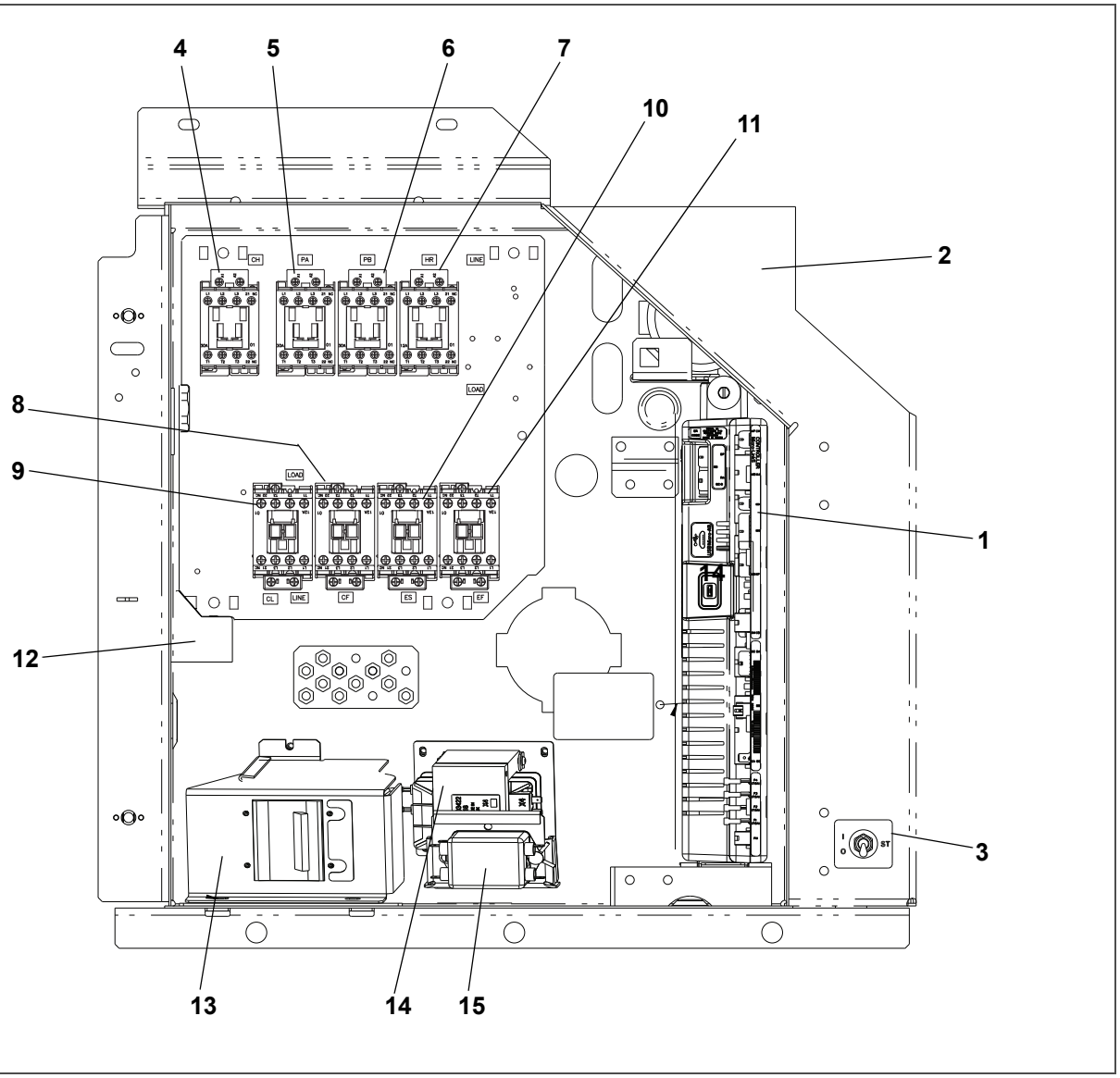
** general location, not shown in figure.

Figure 3.6 Control Box Section



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

- - - - -

3.3 Main Component Descriptions

3.3.1 Compressor

The compressor, shown in **Figure 3.7**, is a variable speed scroll compressor with a permanent magnet motor. 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 contains a terminal box, oil drain, refrigerant discharge and suction connections.

Figure 3.7 Compressor

3.3.2 Variable Frequency Drive

The variable frequency drive (VFD), shown in **Figure 3.8**, drives the compressor variable speed motor.

NOTE: The VFD has permanent magnet motor control, and therefore it is not possible to bypass the VFD.

Figure 3.8 Variable Frequency Drive (VFD)

3.3.3 Condenser Coil and Fan

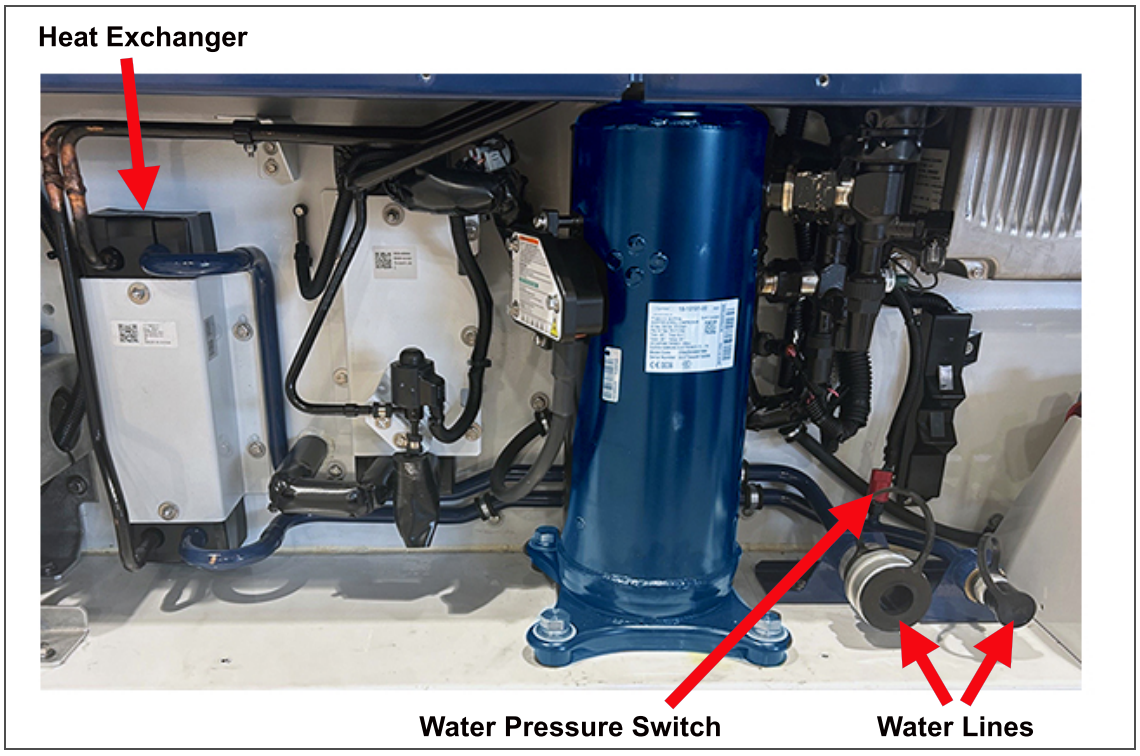
From the compressor, the refrigerant flows to the air-cooled condenser, shown in **Figure 3.9**. The condenser fan blows the air across the coil fins and tubes to cool the gas to saturation temperature. By removing latent heat, the gas condenses to a high pressure / high temperature liquid and flows to the receiver. The fan is dual speed to enable low speed operation under light load to minimize power usage while maintaining capacity.

Figure 3.9 Condenser Coil and Fan (Cover Removed)

3.3.4 Water-Cooled Condenser Option

The unit may contain an optional brazed plate water-cooled condenser (WCC), shown in **Figure 3.10**. The WCC contains a heat exchanger, water lines and a water pressure switch. When operating with a 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.

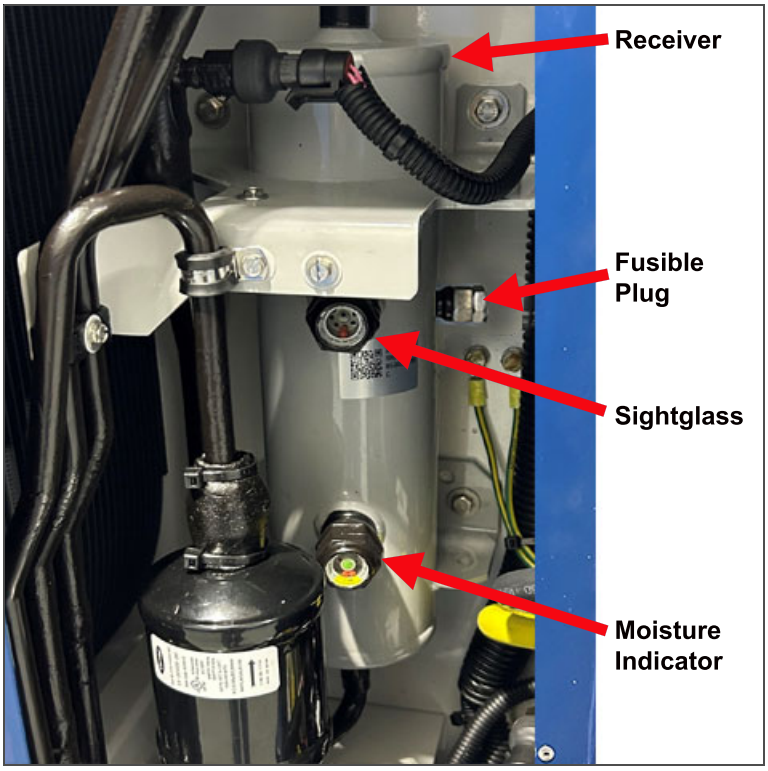
Figure 3.10 Brazed Plate Water-Cooled Condenser



3.3.5 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

Figure 3.11 Receiver with Fusible Plug



3.3.6 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

3.3.7 Economizer

The economizer, shown in **Figure 3.13**, is only active when the unit enables economized mode and the controller energizes the economizer expansion valve (ECV), see **Figure 3.21**. The liquid refrigerant flows through the ECV to the economizer 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. If economized mode is not active, the economizer is bypassed and refrigerant flows directly to the EEV.

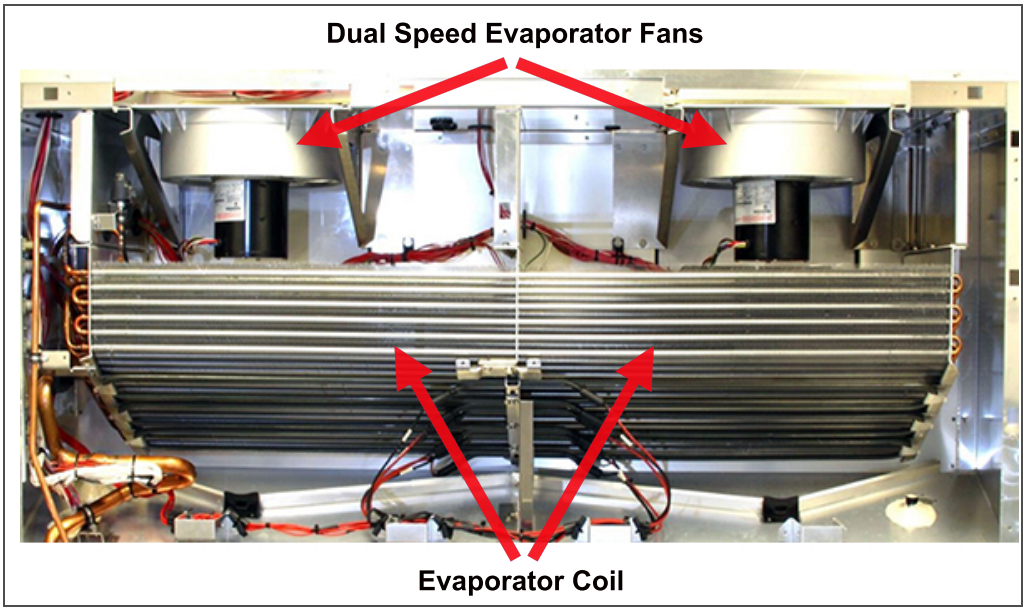
NOTE: The EEV position (%) reading can be viewed on the unit display at function code Cd54.

Figure 3.13 Economizer

3.3.8 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.

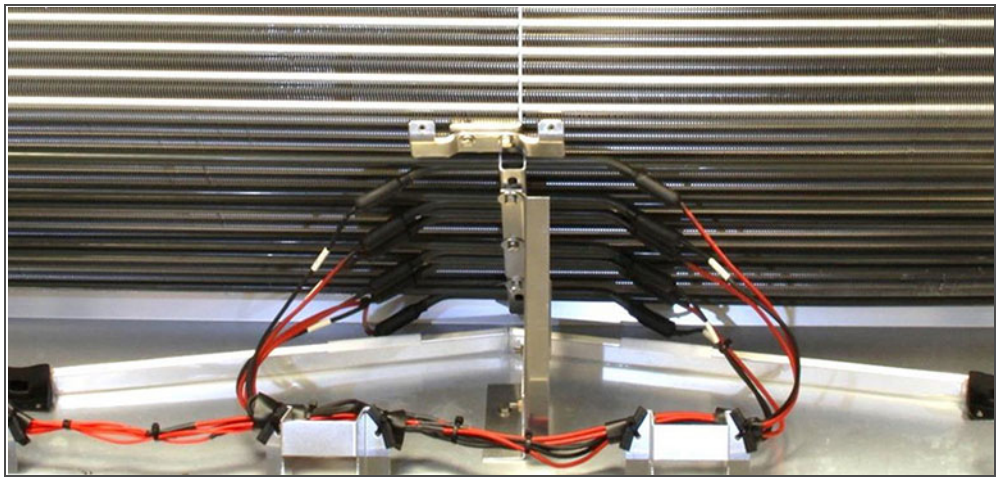
Figure 3.14 Evaporator Coil and Fans



3.3.9 Heaters

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

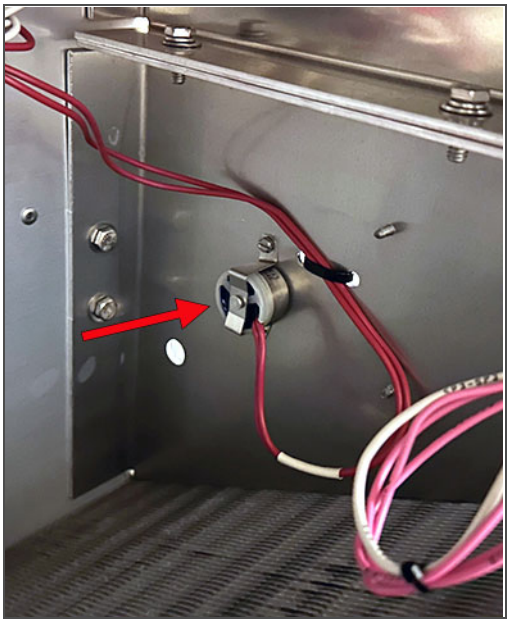
Figure 3.15 Heaters



3.3.10 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)



3.3.11 Evaporator Access Panels and Air Makeup Vent

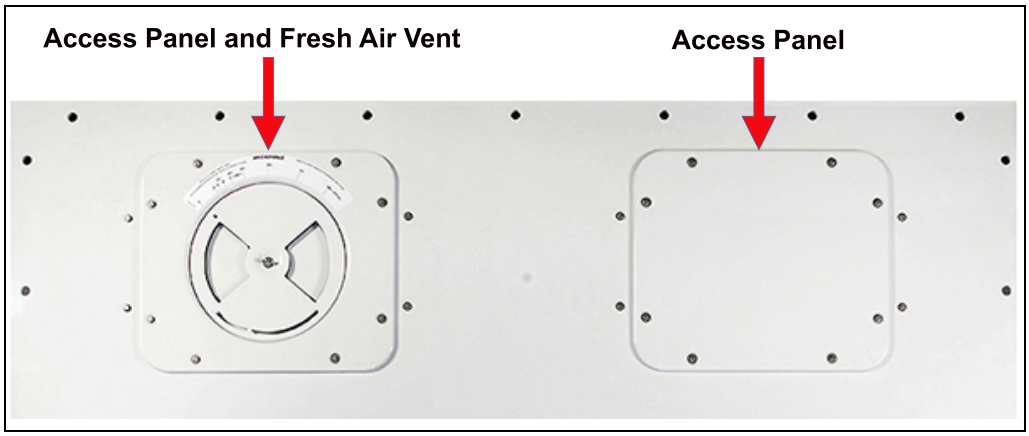
Most evaporator components are accessible by removing the upper back rear panel, inside the container unit. They may also be accessed via the evaporator fan access panels on the front of the unit, as shown in **Figure 3.17**.

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 5.5** for the procedure to adjust the fresh air makeup vent.

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

Figure 3.17 Access Panels and Fresh Air Makeup Vent

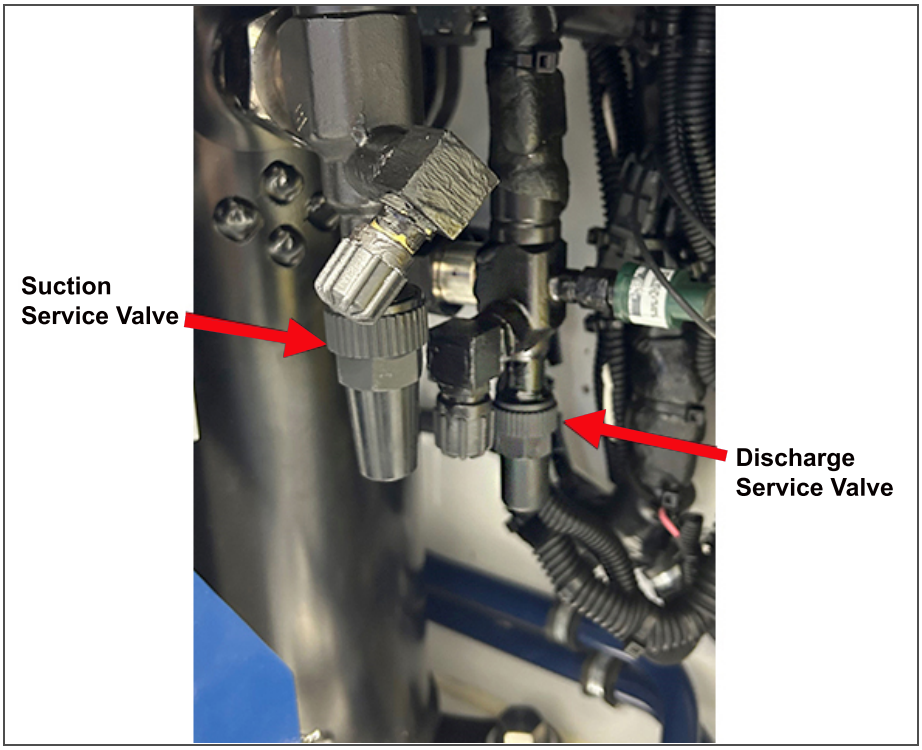


3.4 Service Valves Descriptions

3.4.1 Compressor Service Valves

The discharge service valve and suction service valve, shown in **Figure 3.18**, 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 or king valve, shown in **Figure 3.19**, is for service procedures related to adding and removing refrigerant.

Figure 3.19 Liquid Line / King Valve

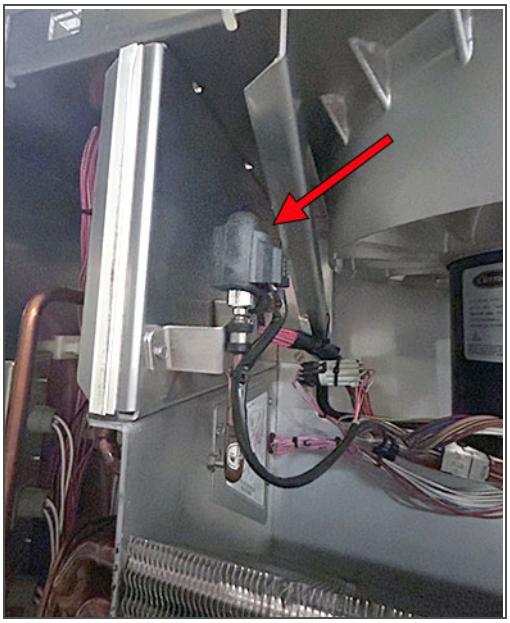
3.5 Refrigerant Valves Descriptions

3.5.1 Electronic Expansion Valve

The electronic expansion valve (EEV), shown in **Figure 3.20**, 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 3.20 Electronic Expansion Valve (EEV)

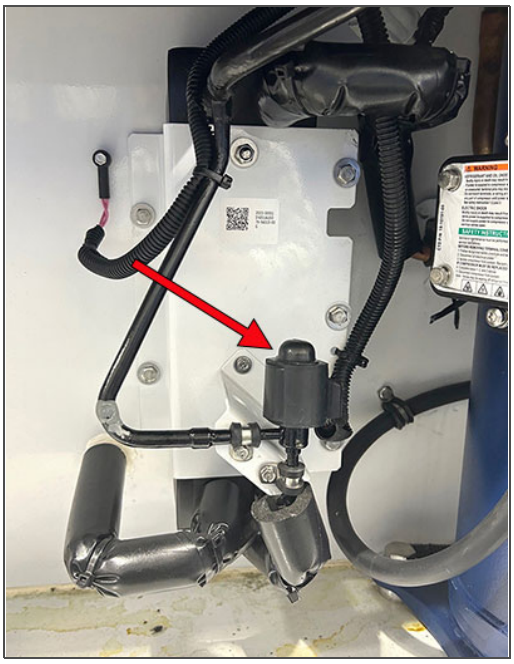


3.5.2 Economizer Expansion Valve

The economizer expansion valve (ECV), shown in **Figure 3.21**, is energized during Economized mode. The liquid refrigerant flows through the ECV to the economizer 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.

NOTE: The ECV position (%) can be viewed on the unit display at function code Cd86.

Figure 3.21 Economizer Expansion Valve (ECV)



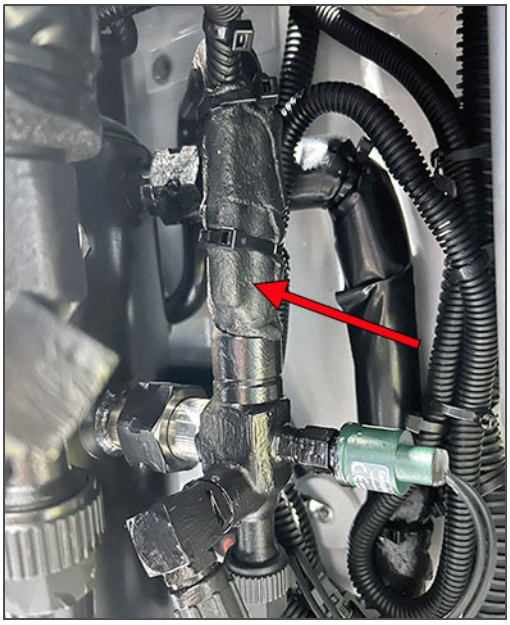
3.6 Refrigerant Probes Description

3.6.1 Compressor Discharge Temperature Sensor

The compressor discharge temperature sensor (CPDS), shown in **Figure 3.22**, 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.

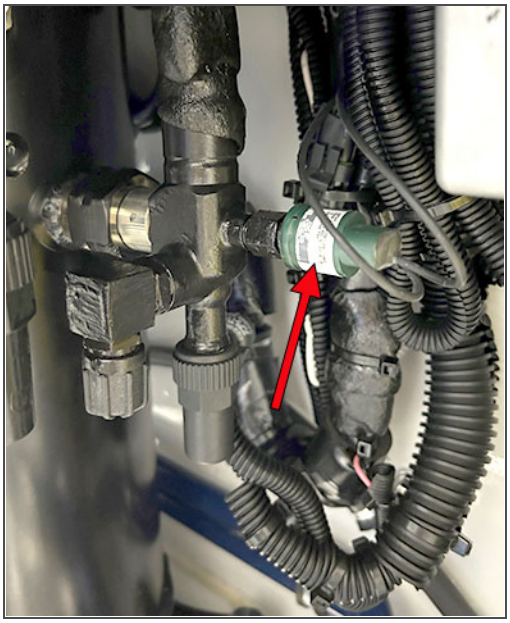
Figure 3.22 Compressor Discharge Temperature Sensor (CPDS)



3.6.2 High Pressure Switch

The high pressure switch (HPS), shown in **Figure 3.23**, monitors abnormally high discharge pressure. It opens at 25 (+/- 1.0) kg/cm^2 | 350 (+/- 10) psig.

Figure 3.23 High Pressure Switch (HPS)

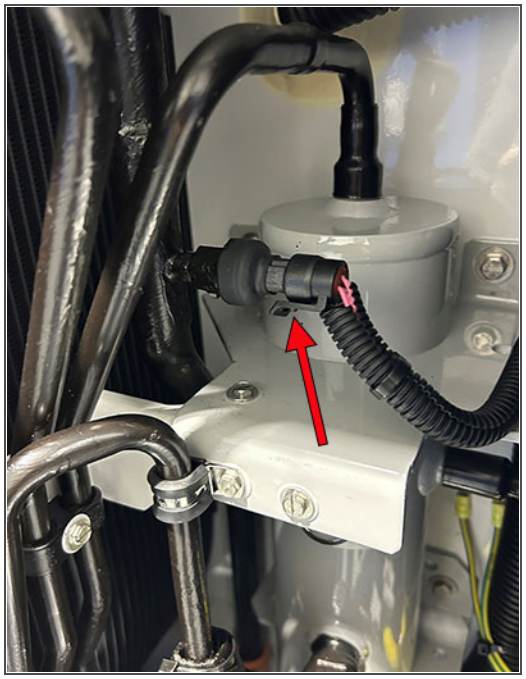


3.6.3 Discharge Pressure Transducer

The discharge pressure transducer (DPT), shown in **Figure 3.24**, 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 3.24 Discharge Pressure Transducer (DPT)



3.6.4 Economizer Pressure Transducer

The economizer pressure transducer (ECP), shown in **Figure 3.25**, monitors refrigerant pressure between the economizer and the compressor. It is located near the economizer connection to the compressor.

NOTE: The ECP reading can be viewed on the unit display at function code Cd85.

Figure 3.25 Economizer Pressure Transducer (ECP)

3.6.5 Economizer Temperature Sensor

The economizer temperature sensor (ECT), shown in **Figure 3.26**, monitors refrigerant temperature between the economizer and the compressor. It is located near the economizer connection to the compressor.

NOTE: The ECT reading can be viewed on the unit display at function code Cd84.

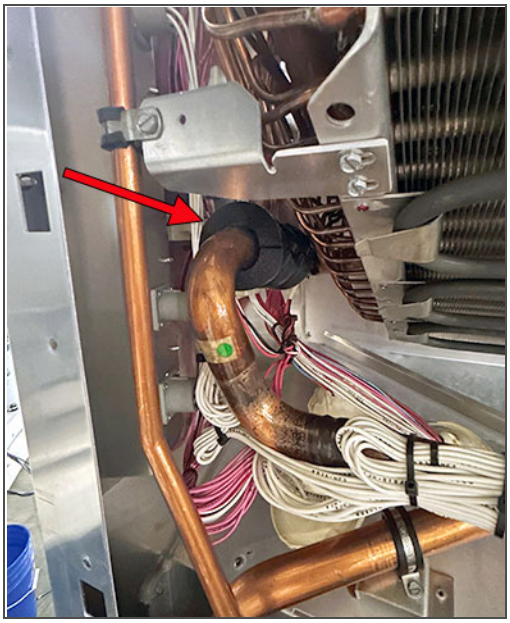
Figure 3.26 Economizer Temperature Sensor (ECT)

3.6.6 Evaporator Temperature Sensor

The evaporator temperature sensor (ETS1 / ETS2), shown in **Figure 3.27**, 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 3.27 Evaporator Temperature Sensor (ETS1 / ETS2)

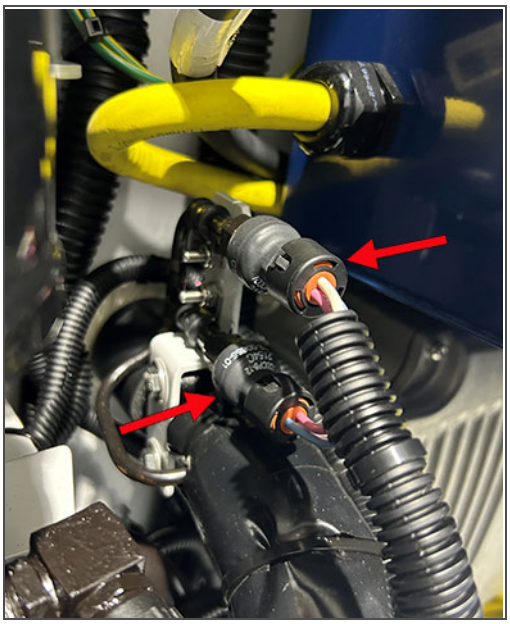


3.6.7 Evaporator / Suction Pressure Transducer

The evaporator pressure transducer (EPT) and suction pressure transducer (SPT), shown in **Figure 3.28**, 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 3.28 Evaporator Pressure Transducers - EPT (bottom) and SPT (top)



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.

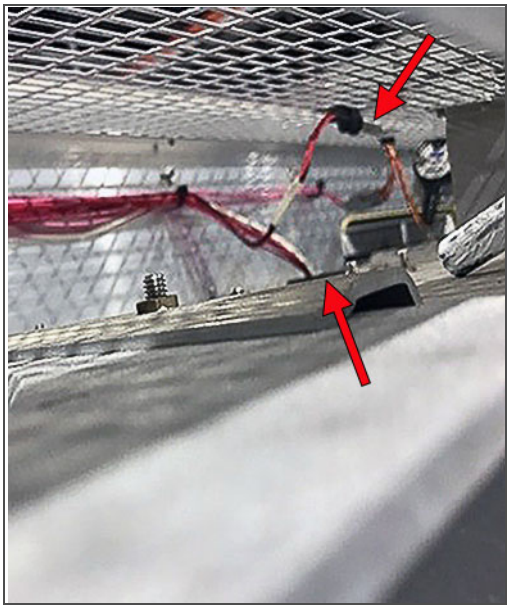
Figure 3.29 Supply Temperature Sensor (STS) / Supply Recorder Sensor (SRS)

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 4.3.3** 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)

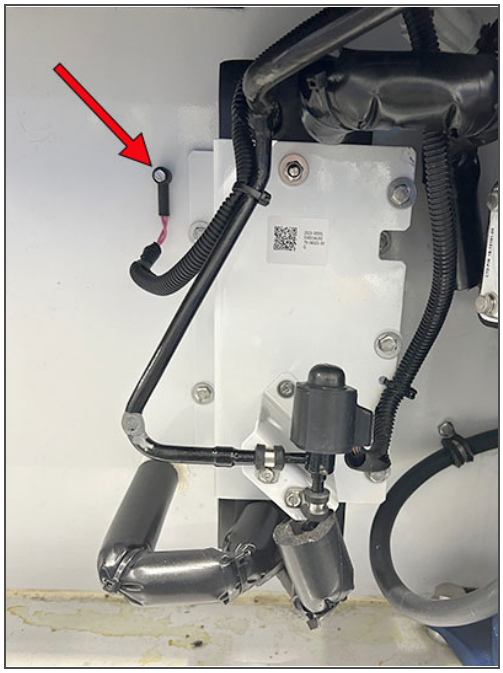


3.7.3 Ambient Temperature Sensor

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 AMBS reading can be viewed on the unit display at function code Cd09.

Figure 3.31 Ambient Temperature Sensor (AMBS)

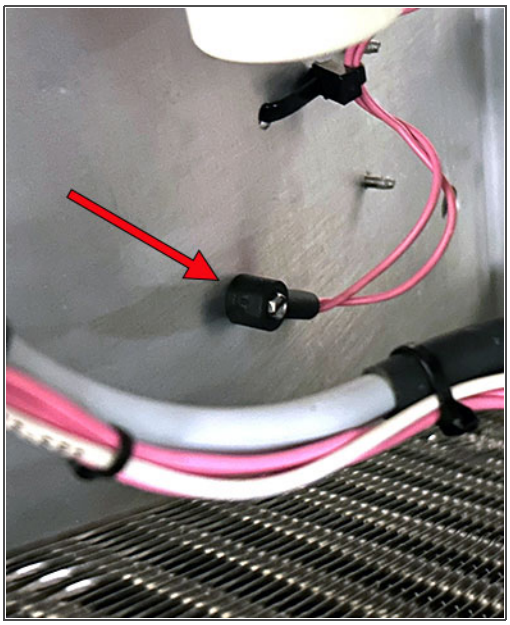


3.7.4 Defrost Temperature Sensor

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 4.3.4** 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 Cd48.

Figure 3.33 Humidity Sensor (HS)

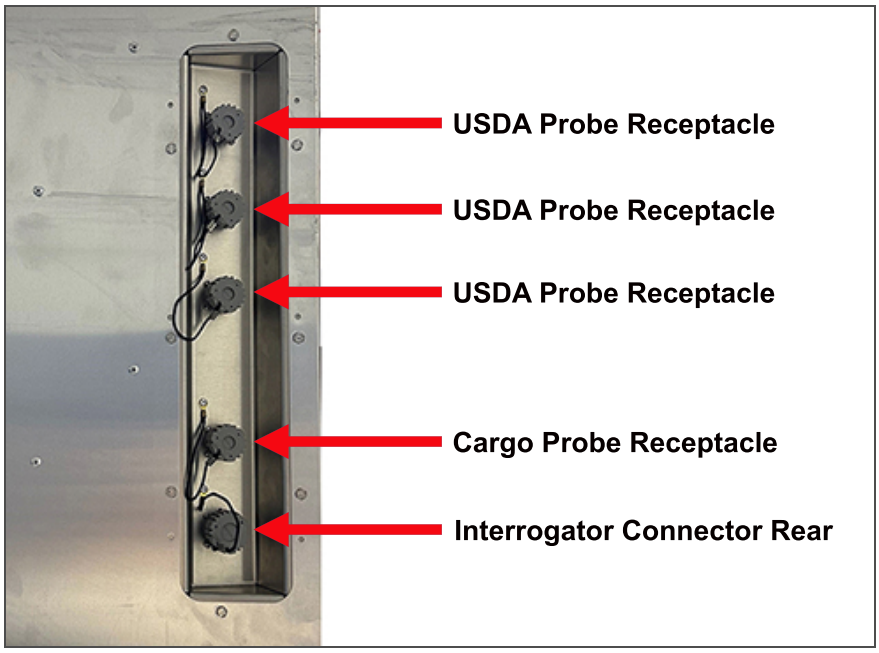
3.7.6 USDA Probes and Cargo Probe

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.

