



Start-Up, Operation, and Maintenance Instructions

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SAFETY CONSIDERATIONS

Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service air-conditioning equipment. If repair is needed, sealed electrical components and intrinsically safe components must be replaced.

Untrained personnel can perform basic maintenance functions of cleaning coils and filters and replacing filters. All other operations should be performed by trained service personnel. When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit, and other safety precautions that may apply.

Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for unbrazing operations. Have fire extinguisher available for all brazing operations.

It is important to recognize safety information. This is the safety-alert symbol . When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

Understand the signal words DANGER, WARNING, CAUTION, and NOTE. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies hazards which **could** result in personal injury or death. CAUTION is used to identify unsafe practices, which **may** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

Screw liquid chillers are designed to provide safe and reliable service when operated within design specifications. When operating this equipment, use good judgment and safety precautions to avoid damage to equipment and property or injury to personnel.

DANGER

Failure to follow these procedures will result in severe personal injury or death.

DO NOT VENT refrigerant relief valves within a building. Outlet from rupture disc or relief valve must be vented outdoors in accordance with the latest edition of ANSI/ASHRAE 15 (American National Standards Institute/American Society of Heating, Refrigerating, and Air-Conditioning Engineers). The accumulation of refrigerant in an enclosed space can displace oxygen and cause asphyxiation.

PROVIDE adequate ventilation in accordance with ANSI/ASHRAE 15, especially for enclosed and low overhead spaces. Inhalation of high concentrations of vapor is harmful and may cause heart irregularities, unconsciousness, or death. Misuse can be fatal. Vapor is heavier than air and reduces the amount of oxygen available for breathing. Product causes eye and skin irritation. Decomposition products are hazardous.

DO NOT USE OXYGEN to purge lines or to pressurize a chiller for any purpose. Oxygen gas reacts violently with oil, grease, and other common substances.

NEVER EXCEED specified test pressures; VERIFY the allowable test pressure by checking the instruction literature and the design pressures on the equipment nameplate.

DO NOT USE air for leak testing. Use only refrigerant or dry nitrogen.

DO NOT VALVE OFF any safety device.

BE SURE that all pressure relief devices are properly installed and functioning before operating any chiller.

RISK OF INJURY OR DEATH by electrocution. High voltage can be present on motor leads even though the motor is not running. Open the power supply disconnect before touching motor leads or terminals.

WARNING

DO NOT USE TORCH to remove any component. System contains oil and refrigerant under pressure.

To remove a component, wear protective gloves and goggles and proceed as follows:

- Shut off electrical power to unit.
- Recover refrigerant to relieve all pressure from system using both high-pressure and low pressure ports.
- Traces of vapor should be displaced with nitrogen and the work area should be well ventilated. Refrigerant in contact with an open flame produces toxic gases.
- Cut component connection tubing with tubing cutter and remove component from unit. Use a pan to catch any oil that may come out of the lines and as a gauge for how much oil to add to the system.
- Carefully un-sweat remaining tubing stubs when necessary. Oil can ignite when exposed to torch flame.

Failure to follow these procedures may result in personal injury or death.

(Warnings continued on next page.)

⚠ WARNING

Failure to follow these procedures may result in personal injury or death.

DO NOT USE eyebolts or eyebolt holes to rig chiller sections or the entire assembly.

DO NOT work on high-voltage equipment unless you are a qualified electrician.

DO NOT WORK ON electrical components, including control panels, switches, or starters, until you are sure ALL POWER IS OFF and no residual voltage can leak from capacitors or solid-state components.

LOCK OPEN AND TAG electrical circuits during servicing. IF WORK IS INTERRUPTED, confirm that all circuits are de-energized before resuming work.

AVOID SPILLING liquid refrigerant on skin or getting it into the eyes. USE SAFETY GOGGLES. Wash any spills from the skin with soap and water. If liquid refrigerant enters the eyes, IMMEDIATELY FLUSH EYES with water and consult a physician.

NEVER APPLY an open flame or live steam to a refrigerant cylinder. Dangerous overpressure can result. When it is necessary to heat refrigerant, use only warm (110°F [43°C]) water.

VERIFY that refrigerant storage cylinders are clean with no residual moisture, oil, or refrigerant that can contaminate the refrigerant charge.

DO NOT REUSE disposable (nonreturnable) cylinders or attempt to refill them. It is DANGEROUS AND ILLEGAL. When cylinder is emptied, evacuate remaining gas pressure, loosen the collar, and unscrew and discard the valve stem. DO NOT INCINERATE.

CHECK THE REFRIGERANT TYPE before adding refrigerant to the chiller. The introduction of the wrong refrigerant can cause damage or malfunction to this chiller.

Operation of this equipment with refrigerants other than those cited herein should comply with ANSI/ASHRAE 15 (latest edition). Contact Carrier for further information on use of this chiller with other refrigerants.

DO NOT ATTEMPT TO REMOVE fittings, covers, etc., while chiller is refrigerant charged or at any time while chiller is running. Be sure pressure is at 0 psig (0 kPa) before breaking any refrigerant connection. Note that chiller will be in a vacuum condition when temperature is below normal room temperature.

CAREFULLY INSPECT all rupture discs and other relief devices AT LEAST ONCE A YEAR. If chiller operates in a corrosive atmosphere, inspect the devices at more frequent intervals.

DO NOT ATTEMPT TO REPAIR OR RECONDITION any relief device when corrosion or build-up of foreign material (rust, dirt, scale, etc.) is found within the valve body or mechanism. Replace the device.

DO NOT install relief devices in series or backwards.

USE CARE when working near or in line with a compressed spring. Sudden release of the spring can cause it and objects in its path to act as projectiles.

USE CARE when working near energized motor. PM motors produce strong electromagnetic fields which can be harmful to those with pacemakers or metallic medical implants.

⚠ WARNING

Rotation of the shaft can generate voltage potential at the motor terminals. If the shaft is to be rotated the motor terminals should be grounded.

⚠ CAUTION

Failure to follow these procedures may result in personal injury or damage to equipment.

DO NOT STEP on refrigerant lines. Broken lines can whip about and release refrigerant, causing personal injury.

DO NOT climb over a chiller. Use platform, catwalk, or staging. Follow safe practices when using ladders.

USE MECHANICAL EQUIPMENT (crane, hoist, etc.) to lift or move inspection covers or other heavy components. Even if components are light, use mechanical equipment when there is a risk of slipping or losing your balance.

BE AWARE that certain automatic start arrangements CAN ENGAGE THE STARTER, TOWER FAN, OR PUMPS. Open the disconnect *ahead of* the starter, tower fans, or pumps.

USE only repair or replacement parts that meet the code requirements of the original equipment.

DO NOT VENT OR DRAIN waterboxes containing industrial brines, liquid, gases, or semisolids without the permission of your process control group.

DO NOT LOOSEN waterbox cover bolts until the waterbox has been completely drained.

DO NOT LOOSEN a packing gland nut before checking that the nut has a positive thread engagement.

PERIODICALLY INSPECT all valves, fittings, and piping for corrosion, rust, leaks, or damage.

PROVIDE A DRAIN connection in the vent line near each pressure relief device to prevent a build-up of condensate or rain water.

DO NOT leave refrigerant system open to air any longer than the actual time required to service the equipment. Seal circuits being serviced and charge with dry nitrogen to prevent contamination when timely repairs cannot be completed.

IMPORTANT: The appliance is not to be used by persons (including children) with reduced physical, sensory, or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instructions to do so.

INTRODUCTION

Prior to initial start-up of the 23XW/XQ unit, those involved in the start-up, operation, and maintenance should be thoroughly familiar with these instructions and other necessary job data. Procedures in this manual are arranged in the sequence required for proper chiller start-up and operation. This book also outlines the control system for those involved in the start-up, operation and maintenance of the unit before performing start-up procedures. It is intended to be used in combination with the 23XW/XQ Screw Liquid Chillers Controls Operation and Troubleshooting manual that describes the controls in detail.

⚠ CAUTION

Do NOT punch holes or drill into the top surface of the control or VFD enclosure for field wiring. Knockouts are provided for field wiring connections. Drilling holes through the top of the cabinet can result in a loss of warranty on the starter assembly because of metal particulate falling on and into electronic components.

⚠ CAUTION

PROVIDE MACHINE PROTECTION. Store machine and starter indoors, protected from construction dirt and moisture. Inspect under shipping tarps, bags, or crates to be sure water has not collected during transit. Keep protective shipping covers in place until machine is ready for installation. Follow latest Water-Cooled Chillers Long Term Storage document located in Chiller Builder Library.

⚠ CAUTION

WHEN FLUSHING THE WATER SYSTEMS isolate the chiller from the water circuits to prevent damage to the heat exchanger tubes.

⚠ CAUTION

This unit uses a microprocessor control system. Do not short or jumper between terminations on circuit boards or modules; control or board failure may result.

Be aware of electrostatic discharge (static electricity) when handling or making contact with circuit boards or module connections. Always touch a chassis (grounded) part to dissipate body electrostatic charge before working inside control panel or use a grounding strap before handling printed circuit boards.

Use extreme care when handling tools near boards and when connecting or disconnecting terminal plugs. Circuit boards can easily be damaged. Always hold boards by the edges and avoid touching components and connections.

This equipment uses, and can radiate, radio frequency energy. If not installed and used in accordance with the instruction manual, it may cause interference to radio communications. The PIC6.1 control boards have been tested and found to comply with the limits for a Class A computing device pursuant to International Standard in North America EN 61000-2/3 which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

Always store and transport replacement or defective boards in anti-static shipping bag.

ABBREVIATIONS AND EXPLANATIONS

Factory-installed additional components are referred to as options in this manual; factory-supplied but field-installed additional components are referred to as accessories.

Frequently used abbreviations in this manual include:

AWG	— American Wire Gage
BMS	— Building Management System
BPHE	— Braised Plate Heat Exchanger
CCN	— Carrier Comfort Network®
DCIB	— Digital Control Interface Board
DVM	— Digital Volt-Ohmmeter
ECDW	— Entering Condenser Water
ECW	— Entering Chilled Water
EMS	— Energy Management System
EXV	— Electronic Expansion Valve
HMI	— Human Machine Interface
HVIB	— High Voltage Interface Board
I/O	— Input/Output
ICP	— Interstage Compressor Piping
IGBT	— Insulated-Gate Bipolar Transistor
IOB	— Input Output Board
LCDW	— Leaving Condenser Water
LCW	— Leaving Chilled Water
LED	— Light-Emitting Diode
MAWP	— Maximum Allowable Working Pressure
NSTV	— Network Service Tool V
OLTA	— Overload Trip Amps
PIC	— Product Integrated Controls
PPE	— Protective Personal Equipment
PWM	— Pulse Width Modulating
RLA	— Rated Load Amps
RMS	— Root Mean Square
SCCR	— Short Circuit Current Rating
SCR	— Silicon Controlled Rectifier
CIOB	— Carrier Input Output Board
VFD	— Variable Frequency Drive
VPF	— Variable Primary Flow

CHILLER FAMILIARIZATION

See Fig. 1 and 2 for product nomenclature and a list of components.

Chiller Information Nameplate

The information nameplate is located on the left side of the chiller power panel.

System Components

The main components include the evaporator and condenser heat exchangers in separate vessels, motor-compressor, refrigerant, power panel, PIC6.1 Touch Screen HMI, economizer, VFD.

Evaporator

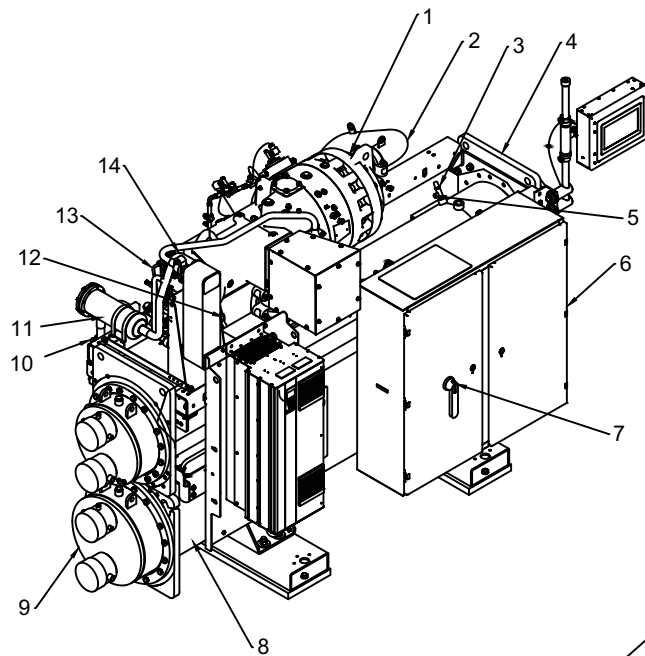
This vessel is located underneath the compressor. The evaporator is maintained at a lower temperature/pressure so evaporating refrigerant can remove heat from water or brine flowing through its internal tubes. Water flows through the internal tubes to provide comfort or process cooling.

Condenser

The condenser operates at a higher temperature/pressure than the evaporator and has water flowing through its internal tubes in order to remove heat from the refrigerant.

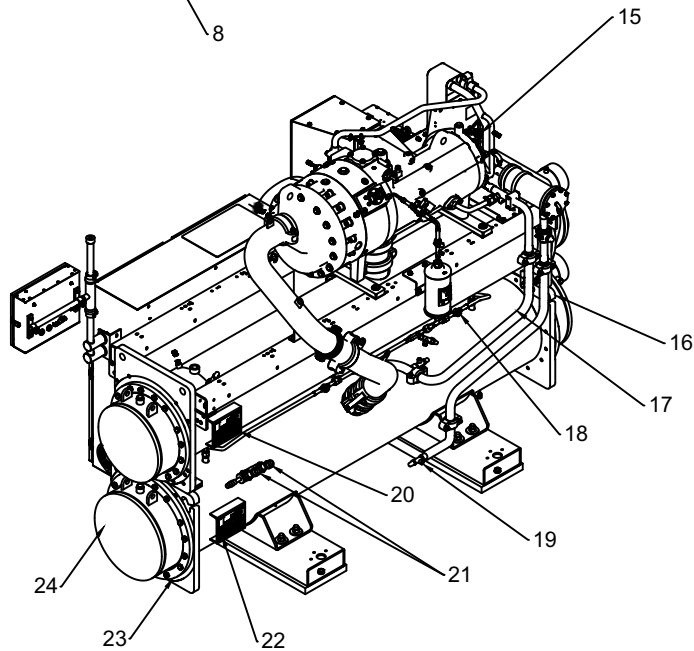
Economizer Option

The 23XW/XQ system utilizes a BPHE to transfer heat from the main stream of liquid refrigerant to a smaller stream of refrigerant, which has been brought to an intermediate pressure by use of an EXV. The intermediate pressure refrigerant leaves the BPHE as a superheated vapor and flows into the compressor. The heat removed by the vaporized refrigerant in the economizer allows the liquid refrigerant in the evaporator to absorb more heat when it evaporates and benefits the overall cooling efficiency cycle. See Fig. 3 for economizer assembly details.

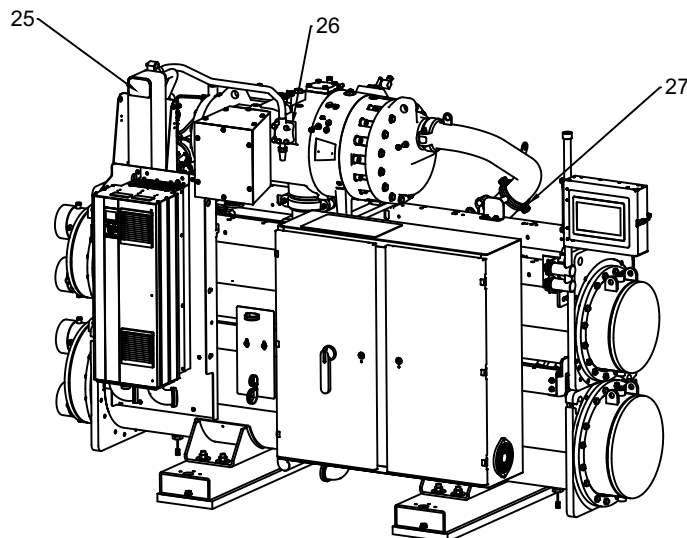


LEGEND

- 1 — Discharge Pipe
- 2 — Compressor Discharge Pipe
- 3 — Evaporator Relief Valve
- 4 — Tubesheet Mounting Brackets
- 5 — Refrigerant Charging Valve
- 6 — Variable Frequency Drive
- 7 — VFD Disconnect
- 8 — Condenser
- 9 — Evaporator Supply/Return End Waterbox
- 10 — Evaporator Inlet Isolation Valve
- 11 — Refrigerant Strainer
- 12 — Motor Cooling Isolation Valve
- 13 — Motor Cooling Supply Line
- 14 — Motor Cooling Line Filter Drier (Hidden)



- 15 — Economizer Gas EXV (Option)
- 16 — Tubesheet Mounting Brackets
- 17 — Main EXV
- 18 — Motor Cooling Sight Glass
- 19 — Condenser Refrigerant Pumpout Valve
- 20 — ASME Nameplate, Evaporator
- 21 — Condenser Relief Valves
- 22 — ASME Nameplate, Condenser
- 23 — Oil Charging Drain Valve
- 24 — Typical Waterbox Drain Coupling (Hidden)



- 25 — Economizer
- 26 — Economizer Muffler (Hidden)
- 27 — Discharge Isolation Valve Assembly (Option or Accessory)

Fig. 2 — Typical 23XW/XQ Compressor Chiller Components

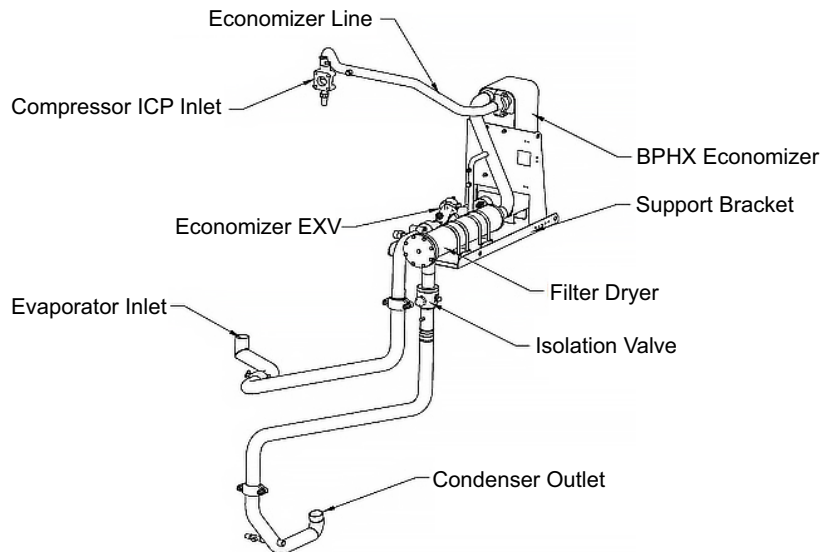


Fig. 3 — Typical 23XW/XQ Economizer Assembly Detail

Motor-Compressor

This component maintains system temperature and pressure differences and moves the heat-carrying refrigerant from the evaporator to the condenser. The 23XW/XQ chiller utilizes a variable frequency drive, twin screw, oil injected helical rotor compressor. The compressor capacity varies from by frame size.

Variable Frequency Drive (VFD)

The VFD variable frequency is a voltage source design that converts line voltage into PWM (pulse width modulating) motor input for motor speed and torque control.

Chiller Power Panel

The control panel includes the input and output boards (IOBs), control transformer, relays, and circuit breakers. It provides the power distribution and protection to the electrical components installed on chiller and has the following functions:

- Communication with PIC6.1 touch screen
- Communication with VFD
- Sensor input and outputs
- Actuators control

PIC6.1 Touch Screen HMI

This panel is the user interface for controlling the chiller and has the following functions:

- Chiller operation
- Chiller diagnostic
- Chiller status display
- Chiller parameter configuration
- Provide open protocol interface to outside BMS (Building Management System)

Expansion Control System

The expansion control system consists of two parallel EXVs supported by a modulating expansion control system valve. The expansion control system valve can increase or decrease the flow area quickly and thereby support system stability and range, while the dual EXV provides precision flow control. The expansion system responds primarily to a liquid level sensor which monitors refrigerant level within the condenser. Figure 4 shows the liquid level assembly detail.

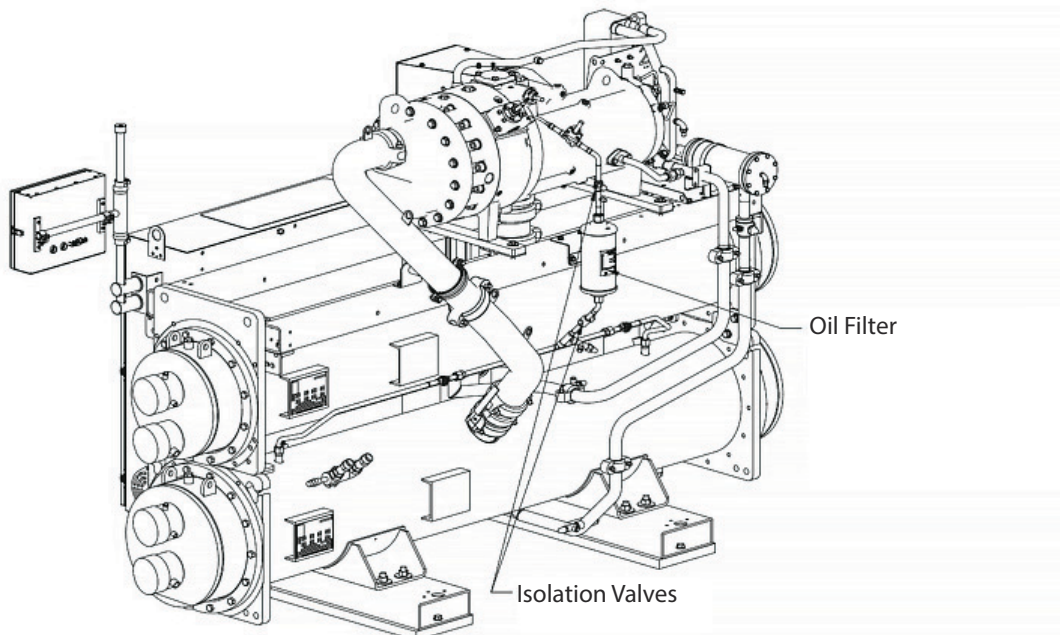


Fig. 4 — Typical 23XW/XQ Oil System

REFRIGERATION CYCLE

The compressor continuously draws refrigerant vapor from the evaporator at a rate controlled. As the compressor suction reduces the pressure in the evaporator, the remaining refrigerant boils at a fairly low temperature (typically 38 to 42°F [3 to 6°C]). The energy required for boiling is obtained from the water flowing through the evaporator tubes. With heat energy removed, the water becomes cold enough to use in an air-conditioning circuit or process liquid cooling.

After taking heat from the water, the refrigerant vapor is compressed. Compression adds heat energy and the refrigerant is quite warm (typically 98 to 102°F [37 to 40°C]) when it is discharged from the compressor into the condenser.

Relatively cool (typically 65 to 90°F [18 to 32°C]) water flowing into the condenser tubes removes heat from the refrigerant, and

the vapor condenses to liquid. The liquid drains from the bottom of the condenser and flows into the high pressure side of the BPHE.

At the outlet of the high pressure side of the BPHE a small portion of refrigerant is separated from the main stream, brought to a lower pressure by an EXV, and fed back through the low pressure side of the BPHE. As the two streams of refrigerant flow through the BPHE heat transferred from the main stream of refrigerant vaporizes the economizer stream. This vapor flows to the compressor for greater cycle efficiency. The amount of vapor introduced is determined by an EXV which meters the flow of vapor to maintain a specified vapor superheat. The cooled liquid flows out of the economizer and into the expansion control system. The expansion control system will meter the refrigerant flow into the evaporator for best system performance. See Fig. 5 for the refrigeration cycle diagram for economized systems.

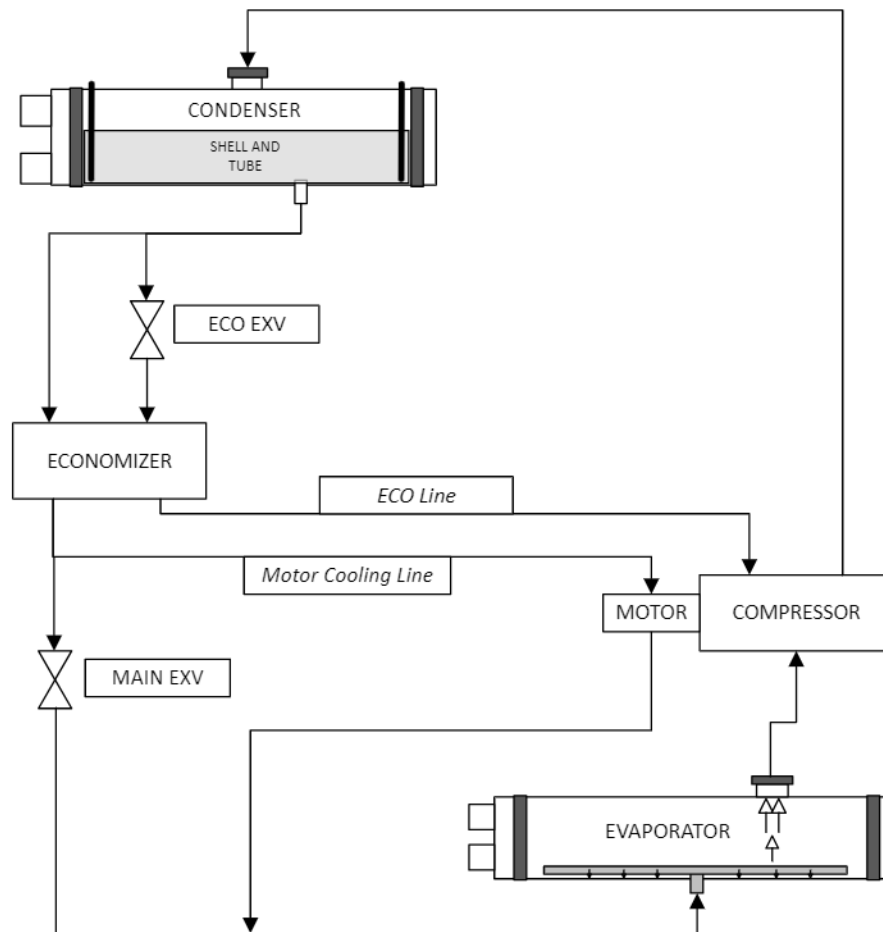


Fig. 5 — Refrigeration Cycle — Refrigeration Cycle - 23XW/XQ Compressor with Economizer

⚠ CAUTION

To avoid adverse effects on chiller operation, considerations must be made to condenser water temperature control. For steady state operation, the minimum operating refrigerant pressure differential between evaporator and condenser is approximately 7 psid (48 kPa) with a maximum evaporator refrigerant temperature of 65°F (18°C). Consult Chiller Builder for required steady state operational limits. Inverted start conditions are acceptable for short durations of time, but for periods exceeding 5 minutes, a special control solution strategy should be used to allow the chiller to establish a minimum refrigerant pressure differential (and thereby adequate equipment cooling).

Motor Cooling System

The motor and compressor bearings are cooled by liquid refrigerant taken from the economizer main line before main EXV.

Refrigerant flow is maintained by the pressure differential that exists due to compressor operation. After exiting the economizer, the motor cooling refrigerant line is divided into two paths: one always open, and one equipped with solenoid (normally open) operated by 23XW/XQ software which are directed of motor winding and bearings. The refrigerant collects in the bottom of the motor casing and is then drained back into the evaporator through the motor refrigerant drainline. The motor is protected by temperature thermistors embedded in the stator windings. An increase in motor winding temperature past the motor override set point (212°F [100°C]) enables the capacity inhibit function. The inhibit is released when the temperature is below the motor override set point. If the motor temperature is greater than compressor motor override temperature plus 10°F (5.5°C) the capacity override will stay active until all the motor winding temps are less than the motor override setpoint minus 2°F (1.1°C). Note that unit will shut down if any motor temperature sensor exceeds 242°F (117°C). See Fig. 6.