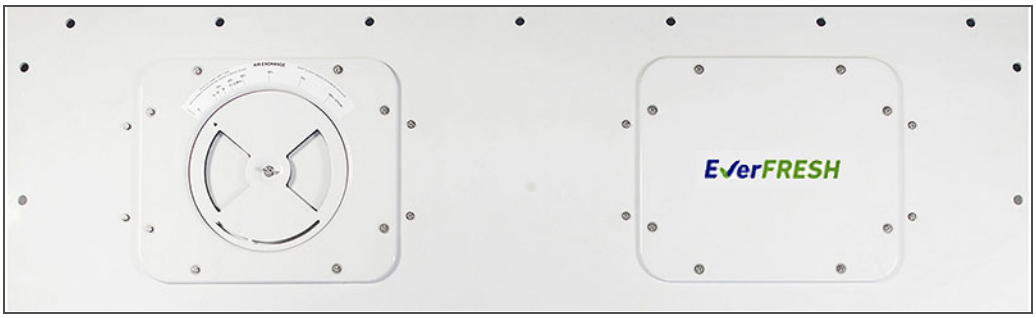
NOTE: The cargo probe reading can be viewed on the unit display at function code dC14.

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 5.9.6** 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 are included in the separate **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

⚠ 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.

⚠ CAUTION

Charge receiver according to nameplate specifications to ensure optimal unit performance.

Table 3–1 Refrigeration System Data

Compressor / Motor Assembly	Model Number	DS4ZB5080FMN
	Type	Hermetically Sealed Variable Speed Scroll type
	Weight (With Oil)	43.1 kg (95 lb)
	Approved Oil	Idemitsu FW56EA
	Oil Charge	1300 ml (44 ounces)
Electronic Expansion Valve Superheat (Evaporator)	Variable	
Economizer Expansion Valve Superheat	Variable	
Heater Termination Thermostat	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

Table 3–1 Refrigeration System Data (Continued)

Refrigerant	R-134a or R-513A	Conforming to AHRI standard 700 specifications.
Refrigerant Charge	Receiver	4.32 kg (9.5 lbs)
Unit Weight	Refer to unit nameplate. See **Figure 2.1**	

3.10 Electrical Data

Table 3–2 Electrical Data

Circuit Breaker	CB-1	25 amps	
Condenser Fan Motor	Nominal Supply	**380 VAC, 3 Phase, 50 Hz +/- 1.25 Hz**	**460 VAC,3 Phase, 60 Hz +/- 1.5 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	400 - 500 VAC
	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 +/- 1.25 Hz**	**460 VAC, 3 Phase, 60 +/- 1.25 Hz**
	Full Load Amps (H / L)	1.07 / 0.47	0.9 / 0.47
	Nominal Horsepower (H / L)	0.36 / 0.05	0.63 / 0.08
	RPM (H / L)	2850 / 1425 rpm	3450 / 1725 rpm
	Voltage Range	360 - 460 VAC	400 - 500 VAC
	Bearing Lubrication	Factory lubricated, additional grease not required	
	Rotation	CW when viewed from shaft end	
Fuses	Control Circuit	7.5 amps (F3, F4)	
	Controller / DataCORDER	7.5 amps (F1, F2)	
Vent Positioning Sensor	Electrical Output	0.5 to 4.5 VDC over 90 degree range	
	Supply Voltage	5 VDC +/- 10%	
	Supply Current	5 mA (typical)	
Electronic Expansion Valve (EEV) / Economizer Expansion Valve (ECV) Nominal Resistance	Coil Feed to Ground (Gray Wire)	47 ohms	
	Coil Feed to Coil Feed	95 ohms	
Variable Frequency Drive (VFD)	Supply Voltage	460 Volts, Variable Frequency	

Table 3–2 Electrical Data (Continued)

Humidity Sensor	Orange wire	Power
	Red wire	Output
	Brown wire	Ground
	Input voltage	5 VDC
	Output voltage	0 to 3.3 VDC
	Output voltage readings verses relative humidity (RH) percentage:	
	30%	0.99 V
	50%	1.65 V
	70%	2.31 V
	90%	2.97 V
Controller	Setpoint Range	-30°C to +30°C (-22°F 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 protectors - IP-EM1 & IP-EM2.

Table 3–3 Safety and Protective Devices

Unsafe Condition	Device	Device Setting
Excessive current draw	Circuit Breaker (CB-1, 25 amp) - Manual Reset	Trips at 29 amps (460 VAC)
Excessive current draw in the control circuit	Fuse (F3 / F4)	7.5 amp rating
Excessive current draw by the controller	Fuse (F1 / F2)	7.5 amp rating
Excessive condenser fan motor winding temperature	Internal Protector (IP-CM) - Automatic Reset	N/A
Excessive compressor motor winding temperature	Internal Protector - Automatic Reset	N/A
Excessive evaporator fan motor(s) winding temperature	Internal Protector(s) (IP-EM) - Automatic Reset	N/A
Abnormally high discharge pressure	High Pressure Switch (HPS)	Opens at 25 kg/cm^2 (350 psig)

3.12 Refrigeration Circuit

See **Figure 3.35** for circuit diagram of an OptimaLINE unit, model 701-001 to 099.

3.12.1 Standard Operation

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.

If an optional water-cooled condenser (WCC) is 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 to the filter drier, which keeps refrigerant clean and dry. It flows to the economizer, which is not active during standard operation, and so it bypasses the economizer and is sent to the electronic expansion valve (EEV).

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

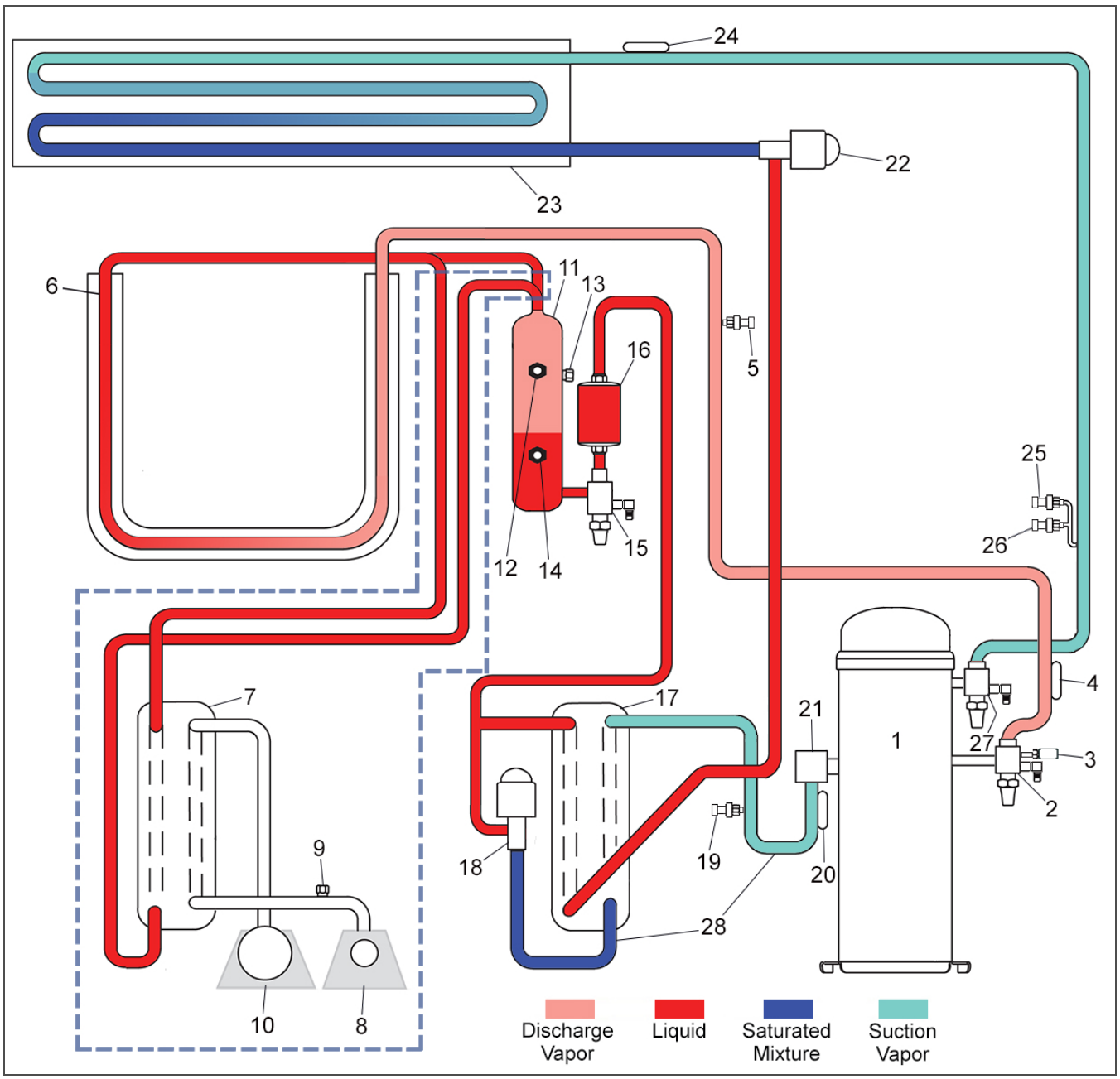
3.12.2 Economized Operation

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, requiring less energy to compress it to the proper 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 expansion valve (ECV).

The liquid refrigerant flows through the ECV, absorbing heat from the liquid refrigerant flowing to the EEV. The resultant “medium” temperature / pressure gas enters the compressor at the economizer port fitting.

Figure 3.35 Refrigeration Circuit Diagram



Note: Objects outlined by dashed lines (- - -) indicate an optional water cooled condenser installed.

1) Compressor
2) Discharge Service Valve
3) High Pressure Switch (HPS)
4) Discharge Temperature Sensor (CPDS)
5) Discharge Pressure Transducer (DPT)
6) Condenser Coil and Fan
7) Water-Cooled Condenser [*optional*]
8) Coupling, Water In [*optional*]
9) Water Pressure Switch [*optional*]
10) Coupling, Water Out [*optional*]
11) Receiver
12) Receiver Sight Glass
13) Fusible Plug
14) Receiver Liquid Level / Moisture Indicator
15) Liquid Line Service Valve
16) Filter Drier
17) Economizer
18) Economizer Expansion Valve (ECV)
19) Economizer Pressure Transducer (ECP)
20) Economizer Temperature Sensor (ECT)
21) Economizer Connection
22) Electronic Expansion Valve (EEV)
23) Evaporator Coil and Fan
24) Evaporator Temperature Sensor (ETS1 / ETS2)
25) Evaporator Pressure Transducer (EPT)
26) Suction Pressure Transducer (SPT)
27) Suction Service Valve
28) Flow of refrigerant back to compressor when Economized mode is active (ECV is energized

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, see **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, as described in **Section 4.2**, functions to operate the unit components as required to provide the desired cargo temperature and humidity. The DataCORDER software, as described in **Section 4.7**, functions to record unit operating parameters and cargo temperature parameters for future retrieval.

⚠ CAUTION

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

⚠ CAUTION

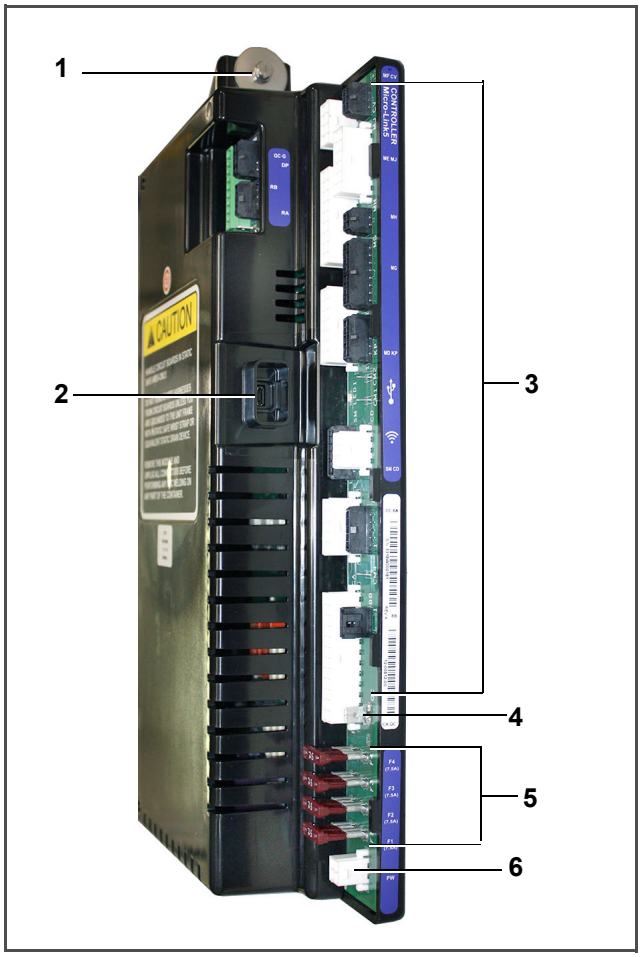
Remove the controller module and unplug all connectors before performing any arc welding on any part of the container.

⚠ CAUTION

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

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

Figure 4.1 Controller / DataCORDER Module

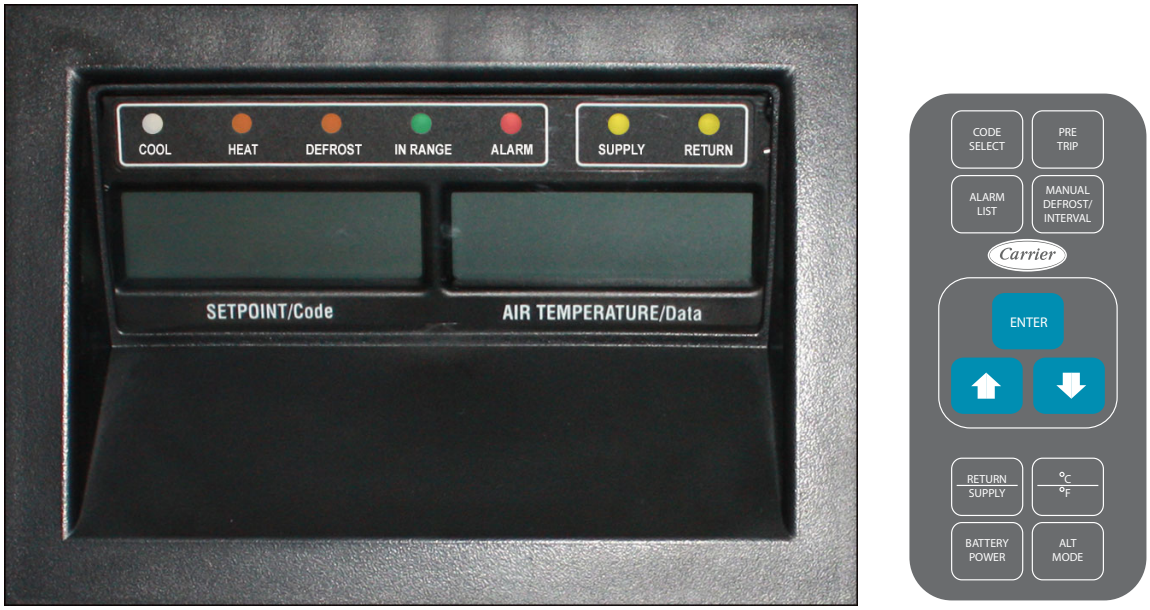


1) Mounting Screw
2) Micro USB Port
3) Wire Harness Connectors
4) Device Power Connector
5) Fuses (7.5A)
6) Controller Power Connector

4.1.2 Display Module and Keypad

The display module and keypad, as shown in **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	Function
COOL (White / Blue)	Energized to indicate the refrigerant compressor is energized.
HEAT (Orange)	Energized to indicate heater operation in heat mode, defrost mode, or dehumidification.
DEFROST (Orange)	Energized to indicate the unit is in defrost mode.
IN RANGE (Green)	Energized to indicate the controlled temperature probe is within specified tolerance of setpoint. The controlling probe in perishable mode is the Supply Temperature Sensor (STS / SRS). The controlling probe in frozen mode is the Return Temperature Sensor (RTS / RRS).
ALARM (Red)	Energized to indicate an active or inactive shutdown alarm in the alarm queue.
SUPPLY (Yellow)	Energized to indicate the Supply Temperature Sensor (STS / SRS) is being used for control. When this LED is illuminated, the temperature displayed in the AIR TEMPERATURE display is the reading at the Supply Temperature Sensor (STS / SRS). This LED will flash if dehumidification is enabled.
RETURN (Yellow)	Energized to indicate the Return Temperature Sensor (RTS / RRS) is being used for control. When this LED is illuminated, the temperature displayed in the AIR TEMPERATURE display is the reading at the Return Temperature Sensor (RTS / RRS).

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.
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.
Arrow Down	Change or scroll selection down.
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, electric heat control, and defrost. Defrost is performed to clear buildup of frost and ice to ensure proper air flow across the evaporator coil.
- 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 checkout 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)

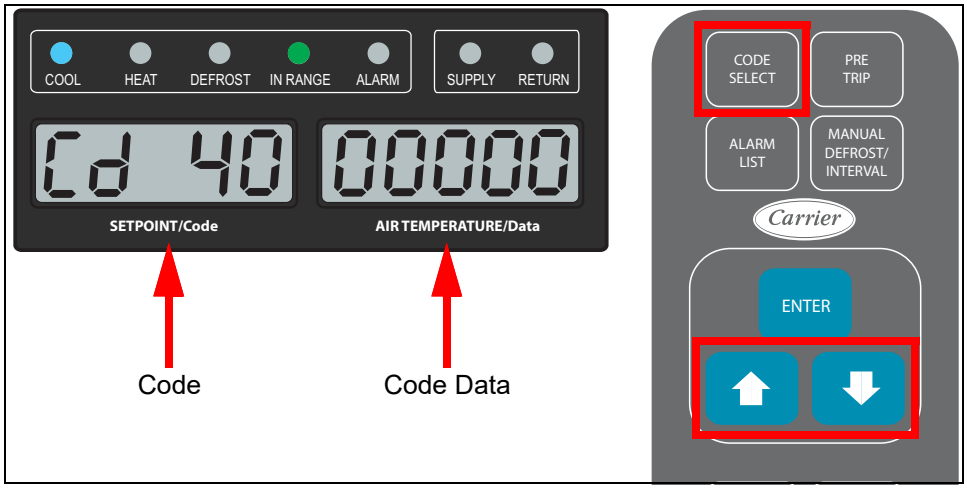
Configuration software is a variable listing of the components available for use by the operational software. This software is factory installed in accordance with the equipment fitted and options listed on the original purchase order. Changes to the configuration software are required only when a new 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)

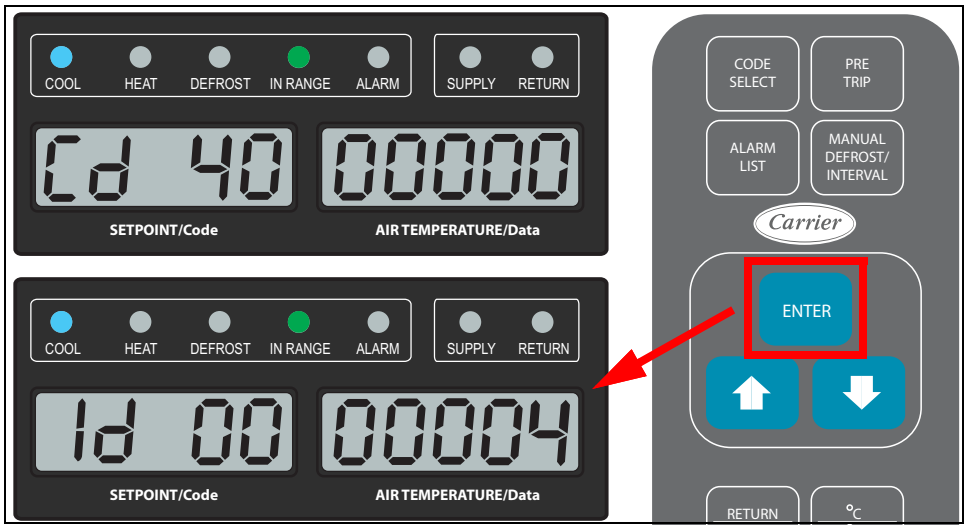
The operational software is the actual operation programming of the controller which activates or deactivates components in accordance with current unit operating conditions and selected modes of operation. The programming is divided into function codes. Some of the codes are read only, while the remaining 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 below the table.

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	Compressor Capacity Percentage	
Cd03	Compressor Current / Percentage / Power	
Cd04	Line Current, Phase A	
Cd05	Line Current, Phase B	
Cd06	Line Current, Phase C	
Cd07	Mains Supply Voltage	
Cd08	Mains Supply Frequency	
Cd09	Ambient Temperature (AMBS)	
Cd10	Evaporator Refrigerant Temperature (ETS)	
Cd11	Compressor Discharge Temperature (CPDS)	
Cd12	Evaporator / Compressor Suction Port Pressure (EPT/SPT)	
Cd14	Compressor Discharge Port Pressure (DPT)	
Cd16	Compressor Motor / Unit Run Time Hour Meter	
Cd17	Relative Humidity Percentage	
Cd18	Software Revision Number	
Cd19	Backup Battery Check	
Cd20	Configuration / Model Number	
Cd21	Capacity Mode (Standard / Economized)	
Cd22	Compressor Run State (ON / OFF)	
Cd23	Evaporator Fan State (HIGH / LOW / OFF)	
Cd25	Time Remaining Until Defrost	
Cd26	Defrost Temperature Sensor (DTS)	
Cd27	Defrost Interval (Hours or Automatic)	x
Cd28	Standard Temperature Unit (°C or F)	x
Cd29	Unit Failure Response Code	x
Cd30	In-Range Tolerance	x
Cd31	Stagger Start Offset Time	x
Cd32	Unit Current Limit	x
Cd40	Container Identification Number	
Cd41	- Reserved for Future Use -	
Cd44	EverFRESH Values	
Cd45	Fresh Air Vent Position	x
Cd46	Fresh Air Flow Display Units	x
Cd48	Dehumidification / Bulb Mode	x
Cd49	Days Since Last Successful Pre-Trip	
Cd50	- Reserved for Future Use -	
Cd51	Automatic Cold Treatment (ACT)	x
Cd53	Automatic Setpoint Change (ASC)	x
Cd54	Electronic Expansion Valve (EEV) Percentage / Evaporator Superheat	
Cd55	Discharge Superheat	
Cd56	Enable Comms Mode	
Cd58	Water Pressure Switch State / Override Logic State	
Cd59	- Reserved for Future Use -	
Cd63	FuelWise	x

Code	Description	Configurable
Cd65	TripWise	x
Cd66	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	
Cd84	Economizer Temperature (ECT)	
Cd85	Economizer Pressure (ECP)	
Cd86	Economizer Expansion Valve (ECV) Percentage / Economizer Superheat	

Cd01 Compressor Capacity Percentage

Cd01 displays the compressor's variable frequency drive (VFD) speed in percentage.

Cd03 Compressor Current / Percentage / Power

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 Mains Supply Voltage

Cd07 displays the main supply voltage.

Cd08 Mains Supply 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, which will result in alarm code AL021.

Cd09 Ambient Temperature (AMBS)

Cd09 displays the Ambient Temperature Sensor (AMBS) reading.

Cd10 Evaporator Refrigerant Temperature (ETS)

Cd10 displays the Evaporator Temperature Sensor (ETS) reading.

Cd11 Compressor Discharge Temperature (CPDS)

Cd11 displays the Compressor Discharge Temperature Sensor (CPDS) reading, using compressor dome temperature.

Cd12 Evaporator / Compressor Suction Port Pressure (SPT)

Cd12 displays the Evaporator Pressure Transducer (EPT) pressure reading in the left display; Press the ENTER key to show the reading for Compressor Suction Transducer (SPT) suction port pressure in the right display.

Cd14 Compressor Discharge Port Pressure (DPT)

Cd14 displays the Compressor Discharge Pressure Transducer (DPT) reading.

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 Percentage

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”.
- If the test result is End of Life, the display will show “EOL”.
- If the test result is Fail, the display will show “FAIL”.
- If the test result detects a temperature out of range condition (greater than 45 deg C), the display will show “toor”. The smart battery will not charge.
- If the test result is Non-Carrier, the display will show “not C”.
- If the test result is No Battery, the display will show “nobAt”.

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 Configuration / Model Number

Cd20 displays the dash number of the model for which the Controller is configured (i.e., if the unit is a 69NT40-701-100, the display will show “01100”).

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 (Standard / Economized)

Cd21 displays the current mode of operation as 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 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 (DTS)

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 or AUTO. Factory default is AUTO. This is the desired period of time between defrost cycles. See **Section 4.3.4** 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 Unit Failure Response Code

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

When QUEST is actively controlling, in-range tolerance is not considered.

“-----” will be displayed whenever Dehumidification or Bulb Mode is enabled.

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 (Factory Default), or 23 amperes.

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.

Cd40 is configured at commissioning to read a valid container ID number. The reading will not display alpha characters; only the numeric portion of the number will display.

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 Fresh Air Vent 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 Fresh Air Flow Display Units

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

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

Cd48 Dehumidification / Bulb Mode

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 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 (78°F or 64.4°F), 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 (78°F or 64.4°F), 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.

Cd51 Automatic Cold Treatment (ACT)

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 5.9.3** 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.

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 display. Turning ACT off clears this entry. This action also resets Cd51 to initial time remaining. ACT must then be turned on to view or modify the additional parameters.

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)

Cd53 controls the Automated Setpoint Change (ASC) Mode option, which allows up to 6 setpoint changes to be pre-programmed over defined periods. 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”.

If the unit is not configured for ASC, then this will not be allowed and Cd53 will display dashes “-----”.

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 5.9.4** 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.

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 to show the reading for Electronic Expansion Valve (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.

Cd63 FuelWise

Cd63 controls FuelWise Mode, which is a power-saving option while operating in the perishable or frozen setpoint range. This option is determined by the setting of configuration variable Power Savings Mode. If the unit is not configured for FuelWise, then Cd63 is not active and the code will display dashes "-----".

Perishable FuelWise Mode is an extension of Perishable Mode. When active, the system will perform Perishable Pulldown operation. The compressor will be turned off when the controlled temperature is less than or equal to the setpoint. During the compressor off-cycle period, the evaporator fans are switched to low speed. When the heater is turned on, or when the compressor is turned on to provide cooling, the evaporator fans are switched to high speed.

Frozen FuelWise Mode is an extension of Frozen Mode. When active, the system will perform Frozen Pulldown operation. The entire refrigeration system, excluding the controller, will be turned off when the control temperature is less than or equal to the setpoint. After the off-cycle period, the unit will turn on the low speed evaporator fans. The system then decides if cooling is necessary based on the current temperature reading, or another off-cycle can be restarted.

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.

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)

Turn On TripWise:

1. Select “On” and press the ENTER key to enable TripWise Mode. See **Section 5.9.2** 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 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 5.9.6** 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 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 "-----" (Cd48, 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 speed as low or high.

Cd84 Economizer Temperature

Cd84 displays the Economizer Temperature Sensor (ECT) reading.

Cd85 Economizer Pressure

Cd85 displays the Economizer Pressure Transducer (ECP) reading.

Cd86 Economizer Expansion Valve (ECV) Percentage / Economizer Superheat

Cd86 displays the reading for the economizer superheat in the right display.

Press the ENTER key to show the Economizer Expansion Valve (ECV) position (%) in the left display.

4.3 Modes of Operation

General operation sequences for cooling, heating and defrost are provided in the following sections. Operational software responds to various inputs. These inputs come from the temperature sensors and pressure transducers, the temperature setpoint, the settings of the configuration variables and the function code assignments. The action taken by the operational software changes as the input values change. Overall interaction of the inputs is described as a “mode” of operation.

4.3.1 Start Up - Compressor Phase Sequence

At start up, the controller logic checks for proper phase sequencing and compressor rotation. If incorrect sequencing is causing the 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.

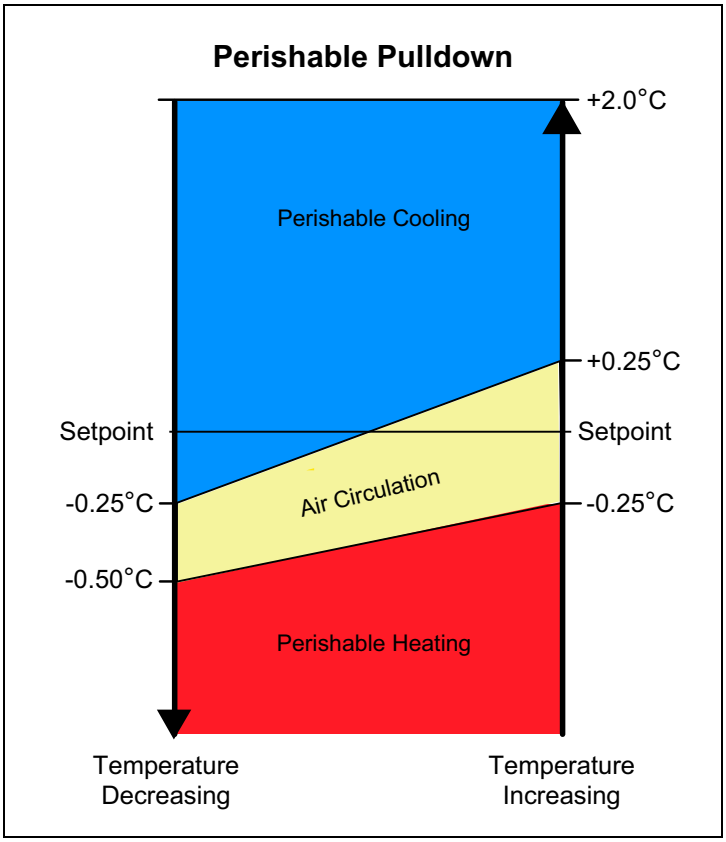
If a backward rotating compressor is detected, an alarm AL017 is flagged (for incorrect wiring). Changing the contactors will not fix the compressor direction as it is automatically set by the VFD (if wired correctly).

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 chosen in configuration variable Heat Lockout Temperature. The controller maintains the supply air temperature at setpoint, the yellow SUPPLY indicator light is illuminated and the default reading on the display window is the Supply Temperature Sensor (STS / SRS). When supply air temperature enters the in-range temperature tolerance, the green IN-RANGE light is illuminated. In-range tolerance is set with code Cd30.

See **Figure 4.3** for Perishable Mode cooling and heating chart.

Figure 4.3 Perishable Mode - Cooling and Heating Chart



4.3.2.1 Perishable Dehumidification

Perishable Dehumidification is provided to control the return air humidity levels inside the container to below a set value. Bulb Mode is an extension of Perishable Dehumidification which allows changes to the evaporator fan speed and/or defrost termination setpoints. This is controlled with code Cd48. See code Cd48 for more details.

4.3.2.2 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 more details.

4.3.2.3 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 more details.

4.3.2.4 Perishable FuelWise Mode

Perishable FuelWise Mode is a power-saving option while operating in the perishable setpoint range and is active when code Cd63 is set to On. This mode helps when transporting temperature-tolerant cargo which do not require continuous high evaporator fan airflow, for removing cargo respiration heat. See code Cd63 description for details.

4.3.2.5 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.

4.3.2.6 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. See code Cd71 description for details.

Refer to the **T-374 EverFRESH Manual** for detailed procedures and technical information related to the EverFRESH controlled atmosphere system.

4.3.2.7 Pharma Mode

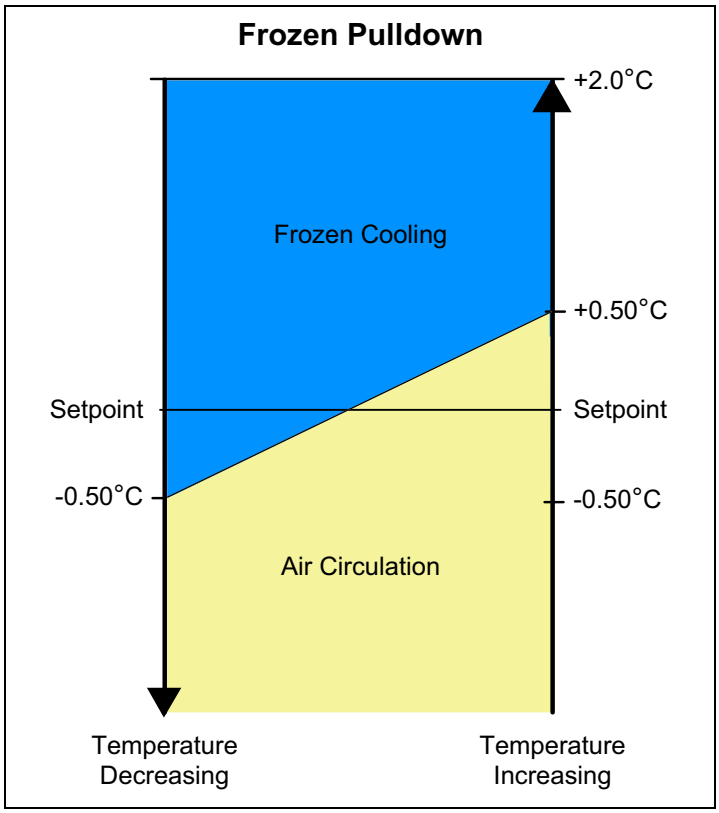
Pharma Mode option allows cargoes to be maintained at temperature setpoints of either 5°C (41°F) or 20°C (68°F), while maintaining lower humidity levels. Pharma Mode is active when a unit is equipped with a humidity sensor, code Cd75 is set to ON and a temperature setpoint has been chosen at Cd75. See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

4.3.3 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 configuration variable Heat Lockout Temperature. In Frozen Mode, the controller maintains the return air temperature at setpoint, the yellow RETURN indicator light is illuminated, and the default reading on the display window is the return temperature sensor (RTS / RRS). When the return air temperature enters the in-range temperature tolerance (Cd30), the green IN-RANGE light will energize. The highest priority is given to bringing the container down to setpoint. The system will generally remain in economized operation except in low load situations.