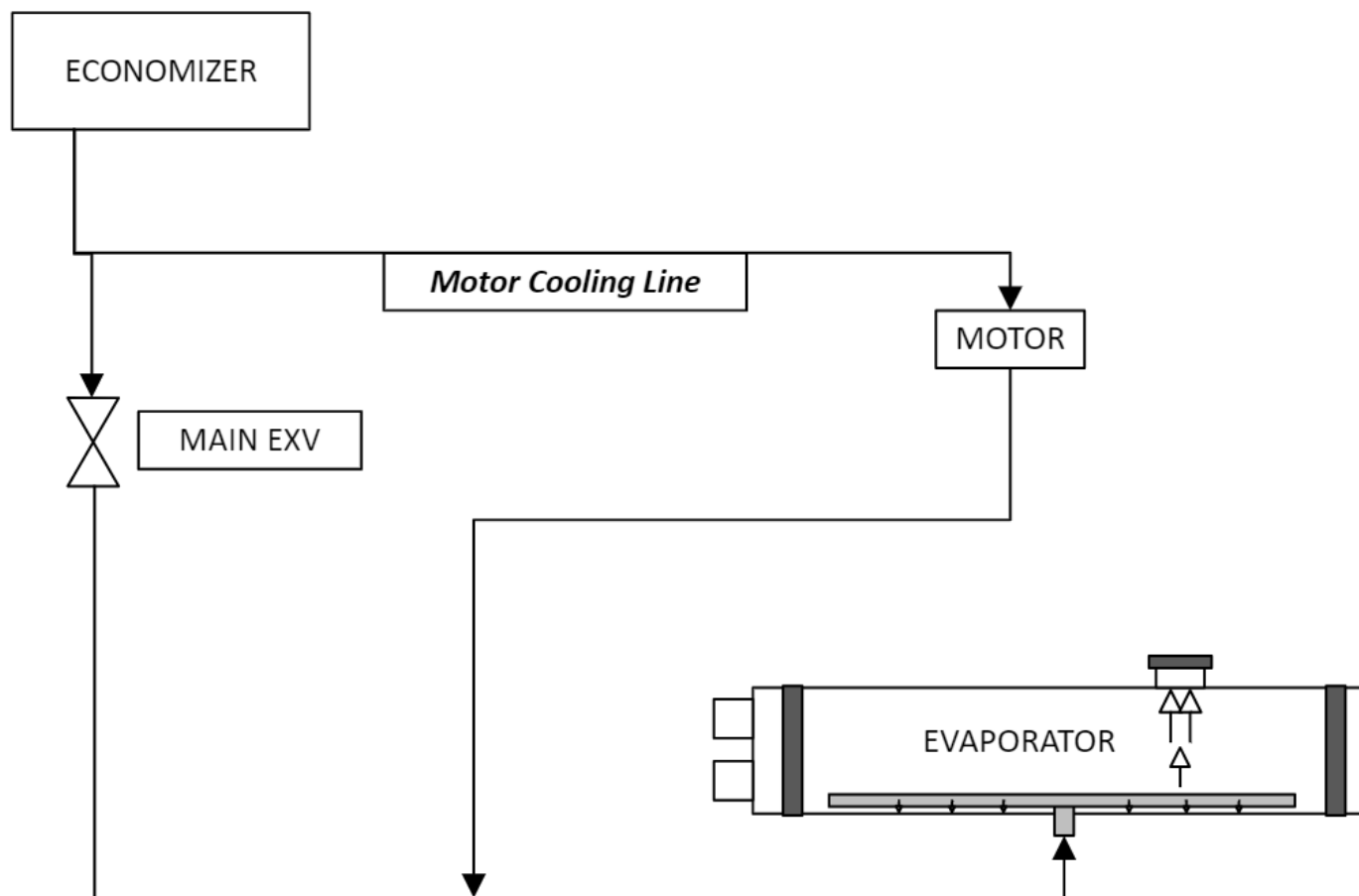
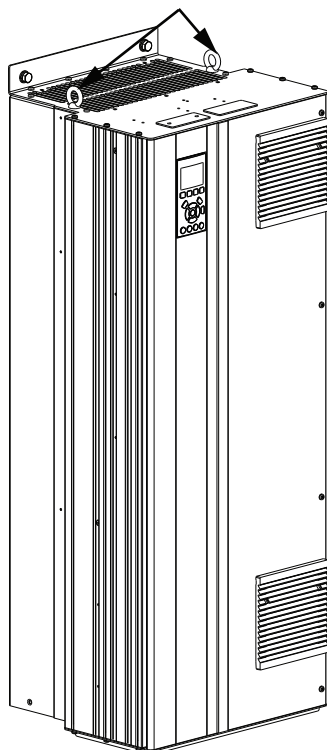


Fig. 6 — Motor Cooling System

VFD

The 23XW/XQ unit mounted starters are Danfoss FC102 VFDs family. The VFDs are used to run Carrier's Interior Permanent Magnet (IPM), gear-less compressors family. The VFD, power panel, and control panel are mounted on the chiller. See manufacturer VFD specific information and VFD schematics. The drives are designed to operate in an ambient range of up to 104°F (40°C) without de-rating the VFD. Consult Engineering for ambient temperatures greater than this value. Both manufacturer's drives are designed to allow service to repair the units without removing them from the chiller. For standard tier drives, line reactors are offered as an option to improve the units' reliability and harmonics. These are offered as freestanding options in addition to the standard tier VFD. See Fig. 7.



NOTE: Hole size is 0.76 in. (20 mm). Rig in all holes simultaneously.

Fig. 7 — VFD Lifting Brackets

CONTROLS

Definitions

ANALOG SIGNAL

An *analog signal* varies in proportion to the monitored source. It quantifies values between operating limits. For example, a temperature sensor is an analog device because its resistance changes in proportion to the temperature, generating many values. The signal can be either voltage or current.

DISCRETE SIGNAL

A *discrete signal* is a 2-position representation of the value of a monitored source. For example, a switch produces a discrete signal indicating whether a value is above or below a set point or boundary by generating an on/off, high/low, or open/closed signal.

General

The 23XW/XQ screw liquid chiller contains a microprocessor based control center that monitors and controls all operations of the chiller. The microprocessor control system matches the cooling capacity of the chiller to the cooling (or heating in case of 23XQ) load while providing state-of-the-art chiller protection. The system controls cooling load within the set point plus the dead band by sensing the leaving chilled or condensed water or brine temperature and regulating EXVs and compressor speed. The compressor uses a combination of an internal check valve, pressure relief valve, twin screw, oil injected helical rotor to control the refrigeration effect in the evaporator by regulating the amount of refrigerant vapor flow into the compressor. An increase in displacement increases the capacity. A decrease in displacement decreases the capacity. The microprocessor-based control center protects the chiller by monitoring the digital and analog inputs and executing capacity overrides or safety shutdowns, if required. The variable frequency drive (VFD) allows compressor start-up and capacity control by modulating the motor frequency based on the operating condition.

PIC6.1 System Components

The chiller control system is called the PIC6.1 (Product Integrated Control 6). See Table 1. As with previous PIC versions, the PIC6.1 system controls the operation of the chiller by monitoring all operating conditions. The PIC6.1 control system can diagnose a problem and let the operator know what the problem is and what to check. It positions the guide vanes and VFD speed to maintain leaving chilled water temperature. It controls the refrigerant expansion system for optimal chiller operation and can interface with auxiliary equipment such as pumps and cooling tower fans to turn them on when required. It continually checks all safeties to prevent any unsafe operating condition. The PIC6.1 controls offer an operator trending function to help the operator monitor the chiller status more easily and for critical compressor motor protection. The PIC6.1 system provides open protocols to support the competitive BMS system and can be integrated into Carrier's Lifecycle System Management for remote monitoring and data management.

Table 1 — Major Controls Components and Panel Locations

PIC6.1 COMPONENT	PANEL LOCATION
Variable Frequency Drive (Standard Tier, High Tier)	Compressor motor end
Remote Monitoring	Power panel, low voltage section
Power Panel	Side of evaporator
HMI	Power panel or remote monitoring on compressor discharge end

NOTE: For detailed information about the PIC6.1 HMI (human machine interface), see the 23XW/XQ with PIC6.1 Controls Operation and Troubleshooting manual.

START-UP/SHUTDOWN/RECYCLE SEQUENCE

Local Start/Stop Control

Local start-up (or manual start-up) is initiated by pressing the gray Start/Stop icon on the HMI interface. See Fig. 8.

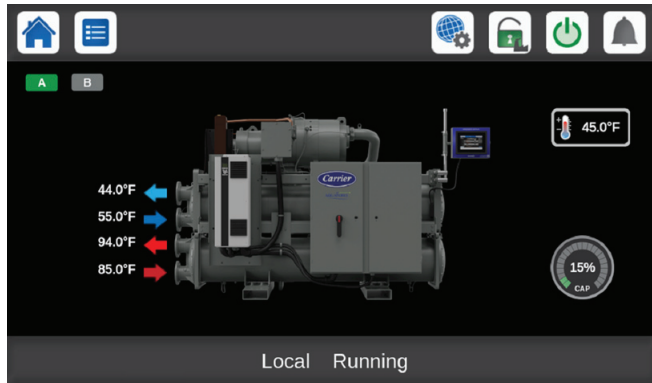


Fig. 8 — Chiller Start/Stop Icon

This initiates the PIC6.1 starting sequence by displaying the list of operating modes. Press Local On to initiate start-up. See Fig. 9.

Prior to start-up the start-to-start timer and the stop-to-start timer must have elapsed and all alarms must be cleared (see Troubleshooting Guide section).

When start-up is initiated the status screen displays the start-up progress and the Start/Stop icon  blinks green.

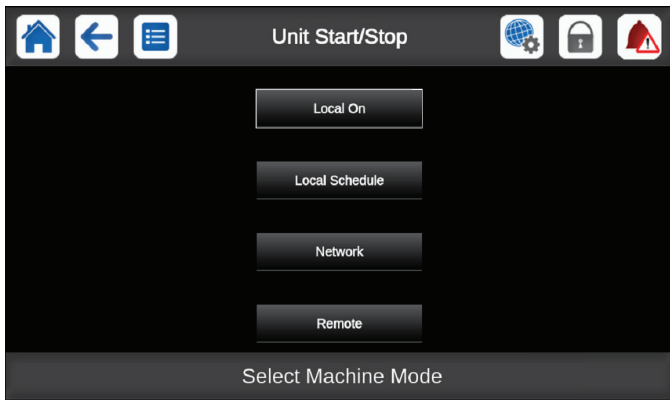


Fig. 9 — Local On

Once local start-up begins, the PIC6.1 control system performs a series of prestart tests to verify that all prestart alerts and safeties are within acceptable limits. Table 2 shows appropriate Prestart Alerts/Alarms conditions. If a test is not successful, the start-up is delayed or aborted.

Five seconds later, the condenser pump relay energizes (when applicable). Thirty seconds later the PIC6.1 control system monitors the chilled water and condenser water flow devices and waits until WATER FLOW VERIFY TIME (operator-configured, default 5 minutes) expires to confirm flow. After flow is verified, the chilled water temperature is compared to CONTROL POINT plus 1/2 CHILLED WATER DEADBAND. If the temperature is less than or equal to this value, the PIC6.1 control system turns off the condenser pump relay and goes into a Recycle mode.

Compressor ontime and service ontime timers start, and the compressor STARTS IN 12 HOURS counter and the number of starts over a 12-hour period counter advance by one.

Failure to verify any of the requirements up to this point will result in the PIC6.1 control system aborting the start and displaying the applicable prestart alert alarm state number near the bottom of the home screen on the HMI panel. A prestart failure does not advance the STARTS IN 12 HOURS counter. Any failure after the ICR/Start relay has energized results in a safety shutdown, advances the starts in 12 hours counter by one, and displays the applicable shutdown status on the display.

The minimum time to complete the entire prestart sequence is approximately 150 seconds. See Fig. 12 for normal start-up timing sequence. See Table 2 for a list of prestart checks.

Table 2 — Prestart Checks

PRESTART CHECK CONDITION ^a	STATE NUMBER ^b
Illegal factory configuration (01: Unit size does not exist, 02: QM code not found, 99: Chiller unit size not configured)	Alarm 70XX
No factory configuration	Alarm 8000
Cooler Flow Switch failure	Alarm 10091
Condenser Flow Switch failure	Alarm 10015
Service maintenance alert	Alarm 13XXX
Oil filter	Alarm 13001
Liquid line filter	Alarm 13002
Check and replace fuses	Alarm 13003
Periodic leakage check	Alarm 13005
Routine service visit	Alarm 13006
Oil analysis	Alarm 13007
Glycol level check	Alarm 13008
Check anti-vibration mounts	Alarm 13009
Compressor Motor temperature too high (Motor temperature > 117°C and it was previously > 100°C for 10 seconds)	Alarm 1101
Database module failure (highly recommended to power cycle the panel)	Alarm 55001
Lenscan module failure (highly recommended to power cycle the panel)	Alarm 56001
Wrong Compressor Type Configuration	Alarm 10123
Compressor reverse rotation (Compressor start and DP < 100 kPa or DP has dropped by 50 kPa in 20 seconds)	Alarm 1113

NOTE(S):

- a. If Prestart Check Condition is True, then resulting State is as indicated in the State Number column.
- b. See the Controls Operation and Troubleshooting guide for alarm and alert codes.

Shutdown

The unit can be stopped locally using the HMI by pressing the green Start/Stop icon . The Unit Start/Stop screen is displayed. Press Confirm Stop (see Fig. 10).

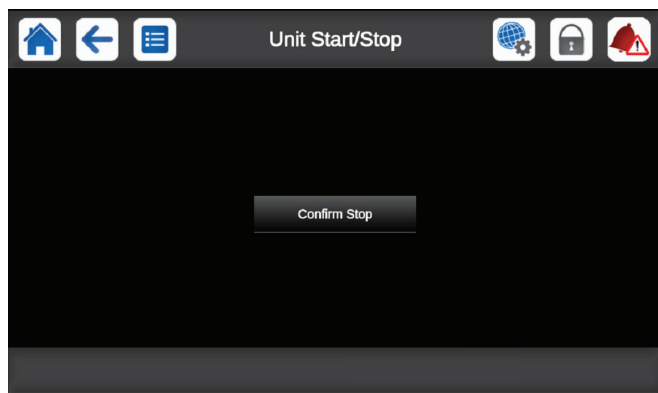


Fig. 10 — Confirm Stop

Chiller shutdown begins if any of the following occurs:

- Local OFF button is pressed
- A recycle condition is present
- The time schedule has gone into unoccupied mode when in Network or Local Schedule control mode
- The chiller protective limit has been reached and chiller is in alarm
- The start/stop status (CHIL_S_S) is overridden to stop from the network when in Network mode

If the chiller is normally shut down from running, soft stop shutdown will be performed. The soft stop feature closes the guide vanes of the compressor automatically if a non-alarm stop signal occurs before the compressor motor is de-energized.

When any one of the above conditions is true, the shutdown sequence stops the compressor by deactivating the compressor start relay.

BEFORE INITIAL START-UP

Job Data Required

- List of applicable design temperatures and pressures (product data submittal) from the Equipment Sales Engineer who sold the equipment
- chiller certified prints
- wiring diagrams
- diagrams and instructions for special controls or options
- 23XW/XQ Installation Instructions

Equipment Required

- mechanic's tools (refrigeration)
- digital volt-ohmmeter (DVM)
- true RMS (root mean square) digital multimeter with clamp-on current probe or true RMS digital clamp-on ammeter rated for at least 575 vac and 1000 amps
- electronic refrigerant leak detector
- absolute pressure manometer or electronic micron gage (see Fig. 11)



Fig. 11 — Digital Vacuum Gage

Remove Shipping Packaging

Remove any packaging material from the unit, VFD, and power panels. Inspect the unit for damage that occurred during shipping or installation. Document any damage that was identified.

Tighten All Gasketed Joints

Gaskets normally relax by the time the chiller arrives at the job-site. Tighten all gasketed joints to ensure a leak-tight chiller (does not apply to refrigerant joints covered by factory insulation).

Gasketed joints (excluding O-ring face seals¹) may include joints at waterbox covers.

See Tables 3 and 4 for bolt torque requirements.

1. O-ring face seals (ORFS) are factory torqued. See Table 5 for (ORFS) torque requirements.

Table 3 — Bolt Torque Requirements, Foot Pounds

BOLT SIZE (in.)	SAE 2, A307 GR A HEX HEAD NO MARKS LOW CARBON STEEL		SAE 5, SOCKET HEAD OR HEX WITH 3 RADIAL LINES, OR SA499 MEDIUM CARBON STEEL		SAE 8, HEX HEAD WITH 6 RADIAL LINES OR SA354 GR BD MEDIUM CARBON STEEL	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
1/4	4	6	5	9	9	13
5/16	7	11	12	18	20	28
3/8	13	19	21	31	32	46
7/16	20	30	34	50	53	75
1/2	31	45	53	75	79	115
9/16	45	65	74	110	115	165
5/8	65	95	104	150	159	225
3/4	104	150	174	250	260	370
7/8	140	200	264	380	414	590
1	210	300	410	580	625	893
1-1/8	329	475	544	780	984	1,410
1-1/4	460	660	770	1,100	1,380	1,960
1-3/8	619	885	1,020	1,460	1,840	2,630
1-1/2	740	1060	1,220	1,750	2,200	3,150
1-5/8	1010	1450	1,670	2,390	3,020	4,310
1-3/4	1320	1890	2,180	3,110	3,930	5,610
1-7/8	1630	2340	2,930	4,190	5,280	7,550
2	1900	2720	3,150	4,500	5,670	8,100
2-1/4	2180	3120	4,550	6,500	8,200	11,710
2-1/2	3070	4380	5,000	7,140	11,350	16,210
2-3/4	5120	7320	8,460	12,090	15,710	22,440
3	6620	9460	11,040	15,770	19,900	28,440

Table 4 — Bolt Torque Requirements, Foot Pounds (Metric Bolts)

BOLT SIZE (Metric)	CLASS 4.8		CLASS 8.8		CLASS 10.9	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
M4	4	6	5	9	9	13
M8	7	11	12	18	20	28
M10	13	19	21	31	32	46
M12	31	45	53	75	79	115
M14	45	65	74	110	115	165
M16	65	95	104	150	159	225
M18, 20	104	150	174	250	260	370
M22	140	200	264	380	414	590
M24	210	300	410	580	625	893
M27	329	475	544	780	984	1410
M30	460	660	770	1100	1380	1960
M33, 36	619	885	1020	1460	1840	2630
M39	740	1060	1220	1750	2200	3150
M42	1010	1450	1670	2390	3020	4310
M45	1320	1890	2180	3110	3930	5610
M48	1630	2340	2930	4190	5280	7550
M52	1900	2720	3150	4500	5670	8100
M56, 60	2180	3120	4550	6500	8200	11710
M64	3070	4380	5000	7140	11350	16210
M68	5120	7320	8460	12090	15710	22440
M72, 76	6620	9460	11040	15770	19900	28440

Table 5 — O-ring Face Seal Torque Requirements

TUBE SIZE (IN.)	ORS WRENCH	MINIMUM N•m (ft-lb)	MAXIMUM N•m (ft-lb)
1/4	11/16	15.9 (11.7)	17.4 (12.8)
3/8	13/16	26.4 (19.5)	29.0 (21.4)
1/2	15/16	35.3 (26.0)	38.8 (28.6)
5/8	1-1/8	52.9 (39.0)	58.2 (42.9)

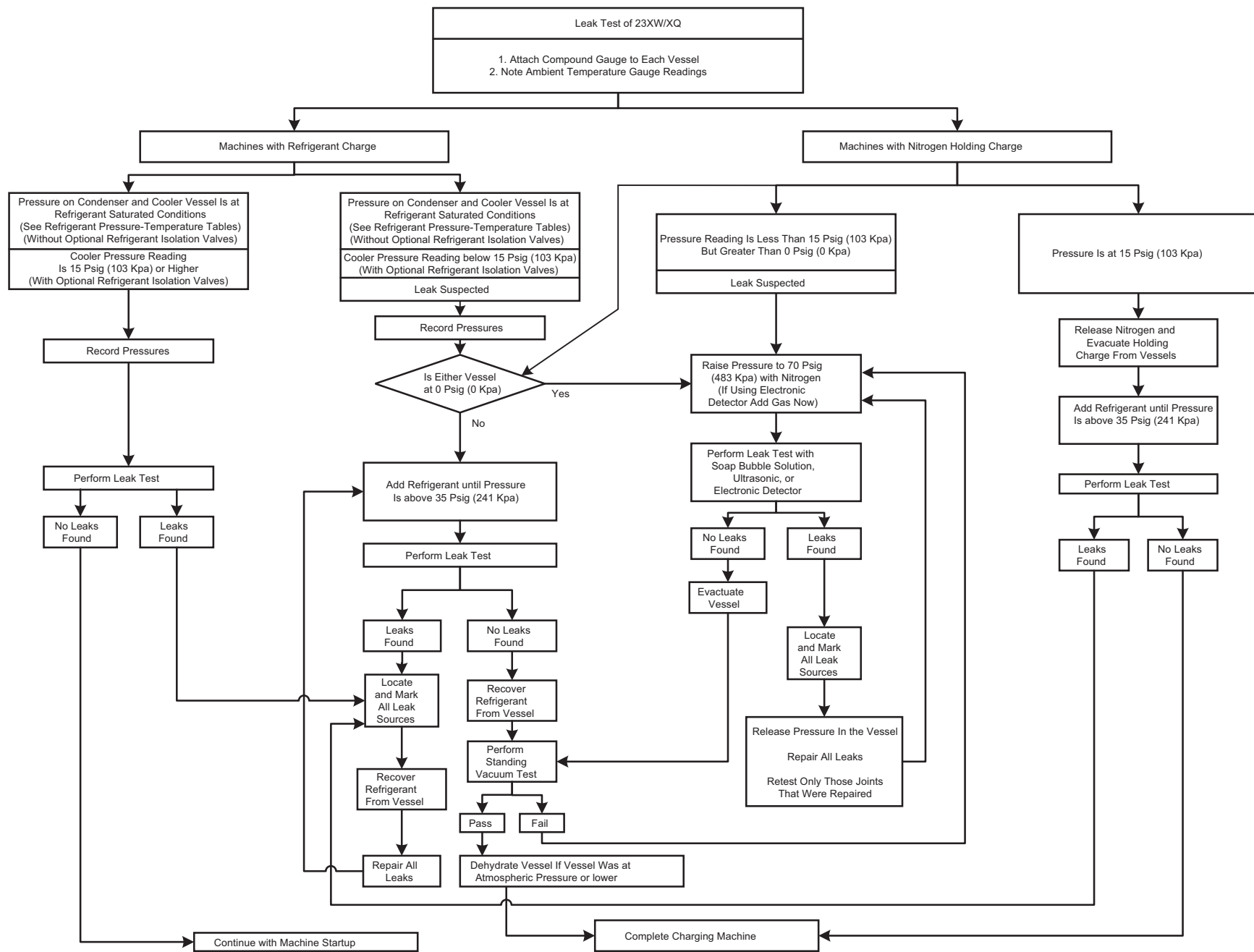
Check Chiller Tightness

Figure 12 outlines the proper sequence and procedures for leak testing.

The 23XW/XQ chillers are shipped with a full refrigerant charge. Units may be ordered with refrigerant shipped separately, along with 15 psig (103 kPa) nitrogen holding charge in each vessel.

To determine if there are any leaks, the unit should be charged with refrigerant. Use an electronic leak detector to check all flanges and solder joints after the chiller is pressurized. If any leaks are detected, follow the leak test procedure (page 17).

If the chiller is spring isolated, keep all springs blocked in both directions to prevent possible piping stress and damage during the transfer of refrigerant from vessel to vessel during the leak test process, or any time refrigerant is being transferred. Adjust the springs when the refrigerant is in operating condition and the water circuits are full.



Check Motor Cooling Valves

Before initial startup verify that the isolation valves on the filter-dryer and economizer line are in the open position. On initial start-up monitor the motor winding temperatures to verify proper cooling.

Economizer Refrigerant Isolation Valves

Before start-up, confirm the two refrigerant isolation valves for the economizer inlet and outlet to evaporator are open.

Refrigerant Tracer

Carrier recommends the use of an environmentally acceptable refrigerant tracer for leak testing with an electronic refrigerant detector. Ultrasonic leak detectors can also be used if the chiller is under pressure. 23XW/XQ offers input contact for refrigerant leak detection.

NOTE: If the unit is charged with refrigerant from the factory and there is pressure on the unit, a leak check can be performed with no other actions.

⚠ WARNING

Do not use air or oxygen as a means of pressurizing the chiller. Mixtures of R-515B/R-1234ze(E) and air can undergo combustion, resulting in equipment damage and possible personal injury.

Leak Test Chiller

Due to regulations regarding refrigerant emissions and the difficulties associated with separating contaminants from the refrigerant, Carrier recommends the following leak test procedure. Refer to Tables 6 and 7 for refrigerant pressure/temperature values.

1. If the pressure readings are normal for the chiller condition:
 - a. Evacuate the charge from the vessels, if present.
 - b. Raise the chiller pressure, if necessary, by adding refrigerant until pressure is at the equivalent saturated pressure for the surrounding temperature.

⚠ CAUTION

Never charge liquid refrigerant into the chiller if the refrigerant saturated temperature is less than 40°F for R-515B/R-1234ze(E). Charge as a gas only, with the cooler and condenser pumps running, until this temperature is reached. Flashing of liquid refrigerant at low temperatures can cause tube freeze-up and considerable damage.

- c. Leak test chiller as outlined in Steps 3 to 7.
2. If the pressure readings are abnormal for the chiller condition:
 - a. Prepare to leak test chillers shipped with refrigerant (Step 2h).
 - b. Check for large leaks by connecting a nitrogen bottle and raising the pressure to 30 psig (207 kPa). Soap test all

joints. If the test pressure holds for 30 minutes, prepare the test for small leaks (Steps 2g and 2h).

- c. Plainly mark any leaks that are found.
 - d. Release the pressure in the system.
 - e. Repair all leaks.
 - f. Retest the joints that were repaired.
 - g. After successfully completing the test for large leaks, remove as much nitrogen, air, and moisture as possible, given the fact that small leaks may be present in the system. Follow the dehydration procedure outlined in the section “Chiller Dehydration” on page 20.
 - h. Slowly raise the system pressure to a maximum of 160 psig (1103 kPa) but no less than 35 psig (241 kPa) for R-515B/R-1234ze(E) by adding refrigerant (below 35 psig refrigerant must be added as a gas). Proceed with the test for small leaks (Steps 3 to 9).
3. Check the chiller carefully with an electronic leak detector or soap bubble solution.
4. Leak Determination — If an electronic leak detector indicates a leak, use a soap bubble solution, if possible, to confirm. Total all leak rates for the entire chiller. Leakage at rates greater than 0.1% of the total charge per year must be repaired. Note the total chiller leak rate on the start-up report.
5. If no leak is found during the initial start-up procedures, complete the transfer of refrigerant gas from the storage tank to the chiller. Retest for leaks.
6. If no leak is found after a retest:
 - a. Transfer the refrigerant to the storage tank and perform a standing vacuum test as outlined in the section “Standing Vacuum Test” on page 19.
 - b. If the chiller fails the standing vacuum test, check for large leaks (Step 2b).
 - c. If the chiller passes the standing vacuum test, dehydrate the chiller. Follow the procedure in the section “Chiller Dehydration” on page 20. Charge the chiller with refrigerant.
7. If a leak is found after a retest, pump refrigerant back into storage tank or, if isolation valves are present, pump refrigerant into the non-leaking vessel. See the section “PUMPOUT AND REFRIGERANT TRANSFER PROCEDURES” on page 31.
8. Transfer the refrigerant until the chiller pressure is at 18 in. Hg (40 kPa absolute).
9. Repair the leak and repeat the procedure, beginning from Step 2h, to ensure a leak-tight repair. (If the chiller is opened to the atmosphere for an extended period, evacuate it before repeating the leak test.)

NOTE: Alternate optional leak testing method is to isolate the water circuits and use a portable water heater to raise the temperature of the evaporator and condenser water circuits to approximately 100°F (38°C) which corresponds to a pressure of approximately 125 psig (860 kPa).