See **Figure 4.4** for Frozen Mode cooling and heating chart.

Figure 4.4 Frozen Mode - Cooling and Heating Chart



4.3.3.1 Frozen FuelWise Mode

Frozen FuelWise Mode complements Perishable FuelWise and provides additional energy savings while operating in the frozen setpoint range. This is enabled / disabled with code Cd63. See code Cd63 description for details.

4.3.4 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.

4.3.5 Defrost Operation

Defrost initiation 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 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 defrost mode is active, defrost can be initiated when any one of the below 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 or AUTO. Factory default is AUTO. This is set at function code Cd27.
   a. Automatic defrost starts with an initial defrost, at 3 hours in perishable and 12 hours in frozen, and then adjusts the interval to the next defrost based on the accumulation of ice on the evaporator coil. Following a start-up or after termination of defrost, the time will not begin counting down until the DTS reading falls below 10°C (50°F). If the reading of DTS rises above termination setting any time during the timer count down, the interval is reset and the countdown starts over. The Auto defrost time is reset to three hours start time after every PTI initiation or trip start interval.
   b. After a new Defrost Interval is selected, the previously selected Interval is used until the next defrost termination, the next time the DTS contacts are OPEN, or the next time power to the control is interrupted. If the previous value or the new value is “OFF”, the newly selected value will be used immediately.
3. **Probe Check:** If defrost is initiated due to Probe Check immediately following the defrost cycle the evaporation fans are started and run for eight minutes to stabilize the temperature throughout the container. A probe check comparison is carried out at the end of the eight minute period if any sensor is found out of calibration. At this time its alarm set is no longer used for control/reorder purposes.
4. **Probe Check Logic:** The logic determines that a Probe Check is necessary based on temperature values currently reported by the supply and return probes
5. **Delta T Logic:** If the difference between return and supply air temperature (Delta T) becomes too great indicating possible reduced airflow over the evaporator coil caused by ice buildup requiring a defrost.

Defrost will terminate when the DTS reading rises above one of two model number configurable options selected, 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.

4.3.6 Defrost Temperature Sensor (DTS) Failure Conditions

The following conditions may indicate a DTS failure. A DTS failure alarm, AL260, is triggered when a failed DTS is indicated by any of the above conditions, and defrost mode is operated by the return temperature sensor (RTS).

1. When the return air temperature falls to 7°C (45°F), the controller does not detect that the DTS reading has dropped to 10°C (50°F) or below.
2. The DTS value is outside of its operating range.
3. The DTS value is found to be inaccurate.
4. If defrost does not terminate correctly and temperature reaches the setpoint of the heat termination thermostat (HTT) 54°C (130°F), the HTT will open to de-energize the heaters, activating AL259. This also indicates a failed DTS.
5. While the HTT remains closed, if the DTS fails to reach its termination setting, defrost will terminate operation within a maximum of 2 hours, determined by supply line voltage. This indicates a failed DTS.

4.3.7 Defrost Timer

The value of the defrost interval timer will be saved at power down and restored at power up. This prevents short power interruptions from resetting an almost expired defrost interval, and possibly delaying a needed defrost cycle.

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 philosophy balances the protection of the refrigeration unit and that of the refrigerated cargo. The action taken when an error is detected always considers the survival of the cargo. Re-checks 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.

Alarms will appear as “AL###” on the unit display. AL0xx are critical alarms, AL2xx are non-critical alarms and AL9xx are controlled atmosphere alarms (for optional EverFRESH unit).

4.4.1 Alarm Action

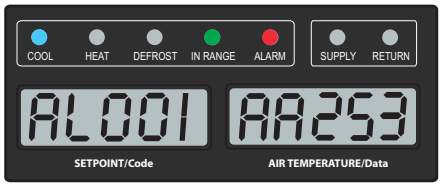
When an Alarm Occurs

- If a detectable problem exists, its alarm code will be alternately displayed with the setpoint on the left display.
- The red ALARM light illuminates for alarm code numbers AL0xx.
- 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.

Procedure to Display Alarm Codes

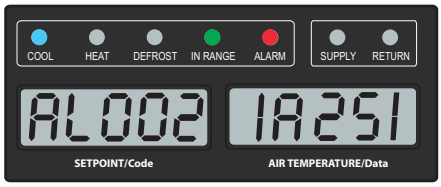
1. While in the default display mode, press the ALARM LIST key, then use the Arrow keys to scroll any alarms archived in the alarm queue. The alarm queue stores up to 64 alarms in the sequence in which they occurred.
2. The left display will show “AL###,” where ### is the alarm number sequentially in the queue. The right display will show the actual alarm code. “AA###” will display for an active alarm, “IA###” will display for an inactive alarm, where “###” is the alarm code.

1st alarm



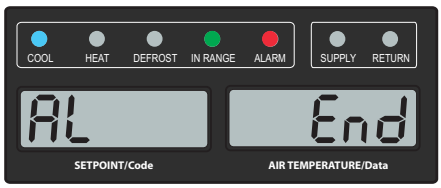
Active Alarm

2nd alarm

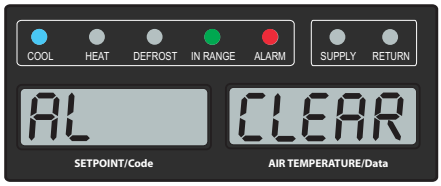


Inactive Alarm

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



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



4.4.2 Alarm Code Descriptions

A summary of alarms is provided in **Table 4–4**, and completed descriptions below the table.

Table 4–4 Alarm Indications - Summary

Code	Description
AL003	Evaporator Superheat Control Failure
AL012	Variable Frequency Drive (VFD) Control Instruction Timeout
AL013	Variable Frequency Drive (VFD) Communication Failure
AL015	Loss of Charge
AL017	Compressor Pressure Delta Failure
AL020	Control Circuit Fuse (F3 / F4) Open
AL021	Micro Circuit Fuse (F1 / F2) Open
AL022	Evaporator Fan Internal Protector Open
AL023	Loss of Phase B
AL025	Condenser Fan Internal Protector Open
AL026	All Supply and Return Air Control Sensors Failure
AL027	Analog to Digital Accuracy Failure
AL065	Discharge Pressure Transducer (DPT) Failure
AL066	All Low Pressure Sensor Failure (EPT and SPT)
AL072	Control Temperature Out of Range
AL091	Variable Frequency Drive (VFD) Voltage
AL092	Variable Frequency Drive (VFD) Internal Failure
AL093	Variable Frequency Drive (VFD) Fan Failure
AL094	Variable Frequency Drive (VFD) Trip Alarm
AL098	Chill Injury
AL202	Economizer Superheat Control Fault
AL204	Economizer Temperature Sensor (ECT) Fault
AL205	Economizer Pressure Transducer (ECP) Fault
AL206	Keypad or Keypad Harness Fault
AL207	Manual Fresh Air Vent Open (with frozen setpoint)
AL208	Compressor Pressure Ratio High
AL214	Phase Sequence Detection Fault
AL218	Discharge Pressure (DPT) High
AL219	Compressor Discharge Temperature (CPDS) High
AL228	Suction Pressure (SPT) Low
AL250	Manual Fresh Air Vent Position Sensor (VPS) Fault
AL251	Data Storage Fault (Non-Volatile Memory Fault)
AL252	Alarm List Full
AL253	Backup Battery Pack Fault
AL254	Supply Temperature Sensor (STS) Fault
AL255	Suction Pressure Transducer (SPT) Fault
AL256	Return Temperature Sensor (RTS) Fault
AL257	Ambient Sensor (AMBS) Fault
AL258	Compressor High Pressure Safety (HPS) 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

Table 4–4 Alarm Indications - Summary

Code	Description
AL265	Discharge Pressure Transducer (DPT) Fault
AL266	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	USDA1 Temperature Out of Range
AL273	USDA2 Temperature Out of Range
AL274	USDA3 Temperature Out of Range
AL275	USDA4 / Cargo Probe Temperature Out of Range
AL286	RTC Battery Low
AL287	RTC Fault
AL289	DataCorder Storage Fault
AL293	Variable Frequency Drive (VFD) Fan 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	EverFRESH Air Valve (EA) Fault
AL981	Water Drain Valve (WDV) Fault
AL982	CO2 Injection Fault
AL983	CO2 Injection Pressure Transducer (IPT) Fault
Err#	Internal Microprocessor Failure
Entr StPt	Enter Setpoint
Lo	Low Mains Voltage
nEEd COnFG	Valid Model Number Configuration needed
nEEd Id	Container ID needed

AL003 Evaporator Superheat Control Failure

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. Replace the EEV if defective.

Component:

Evaporator Temperature Sensors (ETS1 & ETS2)

Troubleshooting:

Verify the accuracy of the temperature sensors. See Sensor Checkout Procedure, **Section 7.10.2**.

Replace ETS1 or ETS2 if defective.

Component:
Evaporator Fans

Troubleshooting:
Confirm that the fans are operating properly. Replace fan(s) if defective. See Evaporator Fan Motor Assembly, **Section 7.6**.

AL012 Variable Frequency Drive (VFD) Control Instruction Timeout

Cause:
Communication timeout between the VFD and the controller after attempted VFD restart.

Component:
Variable Frequency Drive (VFD)

Troubleshooting:
Perform a unit power-cycle. If the alarm persists, replace the VFD.

AL013 Variable Frequency Drive (VFD) Communication Failure

Cause:
The controller loses reliable communication (no response for 3 seconds) with the VFD. Make sure that the latest unit software is installed. Restart the unit to see if the alarm returns. If the alarm does not clear, then follow troubleshooting below.

Component:
VFD or Controller

Troubleshooting:
Check continuity of the RB connector to the VFD. Power cycle the unit. If alarm cannot be reset, replace the VFD.

AL015 Loss of Charge

Cause:
Discharge pressure is low, unit unable to start-up normally. Discharge Pressure Transducer (DPT) reading is valid but low (below expected)..

Component:
Refrigerant Charge

Troubleshooting:
Check unit for leaks. Rectify refrigerant leaks. Remove refrigerant charge (**Section 7.1.6**), evacuate the unit (**Section 7.1.8**), and recharge the unit to rated charge (**Section 7.1.6**)

AL017 Compressor Pressure Delta Failure

Cause:
The compressor has attempted to start 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:
VFD Wiring

Troubleshooting:
Confirm compressor to VFD wiring is correct. See Section for details.

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 Manifold Gauge Set, **Section 7.1.1**.

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 Compressor Service, **Section 7.2**.

AL020 Control Circuit Fuse (F3 / F4) 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 it's open, check the CL, 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 QC

Troubleshooting:
If voltage is not present, check ST7. If voltage is present, it indicates a defective microprocessor. See Controller Service, **Section 7.8**.

AL021 Micro Circuit 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 Controller Service, **Section 7.8**.

AL022 Evaporator Fan Internal Protector Open

Cause:

The evaporator motor internal protector (IP) is open.

Component:

Evaporator motor

Troubleshooting:

Shut down the unit and disconnect power. Check the harness between CA22 and CA12. If open circuit, check the evaporator motor IP at plug connection pins 4 & 6. Replace defective evaporator fan motor. See Evaporator Fan Motor Service, **Section 7.6**.

AL023 Loss of Phase B

Cause:

The compressor is running and the controller determines that the compressor internal protector and HPs are closed. Or, the high speed evaporator fan motor is energized and the 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 the compressor contactor and high speed evaporator contactor. Replace the defective component.

AL025 Condenser Fan Internal Protector Open

Cause:

The condenser fan motor internal protector (IP) is open.

Component:

Insufficient air flow

Troubleshooting:

Shut down the unit and check the condenser fan for obstructions. Remove obstructions.

Component:

Condenser fan motor

Troubleshooting:

Shut down the unit and disconnect power. Check resistance at the harness between CA23 and CA11. If open, check condenser fan motor IP at plug connection pins 4 & 6. Replace the condenser fan motor if defective. See Condenser Fan Motor Assembly Service, **Section 7.3**.

AL026 All Supply and Return Air Control Sensors Failure

Cause:

The sensors are out of range.

Component:

All sensors detected as out of range.

Troubleshooting:

Perform a 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 7.10**.

AL027 Analog to Digital Accuracy Failure

Cause:

The controller AD converter is faulty.

Component:

Controller

Troubleshooting:

Power cycle the unit. If the alarm persists, it indicates a defective microprocessor. Replace defective microprocessor. See Controller Service, **Section 7.8**.

AL065 Discharge Pressure Transducer (DPT) Failure

Cause:

The Compressor Discharge Pressure Transducer (DPT) is out of range.

Component:

Discharge Pressure Transducer (DPT)

Troubleshooting:

Confirm accurate DPT pressure readings. See Refrigerant Service, **Section 7.1**.

Replace the DPT if defective.

AL066 All Low Pressure Sensor Failure (EPT and SPT)

Cause:

Both Suction Pressure Transducer (SPT) and Evaporator Pressure Transducer (EPT) values are outside of their operating range and the compressor has been on for at least 60 continuous seconds of controller clock time (RTC).

Component:

SPT and EPT

Troubleshooting:

Check each pressure transducer individually and replace if faulty. Refer to alarms AL255 (for SPT) and AL266 (for EPT) to view recommended actions for checking the transducers.

The alarm will become inactivate if at least one of the two transducers is repaired or replaced.

AL072 Control Temperature Out of Range

Cause:

This alarm occurs after the unit goes in-range for 30 minutes then out of range for a continuous 120 minutes.

Component:

Refrigeration system

Troubleshooting:

Verify that the unit is operating correctly. Power cycle the unit. Check that control temperature is in range. Any pre-trip mode resets the timers.

AL091 Variable Frequency Drive (VFD) Voltage

Cause:

There is a missing mains phase or a mains imbalance. Or, the internal VFD current or voltage limits are exceeded. Or, An earth fault was detected on motor outputs.

Component:

Compressor

Troubleshooting:

Check the resistance between windings of the compressor. If open or shorted, replace compressor: Else, check the VFD.

Component:

VFD

Troubleshooting:

Check the following trouble areas:

- Check the compressor contactor voltages.
- Check compressor and VFD wiring, including compressor continuity.
- Check connection from the compressor motor output terminals to ground.

If the above checks are good, then replace the VFD.

AL092 Variable Frequency Drive (VFD) Internal Failure

Cause:

An internal fault occurred in the Variable Frequency Drive (VFD).

Component:

Variable Frequency Drive (VFD)

Troubleshooting:

Power cycle the unit. If the alarm cannot be reset, replace the VFD.

AL093 Variable Frequency Drive (VFD) Fan Failure

Cause:

The Variable Frequency Drive (VFD) temperature exceeded the trip level with a fan error detected.

Component:

Variable Frequency Drive (VFD) Fan

Troubleshooting:

Verify that the fan inlet and outlets are clear and the fan is free to rotate. If the alarm cannot be reset, replace the VFD fan. See VFD Fan Replacement, **Section 7.2.3**.

AL094 Variable Frequency Drive (VFD) Trip Alarm

Cause:

An internal Variable Frequency Drive (VFD) alarm has been detected.

Component:

Condenser fan or coil

Troubleshooting:

Check condenser fan or coil for blockage.

Component:

Variable Frequency Drive (VFD)

Troubleshooting:

If the above checks are good and a unit power cycle does not reset the alarm, replace the VFD.

AL098 Chill Injury

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 the 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.

AL202 Economizer Superheat Control Fault

Cause:

Low Economizer or Discharge Superheat while the Economizer Expansion Valve (ECV) is 0% open

Component:

Economizer Expansion Valve (ECV)

Troubleshooting:

Check the ECV wiring and ensure that stepper driver is installed securely. Check operation of the ECV. Replace the ECV if defective.

AL204 Economizer Temperature Sensor (ECT) Fault

Cause:

The Economizer Temperature Sensor (ECT) is out of range.

Component:

Economizer Temperature Sensor (ECT)

Troubleshooting:

Test the ECT. See **Section 7.10.2**, Sensor Checkout Procedure. Replace the ECT if defective. See **Section 7.10.6**, Sensor Replacement.

AL205 Economizer Pressure Transducer (ECP) Fault

Cause:

The Economizer Pressure Transducer (ECP) is out of range.

Component:

Economizer Pressure Transducer (ECP)

Troubleshooting:

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

AL206 Keypad or Keypad Harness Fault

Cause:

The 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 returns after five minutes, replace the keypad.

AL207 Manual Fresh Air Vent Open (with frozen setpoint)

Cause:

The unit has a frozen setpoint and Vent Position Sensor (VPS) is indicating that the fresh air vent is open.

Component:

Vent Position Sensor (VPS)

Troubleshooting:

Manually reposition the vent to 0% and confirm with code Cd45. If Cd45 is not reading 0%, perform a calibration of the panel. See Vent Position Sensor Service, **Section 7.11.3**.

If a zero reading can not be obtained, replace the defective VPS. If the unit is loaded, make sure that the vent is closed. Note and replace the VPS on the next PTI.

AL208 Compressor Pressure Ratio High

Cause:

The controller detects that 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 Refrigerant Service, **Section 7.1**.

Replace the DPT if defective.

AL214 Phase Sequence Detection Fault

Cause:

The 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 and correct if needed. Confirm pressure readings during start-up. Suction pressure should decrease and discharge pressure should increase.

Component:

Current sensor

Troubleshooting:

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

AL218 Discharge Pressure (DPT) High

Cause:

Discharge pressure is over the maximum for 10 minutes within the last hour.

Component:

Restrictions in the refrigeration system.

Troubleshooting:

Verify that the liquid line service valve is fully open. Open as needed.

Component:

Filter drier

Troubleshooting:

Check the filter drier. If it is iced up or very cold, then the filter drier needs replacement. See Filter Drier Service, **Section 7.5**.

Component:

Condenser Fan

Troubleshooting:

Check the condenser fan for proper operation. Correct as required.

Component:

Discharge Pressure Transducer (DPT)

Troubleshooting:

Confirm accurate DPT pressure readings. See Refrigerant Service, **Section 7.1**.

Replace the DPT if defective.

Component:
Non-condensables in the refrigeration system

Troubleshooting:
With the unit off, allow the system to stabilize to ambient temperature. Check system pressure against the Pressure / Temperature chart. Correct as required. See Refrigerant Service, **Section 7.1**.

Component:
Refrigerant

Troubleshooting:
Check refrigerant level. Correct as required. See Refrigerant Service, **Section 7.1**.

AL219 Compressor Discharge Temperature (CPDS) High

Cause:
Discharge temperature exceeds 135°C (275°F) for 10 minutes within the last hour.

Component:
Restrictions in the refrigeration system

Troubleshooting:
Verify that the discharge service valve is fully open. Open the valve as needed. Check the unit for air flow restrictions. Clean or remove debris from coils.

Component:
Non-condensables in the refrigeration system.

Troubleshooting:
With the unit off, allow the system to stabilize to ambient temperature. Check system pressure against the Pressure / Temperature chart. Correct as required. See Refrigerant Service, **Section 7.1**.

Component:
Additional alarms such as AL216, AL024

Troubleshooting:
Check compressor operation. If the alarm persists, it may indicate a failing compressor. See Compressor Service, **Section 7.2**. Replace the compressor if defective.

AL228 Suction Pressure (SPT) Low

Cause:
The unit has three low suction pressure cycles within 30 minutes.

Component:
Suction Pressure Transducer (SPT)

Troubleshooting:
Check transducer wiring and confirm an accurate SPT pressure reading by comparing the value to the Evaporator Pressure Transducer (EPT) reading. See Refrigerant Service, **Section 7.1**. Replace the SPT if defective.

AL250 Manual Fresh Air Vent Position Sensor (VPS) Fault

Cause:
Vent Position Sensor (VPS) is out of range.

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.

AL251 Data Storage Fault (Non-Volatile Memory Fault)

Cause:

Controller memory failure

Component:

Controller

Troubleshooting:

1. Press the ENTER key when “CLEAr” is displayed to attempt to clear the alarm. If the action is successful (all alarms are inactive), alarm 251 will reset.
2. Power cycle the unit. If the alarm persists, it indicates that controller memory is defective. Replace the controller. See Controller Service, **Section 7.8**.

AL252 Alarm List Full

Cause:

The alarm list queue is full.

Component:

Active alarms

Troubleshooting:

Repair any alarms in the queue that are active, indicated by “AA”. See Clearing Alarms, **Section 4.4**.

AL253 Backup 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 is present.

Component:

Battery

Troubleshooting:

Perform a battery test in code Cd19 to determine the failure mode of the battery. To clear the alarm, replace the battery pack. See Battery Replacement, **Section 7.8.3**. If after replacement the alarm continues, run a test at Cd19 to determine whether the replaced battery is good.

AL254 Supply Temperature Sensor (STS) Fault

Cause:

The Supply Temperature Sensor (STS) reading is invalid.

Component:

Supply Temperature Sensor (STS)

Troubleshooting:

Perform a 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 7.10**.

AL255 Suction Pressure Transducer (SPT) Fault

Cause:

The Suction Pressure Transducer (SPT) is out of range.

Component:

Suction Pressure Transducer (SPT)

Troubleshooting:

Confirm accurate SPT pressure readings. See Refrigerant Service, **Section 7.1**. Performing a pre-trip P5-9 test will also check the transducers. See Pre-Trip Testing, **Section 5.7**. Replace the SPT if defective.

AL256 Return Temperature Sensor (RTS) Fault

Cause:
The Return Temperature Sensor (RTS) reading is invalid.

Component:
Return Temperature Sensor (RTS)

Troubleshooting:
Perform a 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 7.10**.

AL257 Ambient Sensor (AMBS) Fault

Cause:
The Ambient Temperature Sensor (AMBS) reading is invalid.

Component:
Ambient Temperature Sensor (AMBS)

Troubleshooting:
Test the AMBS. See Sensor Checkout Procedure **Section 7.10.2**. Replace the AMBS if defective. See Temperature Sensor Service **Section 7.10**.

AL258 Compressor High Pressure Safety (HPS) Open

Cause:
The High Pressure Switch (HPS) remains open for at least one minute.

Component:
High Pressure Switch (HPS)

Troubleshooting:
Test the HPS. See Checking High Pressure Switch, **Section 7.2.4**. Replace the HPS if defective. See Temperature Sensor Service **Section 7.10**

Component:
Refrigeration system.

Troubleshooting:
Check the unit for air flow restrictions. Clean or remove any debris from coils.

AL259 Heat Termination Thermostat (HTT) Open

Cause:
The Heat Termination Thermostat (HTT) is open.

Component:
Heat Termination Thermostat (HTT)

Troubleshooting:
Check resistance between CA21 and CA10. If resistance is 0 ohms, the switch is closed. If resistance is infinite (OL), the switch is open. Replace the HTT if defective. See Sensor Replacement, **Section 7.10.6**.

AL260 Defrost Temperature Sensor (DTS) Fault

Cause:
The Defrost Temperature Sensor (DTS) failed to open.

Component:
Defrost Temperature Sensor (DTS)

Troubleshooting:
Refer to the

Test the DTS. See Sensor Checkout Procedure, **Section 7.10.2**. Replace the DTS if defective. See Sensor Replacement, **Section 7.10.6**.

AL261 Improper Heater Current Fault

Cause:
The current draw during heat or defrost mode is improper.

Component:
Heater(s)

Troubleshooting:
While in heat or defrost mode, check for proper current draw at the heater contactors. Reference the Electrical Data table in **Section 3.10**. Replace the heater(s) if defective. See Heater Service, **Section 7.6**.

Component:
Contactor

Troubleshooting:
Check voltage at the heater contactor on the heater side. If no voltage is present, replace the heater contactor if defective.

AL263 Exceed Current Limit Setting

Cause:
The unit is operating above the 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 the supply voltage / frequency is within specification and balanced according to the Electrical Data table in **Section 3.10**. Correct the power supply.

Component:
Current limit set too low

Troubleshooting:
Check the current limit setting with code Cd32. Raise the current limit at Cd32 (maximum of 23 amps).

AL264 Discharge Temperature Sensor (CPDS) Fault

Cause:
The Discharge Temperature Sensor (CPDS) is out of range.

Component:
Discharge Temperature Sensor (CPDS)

Troubleshooting:
Test the CPDS. See Sensor Checkout Procedure, **Section 7.10.2**. Replace the CPDS if defective. See Sensor Replacement, **Section 7.10.6**.

AL265 Discharge Pressure Transducer (DPT) Fault

Cause:
The Compressor Discharge Pressure Transducer (DPT) is out of range.

Component:
Discharge Pressure Transducer (DPT)

Troubleshooting:
Confirm accurate DPT pressure readings. See Refrigerant Service, **Section 7.1**. Replace the DPT if defective.

AL266 Evaporator Pressure Transducer (EPT) Fault

Cause:

The Evaporator Pressure Transducer (EPT) is out of range.

Component:

Evaporator Pressure Transducer (EPT)

Troubleshooting:

Confirm accurate EPT pressure readings. See Refrigerant Service, **Section 7.1**. Performing a pre-trip P5-9 test will also check the transducers. Replace the EPT if defective.

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

AL267 Humidity Sensor (HS) Fault

Cause:

The Humidity Sensor (HS) reading is 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 and replace the HS if the alarm persists.

AL269 Evaporator Temperature Sensors (ETS1 / ETS2) Fault

Cause:

The Evaporator Temperature Sensor (ETS1 / ETS2) is out of range.

Component:

Evaporator Temperature Sensor (ETS1 / ETS2)

Troubleshooting:

Test the sensor. See the Sensor Checkout Procedure, **Section 7.10.2**. Replace the ETS if defective.

AL270 Supply Recorder Sensor (SRS) Fault

Cause:

The Supply Recorder Sensor (SRS) is out of range.

Component:

Supply Recorder Sensor (SRS)

Troubleshooting:

Perform a 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 7.10**.

AL271 Return Recorder Sensor (RRS) Fault

Cause:

The Return Recorder Sensor (RRS) is out of range.

Component:

Return Recorder Sensor (RRS)

Troubleshooting:

Perform a 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 7.10**.

AL272 USDA1 Temperature Out of Range

Cause:
The USDA Temp 1 Sensor is out of range.

Component:
Sensor

Troubleshooting:
Validate sensor values. See the Sensor Checkout Procedure, **Section 7.10.2**. Replace the sensor if defective. If not, verify harness wiring and controller connections.

AL273 USDA2 Temperature Out of Range

Cause:
The USDA Temp 2 Sensor is out of range.

Component:
Sensor

Troubleshooting:
Validate sensor values. See the Sensor Checkout Procedure, **Section 7.10.2**. Replace if defective. If not, verify harness wiring and controller connections.

AL274 USDA3 Temperature Out of Range

Cause:
The USDA Temp 3 Sensor is out of range.

Component:
Sensor

Troubleshooting:
Validate sensor values. See the Sensor Checkout Procedure, **Section 7.10.2**. Replace if defective. If not, verify harness wiring and controller connections.

AL275 USDA4 / Cargo Probe Temperature Out of Range

Cause:
The Cargo Probe 4 Sensor is out of range.

Component:
Sensor

Troubleshooting:
Validate sensor values. See the Sensor Checkout Procedure, **Section 7.10.2**. Replace if defective. If not, verify harness wiring and controller connections.

AL286 RTC Battery Low

Cause:
The Real Time Clock (RTC) battery output is low.

Component:
RTC battery

Troubleshooting:
Power cycle the unit and monitor 24 hours to verify the alarm goes inactive. If the alarm stays active, replace the battery.

AL287 RTC Fault

Cause:
The Real Time Clock (RTC) time is invalid.

Component:
RTC

Troubleshooting:
Power cycle the unit. Reset the clock. Verify correct time is maintained. Replace the RTC battery and test again.

AL289 DataCorder Storage Fault

Cause:
The DataCORDER is unable to store data.

Component:
DataCORDER

Troubleshooting:
Power cycle the unit and verify that the alarm goes inactive. If the alarm stays active, replace the controller. See Controller Service, **Section 7.8**.

AL293 Variable Frequency Drive (VFD) Fan Fault

Cause:
A fan error was detected while the VFD temperature is not exceeding trip level.

Component:
VFD fan

Troubleshooting:
Check if the fan is blocked, disconnected, or not running due to other reasons. Replace the fan if defective.

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 7.11.3** 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 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 normal operation range, after an initial signal 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.

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 EverFRESH 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 Fault

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 (IPT) Fault

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.

Troubleshooting:

ERR 0: RAM failure. This indicates that the controller working memory has failed.

ERR 1: Program memory failure. This 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

ERR 4: N/A

ERR 5: A-D failure. The controller’s analog to digital converter has failed.

ERR 6: I/O Board failure. The internal program / update has failed.

ERR 7: Controller failure. The internal version / firmware is incompatible.

ERR 8: DataCORDER failure. The internal DataCORDER memory has failed.

ERR 9: Controller failure. The internal controller memory has failed.

Entr StPt Enter Setpoint

Cause:

The controller is prompting the operator to enter a setpoint.

Lo Low Mains Voltage

Cause:

This message will be alternately displayed with the setpoint whenever the supply voltage is less than 75% of its proper value.

nEEd ConFG Valid Model Number Configuration needed

Cause:

The controller is prompting the operator to enter a valid model number.

nEEd Id Container ID needed

Cause:

The controller is prompting the operator to enter a valid Container ID.

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 with the keypad.

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 tests can only be initiated by the PRE-TRIP key. See **Section 5.7** for operating procedure to initiate a Pre-Trip.

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

- 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.

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

- Automatic Cold Treatment (ACT) is not 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:

- The PRE-TRIP key is pressed and no selection is made for five seconds.
- The PRE-TRIP key is pressed and held for one to two seconds while tests are being executed.
- Pre-Trip was initiated by communications and any Pre-Trip test fails.

4.5.4 Pre-Trip Test Codes

A summary of alarms is provided in **Table 4–5**, and completed descriptions below the table.

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	Low Speed Condenser Fan On	x	x	x
P2-1	Low Speed Condenser Fan Off	x	x	x
P2-2	High Speed Condenser Fan On	x	x	x
P2-3	High Speed 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
P5-7	Primary vs. Secondary Evaporator Temperature Thermistor	x	x	x
P5-8	Future Expansion	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 Transducer	x	x	x
P6-3	Suction Pressure Transducer	x	x	x
P6-4	Economizer Temperature Sensor	x	x	x
P6-5	Economizer Pressure Sensor	x	x	x
P6-6	Variable Frequency Drive (VFD)	x	x	x
P6-7	Evaporator Expansion Valve (EEV)	x	x	x
P6-8	Economizer Expansion Valve (ECV)	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	

P0 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.

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.

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. If the unit has a Water Pressure Switch and it is open, then this test will be skipped.

P2-0 Low Speed Condenser Fan On

The condenser fan starts in the off condition and current draw is measured. The low speed condenser fan contactor is energized and the current draw is measured for 10 continuous seconds. The change in current draw between OFF state and energized state is then recorded.

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

P2-1 Low Speed Condenser Fan Off

The low speed condenser fan contactor is de-energized and unit current draw is measured for 10 continuous seconds. The change in current draw between energized state and OFF state is then recorded.

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

P2-2 High Speed Condenser Fan On

The condenser fan starts in the off condition and current draw is measured. The high speed condenser fan contactor is energized and the current draw is measured for 10 continuous seconds. The change in current draw between OFF state and energized state is then recorded.

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

P2-3 High Speed Condenser Fan Off

The high speed condenser fan contactor is de-energized and unit current draw is measured for 10 continuous seconds. The change in current draw between energized state and OFF state is then recorded.

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

P3 Low Speed Evaporator Fan 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.

P3-0 Low Speed Evaporator Fan Motors On

The low speed evaporator fans start in the off condition and current draw is measured. The low speed evaporator fan contactor is energized and the current draw is measured for 4 seconds. The change in current draw is then recorded.

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

P3-1 Low Speed Evaporator Fan Motors Off

The low speed evaporator fan contactor is de-energized and unit current draw is measured for 2 seconds. The change in current draw between energized state and OFF state is then recorded.

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

P4 High Speed Evaporator Fan Current Draw

For P4 tests, 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.

P4-0 High Speed Evaporator Fan Motors On

The evaporator fans start in the off condition, current draw is measured. The high speed evaporator fan contactor is energized and current draw is measured for 4 seconds. The change in current draw is then recorded.

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

P4-1 High Speed Evaporator Fan Motors Off

The high speed evaporator fan contactor is de-energized and unit current draw is measured for 2 seconds. The change in current draw between energized state and OFF state is then recorded.

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

P5 Air Stream Sensors

The P5 tests are to check the validity of the air stream temperature sensors.

P5-0 Supply / Return Probe

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.

P5-1 Supply Probes

The temperature difference is compared between the supply temperature sensor (STS) and supply recorder sensor (SRS).

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

P5-2 Return Probes

The temperature difference is compared between the return temperature sensor (RTS) and return recorder sensor (RRS).

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

The results of pre-trip tests 5-0, 5-1 and 5-2 are used to activate or clear control probe alarms.

P5-7 Primary vs. Secondary Evaporator Temperature Thermistor

This test compares the temperature of both the primary Evaporator Temperature Sensor (ETS1) and secondary Evaporator Temperature Sensor (ETS2).

The test passes when ETS2 is within +/- 0.5°C of ETS1. Otherwise, it fails.

P5-9 Primary vs. Secondary Evaporator Pressure Transducer

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 STS is -30°C to -18°C (-22°F to -0.4°F); Pass / Fail tolerance is +/- 4.4 psig.
- Temperature range of STS is -18°C to 15.6°C (-0.4°F to 60°F); Pass / Fail tolerance is +/- 1.5 psig.
- Temperature range of STS is 15.6°C to 50°C (60°F to 122°F); Pass / Fail tolerance is +/- 4.4 psig.

P5-10 Humidity Sensor Controller Configuration Verification

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

The test passes if the controller configuration has humidity sensor in. The test fails if the controller configuration has humidity sensor out and Vout is greater than 0.20 Volts for the humidity sensor. The test is skipped if the controller configuration has the humidity sensor out and Vout is less than 0.20 Volts.

P5-11 Humidity Sensor Installation Verification

This is a Pass / Fail test of 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.

P5-12 Humidity Sensor Range Check

This is a Pass / Fail test of the Humidity Sensor (HS) range. The test passes if Vout for the HS is between 0.33 and 4 Volts. The test fails if Vout is outside of this range.

P6 Refrigerant Probes, Compressor and Valves

The P6 tests are for pass / fail testing of the discharge temperature sensor (CPDS), suction temperature sensor (ETS 1/2), discharge pressure sensor (DPT), suction pressure sensors (SPT), economizer temperature sensor (ECT), economizer pressure sensor (ECP) variable frequency drive (VFD), economizer expansion valve (ECV) and evaporator expansion valve (EEV).

P6-0 Discharge Thermistor

If Alarm 264 Discharge Temperature Sensor (CPDS) Fault is active the test fails. Otherwise, the test passes.

P6-1 Suction Thermistor

If the evaporator temperature sensor (ETS1) or secondary evaporator temperature sensor (ETS2) is outside of its operating range, the test fails. Otherwise the test passes.

P6-2 Discharge Pressure Transducer

If Alarm 265 Discharge Pressure Transducer (DPT) Fault is active, the test fails. Otherwise, the test passes.

P6-3 Suction Pressure Transducer

If Alarm 255 Suction Pressure Transducer (SPT) Fault or Alarm 266 Evaporator Pressure Transducer (EPT) Fault is active the test fails. Otherwise the test passes.

P6-4 Economizer Temperature Sensor

If Alarm 204 Economizer Temperature Sensor (ECT) Fault is active, the test fails. Otherwise, the test passes.

P6-5 Economizer Pressure Sensor

If Alarm 205 Economizer Pressure Sensor (ECP) Fault is active, the test fails. Otherwise, the test passes.

P6-6 Variable Frequency Drive (VFD)

After a start-up period, the variable frequency drive (VFD) increases the compressor speed while the EEV is held steady.

Test passes if the pressure variation meets the criteria.

NOTE: The VFD test may skip at low temperatures and that an EEV Pass indicates that the VFD is functioning properly.

P6-7 Evaporator Expansion Valve (EEV)

The variable frequency drive (VFD) holds the compressor speed steady while the EEV is closed.

Test passes if the pressure variation meets the criteria.

P6-8 Economizer Expansion Valve (ECV)

After suction pressure is reduced, the compressor is shut off and the valves are closed. When the economizer expansion valve (ECV) opens, the pressure variation is checked.

Test passes if the pressure variation meets the criteria.

P7 High Pressure Switch

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

P7-0 High Pressure Switch (HPS) Open

The unit runs in full cooling with the condenser fan off.

The test passes if the high pressure switch (HPS) opens before 15 minutes (900 seconds) after the condenser fan is turned off. Otherwise the test fails.

When this test passes, the condenser fan is turned on.

NOTE: This test will only run once every year.

P7-1 High Pressure Switch (HPS) Close

The unit runs for up to 1 minute (60 seconds) after the high pressure switch (HPS) opens.

The test passes if the HPS closes within the time period, otherwise it fails.

P8 Perishable Mode

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

If the control temperature is below 15.6°C (60°F), the setpoint is changed to 15.6°C (60°F), 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 (60°F) 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 Pulldown

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. Otherwise the test fails.

P8-2 Perishable Mode Maintain Temperature

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

A fifteen minute timer is started, and the system will attempt to minimize control temperature error (supply temperature minus setpoint) until the timer expires. The control temperature will be sampled each minute starting at the beginning of P8-2. During P8-2, the left display will read “P8-2,” and the right display will show the supply air temperature. When the test is completed, the average control temperature error will be compared to the pass/fail criteria.

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.

P9 Defrost Termination Thermostat (DTT)

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 only with the “Auto2” sequence selected.

P9-0 DTT Closed and Open

The unit runs in full cooling for up to 30 minutes to get the Defrost Temperature Sensor (DTS) temperature below 10°C (50°F). Once DTS goes below 10°C (50°F), defrost is initiated. After initiation, DTS is given up to 2 hours to go above 25.6°C (78°F) to terminate defrost.

P10 Frozen Mode

P10 tests are included only with the “Auto2” sequence selected.

P10-0 Frozen Mode

If the container temperature is below 7.2°C (45°F), the setpoint is changed to 7.2°C (45°F), 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 (45°F). 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

Control temperature must be at least 7.2°C (45°F).

The setpoint is changed to -17.8°C (0°F). 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 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.

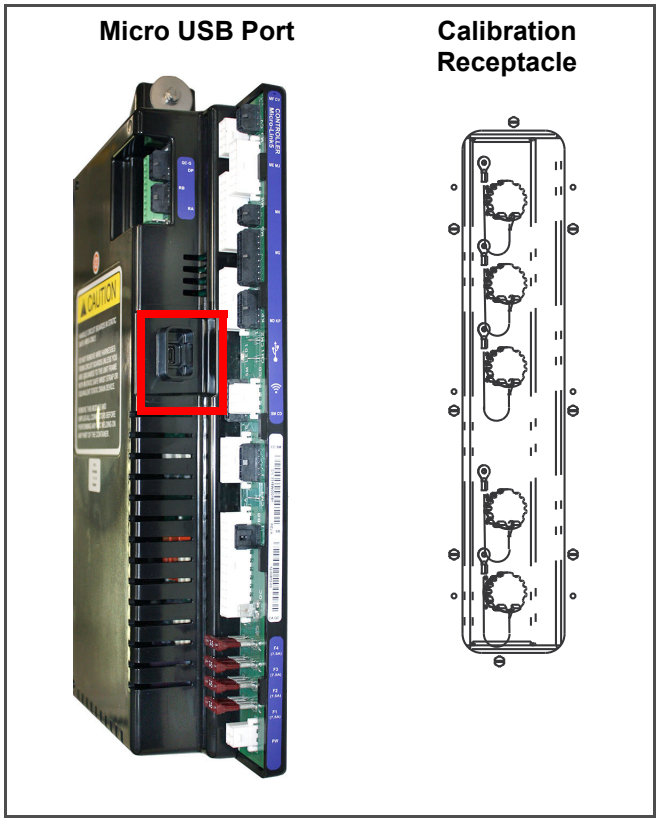
4.6 Controller Communications

The ML5 controller allows the following methods for connectivity, as shown in **Figure 4.5**:

- 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-383PL Parts Manual for a list of available tools for interfacing with the ML5 controller.

Figure 4.5 Connections to the Controller



4.6.1 Micro USB Port Connection

Insert a Micro USB device into the controller's USB port to perform programming functions. These functions are available from the Alt Mode > USb menu on the display. These procedures are detailed in the Controller Programming section of the manual, see **Section 7.9**.

The following can be performed with a USB drive:

- Download data from the DataCORDER.
- Upload controller software.
- Upload controller configuration.

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

- Download data from the DataCORDER.
- Upload controller configuration.
- 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.

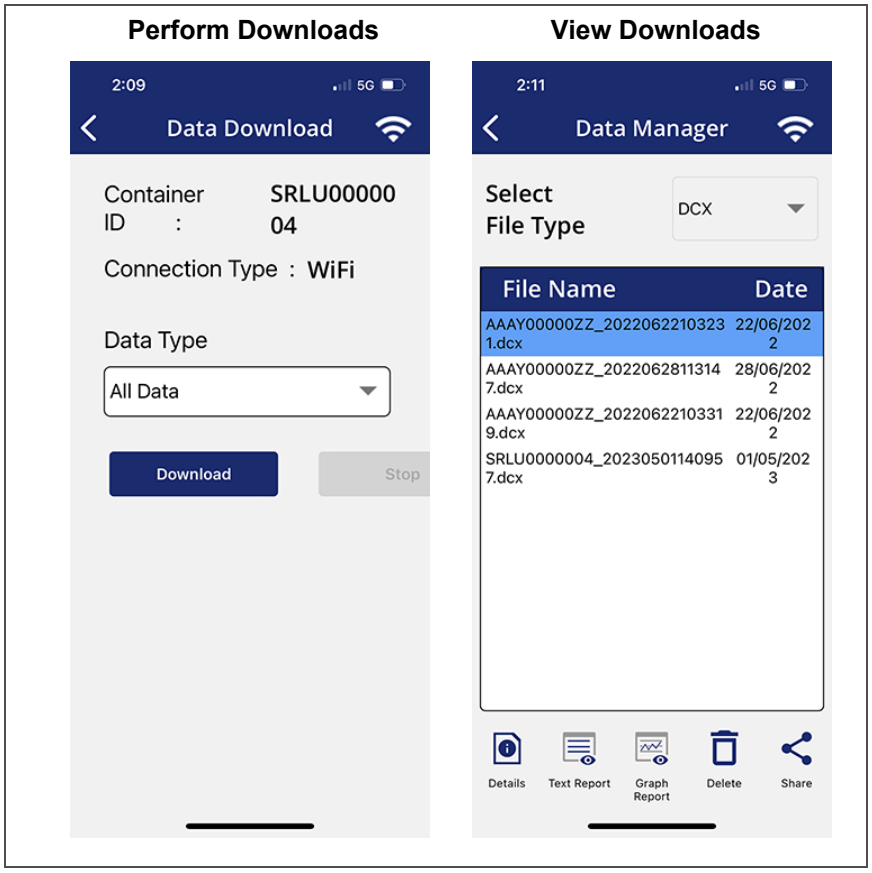
The unit display will show whether the unit WiFi is connected and transmitting:

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 4.6**.

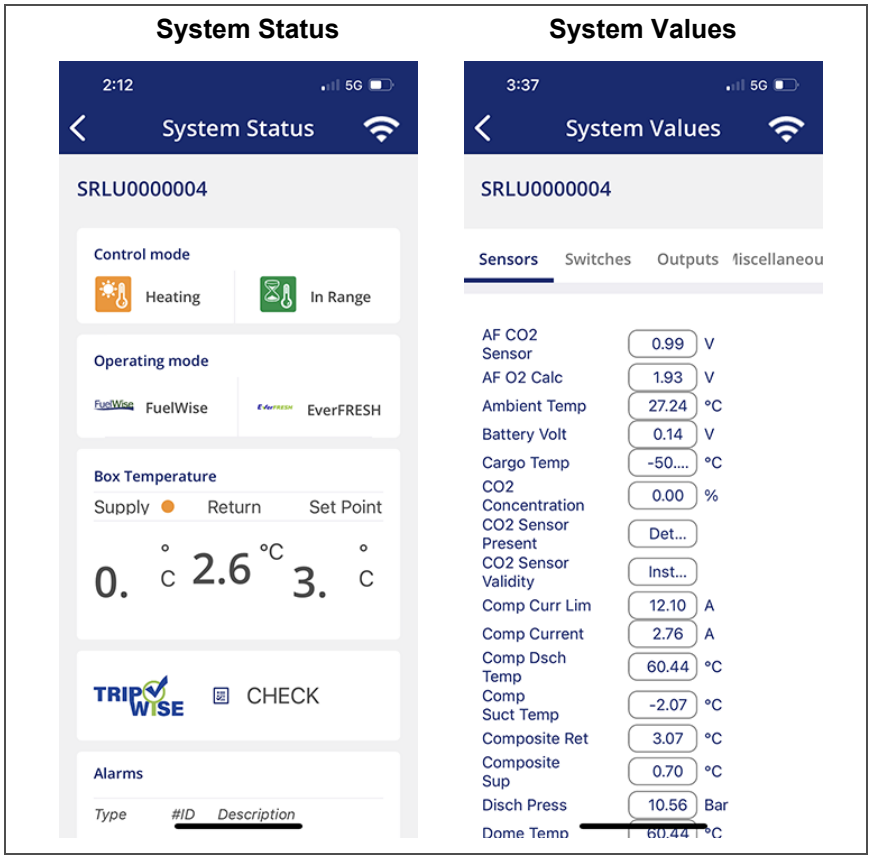
Figure 4.6 ContainerLINK - Downloads



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 4.7**:

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

Figure 4.7 ContainerLINK - View Real Time Data

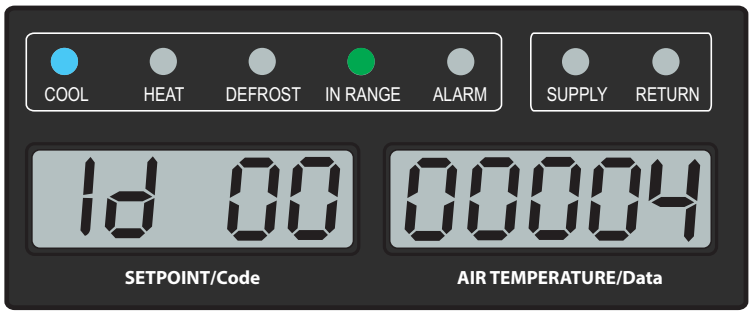


4.6.2.1 Obtaining Container Unit ID and Wireless Password

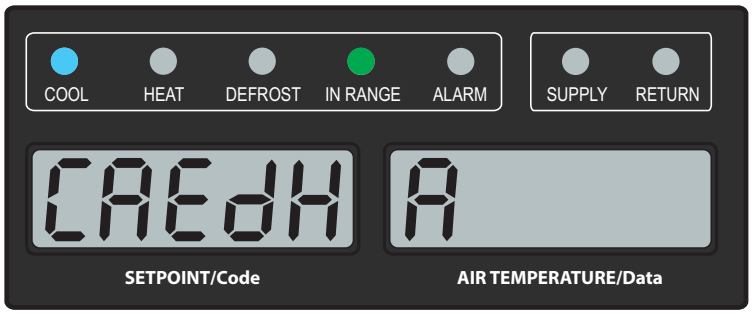
This procedure explains how to use the unit display to determine the container unit ID and wifi password. These are needed to connect to the ContainerLINK™ app.

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.



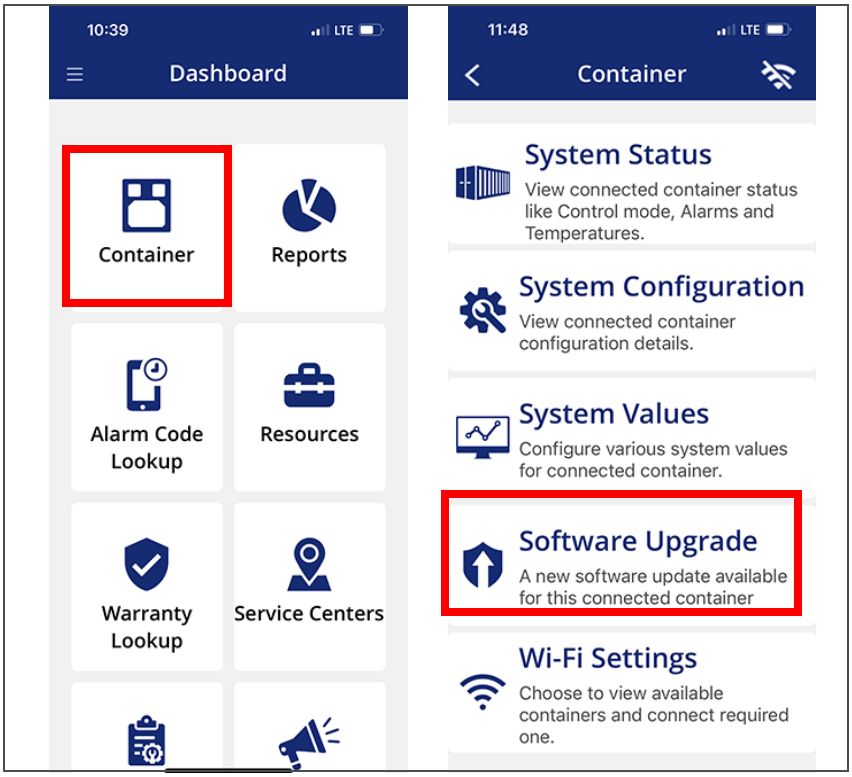
2. On the display, look up the six character wireless password. The password changes every four hours.
   a. Press the ALT MODE key.
   b. Use the Arrow keys to display "nEt", then press ENTER.
   c. Use the Arrow keys to display "PASSW EntR", then press ENTER.
   d. The display will show a 6 character 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

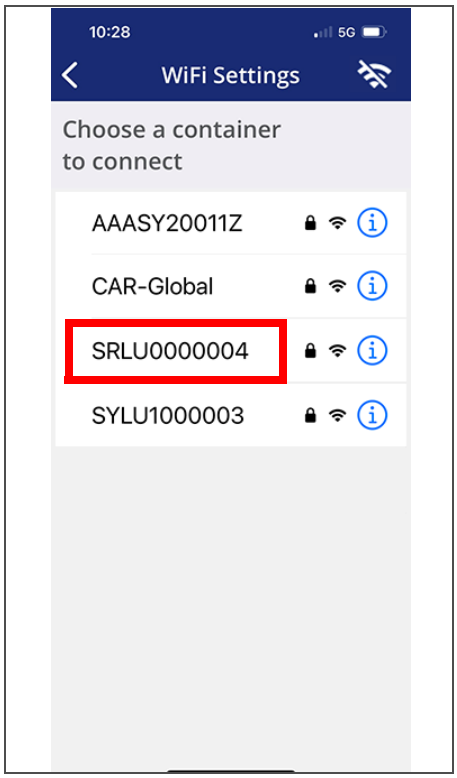
This procedure explains how to enter wifi settings for a particular container unit into the ContainerLINK app to establish a connection to the unit.

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

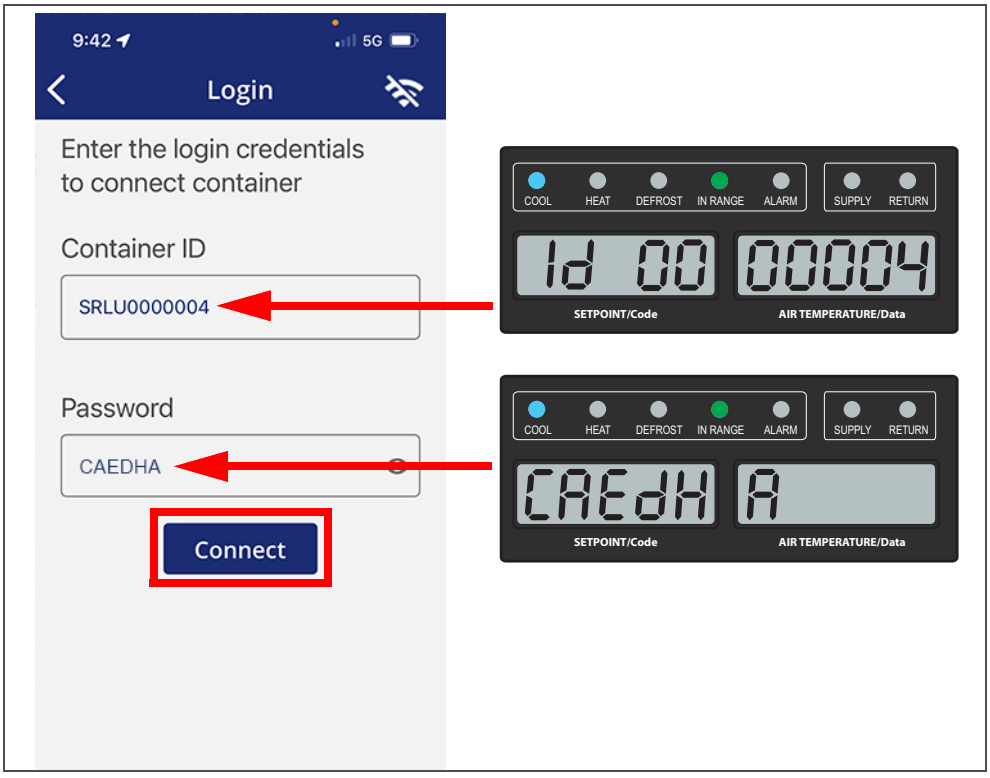


2. Depending on the mobile device, all available networks (along with Container IDs) within range may appear. Choose a Container ID to connect to. See **Section 4.6.2.1** for obtaining Container ID.

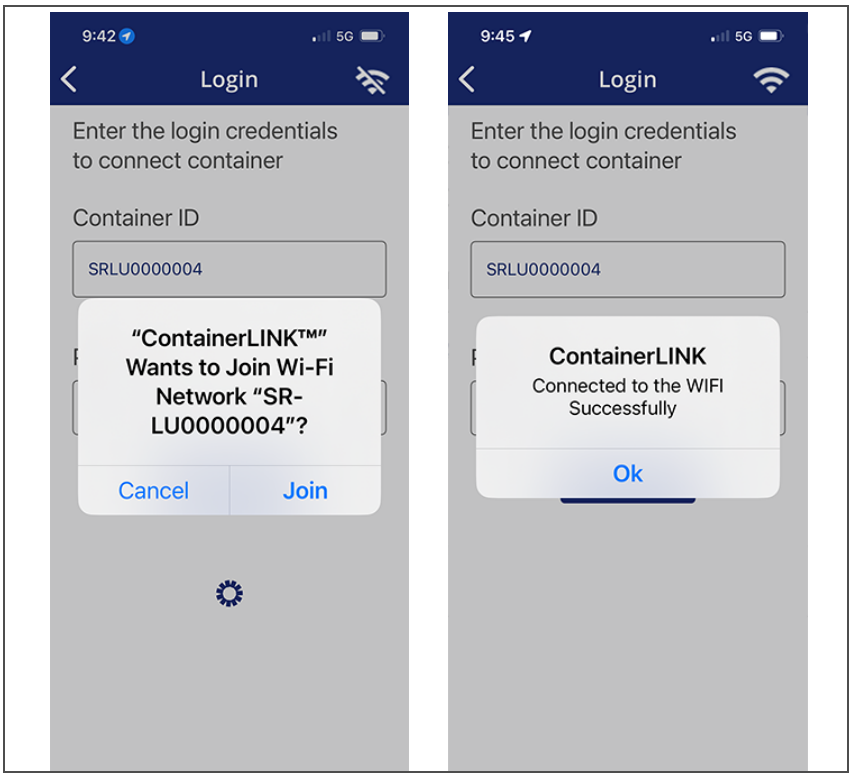
   On some mobile devices, this screen is bypassed and the Login screen appears directly.



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.



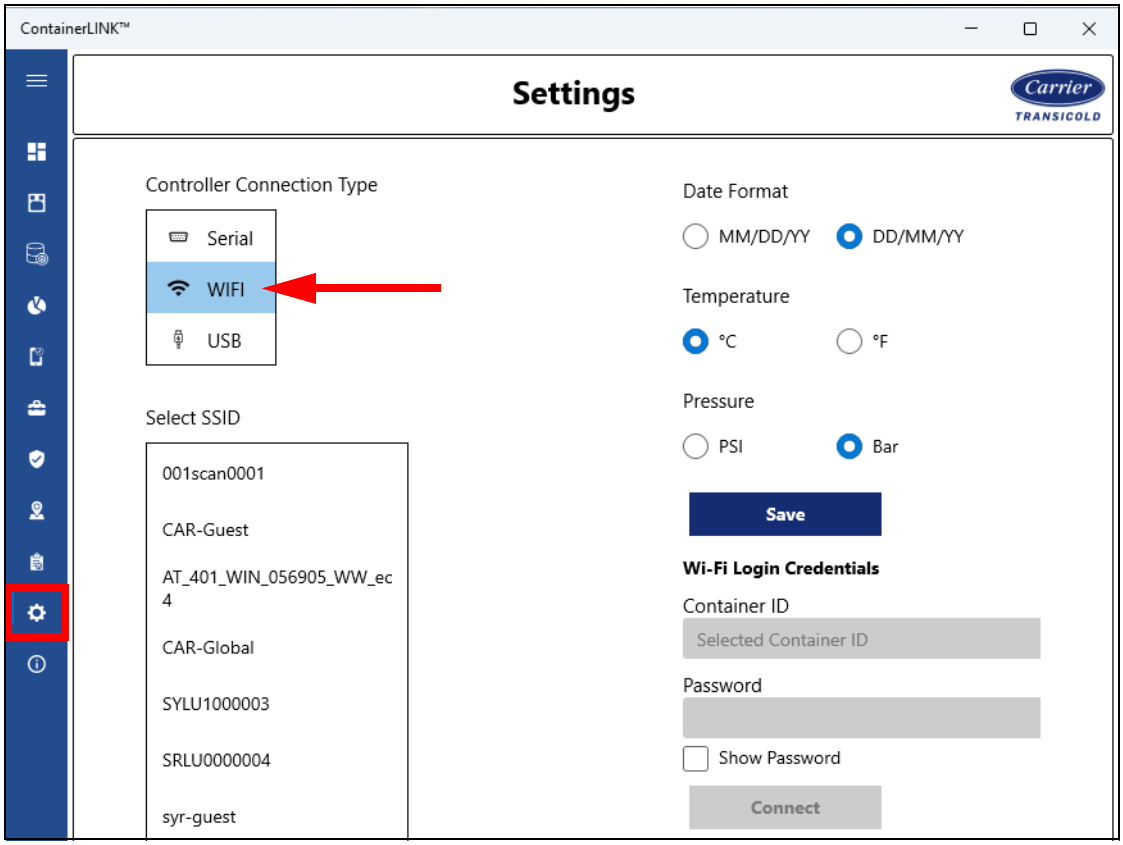
4. If a prompt asks to Join the network, select Join. After clicking Connect, a message will appear “Connected to the WIFI Successfully”. Click OK to begin using the connected features of ContainerLINK™.



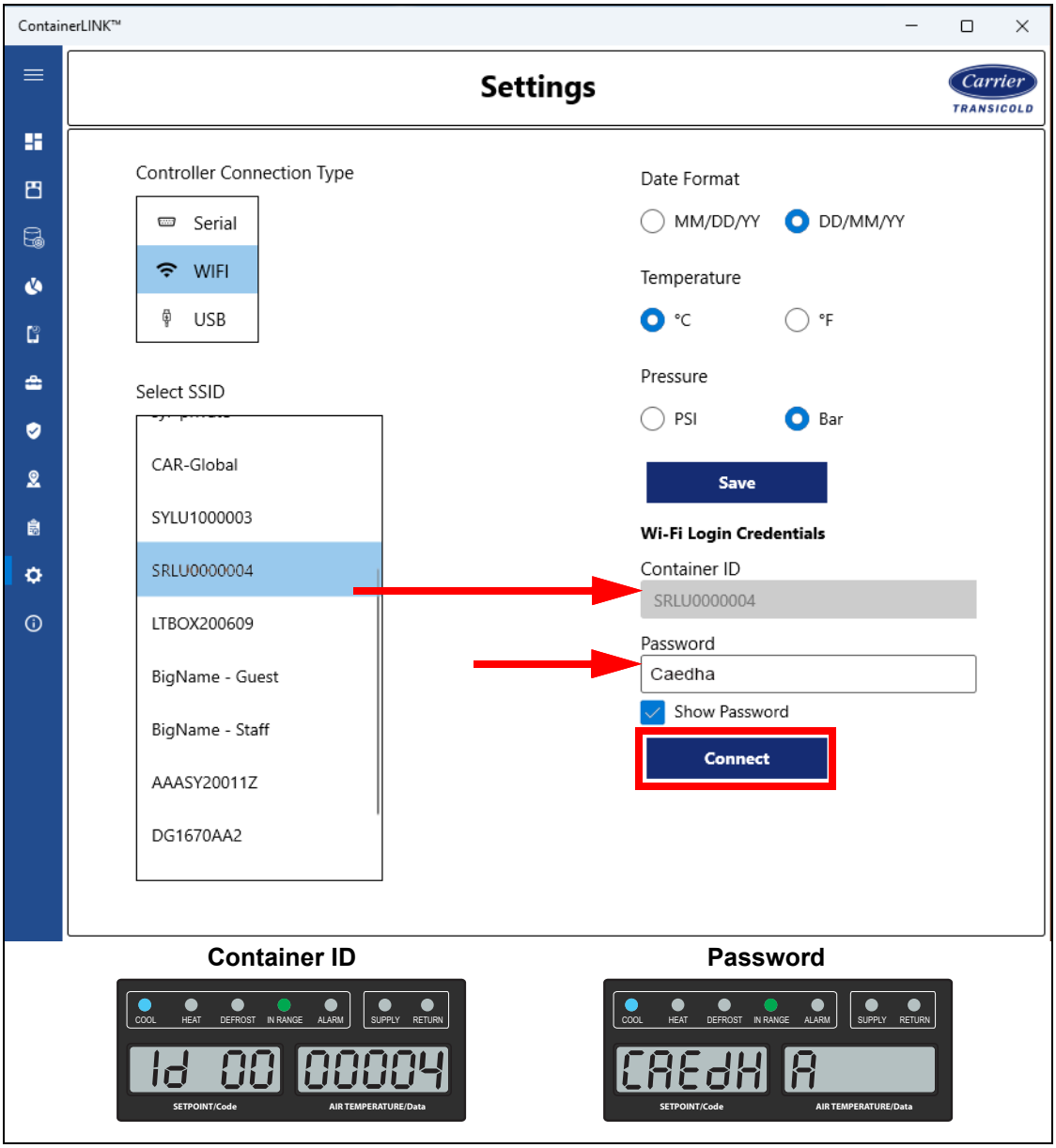
4.6.2.3 Connecting a Laptop with ContainerLINK to a Unit

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.

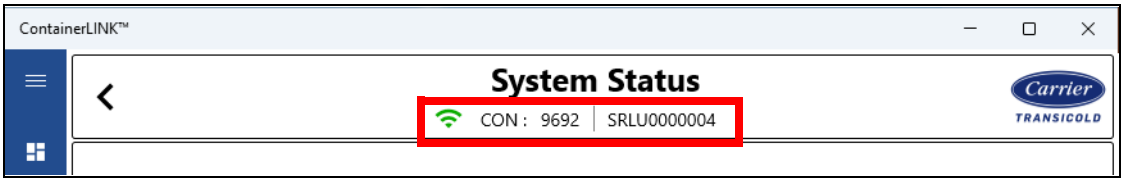


2. Choose the container unit to connect from the Select SSID box. After selecting, the ID is filled into the Container ID box on the right. Type in the password and click Connect. See **Section 4.6.2.1** for container ID and password information.



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

Optional front and rear interrogation receptacles are available on a unit. The front receptacle, mounted under the control box, is for connectivity to third party devices. The rear receptacle, located inside the unit with 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 functions are accessed by keypad selections and viewed on the display.

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 functions include the following:

- 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, etc).

4.7.2 DataCORDER Configuration Software

The configuration software controls the DataCORDER recording and alarm functions. 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. A list of the configuration variables is provided in **Table 4–6**.

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

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.

Descriptions of DataCORDER operation for each variable setting are provided in the following paragraphs.

dCF02 - Sensor Configuration

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.

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.

- Control mode
- Control temperature
- Frequency
- Humidity
- Phase A, B, C current
- Main voltage
- Evaporator expansion valve percentage
- Discrete outputs (Bit mapped - require special handling if used)
- Discrete inputs (Bit mapped - require special handling if used)
- Ambient Temperature Sensor (AMBS)
- Evaporator Temperature Sensor (ETS1 / ETS2)
- Compressor Discharge Temperature Sensor (CPDS)
- Return Temperature Sensor (RTS)
- Supply Temperature Sensor (STS)
- Defrost Temperature Sensor (DTS)
- Discharge Pressure Transducer (DPT)
- Suction Pressure Transducer (SPT)
- Evaporator Pressure Transducer (EPT)
- Vent Position Sensor (VPS)

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

dCF03 - Logging Interval

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).

dCF04 - Thermistor Format

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.

dCF05 & dCF06 - Sampling Type

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.

dCF07 through dCF10 - Alarm Configuration

USDA and cargo probe alarms may be configured to OFF, ON or AUTO. If a probe alarm is configured to OFF, the alarm for this probe is always disabled. If a probe alarm is configured to ON, the associated alarm is always enabled.

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

4.7.3 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 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.

Descriptions of DataCORDER function codes are provided in the following paragraphs.

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 - USDA 1 Temperatures

Current readings of the USDA #1 probe.

dC4 - USDA 2 Temperatures

Current readings of the USDA #2 probe.

dC5 - USDA 3 Temperatures

Current readings of the USDA #3 probe.

dC14 - Cargo Probe 4 Temperature

Current reading of the cargo probe #4.

dC22 - USDA 1 Sensor Calibration

Current calibration offset value for the USDA #1 probe. This is entered via the interrogation program.

dC23 - USDA 2 Sensor Calibration

Current calibration offset value for the USDA #2 probe. This is entered via the interrogation program.

dC24 - USDA 3 Sensor Calibration

Current calibration offset value for the USDA #3 probe. This is entered via the interrogation program.

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 - Backup Battery Test

Shows the current status of the optional battery pack.

PASS: Battery pack is fully charged. FAIL: Battery pack voltage is low.

dC32 - Time: Hour, Minute

Current time on the real time clock (RTC) in the DataCORDER.

dC33 - Date: Month, Day

Current date (month and day) on the RTC in the DataCORDER.

dC34 - Date: Year

Current year on the RTC in the DataCORDER.

dC35 - Cargo Probe 4 Calibration

Current calibration value for the Cargo Probe. This is entered via the interrogation program.

4.7.4 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.