Table 6 – Pressure – Temperature (F)

TEMPERATURE (F)	R-1234ze(E) Pressure (psig)	R-515B	
		Liquid Phase Pressure (psig)	Vapor Phase Pressure (psig)
0	0.82	0.71	0.69
2	1.58	1.46	1.44
4	2.36	2.23	2.22
6	3.17	3.04	3.03
8	4.02	3.88	3.86
10	4.89	4.75	4.73
12	5.79	5.65	5.63
14	6.73	6.58	6.56
16	7.70	7.54	7.52
18	8.71	8.54	8.52
20	9.75	9.57	9.55
22	10.82	10.64	10.62
24	11.93	11.74	11.72
26	13.08	12.89	12.87
28	14.27	14.06	14.04
30	15.49	15.28	15.26
32	16.76	16.54	16.52
34	18.06	17.84	17.81
36	19.41	19.18	19.15
38	20.80	20.56	20.53
40	22.23	21.98	21.96
42	23.71	23.45	23.42
44	25.23	24.96	24.93
46	26.80	26.52	26.49
48	28.41	28.12	28.10
50	30.07	29.78	29.75
52	31.78	31.48	31.45
54	33.54	33.23	33.20
56	35.35	35.03	35.00
58	37.21	36.88	36.85
60	39.13	38.78	38.75
62	41.10	40.74	40.70
64	43.12	42.75	42.71
66	45.20	44.81	44.78
68	47.33	46.93	46.90
70	49.52	49.11	49.08
72	51.77	51.35	51.31
74	54.08	53.64	53.61
76	56.45	56.00	55.96
78	58.87	58.42	58.38
80	61.37	60.89	60.85
82	63.92	63.43	63.39
84	66.54	66.04	66.00
86	69.23	68.71	68.67
88	71.98	71.45	71.40
90	74.80	74.25	74.21
92	77.69	77.12	77.08
94	80.64	80.06	80.02
96	83.67	83.07	83.03
98	86.77	86.16	86.11
100	89.94	89.31	89.26
102	93.19	92.45	92.49
104	96.51	95.85	95.80
106	99.91	99.23	99.18
108	103.39	102.68	102.63
110	106.94	106.22	106.17
112	110.57	109.83	109.78
114	114.29	113.53	113.47
116	118.09	117.31	117.25
118	121.97	121.16	121.11
120	125.93	125.11	125.05
122	129.98	129.14	129.08
124	134.12	133.25	133.19
126	138.35	137.45	137.40
128	142.66	141.75	141.69
130	147.07	146.13	146.07
132	151.56	150.61	150.54
134	156.15	155.17	155.11
136	160.84	159.83	159.77
138	165.62	164.59	164.52
140	170.50	169.44	169.38

Table 7 – Pressure – Temperature (C)

TEMPERATURE (F)	R-1234ze(E) Pressure (kPa_g)	R-515B	
		Liquid Phase Pressure (kPa_g)	Vapor Phase Pressure (kPa_g)
-17.78	5.68	4.87	4.78
-16.67	10.88	10.04	9.94
-15.56	16.28	15.41	15.31
-14.45	21.88	20.97	20.87
-13.33	27.69	26.74	26.63
-12.22	33.71	32.72	32.61
-11.11	39.95	38.92	38.81
-10.00	46.41	45.34	45.23
-8.89	53.10	51.99	51.87
-7.78	60.03	58.87	58.75
-6.67	67.19	65.99	65.86
-5.56	74.60	73.36	73.22
-4.44	82.26	80.97	80.83
-3.33	90.18	88.84	88.70
-2.22	98.36	96.97	96.82
-1.11	106.80	105.36	105.21
0.00	115.52	114.03	113.88
1.11	124.52	122.98	122.82
2.22	133.81	132.21	132.05
3.33	143.39	141.73	141.56
4.44	153.26	151.54	151.38
5.56	163.45	161.66	161.49
6.67	173.94	172.09	171.91
7.78	184.74	182.84	182.65
8.89	195.87	193.90	193.71
10.00	207.33	205.29	205.10
11.11	219.12	217.01	216.82
12.22	231.26	229.08	228.88
13.33	243.74	241.49	241.28
14.44	256.58	254.25	254.04
15.56	269.77	267.37	267.16
16.67	283.34	280.86	280.64
17.78	297.28	294.72	294.50
18.89	311.60	308.96	308.73
20.00	326.31	323.59	323.35
21.11	341.42	338.61	338.37
22.22	356.92	354.03	353.78
23.33	372.84	369.85	369.60
24.44	389.17	386.09	385.83
25.56	405.92	402.75	402.48
26.67	423.10	419.83	419.56
27.78	440.72	437.35	437.08
28.89	458.78	455.32	455.03
30.00	477.29	473.73	473.44
31.11	496.26	492.59	492.30
32.22	515.70	511.92	511.62
33.33	535.61	531.72	531.42
34.44	556.00	552.00	551.69
35.56	576.87	572.76	572.44
36.67	598.25	594.02	593.70
37.78	620.12	615.78	615.45
38.89	642.51	638.04	637.70
40.00	665.41	660.82	660.48
41.11	688.84	684.13	683.78
42.22	712.81	707.96	707.61
43.33	737.31	732.34	731.97
44.44	762.37	757.26	756.89
45.56	787.98	782.73	782.36
46.67	814.16	808.77	808.39
47.78	840.92	835.39	835.00
48.89	868.25	862.58	862.19
50.00	896.18	890.36	889.96
51.11	924.70	918.73	918.33
52.22	953.59	947.71	947.30
53.33	983.59	977.30	976.89
54.44	1014.00	1007.50	1007.10
55.56	1045.00	1038.40	1037.90
56.67	1076.60	1069.90	1069.40
57.78	1108.90	1102.00	1101.50
58.89	1141.90	1134.80	1134.30
60.00	1175.50	1168.20	1167.80

Standing Vacuum Test

When performing the standing vacuum test or chiller dehydration, use a manometer or a wet bulb indicator. Dial gages cannot indicate the small amount of acceptable leakage during a short period of time.

1. Attach an absolute pressure manometer or wet bulb indicator to the chiller.
2. Evacuate the vessel to at least 18 in. Hg vac (41 kPa [abs]), using a vacuum pump or a pumpout unit.
3. Valve off the pump to hold the vacuum and record the manometer or indicator reading.
 - a. If the leakage rate is less than 0.05 in. Hg (0.17 kPa) in 24 hours, the chiller is sufficiently tight.
 - b. If the leakage rate exceeds 0.05 in. Hg (0.17 kPa) in 24 hours, re-pressurize the vessel and test for leaks.
4. Repair the leak, retest, and proceed with dehydration.

Check the Installation

Use the following instructions to verify the condition of the installation. Note that the contractor should not apply power to the chiller before the Carrier Start-up Technician arrives at the job site.

1. Inspect the water piping to the chiller to confirm it is correct. Confirm it is adequately supported from the chiller and there are isolation valves installed.
2. Turn off, lock out, and tag the input power to the drive.
3. Wait a minimum of 8 minutes (for Danfoss Drive) for the DC bus to discharge.
4. All wiring should be installed in conformance with the applicable local, national, and international codes (e.g., NEC/CSA).
5. Remove any debris, such as metal shavings, from the enclosure.
6. Check that there is adequate clearance around the machine.
7. Verify that the wiring to the terminal strip and the power terminals is correct and that no external voltage potential is connected to any of the inputs.
8. Verify that all of the VFD power module circuit board connectors are fully engaged and taped in place.
9. Check that the field-installed wire size is within terminal specifications and that the wires are tightened properly and adequately supported.
10. Check that specified branch circuit protection is installed and correctly rated.
11. Check that the incoming power is within $\pm 10\%$ of chiller nameplate voltage.
12. Verify that a properly sized ground wire is installed and a suitable earth ground is used. Check for and eliminate any grounds between the power leads. Verify that all ground leads are unbroken to the power supply. Only a wye secondary power supply transformer with solidly grounded neutral is acceptable as a power supply to this chiller. If a ground wire is not present or the transformer secondary is any other type than a wye with solidly grounded delta, please contact the Technical Service Manager or Service Engineering.

Inspect Wiring

WARNING

Do not check the voltage supply without proper equipment and precautions. Serious personal injury may result. Follow power company recommendations.

CAUTION

Do not apply any kind of test voltage, even for a rotation check, if the chiller is under a dehydration vacuum. Insulation breakdown and serious damage may result.

WARNING

Do not apply power unless a qualified Carrier technician is present. Serious personal injury may result.

1. Examine the wiring for conformance to the job wiring diagrams and all applicable electrical codes.
2. Ensure that the VFD is protected by fused disconnects or circuit breakers as per electrical code.
3. Compare the ampere rating on the VFD nameplate to rating on the compressor nameplate.
4. Check that there is adequate service clearance around the machine.
5. Check that specified branch circuit protection is installed and correctly rated.
6. Ensure there is capability to turn off, lock out, and tag the input power to the drive.
7. If power is applied to the drive then wait for the DC bus to discharge and check DC bus voltage prior to starting any work. FC-102 drives have a label that indicates the capacitor discharge time dependent on drive sizes.
8. Inspect the control panels and VFD enclosure to ensure that the contractor has used the knockouts or provided top hat to feed the wires into the enclosures. Generally, wiring into the top of the enclosures can allow debris to fall into the enclosures. Clean and inspect the interior of the power panel and VFD enclosure if this has occurred. If metal particulate has fallen into the rectifier or inverter assemblies contact Service Engineering or your Technical Service Manager for further instructions.
9. Check that the incoming power is within $\pm 10\%$ of chiller nameplate voltage.
10. Check that the room environmental conditions match the chiller enclosure type. If the installation location does not have four walls and a roof, please contact the Technical Service Manager or Service Engineering.
11. Ensure the customer's contractor has verified proper operation of the pumps, cooling tower fans, and associated auxiliary equipment. This includes ensuring motors are properly lubricated and have proper electrical supply and proper rotation. The chiller or the building automation system must be capable of establishing water flow when the unit is in operation or off line for the freeze protection algorithm in the chiller controls to be effective. Pump control must be maintained for freeze protection algorithm.
12. Verify that the incoming source does not exceed the SCCR (short circuit current rating) of the equipment marking.
13. Ensure all electrical equipment and controls are properly grounded in accordance with the job drawings, certified drawings, and all applicable electrical codes.

Chiller Dehydration

Dehydration is recommended if the chiller has been open for a considerable period of time, if the chiller is known to contain moisture, or if there has been a complete loss of chiller holding charge or refrigerant pressure.

⚠ CAUTION

Do not start or megohm-test the compressor motor or any other pump motor, even for a rotation check, if the chiller is under dehydration vacuum. Insulation breakdown and severe damage may result.

⚠ WARNING

Power to the motor and VFD must be disconnected by an isolation switch before placing the machine under a vacuum. To be safe, isolate input power before evacuating the chiller if you are not sure if there are live leads to the hermetic motor.

Dehydration can be done at room temperatures. Using a cold trap (Fig. 13) may substantially reduce the time required to complete the dehydration and is recommended should the unit be exposed to liquid moisture. The higher the room temperature, the faster dehydration takes place. At low room temperatures, a very deep vacuum is required to boil off any moisture and heating of the water in the water circuits of the chiller to approximately 100°F (38°C) may be required.

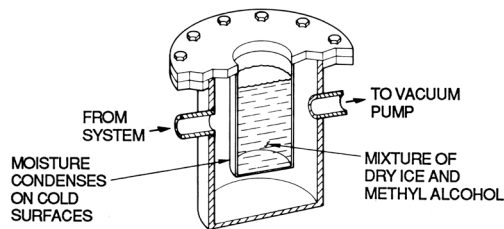


Fig. 13 — Dehydration Cold Trap

Perform dehydration as follows:

1. Connect a high capacity vacuum pump (5 cfm [.002 m³/s] or larger is recommended) to the refrigerant vacuum/charging valve (Fig. 2). Tubing from the pump to the chiller should be as short in length with a minimum diameter of 0.5 in. (13 mm) and as large in diameter as possible to provide least resistance to gas flow.
2. Use an absolute pressure manometer or a electronic micron gage to measure the vacuum. Open the shutoff valve to the vacuum indicator only when taking a reading. Leave the valve open for 3 minutes to allow the indicator vacuum to equalize with the chiller vacuum.
3. If the entire chiller is to be dehydrated, open all isolation valves (if present).
4. With the chiller ambient temperature at 60°F (15.6°C) or higher, operate the vacuum pump until the manometer reads 185 psig (1275 kPa), or a vacuum indicator reads 35°F (1.7°C). Operate the pump an additional 2 hours.
5. Do not apply a greater vacuum than 29.73 in. Hg vac (755.1 mm Hg) or go below 33°F (0.56°C) on the wet bulb vacuum indicator. At this temperature and pressure, isolated pockets of moisture can turn into ice. The slow rate of evaporation (sublimation) of ice at these low temperatures and pressures greatly increases dehydration time.
6. Valve off the vacuum pump, stop the pump, and record the instrument reading.
7. After a 2-hour wait, take another instrument reading. If the reading has not changed, dehydration is complete. If the reading indicates vacuum loss, repeat Steps 4 and 5.

8. If the reading continues to change after several attempts, perform a leak test (maximum 160 psig [1103 kPa] pressure). Locate and repair the leak, and repeat dehydration.
9. Once dehydration is complete, the evacuation process can continue. The final vacuum prior to charging the unit with refrigerant should in all cases be 29.9 in. Hg (500 microns, 0.07 kPa [abs]) or less.

Inspect Water Piping

Refer to piping diagrams provided in the certified drawings and the piping instructions in the 23XW/XQ Installation Instructions manual. Inspect the piping to the evaporator and condenser. Be sure that the flow directions are correct and that all piping specifications have been met.

Piping systems must be properly vented with no stress on water-box nozzles and covers. Water flows through the evaporator and condenser must meet job requirements. Measure the pressure drop across the evaporator and the condenser.

⚠ CAUTION

Water must be within design limits, clean, and treated to ensure proper chiller performance and to reduce the potential of tube damage due to corrosion, scaling, or erosion. Carrier assumes no responsibility for chiller damage resulting from untreated or improperly treated water.

Check Safety Valves

Be sure safety valves have been piped to the outdoors in compliance with the latest edition of ANSI/ASHRAE Standard 15 and applicable local safety codes. Piping connections must allow for access to the valve mechanism for periodic inspection and leak testing.

The standard 23XW/XQ relief devices are set to relieve at 220 psig (1516.85 kPa) chiller design pressure.

Ground Fault Troubleshooting

Follow this procedure only if ground faults are declared by the chiller controls. Test the chiller compressor motor and its power lead insulation resistance with a 500-v insulation tester such as a megohmmeter.

1. Open the VFD main disconnect switch and follow lockout/tagout rules.

⚠ CAUTION

The motor leads must be disconnected from the VFD before an insulation test is performed. The voltage generated from the tester can damage the VFD.

2. Perform test 1: For 3-lead motor, tie terminals 1, 2, and 3 together and test between the group and ground.
 - a. With the tester connected to the motor leads, take 10-second and 60-second megohm readings.
 - b. Divide the 60-second resistance reading by the 10-second reading. The ratio, or polarization index, must be one or higher. Both the 10 and 60-second readings must be at least 50 megohms. If the readings are unsatisfactory, repeat the test at the motor with the power leads disconnected. Satisfactory readings in this second test indicate the fault is in the power leads.
3. Perform test 2: Only perform this test if the unit has been disassembled at the job site, if the starter has been removed, or during annual maintenance.

Perform a megohm test from each terminal to ground. The megohm value should be greater than 20 megohm. Note that if a megohm test is performed between the terminals it will

show a direct short and is not a valid test because of the 3 terminal motor internal delta configuration.

Carrier Comfort Network Interface

The Carrier Comfort Network® (CCN) communication bus wiring is supplied and installed by the electrical contractor. It consists of shielded, 3-conductor cable with drain wire.

The system elements are connected to the communication bus in a daisy chain arrangement. The positive pin of each system element communication connector must be wired to the positive pins of the system element on either side of it. The negative pins must be wired to the negative pins. The signal ground pins must be wired to the signal ground pins. See installation manual.

NOTE: Conductors and drain wire must be 20 AWG (American Wire Gauge) minimum stranded, tinned copper. Individual conductors must be insulated with PVC, PVC/nylon, vinyl, PTFE (PolyTetraFluoroEthylene), or polyethylene. An aluminum/polyester 100% foil shield and an outer jacket of PVC, PVC/nylon, chrome vinyl, or PTFE with a minimum operating temperature range of -4°F to 140°F (-20°C to 60°C) is required. See Table 8 for cables that meet the requirements.

Table 8 — Manufacturers and Cable Numbers

Manufacturer	Cable No.
ALPHA	2413 or 5643
AMERICAN	A22503
BELDEN	8772
COLUMBIA	02525

When connecting the CCN communication bus to a system element, a color code system for the entire network is recommended to simplify installation and checkout. The color code shown in Table 9 is recommended.

Table 9 — Recommended Color Code

SIGNAL TYPE	CCN BUS CONDUCTOR INSULATION COLOR	CCN TERMINAL CONNECTION
+	Red	Red (+)
GROUND	Black	Black (G)
-	White	White (-)

⚠ WARNING

BE AWARE that certain automatic start arrangements *can engage the starter*. Open the disconnect *ahead* of the starter in addition to shutting off the chiller or pump. Failure to follow this procedure may result in personal injury by electric shock.

⚠ WARNING

The main disconnect on the starter front panel may not de-energize all internal circuits. Open all internal and remote disconnects before servicing the starter. Failure to follow this procedure may result in personal injury by electric shock.

Charge Refrigerant into Chiller

⚠ CAUTION

The transfer, addition, or removal of refrigerant in spring isolated chillers may place severe stress on and damage external piping if springs have not been blocked in both up and down directions.

⚠ CAUTION

Always operate the condenser and chilled water pumps during charging operations to prevent freeze-ups.

The standard chiller is shipped with the refrigerant already charged in the vessels. However, the chiller may be ordered with a nitrogen holding charge of 15 psig (103 kPa). Evacuate the nitrogen from the entire chiller, and charge the chiller from refrigerant cylinders. The full refrigerant charge in the 23XW/XQ chiller will vary with chiller components and design conditions. An approximate charge may be determined by adding the condenser, evaporator, and economizer charge (as applicable). Obtain refrigerant charge information from unit nameplate or from sales documents/E-Cat.

CHILLER EQUALIZATION WITHOUT A PUMPOUT UNIT

⚠ CAUTION

When equalizing refrigerant pressure on the 23 Series chiller after service work or during the initial chiller start-up, *do not use the discharge isolation valve to equalize*. A charging hose (connected between the charging valves on top of the cooler and condenser) should be used as the equalization valve. Failure to follow this procedure may damage equipment.

The following steps describe how to equalize refrigerant pressure in an isolated chiller without a pumpout unit.

1. Use Quick Test to access cooler and condenser pump control.

IMPORTANT: Turn on the chilled water and condenser water pumps to prevent freezing.

2. Connect a charging hose between the charging valves on top of the evaporator and condenser. Slowly open the refrigerant charging valves. The chiller cooler and condenser pressures will gradually equalize. This process takes approximately 15 minutes.
3. Once the pressures have equalized, the cooler isolation valve and the condenser isolation valve may now be opened.

TRIMMING REFRIGERANT CHARGE

The 23 Series chiller is shipped with the correct charge for the design duty of the chiller. Trimming the charge can best be accomplished when the design load is available. To trim the charge, check the temperature difference between the leaving chilled water temperature and cooler refrigerant temperature at full load design conditions. If necessary, add or remove refrigerant to bring the temperature difference to design conditions or minimum differential. Obtain refrigerant charge information from unit nameplate or from sales documents/E-Cat.

Software Configuration

⚠ WARNING

Do not operate the chiller before the control configurations have been checked and a Calibration and Control Test has been satisfactorily completed. Protection by safety controls cannot be assumed until all control configurations have been confirmed.

See the 23XW/XQ with PIC6.1 Controls Operation and Troubleshooting manual for instructions on using the PIC6.1 interface to configure the 23XW/XQ unit. As the unit is configured, all configuration settings should be written down. A log, such as the one shown starting on page CL-1, provides a list for configuration values.

HOME SCREEN

The home screen is the first screen shown after switching the unit on. See Fig. 14. Note the Globe  and Lock  icons.



Fig. 14 — Home Screen

The Globe icon  on the Home screen allows access to language and measurement settings. See Fig. 15.



Fig. 15 — Language and Units Selection Screen

NOTE: The flags shown are not all supported. Contact chiller marketing to learn about current language status.

The Lock icon  on the Home screen allows access to the password menu and displays current software version. See Fig. 16.

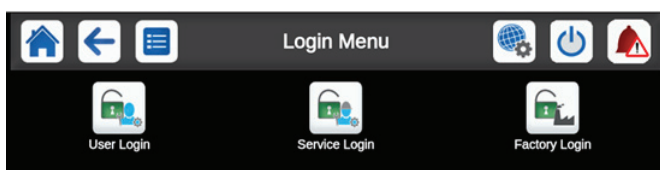


Fig. 16 — Login Screen

CHANGE THE SET POINTS

To access the set point screen, press the lock icon on the Main Menu. In the User Login menu, enter the password (default USER password = 1111), and click accept. The screen will then default back to the home screen. See Fig. 14. The Service Login access is reserved for access to equipment service tables.

The Main Menu screen is displayed. See Fig. 17 and 18. Press the Setpoint Table icon.

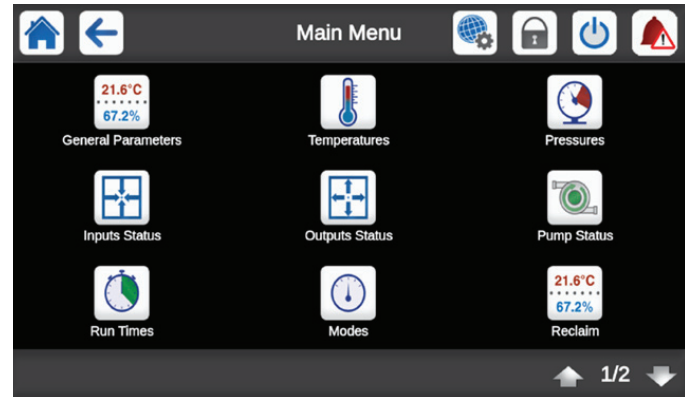


Fig. 17 — Main Menu, Page 1

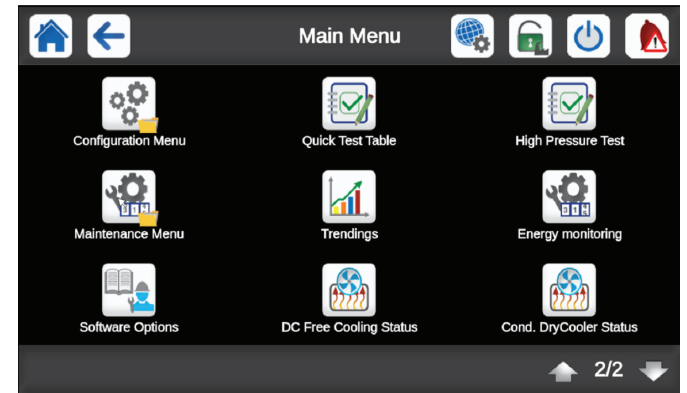


Fig. 18 — Main Menu, Page 2

INPUT THE LOCAL OCCUPIED SCHEDULE

Access the schedule menu (*Main Menu*→*Configuration Menu*→*Schedule Menu*) and set up the occupied time schedule according to the customer's requirements. If no schedule is available, the default is factory set for 24 hours occupied, 7 days per week including holidays. When the control mode is LOCAL SCHEDULE, the chiller will be automatically started if the configured local schedule is occupied and will be automatically shut down by the unoccupied schedule.

The Network Schedule should be configured if a CCN system is being installed. When control mode is NETWORK, the chiller can be started and stopped by the CHIL_S_S software point as written by other equipment through the network command and network schedule. The Schedule Menu contains a table to set the Network Schedule if required.

For more information about setting time schedules, please refer to the PIC6.1 Control User Manual.

INPUT SERVICE CONFIGURATIONS

See Fig. 19-20 for 23XW/XQ Configuration Tables. For specific values for the following configurations, refer to the chiller performance data or job-specific data sheet:

1. Password
2. Log in/log out
3. Input time and date
4. Service parameters
5. Equipment configuration
6. Automated control quick test

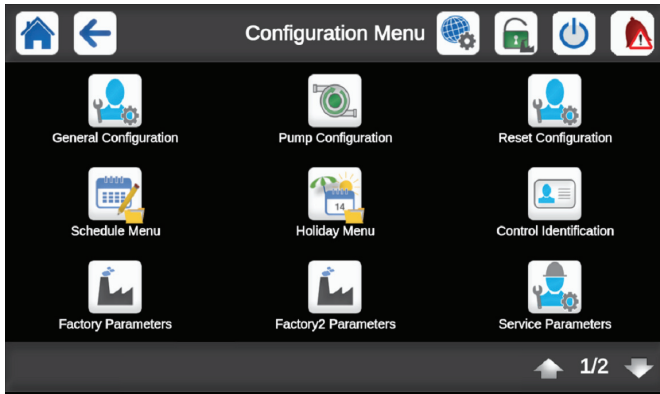


Fig. 19 — 23XW/XQ Configuration Tables, Page 1 (Factory Login View)

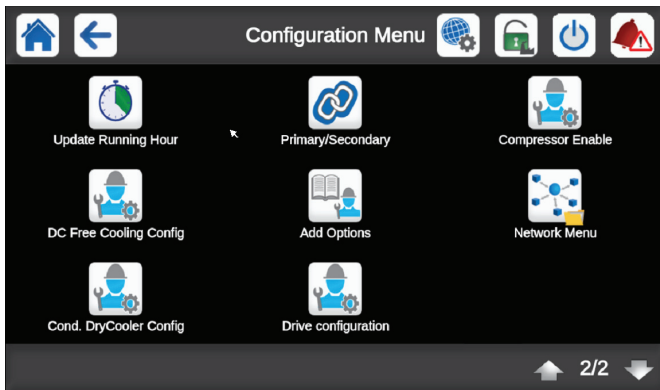


Fig. 20 — 23XW/XQ Configuration Tables, Page 2 (Factory Login View)

PASSWORD

A user password must be entered to access the Set Point or other common user tables. See Fig. 21-22. User password can be changed from the General Configuration Menu. USER CONFIGURATION allows change of the User access password. The default User password is 1111.

IMPORTANT: Be sure to remember the password. Retain a copy for future reference. Without the user password, access will not be possible unless accessed by a Carrier representative. Factory password is required to enter configuration menus required for chiller setup.

A 7-day access code to Service tables can be granted by Admin. Access to Factory tables requires deciphering of a QR code by authorized user of the Carrier SMARTService® app. The password changes periodically and ensures that only authorized users can adjust key product configuration and maintenance data.

Service and Factory login icon becomes visible after 72 hours of PIC6.1 HMI power-up followed by a power cycle. Up to this point the controller will accept “4444”.

For customers who require full access to the PIC6.1 controller, the controller can be configured for “Special User Login” mode, which disables the QR code requirement for Factory tables and replaces it with a static ten-digit password.

NOTE: This option reduces the cyber security protection of the chiller controls.

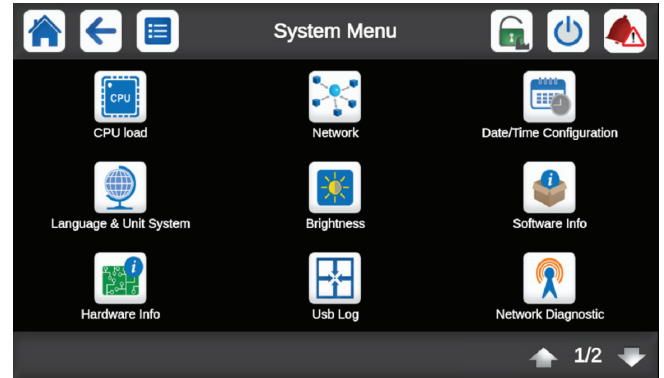


Fig. 21 — 23XW/XQ System Menu, Page 1

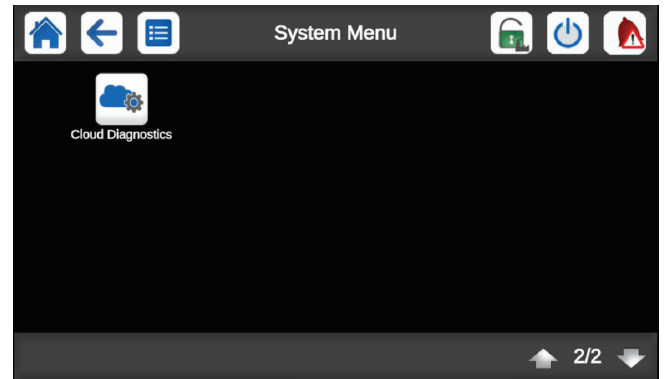


Fig. 22 — 23XW/XQ System Menu, Page 2

INPUT TIME AND DATE

Set day and time and, if applicable, holidays through MAIN MENU SYSTEM CONFIGURATION and then select Date/Time Configuration. See the Controls Operation and Troubleshooting guide for details. Because a schedule is integral to the chiller control sequence, the chiller will not start until the time and date have been set.

MODIFY CONTROLLER IDENTIFICATION IF NECESSARY

The CCN address can be changed from the Configuration Menu. Change this address under CONTROL IDENTIFICATION for each chiller if there is more than one chiller at the jobsite. Write the new address on the PIC6.1 Touch Screen module for future reference.

CONFIGURE TABLES

Access the related tables through MAIN MENU CONFIGURATION MENU (Fig. 19) to modify or view job site parameters shown in 23XW/XQ Configuration tables. Table 10 shows general configurations. Tables 11-16 should be verified or configured during startup/commissioning. Consult chiller nameplates as indicated. Tables 13-15 include typical parameters; for the complete list of parameters, consult the Initial Start-up Checklist in this manual or 23XW/XQ Controls Operation and Troubleshooting Manual.