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 repairs.
   - Check visually that the evaporator fan motor mounting bolts are properly secured. See **Section 7.6**.
   - Check for visible corrosion on the evaporator stator and fan deck. See **Section 7.6**.
   - Check for dirt or grease on evaporator fans or fan deck and clean if necessary. See **Section 7.6**.
   - Check evaporator coil for cleanliness or obstructions. Wash with fresh water. See **Section 7.6**.
   - Check defrost drain pans and drain lines for obstructions and clear if necessary. Wash with fresh water.
   - Check panels on the 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 7.3**.
3. Open the control box door. Check for loose electrical connections or hardware.
4. Check color of the 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 the power receptacle.

5.2.1 Connecting to 380/460 VAC Power

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

5.3 Starting and Stopping Instructions

⚠ WARNING

Make sure that the unit circuit breaker(s) (CB-1 & optional CB-2) and the Start-Stop switch (ST) are in the "O" (OFF) position before connecting to any electrical power source.

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

5.3.1 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 switch (ST) 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 5.4**.

5.3.2 Stopping the Unit

1. Turn the Start-Stop switch (ST) Off ("0").

5.4 Start-Up Inspection

1. Check rotation of the condenser fan and evaporator fans.
2. Check, and if required, reset controller function codes (Cd27 through Cd32) in accordance with desired operating parameters.
   - **Cd27 Defrost Interval (Hours or Automatic)**
   - **Cd28 Temperature Units (°C or F)**
   - **Cd29 Unit Failure Response Code**
   - **Cd30 In-Range Tolerance**
   - **Cd31 Stagger Start Offset Time (Seconds)**
   - **Cd32 System Current Limit (Amperes)**
3. Check and, if required, set the DataCORDER sensor configuration at variable dCF02 in accordance with the desired recording parameter. See **Table 4–7** for sensor configurations.
4. Enter a Trip Start:
   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.

5.5 Adjusting Fresh Air Makeup Vent

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

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

Units may be equipped with a Vent Position Sensor (VPS). The VPS determines the position of the upper fresh air vent (as equipped) and sends data to the controller display.

5.5.1 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.

5.5.2 Vent Position Sensor

The optional Vent Position Sensor (VPS) allows the user to determine the position of the fresh air vent via Cd45. This function code is accessible via the CODE SELECT key.

The 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). Function code Cd45 will display the fresh air vent position.

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

- Trip Start
- Every power cycle
- Midnight
- Manual changes greater than 5 CMH (3 CFM) remaining in the new position for at least four minutes

NOTE: The user has four minutes to make necessary adjustments to the vent setting. This time calculation begins on the initial movement of the sensor. The vent can be moved to any position within the four minutes. On completion of the first four minutes, the vent is required to remain stable for the next four minutes. If vent position changes are detected during the four-minute stability period, AL250 will be generated. This provides the user with the ability to change the vent setting without generating multiple events in the DataCORDER.

5.6 Connecting Water-Cooled Condenser

The water-cooled condenser (WCC), see **Section 3.3.4**, 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.

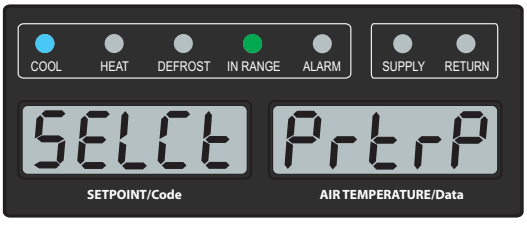
1. Connect the water supply line to the inlet side of the condenser and the discharge line to the outlet side of the condenser. See **Figure 3.10**.
2. Maintain a flow rate of 11 to 26 liters per minute (3 to 7 gallons per minute). The Water Pressure Switch (WPS) will open to de-energize the condenser 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.

5.7 Performing a Pre-Trip

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.



3. To Run an Automatic Test: Scroll through the selections by pressing the Arrow keys to display AUtO1, AUtO2 or AUtO3 as desired, then press the ENTER key.
   - The unit will execute the series of tests without any additional need for user interaction. These tests vary in length, depending on the component under test.
   - While tests are running, “P#-#” will appear on the left display; the #’s indicate the test number and sub-test. The right display will show a countdown time in minutes and seconds, indicating the amount of time remaining in the test.
   - When a Pre-Trip Auto 1 test runs to completion without a failure or interruption, the unit will exit Pre-Trip mode and return to normal control operation.
   - When a Pre-Trip Auto 2 test runs to completion without a failure or interruption, the unit will exit Pre-Trip and display “Auto 2” “end.” The unit will suspend operation. Press the ENTER key to return to normal control operation.
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 Pre-Trip 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 component operation. At the conclusion, “PASS” or “FAIL” will be displayed. This message will remain displayed for up to three minutes, during which time a user may select another test. If the three minute time period expires, the unit will terminate Pre-Trip and return to control mode operation.
   - While the tests are being executed, the user may terminate the Pre-Trip diagnostics by pressing and holding the PRE-TRIP key. The unit will then resume normal operation. If the user decides to terminate a test but remain at the test selection menu, the user may press the Up Arrow key. When this is done, all test outputs will be de-energized and the test selection menu will be displayed.
   - Throughout the duration of any Pre-Trip test (except the P-7 high pressure switch tests), the current limiting and pressure limiting processes are both active. The current limiting process only is active for P-7.

5.7.2 Displaying Pre-Trip Test Results from the Keypad

1. Press the PRE-TRIP key to access the Pre-Trip test selection menu.
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 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.

5.9.2 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.

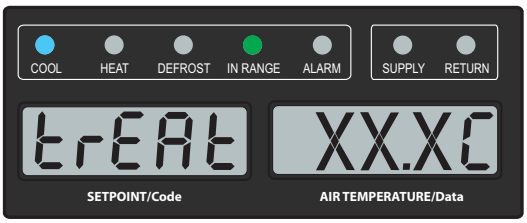
5.9.3 Automatic Cold Treatment (ACT) Mode

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 Automatic Cold Treatment (ACT)** description for more information.

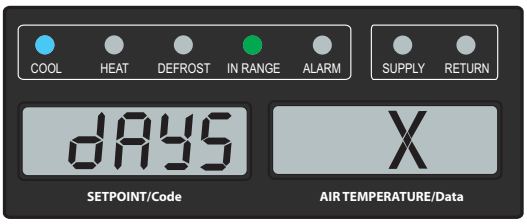
NOTE: Automatic Cold Treatment (ACT) and Automatic Setpoint Change (ASC) can not be enabled simultaneously. Setting one will deactivate the other.

Turning On and Setting ACT:

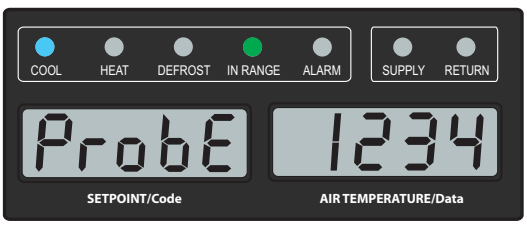
1. Enter the required cargo setpoint. It must be lower than the treatment temperature discussed in step 5.
2. Press the CODE SELECT key.
3. Use the Arrow keys to scroll to Cd51, and then press the ENTER key.
4. Use the Arrow keys to bring up "On" and press the ENTER key.
5. The display will show “trEAt | ##.#°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.



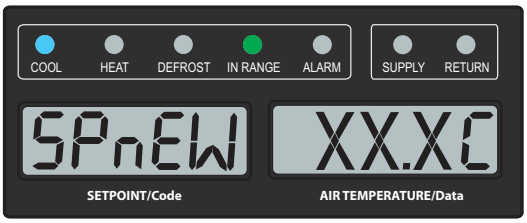
6. The display will show “dAyS | #” with the right display flashing the days for cold treatment. Use the Arrow keys to select the desired days and press ENTER to confirm.



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



8. 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.



9. 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. Use the Arrow keys to bring up "Off" in the right display and press the ENTER key.

5.9.4 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 Automatic Setpoint Change (ASC)** description for more information.

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. 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. 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“.

5.9.5 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.

5.9.6 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.

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

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

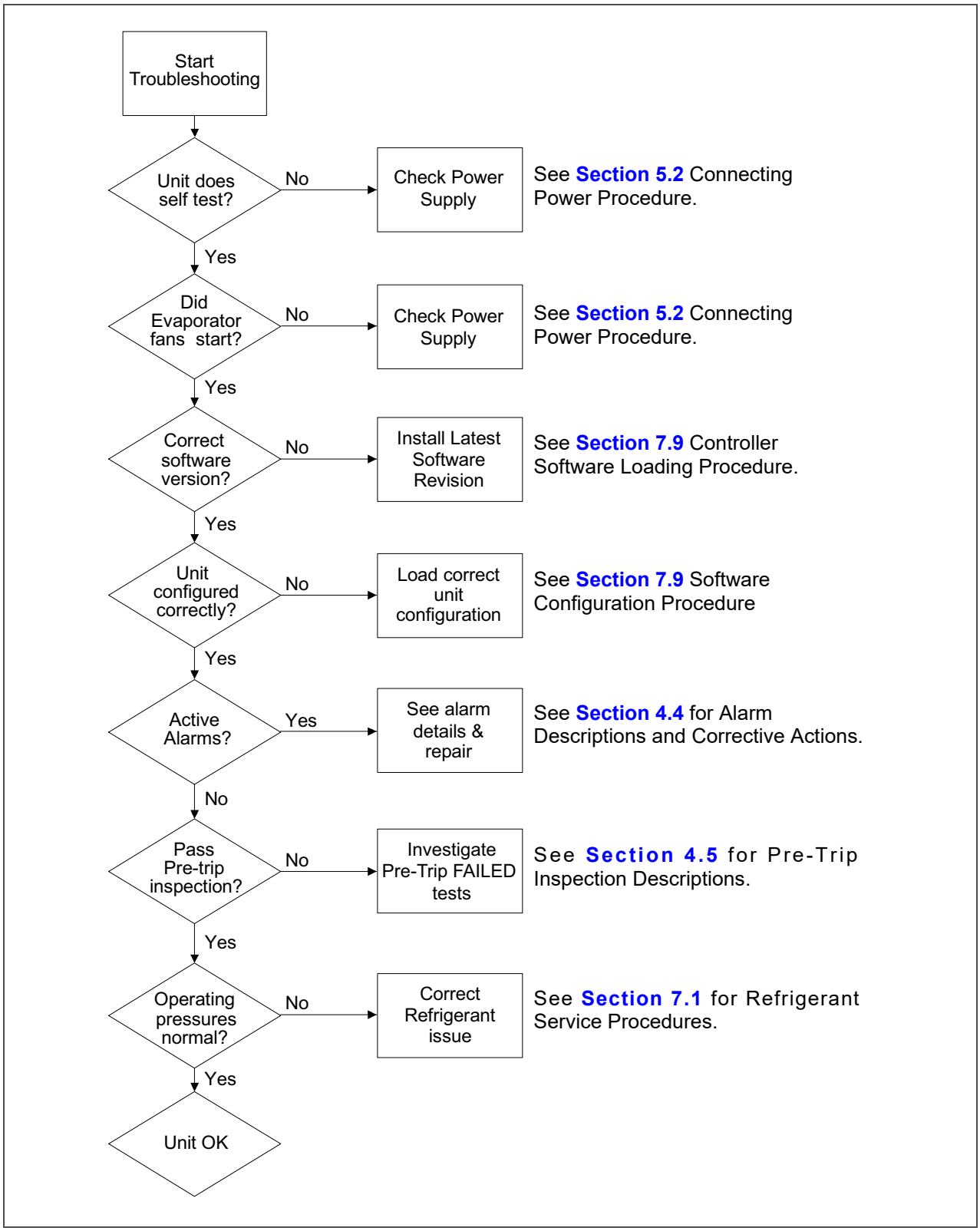


Table 6–1 Troubleshooting Symptoms

Condition	Possible Cause	Remedy / Reference
6.1 Unit will not Start or 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
Loss of control power	Circuit breaker OFF or defective	Check
	Control transformer defective	Replace
	Fuse (F3 / F4) blown	Check
	Start-Stop switch (ST) OFF or defective	Check
Component(s) not operating	Evaporator fan motor internal protector open	**Section 7.6**
	Condenser fan motor internal protector open	**Section 7.3**
	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
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 7.1.6**
	Evaporator coil covered with ice	**Section 6.6**
	Evaporator coil plugged with debris	**Section 7.6**
	Evaporator fan(s) rotating backwards	**Section 7.6**
	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 7.3**
	Compressor worn	**Section 7.2**
	Current limit (Cd32) set to wrong value	See Cd32
	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 6.13**
	Abnormal currents	**Section 6.14**
	Controller malfunction	**Section 6.9**
	Evaporator fan or motor defective	**Section 7.6**
	Compressor service valves or liquid line shutoff valve partially closed	Open valves completely
	Frost on coil	**Section 6.10**
	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 7.6**
	Heat relay defective	Check
	Heater termination thermostat open	
Unit will not heat or has insufficient heat	Heater(s) defective	**Section 7.6**
	Heater contactor or coil defective	Replace
	Evaporator fan motor(s) defective or rotating backwards	**Section 7.6**
	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	
6.6 Unit will not Defrost Properly		
Will not initiate defrost automatically	Defrost timer malfunction (Cd27)	**Link**
	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 7.6**
Frequent defrost	Load is wet	Normal
6.7 Abnormal Pressures		
High discharge pressure	Condenser coil dirty	**Section 7.3**
	Condenser fan rotating backwards	**Section 7.3**
	Condenser fan inoperative	**Section 7.3**
	Refrigerant overcharge or non-condensibles	
	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 7.5**
	Refrigerant charge low	
	Evaporator air flow not existent or air flow restricted	**Section 7.6**
	Frost on evaporator coil excessive	**Section 6.6**
	Evaporator fan(s) rotating backwards	**Section 7.6**
	Electronic Expansion Valve (EEV) control malfunction	Replace
Suction and discharge pressures tend to equalize when unit is operating	Compressor operating in reverse	**Section 6.12**
	Compressor cycling / stopped	Check
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 6.12**
	Mounting bolts loose or resilient mounts worn	Tighten / Replace
	Upper mounting loose	
	Slugging loose	
Condenser Fan	Bent, loose or striking venturi	Check
	Motor bearings worn	**Section 7.3**
	Motor shaft bent	**Section 7.3**
Evaporator Fan	Bent, loose or striking venturi	Check
	Motor bearings worn	**Section 7.6**
	Motor shaft bent	**Section 7.6**

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 7.10**
	Wiring defective	Check
	Refrigerant charge low	
6.10 No Evaporator Air Flow or Restricted Air Flow		
Evaporator coil blocked	Coil has frost build-up	**Section 6.6**
	Coil dirty	**Section 7.6**
No or partial evaporator air flow	Evaporator fan motor internal protector open	**Section 7.6**
	Evaporator fan motor(s) defective	**Section 7.6**
	Evaporator fan(s) loose or defective	**Section 7.6**
	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 7.5**
	Refrigerant charge low	
	Evaporator air flow not existent or air flow restricted	**Section 7.6**
	Evaporator coil excessive frost build-up	**Section 7.6**
	Evaporator fan(s) rotating backwards	**Section 7.6**
	Electronic Expansion Valve (EEV) control malfunction	**Section 7.7**
	Sensor loose or insufficiently clamped	Replace
High suction pressure with low superheat	Valve contains foreign material	**Section 7.7**
	Suction Pressure Transducer (SPT) or Evaporator Pressure Transducer (EPT) failed	Replace
	Electronic Expansion Valve (EEV) control malfunction	**Section 7.7**
	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 7.7**
6.12 Compressor Operating in Reverse		
⚠ 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 within the VFD.	Check

Table 6–1 Troubleshooting Symptoms (Continued)

Condition	Possible Cause	Remedy / Reference
6.13 Abnormal Temperatures		
High discharge temperature	Condenser coil dirty	**Section 7.3**
	Condenser fan rotating backwards	**Section 7.3**
	Condenser fan inoperative	**Section 7.3**
	Refrigerant overcharge or non-condensibles	
	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 Expansion Valve (ECV) failed or plugged	Replace
	Sensor loose or insufficiently clamped	Replace
6.14 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

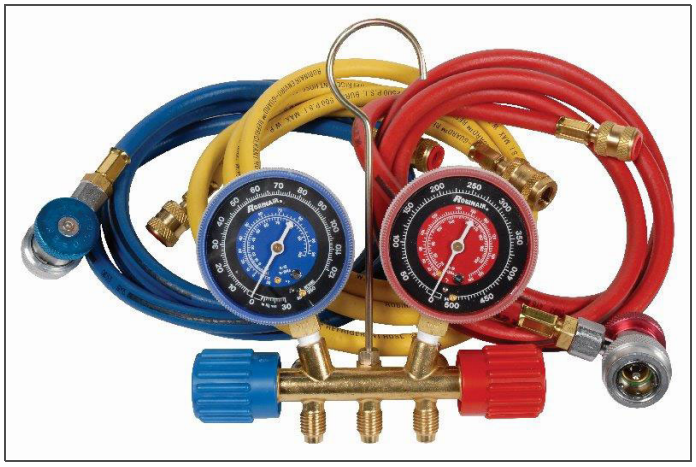
When charging the unit with R-513A refrigerant, charge as a liquid only. R-513A is an azeotrope blend containing R-1234yf and R-134a. Charging or topping off as a vapor will result in an incorrect mixture of blend in the system.

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, connects to a refrigeration system to determine system operating pressures, add refrigerant charge and to equalize or evacuate the system. The manifold gauge set with self-sealing hoses and couplers is required for service of the models covered within this manual. 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).

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.

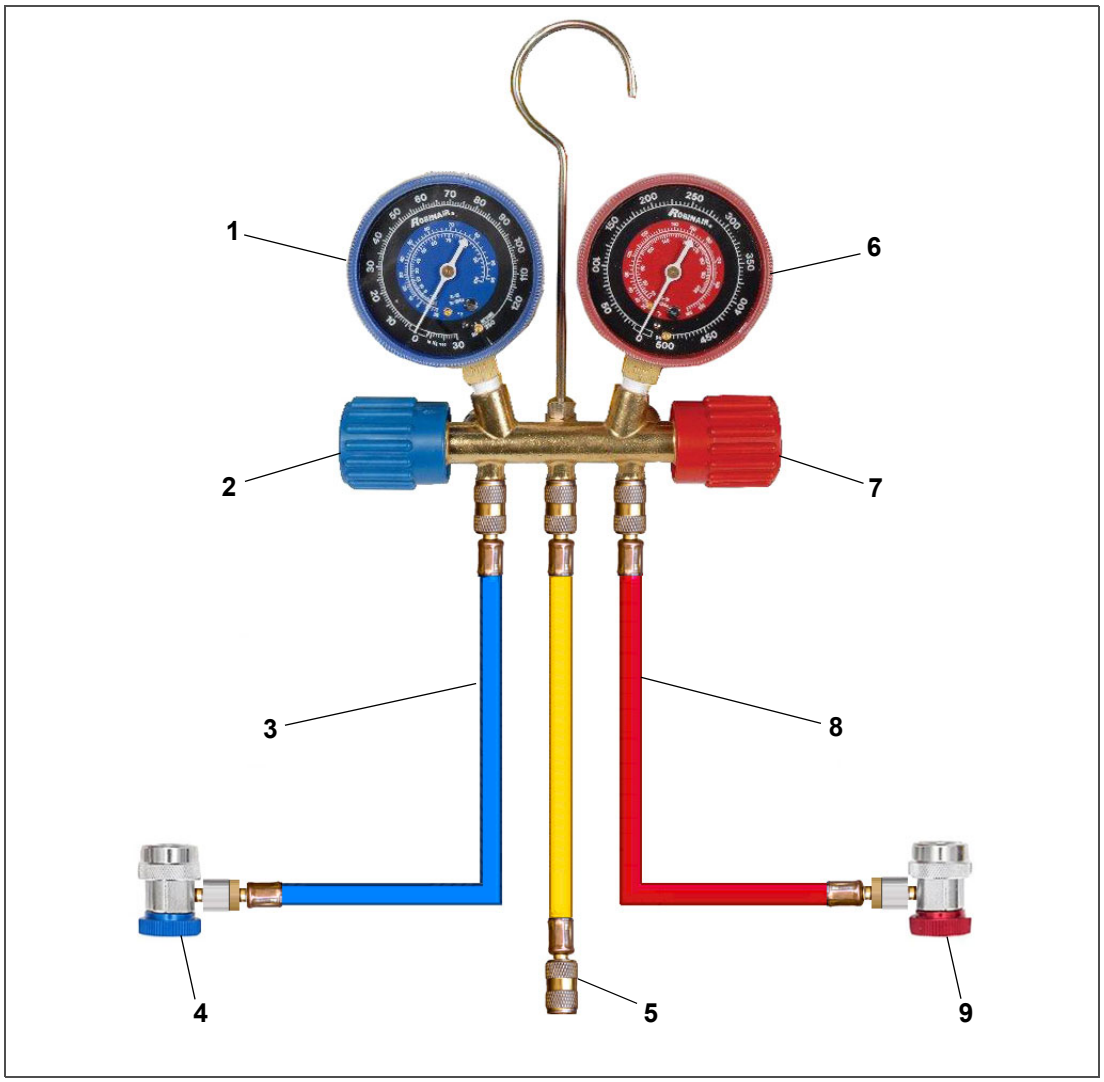
Once connected, the following procedures can be performed:

- 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. Refer to **Figure 7.2** for reference.

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 to use.

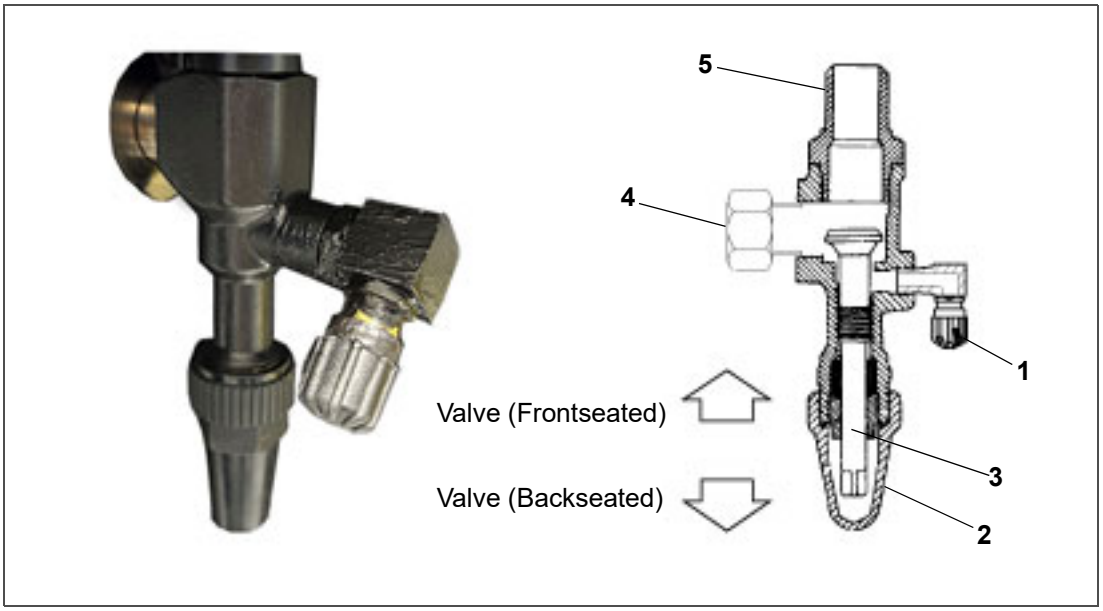
7.1.3 Service Connections

There are three service valves on the unit for connecting to the manifold gauge set and performing refrigerant service: compressor suction valve, 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 3.4.1** for compressor suction and discharge valve.

See **Figure 3.4.2** for liquid line (king) valve.

Figure 7.3 Service Valve



1) Access Valve
2) Stem Cap
3) 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.

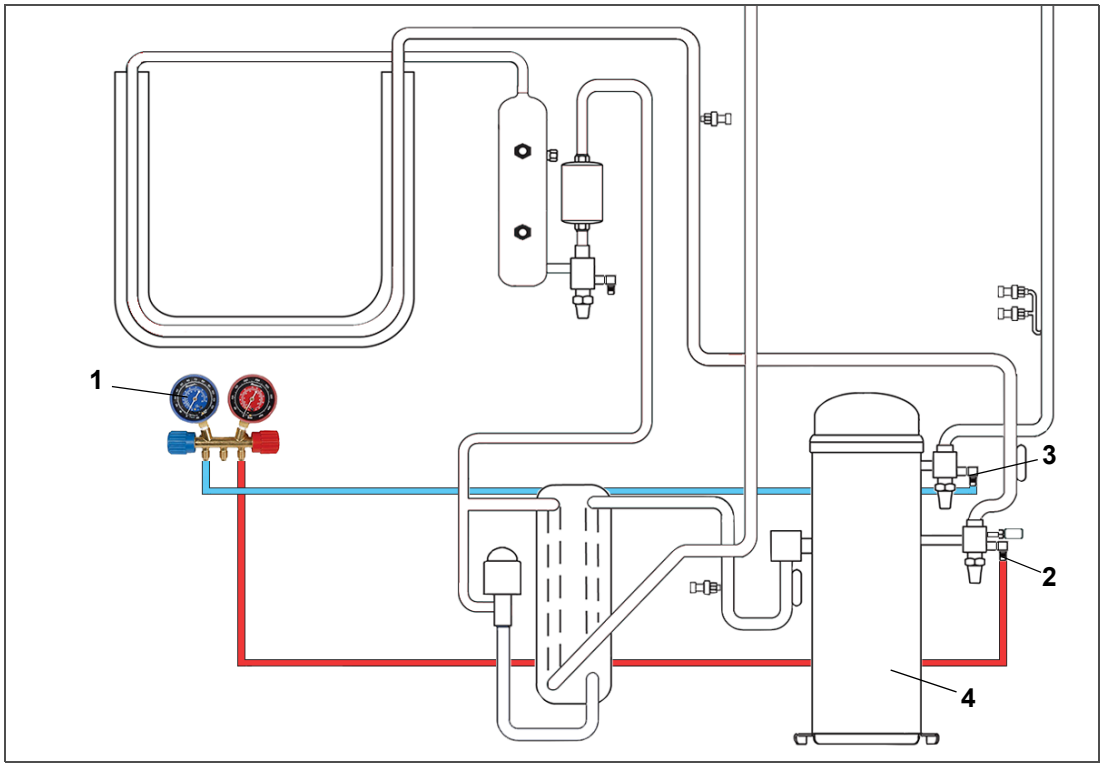
For the procedure for adding a full refrigerant charge, the manifold gauge set connects to the suction service valve (blue hose), liquid line service valve (red hose) and refrigerant cylinder (yellow hose).

- See **Figure 7.6** for illustration.

For the procedure to evacuate and dehydrate the system, 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 and Checking Charge



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

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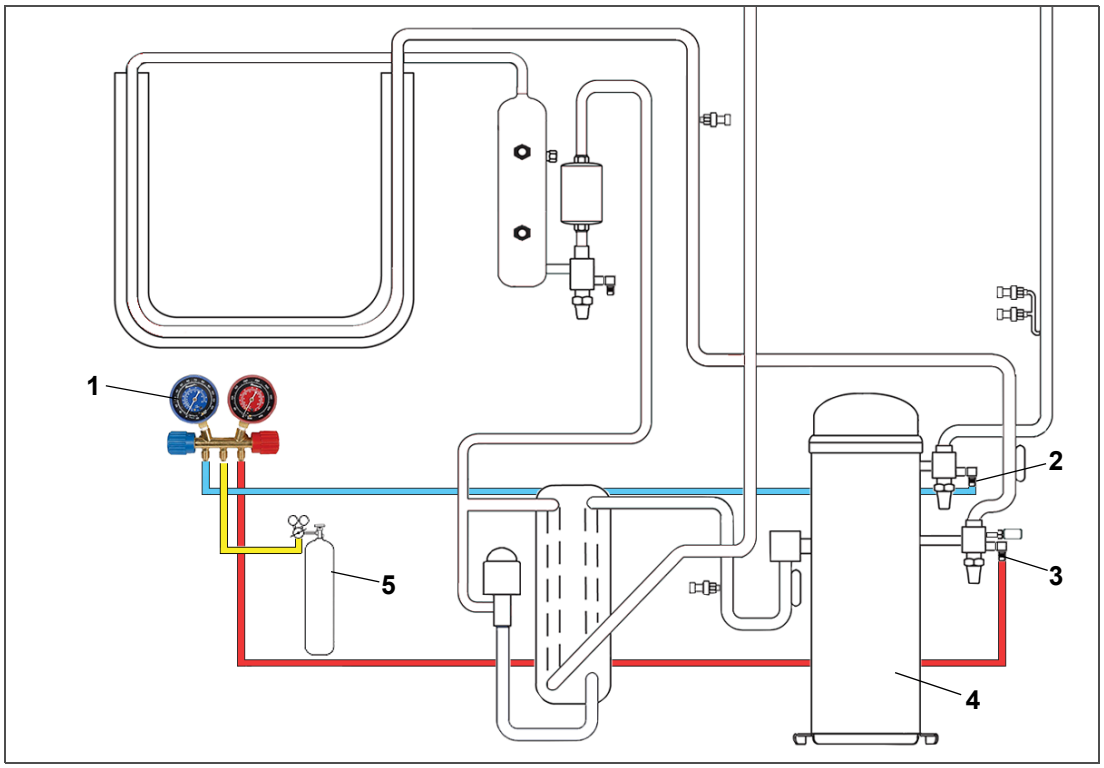
Figure 7.5 Connection for Adding a Partial Charge



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

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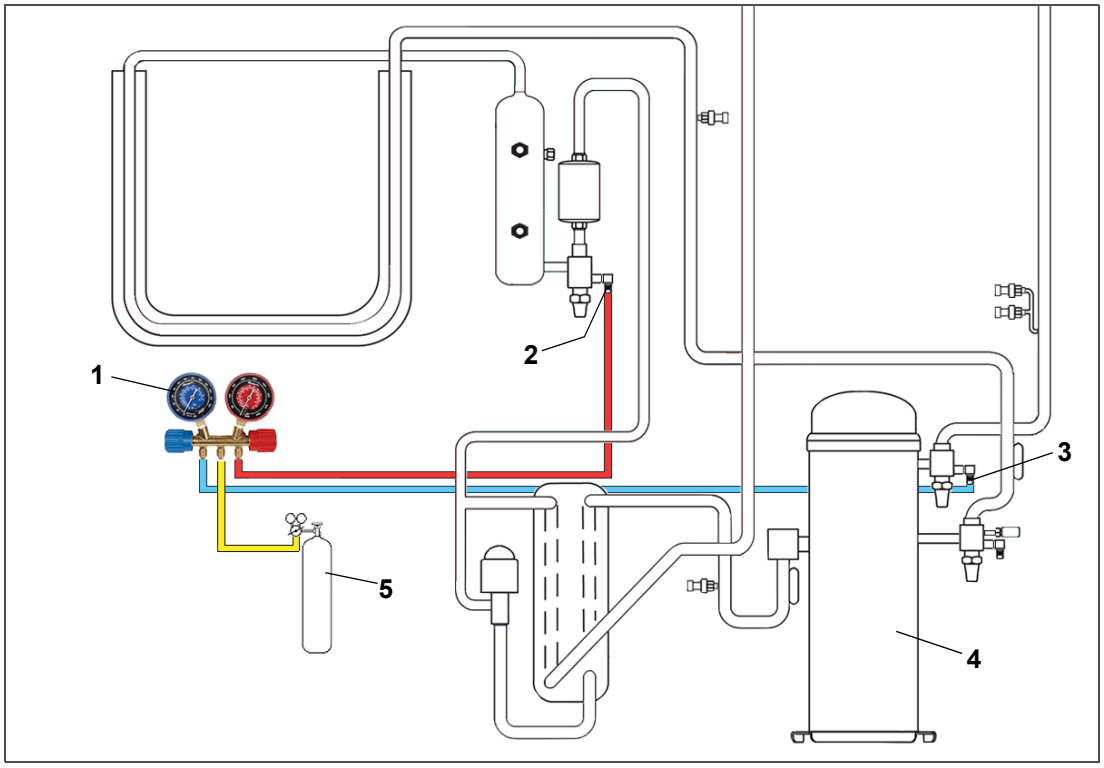
Figure 7.6 Connection for Adding a Full Charge (Liquid)



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

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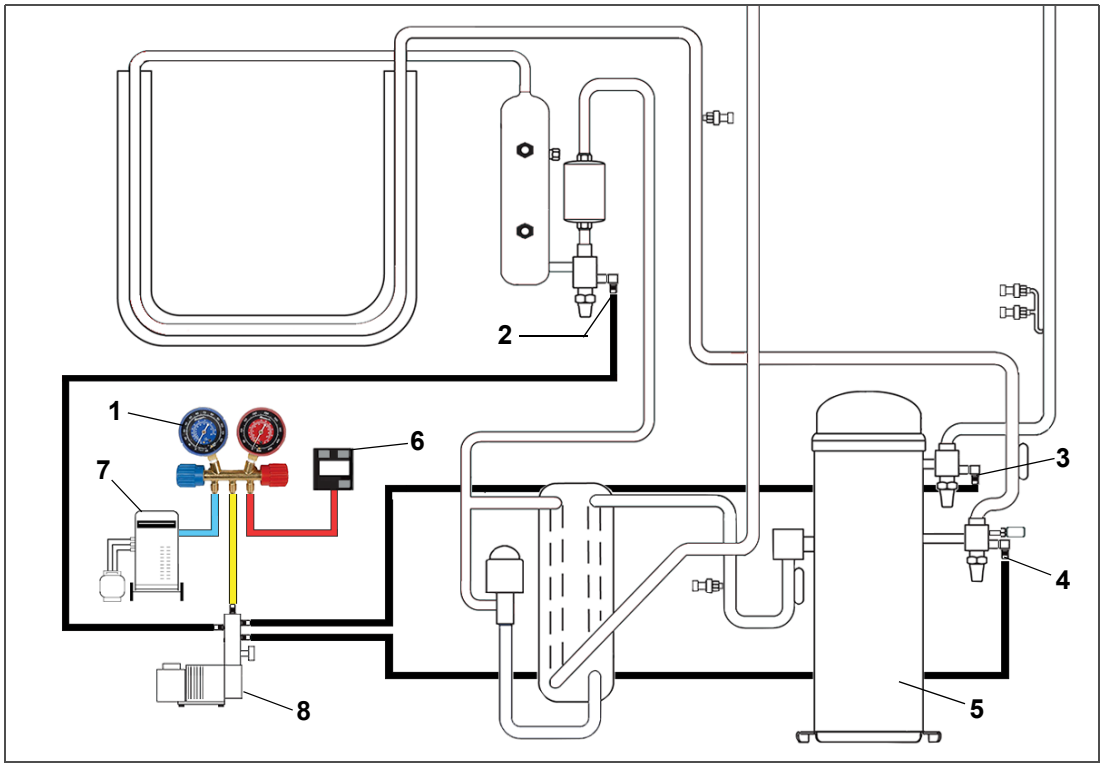
Figure 7.7 Connection for Evacuation and Dehydration



1) Manifold Gauge Set
2) Liquid Line Service Valve
3) Discharge Service Valve
4) Suction Service Valve
5) Compressor
6) Vacuum 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 gauge set hand valves.
6. Remove 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. To read 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. To read 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 Refrigerant Charge

⚠ WARNING

EXPLOSION HAZARD: Failure to follow this WARNING can result in death, serious personal injury and / or property damage. Never use air or gas mixtures containing oxygen (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.

7.1.6.1 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). Let the unit stabilize. Then set the controller unit setpoint to -25°C (-13°F) and immediately check the fluid level.

   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, see **Section 7.1.6.2** and **Section 7.1.6.3** to add or remove refrigerant as required.

7.1.6.2 Adding Refrigerant to System - Full Charge

1. Evacuate the unit and leave in a deep vacuum. See **Section 7.1.8.2**.
2. Place the refrigerant cylinder on a scale. Connect the manifold gauge set to the suction service valve, liquid line service valve and refrigerant cylinder. Purge the charging line at the liquid line service valve and then note the weight of the cylinder and refrigerant.

   See **Section 7.1.4.1** for procedure to connect to valves. See **Figure 7.6** for connection diagram.

3. Open the liquid valve on the cylinder. Open the liquid line valve halfway and allow liquid refrigerant to flow into the unit until the correct weight of refrigerant has been added as indicated by scales

   Charge amounts are found on in **Section 3.9** and also on the unit nameplate, see **Figure 2.1**.

4. It may be necessary to finish charging the unit through the suction service valve in gas form, due to pressure rise in the high side of the system.
5. Backseat the liquid line service valve to close off the gauge port. Close the liquid valve on the cylinder.
6. Start the unit in cooling mode. Run for approximately 10 minutes and check the refrigerant charge.
7. Ensure that the indicator in the receiver sight glass is at the correct level when fully charged.

7.1.6.3 Adding Refrigerant to System - Partial Charge

1. Examine the refrigerant system for any evidence of leaks, and repair as necessary. See **Section 7.1.7**.
2. Maintain the conditions outlined in the beginning of this section. See **Section 7.1.6.1**.
3. Fully backseat the suction service valve and remove the service port cap.
4. Connect the charging line between the suction service valve port and the refrigerant cylinder.
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 valve fully. If the compressor is operated in a vacuum, internal damage may result.

7.1.7 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 (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.

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 7.1.8**.
4. Charge the unit with refrigerant. See **Section 7.1.6**.

7.1.8 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.

7.1.8.1 Preparation

1. Make necessary repairs to the unit and perform a refrigerant leak check to the system. See **Section 7.1.7**.
2. 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.

   NOTE: 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.

7.1.8.2 Evacuating and Dehydrating - Complete System

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

   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 7.7** for connection diagram.

2. 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.
3. Test the evacuation setup for leaks by backseating the unit service valves and drawing a deep vacuum with the vacuum pump and gauge valves open. Shut off the pump and check to see if the vacuum holds. Repair leaks if necessary.
4. Midseat the refrigerant system service valves.
5. Open the vacuum pump and electronic vacuum gauge valves, if they are not already open. Start the vacuum pump 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.
6. 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.
7. If refrigerant was used, remove using a refrigerant recovery system. If nitrogen was used, relieve the pressure.
8. Repeat steps 5 and 6 one time.
9. Remove the copper tubing and change the filter drier. Evacuate unit to 500 microns. Close the electronic vacuum gauge and vacuum pump valves. Shut off the vacuum pump. Wait five minutes to see if vacuum holds. This procedure checks for residual moisture and/or leaks.
10. With a vacuum still in the unit, the refrigerant charge may be drawn into the system from a refrigerant container on weight scales.

7.1.8.3 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.

7.1.9 Converting Refrigerant to R-513A

The OptimaLINE compressor, for models 701-001 to 099, is capable of being field converted to R-513A refrigerant at a later date as requested by the unit owner.

Conversion from R-134a to R-513A:

To convert, purchase the R-513A Service Kit, part number 76-66719-00. This kit comes with complete instructions for conversion. Contact a Carrier Field Service engineer if more assistance is needed.

7.2 Compressor

⚠ WARNING

Make sure the start/stop switch is OFF, unit circuit breaker (CB-1) is OFF and the power plug disconnected before servicing unit components or moving parts. Follow local lockout / tagout procedures for working on equipment.

⚠ WARNING

The compressor can run at hot surface temperatures. A compressor shield is in place to prevent contact with the compressor.

⚠ WARNING

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

⚠ CAUTION

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

⚠ CAUTION

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 Replacing the Compressor

The compressor is a Samsung variable speed scroll compressor with rotalock connections for suction and discharge ports and the economizer port.

NOTE: DO NOT add any oil to the replacement compressor, as it is shipped with a full oil charge.

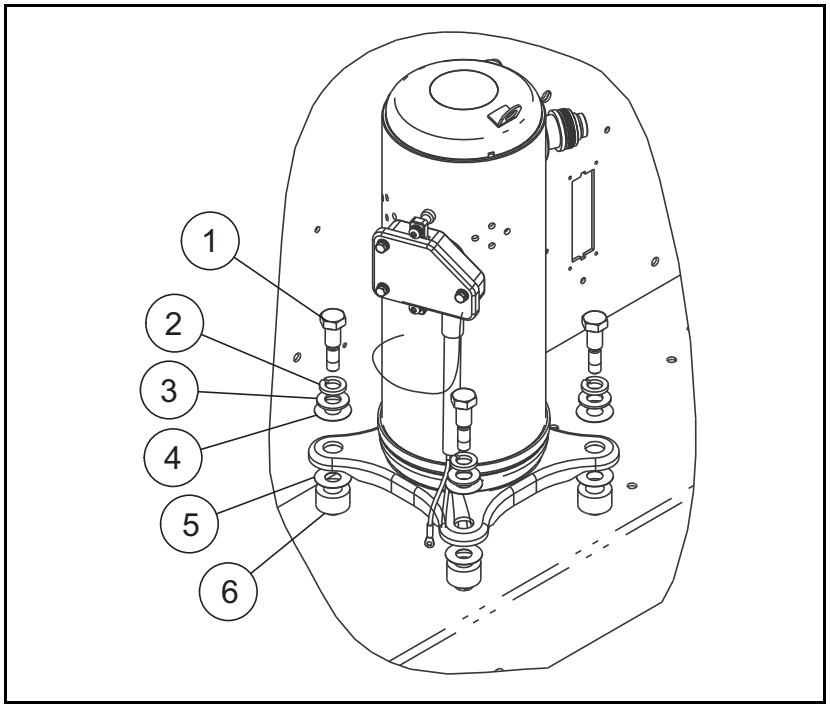
1. Turn the unit On “I” a the Start-Stop switch (ST) and run in full cool mode for 10 minutes.
2. Turn the unit Off “0” at the Start-Stop switch (ST), turn the circuit breaker (CB-1) Off and disconnect unit power.
3. Remove all remaining refrigerant from the compressor using a refrigerant recovery system. See **Figure 7.7** for connection diagram.
4. Remove the compressor guard grille.
5. Open the variable frequency drive (VFD) service cover to gain access to the compressor wiring.
6. Disconnect the compressor wires on the VFD terminals making a note of the exact wire positions as the replacement compressor will need to be wired using the same connections.
7. Remove the compressor power cable from the conduit connection on the VFD, leaving the power cable attached to the compressor.
8. Remove the Rotalock fittings from the suction service and discharge service connections, and uncouple the economizer line from the compressor.
9. Remove and save the compressor mounting hardware, including the bushings.
10. Remove (slide out) the old compressor from the unit.

11. Wire tie the power cable to the compressor.
12. Slide the new compressor into the unit.

    NOTE: DO NOT add any oil to the replacement compressor, as it is shipped with a full oil charge.

13. Reusing the hardware from the old compressor, place the washers on each side of the bushing, and the new Mylar washer on the bottom of it as shown in **Figure 7.8**. Install the four base mounting bolts loosely.

Figure 7.8 Compressor Base Mounting Hardware



1) Bolt, Shoulder
2) Washer, Lock
3) Washer, Plain
4) Washer
5) Washer
6) Bushing

14. Place the new Teflon seals at the compressor suction, discharge and economizer connections. Hand tighten all three connections.
15. Torque the four base-mounting screws to 58 Nm (43 ft-lbs.).
16. Torque the compressor ports / connections.

Service Valve / Connection	Torque Value
Suction Rotalock	143 to 161 Nm (106-119 ft-lbs.)
Discharge Rotalock	108.5 to 135.5 Nm (80-100 ft-lbs.)
Economizer Connection	108.5 to 135.5 Nm (80-100 ft-lbs.)

17. Re-connect the power cable from the compressor to the VFD.
18. Replace the filter drier. See **Section 7.5.2**.
19. Perform a leak check of the system. See **Section 7.1.7**
20. Evacuate the system to 1000 microns. if the unit was pumped down before the replaced compressor was removed. Otherwise, evacuate the complete unit and charge it with a full charge of refrigerant, as specified on the unit nameplate.

    See **Section 7.1.8** for evacuation procedure.

    See **Section 7.1.6.2** for adding refrigerant charge procedure.

21. Backseat all service valves, connect power to the unit and run for at least 20 minutes.

7.2.2 Replacing the Variable Frequency Drive (VFD)

The compressor variable speed synchronous motor is driven by a variable frequency drive (VFD), shown in **Figure 7.9**.

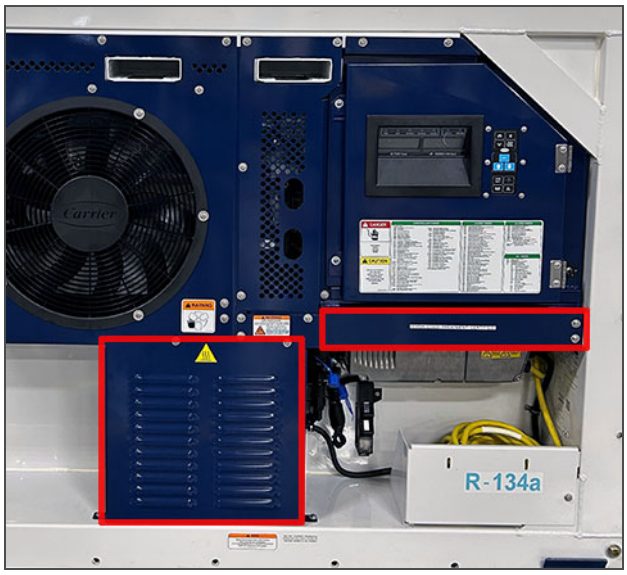
NOTE: When a VFD fails, it can not be bypassed and therefore the compressor will not run.

Figure 7.9 Variable Frequency Drive (VFD)

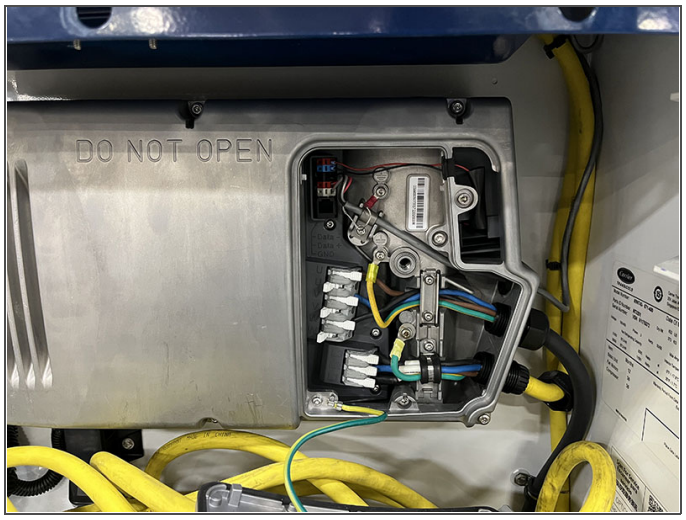
⚠ CAUTION

Electrical Hazard. After disconnecting the power supply, wait seven minutes before servicing the Variable Frequency Drive (VFD) to allow capacitors to completely discharge.

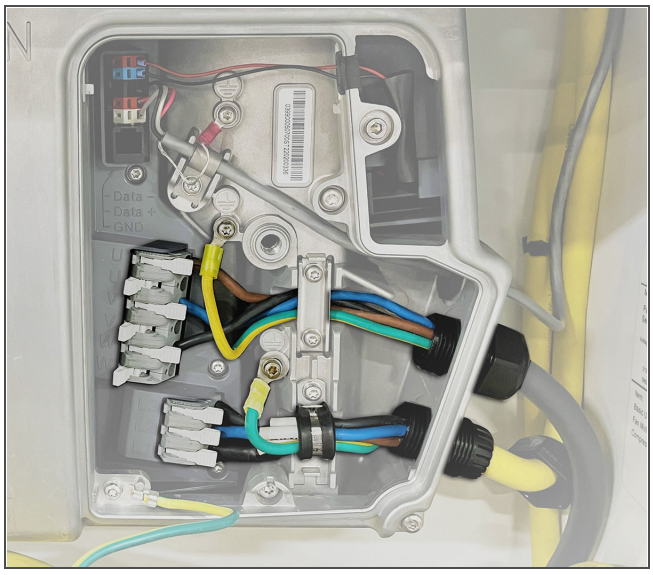
1. Turn the unit start-stop switch (ST) and unit circuit breaker (CB-1) off and disconnect power to the unit.
2. Remove the bracket / guard below the control box for better access to the VFD. Save the mounting hardware. **Note**: the compressor guard may also need to be removed to gain proper access.



3. Open the VFD service cover to gain access to the wiring.



4. Release both sets of wires (compressor power cable and line power cable) from the VFD terminals. Make a note of the exact wire position as the same connections must be done on the replacement VFD.



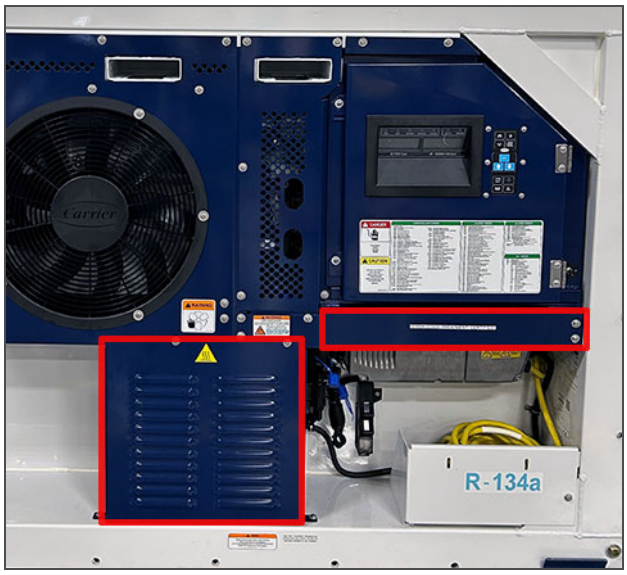
5. Remove both conduit connectors and cable assemblies from the VFD.
6. Carefully remove the VFD from the unit back wall by removing and saving the four mounting bolts.
7. Install and wire the new VFD by reversing the above steps

7.2.3 Replacing the Variable Frequency Drive (VFD) Fan

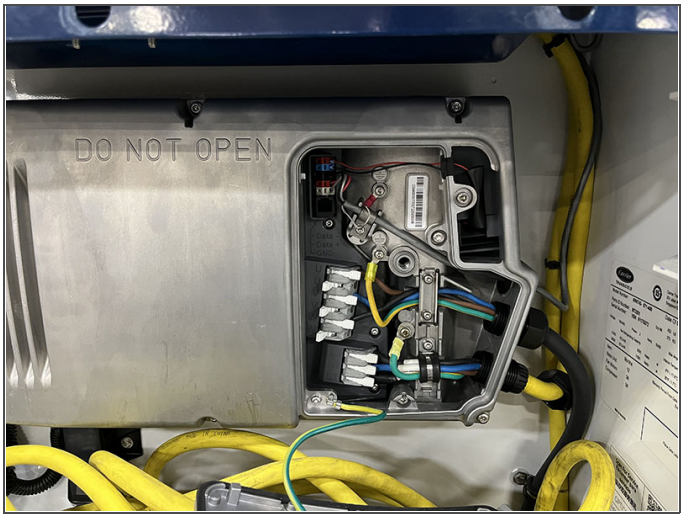
The procedure to replace the VFD fan is detailed below. This procedure is also included in document # 98-02763-00 which is included with the VFD fan replacement service kit, part # 76-00932-00.

1. Turn the unit start-stop switch (ST) and unit circuit breaker (CB-1) off and disconnect power to the unit.

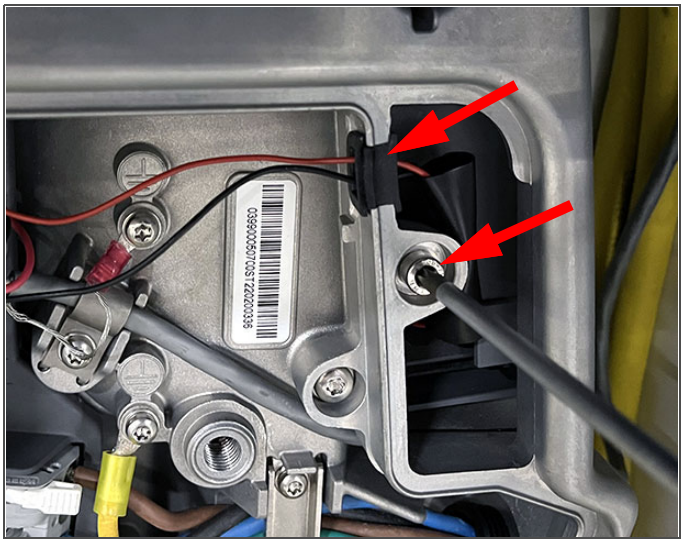
2. Remove the bracket / guard below the control box for better access to the VFD. Save the mounting hardware. **Note**: the compressor guard may also need to be removed to gain proper access.



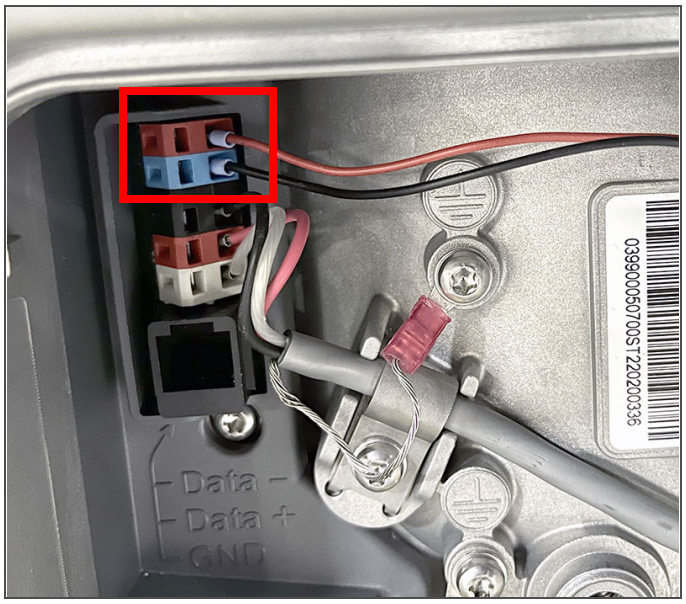
3. Open the VFD service cover to gain access to the fan assembly.



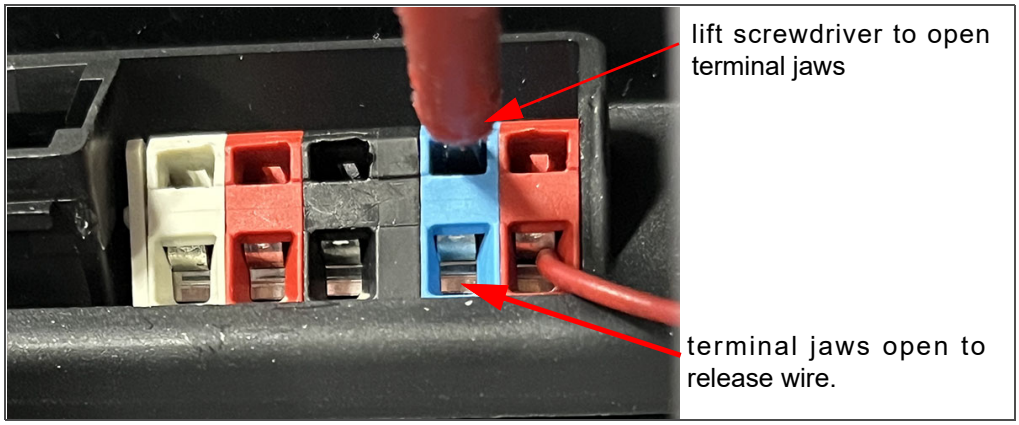
4. Remove and save the fan bolt by using a Torx T25 screwdriver. Then, loosen and pull out the fan wire grommet.



5. Remove (pull out) the red and black fan wires from the terminal.

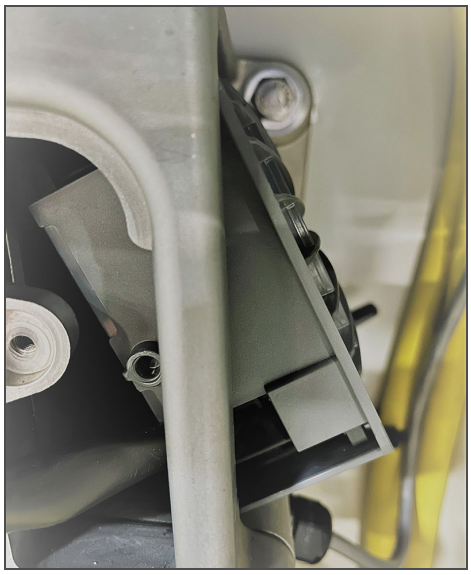


This is done by inserting a small flathead screwdriver in the terminal hole above the wire to be removed, followed by a gentle lifting the screwdriver until the terminal jaws open and the wire is free to be pulled out.



6. Pull up the fan lever lock, located in the bottom back corner.

7. Pull the lower end of the fan assembly radially out. Use a screwdriver to pull out the fan assembly if needed.



8. The replacement fan (part # 10-00560-31) comes with new wire grommet installed. Assemble the replacement VFD fan by reversing the order of the above steps:
   a) Secure the fan by tightening the torx bolt. Use a T25 screwdriver to tighten the bolt. See step 4 above.
   b) Verify that the fan wires (black and red) are properly routed and connected at the terminals (red wire in the red terminal and black wire in the blue terminal). See steps 5 and 6 above.
   c) Verify the new wire grommet is correctly secured before installing the VFD service cover. See step 4.
   d) Secure the bracket / guard removed in step 2 above using the same hardware.

7.2.4 Checking the High Pressure Switch

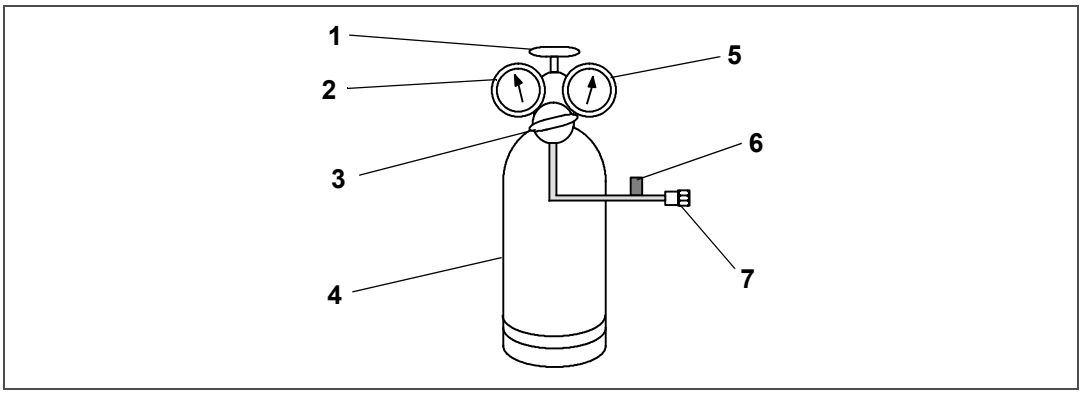
The high pressure switch (HPS) is not adjustable. It can be checked by connecting to a cylinder of dry nitrogen and checking when the switch opens and closes.

⚠ WARNING

Do not use a nitrogen cylinder without a pressure regulator.

1. Set the nitrogen pressure regulator at 26.4 kg/cm^2 (375 psig) with the bleed-off valve closed.
2. Close the valve on the cylinder and open the bleed-off valve.
3. 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 25 kg/cm^2 (350 psig). If a light is used, the light will go out. If an ohmmeter is used, the meter will indicate open circuit.
4. Slowly open the bleed-off valve to decrease the pressure. The switch should close at 18 kg/cm^2 (250 psig).
5. Remove the switch as outlined in **Section 7.2.5**.
6. Connect an ohmmeter or continuity light across the switch terminals. An ohmmeter will indicate no resistance. A continuity light will be illuminated if the switch closed after relieving compressor pressure.
7. Connect a hose to a cylinder of dry nitrogen. See **Figure 7.10**.

Figure 7.10 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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7.2.5 Replacing the High Pressure Switch

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

7.3 Condenser Coil and Fan

⚠ WARNING

Make sure the start/stop switch is OFF, unit circuit breaker (CB-1) is OFF and the power plug disconnected before servicing unit components or moving parts. Follow local lockout / tagout procedures for working on equipment.

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

7.3.1 Cleaning the Condenser Coil

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

1. Turn the unit start-stop switch (ST) and unit circuit breaker (CB-1) off and disconnect power to the unit.
2. Remove the condenser fan grille.
3. Starting from the top of the coil, use a water hose with a nozzle to wash the coil from the inside out.
4. Systematically wash across the inside top face of the coil until the water runs clean.
5. Wash down the center section and then through the bottom of the coil. Continue washing until the water runs clear.
6. After the coil is clean, rinse the condenser fan to remove any dirt build up from the blades.
7. Replace the condenser fan grille ensuring that it is centered around the fan.

7.3.2 Removing the Condenser Coil

1. Using a refrigerant reclaim system remove the refrigerant charge.
2. Turn the unit start-stop switch (ST) and unit circuit breaker (CB-1) off and disconnect power to the unit.
3. Remove the condenser fan grille. Retain all bolts and washers for reuse.
4. Remove the condenser fan.
5. Remove the infill panels to the left and right of the condenser fan shroud.
6. Remove the condenser fan shroud.
7. Unplug the condenser fan motor.
8. Remove and retain sufficient putty from around the motor wire harness to allow the harness to be slid back through the side support bracket.
9. 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.
10. Remove and retain sufficient putty from around the drain lines to allow the tubes to be slid back through the side support bracket.
11. Remove the filter drier.
12. Unbraze the inlet connection to the coil.
13. Remove the cushion clamps securing the liquid line to the top and bottom receiver brackets. Retain all clamps and securing hardware.
14. Place a support under the condenser coil before releasing the coil from the frame.
15. Remove the lower mounting bracket bolts from the inside of the coil.
16. Remove the top mounting bracket bolts and grille extension mount from inside the coil.
17. Remove the side support bracket mounting bolts.
18. Slide the condenser assembly with the receiver out of the unit.

7.3.3 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.

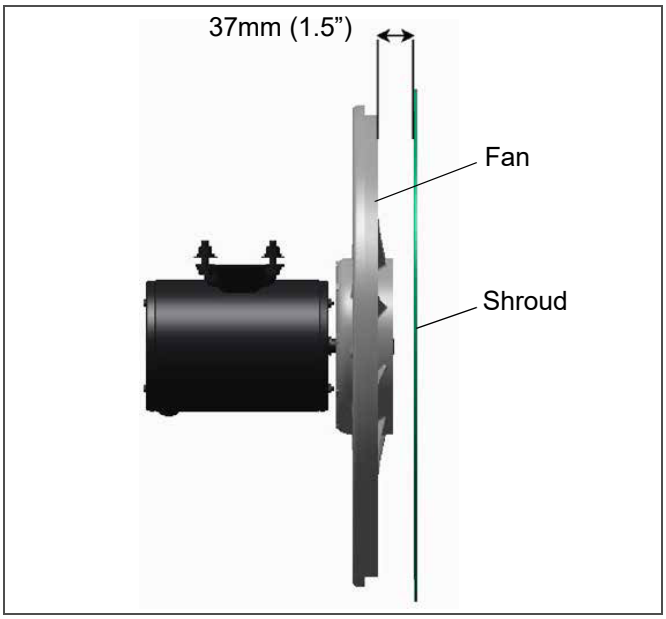
7.3.4 Installing the Condenser Coil

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 7.1.7**.
10. Evacuate the entire unit. See **Section 7.1.8**.
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 7.11**.

Figure 7.11 Condenser Fan Position



19. Use Loctite “H” on the fan set screws, and tighten.
20. Refit left and right infill panels.
21. Refit the condenser fan grille, ensuring the grille is properly centered around the condenser fan.
22. Evacuate the entire unit. See **Section 7.1.8**.
23. Recharge the unit with the charge shown on the unit serial plate. See **Section 7.1.6**. It is important for proper unit operation that the charge is weighed into the unit.

7.3.5 Replacing the Condenser Fan Motor

1. Turn the unit start-stop switch (ST) and unit circuit breaker (CB-1) off and disconnect power to the unit.
2. Remove the condenser fan grille. Retain all bolts and washers for reuse.
3. Remove the condenser fan by loosening the two set screws.
4. 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.

5. Note the number of shims on each side of the motor. The same configuration is required to refit the new motor.
6. Remove the fan motor mounting hardware and remove the motor.
7. Loosely mount the new motor using new lock nuts.
8. Connect the fan motor wiring to the new fan motor.
9. Replace the shims in the same configuration as they were removed.
10. Tighten the fan motor mounting bolts to properly secure the motor.
11. To make sure that the motor is aligned properly, slide the condenser fan onto the motor shaft reversed but do not secure.
12. 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.
13. Remove the condenser fan, and connect the fan motor wiring to the fan motor.
14. 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 7.11**.
15. Use Loctite “H” on the fan set screws, and tighten.
16. Refit the left and right infill panels.
17. Refit the condenser fan grille, ensuring the grille is properly centered around condenser fan.

7.4 Water-Cooled Condenser Cleaning

The water-cooled condenser (WCC) 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. The condenser coil condition can be checked by comparing the leaving water temperature with the actual condensing temperature. A larger than normal difference between these two values, coupled with a small difference in temperature of entering and exiting condensing water, is an indication of a dirty coil. If the WCC 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.

7.4.1 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.

7.4.2 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.

7.5 Filter Drier

⚠ WARNING

Make sure the start/stop switch is OFF, unit circuit breaker (CB-1) is OFF and the power plug disconnected before servicing unit components or moving parts. Follow local lockout / tagout procedures for working on equipment.

The filter drier, as shown in **Figure 7.12**, should be replaced any time the system is opened for service.

Figure 7.12 Filter Drier

7.5.1 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.

7.5.2 Replacing the Filter Drier

1. Evacuate the unit. See **Section 7.1.8**.
2. Replace the filter drier. Torque to 43-47 Nm (32-35 ft-lbs).
3. Recharge the unit. See **Section 7.1.6**.
4. After unit is in operation, inspect for moisture in the system and check charge.

7.6 Evaporator Coil, Heaters and Fan

⚠ WARNING

Make sure the start/stop switch is OFF, unit circuit breaker (CB-1) is OFF and the power plug disconnected before servicing unit components or moving parts. Follow local lockout / tagout procedures for working on equipment.

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.

7.6.1 Evaporator Section Cleaning

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 evaporator stator and fan deck.

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

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

Typically any aluminum oxide that becomes detached from evaporator fan stators will be blown into the wet evaporator coil where it will be caught and then flushed out of the unit during routine defrost cycles.

However, it is still highly recommended that after carrying cargo subject to fumigation procedures, that the inside of the unit be thoroughly cleansed prior to reuse.

Carrier Transicold has identified a fully biodegradable and environmentally safe alkaline cleaning agent (Tri-Pow'r® HD) for the unit. This will assist in helping to remove the corrosive fumigation chemicals and dislodging of the corrosive elements. This cleaner is available from the Carrier Transicold Performance Parts Group (PPG) and can be ordered through any of the PPG locations; Part Number NU4371-88.

As a general safety precaution, before using this product, refer to and retain the Material Safety Data (MSDS) sheet.

7.6.1.1 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.

7.6.1.2 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.

7.6.2 Replacing the Evaporator Coil

1. Pump down the unit.

⚠ WARNING

Make sure the start/stop switch is OFF, unit circuit breaker (CB-1) is OFF and the power plug disconnected before servicing unit components or moving parts. Follow local lockout / tagout procedures for working on equipment.