Table 10 — General Configuration

NO.	VARIABLE	DISPLAY TEXT	STATUS	DEFAULT	UNIT
1	prio_cir	Cir Priority Sequence	0 to 2	0	—
2		0 = Auto, 1 = A Prio			
3		2 = B Prio			
4	seq_typ	Staged Loading Sequence	no / yes	no	—
5	ramp_set	Ramp Loading Select	no / yes	no	—
6	transcap	Cap. to Start 2nd Cir	30 to 100	50	%
7	off_on_d	Unit Of to On Delay	1 to 15	1	min
8	lim_set	Demand Limit Type Select	0 to 2	0	—
9		0 = None			
10		1 = Switch Control			
11		2 = 4-20mA Control			
12	nh_start	Night Mode Start Hour	hh:mm	00:00	—
13	nh_end	Night Mode End Hour	hh:mm	00:00	—
14	nh_limit	Night Capacity Limit	0 to 100	100	%
15	ice_cnfg	Ice Mode Enable	no / yes	no	—
16	shortcyc	Short Cycle Management	no / yes	no	—
17	al_rever	Alarm Output Reverse	no / yes	no	—

Table 11 — Pump Configuration

NO.	VARIABLE	DISPLAYED TEXT	STATUS	DEFAULT	UNIT
1	hpumpseq	Condenser Pumps Sequence	0 to 4	0 = no pump	—
2	cpumpseq	Cooler Pumps Sequence	0 to 4	0 = no pump	—
3		0 = No Pump			
4		1 = One Pump Only			
5		2 = Two Pumps Auto			
6		3 = Pump#1 Manual			
7		4 = Pump#2 Manual			
8	pump_del	Pump Auto Rotation Delay	24 to 3000	48	hour
9	pump_per	Pump Sticking Protection	no / yes	no	—
10	pump_sby	Stop Pump During Standby	no / yes	no	—
11	pump_loc	Flow Checked if Pump Off	no / yes	yes	—
12	stopheat	Cooler Pump During Standby	no / yes	no	—
13	stopcool	Cond Pump Off in Cool	no / yes	no	—
14	pg_evsp	Prop PID gain EVSP Control	–20 to 20	1.2	—
15	ig_evsp	Int PID gain EVSP Control	–5 to 5	0.2	—
16	dg_evsp	Deri PID gain EVSP Control	–20 to 20	0.4	—
17	min_evsp	Min Speed EVSP Control	0 to 100	50	—
18	max_evsp	Max Speed EVSP Control	0 to 100	100	—

Table 12 — Reset Configuration

NO.	VARIABLE	DISPLAYED TEXT	STATUS	DEFAULT	UNIT
1	cr_sel	Cooling Reset Select	0 to 4	0	—
2	hr_sel	Heating Reset Select	0 to 4	0	—
3		0 = None, 1 = OAT			
4		2 = Delta, 4 = Space Temp			
5		3 = 4-20mA Control			
6					
7		Cooling			
8	oat_crno	OAT No Reset Value	–10.0 to 51.67 14.0 to 125.0	–10 14	°C °F
9	oat_crfu	OAT Full Reset Value	–10.0 to 51.67 14.0 to 125.0	–10 14	°C °F
10	dt_cr_no	Delta No Reset Value	0 to 25	0	°F
11	dt_cr_fu	Delta Full Reset Value	0 to 25	0	°F
12	v_cr_no	Current No Reset Value	0 to 20	0	mA
13	v_cr_fu	Current Full Reset Value	0 to 20	0	mA
14	spacr_no	Space No Reset Value	–10.0 to 51.67 14.0 to 125.0	–10 14	°C °F

Table 12 — Reset Configuration (cont)

NO.	VARIABLE	DISPLAYED TEXT	STATUS	DEFAULT	UNIT
15	spacr_fu	Space Full Reset Value	–10.0 to 51.67 14.0 to 125.0	–10 14	°C °F
16	cr_deg	Cooling Reset Degree Value	–16.67 to 16.67 –30.0 to 30.0	0 0	°C °F
17					
18	Heating				
19	oat_hrno	OAT No Reset Value	–10.0 to 51.67 14.0 to 125.0	–10 14	°C °F
20	oat_hrfu	OAT Full Reset Value	–10.0 to 51.67 14.0 to 125.0	–10 14	°C °F
21	dt_hr_no	Delta No Reset Value	0 to 25	0	°F
22	dt_hr_fu	Delta Full Reset Value	0 to 25	0	°F
23	v_hr_no	Current No Reset Value	0 to 20	0	mA
24	v_hr_fu	Current Full Reset Value	0 to 20	0	mA
25	spahr_no	Space No Reset Value	–10.0 to 51.67 14.0 to 125.0	–10 14	°C °F
26	spahr_fu	Space Full Reset Value	–10.0 to 51.67 14.0 to 125.0	–10 14	°C °F
27	hr_deg	Heating Reset Degree Value	–16.67 to 16.67 –30.0 to 30.0	0 0	

Table 13 — Factory Parameters

NO.	VARIABLE	DISPLAY TEXT	STATUS	DEFAULT	UNIT
1		Configuration			—
2	app_cfg	Conf: Applied Config	No / Yes	Yes	—
3	country	Conf: Country	0 to 2	1=NA	—
4	tier	Conf: Unit Tier	1 to 1	1	—
5	unitsize	Conf: Unit Capacity	0 to 2000	0	—
6	refr_typ	Conf: Refrigerant Fluid	1 to 2	2=R1234ze or R515B	—
7	unit_type	Unit Type (Heatpump = 2)	1 to 2	1	—
8	freq	Power Supply Frequency	1 to 2	1	—
9	volt	Power Supply Voltage	1 to 5	1	—
10		Option			—
11	flui_typ	Opt: Cooler Fluid Type	1 to 4	1	—
12	optcondt	Opt: High Condensing Tmp	1 to 2	1	—
13	hotgasb	Opt: Hot Gas Bypass (NA Only)	No / Yes	No	—
14	cond_fsw	Opt: Cond. Flow-Switch	No / Yes	No	—
15	leak_chk	Opt: Ref. Leak Detection	No / Yes	No	—
16	dcfc_sel	DC/FC (EMEA Only)	No / Yes	No	—
17	emm_opt	Opt: Energy Mgnt	No / Yes	No	—
18	prim_sec	Opt: Primary Sec	No / Yes	No	—
19	cpass_nb	Opt: Cooler Pass Nb	1 to 3	2	—
20	con_evap	Opt: Connection Evap	0 to 1	0	—
21	cond_3wv	Opt: Condenser 3 way Valve	No / Yes	No	—
22	dryc_sel	Opt: Condenser Dry Cooler (EMEA Only)	No / Yes	No	—
23		Special			—
24	QM_code	Special: QM Code	0 to 0	0	—
25		Access			—
26	fac_pass	Access: Factory Password	0 to 9999		—

Table 14 — Factory 2 Parameters

NO.	VARIABLE	DISPLAY TEXT	STATUS	DEFAULT	UNIT
1		Unit			
2	nb_cir	Number of Circuits	1 to 2	1	—
3	lri3	Normally Open	No / Yes	No	—
4		Circuit A			
5	cpfrm_a	Cir A- Compr. Frame Ref.	1 to 4	1	—
6	cpmot_a	Cir A- Compr. Motor Type	1 to 2	1	—
7	cpmin_a	Cir A- Compr. Min Freq.	0 to 9999	—	Hz
8	cpmax_a	Cir A- Compr. Max Freq.	0 to 9999	—	Hz
9	drvref_a	Cir A- Drive Ref.	—	—	—
10	mexv_a	Cir A- Main EXV Ref.	—	—	—
11	eexv_a	Cir A- Eco. EXV Ref.	—	—	—

Table 15 — Service Parameters

NO.	VARIABLE	DISPLAY TEXT	STATUS	DEFAULT	UNIT
1	flow_sp	Flow Switch Sp	0 to 60	0	—
2	cond_typ	Condenser Fluid Type	1 to 2	1 = Water	—
3	ewt_opt	Entering Fluid Control	No / Yes	No	—
4	freezesp	Brine Freeze Setpoint	–28.89 to 1.11 –20.0 to 37.4	1.11 34.0	°C °F
5	mini_lwt	Brine Minimum Fluid Temp.	–20.0 to 37.4	37.4	°F
6	brine_c	Brine Concentration (%)	0 to 100	25	%
7	brine_t	Brine Type (0 = EG, 1 = PG)	0 to 1	0	—
8	fastcapr	Option: Fast Cap. Rec.	0 to 1	0	—
9	leak_thr	Leakage Charge Threshold	0 to 5	2.5	V
10	leak_tmr	Leakage Charge Timer	0 to 600	60	Min
11	RFI_conf	RFI Filter	Off / On	On	-
12	metric	Blackbox Metric Units	No / Yes	Yes	-
13	freez_ov	Freeze Override Offset	0 to 3.2 0 to 5.8	0 0	°C °F
14	auto_sm	Auto Start When SM Lost	disable / enable	disable	—
15	pg_3wv	Prop PID Gain 3way Valv.	–20.0 to 20.0	2	—
16	lg_3wv	Int PID Gain 3way Valv.	–5.0 to 5.0	0.2	—
17	dg_3wv	Deri PID Gain 3way Valv.	–20.0 to 20.0	0.4	—
18	min_3wv	3way Valve Min Speed	0 to 50	0	%
19	max_3wv	3way Valve Max Speed	30 to 100	100	%
20		Access			
21	ser_pass	Access: Service Password	0 to 9999		—
22		Force			
23	cdrv_cfg	Send Comp. Drive Config.	No / Yes	Yes	—
24	mxheatsp	Max Heating Sp Val.	26.7 to 60.0 80.0 to 140.0	52 125.6	°C °F
25	hgbp_hys	HGBP Hysteresis	1 to 10	2	Hz
26	hgbp_off	HGBP Offset	1 to 10	5	Hz

Table 16 — Drive Configuration

NO.	VARIABLE	DISPLAY TEXT	STATUS	DEFAULT	UNIT
1	Comp. Drive Config. Cir. A				
2	p_4_19_A	4-19: Max Output Freq. A	—	—	—
3	p_1_20_A	1-20: Motor kW A	—	—	—
4	p_1_22_A	1-22: Motor Volts A	—	—	—
5	p_1_23_A	1-23: Motor Frequency A	—	—	—
6	p_1_24_A	1-24: Motor Amperage A	—	—	—
7	p_1_25_A	1-25: Motor RPM A	—	—	—
8	p_3_03_A	3-03: Max Reference A	—	—	—
9	p_3_41_A	3-41: Ramp Up A	—	—	—
10	p_3_42_A	3-42: Ramp Down A	—	—	—
11	p_4_12_A	4-12: Motor Speed Low Limit A	—	—	—
12	p_4_14_A	4-14: Motor Speed High Limit A	—	—	—
13	p_4_18_A	4-18: Current Limit A	—	—	—
14	p_14_11_A	14-11: Main Volt. Fail A	—	—	—
15	Comp. Drive Config. Cir. B				
16	p_4_19_B	4-19: Max Output Freq. B	—	—	—
17	p_1_20_B	1-20: Motor kW B	—	—	—
18	p_1_22_B	1-22: Motor Volts B	—	—	—
19	p_1_23_B	1-23: Motor Frequency B	—	—	—
20	p_1_24_B	1-24: Motor Amperage B	—	—	—
21	p_1_25_B	1-25: Motor RPM B	—	—	—
22	p_3_03_B	3-03: Max Reference B	—	—	—
23	p_3_41_B	3-41: Ramp Up B	—	—	—
24	p_3_42_B	3-42: Ramp Down B	—	—	—
25	p_4_12_B	4-12: Motor Speed Low Limit B	—	—	—
26	p_4_14_B	4-14: Motor Speed High Limit B	—	—	—
27	p_4_18_B	4-18: Current Limit B	—	—	—
28	p_14_11_B	14-11: Main Volt. Fail B	—	—	—

Field Set Up and Verification

IMPORTANT: Some parameters are specific to the chiller configuration and will need to be verified prior to operation. All command functions must be initiated from the HMI.

Use the HMI touch screen to confirm that VFD values match the chiller parameter labels and Chiller Builder design data sheet. Locate VFD values from **Main Menu → Configuration Menu**.

LABEL LOCATIONS

Verify the following labels have been installed properly and match the chiller requisition:

- Surge Parameters — Located inside the HMI chiller control panel.
- Chiller identification nameplate — Located on the left side of the power panel. See Fig. 23.
- VFD Nameplate data - located on the right side of the VFD. See Fig. 23.

MODIFY EQUIPMENT CONFIGURATION IF NECESSARY

The EQUIPMENT SERVICE table has screens to select, view, or modify parameters. Carrier's certified drawings have the configuration values required for the jobsite. Modify these values only if requested. Modifications can include:

- Chilled water reset
- Entering chilled water control (Enable/Disable)
- 4 to 20 mA demand limit
- Frequent restart option (Enable/Disable)
- Remote contact option (Enable/Disable)

See the 23XW/XQ with PIC6.1 Controls Operation and Troubleshooting guide for more details about these functions; see the Control Panel Schematic for field wiring.

Carrier	
MODEL NUMBER	
SERIAL NUMBER	
MACHINE NAMEPLATE SUPPLY DATA	
VOLTS/PHASE-HERTZ	
VFD INPUT AMPS	
OVERLOAD TRIP AMPS	
MAX FUSE/CIRCUIT BREAKER SIZE	
MIN SUPPLY CIRCUIT CAPACITY	
MACHINE ELECTRICAL DATA	
MOTOR NAMEPLATE VOLTAGE	
COMPRESSOR 100% SPEED Hz	
RATED LINE VOLTAGE	
RATED LINE AMPS	
RATED LINE KILOWATTS	
MOTOR RATED LOAD KW	
MOTOR RATED LOAD AMPS	
MOTOR NAMEPLATE AMPS	
MOTOR NAMEPLATE RPM	
MOTOR NAMEPLATE KW	
INVERTER PWM FREQUENCY Hz	
STATOR WINDING RESISTANCE OHMS	
MOTOR D-AXIS INDUCTANCE mH @100	
MOTOR Q-AXIS INDUCTANCE mH @100	
MOTOR BACK EMF VOLTS	
SECCr kA	
MOTOR RATED TORQUE N m	
FOR INSTALLATION ONLY IN LOCATIONS NOT ACCESSIBLE TO THE GENERAL PUBLIC	
SAFETY CODE CERTIFICATION	
THIS UNIT IS DESIGNED, CONSTRUCTED AND TESTED IN CONFORMANCE WITH ASHRAE 34 (LATEST REVISION). SAFETY CODE FOR MECHANICAL REFRIGERATION.	
FOR INSTALLATION ONLY IN LOCATIONS NOT ACCESSIBLE TO THE GENERAL PUBLIC	
2008030131 REV. C	

Carrier	
MODEL NUMBER	
SERIAL NUMBER	
REFRIGERATION MACHINE	
MODEL NUMBER	SERIAL NO.
MACHINE	
COMPRESSOR	
EVAPORATOR	
CONDENSER	
ECONOMIZER	
VFD	N/R
REFRIGERANT	LBS. CHARGED KGS.
TEST PRESSURE	PSI KPA
MAX. ALLOW. PRESSURE	PSI KPA
CLR. WATER PRESSURE	PSI KPA
COND. WATER PRESSURE	PSI KPA
RATED TONS	
RATED KW	
 R1234ze(E) A2L CLASS PER ASHRAE 34	
CARRIER CHARLOTTE 9701 OLD STATESVILLE ROAD CHARLOTTE, NORTH CAROLINA 28269 MADE IN USA PRODUCTION YEAR: 20XX	
SAFETY CODE CERTIFICATION	
THIS UNIT IS DESIGNED, CONSTRUCTED AND TESTED IN CONFORMANCE WITH ASHRAE 34 (LATEST REVISION). SAFETY CODE FOR MECHANICAL REFRIGERATION.	
FOR INSTALLATION ONLY IN LOCATIONS NOT ACCESSIBLE TO THE GENERAL PUBLIC	
2008030131	

Fig. 23 — Nameplate

NOTE: Nameplate on the right to be used only with units containing A2L refrigerant. The equivalent non-A2L nameplate is to be used on other units.

Perform a Controls Test (Quick Test)

NOTE: The QUICK TEST screens can only be accessed when the chiller is in STOP mode.

Check the safety controls status by performing an automated controls test. First, perform a Quick Calibration Test (Path **Main Menu → Quick Calibration**). This is required for all modulating analog actuators. Upon successful calibration, use Quick Test (**Main Menu → Quick Test**) to verify operation on desired components. Note that this is a very useful feature for troubleshooting. On the QUICK TEST table screen, select a test to be performed.

The Quick Test checks all outputs and inputs for proper functionality. In order to successfully proceed with the controls test, the compressor must be off with no alarms showing, and voltage should be within $\pm 10\%$ of rating plate value. If an error occurs, the operator can try to address the problem as the test is being done or note the problem and proceed to the next test.

When the controls test is finished the test stops and the QUICK TEST menu displays. If a specific automated test procedure is not completed, access the particular control test to test the function when ready. Disable Quick Test feature when testing is complete. For information about calibration, see the sections Checking Pressure Transducers, page 40, and High Altitude Locations, page 40.

OPTIONAL EVAPORATOR AND CONDENSER PRESSURE TRANSDUCER AND WATERSIDE FLOW DEVICE CALIBRATION

Pressure sensor calibration can be initiated from **Main Menu → Maintenance Menu → Pressure Sensor Calib**. Calibration can be checked by comparing the pressure readings from the transducer to an accurate refrigeration gage reading. The transducer can be checked and calibrated at 2 pressure points. These calibration points are 0 psig (0 kPa) and between 25 psig (173 kPa) and 250 psig (1724 kPa). To calibrate these transducers:

1. Shut down compressor, evaporator, and condenser pumps.
2. Disconnect the transducer in question from its Schrader fitting for evaporator or condenser transducer calibration. For pump pressure or bearing pressure or flow device calibration keep transducer in place.

NOTE: If the evaporator or condenser vessels are at 0 psig (0 kPa) or are open to atmospheric pressure, the transducers can be calibrated for zero without removing the transducer from the vessel.

3. Access the PRESSURE screen from the Main Menu and view the particular transducer reading (the evaporator pressure, condenser pressure, economizer pressure, pump inlet pressure, pump outlet pressure, bearing inlet pressure, bearing outlet pressure).
4. To calibrate a device, view the particular reading on the screen. It should read 0 psig (0 kPa). If the reading is not 0 but within 5 psig (35 kPa), the value may be set to zero while the appropriate transducer parameter is highlighted. The value will now go to zero. No high end calibration is necessary for flow devices. If the transducer value is not within the calibration range, the transducer will return to the original reading. If the pressure is within the allowed range (noted above), check the voltage ratio of the transducer. To obtain the voltage ratio, divide the voltage (dc) input from the transducer by the supply voltage signal (see Maintenance Others in Maintenance Menu) or measure across the positive (+ red) and negative (– black) leads of the transducer. The voltage ratio must be between 0.80 and 0.11 for the software to allow calibration. Rotate the waterside flow pressure device from the inlet nozzle to the outlet nozzle and repeat this step. If rotating the waterside flow device does not allow calibration then pressurize the

transducer until the ratio is within range. Then attempt calibration again.

5. A high pressure point can be calibrated between 100 and 250 psig (689.5 and 1723.7 kPa) by attaching a regulated pressure source (usually from a nitrogen cylinder with high resolution pressure gage). The high pressure point can be calibrated by accessing the appropriate transducer parameter on the PRESSURES screen, highlighting the parameter, then increasing or decreasing the value to the exact pressure on the refrigerant gage.

Pressures at high altitude locations must be compensated for, so the chiller temperature/pressure relationship is correct. This is set in the Service Parameters (Configuration Menu).

The PIC6.1 does not allow calibration if the transducer is too far out of calibration. In this case, a new transducer must be installed and re-calibrated.

IMPORTANT: When screen display calibration is complete, do not press Calibration Enable/Disable since the new values will be deleted. Values are kept by exiting the pressure sensor table.

OPTIONAL THERMAL DISPERSION FLOW SWITCH CALIBRATION

Set the flow through the water circuit to the minimum safe flow that will be encountered.

Reduce the sensitivity of the switch by turning the adjustment counter-clockwise until the yellow LED turns off. This indicates that the switch is now open.

Increase the sensitivity of the flow switch by turning the adjustment potentiometer clockwise until the yellow LED is lit.

In case of nuisance trips at low flow, increase the sensitivity of the switch by turning the potentiometer clockwise.

INITIAL START-UP

Preparation

Before starting the chiller (cooling mode), verify:

1. Power is on to the VFD, chiller control panel, water pumps, and other equipment as required.
2. Cooling tower water is at proper level and at-or-below design entering temperature.
3. Chiller is charged with refrigerant and all refrigerant valves are in their proper operating positions.
4. Valves in the evaporator and condenser water circuits are open and flow is as per design.

NOTE: If the pumps are not automatic, ensure water is circulating properly.

To Prevent Accidental Start-Up

A chiller STOP override setting may be entered to prevent accidental start-up during service or whenever necessary. From the Main Menu, access the Configuration Menu and use the Compressor Enable (CP_ENABL) feature. Change Compressor Disable to Yes; then execute the command by touching the lightning button. To restart the chiller, access the same screen and change the Stop Override option to No. Capacity control can be viewed at Main Menu > Maintenance Menu > Capacity Control (CAPACTRL).

Check Chiller Operating Condition

Check to be sure that chiller temperatures, pressures, water flows, and refrigerant levels indicate the system is functioning properly.

Instruct the Customer Operator(s)

Ensure the operator understands all operating and maintenance procedures. Point out the various chiller parts and explain their function as part of the complete system.

EVAPORATOR-CONDENSER

Relief devices, refrigerant charging valve, temperature sensor locations, pressure transducer locations, condenser liquid level sensor, main EXV, Schrader fittings, waterboxes and tubes, and vents and drains.

MOTOR COMPRESSOR ASSEMBLY

Semi-hermetic casing, check valve, pressure relief valve, twin screw, oil injected helical rotor, motor, temperature sensors, and compressor serviceability.

ECONOMIZER

BPHE and economizer EXVs. Pressure transducer and temperature sensor location.

CONTROL SYSTEM

NETWORK and LOCAL start, reset, menu, softkey functions, HMI operation, occupancy schedule, set points, safety controls, and auxiliary and optional controls.

AUXILIARY EQUIPMENT

Starters and disconnects, separate electrical sources, pumps, and cooling tower (if applicable).

DESCRIBE CHILLER CYCLES

Refrigerant, motor cooling, and liquid reclaim.

REVIEW MAINTENANCE

Scheduled, routine, and extended shutdowns, importance of a log sheet, importance of water treatment and tube cleaning, and importance of maintaining a leak-free chiller.

SAFETY DEVICES AND PROCEDURES

Electrical disconnects, relief device inspection, and handling refrigerant.

CHECK OPERATOR KNOWLEDGE

Start, stop, and shutdown procedures, safety and operating controls, refrigerant charging, and job safety.

REVIEW MANUALS

Refer to the Start-Up, Operation, and Maintenance Manual and the Controls, Operation and Trouble-shooting Manual.

OPERATING INSTRUCTIONS

Operator Duties

1. Become familiar with the chiller and related equipment before operating the chiller.
2. Prepare the system for start-up, start and stop the chiller, and place the system in a shutdown condition.
3. Maintain a log of operating conditions and document any abnormal readings.
4. Inspect the equipment, make routine adjustments, and perform a Control Test. Maintain the proper refrigerant levels.
5. Protect the system from damage during shutdown periods.
6. Maintain set point, time schedules, and other PIC functions.

Prepare the Chiller for Start-Up

Follow the steps described in the Initial Start-Up section, page 29.

To Start the Chiller

1. Start the water pumps, if they are not automatic.
2. Press the Start/Stop icon on the HMI home screen to start the system. If the chiller is in the OCCUPIED mode and the start timers have expired, the start sequence will start. Follow the procedure described in the Start-Up/Shutdown/Recycle Sequence section, page 11.

Check the Running System

After the compressor starts, the operator should monitor the display and observe the parameters for normal operating conditions:

1. The moisture indicator sight glass on the oil line should indicate flow of oil and dry condition.
2. The condenser pressure and temperature varies with the chiller design conditions. Typically the pressure will range from 37 to 130 psig (260 to 900 kPa), with a corresponding temperature range of 60 to 122°F (15 to 50°C) in standard units. The condenser entering water temperature should be controlled below the specified design entering water temperature to save on compressor kilowatt requirements (for 23XW/XQ units).
3. Evaporator pressure and temperature also will vary with the design conditions. Typical pressure range will be between 20 to 58 psig (135 to 400 kPa), with a corresponding temperature range of 37 to 77°F (3 to 25°C).
4. The active electrical demand setting can be overridden to limit the compressor kW, or the pulldown rate can be decreased to avoid a high demand charge. It may be necessary to demand limit chiller. Base Demand Limit % is set at the Setpoint Menu in the Main Menu. Demand limit is based on chiller amps and kW is based on configured Demand Limit Source in *Main Menu*→*Configuration Menu*→*General Parameters*. Pulldown rate can be based on load rate or temperature rate and is viewed at *Main Menu*→*Configuration Menu*→*General Parameters*.

To Stop the Chiller

The occupancy schedule starts and stops the chiller automatically once the time schedule is configured.

The unit can be stopped manually using the HMI by pressing the green Start/Stop icon . The Unit Start/Stop screen is displayed. Press Confirm Stop. The compressor will then follow the normal shutdown sequence as described in the Start-Up/Shutdown/Recycle Sequence section on page 11. The chiller is now in the OFF control mode.

IMPORTANT: Do not attempt to stop the chiller by opening an isolating knife switch. High intensity arcing may occur.

If the chiller is stopped by an alarm condition, *do not restart the chiller* until the problem is diagnosed and corrected.

After Limited Shutdown

No special preparations should be necessary. Follow the regular preliminary checks and starting procedures.

Preparation for Extended Shutdown

The refrigerant should be transferred into the pumpout storage tank (if supplied; see “PUMP-OUT AND REFRIGERANT TRANSFER PROCEDURES” on page 31) to reduce chiller

pressure and the possibility of leaks. Maintain a holding charge of 5 to 10 lb (2.27 to 4.5 kg) of refrigerant or nitrogen to prevent air from leaking into the chiller.

For season chiller shutdown and lay-up, if the treated water is not drained then provisions should be made to start the pumps weekly to circulate the water and avoid corrosion. Consult the water treatment company for details. Carrier is not responsible for waterside corrosion.

If freezing temperatures are likely to occur in the chiller area, drain the chilled water, the condenser water, and the pumpout condenser water circuits to avoid freeze-up. Keep the waterbox drains open.

It is recommended not to store the refrigerant in the unit if below freezing temperatures are anticipated. A nitrogen holding charge is recommended in this case.

After Extended Shutdown

Ensure water system drains are closed. It may be advisable to flush water circuits to remove any soft rust that may have formed. This is a good time to brush the tubes and inspect the Schrader fittings on the waterside flow devices for fouling, if necessary. Brushing the tubes will also confirm the absence of any debris or particulate lodged in the tubes that could result in tube failure.

Match the actual to the recorded nitrogen pressure prior to the extended shutdown to determine if a leak is present. Check the evaporator pressure on the HMI panel and compare it to the original holding charge that was left in the chiller. If, after adjusting for ambient pressure changes, any change in pressure is indicated, check for refrigerant leaks. See Check Chiller Tightness section, page 15.

If charge was removed, recharge the chiller by transferring refrigerant from the pumpout storage tank (if supplied). Follow the Pumpout and Refrigerant Transfer Procedures section on page 31. Observe freeze-up precautions.

Carefully make all regular preliminary and running system checks.

Cold Weather Operation

When the entering condenser water temperature drops very low, the operator should automatically cycle the cooling tower fans off to keep the temperature up and tower bypass piping or condenser water flow modulation may be required.

Refrigeration and Service Log

A refrigeration log (as shown in Fig. 24), is a convenient checklist for routine inspection and maintenance and provides a continuous record of chiller performance. It is also an aid when scheduling routine maintenance and diagnosing chiller problems.

Keep a record of the chiller pressures, temperatures, and liquid levels on a sheet similar to the one in Fig. 24. Automatic recording of data is possible by exporting the data from the PIC6.1 controller. Contact a Carrier representative for more information.

REFRIGERATION LOG CARRIER 23XW/XQ SCREW REFRIGERATION MACHINE

PLANT _____ MACHINE MODEL NO. _____ MACHINE SERIAL NO. _____

DESCRIPTION			DATE				
EVAPORATOR	REFRIGERANT	PRESSURE SAT					
		LIQUID TEMP					
	WATER	FLOW					
		TEMP IN					
		TEMP OUT					
CONDENSER	REFRIGERANT	PRESSURE SAT					
		TEMP SAT					
		LEVEL					
	WATER	FLOW					
		TEMP IN					
		TEMP OUT					
COMPRESSOR	CAPACITY	DISPLACEMENT					
		RUNNING AMPS					
	VFD	ACTUAL SPEED					

REMARKS: Indicate shutdowns on safety controls, repairs made, and inhibitor or refrigerant added or removed. Include amounts.

Fig. 24 — Refrigeration Service Log

PUMPOUT AND REFRIGERANT TRANSFER PROCEDURES

Preparation

The 23XW/XQ chiller system refrigerant can be pumped for service work to either the chiller compressor vessel or chiller condenser vessel by using the optional pumpout system. If a pumpout storage tank is supplied, the refrigerant can be isolated in the storage tank. The following procedures describe how to transfer refrigerant from vessel to vessel and perform chiller evacuation.

CAUTION

The power to the pumpout compressor oil heater must be on whenever any valve connecting the pumpout compressor to the chiller or storage tank is open. Leaving the heater off will result in oil dilution by refrigerant and can lead to compressor failure.

If the compressor is found with the heater off and a valve open, the heater must be on for at least 4 hours to drive the refrigerant from the oil. When heating the oil the compressor suction must be open to a vessel to give the refrigerant a means to leave the compressor.

CAUTION

Always run the chiller cooler and condenser water pumps and always charge or transfer refrigerant as a gas when the chiller pressure is less than 35 psig (241 kPa) or the refrigerant saturated temperature is less than 40°F. Below these liquid refrigerant flashes into gas, resulting in extremely low temperatures in the cooler/condenser tubes and possibly causing tube freeze-up.

⚠ DANGER

During transfer of refrigerant into and out of the optional storage tank, carefully monitor the storage tank level gage. Do not fill the tank more than 90% of capacity to allow for refrigerant expansion. Overfilling may result in damage to the tank or the release of refrigerant which will result in personal injury or death.

⚠ CAUTION

Do not mix refrigerants from chillers that use different compressor oils. Compressor damage can result.

Operating the Optional Pumpout Unit

Oil should be visible in the pumpout unit compressor sight glass under all operating conditions and during shutdown. If oil is low, add oil.

TO READ REFRIGERANT PRESSURES (during pumpout or leak testing):

1. The display on the chiller control panel is suitable for determining refrigerant-side pressures and low (soft) vacuum. To assure the desired range and accuracy when measuring evacuation and dehydration, use a quality vacuum indicator or manometer. This can be placed on the Schrader connections on each vessel by removing the pressure transducer.
2. To determine pumpout storage tank pressure, a 30 in. Hg vacuum –0 to 400 psi (0 to 2758 kPa) gage is attached to the storage tank.