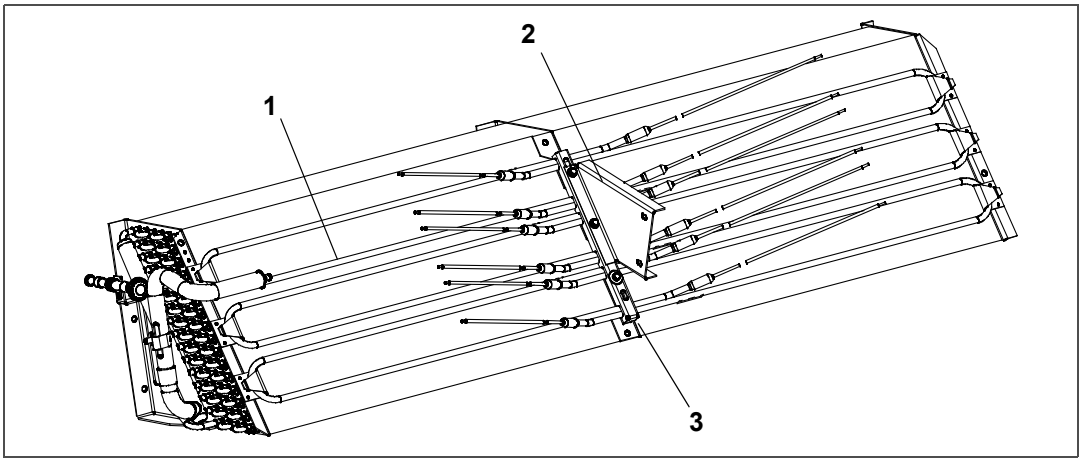
2. With power OFF and power plug removed, remove the screws securing the panel covering the evaporator section (upper panel).

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 7.10**.
7. Remove middle coil support.
8. After defective coil is removed from unit, remove defrost heaters and install on replacement coil.
9. Install coil assembly by reversing above steps.
10. Leak check connections. Evacuate and add refrigerant charge.

7.6.3 Testing the Evaporator Heaters

The heaters, see **Figure 7.13**, 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 7.13 Heater Arrangement



1) Heater Element
2) Bracket
3) Retainer

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

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

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

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

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

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

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

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

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

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

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

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

3. Identify the faulty heater(s) for units with a heater access panel:
   a) Open the access panel and cut out all wire splices to isolate all heaters inside of the unit.
   b) Repeat the Megger test on each individual heater. Connect the ground clip to the outer metal sheath of the heater and the test clip to one of the wires from the same heater.
   c) Replace any heater where the readings are < 1 Mohm.
4. Identify the faulty heater(s) for units without a heater access panel:
   a) Remove all six connections from the Heater (HR) contactor load side, which splits the six heaters into three separate pairs.
   b) Identify the following three wires: DHTL, DHML, DHBL. There is one from each load connection.
   c) Repeat the Megger test on each pair of heaters to identify the faulty heater pair. Connect the ground clip from the insulation tester to a fixed ground point on the unit, preferably the ground plate in the control box. Connect the test clip to one of the wires stated above.
   d) Test all three wires and replace any heater pair that has readings < 1 Mohm.
5. If the unit is loaded, and the heater can not be immediately replaced, perform the following steps:
   a) Identify the wire at the opposite end of the faulty heater pair: DHTL - DHTR, DHML - DHMR, DHBL - DHBR.
   b) Isolate the two wires.
   c) Reconnect the remaining good wiring pairs to their original connections.
   d) The unit will fail the PTI test P1-0 at the next pre-trip inspection. Repair action can be taken at that time.
6. If the unit is empty, replace the faulty heater:

⚠ WARNING

Make sure the start/stop switch is OFF, unit circuit breaker (CB-1) is OFF and the power plug disconnected before servicing unit components or moving parts. Follow local lockout / tagout procedures for working on equipment.

   a) With the heater pair identified, remove the upper back panel inside the container.
   b) Identify the center point connection for the heater pair (black wiring from heaters) either against the unit back wall or in the wiring loom.
   c) Cut the splice to separate the two heaters.
   d) Carry out a Megger check on the two heaters in the same way as for units with heater panel. Replace any heater where the Megger readings are < 1 Mohms.

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

   e) Remove the hold-down clamp securing the heater(s) to the coil.
   f) Verify that the heaters are not hot before handling them.
   g) Lift the bent end of the heater (with the opposite end down and away from the coil). Move the heater to the side enough to clear the heater end support and remove.
   h) To install heater, reverse steps.
   i) Reconnect all wiring using new splices and heat shrink where needed. The heat shrink MUST have a 'melt-able' liner to ensure that the connections are properly sealed when shrunk. This can be seen as a 'Ring' of melt liner pushed from under the heat shrink at each end of the shrink tube.

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

7.6.4 Replacing the Evaporator Fan Assembly

⚠ WARNING

Make sure the start/stop switch is OFF, unit circuit breaker (CB-1) is OFF and the power plug disconnected before servicing unit components or moving parts. Follow local lockout / tagout procedures for working on equipment.

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

7.6.5 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.
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.

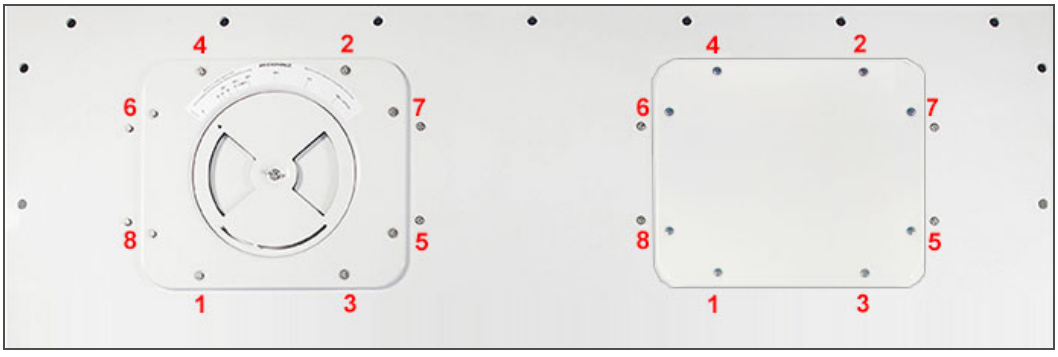
7.6.6 Assembling the Evaporator Fan Assembly

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

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

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

Figure 7.14 Access Panel Torque Pattern



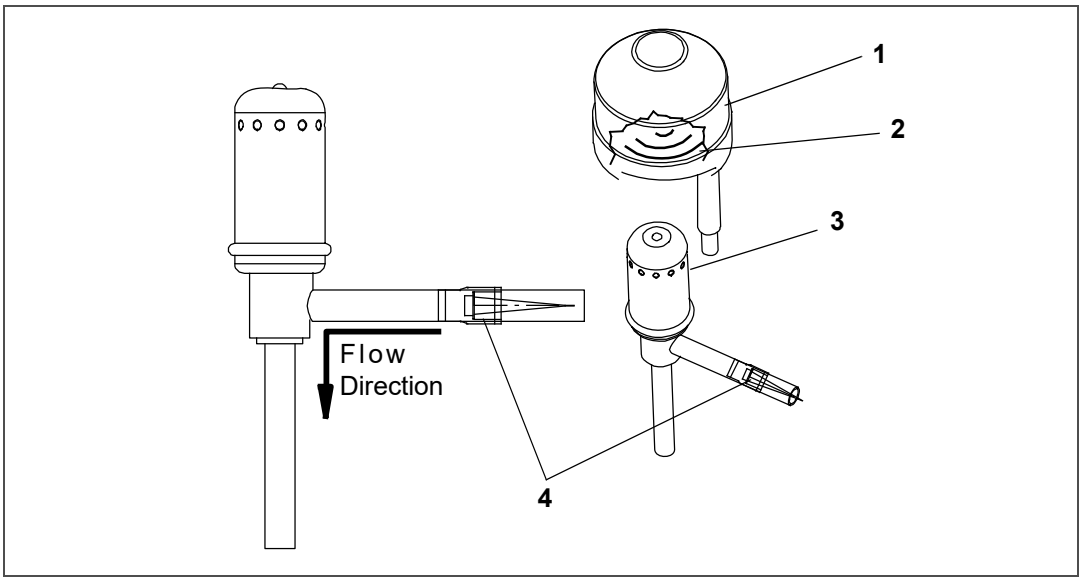
7.7 Expansion Valve (ECV / EEV)

⚠ WARNING

Make sure the start/stop switch is OFF, unit circuit breaker (CB-1) is OFF and the power plug disconnected before servicing unit components or moving parts. Follow local lockout / tagout procedures for working on equipment.

The expansion valve, as shown in **Figure 7.15**, is an automatic device that maintains required superheat of the refrigerant. Unless the valve is defective, it seldom requires any maintenance other than periodic inspection to ensure that the thermal bulb is tightly secured to the suction line and wrapped with insulating compound.

Figure 7.15 Expansion Valve (ECV / EEV)



1) Coil Boot
2) Coil
3) Expansion Valve
4) Strainer

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The Economizer Expansion Valve (ECV), as shown in **Figure 7.16**, maintains superheat of the refrigerant gas leaving at the point of bulb attachment, regardless of suction pressure.

Figure 7.16 Economizer Expansion Valve (ECV)

The Electronic Expansion Valve (EEV, as shown in **Figure 7.17**, maintains superheat of the refrigerant gas leaving the evaporator. The valve functions are: (a) automatic response of refrigerant flow to match the evaporator load and (b) prevention of liquid refrigerant entering the compressor.

Figure 7.17 Electronic Expansion Valve (EEV)

7.7.1 Removing an Expansion Valve (ECV or EEV)

1. Pump down the compressor.
2. Frontseat both suction and discharge valves.
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. Remove the valve. Alternatively, use a wet rag to keep the valve cool. Heat inlet and outlet connections to valve body and remove valve.
6. Clean the valve stem with mild cleaner, if necessary.

7.7.2 Installing an Expansion Valve (ECV or 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 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 7.5.2**.
4. Evacuate to 500 microns by placing the vacuum pump on the liquid line and suction service valve. See **Section 7.1.8**.
5. Open the liquid line service valve and check refrigerant level.
6. Check superheat.
7. Check unit operation by running a Pre-Trip inspection. See **Section 4.5**.

7.8 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.

7.8.1 Handling Modules

⚠ CAUTION

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

⚠ CAUTION

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

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

1. Obtain a grounding wrist strap (Carrier Transicold P/N 07-00304-00) and a static dissipation mat (Carrier Transicold P/N 07-00277-00). The wrist strap, when properly grounded, will dissipate any potential static buildup on the body. The dissipation mat will provide a static-free work surface on which to place and/or service the modules.
2. Disconnect and secure power to the unit.
3. Place strap on wrist and attach the ground end to any exposed unpainted metal area on the refrigeration unit frame (bolts, screws, etc.).
4. Carefully remove the module. Do not touch any of the electrical connections if possible. Place the module on the static mat.

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

7.8.2 Replacing the Controller

Removal:

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

Installation:

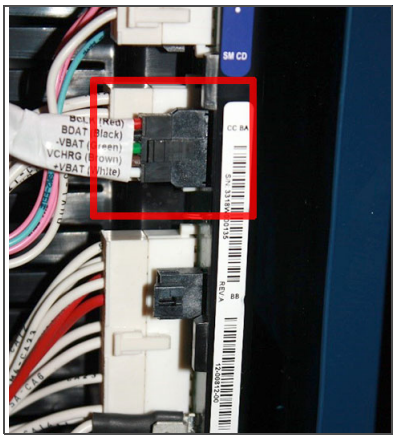
1. Install the module by reversing the removal steps.
2. Torque values for mounting screws, see **Figure 4.1**, are 0.23 mkg (20 inch-pounds). Torque value for the connectors is 0.12 mkg (10 inch-pounds).

7.8.3 Replacing the Battery

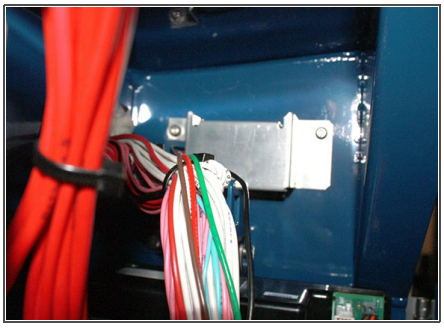
The Carrier rechargeable battery pack part # is 79-04262-01.

1. Turn unit power Off and disconnect the power supply.
2. Open the control box door and remove the high voltage shield (if installed).

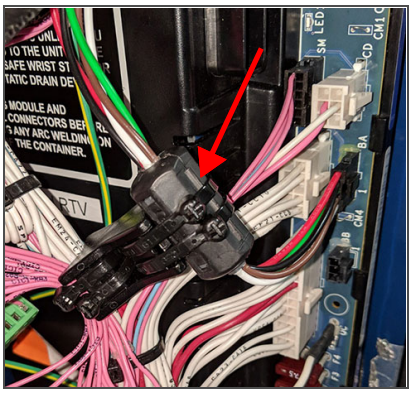
3. Disconnect the battery connection at the "BA" connector and carefully remove wire ties along the battery wires leading back to the battery pack.



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



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



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

7.8.4 AC Line Filter

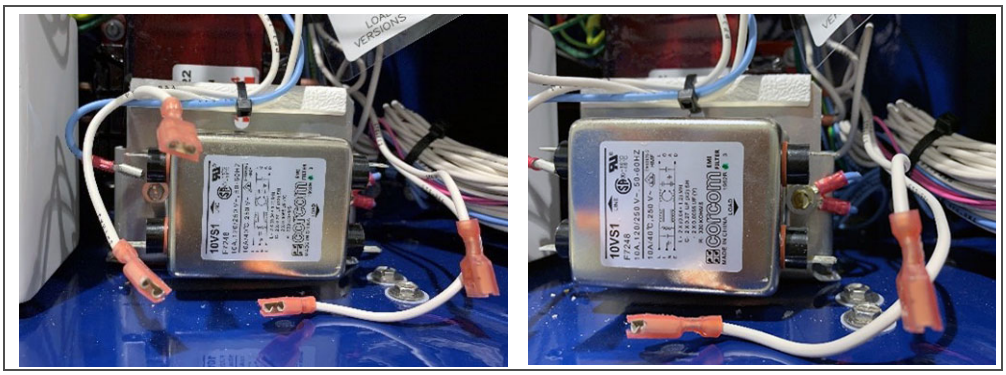
There is an AC Line Filter installed between the Control Transformer and the PW Connector on the ML5 controller. This filter reduces Electromagnetic Voltage Transients induced / coupled on to the 36 VAC Control Transformer secondary of the Transformer.

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.

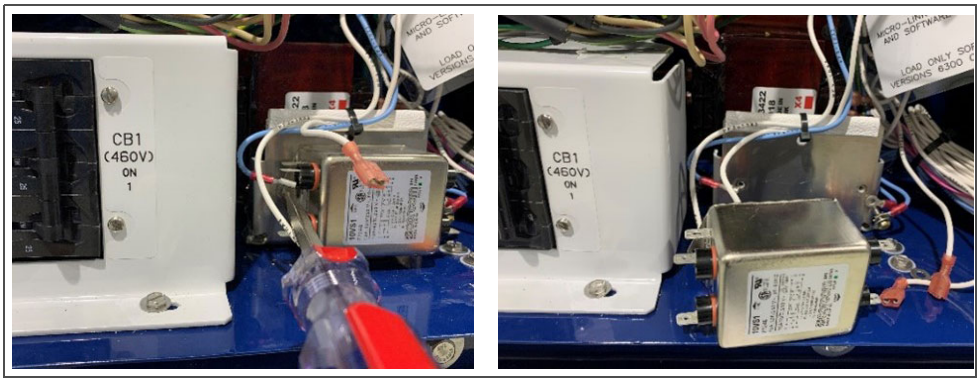
Apply power to the container, turn on the ST switch, and verify that 36 VDC is present across pins 1 and 3 on the AC Line Filter. Once input power is verified, check the power on the output of the filter on pins 2 and 4. Input and output voltages should match. If the control voltages do not match, or output power appears to be fluctuating, the filter capability of the power filter can be tested.

7.8.4.1 Testing the Filter

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.

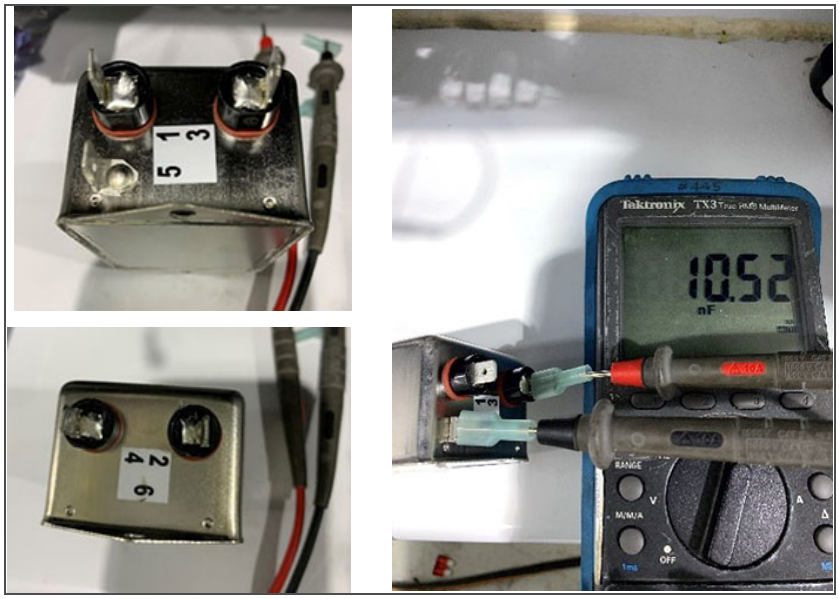


3. Remove the remaining mounting bolt on the left side (line input) and pull from the system control box.



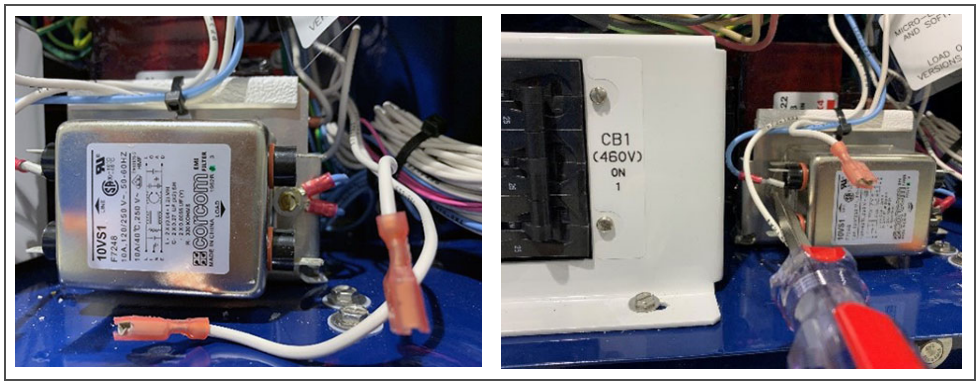
4. With the power filter removed, check for a capacitance reading of 0.54 uF +/-10% across pins 1 and 3. And then across pins 2-4.

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.

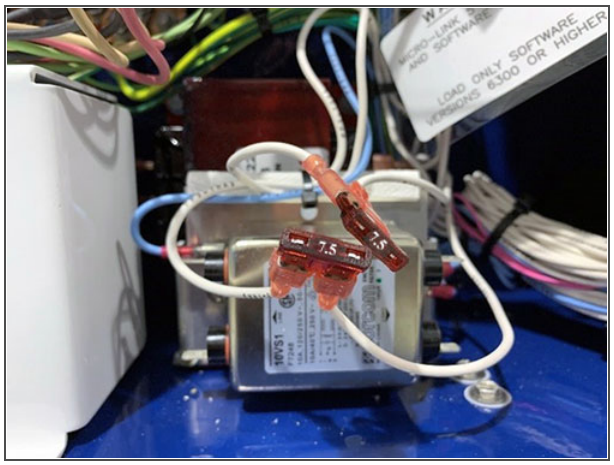


8. Connect wires to the power filter using the hot stamping on the wire harness and pin marking on the power filter.

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

7.8.4.2 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



7.9 Controller Programming Procedures

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 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.

7.9.1 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.

7.9.2 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.

7.9.3 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 ml5 extension (.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 "701 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.
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.

7.9.4 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.

7.9.5 Setting the Container ID

This procedure explains how to set the Container ID, which can be found in Function Code Cd40. 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.

7.10 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).

7.10.1 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).

7.10.2 Sensor Checkout Procedure - Ice-Water Bath

This procedure is to verify the accuracy of a temperature sensor by placing in an ice-water bath.

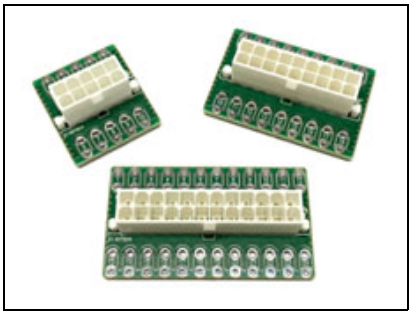
1. Remove the sensor and place in a 0°C (32°F) ice-water bath. See **Section 7.10.1** for ice-water bath preparation.
2. Start the unit and check the sensor reading on the control panel. Readings should be 0°C (32°F). If the reading is correct, reinstall the sensor. If the reading is incorrect, continue 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.

7.10.3 Sensor Checkout Procedure - Control Box

A sensor can be tested from the control box by utilizing the controller harness tool, see **Figure 7.18**, part number 76-50256-00. This tool reduces the risk of damaging the controller pins when probing the system harness.

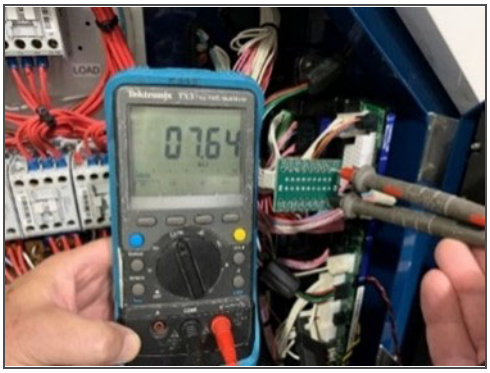
This procedure is described in detail in TechLINE article TL004-2022.

Figure 7.18 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 9–1** and **Table 9–2**.

7.10.4 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.

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: Only the latest 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.

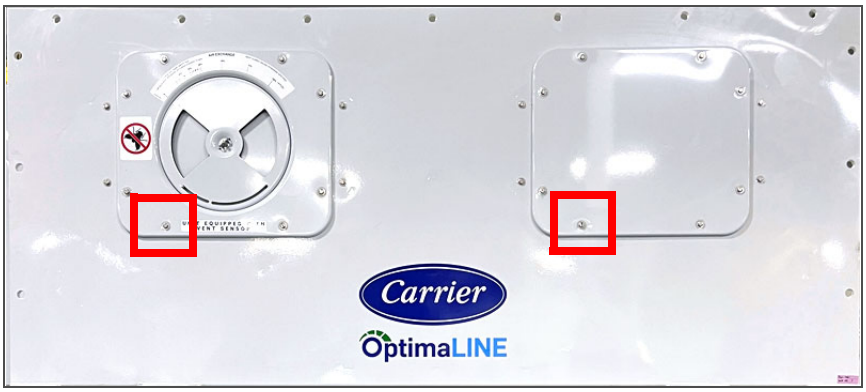
GDP Calibration, Removing Supply Sensors (STS / SRS) from Unit:

1. Locate the supply sensors cover assembly on the suction side of the compressor. Remove the two fasteners securing the cover of the sensors.

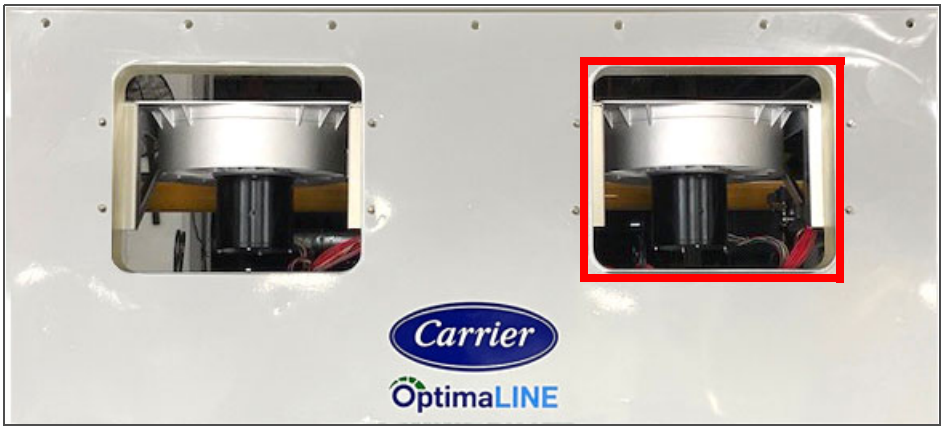
   Remove the cover and rotate the supply air sensors, STS / SRS, in a clockwise direction and remove the sensors from the sensor housing.

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

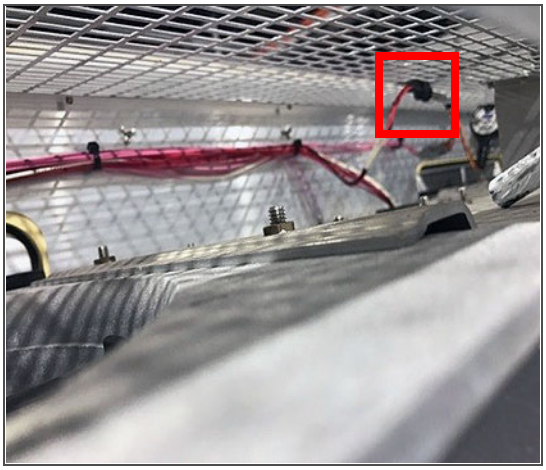
1. Remove both front access panels from the unit by removing 8 fasteners from each panel. Save all hardware for re-installation.



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.



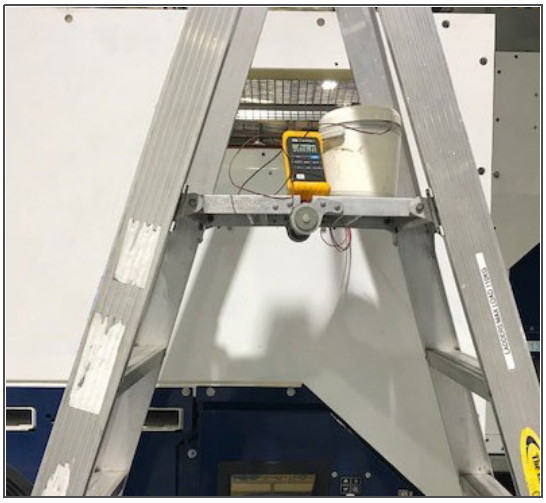
4. Cut all the wire ties that are securing the sensors to the harness and remove sensor.

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 7.10.1** 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 7.10.6** 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.

7.10.5 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.

USDA Recording

A special type of recording is used for USDA cold treatment purposes. Cold treatment recording requires three remote temperature probes be placed at prescribed locations in the cargo. Provision is made to connect these probes to the DataCORDER via receptacles located at the rear left-hand side of the unit. Four or five receptacles are provided. The four 3-pin receptacles are for the probes. The 5-pin receptacle is for the Interrogator. The probe receptacles are sized to accept plugs with tri-cam coupling locking devices. A label on the back panel of the unit shows which receptacle is used for each probe.

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

USDA Cold Treatment Procedure:

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

1. From the ContainerLINK application, navigate to the Container > System Configuration screen. Then, select the DataCorder Configuration tab.
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 7.10.1** 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 Container > Probe Calibration screen. 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, when entered into the controller by the user or automatically depending on how ContainerLINK is configured, 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 back to the Container > System Configuration screen. Fill out the Trip Comment and ISO Trip Header information. Then, select Start New Trip to perform a Trip Start.
12. Bring up Code Cd51 on the unit display, enable Automatic Cold Treatment (ACT) and configure as required. See **Section 5.9.3** for procedure.

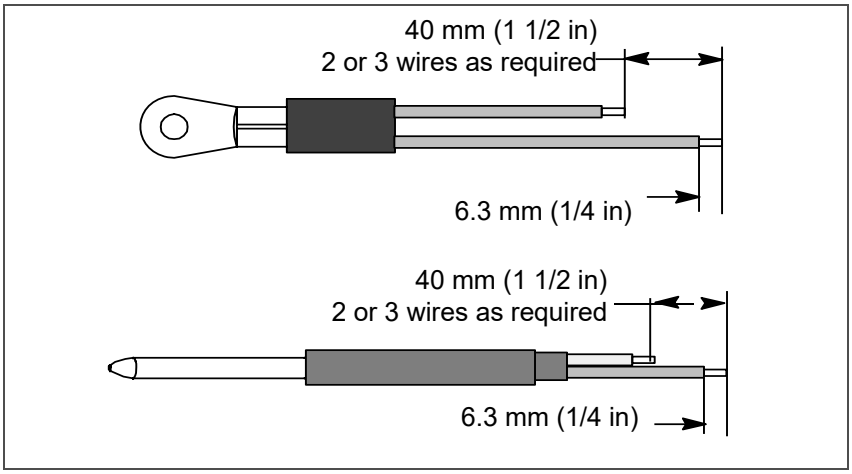
7.10.6 Replacing a Sensor

⚠ WARNING

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

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

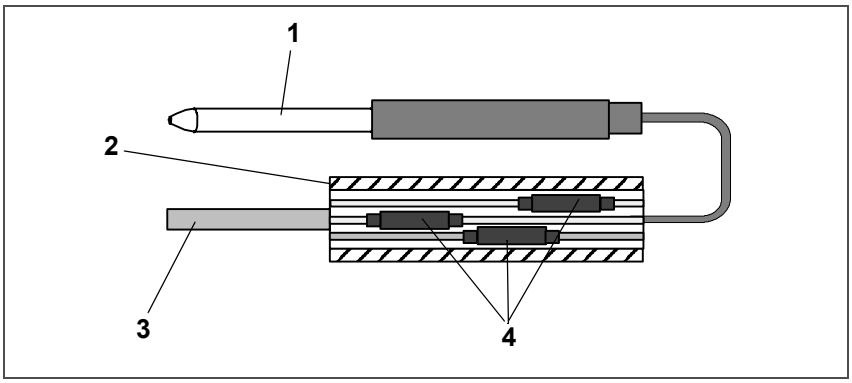
Figure 7.19 Sensor Types



1. Turn unit power off (“0”) at the Start-Stop switch (ST). 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 7.19**.
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 7.20**.

Figure 7.20 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 7.20**.
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 7.20** and re-check sensor resistance.
    - Supply Sensor (STS / SRS) Positioning, see **Figure 7.21**
    - Return Sensor (RTS / RRS) Positioning, see **Figure 7.22**
    - Evaporator Temperature Sensor (ETS1 / ETS2) Positioning, see **Figure 7.23**
14. Reinstall the sensor.
    - Supply Sensor STS and SRS Installation, see **Section 7.10.7**
    - Return Sensor (RTS / RRS) Installation, see **Section 7.10.8**
    - Defrost Termination Sensor (DTS) Installation, see **Section 7.10.9**
    - Evaporator Temperature Sensor (ETS1 / ETS2) Installation, see **Section 7.10.10**

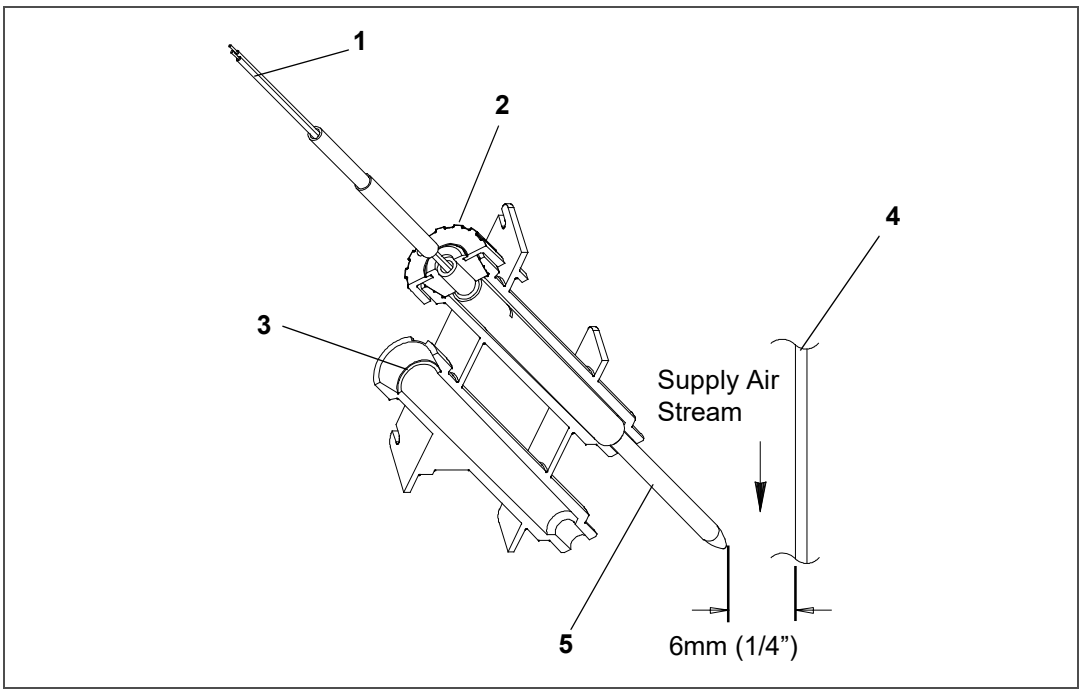
NOTE: The P5 Pre-Trip test must be run to deactivate probe alarms. See **Section 5.7**.

7.10.7 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 7.21**.