⚠ CAUTION

Transfer, addition, or removal of refrigerant in spring-isolated chillers may place severe stress on and damage external piping if springs have not been blocked in both up and down directions.

POSITIVE PRESSURE CHILLERS WITH STORAGE TANKS

In the Valve/Condition tables that accompany these instructions, the letter “C” indicates a closed valve.

⚠ CAUTION

Always run chiller cooler and condenser water pumps and always charge or transfer refrigerant as a gas when chiller vessel pressure is less than 35 psig (241 kPa). Below these pressures, liquid refrigerant flashes into gas, resulting in extremely low temperatures in the cooler/condenser tubes and possibly causing tube freeze-up.

Transfer Refrigerant from Pumpout Storage Tank to Chiller

⚠ WARNING

During transfer of refrigerant into and out of the 23XW/XQ storage tank, carefully monitor the storage tank level gage. Do not fill the tank more than 90% of capacity to allow for refrigerant expansion. Overfilling may result in damage to the tank and personal injury.

1. Equalize refrigerant pressure.
 - a. Turn on chiller water pumps and monitor chiller pressures.
 - b. Close pumpout and storage tank valves 2, 4, 5, and 10, and close refrigerant charging valve 7; open chiller isolation valve 11 and any other chiller isolation valves, if present.
 - c. Open pumpout and storage tank valves 3 and 6; open chiller valves 1a and 1b.

VALVE	1A	1B	2	3	4	5	6	7	10	11
CONDITION			C		C	C		C	C	

- d. Gradually crack open valve 5 to increase chiller pressure to 35 psig (241 kPa). Slowly feed refrigerant to prevent freeze-up.
 - e. Open valve 5 fully after the chiller pressure rises above the freezing point of the refrigerant. Let the storage tank and chiller pressure equalize. Open refrigerant charging valve 7 and storage tank charging valve 10 to let liquid refrigerant drain into the chiller.

VALVE	1A	1B	2	3	4	5	6	7	10	11
CONDITION			C		C					

2. Transfer remaining refrigerant.
 - a. Close valve 5 and open valve 4. Turn off pumpout condenser water, and turn on pumpout compressor in manual mode to push liquid refrigerant out of storage tank. Monitor the storage tank level until tank is empty.
 - b. Close refrigerant charging valves 7 and 10.
 - c. Turn off the pumpout compressor.
 - d. Turn off the chiller water pumps.
 - e. Close valves 3 and 4.
 - f. Open valves 2 and 5.

VALVE	1A	1B	2	3	4	5	6	7	10	11
CONDITION				C	C			C	C	

- g. Turn on pumpout condenser water.
 - h. Run the pumpout compressor in manual mode until the storage tank pressure reaches 5 psig (34 kPa), 18 in. Hg vacuum (41 kPa absolute).
 - i. Turn off the pumpout compressor.
 - j. Close valves 1a, 1b, 2, 5, and 6.

VALVE	1A	1B	2	3	4	5	6	7	10	11
CONDITION	C	C	C	C	C	C	C	C	C	

- k. Turn off pumpout condenser water.

Transfer the Refrigerant from Chiller to Pumpout Storage Tank

1. Equalize refrigerant pressure.
 - a. Valve positions:

VALVE	1A	1B	2	3	4	5	6	7	10	11
CONDITION			C		C	C		C	C	

- b. Slowly open valve 5 and refrigerant charging valves 7 and 10 to allow liquid refrigerant to drain by gravity into the storage tank.

VALVE	1A	1B	2	3	4	5	6	7	10	11
CONDITION			C		C					

2. Transfer the remaining liquid.
 - a. Turn off pumpout condenser water. Place valves in the following positions:

VALVE	1A	1B	2	3	4	5	6	7	10	11
CONDITION				C	C					

- b. Run the pumpout compressor in automatic mode until vacuum switch is satisfied and compressor stops. Close valves 7 and 10.

VALVE	1A	1B	2	3	4	5	6	7	10	11
CONDITION				C	C			C	C	

- c. Turn off the pumpout compressor.
3. Remove any remaining refrigerant.
 - a. Turn on chiller water pumps.
 - b. Turn on pumpout condenser water.
 - c. Place valves in the following positions:

VALVE	1A	1B	2	3	4	5	6	7	10	11
CONDITION			C			C		C	C	

- d. Run the pumpout compressor until the chiller pressure reaches 35 psig (241 kPa); then shut off the pumpout compressor. Warm chiller condenser water will boil off any entrapped liquid refrigerant and chiller pressure will rise.
 - e. When chiller pressure rises to 40 psig (276 kPa), turn on the pumpout compressor until the pressure again reaches 35 psig (241 kPa); then turn off the pumpout compressor. Repeat this process until the chiller pressure no longer rises; then turn on the pumpout compressor and pump out until the chiller pressure reaches 18 in. Hg vacuum (41 kPa absolute). This can be done in On or Automatic mode.
 - f. Close valves 1a, 1b, 3, 4, and 6.

VALVE	1A	1B	2	3	4	5	6	7	10	11
CONDITION	C	C	C	C	C	C	C	C	C	

- g. Turn off the pumpout condenser water.
4. Establish vacuum for service. To conserve refrigerant, operate the pumpout compressor as described in Step 3e until the chiller pressure is reduced to 18 in. Hg vacuum (41 kPa absolute). This operation can be done in Automatic or On mode. In Automatic mode, the compressor will stop automatically at approximately 15 in. Hg vacuum (51 kPa absolute).

CHILLERS WITH ISOLATION VALVES

Transfer All Refrigerant to Chiller Condenser Vessel

1. Push refrigerant into chiller condenser vessel.
 - a. Turn on the chiller water pumps and monitor the chiller pressure.
 - b. Valve positions:

VALVE	1A	1B	2	3	4	5	11
CONDITION				C	C		

- c. Equalize refrigerant in the chiller cooler and condenser.
 - d. Turn off chiller water pumps and pumpout condenser water supply.
 - e. Turn on pumpout compressor to push liquid out of the chiller cooler vessel.
 - f. When all liquid has been pushed into the chiller condenser vessel, close the cooler refrigerant isolation valve (11).
 - g. Turn on the chiller water pumps.
 - h. Turn off the pumpout compressor.
2. Evacuate gas from chiller cooler vessel.
 - a. Close liquid line service valves 2 and 5; open valves 3 and 4.

VALVE	1A	1B	2	3	4	5	11
CONDITION			C			C	C

- b. Turn on pumpout condenser water.
 - c. Run pumpout compressor until the chiller cooler vessel pressure reaches 18 in. Hg vacuum (41 kPa absolute). Monitor pressures on the chiller control panel and on refrigerant gages. This operation can be done in Automatic or On mode. In Automatic mode, the compressor will stop automatically at approximately 15 in. Hg vacuum (51 kPa absolute).
 - d. Close valve 1a.
 - e. Turn off pumpout compressor.
 - f. Close valves 1b, 3, and 4.

VALVE	1A	1B	2	3	4	5	11
CONDITION	C	C	C	C	C	C	C

- g. Turn off pumpout condenser water.
 - h. Turn off chiller water pumps and lock out chiller compressor.

Transfer All Refrigerant to Chiller Cooler Vessel

1. Push refrigerant into the chiller cooler vessel.
 - a. Turn on the chiller water pumps and monitor the chiller pressure.
 - b. Valve positions:

VALVE	1A	1B	2	3	4	5	11
CONDITION				C	C		

- c. Equalize refrigerant in the chiller cooler and condenser.
 - d. Turn off chiller water pumps and pumpout condenser water.
 - e. Turn on pumpout compressor to push refrigerant out of the chiller condenser.
 - f. When all liquid is out of the chiller condenser, close valve 11 and any other liquid isolation valves on the chiller.
 - g. Turn off the pumpout compressor.
2. Evacuate gas from chiller condenser vessel.
 - a. Turn on chiller water pumps.

- b. Make sure that liquid line service valves 3 and 4 are closed and valves 2 and 5 are open.

VALVE	1A	1B	2	3	4	5	11
CONDITION				C	C		C

- c. Turn on pumpout condenser water.
 - d. Run the pumpout compressor until the chiller condenser reaches 18 in. Hg vacuum (41 kPa absolute) in Manual or Automatic mode. Monitor pressure at the chiller control panel and refrigerant gages.
 - e. Close valve 1b.
 - f. Turn off pumpout compressor.
 - g. Close valves 1a, 2, and 5.

VALVE	1A	1B	2	3	4	5	11
CONDITION	C	C	C	C	C	C	C

- h. Turn off pumpout condenser water.
 - i. Turn off chiller water pumps and lock out chiller compressor.

Return Refrigerant to Normal Operating Conditions

1. Be sure that the chiller vessel that was opened has been evacuated.
2. Turn on chiller water pumps.
3. Open valves 1a, 1b, and 3.

VALVE	1A	1B	2	3	4	5	11
CONDITION			C		C	C	C

4. Crack open valve 5, gradually increasing pressure in the evacuated chiller vessel to 35 psig (241 kPa). Feed refrigerant slowly to prevent tube freeze-up.
5. Leak test to ensure chiller vessel integrity.
6. Open valve 5 fully.

VALVE	1A	1B	2	3	4	5	11
CONDITION			C		C		C

7. Close valves 1a, 1b, 3, and 5.
8. Open chiller isolation valve 11 and any other isolation valves, if present.

VALVE	1A	1B	2	3	4	5	11
CONDITION	C	C	C	C	C	C	

9. Turn off chiller water pumps.

DISTILLING THE REFRIGERANT

1. Transfer the refrigerant from the chiller to the pumpout storage tank as described in the Transfer the Refrigerant from Chiller to Pumpout Storage Tank section on page 32.
2. Equalize the refrigerant pressure.
 - a. Turn on chiller water pumps and monitor chiller pressures.
 - b. Close pumpout and storage tank valves 2, 4, 5, and 10, and close chiller charging valve 7; open chiller isolation valve 11 and any other chiller isolation valves, if present.
 - c. Open pumpout and storage tank valves 3 and 6; open chiller valves 1a and 1b.

VALVE	1A	1B	2	3	4	5	6	7	10	11
CONDITION			C		C	C		C	C	

- d. Gradually crack open valve 5 to increase chiller pressure to 35 psig (241 kPa). Slowly feed refrigerant to prevent freeze-up.
 - e. Open valve 5 fully after the chiller pressure rises above the freezing point of the refrigerant. Let the storage tank and chiller pressure equalize.
3. Transfer remaining refrigerant.
 - a. Close valve 3.

- b. Open valve 2.

VALVE	1A	1B	2	3	4	5	6	7	10	11
CONDITION				C	C			C	C	

- c. Turn on pumpout condenser water.
d. Run the pumpout compressor until the storage tank pressure reaches 5 psig (34 kPa), 18 in. Hg vacuum (41 kPa absolute) in Manual or Automatic mode.
e. Turn off the pumpout compressor.
f. Close valves 1a, 1b, 2, 5, and 6.
g. Turn off pumpout condenser water.

VALVE	1A	1B	2	3	4	5	6	7	10	11
CONDITION	C	C	C	C	C	C	C	C	C	

4. Drain the contaminants from the bottom of the storage tank into a container. Dispose of contaminants safely.

GENERAL MAINTENANCE

Refrigerant Properties

The standard refrigerant for the 23XW/XQ chiller is R-515B/R-1234ze(E). At normal atmospheric pressure, R-515B/R-1234ze(E) will boil at -2°F (-18.9°C) and must, therefore, be kept in pressurized containers or storage tanks. The refrigerant is practically odorless when mixed with air and is noncombustible at atmospheric pressure. Read the Material Safety Data Sheet and the latest ASHRAE Safety Guide for Mechanical Refrigeration to learn more about safe handling of this refrigerant.

DANGER

R-515B/R-1234ze(E) will dissolve oil and some non-metallic materials, dry the skin, and, in heavy concentrations, may displace enough oxygen to cause asphyxiation. When handling this refrigerant, protect the hands and eyes and avoid breathing fumes.

Adding Refrigerant

Follow the procedures described in the Trim Refrigerant Charge section, page 34.

CAUTION

Always ensure to have water flow and lock out the compressor when transferring refrigerant. Liquid refrigerant may flash into a gas and cause possible freeze-up and damage to the unit when the chiller pressure is below 40 psig (277 kPa) for R-513A, 22 psig (153 kPa) for R-515B or 22 psig (153 kPa) for R-1234ze(E).

Adjusting the Refrigerant Charge

If the addition or removal of refrigerant is required to improve chiller performance, follow the procedures given under the Trim Refrigerant Charge section, page 34.

Refrigerant Leak Testing

Because the refrigerant pressure is above atmospheric pressure at room temperature, leak testing can be performed with refrigerant in the chiller. Use an electronic halogen leak detector, soap bubble solution, or ultrasonic leak detector. Ensure that the room is well ventilated and free from concentration of refrigerant to keep false readings to a minimum. Before making any necessary repairs to a leak, transfer all refrigerant from the leaking vessel.

Leak Rate

It is recommended by ASHRAE that chillers be taken off line immediately and repaired if the refrigerant leak rate for the entire

chiller is more than 10% of the operating refrigerant charge per year.

Carrier recommends that leaks totaling less than the above rate but more than a rate of 0.1% of the total charge per year should be repaired during annual maintenance or whenever the refrigerant is transferred for other service work.

Test After Service, Repair, or Major Leak

If all the refrigerant has been lost or if the chiller has been opened for service, the chiller or the affected vessels must be pressure tested and leak tested. Refer to the Leak Test Chiller section on page 17 to perform a leak test.

WARNING

R-515B/R-1234ze(E) should not be mixed with air or oxygen and pressurized for leak testing. In general, this refrigerant should not be present with high concentrations of air or oxygen above atmospheric pressures, because the mixture can undergo combustion.

TESTING WITH REFRIGERANT TRACER

Use an environmentally acceptable refrigerant as a tracer for leak test procedures. Use dry nitrogen to raise the machine pressure to leak testing levels.

TESTING WITHOUT REFRIGERANT TRACER

Another method of leak testing is to pressurize with nitrogen only and to use a soap bubble solution or an ultrasonic leak detector to determine if leaks are present.

TO PRESSURIZE WITH DRY NITROGEN

NOTE: Pressurizing with dry nitrogen for leak testing should not be done if the full refrigerant charge is in the vessel because purging the nitrogen is very difficult.

1. Connect a copper tube from the pressure regulator on the cylinder to the refrigerant charging valve. Never apply full cylinder pressure to the pressurizing line. Follow the listed sequence.
2. Open the charging valve fully.
3. Slowly open the cylinder regulating valve.
4. Observe the pressure gage on the chiller and close the regulating valve when the pressure reaches test level. *Do not exceed 140 psig (965 kPa).*
5. Close the charging valve on the chiller. Remove the copper tube if it is no longer required.

Repair Leaks, Retest, Standing Vacuum Test

After pressurizing the chiller, test for leaks with a leak detector, electronic halide leak detector, soap bubble solution, or ultrasonic leak detector. Bring the chiller back to atmospheric pressure, repair any leaks found, and retest.

After retesting and finding no leaks, apply a standing vacuum test. Then dehydrate the chiller. Refer to the Standing Vacuum Test and Chiller Dehydration sections (pages 19 and 20) in the Before Initial Start-Up section.

Trim Refrigerant Charge

If to obtain optimal chiller performance it becomes necessary to adjust the refrigerant charge, operate the chiller at design load and then add or remove refrigerant slowly until the difference between the leaving chilled water temperature and the evaporator refrigerant temperature reaches design conditions or becomes a minimum. *Do not overcharge.* Use evaporator sight glasses to visually determine optimum charge. Look at evaporator approach and discharge superheat compared with design. With LTD being at design condition, stop adding charge when discharge superheat starts to drop.

To remove any excess refrigerant, follow the procedure in “Transfer the Refrigerant from Chiller to Pumpout Storage Tank” on page 32.

SCHEDULED MAINTENANCE

Establish a regular maintenance schedule based on your actual chiller requirements such as chiller load, run hours, and water quality. *The time intervals listed in this section are offered as guides to service only.*

Run Times

The HMI will display Compressor Starts Number, Compressor Running Hours, and After Service Hours on the **Main Menu** → **Run Times** screen. The After Service Hours should be reset to zero by the service person or the operator each time major service work is completed so that the time between service events can be viewed and tracked. Previous values and associated dates should be logged for future reference prior to resetting.

Inspect the Power Panel

Maintenance consists of general cleaning and tightening of connections. Vacuum the control cabinets to eliminate dust build-up. If the chiller control malfunctions, refer to the Troubleshooting Guide section on page 36 for control checks and adjustments.

⚠ WARNING

Ensure power to the starter is isolated when cleaning and tightening connections inside the starter enclosure. Failure to disconnect power could result in electrocution.

Changing Refrigerant Filters

Change the filter drier on an annual basis or when the chiller is opened for repairs. The filters can be isolated so they can be changed with refrigerant remaining in the chiller. Change strainers/filters by closing isolation valves and recover the trapped refrigerant. The filter cartridge can be replaced by opening the bolted end of the strainer housing. Follow good service practice and evacuate the disturbed areas after filter/strainer replacement.

Inspect Safety Relief Devices and Piping

The relief device on this chiller protects the system against the potentially dangerous effects of overpressure. To ensure against damage to the equipment and possible injury to personnel, these devices must be kept in peak operating condition.

As a minimum, the following maintenance is required.

1. At least once a year, disconnect the vent piping at the valve outlet and carefully inspect the relief valves for any evidence of internal corrosion or rust, dirt, scale, leakage, etc. Verify that vent piping has a section leaning away from the relief valves to avoid the valve outlet becoming a trap for dirt, condensation etc.
2. If corrosion or foreign material is found, do not attempt to repair or recondition. *Replace the safety relief device.*
3. If the chiller is installed in a corrosive atmosphere or the relief devices are vented into a corrosive atmosphere, inspect the safety relief devices at more frequent intervals.

Inspect Heat Exchanger Tubes and Flow Devices

EVAPORATOR AND OPTIONAL FLOW DEVICES

Inspect and clean the evaporator tubes at the end of the first operating season. Because these tubes have internal ridges, a rotary-type tube cleaning system is needed to fully clean the tubes. Inspect the tubes' condition to determine the scheduled frequency for future cleaning and to determine whether water treatment in the chilled water/brine circuit is adequate. Inspect the entering and leaving chilled water temperature sensors and flow devices for

signs of corrosion or scale. Replace a sensor or Schrader fitting if corroded or remove any scale if found.

CONDENSER AND OPTIONAL FLOW DEVICES

Since this water circuit is usually an open-type system, the tubes may be subject to contamination and scale. Clean the condenser tubes with a rotary tube cleaning system at least once per year and more often if the water is contaminated. Inspect the entering and leaving condenser water sensors and flow devices for signs of corrosion or scale. Replace the sensor or Schrader fitting if corroded or remove any scale if found.

Higher than normal condenser pressures, together with the inability to reach full refrigeration load, usually indicate dirty tubes or air in the chiller. If the refrigeration log indicates a rise above normal condenser pressures, check the condenser refrigerant temperature against the leaving condenser water temperature. If this reading is more than what the design difference is supposed to be, the condenser tubes may be dirty, water flow may be incorrect, or non-condensables have contaminated the refrigerant circuit. To resolve, check the purge status. If purge is operating normally and does not have excessive run time, that may be an indication to double check pressure transducer and temperature readings along with flow.

During the tube cleaning process, use brushes specially designed to avoid scraping and scratching the tube wall. Contact your Carrier representative to obtain these brushes. Do not use wire brushes. Hard scale may require chemical treatment for its prevention or removal. Consult a water treatment specialist for proper treatment.

Water Leaks

The refrigerant moisture indicator located on the main and economizer EXV (if installed) indicates whether there is water or air leakage during chiller operation. Water leaks should be repaired immediately.

⚠ CAUTION

The chiller must be dehydrated after repair of water leaks or damage may result. See Chiller Dehydration section, page 20.

Water Treatment

Untreated or improperly treated water may result in corrosion, scaling, erosion, or algae. The services of a qualified water treatment specialist should be obtained to develop and monitor a treatment program.

⚠ CAUTION

Water must be within design flow limits, clean, and treated to ensure proper chiller performance and reduce the potential of tube damage due to corrosion, scaling, erosion, and algae. Carrier assumes no responsibility for chiller damage resulting from untreated or improperly treated water. If the unit is going to be stored for an extended period of time, Carrier has specific long-term storage requirements that are documented and available from the chiller sales group.

Inspect the VFD

Before working on any starter, shut off the chiller, then open and tag all disconnects supplying power to the starter.

⚠ CAUTION

The motor leads must be disconnected from the VFD before an insulation test is performed. The voltage generated from the tester can damage the drive components.

⚠ CAUTION

Failure to follow these procedures may result in personal injury or damage to equipment.

TO AVOID an electric shock hazard, verify that the voltage on the bus capacitors has discharged completely before servicing. Check the DC bus voltage at the power terminal block by measuring between the +DC and –DC terminals, between the +DC terminal and the chassis, and between the –DC terminal and the chassis. The voltage must be zero for all three measurements.

⚠ WARNING

DC bus capacitors retain hazardous voltages after input power has been disconnected. An isolated multimeter will be needed to measure DC bus voltage and to make resistance checks.

After disconnecting input power, wait 5 minutes for the DC bus capacitors to discharge and then check the voltage with a voltmeter rated for the DC bus voltage to ensure the DC bus capacitors are discharged before touching any internal components. Failure to observe this precaution could result in severe bodily injury or loss of life.

⚠ WARNING

The disconnect on the starter front panel does not always de-energize all internal circuits. Open all internal and remote disconnects before servicing the starter. Failure to follow this procedure may result in personal injury by electric shock.

Every 3-6 months inspect the air filter of the Danfoss VFD. To remove dirt the filter can be vacuumed or washed. If washed let the filter dry completely before re-installing. If the dirt removed appears oily, replace filter.

Periodically vacuum accumulated debris on the internal parts. Use electrical cleaner for electrical parts as required. Perform visual inspection of the capacitors located on the DC bus and inductors. Check cooling fan operation. Check condensate drain for the VFD enclosure.

Power connections on newly installed starters may relax and loosen after a short period of operation. Turn power off and retighten. Recheck annually thereafter.

⚠ CAUTION

Loose power connections can cause voltage spikes, overheating, malfunctioning, or failures.

Verification of Pressure Transducers

Once a year, the pressure transducers should be checked against a pressure gage reading. Check all pressure transducers: evaporator pressure, leaving economizer pressure, pressure on economized line to compressor, oil inlet pressure, discharge pressure, and optional evaporator entering and leaving water pressure, as well as condenser entering and leaving water pressure. See Fig. 25.

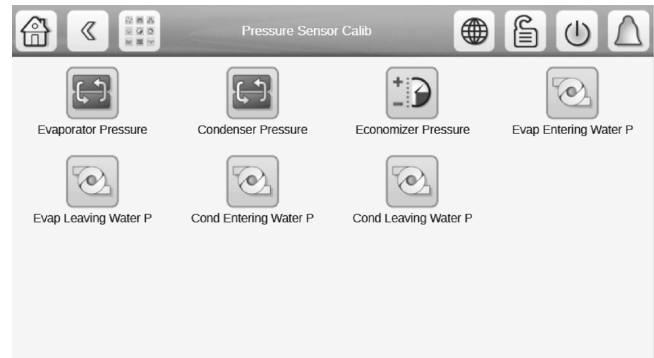


Fig. 25 — Pressure Sensor Calibration Menu

Verification of Temperature Thermistors

Verify the temperature thermistors for entering chilled water (ECW), leaving chilled water (LCW), entering condenser water (ECDW), leaving condenser water (LCDW).

Ordering Replacement Chiller Parts

When ordering Carrier specified parts, the following information must accompany an order:

- chiller model number and serial number
- name, quantity, and part number of the part required
- delivery address and method of shipment.

TROUBLESHOOTING GUIDE

Overview

The PIC6.1 control system has many features to help the operator and technician troubleshoot a 23XW/XQ chiller.

- The HMI shows the chiller's actual operating conditions and can be viewed while the unit is running.
- The HMI default screen indicates when an alarm occurs. Once all alarms have been cleared (by correcting the problems), the HMI default screen indicates normal operation. For information about displaying and resetting alarms and a list of alert codes, see the 23XW/XQ with PIC6.1 Controls Operation and Troubleshooting manual.
- The Configuration menu screens display information that helps to diagnose problems with chilled water temperature control, chilled water temperature control overrides, surge algorithm status, and time schedule operation.
- If an operating fault is detected, an alarm indicator is displayed on the HMI default screen. A more detailed message — along with a diagnostic message — is also stored in the Current Alarms table.
- Review the Alarms History table to view other less critical events which may have occurred. Compare timing of relevant events and alarms.

For detailed information about alarms, see the 23XW/XQ with Controls Operation and Troubleshooting manual. Press the bell icon in the top right corner of the home screen to access current alarms and alarm history, and to reset alarms.

Checking Display Messages

The first area to check when troubleshooting the 23XW/XQ is the HMI display. Status messages are displayed on the screen, and the alarm icon indicates a fault. For a complete list of alarms, see the 23XW/XQ with Controls Operation and Troubleshooting manual.

Checking Temperature Sensors

All temperature sensors are thermistor-type sensors. This means that the resistance of the sensor varies with temperature. All sensors have the same resistance characteristics. If the controls

are on, determine sensor temperature by measuring voltage drop; if the controls are powered off, determine sensor temperature by measuring resistance. Compare the readings to the values listed in Tables 17 and 18.

RESISTANCE CHECK

Turn off the control power and, from the module, disconnect the terminal plug of the sensor in question. With a digital ohmmeter, measure sensor resistance between receptacles as designated by the wiring diagram. The resistance and corresponding temperature are listed in Tables 17 and 18. Check the resistance of both wires to ground. This resistance should be infinite.

VOLTAGE DROP

The voltage drop across any energized sensor can be measured with a digital voltmeter while the control is energized. Tables 17 and 18 list the relationship between temperature and sensor voltage drop (volts dc measured across the energized sensor). Exercise care when measuring voltage to prevent damage to the

sensor leads, connector plugs, and modules. Sensors should also be checked at the sensor plugs.

CAUTION

Relieve all refrigerant pressure or drain the water before removing any thermowell threaded into the refrigerant pressure boundary. Failure to do so could result in personal injury and equipment damage.

CHECK SENSOR ACCURACY

Place the sensor in a medium of known temperature and compare that temperature to the measured reading. The thermometer used to determine the temperature of the medium should be of laboratory quality with 0.5°F (0.25°C) graduations. The sensor in question should be accurate to within 2°F (1.2°C).

See Fig. 2 for sensor locations. The sensors are immersed directly in the refrigerant or water circuits. When installing a new sensor, apply a pipe sealant or thread sealant to the sensor threads.

Table 17 — Thermistor Temperature (F) vs. Resistance/Voltage Drop

TEMPERATURE (F)	PIC VOLTAGE DROP (V)	RESISTANCE (OHMS)	TEMPERATURE (F)	PIC VOLTAGE DROP (V)	RESISTANCE (OHMS)	TEMPERATURE (F)	PIC VOLTAGE DROP (V)	RESISTANCE (OHMS)
-25	4.700	97,706	66	2.565	6,568	157	0.630	893
-24	4.690	94,549	67	2.533	6,405	158	0.619	876
-23	4.680	91,474	68	2.503	6,246	159	0.609	859
-22	4.670	88,480	69	2.472	6,092	160	0.599	843
-21	4.659	85,568	70	2.440	5,942	161	0.589	827
-20	4.648	82,737	71	2.409	5,796	162	0.579	812
-19	4.637	79,988	72	2.378	5,655	163	0.570	797
-18	4.625	77,320	73	2.347	5,517	164	0.561	782
-17	4.613	74,734	74	2.317	5,382	165	0.551	768
-16	4.601	72,229	75	2.287	5,252	166	0.542	753
-15	4.588	69,806	76	2.256	5,124	167	0.533	740
-14	4.576	67,465	77	2.227	5,000	168	0.524	726
-13	4.562	65,205	78	2.197	4,880	169	0.516	713
-12	4.549	63,027	79	2.167	4,764	170	0.508	700
-11	4.535	60,930	80	2.137	4,650	171	0.499	687
-10	4.521	58,915	81	2.108	4,539	172	0.491	675
-9	4.507	56,981	82	2.079	4,432	173	0.484	663
-8	4.492	55,129	83	2.050	4,327	174	0.476	651
-7	4.477	53,358	84	2.021	4,225	175	0.468	639
-6	4.461	51,669	85	1.993	4,125	176	0.460	628
-5	4.446	50,062	86	1.965	4,028	177	0.453	616
-4	4.429	48,536	87	1.937	3,934	178	0.445	605
-3	4.413	47,007	88	1.909	3,843	179	0.438	595
-2	4.396	45,528	89	1.881	3,753	180	0.431	584
-1	4.379	44,098	90	1.854	3,667	181	0.424	574
0	4.361	42,715	91	1.827	3,582	182	0.418	564
1	4.344	41,380	92	1.800	3,500	183	0.411	554
2	4.325	40,089	93	1.773	3,420	184	0.404	544
3	4.307	38,843	94	1.747	3,342	185	0.398	535
4	4.288	37,639	95	1.721	3,266	186	0.392	526
5	4.269	36,476	96	1.695	3,192	187	0.385	516
6	4.249	35,354	97	1.670	3,120	188	0.379	508
7	4.229	34,270	98	1.644	3,049	189	0.373	499
8	4.209	33,224	99	1.619	2,981	190	0.367	490
9	4.188	32,214	100	1.595	2,914	191	0.361	482
10	4.167	31,239	101	1.570	2,849	192	0.356	474
11	4.145	30,298	102	1.546	2,786	193	0.350	466
12	4.123	29,389	103	1.523	2,724	194	0.344	458
13	4.101	28,511	104	1.499	2,663	195	0.339	450
14	4.079	27,663	105	1.476	2,605	196	0.333	442
15	4.056	26,844	106	1.453	2,547	197	0.328	435
16	4.033	26,052	107	1.430	2,492	198	0.323	428
17	4.009	25,285	108	1.408	2,437	199	0.318	421
18	3.985	24,544	109	1.386	2,384	200	0.313	414
19	3.960	23,826	110	1.364	2,332	201	0.308	407
20	3.936	23,130	111	1.343	2,282	202	0.304	400
21	3.911	22,455	112	1.321	2,232	203	0.299	393
22	3.886	21,800	113	1.300	2,184	204	0.294	387
23	3.861	21,163	114	1.279	2,137	205	0.290	381
24	3.835	20,556	115	1.259	2,092	206	0.285	374
25	3.808	19,967	116	1.239	2,047	207	0.281	368
26	3.782	19,396	117	1.219	2,003	208	0.277	362
27	3.755	18,843	118	1.200	1,961	209	0.272	356
28	3.727	18,307	119	1.180	1,920	210	0.268	351
29	3.700	17,787	120	1.161	1,879	211	0.264	345
30	3.672	17,284	121	1.143	1,840	212	0.260	339
31	3.644	16,797	122	1.124	1,801	213	0.256	334
32	3.617	16,325	123	1.106	1,764	214	0.252	329
33	3.588	15,868	124	1.088	1,727	215	0.248	323
34	3.559	15,426	125	1.070	1,691	216	0.245	318
35	3.530	14,997	126	1.053	1,656	217	0.241	313
36	3.501	14,582	127	1.036	1,622	218	0.237	308
37	3.471	14,181	128	1.019	1,589	219	0.234	303
38	3.442	13,791	129	1.002	1,556	220	0.230	299
39	3.412	13,415	130	0.986	1,524	221	0.227	294
40	3.382	13,050	131	0.969	1,493	222	0.224	289
41	3.353	12,696	132	0.953	1,463	223	0.220	285
42	3.322	12,353	133	0.938	1,433	224	0.217	280
43	3.291	12,021	134	0.922	1,404	225	0.214	276
44	3.260	11,699	135	0.907	1,376	226	0.211	272
45	3.229	11,386	136	0.893	1,348	227	0.208	267
46	3.198	11,082	137	0.878	1,321	228	0.205	263
47	3.167	10,787	138	0.864	1,295	229	0.203	259
48	3.135	10,500	139	0.849	1,269	230	0.198	255
49	3.104	10,221	140	0.835	1,244	231	0.195	251
50	3.074	9,949	141	0.821	1,219	232	0.192	248
51	3.042	9,689	142	0.808	1,195	233	0.190	244
52	3.010	9,436	143	0.795	1,172	234	0.187	240
53	2.978	9,190	144	0.782	1,149	235	0.184	236
54	2.946	8,951	145	0.769	1,126	236	0.182	233
55	2.914	8,719	146	0.756	1,104	237	0.179	229
56	2.882	8,494	147	0.744	1,083	238	0.176	226
57	2.850	8,275	148	0.731	1,062	239	0.174	223
58	2.819	8,062	149	0.719	1,041	240	0.172	219
59	2.788	7,855	150	0.707	1,021	241	0.169	216
60	2.756	7,655	151	0.696	1,002	242	0.167	213
61	2.724	7,460	152	0.684	983	243	0.164	210
62	2.692	7,271	153	0.673	964	244	0.162	207
63	2.660	7,088	154	0.662	945	245	0.160	204
64	2.628	6,909	155	0.651	928	246	0.158	201
65	2.596	6,736	156	0.640	910	247	0.155	198
						248	0.153	195

Table 18 — Thermistor Temperature (C) vs. Resistance/Voltage Drop

TEMPERATURE (C)	PIC VOLTAGE DROP (V)	RESISTANCE (OHMS)	TEMPERATURE (C)	PIC VOLTAGE DROP (V)	RESISTANCE (OHMS)
-33	4.722	105 616	44	1.338	2 272
-32	4.706	99 640	45	1.300	2 184
-31	4.688	93 928	46	1.263	2 101
-30	4.670	88 480	47	1.227	2 021
-29	4.650	83 297	48	1.192	1 944
-28	4.630	78 377	49	1.158	1 871
-27	4.608	73 722	50	1.124	1 801
-26	4.586	69 332	51	1.091	1 734
-25	4.562	65 205	52	1.060	1 670
-24	4.538	61 343	53	1.029	1 609
-23	4.512	57 745	54	0.999	1 550
-22	4.486	54 411	55	0.969	1 493
-21	4.458	51 341	56	0.941	1 439
-20	4.429	48 536	57	0.913	1 387
-19	4.399	45 819	58	0.887	1 337
-18	4.368	43 263	59	0.861	1 290
-17	4.336	40 858	60	0.835	1 244
-16	4.303	38 598	61	0.811	1 200
-15	4.269	36 476	62	0.787	1 158
-14	4.233	34 484	63	0.764	1 117
-13	4.196	32 613	64	0.741	1 079
-12	4.158	30 858	65	0.719	1 041
-11	4.119	29 211	66	0.698	1 006
-10	4.079	27 663	67	0.677	971
-9	4.037	26 208	68	0.657	938
-8	3.994	24 838	69	0.638	906
-7	3.951	23 545	70	0.619	876
-6	3.906	22 323	71	0.601	846
-5	3.861	21 163	72	0.583	818
-4	3.814	20 083	73	0.566	791
-3	3.765	19 062	74	0.549	765
-2	3.716	18 097	75	0.533	740
-1	3.667	17 185	76	0.518	715
0	3.617	16 325	77	0.503	692
1	3.565	15 513	78	0.488	670
2	3.512	14 747	79	0.474	648
3	3.459	14 023	80	0.460	628
4	3.406	13 341	81	0.447	608
5	3.353	12 696	82	0.434	588
6	3.298	12 087	83	0.422	570
7	3.242	11 510	84	0.410	552
8	3.185	10 963	85	0.398	535
9	3.129	10 444	86	0.387	518
10	3.074	9 949	87	0.376	502
11	3.016	9 486	88	0.365	487
12	2.959	9 046	89	0.355	472
13	2.901	8 628	90	0.344	458
14	2.844	8 232	91	0.335	444
15	2.788	7 855	92	0.325	431
16	2.730	7 499	93	0.316	418
17	2.672	7 160	94	0.308	405
18	2.615	6 839	95	0.299	393
19	2.559	6 535	96	0.291	382
20	2.503	6 246	97	0.283	371
21	2.447	5 972	98	0.275	360
22	2.391	5 711	99	0.267	349
23	2.335	5 463	100	0.260	339
24	2.280	5 226	101	0.253	330
25	2.227	5 000	102	0.246	320
26	2.173	4 787	103	0.239	311
27	2.120	4 583	104	0.233	302
28	2.067	4 389	105	0.227	294
29	2.015	4 204	106	0.221	286
30	1.965	4 028	107	0.215	278
31	1.914	3 861	108	0.210	270
32	1.865	3 701	109	0.205	262
33	1.816	3 549	110	0.198	255
34	1.768	3 404	111	0.193	248
35	1.721	3 266	112	0.188	242
36	1.675	3 134	113	0.183	235
37	1.629	3 008	114	0.178	229
38	1.585	2 888	115	0.174	223
39	1.542	2 773	116	0.170	217
40	1.499	2 663	117	0.165	211
41	1.457	2 559	118	0.161	205
42	1.417	2 459	119	0.157	200
43	1.377	2 363	120	0.153	195

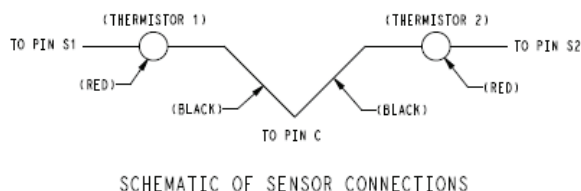


Fig. 26 — Motor Sensor Wiring

Checking Pressure Transducers

There are 5 factory-installed pressure transducers measuring refrigerant pressure: compressor discharge, pressure after economizer before main EXV, evaporator pressure, economizer vapor discharge pressure and oil pressure.

Each transducer is supplied with 5 vdc power. If the transducer reading is suspected of being faulty, check the voltage, which should be 5 vdc $\pm$ 0.5 v. Recalibrate and replace the transducer if correct voltage is being supplied, but displayed values are incorrect. Additionally, check that any external inputs have not been grounded.

TRANSDUCER REPLACEMENT

All transducers except the compressor high pressure switch (located on discharge pipe) are mounted on Schrader-type fittings. Transducers installed on Schrader-type fittings can be removed without the need to remove refrigerant from the vessel when replacing the transducers. Disconnect the transducer wiring. *Do not pull on the transducer wires.* Unscrew the transducer from the Schrader fitting. When installing a new transducer, do not use pipe sealer (which can plug the sensor). Put the plug connector back on the sensor and snap into place. Check for refrigerant leaks.

⚠ WARNING

Be sure to use a back-up wrench on the Schrader fitting whenever removing a transducer, since the Schrader fitting may back out with the transducer, causing a large leak and possible injury to personnel.

EVAPORATOR AND CONDENSER PRESSURE TRANSDUCER CALIBRATION

Calibration can be checked by comparing the pressure readings from the transducer to an accurate refrigeration gage reading. These readings can be viewed or calibrated from the HMI screen. The transducer can be checked and calibrated at 2 pressure points. These calibration points are 0 psig (0 kPa) and between 25 and 250 psig (173 and 1724 kPa). Connect pressure transducer to Schrader connection. To calibrate these transducers:

1. Shut down compressor, evaporator, and condenser pumps.

NOTE: There should be no flow through the heat exchangers.

2. Disconnect transducer in question from its Schrader fitting for evaporator or condenser transducer calibration. For other pressure or flow device calibration, leave transducer in place.

NOTE: If the evaporator or condenser vessels are at 0 psig (0 kPa) or are open to atmospheric pressure, the transducers can be calibrated for zero without removing the transducer from the vessel.

3. Access the PRESSURE or (if water side pressure) HYDRAULIC STATUS screen and view the particular transducer reading. To calibrate pressure or waterside flow device, view the particular reading. It should read 0 psig (0 kPa). If the reading is not 0 psig (0 kPa), but within $\pm$ 5 psig (35 kPa), the value may be set to zero from the Maintenance Menu while the appropriate transducer parameter is highlighted. The value will now go to zero.

4. If the transducer value is not within the calibration range, the transducer returns to the original reading. If the pressure is within the allowed range (noted above), check the voltage ratio of the transducer. To obtain the voltage ratio, divide the voltage (dc) input from the transducer by the supply voltage signal or measure across the positive (+ red) and negative (– black) leads of the transducer. The input to reference voltage ratio must be between 0.80 and 0.11 for the software to allow calibration. Rotate the waterside flow pressure device from the inlet nozzle to the outlet nozzle and repeat this step. If rotating the waterside flow device does not allow calibration, pressurize the transducer until the ratio is within range. Then attempt calibration again.
5. Installation of pressure transducers into water nozzles using flushable dirt leg trap is suggested; see Fig. 27. Pressures can be calibrated between 100 and 250 psig (689.5 and 1723.7 kPa) by attaching a regulated 250 psig (1724 kPa) pressure (usually from a nitrogen cylinder). For calibration, access the Pressure Sensor Calibration Menu from the Maintenance Menu and calibrate the appropriate sensor.

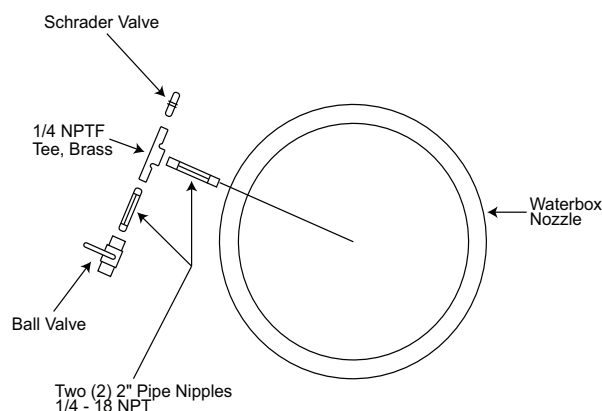


Fig. 27 — Suggested Installation of Pressure Transducers into Water Nozzles Using Flushable Dirt Leg Trap

The PIC6.1 control system does not allow calibration if the transducer is too far out of calibration. In this case, a new transducer must be installed and re-calibrated.

The EXV motor winding resistance can be checked by removal of the EXV plug. The resistance across coil I should be 52 Ohm ($\pm$ 10%) and the resistance across coil II should be 52 Ohm ($\pm$ 10%). See Fig. 28.

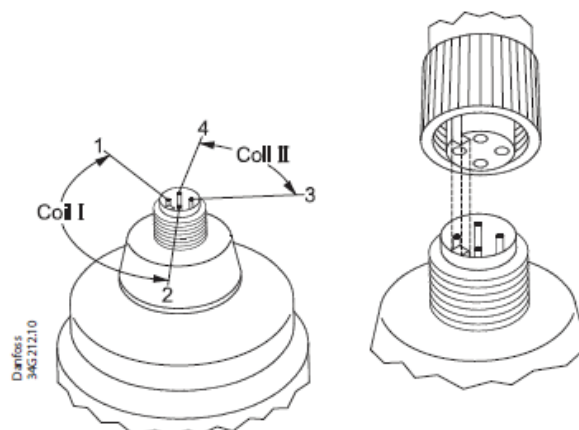


Fig. 28 — EXV Coil Check

High Altitude Locations

Because the chiller is initially calibrated at sea level, it is necessary to recalibrate the pressure transducers if the chiller has been moved to a high altitude location. Note that Atmospheric

Pressure can be adjusted in the Service Parameters Menu (located in the Configuration Menu).

Quick Test and 23XW/XQ Quick Test

The Quick Test feature is located in the Main Menu. Use this feature to test chiller status, test the status of various actuators, view water temperature deltas, and test pump and relays, as well as EXCSV (expansion control system valve), alarms, condenser, and chilled water pumps. The tests can help to determine whether a switch is defective or a pump relay is not operating, as well as other useful troubleshooting issues.

End of Life and Equipment Disposal

This equipment has an average design life span of 25 years and is constructed of primarily steel and copper. Content of control

panels includes but is not limited to common electrical components such as fuses, starters, circuit breakers, wire, capacitors and printed circuit boards. Prior to disposal it will be necessary to remove all fluids such as water, refrigerant, and oil (if applicable) using the current industry guidelines for recovery/disposal. In addition electrical components may need to be collected for recovery and recycling as per local directives.

Physical Data

Fig. 29-33 provide additional information on compressor fits and clearances, physical and electrical data, and wiring schematics for the operator’s convenience during troubleshooting. For weight information, please refer to weight calculator.

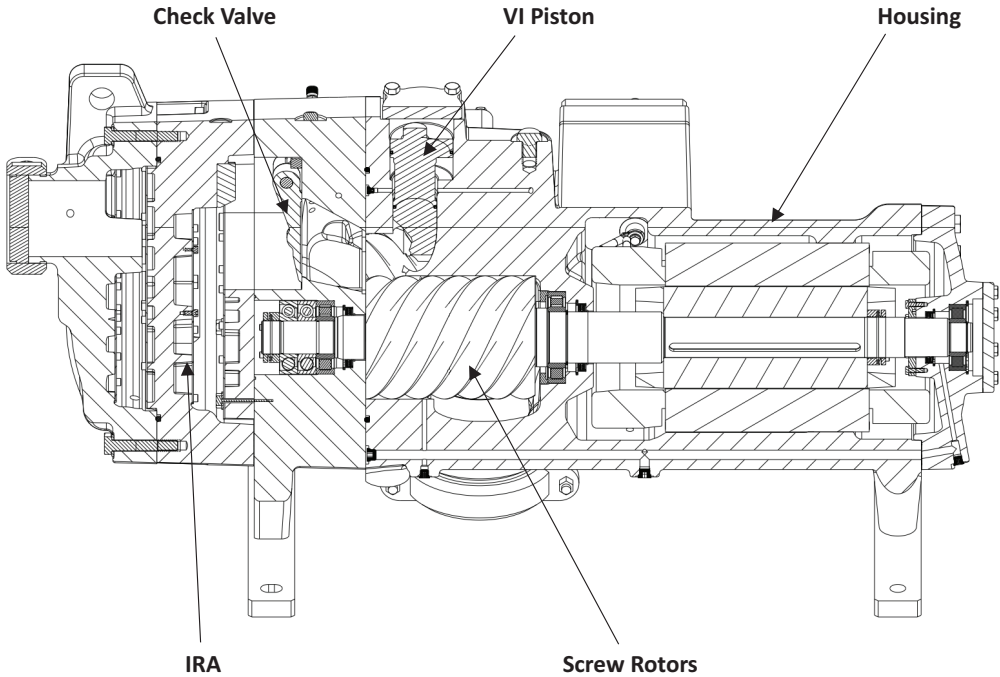


Fig. 29 — 23XW/XQ Compressor Components

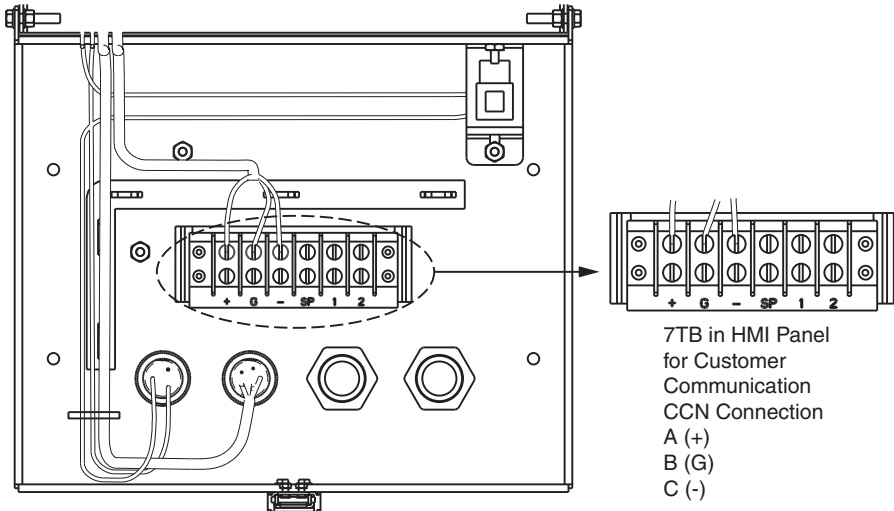


Fig. 30 — HMI Panel

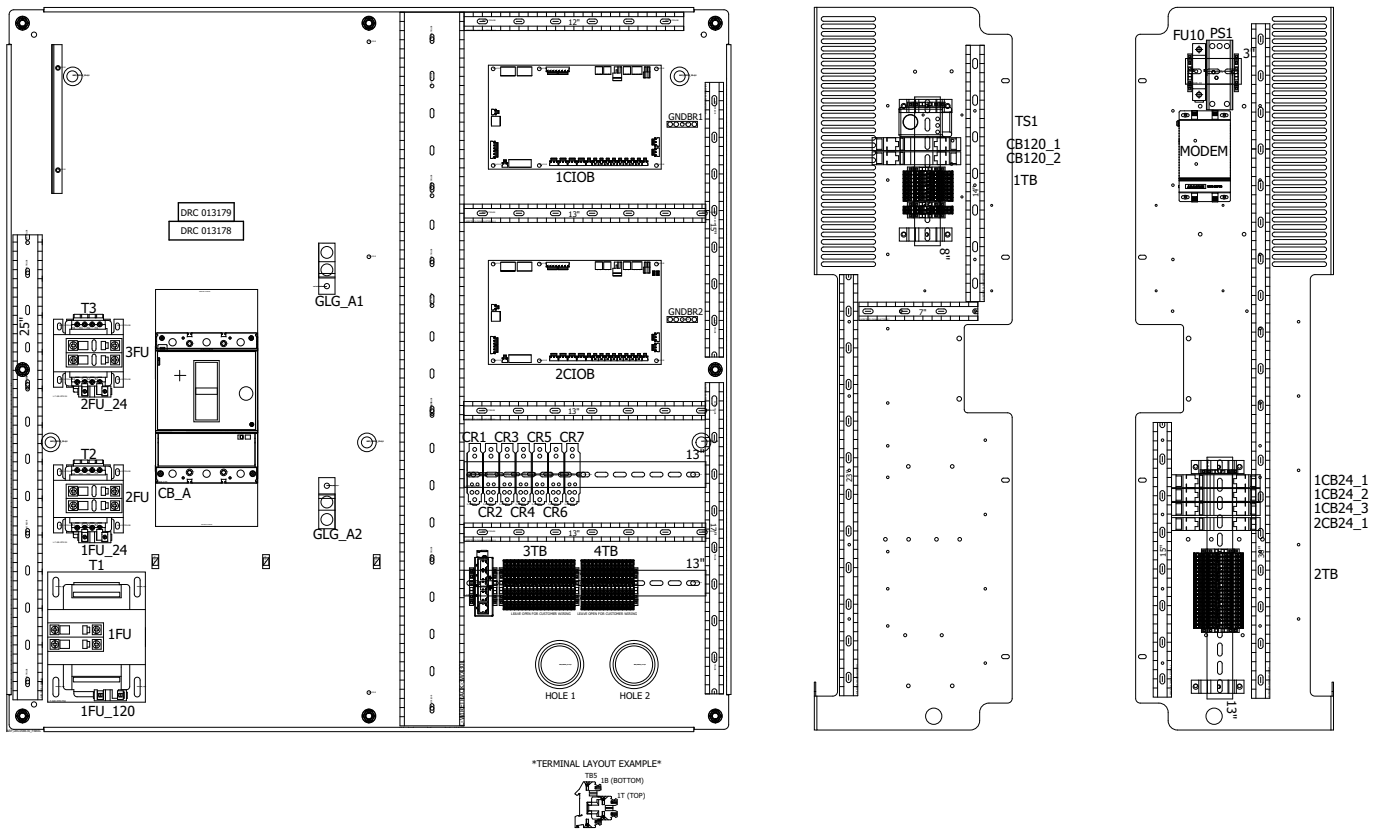


Fig. 31 — Control Panel Layout

1CIOB

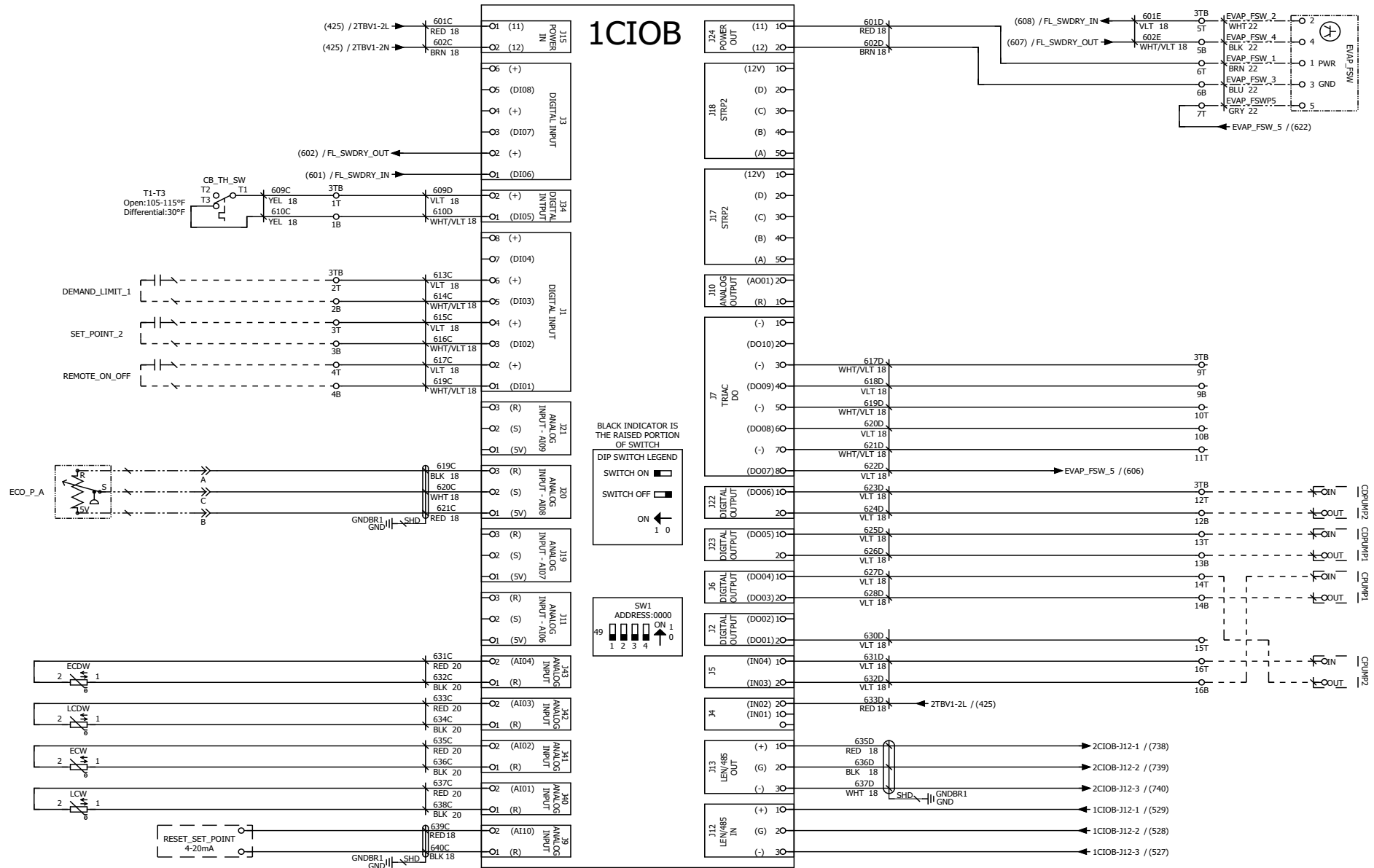
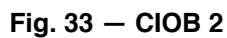


Fig. 32 – CIOB 1



LEGEND FOR FIG. 32-33

Abbreviations

DS	— Disconnect Switch
DIS_P_A	— Discharge Pressure Transducer 1, Circuit A
SUC_P_A	— Suction Pressure Transducer 1, Circuit A
LIQ_P_A	— Liquid Pressure Transducer EXV1, Circuit A
OIL_P_A	— Oil Pressure Transducer 1, Circuit A
ECO_P_A	— Economizer Pressure Transducer 1, Circuit A
CB	— Circuit Breaker
EXV_A	— Electronic Expansion Valve 1, Circuit A
ECOEXV_A	— Electronic Expansion Valve Economizer 1, Circuit A
ETH_SW	— Ethernet Switch
REST	— Remote Emergency Stop Input
MTRW_A	— Compressor Motor Temperature Sensor 1, Circuit A
FU	— Fuse
PIC6_HMI	— Human Machine Interface (Tough Screen)
HP_SW1_A,	— High Pressure Switches 1 and 2, Circuit A
HP_SW2_A	
PS	— Power Supply
LCW	— Evaporator Leaving Water Temperature Sensor
ECW	— Evaporator Entering Water Temperature Sensor
DGT_A	— Discharge Gas Temperature Sensor 1, Circuit A
ECO_T_A	— Economizer Temperature Sensor 1, Circuit A
LCDW	— Condenser Leaving Water Temperature Sensor
LIQ_T_A	— Liquid Temperature Sensor Entering EXV1, Circuit A
ECDW	— Condenser Entering Water Temperature Sensor
OIL1_L_A,	— Oil Level Detectors 1 and 2, Circuit A
OIL2_L_A	
EVAP_FSW	— Evaporator Pump Flow Switch
SPD	— Surge Protective Device
T1, T1, T3	— Transformers
TB	— Terminal Blocks
UPS	— Uninterrupted Power Supply
CTRL BOX	— Control Box
SWVL BOX	— Remote Swivel Box
PBRK	— Power Breaker
CBCC	— Circuit Breaker, Control Circuit
CB_TH_SW	— Control Box Safety Thermostat Switch
CPUMP1,	— Cooler (Evaporator) Pumps 1 and 2
CPUMP2	
CDPUMP1,	— Condenser Pumps 1 and 2
CDPUMP2	
CPUMP1_OUT,	— Cooler (Evaporator) Pumps 1 and 2 Dry Contact Output
CPUMP2_OUT	
CDPUMP1_OUT,	— Condenser Pumps 1 and 2 Dry Contact Output
CDPUMP2_OUT	
CPUMP1_OUT,	— Cooler (Evaporator) Pumps 1 and 2 Dry Contact Input
CPUMP2_OUT	
CDPUMP1_IN,	— Condenser Pumps 1 and 2 Dry Contact Input
CDPUMP2_IN	
VI_SV_A	— Capacity Control Valve, Circuit A
OIL_SOL_A	— Oil Valve, Circuit A
MRTCL3_A	— Motor Cooling Solenoid Valves 3, Circuit A
OIL_DL_A	— Manifold Oil Solenoid, Circuit A
MTRCL3_A	— Motor Cooling Solenoid Valves 3, Circuit A
OIL_DL_A	— Oil Valve, Circuit A
MTRCL3_A	— Motor Cooling Solenoid Valves 3, Circuit A
OIL_DL_A	— Manifold Oil Solenoid, Circuit A
CVPUMP	— Cooler Variable Pump
CVPUMP_CMD	— Cooler Variable Pump Command Analog Signal
CD3WV	— Condenser Three (3) Way Valve
CD3WV_CMD	— Condenser Three (3) Way Valve Command Analog Signal
CR	— Control Relay