Figure 7.21 Supply Sensor (STS / SRS)



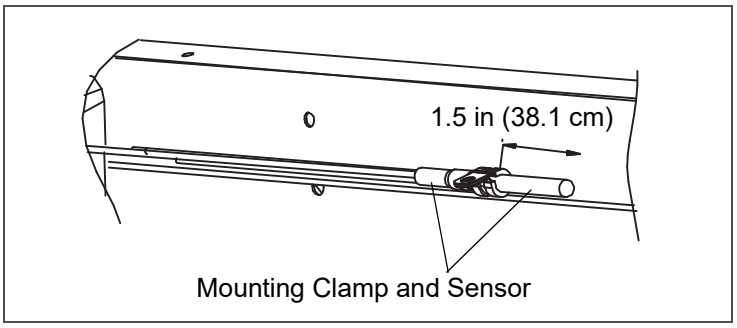
1) Sensor Wire
2) Cap & Grommet Assembly
3) Probe Holder
4) Evaporator Back Panel
5) Supply Sensor

- - - - -

7.10.8 Installing a Return Sensor (RTS / RRS)

Reinstall the Return Temperature or Return Recorder sensor (RTS / RRS), as shown in **Figure 7.22**. For proper placement of the return sensor, be sure to position the enlarged positioning section of the sensor against the side of the mounting clamp.

Figure 7.22 Return Sensor (RRS / RTS)



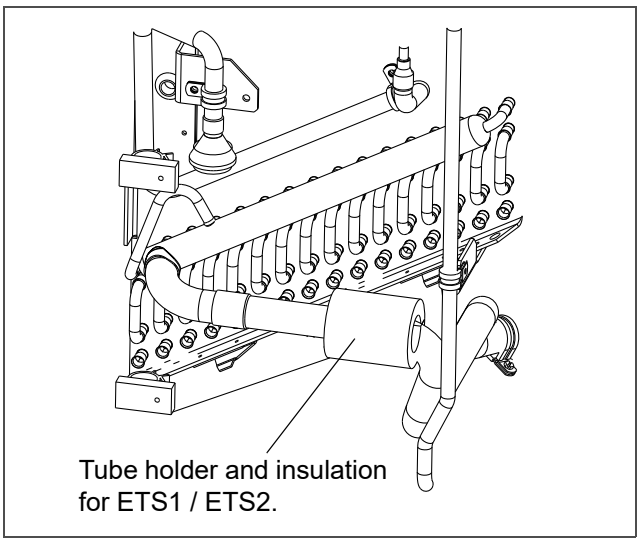
7.10.9 Installing a Defrost Temperature Sensor (DTS)

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

7.10.10 Installing an Evaporator Temperature Sensor (ETS1 / ETS2)

The Evaporator Temperature Sensors (ETS1 / ETS2) are located in a tube holder under insulation, as illustrated in **Figure 7.23**. 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.

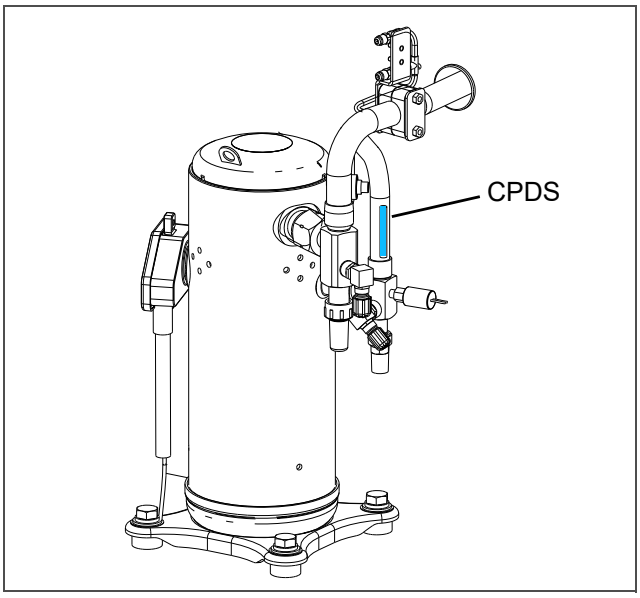
Figure 7.23 Evaporator Temperature Sensor (ETS1 / ETS2)



7.10.11 Installing a Compressor Discharge Temperature Sensor (CPDS)

The Compressor Discharge Temperature Sensor (CPDS), see **Figure 7.24**, monitors refrigerant temperature in the dome of the compressor.

Figure 7.24 Compressor Discharge Temperature Sensor (CPDS)



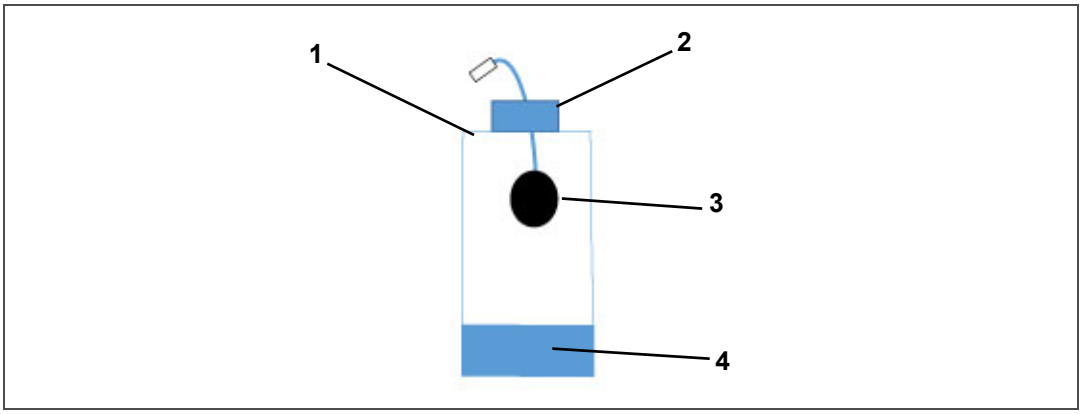
1. Ensure the unit is disconnected from the power source.
2. Verify that the Start-Stop switch (ST) is in the “0” position.
3. Remove the existing sensor.
4. Clean all silicone sealer and dielectric compound from the sensor well. Make sure that the well is clean and dry. The top of the compressor, where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

7.11 Optional Sensors

7.11.1 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.

Figure 7.25 Humidity Sensor (HS)



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

- - - - -

7.11.2 Checking the Humidity Sensor

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

Items Required:

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

Procedure:

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

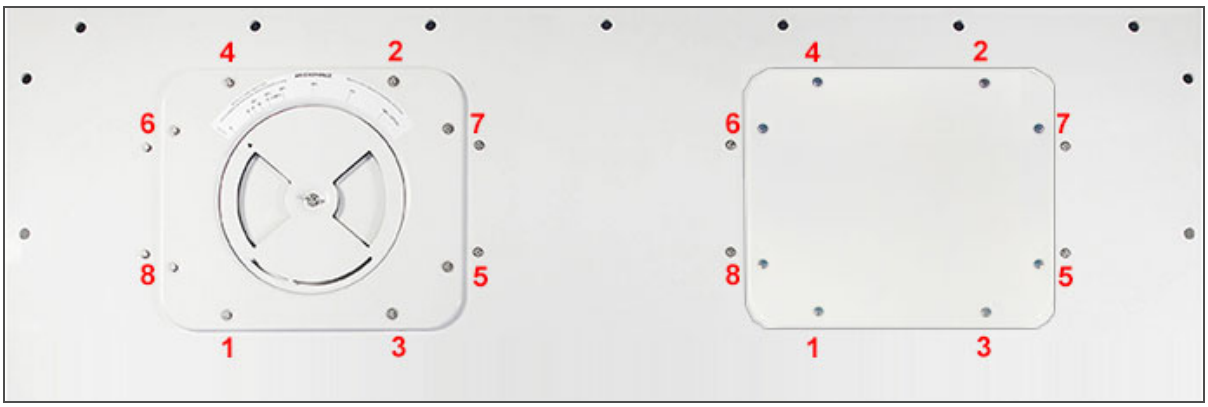
NOTE: To ensure saturation, add additional salt until it settles at the bottom without dissolving while shaking.

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

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

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.



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

7.11.3 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.

7.11.3.1 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.

7.11.4 Cargo Sensor

The optional cargo sensor should have an operational check performed while container box temperatures are above 3°C (37.4°F). Temperatures lower than this can cause frost build up on the cargo sensor lens, giving a false reading.

7.11.4.1 Cargo Sensor Operational Check

1. Insert and lock the new cargo sensor connector into the USDA Cargo Sensor Port (top port) ensuring pins are correctly aligned.
2. Turn unit power On. On the very first initial power on, the cargo will go into a service checkout (installation mode) for a duration of 30 minutes, updating every few seconds, for the checkout of the cargo sensor reading.

   After this 30 minutes in the installation mode, the sensor goes into the normal function mode, updating the cargo status every 6 hours, whenever the controller is powered on.

To reinitialize the 30 minute installation mode, the battery within the cargo sensor needs to be removed and reinstalled.

3. Press the ALT. MODE key on the keypad.
4. Use the Arrow keys until “dC” is displayed, then press the ENTER key.
5. Use the Arrow keys until “dC14” is displayed, then press ENTER to display the readout.
6. 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.

7.12 EverFRESH® Service

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

7.13 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.

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 two sets depending on the unit configuration:

OptimaLINE Units, Models 701-001 to 099

- **Schematic Legend**
- **Schematic Diagram**
- **Wiring Diagram (Sheet 1)**
- **Wiring Diagram (Sheet 2)**

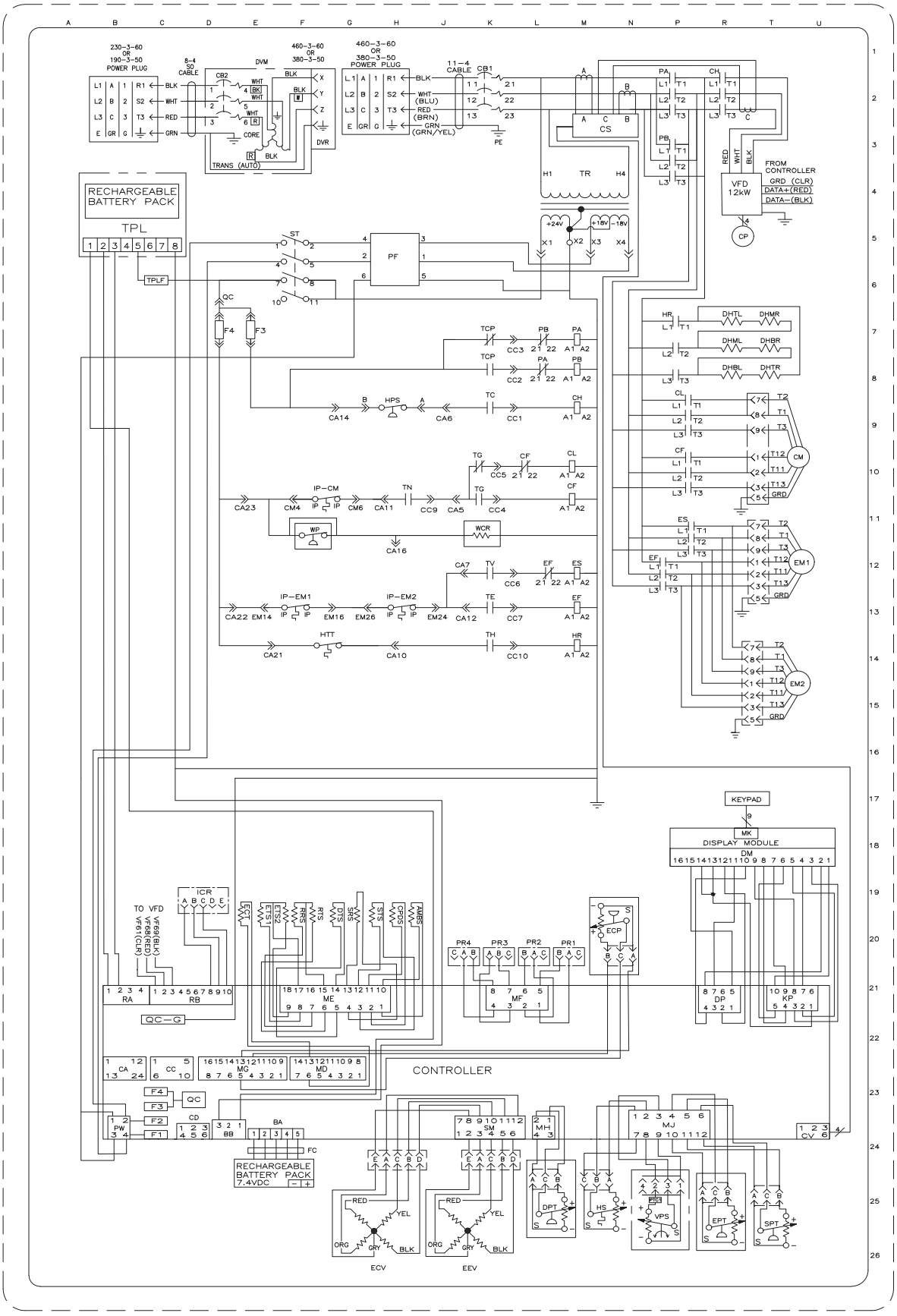
Electrical Schematic and Wiring Diagrams

Schematic Legend

ZONE	SYMBOL	DESCRIPTION
G20	AMBS	– AMBIENT SENSOR
H22	C	– CONTROLLER
J1	CB1	– CIRCUIT BREAKER 460V
D1	CB2	– OPTIONAL CIRCUIT BREAKER 230V (DVM OPTION) TERMINAL BLOCK WHEN CB2 NOT PRESENT
K10,N10	CF	– CONDENSER FAN CONTACTOR (HIGH SPEED)
L10,N8	CL	– CONDENSER FAN CONTACTOR (LOW SPEED)
L8,P1	CH	– COMPRESSOR CONTACTOR
F11,G11,T10	CM	– CONDENSER FAN MOTOR
R5	CP	– COMPRESSOR MOTOR
G20	CPDS	– DISCHARGE TEMPERATURE SENSOR
M2	CS	– CURRENT SENSOR
R8	DHBL	– DEFROST HEATER – BOTTOM LEFT
T7	DHBR	– DEFROST HEATER – BOTTOM RIGHT
R7	DHML	– DEFROST HEATER – MIDDLE LEFT
T7	DHMR	– DEFROST HEATER – MIDDLE RIGHT
R7	DHTL	– DEFROST HEATER – TOP LEFT
T8	DHTR	– DEFROST HEATER – TOP RIGHT
P18	DM	– DISPLAY MODULE
L25	DPT	– DISCHARGE PRESSURE TRANSDUCER
F20	DTS	– DEFROST TEMPERATURE SENSOR
D1	DVM	– DUAL VOLT MODULE (OPTIONAL)
F3	DVR	– DUAL VOLTAGE RECEPTACLE (OPTIONAL)
M20	ECP	– ECONOMIZER PRESSURE TRANSDUCER
D19	ECT	– ECONOMIZER TEMPERATURE SENSOR
G26	ECV	– ECONOMIZER EXPANSION VALVE
H26	EEV	– EVAPORATOR EXPANSION VALVE
L12,L13,N11	EF	– EVAPORATOR FAN CONTACTOR (HIGH SPEED)
T11,T13 E13,F13,G13	EM	– EVAPORATOR FAN MOTOR
P25	EPT	– EVAP. PRESSURE TRANSDUCER
P10,L13	ES	– EVAPORATOR FAN CONTACTOR (LOW SPEED)
D20	ETS	– EVAPORATOR TEMPERATURE SENSOR (SUCTION)
B23,B24,D7	F	– FUSE
	FLA	FULL LOAD AMPS
E24	FC	– FERRITE CLAMP
G9	HPS	– HIGH PRESSURE SWITCH
N7,L14	HR	– HEATER CONTACTOR
M25	HS	– HUMIDITY SENSOR (OPTIONAL)
E15	HTT	– HEAT TERMINATION THERMOSTAT
C19	ICR	– INTERROGATOR CONNECTOR REAR
E13,F11,G13	IP	– INTERNAL PROTECTOR
L7,K8,N1	PA	– UNIT PHASE CONTACTOR
K7,L8,N3	PB	– UNIT PHASE CONTACTOR
G5	PF	– POWER FILTER
J20,K20,L20	PR	– PROBE RECEPTACLE (USDA OPTION)
M25	PTC1	– PTC FOR VENT POSITION SENSOR (UPPER)
E20	RRS	– RETURN RECORDER SENSOR
E20	RTS	– RETURN TEMPERATURE SENSOR
R25	SPT	– SUCTION PRESSURE TRANSDUCER
F20	SRS	– SUPPLY RECORDER SENSOR
F5	ST	– START–STOP SWITCH
F20	STS	– SUPPLY TEMPERATURE SENSOR
J9	TC	– CONTROLLER RELAY (COOLING)
J7,J8	TCP	– CONTROLLER RELAY (PHASE SEQUENCING)
J13	TE	– CONTROLLER RELAY (HIGH SPEED EVAPORATOR FANS)
J10,J11	TG	– CONTROLLER RELAY (HIGH & LOW SPEED CONDENSER FANS)
J14	TH	– CONTROLLER RELAY (HEATING)
B4	TPL	– TRIPLINK (OPTION)
J11	TN	– CONTROLLER RELAY (CONDENSER FAN)
M3	TR	– TRANSFORMER
D3	TRANS	– TRANSFORMER AUTO 230/460 (OPTION)
J13	TV	– CONTROLLER RELAY (LOW SPEED EVAPORATOR FANS)
R4	VFD	– VARIABLE FREQUENCY DRIVE
N25	VPS	– VENT POSITIONING SENSOR (UPPER) (OPTION)
J12	WCR	– WETTING CURRENT SENSOR (OPTION)
E12	WP	– WATER PRESSURE SWITCH (OPTION)

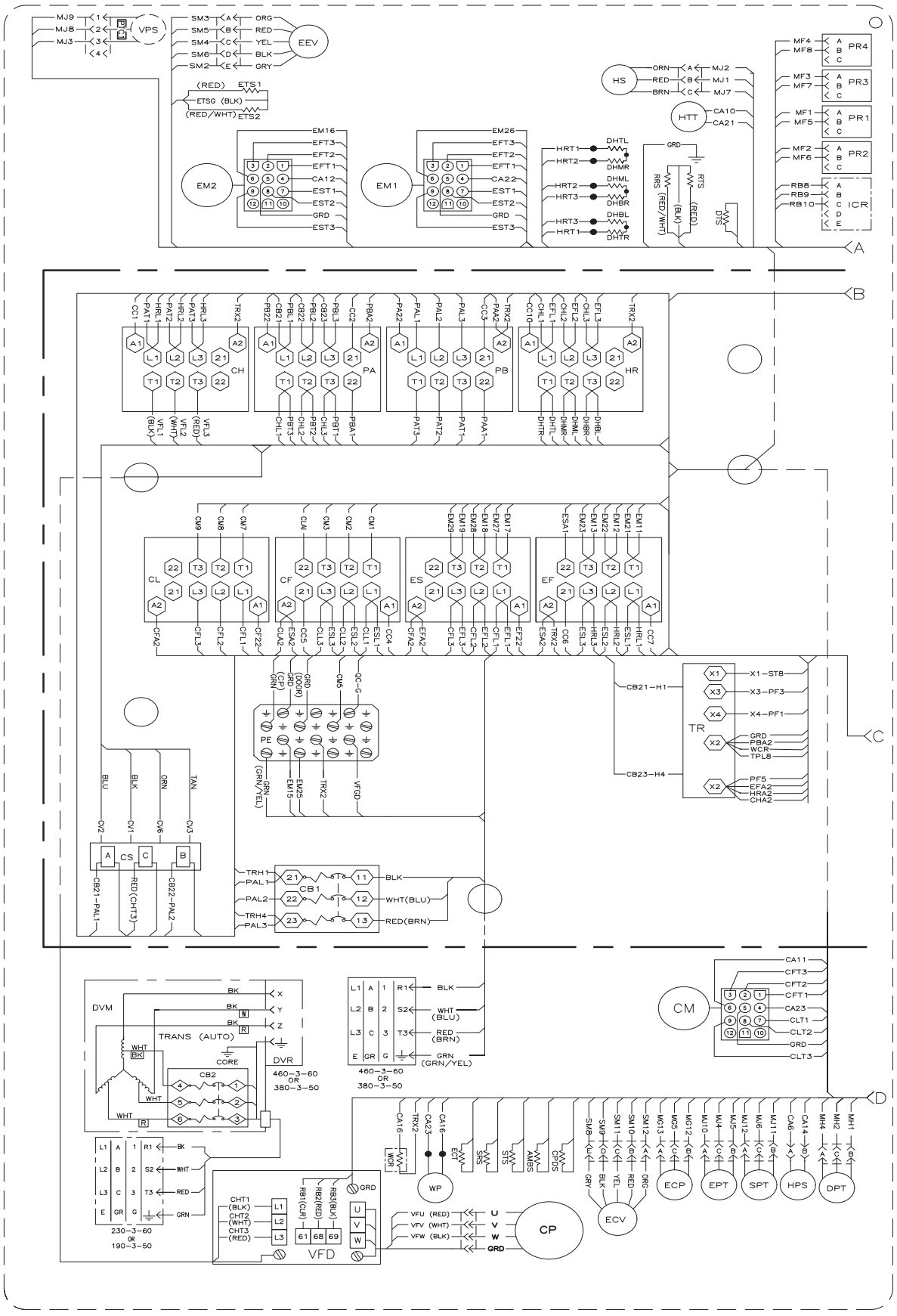
Electrical Schematic and Wiring Diagrams

Schematic Diagram



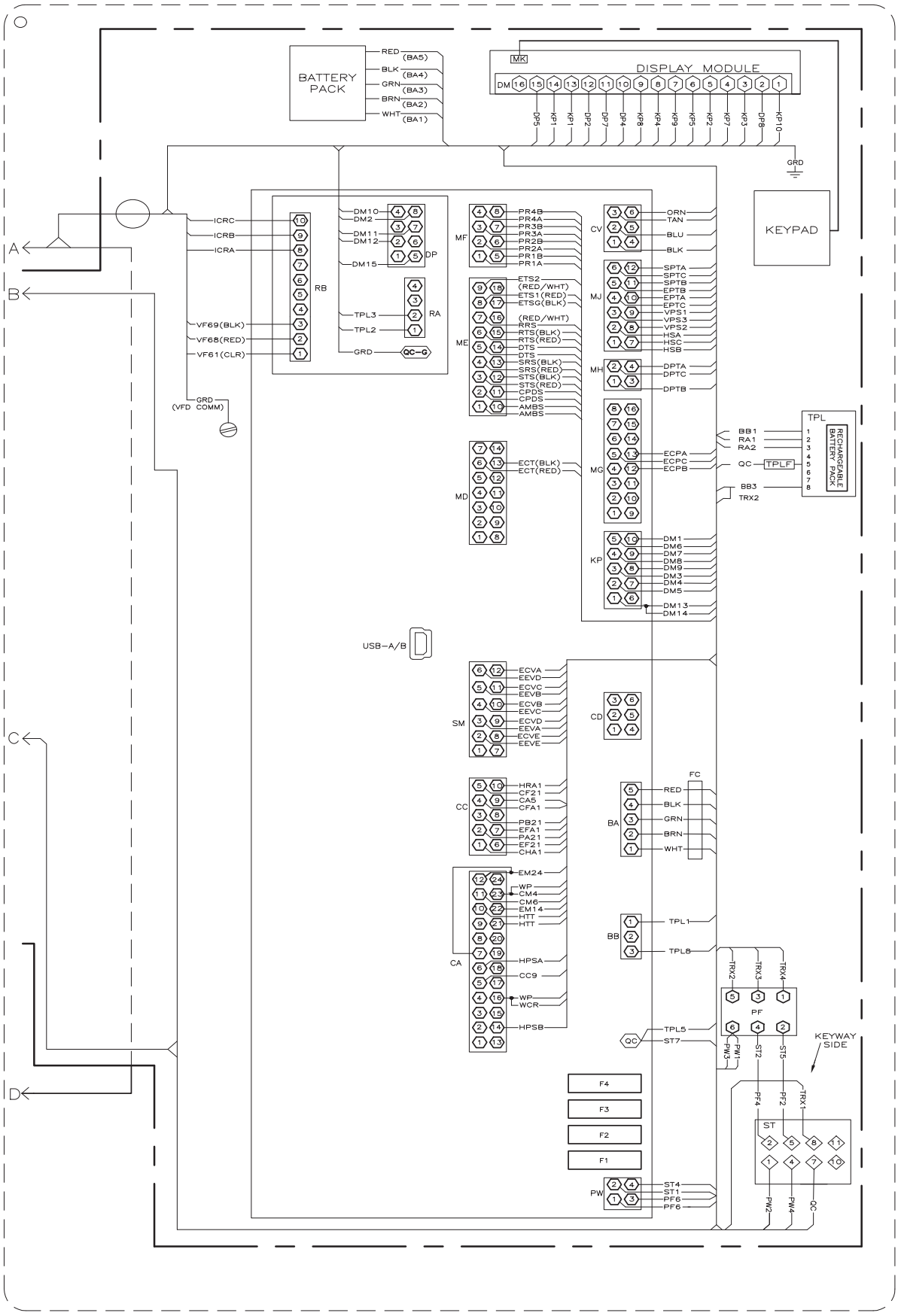
Electrical Schematic and Wiring Diagrams

Wiring Diagram (Sheet 1)



Electrical Schematic and Wiring Diagrams

Wiring Diagram (Sheet 2)



Section 9
Appendix

9.1 Sensor Resistance Tables

Table 9–1 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 9–2 Sensor Resistance - CPDS

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

Table 9–3 Sensor Resistance - Economizer Temperature Sensor (ECT)

Condition	Output Resistance (OHMS)	
	Minimum	**Maximum**
TA = 150°C (302°F)	1772	1934
TA = 100°C (212°F)	6,603	6,997
TA = 25°C (77°F)	95,785	104,440
TA = 0°C (32°F)	296,717	342,226

9.2 Refrigerant Pressure Temperature Charts

Table 9–4 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
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

Table 9–4 R-134a Refrigerant Pressure Temperature Chart

Note: Underline figures are inches of mercury vacuum

°F	°C	PSIG		°C	°F	BAR
66	18.9	65.4		13	55.4	3.58
68	20.0	68.2		14	57.2	3.73
70	21.1	71.1		15	59.0	3.88
72	22.2	74.1		16	60.8	4.04
74	23.3	77.1		17	62.6	4.21
76	24.4	80.2		18	64.4	4.37
78	25.6	83.4		19	66.2	4.54
80	26.7	86.7		20	68.0	4.72
82	27.8	90.0		21	69.8	4.90
84	28.9	93.5		22	71.6	5.08
86	30.0	97.0		23	73.4	5.27
88	31.1	100.6		24	75.2	5.46
90	32.2	104.3		25	77.0	5.65
92	33.3	108.1		26	78.8	5.85
94	34.4	112.0		27	80.6	6.06
96	35.6	115.9		28	82.4	6.27
98	36.7	120.0		29	84.2	6.48
100	37.8	124.2		30	86.0	6.70
102	38.9	128.4		31	87.8	6.93
104	40.0	132.7		32	89.6	7.15
106	41.1	137.2		33	91.4	7.39
108	42.2	141.7		34	93.2	7.63
110	43.3	146.4		35	95.0	7.87
112	44.4	151.1		36	96.8	8.12
114	45.6	156.0		37	98.6	8.37
116	46.7	160.9		38	100.4	8.63
118	47.8	166.0		39	102.2	8.90
120	48.9	171.2		40	104.0	9.17
122	50.0	176.5		41	105.8	9.44
124	51.1	181.8		42	107.6	9.72
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 9–5 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
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

Table 9–5 R-513A Refrigerant Pressure Temperature Chart

Note: Underline figures are inches of mercury vacuum

°F	°C	PSIG		°C	°F	BAR
66	18.9	78.7		13	55.4	4.39
68	20.0	81.8		14	57.2	4.56
70	21.1	85.0		15	59.0	4.73
72	22.2	88.2		16	60.8	4.91
74	23.3	91.6		17	62.6	5.09
76	24.4	95.0		18	64.4	5.27
78	25.6	98.5		19	66.2	5.46
80	26.7	102.1		20	68.0	5.65
82	27.8	105.7		21	69.8	5.85
84	28.9	109.5		22	71.6	6.05
86	30.0	113.3		23	73.4	6.26
88	31.1	117.3		24	75.2	6.47
90	32.2	121.3		25	77.0	6.68
92	33.3	125.4		26	78.8	6.90
94	34.4	129.6		27	80.6	7.13
96	35.6	133.9		28	82.4	7.36
98	36.7	138.3		29	84.2	7.59
100	37.8	142.8		30	86.0	7.83
102	38.9	147.4		31	87.8	8.07
104	40.0	152.0		32	89.6	8.32
106	41.1	156.8		33	91.4	8.57
108	42.2	161.7		34	93.2	8.83
110	43.3	166.7		35	95.0	9.10
112	44.4	171.8		36	96.8	9.37
114	45.6	177.0		37	98.6	9.64
116	46.7	182.3		38	100.4	9.92
118	47.8	187.7		39	102.2	10.21
120	48.9	193.3		40	104.0	10.50
122	50.0	198.9		41	105.8	10.79
124	51.1	204.7		42	107.6	11.10
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

9.3 Bolt Torque Values

Table 9–6 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 10
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 OptimaLINE Container Unit:

Model: 69NT40-701-001 to 099

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 61000-6-4:2019 EN 61000-6-2:2019 EN 61000-3-12:2011 EN 61000-4-2:2009 EN 61000-4-3:2006 EN 61000-4-4:2012 EN 61000-4-5:2014 EN 61000-4-6:2013 EN 61000-4-8:2010 EN 61000-4-11:2004 EN 61000-3-11:2000	EN 301 489-1 v2.2.3 EN 301 489-17 V2.2.3 EN 301 489-52 V2.2.3

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:

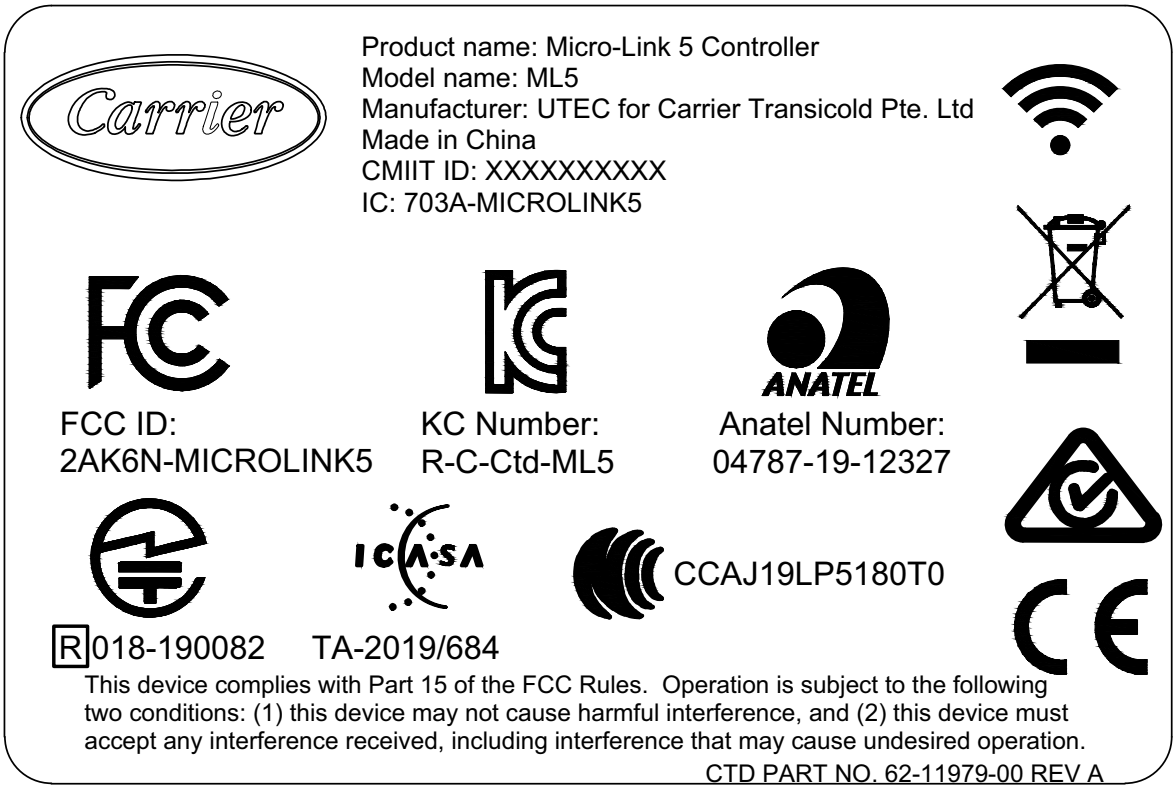
Shaun Bretherton
Regional Service Manager EMEA
Waalhaven Oostzijde 85 3087 BM Rotterdam
The Netherlands

DocuSigned by:
Nader Awwad
1B83EFEDEAAD48A...

08-Jul-24 | 7:32 PM SGT

Nader Awwad, Engineering Director
Carrier Transicold
P.O. Box 4805
Syracuse, New York 13221 USA
(Authorized person to sign declaration on behalf of the manufacturer)

Section 11
Wireless Certification



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

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

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

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

China RoHS per SJ/T 11364-2014

产品中有害物质的名称及含量

部件名称	有害物质					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr (VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
金属板部件	O	O	O	O	O	O
塑料部件	O	O	O	O	O	O
盘管组件	X	O	O	O	O	O
加热部件	O	O	O	O	O	O
马达，压缩机与风扇组件	O	O	O	O	O	O
温度控制微处理器系统	X	O	O	O	O	O
断路器与接触器	O	O	O	O	O	O
变压器	O	O	O	O	O	O
传感器	X	O	O	O	O	O
通讯组件	O	O	O	O	O	O
阀组件	X	O	O	O	O	O
电缆线/电源	O	O	O	O	O	O
电池	O	O	X	O	O	O
标签与绝缘材料	O	O	O	O	O	O
玻璃部件	X	O	O	O	O	O

本表格依据 SJ/T 11364 的规定编制。
O：表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。
X：表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。

62-66122-00, Rev A

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