Symbols

TYPICAL ELECTRICAL COMPONENTS' SYMBOL LEGEND			
	NON-FUSE DISCONNECT SWITCH		POWER CONTACTOR
	MOLDED CASE CIRCUIT BREAKER THERMAL MAGNETIC		LINE/LOAD REACTOR
	FUSIBLE DISCONNECT SWITCH		POWER/CONTROL TRANSFORMER (SINGLE PHASE)
	MINIATURE CIRCUIT BREAKER 2 POLES (UL489)		GROUND
	MINIATURE CIRCUIT BREAKER 1 POLES (UL489)		CURRENT TRANSDUCER
	FUSE BLOCK SWITCHABLE TYPICAL - 2 POLES		INDUCTOR
	FUSE BLOCK TYPICAL - 1 POLE		CAPACITOR
	MANUAL MOTOR PROTECTION (MMP)		RESISTOR
			LIGHT
			PUSHED BUTTON TYPICAL - NO (NORMALLY OPEN)
			EMERGENCY STOP TYPICAL - NC (NORMALLY CLOSE)
			SELECTOR SWITCH (TYPICAL 4 POSITIONS 2 NC + 2 NO)
			PANEL WIRING FACTORY EQUIPMENT WIRING
			FIELD WIRING
			OPTION WIRING
			GENERAL TERMINAL BLOCKS FUSIBLE TERMINAL BLOCKS
			CONTROL RELAY (COIL)
			CONTROL RELAY NO CONTACT
			CONTROL RELAY NC CONTACT
			TYPICAL MULTI-CONDUCTOR CABLE (SHIELDED) RED, BLACK, WHITE, AND SHIELD
			USB PORT
			ETHERNET PORT
			THERMOSTAT NO/NC
			THERMOSTAT NO
			THERMISTOR
			PRESSURE SWITCH TYPICAL - NC
			SOLENOID VALVE
			FLOW SWITCH TYPICAL - NO
			PRESSURE TRANSDUCER
			WIRE CONNECTING CONTINUATION

SINGLE WIRE CONDUCTORS - CONTROL PANEL COLOR CODING		
COLOR	DESCRIPTION	TYPICAL VOLTAGE
BLACK (BLK)	UNGROUND AC POWER/CONTROL CIRCUITS OPERATING AT THE SUPPLY VOLTAGE	208-600VAC
BLACK (BLK)	UNGROUND AC CONTROL CIRCUITS OPERATING AT A VOLTAGE LESS THAN THE SUPPLY VOLTAGE	115-240VAC
WHITE (WHT)	GROUND AC CURRENT-CARRYING CONTROL CIRCUIT CONDUCTOR	115-240VAC
RED (RED)	AC CONTROL CIRCUITS OPERATING AT A VOLTAGE LESS THAN THE SUPPLY VOLTAGE	24VAC
TAN OR BROWN (TAN OR BRN)	AC CONTROL CIRCUITS OPERATING AT A VOLTAGE LESS THAN THE SUPPLY VOLTAGE	24V
YELLOW (YEL)	POWER WIRING FOR SERVICE CIRCUIT	208-600VAC
BLUE (BLU)	UNGROUND DC CONTROL CIRCUITS	5-60VDC
WHITE WITH BLUE STRIPES (WHT/BLU)	GROUND DC CURRENT-CARRYING CONTROL CIRCUIT	5-60VDC
VIOLET (VLT)	INSTRUMENTATION SIGNAL REFERENCE	24VAC REF +
VIOLET WITH WHITE STRIPES (VLT/WHT)	INSTRUMENTATION SIGNAL REFERENCE	24VAC REF -
<= 4AWG (21.2mm²): GREEN (GRN)/GREEN WITH YELLOW STRIPES (GRN/YEL) > 4AWG (mm²): BLACK WITH GREEN TAPES	GROUND CONDUCTORS	ALL
<= 4AWG (21.2mm²): VIOLET (OR PURPLE) > 4 AWG (mm²): BLACK WITH VIOLET (OR PURPLE) TAPES	HIGH VOLTAGE SUPPLYING POWER, UNGROUND DC CIRCUITS	> 60VDC
<= 4AWG (mm²): VIOLET (OR PURPLE) WITH WHITE TAPES > 4 AWG (mm²): BLACK WITH VIOLET (OR PURPLE) AND WHITE TAPES	HIGH VOLTAGE SUPPLYING POWER, GROUND DC CIRCUITS	> 60VDC

APPENDIX A — PIC6.1 SCREEN AND MENU STRUCTURE

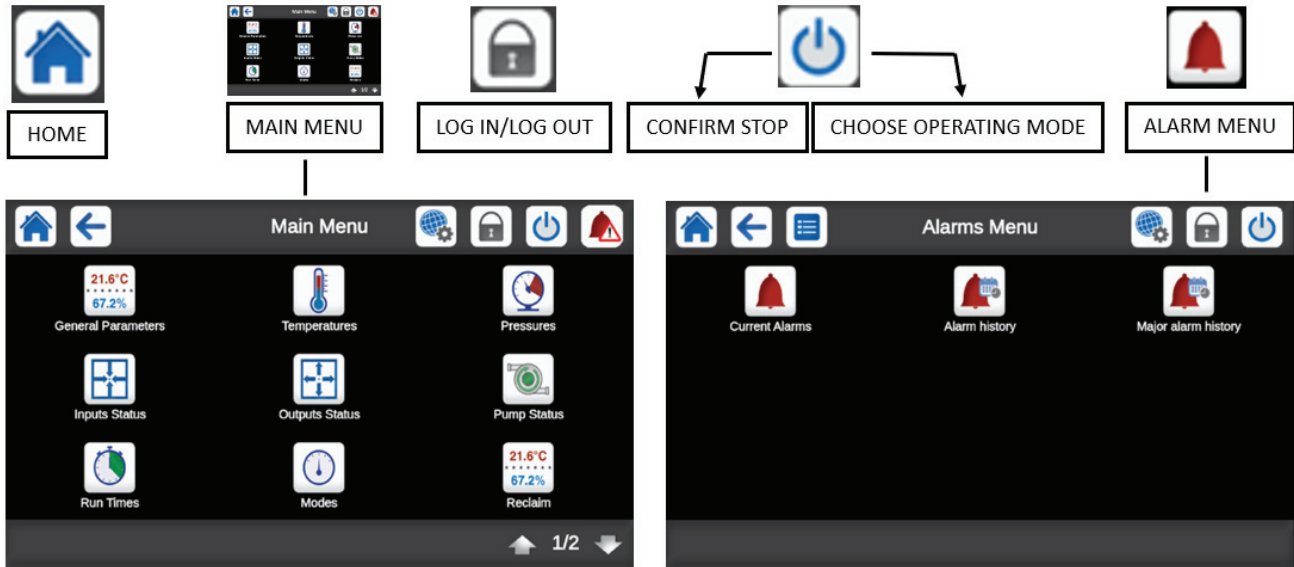


Fig. A — Screen Structure, Basic Level

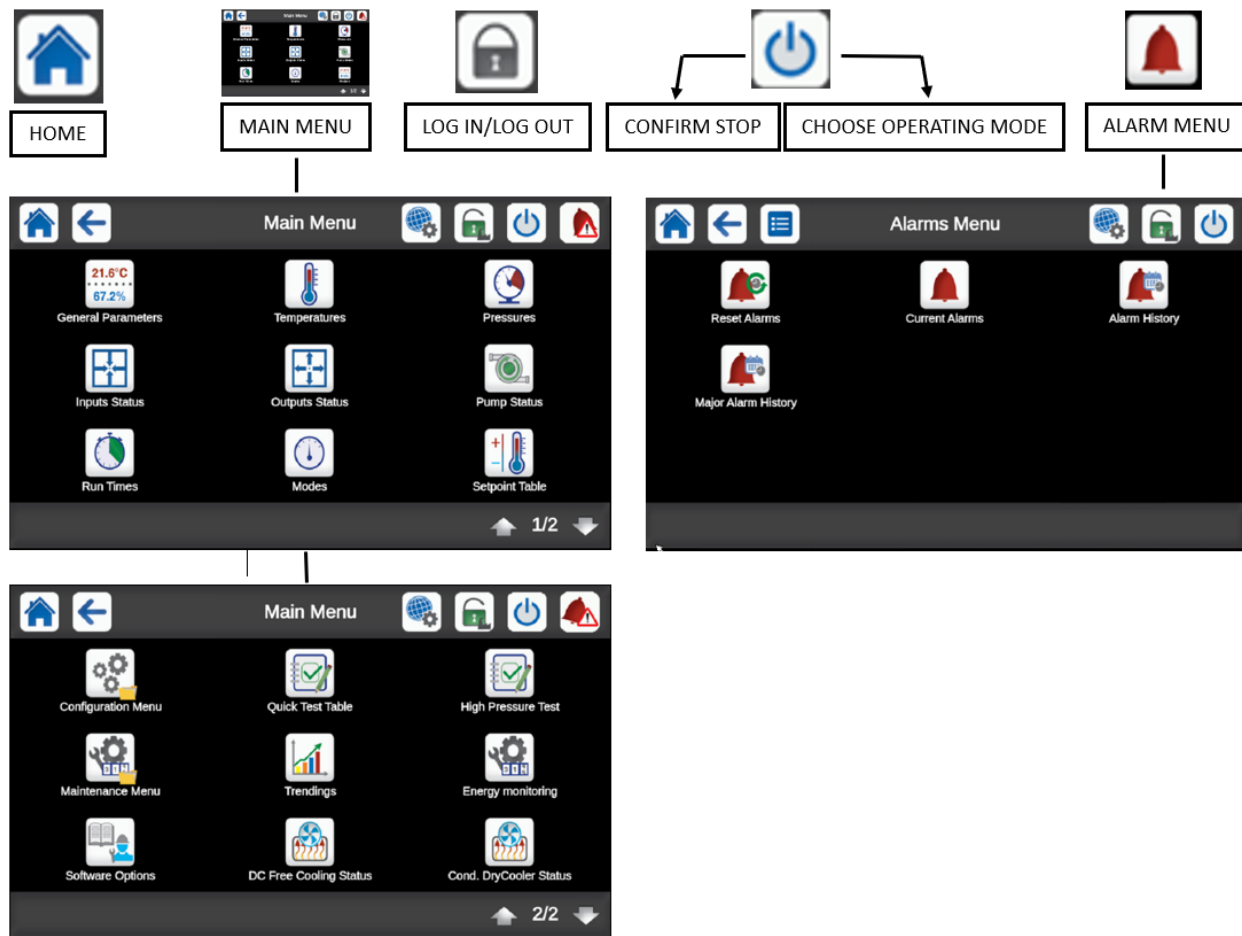


Fig. B — Screen Structure, Factory Service Level

APPENDIX A — PIC6.1 SCREEN AND MENU STRUCTURE (cont)

Main Menu Description

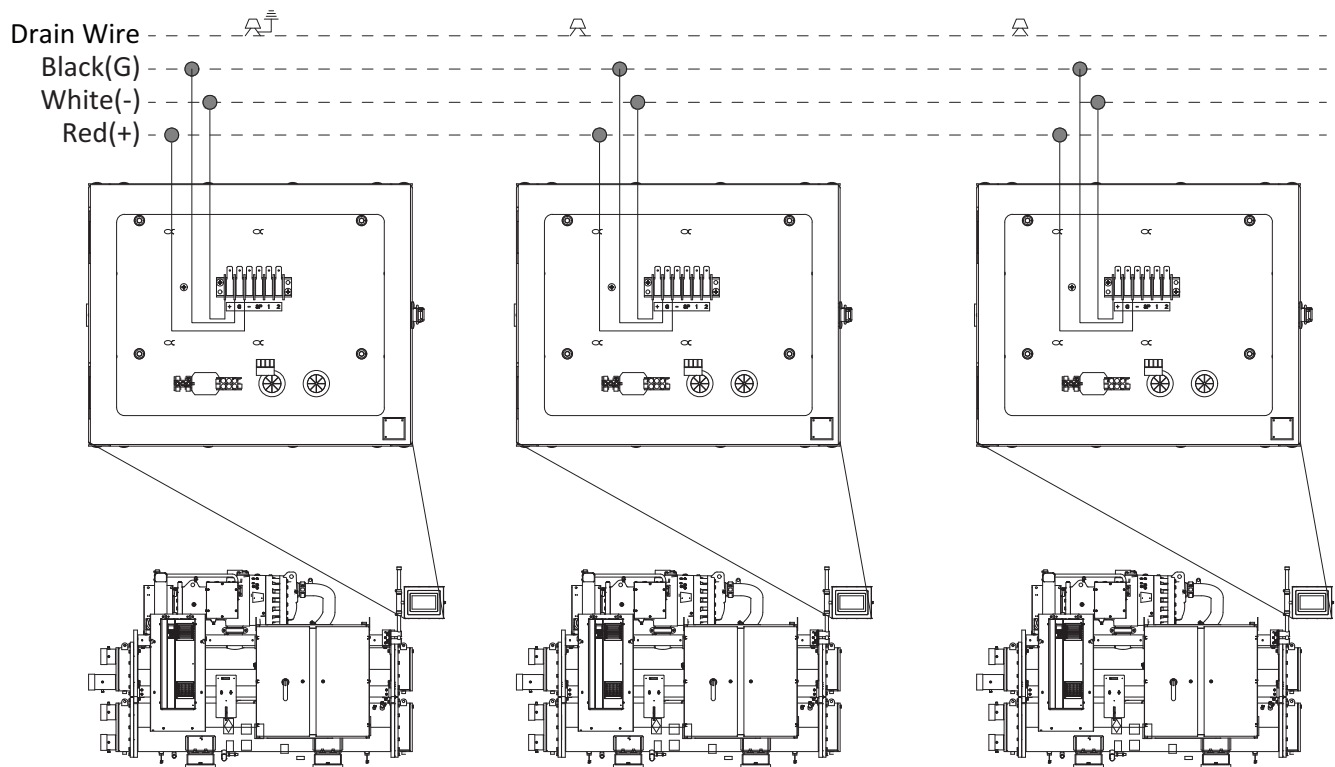
ICON	DISPLAYED TEXT ^a	ACCESS	ASSOCIATED TABLE ^b
	General Parameters	Basic, User, Factory	GENUINT
	Temperatures	Basic, User, Factory	TEMP
	Pressures	Basic, User, Factory	PRESSURE
	Inputs Status	Basic, User, Factory	INPUTS
	Outputs Status	Basic, User, Factory	OUTPUTS
	Pump Status	Basic, User, Factory	PUMPSTAT
	Run Times	Basic, User, Factory	RUNTIME
	Modes	Basic, User, Factory	MODES
	Setpoint Table	Factory	SETPOINT
	Configuration Menu	User (limited), Factory	CONFIG
	Quick Test Table	Factory	QCK_TEST
	High Pressure Test	Factory	HP_TEST
	Maintenance Menu	User, Factory	MAINTAIN
	Trendings	Basic, User, Factory	TRENDING
	Energy Monitory	User	ENERGY
	Software Options	User, Factory	OPT_STA
	DC Free Cooling Status	Basic, User, Factory	DCFC_STA
	Cond. DryCooler Status	Basic, User, Factory	DRYC_STA

NOTE(S):

a. Displayed text depends on the selected language (default is English).

b. See the 23XW/XQ with PIC6.1 Controls Operation and Troubleshooting manual for table details.

APPENDIX B — CCN COMMUNICATION WIRING FOR MULTIPLE CHILLERS (TYPICAL)



NOTE : Field-supplied terminal strip must be located in control panel.

APPENDIX C — MAINTENANCE SUMMARY AND LOG SHEETS

23XW/XQ Maintenance Interval Requirements

WEEKLY			
COMPRESSOR	None.	CONTROLS	Review PIC6.1 Alarm/Alert History.
EVAPORATOR	None.	VFD	None.
CONDENSER	None.		
MONTHLY			
COMPRESSOR	None.	CONTROLS	None.
FIRST YEAR			
COMPRESSOR	Replace oil filter and filter drier.	EXVS	Clean EXV strainers.
ANNUALLY			
COMPRESSOR		CONTROLS	
EVAPORATOR	Inspect and clean evaporator tubes. Confirm there is no foreign debris in the tubes or waterboxes from the water system. Inspect all pressure relief devices. Leak test. Verify water pressure differential. Inspect water pumps. Send refrigerant sample out for analysis.	VFD	Perform general cleaning. Tighten connections. Perform visual inspection of the capacitors located on the DC bus and inductors. Check cooling fan operation. Replace or clean air filter.
CONDENSER	Inspect and clean condenser tubes. Leak test. Verify water pressure differential. Inspect water pumps and cooling tower.	POWER PANEL	Perform general cleaning of air filter located in the door of the high voltage section. Filter mesh is made of washable aluminum. Verify that fan is operating. Fan exit is located on the back of the high voltage section. Fan will operate when enclosure temperature exceeds 70°F (21°C).
EVERY 3 TO 5 YEARS			
COMPRESSOR	None.	CONTROLS	
EVAPORATOR	Perform eddy current test.	VFD	None.
CONDENSER	Inspect EXVs and clean or replace strainers. Perform eddy current test.		
SEASONAL SHUTDOWN			
COMPRESSOR	None.	CONTROLS	None.
EVAPORATOR	Isolate and drain waterbox. Remove waterbox cover from one end. Use compressed air to clear tubes.	VFD	None.
CONDENSER	Isolate and drain waterbox. Remove waterbox cover from one end. Use compressed air to clear tubes.		

NOTE: Equipment failures caused by lack of adherence to the Maintenance Interval Requirements are not covered under warranty.

APPENDIX D — REMOTE CONNECTIVITY SETUP (BY CARRIER SERVICE)

Introduction

Cellular Remote Connectivity is a system developed by Carrier to remotely monitor a chiller. It consists of a PIC6.1 controller, ethernet switch, cellular modem, and an antenna. The option is included standard with all applied 23 Series equipment. For a new chiller there is a free period of operation with remote connectivity after commissioning. Attached documentation is based on use of Sierra wireless router/modem. This appendix describes typical commissioning steps required for a chiller supplied with the Remote Connectivity option. For support or when completed contact the Command Center at 1-833-257-6280 or email at EETSupport@carrier.com. Typical component interactions are shown in Fig. C.

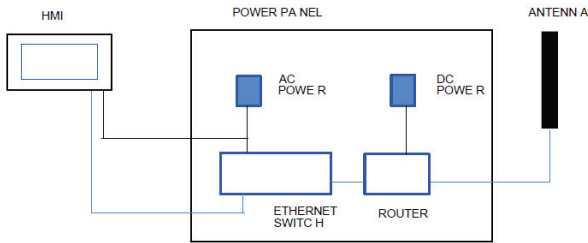


Fig. C — Remote Connectivity

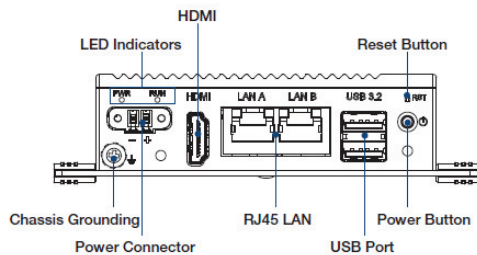
Verification and Testing

First locate the cellular antenna which is located in the chiller control/power panel. This component is not installed at the factory since optimum mounting location is needed to be identified at the site as part of Remote Connectivity commissioning.

Next, identify the location of the router and ethernet switch in the power panel. There will typically be hazardous voltage in the control panel where the remote connectivity hardware pieces are installed. Therefore make all connections prior to connecting power to the chiller as otherwise it is required to wear appropriate PPE to protect against arch flash potential and other electrical hazards.

1. Verify that PIC6.1 is connected via ethernet to the ethernet switch.
2. Verify that antenna is installed to cellular antenna connection. See Fig. D.

Front I/O



Rear I/O

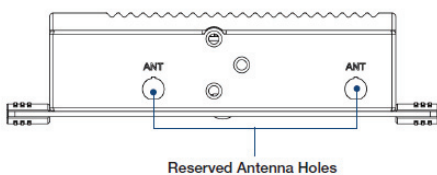


Fig. D — End Views of Remote Connectivity Hardware

3. Verify that a SIM card is installed (before power up).

4. Modem powers up when power is applied to chiller. The Power LED will be off when there is no power applied. The Power LED will be solid red when power is on and there is no cellular signal and solid green when attached to a cellular network. The User LED is not used.
5. Navigate to PIC6.1 System Configuration→Ethernet Configuration and record the PIC6.1 MAC address of ETH0 (example 52:CC:00:02:11:C4).
6. Default ethernet IP address for the Sierra modem is 169.254.1.1. Set the interface for the PIC6.1 ethernet port which is going to be used to 169.254.101 for the first chiller and if multiple chillers increase last digit by one for each chiller. APPLY the setting in the PIC6.1 menu. Up to a total of 5 chillers can be installed to one modem (if required).
7. For the PIC6.1 ethernet port which is going to be used ensure that Subnet mask is 255.255.0.0.
8. Navigate to the PIC6.1 System Configuration→Gateway/DNS Config menu. Set Gateway 0 IP to 169.254.1.1 and Gateway Destination/Mask to 0.0.0.0/0. Apply the changes.
- NOTE: Gateway 1 is generally not used in SmartService applications. However, presently you must set Gateway 1 to the same settings as Gateway 0 and apply the settings.
9. Set DNS Servers to 169.254.1.1 and APPLY the change; the status should show “DNS applied successfully”.
10. Test connectivity (PIC6.1 System Configuration→Network Diagnostic:

- a. Run ping test to modem: Enter 169.254.1.1 into Server Address and select appropriate ethernet port. Then select “Run PING test”. If the PIC6.1 can connect to the modem the PIC6.1 will display “In Progress” followed by “Pass”.
 - b. Run ping test to internet: Enter 8.8.8.8 into Server Address and select appropriate ethernet port. Then select “Run PING test”. If the PIC6.1 can connect to the modem the PIC6.1 will display “In Progress” followed by “Pass”.
 - c. Run could test to SmartService cloud. Note that if previous ping test has failed then this test will also fail. In addition verify on the PIC6.1 Network Diagnostic page that “IOT certificate status: Present” is noted near top of page. If the IOB certificate is not present, then it will have to be loaded. Contact Service Engineering or Technical Service Manager.
11. Verify Time, Date and Time Zone. PIC6.1 System Configuration→Date/Time Configuration.

Connect to SmartService

Upon successful completion, contact the Command Center at 1-833-257-6280 or email EETSupport@carrier.com. The Command Center will set up the chillers in CarrierSmart or see if they are already onboarded properly.

When contacting the Command Center please have the following information available:

Jobsite Information:

- Street Address, City, State and Zip code
- CCS Office
- CCS Market
- Carrier Job number or Contract number

Chiller data (for each chiller being onboarded):

- Job site Designation (e.g Chiller 1 or alike used to identify the chiller at the job site)
- Model Number
- Full Serial Number
- Eth0 MAC Address

APPENDIX E — A2L REFRIGERANT INSTALLATION SUPPLEMENT

SAFETY CONSIDERATIONS

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

Untrained personnel can perform basic maintenance functions of cleaning and replacing filters. All other operations should be performed by trained service personnel. When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit, and other safety precautions that may apply.

Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for unbrazing operations. Have fire extinguisher available for all brazing operations.

It is important to recognize safety information. This is the safety-alert symbol . When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

Understand the signal words DANGER, WARNING, CAUTION, and NOTE. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies hazards which **could** result in personal injury or death. CAUTION is used to identify unsafe practices, which **may** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

Centrifugal liquid chillers are designed to provide safe and reliable service when operated within design specifications. When operating this equipment, use good judgment and safety precautions to avoid damage to equipment and property or injury to personnel.

INTRODUCTION

The 23XW-XQ chillers may contain R-1234ze(E) refrigerant. This refrigerant is classified as A2L, considered mildly flammable and nontoxic.

PURPOSE

This document provides specific guidance for safe installation of the 23XW-XQ chillers due to this lower flammable refrigerant use for indoor applications isolated from the general public per ANSI/ASHRAE Standard 15 (latest edition) and in compliance with UL 60335-2-40.

R-1234Ze(E) CHARACTERISTICS

R-1234ze(E) refrigerant is classified as Class 2L since it meets all four of the following conditions:

1. Exhibits flame propagation when tested at 140°F (60°C) and 14.7 psia (101.3 kPa).
2. Lower Flammability Limit (LFL) is as follows:
 $LFL > 0.0062 \text{ lbm/ft}^3$ (0.10 kg/m³)
R-1234ze(E) LFL = 0.0189 lbm/ft³ (0.303 kg/m³)
3. Heat of combustion is as follows:
Heat of Combustion < 8169 Btu/lbm (19,000 kJ/kg) at 77°F (25°C) and 14.7 psia (101.3 kPa)
R-1234ze(E) Heat of Combustion = 4.34 Btu/lbm (10.1 kJ/kg)
4. Maximum burning velocity is as follows:
Maximum burning velocity $\leq 3.9 \text{ in/sec}$ (10 cm/s) when tested at 73.4°F (23.0°C) and 14.7 psia (101.3 kPa) in dry air
R-1234ze(E) Burning Velocity = 0.47 in/sec (1.2 cm/s)

R-1234ze(E) Refrigerant Concentration Limit (RCL) = 16,000 ppm

R-1234ze(E) Occupational Exposure Limit (OEL) = 800 ppm

WARNING

This manual is intended for use by owner or Carrier authorized service personnel.

Be sure you understand and follow the procedures and safety precautions contained in the chiller instructions as well as those listed in this guide.

CAUTION

Screw liquid chillers are designed to provide safe and reliable service when operated within design specifications. When operating this equipment, use good judgment and safety precautions to avoid damage to equipment and property or injury to personnel.

CAUTION

The refrigeration system including piping must be installed in accordance with national and local codes and standards, such as ASHRAE 15 (latest edition), IAPMO Uniform Mechanical Code, ICC International Mechanical Code, or CSA B52, and UL 48416 or UL/CSA 60335-2-40 listings, the manufacturer's instructions, and any markings on the equipment restricting the installation.

TERMINOLOGY

Immediately Dangerous to Life or Health (IDLH)

The maximum concentration from which unprotected persons are able to escape within 30 minutes without escape-impairing symptoms or irreversible health effects.

Refrigerant Concentration Limit (RCL)

The refrigerant concentration limit, in air, determined in accordance with ASHRAE34 standard and intended to reduce the risks of acute toxicity, asphyxiation, and flammability hazards in normally occupied, enclosed spaces.

Occupational Exposure Limit (OEL)

The time-weighted average (TWA) concentration for a normal eight-hour workday and a 40-hour workweek to which nearly all workers can be repeatedly exposed without adverse effect, based on the OSHA PEL, ACGIH TLV-TWA, TERA OARS-WEEL, or consistent value.

Effective Dispersal Volume Charge (EDVC)

The maximum amount of refrigerant charge permitted to disperse in the event of a leak for a volume.

Lower Flammability Limit (LFL)

The minimum concentration of a refrigerant can ignite with air at sea level. The refrigerant/air mixture won't ignite below that.

APPENDIX E — A2L REFRIGERANT INSTALLATION SUPPLEMENT (cont)

LABELING

For appliances containing a flammable refrigerant, ensure there are labels on the equipment stating **FLAMMABLE REFRIGERANT**.

SAFETY INSTRUCTIONS

WARNING

Prior to beginning work on systems containing flammable refrigerants, safety checks are necessary to ensure that the risk of ignition is minimized.

The following recommendations should be carefully observed as part of installation, operation, maintenance or service prior to conducting work on the system:

Personal Training

This equipment must be installed and operated by trained and qualified personnel who have received suitable instruction in its use.

When a chiller is used with A2L Flammable Refrigerant, training is required for the working personnel for installation, service and repair operations. Training competency should be documented by a certificate from an accredited national training organization or manufacturer.

The training should include the substance of the following:

1. Information about the explosion potential of flammable refrigerants to show that flammables may be dangerous when handled without care.
2. Information about **POTENTIAL IGNITION SOURCES**, especially those that are not obvious, such as lighters, light switches, or electric heaters.
3. Information about different safety concepts such as:
 - a. Unventilated areas
 - b. Ventilated enclosures
 - c. Ventilated rooms
4. Information about refrigerant detectors:
 - a. Principle of function, including influences on the operation.
 - b. Procedures to repair, check, or replace a refrigerant detector or parts of it in a safe way.
 - c. Procedures to disable a refrigerant detector in case of repair work on the refrigerant carrying parts.
5. Information about the concept of sealed components and sealed enclosures according to IEC 60079-15:2010.
6. Information about correct working procedures such as:
 - a. Commissioning
 - b. Maintenance
 - c. Repair
 - d. Decommissioning
 - e. Disposal

Ventilated Area

Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation should continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.

Cabling

Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges or any other adverse environmental effects. The check should also take into account the effects of aging or continual vibration from sources such as compressors or fans.

Presence of Fire Extinguisher

If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire extinguishing equipment should be available to hand. Have a dry powder or CO₂ fire extinguisher adjacent to the charging area.

General Work Area

All maintenance staff and others working in the local area should be instructed on the nature of work being carried out. Work in confined spaces should be avoided.

Work Procedure

Work should be undertaken under a controlled procedure so as to minimize the risk of a flammable gas or vapor being present while the work is being performed.

Checking for Presence of Refrigerant

The area should be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants; i.e., non-sparking, adequately sealed, or intrinsically safe.

For more information about refrigerant detectors, see Detection of Flammable Refrigerants in the next section.

No Ignition Sources

No person carrying out work in relation to a refrigerating system which involves exposing any pipe work should use any sources of ignition in such a manner that it may lead to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation repair, removal, and disposal, during which refrigerant can possibly be released to the surrounding space. Prior to work taking place, the area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks. “No Smoking” signs should be displayed.

Checks to the Refrigerant Equipment

Where electrical components are being changed, they should be fit for the purpose and to the correct specification. At all times the manufacturer’s maintenance and service guidelines should be followed. If in doubt, consult the manufacturer’s technical department for assistance.

The following checks should be applied to installations using flammable refrigerants:

1. The ventilation machinery and outlets are operating adequately and are not obstructed.
2. If an indirect refrigerating circuit is being used, the secondary circuit should be checked for the presence of refrigerant.
3. Marking to the equipment is visible and legible. Markings and signs that are illegible should be corrected.
4. Refrigerating pipe or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being so corroded.

APPENDIX E — A2L REFRIGERANT INSTALLATION SUPPLEMENT (cont)

WARNING

Do not use means to accelerate the defrosting process or to clean, other than those recommended by the manufacturer. The equipment must be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance or an operating electric heater). Do not pierce or burn. Be aware that refrigerants may not contain an odor.

DETECTION OF FLAMMABLE REFRIGERANTS

Under no circumstances should potential sources of ignition be used in searching for or detection of refrigerant leaks. Do not use a halide torch or any other detector using a naked flame.

Each refrigerating machinery room should contain one or more refrigerant detectors with sensing element located in areas where refrigerant from a leak will concentrate, with one or more set points that activate response alarms automatically to deenergize the following:

- Refrigerant compressors
- Refrigerant pumps
- Normally closed automatic refrigerant valves
- Other unclassified electrical sources of ignition with apparent power rating greater than 1 kVA, where the apparent power is the product of the circuit voltage and current rating.

and for mechanical ventilation. Multiport-type devices should be prohibited.

Leak detection equipment should be set at a percentage of the LFL of the refrigerant and should be calibrated to the refrigerant employed, and the appropriate percentage of gas (25% maximum) is confirmed.

Detection of refrigerant concentration that exceeds the lower value of below:

0.004725 lbm/ft³ (0.07575 kg/m³) for R-1234ze(E)

OR

The upper detection limit of the refrigerant detector

should automatically deenergize the following equipment in the machinery room:

- a. Refrigerant compressors
- b. Refrigerant pumps
- c. Normally closed automatic refrigerant valves
- d. Other unclassified electrical sources of ignition with apparent power rating greater than 1 kVA, where the apparent power is the product of the circuit voltage and current rating.

The following leak detection methods are deemed acceptable for all refrigerant systems.

Electronic Leak Detectors

Electronic leak detectors may be used to detect refrigerant leaks capable of detecting each of the specific refrigerant designations in the machinery room.

In the case of flammable refrigerants, the sensitivity may not be adequate, or may need recalibration. (Detection equipment should be calibrated in a refrigerant-free area.) Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used.

CALIBRATION

Leak detection equipment should be set at a percentage of the LFL of the refrigerant and should be calibrated to the

refrigerant employed, and the appropriate percentage of gas (25% maximum) is confirmed.

In the case for R-1234ze(E) below, the detection should be if it exceeds the lower value of:

0.004725 lbm/ft³ (0.07575 kg/m³)

OR

The upper detection limit of the refrigerant detector.

SET POINT

The refrigerant detectors should activate ventilation at a set point and response time, at an airflow rate not less than the value determined below. There are a couple of set points. One is based on OEL value and the other one is based on RCL value.

OEL Set Point

The refrigerant detector should have a set point not greater than 800 ppm for R-1234ze(E) ONLY IF this value is the lowest OEL value for any refrigerant designation in the machinery room.

For refrigerants that do not have a published OEL value, use a value approved by the Authority Having Jurisdiction (AHJ).

Response time required for this set point is 300 seconds or less. The Alarm Type is “Trouble Alarm”. It should activate Ventilation Level 1 and an “Automatic” reset type is required.

The refrigerant detector should have a set point not greater than the lowest RCL value for any refrigerant designation in the machinery room.

RCL Set Point

For R-1234ze(E), RCL value is 16,000 ppm. This value should be checked against the other refrigerants’ RCL value used in the machinery room and if it is lower than any others then the Set Point should be set to 16,000 ppm.

For refrigerants that do not have a published RCL value, use a value approved by Authority Having Jurisdiction (AHJ).

Response time required for this set point is 15 seconds or less. The Alarm Type is “Emergency Alarm”. It should activate Ventilation Level 2 and an “Manual” reset type is required.

Manual reset type alarms should have the reset located inside the refrigerating machinery room.

IMPORTANT: Alarms set at levels other than OEL and RCL (such as IDLH) and automatic reset alarms are permitted with the condition that the meaning of each alarm should be clearly marked by signage near the annunciators.

Leak Detection Fluids

Leak detection fluids are suitable for use with most refrigerants but the use of detergents containing chlorine should be avoided as the chlorine may react with the refrigerant and corrode the copper pipework. Examples of leak detection fluids are the bubble method and fluorescent method agents.

Alarm Testing

The refrigerant detector should provide a means for automatic self testing and in the event of failure, a trouble alarm signal should be transmitted to an approved monitored location.

The refrigerant detector should be tested during installation and annually thereafter, or at an interval not exceeding the manufacturer’s installation instructions, whichever is less.

The alarm should have visual and audible annunciation inside the refrigerating machinery room and outside each entrance to the refrigerating machinery room.

The refrigerant detector set points should activate an alarm in accordance with the type of reset.

APPENDIX E — A2L REFRIGERANT INSTALLATION SUPPLEMENT (cont)

WARNING

When a remote located refrigerant sensor is specified by the manufacturer, the instructions should state when it is required and how to install and connect the sensor.

VENTILATION

Ventilation System

Machinery rooms should be vented to the outdoors by a mechanical ventilation system, to prevent accumulation of refrigerant due to leaks or a rupture of a refrigerating system or portion thereof.

This mechanical ventilation system should be in accordance with all of the following:

1. Contain at least one power-driven or multi-speed fan.
2. Electric motors driving fans should not be placed inside ducts; fan rotating elements should be nonferrous or non-sparking, or the casing should consist of or be lined with such material.
3. Include provision to supply makeup air to replace the air being exhausted; ducts for supply to and exhaust from the machinery room should serve no other area; the makeup air supply locations should be positioned relative to the exhaust air locations to avoid short circuiting.

WARNING

Chillers using A2L refrigerants, connected via an air duct system to one or more rooms, the supply and return air should be directly ducted to the space. Open areas such as false ceilings should not be used as a return air duct.

4. The exhaust air inlet ducts should be located in an area where refrigerant from a leak is expected to concentrate, in consideration of the location of the replacement supply air paths, refrigerating machines, and the density of the refrigerant relative to air.

WARNING

Upon detection of a leak, the zoning dampers are driven fully open and additional mechanical ventilation is activated.

5. The bottom of the exhaust air ducts elevation where air is exhausted from the room should not be more than 4 in. (100 mm) above the floor of the lowest point of the machinery room for R-1234ze(E) refrigerants that are heavier than air.
6. The location where the mechanical ventilation air extracted from the space is discharged should be separated by a sufficient distance, but not less than 9 ft 83 in. (3 m), from the mechanical ventilation air intake openings, to prevent recirculation to the space.
7. The discharge of the exhaust air should be to the outdoors in such a manner as not to cause a nuisance or danger.
8. When multiple refrigerant designations are in the machinery room, evaluate the required airflow according to each refrigerating system, and the highest airflow quantity should apply.

WARNING

Keep any required ventilation openings clear of obstruction.

IMPORTANT: Servicing should be performed only as recommended by the manufacturer

Ventilation Volumetric Air Flow Rates

Ventilation airflow rates for Levels 1 and 2 are not less than the value determined below.

LEVEL 1 VENTILATION FOR 23XW/XQ

Case 1: Operated when occupied, and operated when activated

The greater of:

- $0.5 \text{ (ft}^3\text{/min per cubic foot)} \times \text{Machine Room Volume (ft}^3\text{)}$
or $20 \text{ (ft}^3\text{/min per Person)} \times \text{No of People}$

OR

- $0.00254 \text{ (m}^3\text{/s per cubic meter)} \times \text{Machine Room Volume (m}^3\text{)}$ or $0.00944 \text{ (m}^3\text{/s per Person)} \times \text{No of People}$

Case 2: Operable when occupied

With or without mechanical cooling of the machinery room, the greater of:

- the airflow rate required to not exceed a temperature rise of 18°F (10°C) above inlet air temperature

OR

- the airflow rate required to not exceed a maximum air temperature of 122°F (50°C) in the machinery room

LEVEL 2 VENTILATION FOR 23XW/XQ

- 19,000 ft³/min Ventilation for > 440 lbm of R-1234ze(E) Refrigerant in the Chiller
- 8.6 m³/s Ventilation for > 190 kg of R-1234ze(E) Refrigerant Charge in the Chiller

WARNING

Check that the total airflow rate for Level 2 ventilation is not less than Level 1 ventilation airflow rate.

Unventilated Machine Room

The unventilated machine room area should be defined as the room area enclosed by the projection to the floor of the walls, partitions and doors of the space in which the equipment is installed with these specific definitions below:

- Spaces connected by only drop ceilings, ductwork, or similar connections should not be considered a single space.
- Spaces divided by partition walls which are no higher than 6 ft (1.8 m) should be considered a single space.
- Rooms on the same floor and connected by an open passageway between the spaces can be considered a single room if the passageway complies with all of the following.
 - It is a permanent opening.
 - It extends to the floor.
 - It is intended for people to walk through.
- The area of the adjacent rooms, on the same floor, connected by permanent opening in the walls and/or doors between occupied spaces, including gaps between the wall and the floor, can be considered a single room.

APPENDIX E — A2L REFRIGERANT INSTALLATION SUPPLEMENT (cont)

Natural Ventilation for Unventilated Machine Room

Connected spaces should be provided with permanent natural ventilation opening(s).

The minimum size of the permanent natural ventilation opening(s) for 23XW/XQ with R-1234ze(E) refrigerant should be calculated using the following formula:

$$A_{vent} = 25.89 \times (1550 - m) \times \text{Sqrt}(A / m) \text{ (I-P)}$$

$$A_{vent} = 0.01173 \times (700 - m) \times \text{Sqrt}(A / m) \text{ (SI)}$$

where

A_{vent} = minimum net free area of a permanent opening, ft² (m²)

A = actual area of the individual room, ft² (m²)

m = allowable refrigerant charge of an individual room, lbm (kg)

- The lower edge of the natural ventilation opening between rooms should be located a maximum of 12 in. (305 mm) above the finished floor.
- The area of any openings above 12 in. (305 mm) from the floor should not be considered in determining compliance with A_{vent} .
- At least 50% of the required opening area A_{vent} should be below 8 in. (200 mm) from the floor.
- The bottom of the lowest openings should not be higher than the point of release when the unit is installed and not more than 4 in. (100 mm) from the floor.
- Openings are permanent openings which cannot be closed.
- The height of the openings between the wall and floor which connect the rooms are not less than 0.787 in. (20 mm).
- A second higher opening should be provided. The total size of the second opening should not be less than 50% of minimum opening area for A_{vent} and should be at least 5 ft (1.5 m) above the floor.

IMPORTANT: The requirement for the second opening can be met by drop ceilings, ventilation ducts, or similar arrangements that provide an airflow path between the connected rooms.

MACHINE ROOM GENERAL REQUIREMENTS

When a refrigerating system with A2L refrigerant is located indoors with other mechanical equipment in a machinery room, then the machinery room should be in accordance with the following:

- A machinery room should be so dimensioned that parts are accessible with space for service, maintenance, and operations. There should be clear head room of not less than 7.25 ft (2.2 m) below equipment situated over passageways.
- With the exception of access doors and panels in air ducts and air-handling units, there should be no openings that will permit passage of escaping refrigerant to other parts of the building.
- There should be no airflow to or from an occupied space through a machinery room unless the air is ducted and sealed in such a manner as to prevent any refrigerant leakage from entering the air stream. Access doors and panels in ductwork and air-handling units should be gasketed and tight fitting.
- Access to the refrigerating machinery room should be restricted to authorized personnel. Doors should be clearly marked, or permanent signs should be posted at each entrance to indicate this restriction.

- There should be no flame-producing device or hot surface over 1290°F (700°C) in the room, other than that used for maintenance or repair. However, if there is combustion equipment installed in the same machinery room with refrigerant-containing equipment, then combustion air is ducted from outside the machinery room and sealed in such a manner as to prevent any refrigerant leakage from entering the combustion chamber. In addition, a refrigerant detector (see “Detection of Flammable Refrigerants” on page 53) is employed to automatically shut down the combustion process in the event of refrigerant leakage.
- Doors communicating with the building should be approved, tight-fitting fire doors, should be self-closing if they open into the building, and should be adequate in number to ensure freedom for persons to escape in an emergency.
- Walls, floor, and ceiling should be tight and of noncombustible construction. Walls, floor, and ceiling separating the refrigerating machinery room from other occupied spaces should be of at least one-hour fire-resistive construction.
- Exterior openings, if present, should not be under any fire escape or any open stairway.
- The machinery room should comply with both ventilation requirements (See “Ventilation” on page 54) and refrigerant detection requirements (see “Detection of Flammable Refrigerants” on page 53), or should be designated as Class I, Division 2 hazardous (classified) electrical location in accordance with the National Electrical Code.
- The mechanical ventilation system should either run continuously with failure of the mechanical ventilation system actuating an alarm, or an alarm will be activated by one or more refrigerant detectors.

Piping

- Keep the installation of pipe-work to a minimum.
- All pipes piercing the interior walls, ceiling, or floor of such rooms should be tightly sealed to the walls, ceiling, or floor through which they pass.
- Pipe-work in the case of flammable refrigerants should not be installed in an unventilated space.
- Flexible pipe elements should be protected against mechanical damage, excessive stress by torsion, or other forces, and they should be checked for mechanical damage annually.
- Precautions should be taken to avoid excessive vibration or pulsation.
- Provision should be made for expansion and contraction of long runs of piping.
- Protection devices, piping, and fittings should be protected as far as possible against adverse environmental effects; for example, the danger of water collecting and freezing in relief pipes or the accumulation of dirt and debris.

APPENDIX E — A2L REFRIGERANT INSTALLATION SUPPLEMENT (cont)

Freeze Protection of Water Piping

⚠ WARNING

An automatic air/refrigerant separator and pressure relief valve must be installed as close as possible to the heat exchanger water nozzle and at a high level in the water outlet from the evaporator or the condenser.

- The pressure relief valve should have a flow rating rated to discharge the refrigerant.
- The air/refrigerant separator and pressure relief valve should discharge the refrigerant to the outside or a double wall refrigerant storage.
- The refrigerant leak should be detected by the detection equipment according to “Detection of Flammable Refrigerants” on page 53.
- The ventilation should safely disperse any released refrigerant according to “Ventilation” on page 54.

⚠ WARNING

The use of untreated water can result in corrosion, erosion, sliming, scaling, or algae formation.

IMPORTANT: It is recommended that the service of a reliable water treatment company be used.

EFFECTIVE DISPERSAL VOLUME

The **effective dispersal volume** (V_{eff}) is the occupied or unoccupied space served by a refrigeration system in which the leaked refrigerant disperses. It should be used to determine the **effective dispersal volume charge** (EDVC) in the system.

The **maximum charge permitted** based on RCL for an effective dispersal volume should be calculated as follows:

For R-1234ze(E):

$$\text{EDVC} = 4.7 \times V_{\text{eff}} \times F_{\text{occ}} \text{ (I-P)}$$

$$\text{EDVC} = 76 \times V_{\text{eff}} \times F_{\text{occ}} / 1000 \text{ (SI)}$$

where

EDVC = effective dispersal volume charge in lb (kg)

V_{eff} = effective dispersal volume in ft³ (m³)

F_{occ} = occupancy adjustment factor (= 0.5 for institutional occupancies; otherwise = 1)

Where a refrigeration system, or a part thereof, is located within an air distribution duct system, or in a space served by an air distribution duct system, the entire air distribution system should be analyzed to determine the worst case distribution of leaked refrigerant.

The **effective dispersal volume** should be established by the following physical enclosure elements:

- Walls
- Floors
- Ceilings
- Windows or doors which can be closed
- Partitions connecting to and extending from the finished floor to more than 5.5 ft (1.7 m) above the floor.
- The areas that contain only continuous refrigerant piping, or contain only joints and connections which are part of connected spaces on the same floor.

- Air ceiling plenum or floor plenum where plenum space is a part of the refrigeration system air distribution system.
- Supply and return ducts.
- Transfer air ductwork.
- Two or more spaces connected by a mechanical ventilation system.
- Closures in the air distribution system.

Where different stories and floor levels connect through an open atrium or mezzanine, the effective dispersal volume is calculated by:

$$V_{\text{eff}} = A_{\text{floor}} \times H_{\text{ceiling}}$$

Where

Effective dispersal volume V_{eff} (ft³)

Floor area of the lowest floor level A_{floor} (ft²)

Ceiling Height H_{ceiling} = 8.2 ft (2.5 m)

Exemptions to the Effective Dispersal Volume

1. If one or more spaces of several arranged in parallel can be closed off from the source of the refrigerant leak, their volumes should not be used in the calculation.
2. Smoke dampers, fire dampers, and combination smoke/fire dampers that close only in an emergency not associated with a refrigerant leak should not be classified as closure devices.
3. Dampers, such as variable-air-volume (VAV) boxes, should not be considered closure devices provided the airflow is not reduced below 10% of its maximum.

REMOVAL AND EVACUATION

When breaking into the refrigerant circuit to make repairs — or for any other purpose — conventional procedures should be used. However, for flammable refrigerants it is important that best practice is followed since flammability is a consideration. The following procedure should be adhered to:

1. Safely remove refrigerant following local and national regulations. The refrigerant charge should be recovered into the correct recovery cylinders.
2. Purge the circuit with inert gas. For equipment containing flammable refrigerants, the system should be purged with oxygen-free nitrogen to render the equipment safe for flammable refrigerants. This process might need to be repeated several times. Compressed air or oxygen should not be used for purging refrigerant systems.
3. Evacuate (optional for A2L).

⚠ CAUTION

Ensure that the outlet for the vacuum pump is not close to any potential ignition sources and that ventilation is available.

4. Purge with inert gas (optional for A2L). For equipment containing flammable refrigerants, refrigerants purging should be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum as in Step 2 (optional for A2L). Repeat this process until no refrigerant is within the system (optional for A2L). When the final oxygen-free nitrogen charge is used, the system should be vented down to atmospheric pressure to enable work to take place.
5. Open the circuit by cutting or brazing.

APPENDIX E — A2L REFRIGERANT INSTALLATION SUPPLEMENT (cont)

COMMISSIONING

⚠ CAUTION

Ensure that the floor area is sufficient for the refrigerant charge or that the ventilation duct is assembled in a correct manner.

⚠ CAUTION

Check safety equipment before putting into service.

IMPORTANT: Connect the pipes and carry out a leak test before charging with refrigerant.

RECOVERY

IMPORTANT: When removing refrigerant from a system, either for servicing or decommissioning, it is recommended good practice that all refrigerants are removed safely.

IMPORTANT: When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge is available.

IMPORTANT: All cylinders to be used are designated for the recovered refrigerant and labeled for that refrigerant; i. e., special cylinders for the recovery of refrigerant).

IMPORTANT: Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.

⚠ CAUTION

Cylinders must be complete with pressure-relief valve and associated shut-off valves in good working order.

⚠ CAUTION

Recovery equipment must be in good working order with a set of instructions concerning the equipment that is at hand and must be suitable for the recovery of all appropriate refrigerants including, when applicable, flammable refrigerants.

⚠ CAUTION

Do not mix refrigerants in recovery units and especially not in cylinders.

⚠ CAUTION

Before using the recovery machine, check that it is in satisfactory working order, has been properly maintained, and that any associated electrical components are sealed to prevent ignition in the event of a refrigerant release.

Consult manufacturer if in doubt.

In addition:

- A set of calibrated weighing scales should be available and in good working order.
- Hoses should be complete with leak-free disconnect couplings and in good condition.

IMPORTANT: The recovered refrigerant should be returned to the refrigerant supplier in the correct recovery cylinder, and the relevant waste transfer note arranged.

⚠ CAUTION

If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant.

The evacuation process should be carried out prior to returning the compressor to the suppliers. Only electric heating to the compressor body should be employed to accelerate this process.

⚠ CAUTION

When oil is drained from system, it must be carried out safely.

DISPOSAL

⚠ CAUTION

Ensure sufficient ventilation at the working place.

- Remove the refrigerant.
- Evacuate the refrigerant circuit.
- Cut out the compressor and drain the oil.

DECOMMISSIONING

If the safety is affected when the equipment is putted out of service, the REFRIGERANT CHARGE should be removed before decommissioning.

⚠ CAUTION

Ensure sufficient ventilation at the working place.

⚠ CAUTION

Be aware that malfunction of the equipment may be caused by refrigerant loss and a refrigerant leak is possible.

- Discharge capacitors in a way that won't cause any spark.
- Remove the refrigerant.

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INITIAL START-UP CHECKLIST
FOR 23XW/XQ SCREWLIQUID CHILLER
 (Remove and use for job file.)

NOTE: To avoid injury to personnel and damage to equipment or property when completing the procedures listed in this start-up checklist, use good judgment, follow safe practices, and adhere to the safety considerations/information as outlined in preceding sections of this Start-Up, Operation, and Maintenance Instructions document.

MACHINE INFORMATION:

NAME _____ SALES ORDER NO. _____
 ADDRESS _____ MODEL _____
 CITY _____ STATE _____ ZIP _____ S/N _____

DESIGN CONDITIONS:

	TONS (kW)	BRINE	FLOW RATE	TEMPERATURE IN	TEMPERATURE OUT	PRESSURE DROP	PASS	SUCTION TEMPERATURE	CONDENSER TEMPERATURE
EVAPORATOR									*****
CONDENSER								*****	

CHILLER LINE SIDE: Volts _____ FLA _____ OLTA _____

REFRIGERANT: Type: _____ Charge _____

CARRIER OBLIGATIONS:

Disassembled at Job Site	Yes ☐	No ☐
Assemble.....	Yes ☐	No ☐
Leak Test	Yes ☐	No ☐
Dehydrate	Yes ☐	No ☐
Charging	Yes ☐	No ☐
Operating Instructions _____ Hrs.		

START-UP TO BE PERFORMED IN ACCORDANCE WITH APPROPRIATE MACHINE START-UP INSTRUCTIONS
JOB DATA REQUIRED:

- | | | |
|---|------------------------------|-----------------------------|
| 1. Machine Installation Instructions | Yes ☐ | No ☐ |
| 2. Machine Assembly, Wiring and Piping Diagrams | Yes ☐ | No ☐ |
| 3. Starting Equipment Details and Wiring Diagrams | Yes ☐ | No ☐ |
| 4. Applicable Design Data (see above) | Yes ☐ | No ☐ |
| 5. Diagrams and Instructions for Special Controls | Yes ☐ | No ☐ |

INITIAL MACHINE PRESSURE: _____

	YES	NO
Was Machine Tight?		
If Not, Were Leaks Corrected?		
Was Machine Dehydrated After Repairs?		

RECORD ACTUAL PRESSURE DROPS Evaporator _____ Condenser _____

CHARGE REFRIGERANT: Initial Charge _____ Final Charge After Trim _____

INSPECT WIRING AND RECORD ELECTRICAL DATA:

RATINGS:

Motor Voltage _____ Motor RLA _____ Chiller LRA Rating _____

Actual Line Voltages: VFD _____ Battery Charge Level _____%

Verify 6-in. clearance surrounding all VFD enclosure louvers. Yes ☐ No ☐

Record:

L1 to ground _____
L2 to ground _____
L3 to ground _____
L1 to L2 _____
L1 to L3 _____
L2 to L3 _____

NOTE: The % of voltage imbalance should be the same for the two different measurements

Visually inspect top of the electrical enclosures for penetrations and internally for metal particulate: Yes ☐ No ☐

VFD Manufacturer _____

VFD Nameplate I.D. Number _____

VFD Serial Number _____

VFD Nameplate Input Rating _____

Mfd in _____

on _____

CONTROLS: SAFETY, OPERATING, ETC.

Perform Quick Calibration (Yes/No) _____

COMPRESSOR MOTOR AND CONTROL PANEL **MUST** BE PROPERLY AND INDIVIDUALLY CONNECTED BACK TO THE EARTH GROUND IN THE VFD (IN ACCORDANCE WITH CERTIFIED DRAWINGS). THE TRANSFORMER SUPPLYING POWER TO THE UNIT SHOULD BE A WYE SECONDARY WITH SOLIDLY GROUNDED NEUTRAL.

Yes _____

WATER/BRINE PUMP CONTROL: Can the Carrier controls independently start the pumps?

Condenser Water Pump Yes ☐ No ☐

Chilled Water Pump Yes ☐ No ☐

RUN MACHINE: Do these safeties shut down machine?

Condenser Water Flow Yes ☐ No ☐

Chilled Water Flow Yes ☐ No ☐

Pump Interlocks (optional) Yes ☐ No ☐

INITIAL START:

Line up all valves in accordance with instruction manual: _____

Start water pumps and establish water flow: _____

Check compressor motor rotation (second stage suction housing sight glass) and record: Counter-clockwise _____

Restart compressor, bring up to speed (operating for at least 2 minutes), and shut down.

Any abnormal coastdown noise? If yes, determine cause: Yes ☐ No ☐

START MACHINE AND OPERATE. COMPLETE THE FOLLOWING:

A: Trim charge and record under Charge Refrigerant section on page CL-1.

B: Take at least two sets of operational log readings and record.

C: Give operating instructions to owner's operating personnel. Given at: _____ Hours

D: Call your Carrier factory representative to report chiller start-up.

E: Return a copy of this checklist to the local Carrier Service office.

SIGNATURES:

CARRIER
TECHNICIAN _____

CUSTOMER
REPRESENTATIVE _____

DATE _____

DATE _____

23XW/XQ PIC6.1 SET POINT TABLE CONFIGURATION SHEET

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Cooling LCW Set point	10 to 120	°F	45	
Base Demand Limit	10.0 to 100.0	%	100.0	

PIC6.1 TOUCH SCREEN Software Version Number: _____

PIC6.1 TOUCH SCREEN Controller Identification: BUS: _____ ADDRESS: _____

23XW/XQ PIC6.1 TIME SCHEDULE CONFIGURATION SHEET PERIOD 1

	DAY FLAG								OCCUPIED TIME	UNOCCUPIED TIME			
	M	T	W	T	F	S	S	H					
Period 1:													
Period 2:													
Period 3:													
Period 4:													
Period 5:													
Period 6:													
Period 7:													
Period 8:													

23XW/XQ PIC6.1 TIME SCHEDULE CONFIGURATION SHEET PERIOD 2

	DAY FLAG								OCCUPIED TIME	UNOCCUPIED TIME			
	M	T	W	T	F	S	S	H					
Period 1:													
Period 2:													
Period 3:													
Period 4:													
Period 5:													
Period 6:													
Period 7:													
Period 8:													

23XW/XQ PIC6.1 TIME SCHEDULE CONFIGURATION SHEET PERIOD 3

	DAY FLAG								OCCUPIED TIME	UNOCCUPIED TIME			
	M	T	W	T	F	S	S	H					
Period 1:													
Period 2:													
Period 3:													
Period 4:													
Period 5:													
Period 6:													
Period 7:													
Period 8:													

EQUIPMENT DECOMMISSIONING

Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its detail. It is recommended good practice that all refrigerant be recovered safely. Prior to the task being carried out, an oil and refrigerant sample shall be taken in case analysis is required prior to re-use of recovered refrigerant. It is essential that electrical power is available before the task is commenced.

- a. Become familiar with the equipment and its operation.
- b. Isolate system electrically.
- c. Before attempting the procedure, ensure that:
 - Mechanical handling equipment is available, if required, for handling refrigerant cylinders;
 - All personal protective equipment is available and being used correctly;
 - The recovery process is supervised at all times by a competent person;
 - Recovery equipment and cylinders conform to the appropriate standards.
- d. Pump down refrigerant system, if possible.
- e. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
- f. Make sure that cylinder is situated on the scales before recovery takes place.
- g. Start the recovery machine and operate in accordance with instructions.
- h. Do not overfill cylinders (no more than 80% volume liquid charge).
- i. Do not exceed the maximum working pressure of the cylinder, even temporarily.
- j. When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.
- k. Recovered refrigerant shall not be charged into another REFRIGERATING SYSTEM unless it has been cleaned and checked.

CUT ALONG DOTTED LINE

CUT ALONG DOTTED LINE